ES300 Series

Hydraulic Servo Drive

USER MANUAL

V1.6

Power Range:

Three-phase 380V (4T) 11~132kW

For safe use of this product, please be sure to read this user manual.

FOREWORD

the ES300 series servo drives developed and manufactured by Sunye Electric !

The ES300 series servo drive is specifically developed for driving permanent magnet servo motors (PMSMs), enabling high-performance vector control of these motors. The ES300 employs high-performance vector control technology, optimized for the process characteristics of injection molding machine drives, such as injection speed and pressure holding accuracy control, and smooth control when working with the injection molding machine controller. It also features background software monitoring, communication bus functionality, and supports multiple encoder types, offering rich and powerful combined functions and stable performance. This product is mainly used in industries such as plastic molding, pipe extrusion, shoemaking, rubber, and metal die casting .

Precautions
●To illustrate product details, illustrations in this manual may sometimes show the product with the outer casing or safety cover removed. When using this product, please ensure that the outer casing or cover is properly installed as specified and operate according to the instructions in this manual.
●The illustrations in this manual are for illustrative purposes only and may differ from the product you order.
●Our company is committed to continuous product improvement, and product functions will be continuously upgraded. Please note that the information provided is subject to change without notice.
●If you encounter any problems during use, please contact our regional distributors or our customer service center directly. Customer service hotline: 400-0755-731

This manual provides relevant precautions and guidance on selection, installation, parameter setting, on-site commissioning, and troubleshooting. Users should carefully read this manual before using this series of servo drives for the first time. Equipment suppliers should include this manual with the equipment and distribute it to the end user, and keep it safe for future use.

Unpacking and inspection :

Please carefully check the contents upon unpacking;

Please check if the model number and VFD rating on the machine's nameplate match your order. The box contains your ordered machine, product certificate, user manual, and warranty card.

Check if the product was damaged during transportation; if any omissions or damages are found, please contact our company or your supplier immediately for resolution.

First-time use:

For first-time users of this product, please read this manual carefully. If you have any questions about its functions or performance, please consult our technical support staff for assistance. This will help you use the product correctly.

CONTENT

CHAPTER 1 SAFETY PRECAUTIONS 3

CHAPTER 2 PRODUCT INFORMATION 6

2.1 Servo Driver Naming Rules 6
2.2 Servo Driver Nameplate 6
2.3 ES300 Servo Driver Series 7
2.4 Technical Specifications 7
2.5 Product Shape and Mounting Hole Dimensions 11
2.6 Servo Driver Options 15
2.7 Servo Driver Braking Component Selection Guide 15
2.8 Routine maintenance and upkeep of the drive 17
2.9 Driver Warranty Information 19

CHAPTER 3 ELECTRICAL INSTALLATION AND WIRING 20

3.1 Mechanical Installation 20
3.2 Electrical Installation 22

CHAPTER 4 OPERATION AND DISPLAY 32

4.1 Introduction to Operation and Display Interface 32
4.2 Organization of Driver Function Codes 34
4.3 Instructions for viewing and modifying function codes 34
4.4 Password settings 35
4.5 Driver start/stop control 35
4.6 Driver operating frequency control 37
4.7 Setting the motor rotation direction 38

CHAPTER 5 QUICK DEBUGGING OF SERVO OIL PUMP 39

5.1 Servo Oil Pump Debugging Flowchart 39
5.2 Motor Trial Run 39
5.3 Servo oil pump application debugging 42

CHAPTER 6: FAULT DIAGNOSIS AND COUNTERMEASURES 50

6.1 Fault alarms and countermeasures 50
6.2 Common Faults and Troubleshooting Methods 56

APPENDIX A MOTOR SELECTION REFERENCE TABLE 58

APPENDIX B OPTIONAL CARD 60

APPENDIX C FUNCTIONAL PARAMETER TABLE 61

APPENDIX D MODBUS COMMUNICATION PROTOCOL 90

Chapter 1 Safety Precautions

Security Definition

In this manual, safety precautions are divided into the following two categories:

 Danger: Failure to operate according to instructions may result in serious injury or even death ;

 Caution: Failure to operate as required may result in moderate or minor injury, or equipment damage.

Users are advised to carefully read this chapter when installing, debugging, and repairing this system, and to strictly follow the safety precautions outlined herein. Our company is not responsible for any injury or loss caused by improper operation.

Safety Precautions :

Stage of Use	Security Level	Operations
Before installation	 Danger	Do not install the device if you find water inside the control system, missing parts, or damaged parts when you unpack it! Do not install if the packing list does not match the actual product name!
	 Caution	Handle with care during transport, otherwise there is a risk of damaging the equipment! Do not use damaged or missing parts of the drive , as there is a risk of injury! Do not touch the components of the control system with your hands, otherwise there is a risk of damage from static electricity!
During installation	 Danger	Please install on a flame-retardant surface such as metal; keep away from flammable materials. Otherwise, it may cause a fire! Do not loosen the bolts securing the equipment components, especially those marked in red!
	 Caution	Do not allow wire ends or screws to fall into the driver , otherwise it will damage the driver! Please install the driver in a location with minimal vibration and away from direct sunlight. When placing two or more drives in the same cabinet, please pay attention to the installation location to ensure proper heat dissipation.
During wiring	 Danger	The work must be carried out by professional electrical engineers; otherwise, unexpected dangers may occur! There must be a circuit breaker between the drive and the power supply, otherwise a fire may occur! Before wiring, please ensure that the power supply is in a zero-energy state, otherwise there is a risk of electric shock! Please ground the driver correctly according to the standard specifications, otherwise there is a risk of electric shock!

Stage of Use	Security Level	Operations
	Caution	Never connect the input power supply to the driver's output terminals (U, V, W). Pay attention to the terminal markings and do not connect the wires incorrectly! Otherwise, you may damage the driver! Never connect the braking resistor directly between the (+) and (-) terminals of the DC bus , otherwise it will cause a fire! Please refer to the manual for the recommended wire gauge ; otherwise, an accident may occur!
Before powering up	Caution	Please confirm that the voltage level of the input power supply is consistent with the rated voltage level of the driver; check that the wiring positions on the power input terminals (R, S, T) and output terminals (U, V, W) are correct; and carefully check for short circuits in the external circuits connected to the driver, and ensure that the connections are secure, otherwise the driver may be damaged! No part of the drive needs to undergo a withstand voltage test, as this test has been performed on the product at the factory ; otherwise, it may cause an accident!
	Danger	The driver must be powered on only after the cover is closed , otherwise it may cause electric shock! All wiring of external components must comply with the instructions in this manual. Wiring must be done correctly according to the circuit connection methods provided in this manual , otherwise an accident may occur!
After powering up	Danger	Do not open the cover after powering on. Otherwise, there is a risk of electric shock! Do not touch any of the driver's input or output terminals. Doing so poses a risk of electric shock!
	Caution	If parameter identification is required, please be aware of the risk of injury from the rotating motor , otherwise it may cause an accident! Do not arbitrarily change the driver manufacturer's parameters , as this may damage the equipment!
Running	Danger	Do not attempt to test signals while the equipment is in operation if you are not a qualified technician , as this may cause personal injury or equipment damage! Do not touch the cooling fan or discharge resistor to test the temperature , as this may cause burns!
	Caution	While the drive is running, avoid letting anything fall into the device , otherwise it may cause damage! Do not use contactors to control the start and stop of the drive , otherwise it will cause damage to the equipment!

Stage of Use	Security Level	Operations
During maintenance	 Danger	Do not attempt to repair or maintain the drive without proper training , as this may result in personal injury or equipment damage! Do not perform maintenance or repairs on the equipment while it is powered on , as this could result in electric shock! Make sure to disconnect the driver's input power for 10 minutes before performing any maintenance or repairs on the driver , otherwise the residual charge on the capacitors may cause harm to people! All pluggable components must be plugged in or unplugged while the power is off! After replacing the driver, the parameters must be set and checked.

Chapter 2 Product Information

2.1 Servo Driver Naming Rules

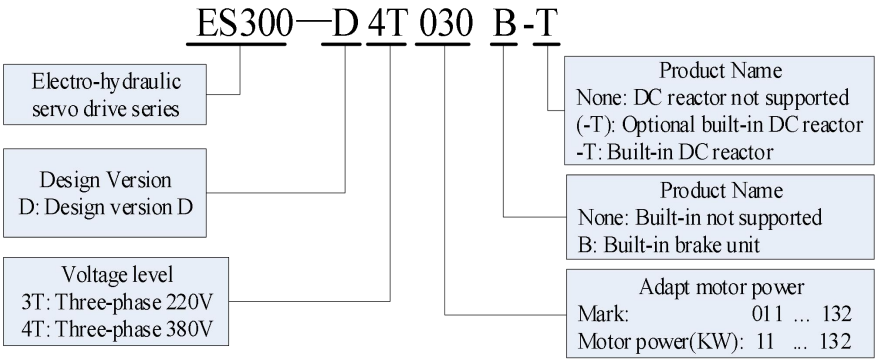


Figure 2-1 . Naming Specifications

2.2 Servo Driver Nameplate

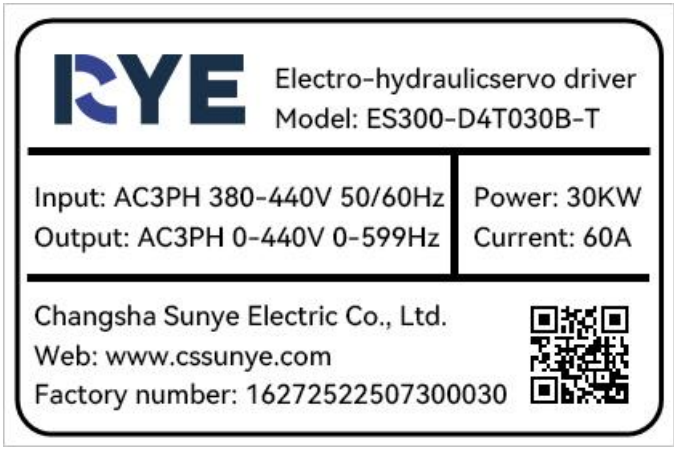


Figure 2-2 . Nameplate

2.3 ES300 Servo Driver Series

Table 2-1 ES300 Driver Models and Technical Data

Drive Model	Input Voltage (V)	Input Current (A)	Output Current (A)	Motor Adapter (kW)
ES300-4T011B	Three-phase 380V Range: -15%~20%	26.0	25.0	11.0
ES300-4T015B		35.0	32.0	15.0
ES300-4T018B		38.5	37.0	18.5
ES300-4T022B		46.5	45.0	22.0
ES300-D4T030B-T		62.0	60.0	30.0
ES300-D4T037B-T		76.0	75.0	37.0
ES300-4T030B-T		62.0	60.0	30.0
ES300-4T037B-T		76.0	75.0	37.0
ES300-4T045B-T		92.0	90.0	45.0
ES300-4T055B-T		113.0	110.0	55.0
ES300-4T075B-T		157.0	152.0	75.0
ES300-4T093B-T		180.0	176.0	93.0
ES300-4T110B-T		214.0	210.0	110.0
ES300-4T132		256.0	253.0	132.0
ES300-4T160-T		307.0	304.0	160.0
ES300-4T185-T		345.0	340.0	185.0
ES300-4T200-T		385.0	380.0	200.0
ES300-4T220-T		430.0	426.0	220.0
ES300-4T250-T		468.0	465.0	250.0
ES300-4T280-T		525.0	520.0	280.0
ES300-4T315-T		590.0	585.0	315.0
ES300-4T355-T		665.0	650.0	355.0
ES300-4T400-T		785.0	725.0	400.0

2.4 Technical Specifications

Table 2-2 Driver Technical Specifications

Item		Specification
Main control performance	Maximum frequency	Vector control: 0~300HZ
	Carrier frequency	0.5k~8kHz
	Input frequency resolution	Digital setting: 0.01Hz Analog settings: Maximum frequency × 0.1 %

Item		Specification
	Control method	Synchronous motors: Closed-loop vector control (FVC); Asynchronous motors: V/F control
	Starting torque	Closed-loop vector control: 0.0Hz/180%
	Speed regulation range	1: 200 (V/F control); 1:1000 (closed-loop vector control)
	Speed stability accuracy (speed control accuracy)	Closed-loop vector control: ± 0.3% (rated synchronous speed)
	Torque control accuracy	Closed-loop vector control: ± 3%
	Torque response	≤ 20ms (Closed-loop vector control)
	Overload capacity	170% rated current for 60 seconds; 200% rated current for 20 seconds
	Torque boost	Automatic torque boost; manual torque boost from 0.1% ~ 30.0%.
	V/F curve	Three types: linear; multi-point; square-shaped V/F curve
	Acceleration/ deceleration curves	Linear or S -curve acceleration/deceleration modes; four acceleration/deceleration times; acceleration/deceleration time range 0.0 s~3000.0 s
	DC braking	DC braking frequency: 0.0 Hz~maximum frequency; braking time: 0.0~36.0 seconds; braking current: 0.0 %~100.0% .
	Jog control	Jogging frequency range: 0.00Hz~50.00Hz; Jogging acceleration/deceleration time: 0.0 s~3000.0 s
	Simple PLC , multi-speed operation	16 speed settings can be achieved via built-in PLC or control terminals.
	Built-in PID	It can easily realize a closed-loop control system for process control.
	Automatic voltage regulator (AVR)	It can automatically maintain a constant output voltage when the mains voltage changes.
	Torque limiting and control	The “excavator” characteristic automatically limits torque during operation to prevent frequent overcurrent tripping; closed-loop vector mode enables torque control.
Personalized function	Power-on peripheral equipment safety self-test	It can perform safety checks on peripheral devices upon power-up, such as grounding and short circuit detection.
	Common DC bus function	It can realize the function of multiple drivers sharing a DC bus.

Item		Specification
	JOG key	Programmable keys: Select for forward/reverse operation / jog operation function
	Multi-bus communication method	Supports two fieldbus applications: Modbus and Can
	Fast current limiting function	Built-in fast current limiting algorithm reduces the probability of driver overcurrent reports and improves the overall anti-interference capability of the system.
	Encoder	Supports differential, open collector, rotary transformer, sine and cosine converters, etc.
	Motor overheat protection	Supports KTY and PTC temperature protection
Running	Run command channel	Three channels: operation panel input, control terminal input, and serial communication port input. Switching between these channels is possible in multiple ways.
	Frequency source	There are 10 frequency sources in total: digital input, analog voltage input, analog current input, pulse input, and serial port input. These can be switched in multiple ways.
	Auxiliary frequency source	Ten auxiliary frequency sources. Allows for flexible auxiliary frequency fine-tuning and frequency synthesis.
	Input terminals	It comes standard with five digital input terminals, compatible with active PNP or NPN input methods; There are three analog input terminals, of which AI1 and AI2 can only be used as voltage inputs, and AI3 can be used as either voltage or current input.
	Output terminals	Two relay output terminals Two analog output terminals, selectable from 0/4mA~20mA or 0/2V~10V respectively, can realize the output of physical quantities such as set frequency, output frequency, and rotation speed.
Display and keyboard operation	LED display	Display parameters
	Button lock and function selection	This allows for partial or complete locking of buttons, defining the active range of certain buttons to prevent accidental operation.
Protection and optional accessories	Protection function	Features include: motor short circuit detection, input/output phase loss protection, overcurrent protection, overvoltage protection, undervoltage protection, overheat protection, and overload protection.
	Optional accessories	LCD control panel, braking components, etc.
Environment	Use place	Indoors, away from direct sunlight, free from dust, corrosive gases, flammable gases, oil mist, water vapor, dripping water, or salt.
	Altitude	Below 1000 meters

Item		Specification
	Ambient temperature	-10 ℃~+50 ℃ (Please reduce the rated capacity if the ambient temperature is between 40 ℃ and 50 ℃)
	humidity	Less than 95 % RH , no water droplets condense.
	vibration	Less than 5.9 m / s² (0.6g)
	Storage temperature	-20 ℃~+ 60 ℃
	Pollution level	2
Product standard	The product complies with safety standards.	IEC61800-5-1:2007
	Products comply with EMC standards	IEC61800-3:2005

2.5 Product Shape and Mounting Hole Dimensions

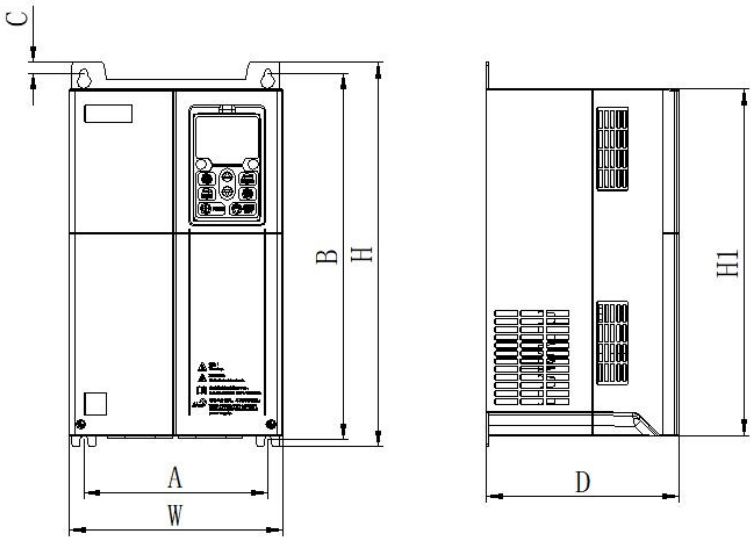


Figure 2-3 . 11~22 KW Plastic Casing External Dimensions and Installation Dimensions Diagram

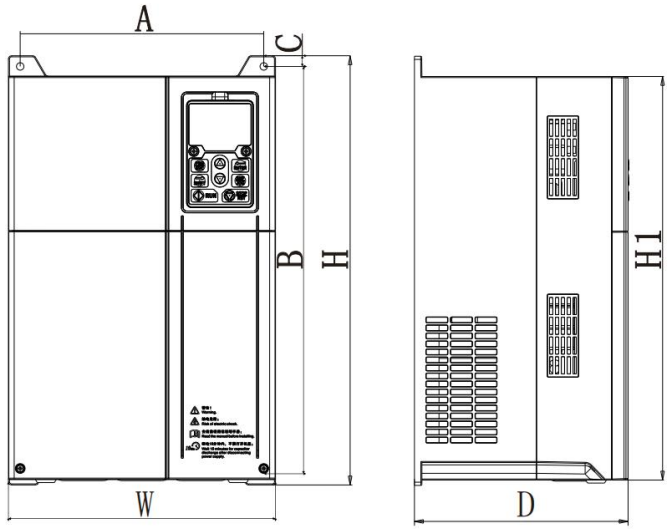


Figure 2-4 . 30~37 KW Plastic Casing External Dimensions and Installation Dimensions Diagram

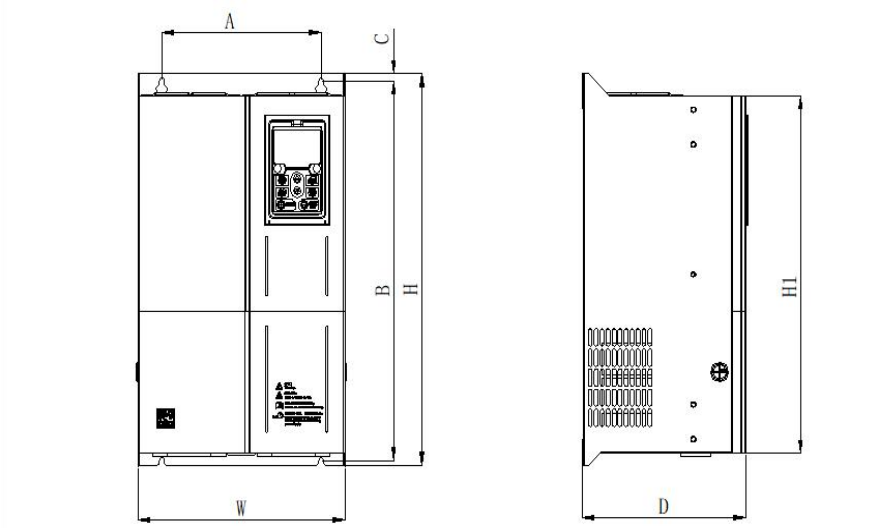


Figure 2-5 30~37 KW Sheet Metal Casing External Dimensions and Installation Dimensions Diagram

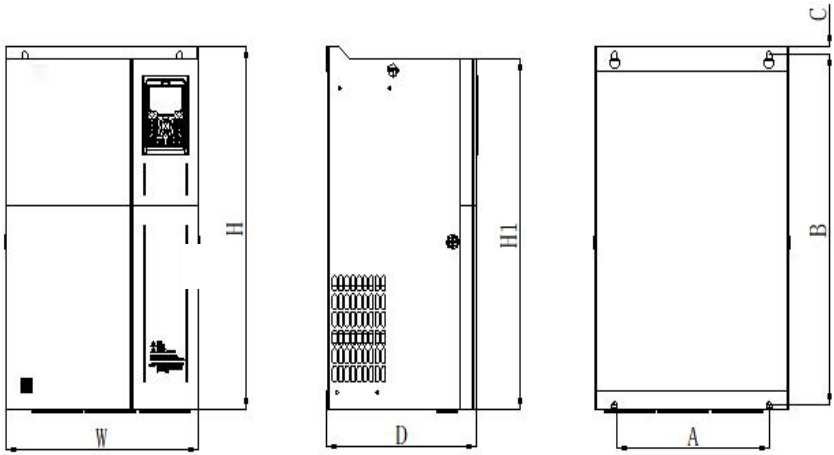


Figure 2-6. 45~132KW VFD External Dimensions and Installation Dimensions Diagram

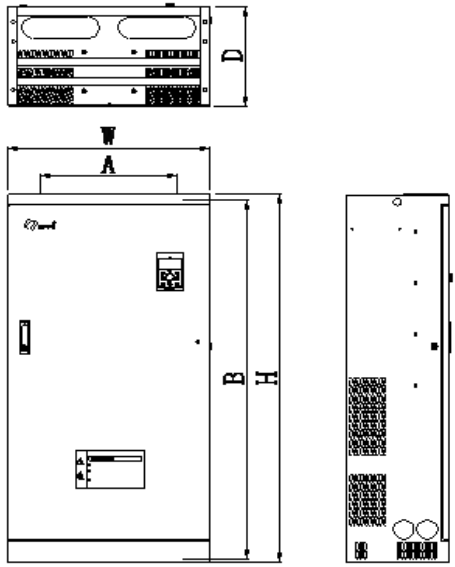


Figure 2-7 . 160~400KW VFD External Dimensions and Installation Dimensions Diagram

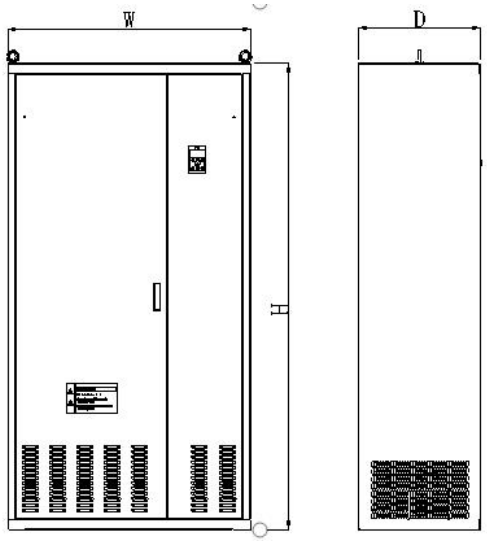


Figure 2-8 . 400~500KW VFD External Dimensions and Installation Dimensions Diagram

Table 2-3 ES300 External Dimensions and Mounting Hole Dimensions

Drive Model	External Dimension(mm)				Mounting Dimension(mm)			Mounting Hole Dimensions
	W	H	H1	D	A	B	C	(mm)
ES300-4T011B	170	345	310	175	142	328.5	10	Φ7
ES300-4T015B								
ES300-4T018B	200	360	325	180	172	343.5	10	Φ7
ES300-4T022B								
ES300-D4T030B-T	250	402	378	200	228	381.5	10	Φ7
ES300-D4T037B-T								
ES300-4T030B-T	260	410	373	205	190	396	8.5	Φ7
ES300-4T037B-T								
ES300-4T045B-T	310	550	535	265	245	531	12	Φ10
ES300-4T055B-T								
ES300-4T075B-T								
ES300-4T093B-T	350	660	640	285	280	641	12	Φ10
ES300-4T110B-T								
ES300-4T132	430	715	700	298	320	695	13	Φ10
ES300-4T160-T	470	1000	-	318	360	972	16	Φ12
ES300-4T185-T								
ES300-4T200-T	520	1088	-	338	380	1060	17	Φ12
ES300-4T220-T								
ES300-4T250-T	650	1220	-	330	440	1190	18	Φ12
ES300-4T280-T								
ES300-4T315-T	740	1290	--	420	500	1255	20	Φ14
ES300-4T355-T								
ES300-4T400-T								
ES300-4T450-T	1060	1800	-	500	-	-	-	-(Stand)
ES300-4T500-T								

2.6 Servo Driver Options

For detailed functions and usage instructions of optional accessories, please refer to the relevant optional accessory descriptions.

If you require any of the above optional accessories, please specify when ordering.

Table 2-4 ES300 Driver Optional Accessories

Name	Model	Function	Remark
Built-in braking unit	Product model numbers ending with " B"	Braking	Built-in braking unit is standard configuration
	Product model number followed by "(B)"		Built-in braking unit is optional.
DC reactor	-T	1. Limit AC ripple superimposed on the DC side; 2. Improve the driver power factor; 3. Suppress high-order harmonics generated by the inverter and reduce external impact; 4. Protect bus capacitors and extend their service life;	Built-in DC reactor
	(-T)		Built-in DC reactor is optional
	None		Not supported DC reactor
Extension cable	CM-CAB	A standard 8-core network cable, compatible with ES300-LED, ES300-LCD, and ES300-LED2.	Available in four sizes: 1 m, 3 m, 5 m, and 10 m.
CAN communication card	CS680-CAN	Achieving communication between multiple pumps converging	/

2.7 Servo Driver Braking Component Selection Guide

Table 2-5 below provides guidance data. Users can select different resistor values and power ratings according to their actual needs (but the resistance value must not be less than the recommended value in the table, and the power rating can be higher). The selection of the braking resistor needs to be determined based on the power generated by the motor in the actual application system, which is related to system inertia, deceleration time, and the energy of the potential load, etc. Customers need to select according to their actual situation. The greater the system inertia, the shorter the required deceleration time, and the more frequent the braking, the higher the power rating and the lower the resistance value of the braking resistor should be.

2.7.1 Selection of Resistance Value

During braking, almost all of the motor's regenerative energy is consumed by the braking resistor. This can be explained by the formula: U*U/R=Pb

U---- The braking voltage for stable braking of the system (it varies from system to system; for a 380VAC system, it is generally taken as 700V).

Pb---- Brake power

2.7.2 Power Selection of Braking Resistor

Theoretically, the power rating of the braking resistor should be the same as the braking power, but considering a derating of 70% , the following formula can be used: 0.7 * Pr = Pb * D

Pr---- Power of the resistor

D---- Braking frequency (the proportion of the regeneration process in the entire working process), generally taken as 10% . Please refer to the table below:

Application Industries	Elevator	Unwinding and rewinding	Centrifuge	Accidental braking load
Proportion	20%~30%	20~30 %	50%~60%	5%

Table 2-5 ES300 Drive Braking Component Selection Table

Drive Model	**Braking torque 150%, Recommended Resistor Value, Power and Braking Unit Model for 5 Seconds.**	**Recommended Resistor Value, Power, and Braking Unit Model for 100% Braking Torque and 15 Seconds.**	**Recommended Resistor Value, Power, and Braking Unit Model for 50% Braking Torque Over 15 Seconds.**
ES300-4T011B	≥40Ω, 1.0kW Built-in Barking Unit	≥50Ω, 0.7kW Built-in Barking Unit	≥60Ω, 0.5kW Built-in Barking Unit
ES300-4T015B	≥30Ω, 1.2kW Built-in Barking Unit	≥40Ω, 1.0kW Built-in Barking Unit	≥50Ω, 0.7kW Built-in Barking Unit
ES300-4T018B	≥24Ω, 2kW Built-in Barking Unit	≥30Ω, 1.2kW Built-in Barking Unit	≥40Ω, 1.0kW Built-in Barking Unit
ES300-4T022B	≥13.6Ω, 3.7kW Built-in Barking Unit	≥30Ω, 1.2kW Built-in Barking Unit	≥40Ω, 1.0kW Built-in Barking Unit
ES300-D4T030B-T	≥13.6Ω, 3.7kW Built-in Barking Unit	≥24Ω, 2kW Built-in Barking Unit	≥30Ω, 4kW Built-in Barking Unit
ES300-D4T037B-T	≥10Ω, 4.5kW BR530-4T075	≥24Ω, 2kW BR530-4T037	≥24Ω, 2kW BR530-4T037
ES300-4T030B-T	≥13.6Ω, 3.7kW Built-in Barking Unit	≥24Ω, 2kW Built-in Barking Unit	≥30Ω, 4kW Built-in Barking Unit
ES300-4T037B-T	≥10Ω, 4.5kW BR530-4T075	≥24Ω, 2kW BR530-4T037	≥24Ω, 2kW BR530-4T037
ES300-4T045B-T	≥6.8Ω, 8.0kW BR530-4T132	≥10Ω, 4.5kW BR530-4T075	≥13.6Ω, 3.7kW BR530-4T075
ES300-4T055B-T			
ES300-4T075B-T			
ES300-4T093B-T	≥2*(6.8Ω, 8.0kW) BR530-4T200	≥6.8Ω, 8.0kW BR530-4T132	≥6.8Ω, 8.0kW BR530-4T132
ES300-4T110B-T			
ES300-4T132			

Drive Model	Braking torque 150%, Recommended Resistor Value, Power and Braking Unit Model for 5 Seconds.	Recommended Resistor Value, Power, and Braking Unit Model for 100% Braking Torque and 15 Seconds.	Recommended Resistor Value, Power, and Braking Unit Model for 50% Braking Torque Over 15 Seconds.
ES300-4T160-T	≥3*(6.8Ω, 8.0kW) BR530-4T315	≥2*(6.8Ω, 8.0kW) BR530-4T200	≥2*(6.8Ω, 8.0kW) BR530-4T200
ES300-4T185-T			
ES300-4T200-T			
ES300-4T220-T	≥3*(6.8Ω, 8.0kW) BR530-4T315	≥2*(6.8Ω, 8.0kW) BR530-4T315	≥2*(6.8Ω, 8.0kW) BR530-4T315
ES300-4T250-T			
ES300-4T280-T			
ES300-4T315-T			
ES300-4T355-T	≥5*(6.8Ω, 8.0kW) BR530-4T630	≥4*(6.8Ω, 8.0kW) BR530-4T450	≥3*(6.8Ω, 8kW) BR530-4T450
ES300-4T400-T			
ES300-4T450-T			
ES300-4T500-T	≥6*(6.8Ω, 8.0kW) BR530-4T630	≥4*(6.8Ω, 8.0kW) BR530-4T630	≥4*(6.8Ω, 8kW) BR530-4T630

Notice:

1. The value of the braking resistor should not be less than the recommended value in the table. If it is less than the recommended value, the braking unit may be damaged.

2. In the table, **×2** indicates that two sets of braking resistors are used in parallel, **×3** indicates that three sets of braking resistors are used in parallel, and so on.

3. Drivers with " B " added to their model number are standard models with a built-in braking unit. If no "B" is added, the driver does not have a built-in braking unit. Please select the corresponding braking unit model according to its braking torque. All products in this series are equipped with a braking unit as standard.

4. The 5S and 15S listed in the table refer to the continuous braking time.

2.8 Routine maintenance and upkeep of the drive

2.8.1 Routine Maintenance

Environmental factors such as temperature, humidity, dust, and vibration can cause internal components of the drive to age, leading to potential drive failures or reducing the drive's lifespan. Therefore, it is necessary to perform daily and periodic maintenance on the drive.

Routine inspection items:

1) Does the sound of the motor change abnormally during operation?

2) Does the motor vibrate during operation?

3) Has the drive installation environment changed?

4) Is the driver cooling fan working properly?

5) Is the drive overheating?

Daily cleaning:

1) The drive should always be kept clean.

2) Effectively removes dust from the drive surface, preventing dust from entering the drive interior. Especially removes metallic dust.

3) Effectively removes oil and grease from the driver's cooling fan.

2.8.2 Regular Inspections

Please regularly inspect areas that are difficult to check during operation.

Regular inspection items:

1) Inspect the air ducts and clean them regularly.

2) Check if the screws are loose.

3) Check the drive for corrosion.

4) Check the wiring terminals for signs of arcing.

5) Main circuit insulation test

Reminder: When measuring insulation resistance with a megohmmeter (please use a DC 500V megohmmeter), disconnect the main return line from the driver. Do not use an insulation resistance meter to test the insulation of the control circuit. High-voltage testing is not required (it has been performed at the factory) **.**

2.8.3 Replacement of Vulnerable Parts of the Driver

The main consumable components of the drive are the cooling fan and the electrolytic capacitors used for filtering; their lifespan is closely related to the operating environment and maintenance conditions. The typical lifespan is:

Device Name	Lifespan
Fan	2~3 years
Electrolytic capacitors	4~5 years

Users can determine the replacement period based on the running time.

1) Cooling fan

Possible causes of damage: bearing wear, blade aging.

Judgment criteria: Check for cracks in the fan blades, etc., and for abnormal vibration sounds when the machine is turned on.

2) Filtering electrolytic capacitors

Possible causes of damage: poor input power quality, high ambient temperature, frequent load fluctuations, and electrolyte aging.

Judgment criteria: whether there is liquid leakage, whether the safety valve is protruding, measurement of electrostatic capacitance, and measurement of insulation resistance.

2.8.4 Drive Storage

After purchasing the drive, users must pay attention to the following points for temporary and long-term storage:

1. When storing, try to pack them into our company's packaging boxes in the original packaging.

2. Long-term storage will cause electrolytic capacitors to deteriorate. It is necessary to ensure that they are powered on once within 2 years, and the power-on time is at least 5 hours. The input voltage must be gradually increased to the rated value using a voltage regulator.

2.9 Driver Warranty Information

The free warranty applies only to the drive itself.

1. Domestic Warranty Information:

① Warranty, replacement, and return are guaranteed within one month of shipment;

② Warranty and replacement within three months of shipment;

③ Warranty coverage is provided for 15 months after shipment, or 18 months from the date of manufacture, based on the barcode on the device.

2. When exporting overseas (excluding domestic), the seller is responsible for warranty service in the place of purchase for 6 months after shipment.

3. After the warranty period, reasonable repair fees will be charged;

4. During the warranty period, a certain repair fee will be charged for the following situations:

① Damage to the machine caused by the user's failure to follow the instructions in the user manual;

② Damage caused by fire, flood, abnormal voltage, etc.;

③ Damage caused by using the drive for abnormal functions;

④ Use the P-type (fan and pump type) drive as a G-type (general purpose) drive;

⑤ Unauthorized tearing off of product nameplates and serial numbers.

5. In the event of a product accident, the liability will be limited to the liability under Clause 1 or 2 at most. If users require more liability protection, please purchase property insurance from an insurance company in advance.

Service fees are calculated according to the manufacturer's unified standards. If there is a contract, the contract shall take precedence.

Chapter 3 Electrical Installation and Wiring

3.1 Mechanical Installation

3.1.1 Installation Environment

1) Ambient temperature: The ambient temperature has a great impact on the life of the drive. The operating ambient temperature of the drive is not allowed to exceed the allowable temperature range (-10 ℃~50 ℃).

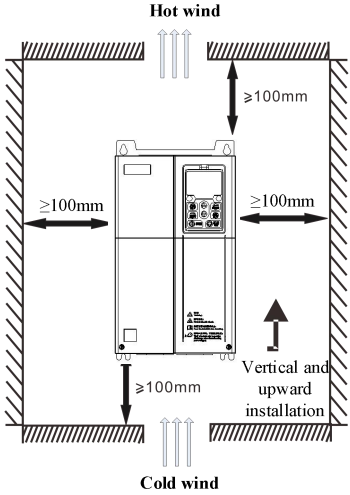
2) Mount the driver on a flame-retardant surface, ensuring sufficient space for heat dissipation. The driver generates a significant amount of heat during operation. Secure it vertically to the mounting bracket using screws.

3) Please install in a location where vibration is minimal. Vibration should not exceed 0.6G . Pay special attention to keeping it away from equipment such as punch presses.

4) Avoid placing it in direct sunlight, damp places, or places with water droplets.

5) Avoid storing in places where there are corrosive, flammable, or explosive gases in the air.

6) Avoid installing in places with oil stains, dust, or metal dust.



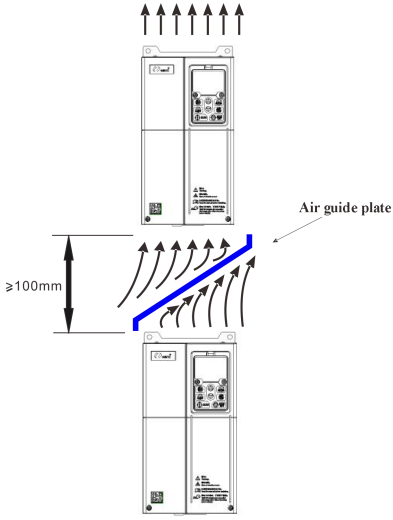


Figure 3-1 . Single Unit Installation Diagram. **Figure 3-2 . ES300 Driver Installation Diagram.**

Note: When installing the driver vertically, please follow the heat insulation guide plate shown in the installation diagram.

3.1.2 The main concern during installation is heat dissipation. Therefore, please note the following:

1) Please install the drive vertically to facilitate heat dissipation upwards. Do not install it upside down. If there are multiple drives in the cabinet, it is best to install them side-by-side. In cases where vertical installation is required, please refer to Figure 3-2 for the diagram and install a heat insulation deflector.

2) The installation space should conform to Figure 3-1 , ensuring sufficient space for the driver's heat dissipation. However, please consider the heat dissipation of other components in the cabinet when arranging the installation.

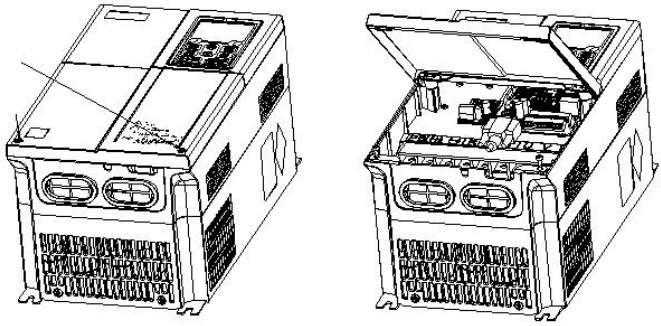
3) The mounting bracket must be made of flame-retardant material.

4) For applications involving metal dust, it is recommended to use an external radiator cabinet installation method. In this case, the fully sealed cabinet space should be as large as possible .

3.1.3 Terminal Cover Removal and Installation

The ES300 series driver uses a plastic housing. To remove the terminal cover of the plastic housing, refer to Figure 3-3 . You can use a tool to push the hook of the terminal cover inward.

After removing two screws, open the box as shown in the right image.



Opening Diagram

Figure 3-3 . Disassembly diagram of the plastic housing terminal cover

3.2 Electrical Installation

3.2.1 Selection Guide for Peripheral Electrical Components of Servo Drivers

Table 3-1 ES300 Driver Peripheral Electrical Component Selection Guide

Drive Model	Circuit Breaker (MCCB) (A)	Contactor (A)	Input Side Main Circuit Wires (mm^2)	Output Side Main Circuit Wires (mm^2)	Control Loop Wiring (mm^2)	Grounding Wire (mm^2)
ES300-4T011B	63	50	6.0	6.0	1.5	6
ES300-4T015B	63	50	10	10	1.5	6
ES300-4T018B	80	65	10	10	1.5	10
ES300-4T022B	80	80	16	16	1.5	16
ES300-D4T030B-T	100	80	16	16	1.5	16
ES300-D4T037B-T	160	95	25	25	1.5	25
ES300-4T030B-T	100	80	16	16	1.5	16
ES300-4T037B-T	160	95	25	25	1.5	25
ES300-4T045B-T	160	115	35	35	1.5	25
ES300-4T055B-T	250	150	50	50	1.5	25
ES300-4T075B-T	250	170	70	70	1.5	35
ES300-4T093B-T	250	205	95	95	1.5	50
ES300-4T110B-T	400	245	120	120	1.5	70
ES300-4T132	400	300	150	150	1.5	95
ES300-4T160-T	400	400	185	185	1.5	95
ES300-4T185-T	630	475	185	185	1.5	95
ES300-4T200-T	630	475	185	185	1.5	120
ES300-4T220-T	800	620	240	240	1.5	150
ES300-4T250-T	800	620	2×150	2×150	1.5	150
ES300-4T280-T	800	620	2×150	2×150	1.5	150
ES300-4T315-T	1000	800	2×150	2×150	1.5	185
ES300-4T355-T	1000	800	2×185	2×185	1.5	185
ES300-4T400-T	1250	800	2×240	2×240	1.5	240

3.2.2 Instructions for use of Peripheral Electrical Components of the Servo Driver

Table 3-2 Instructions for Use of Peripheral Electrical Components for the ES300 Driver

Componet Name	Installation location	Function Description
Circuit breaker	Input loop front end	Disconnect power supply when downstream equipment experiences overcurrent
Contactor	Between the circuit breaker and the driver input side	When powering on and off the drive , avoid frequent power-on/off operations (less than twice per minute) or direct start operations via contactor .
AC input reactor	Driver input side	1) Improve the power factor on the input side; 2) Effectively eliminates high-order harmonics on the input side, preventing damage to other equipment caused by voltage waveform distortion ; 3) Eliminate input current imbalance caused by phase-to-phase imbalance of the power supply.
EMC input filter	Driver input side	1) Reduce conducted and radiated interference from the driver to the outside world; 2) Reduce conducted interference flowing from the power supply to the driver and improve the driver's anti-interference capability.
AC output reactor	It is mounted close to the driver, between the driver output side and the motor.	The output side of a driver typically contains a significant number of high-order harmonics. When the motor and driver are far apart, due to the large distributed capacitance in the circuit, a certain harmonic may resonate in the circuit, leading to two main effects: 1)Damaging the motor's insulation will eventually damage the motor. 2)This generates a large leakage current, causing the driver to frequently activate its protection mode. For drives and motors that are more than 100 meters apart, it is recommended to install an output AC reactor.

3.2.3 Wiring Method

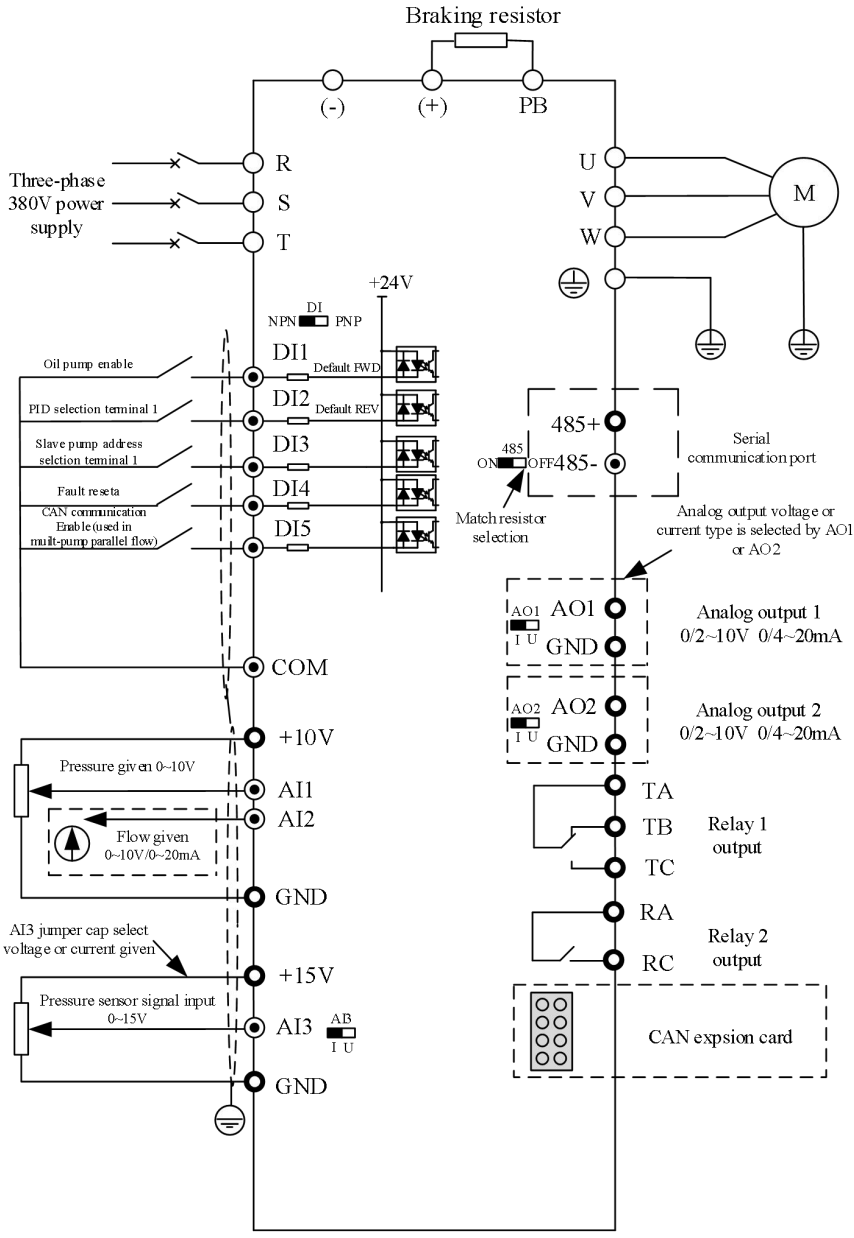


Figure 3-4 . Wiring diagram

3.2.4 Main circuit terminals and wiring

Three-phase driver main circuit terminal instructions:

Terminal markings	Name	Description
R, S, T	Three-phase power input terminals	AC input three-phase power supply connection point
(+) , (-)	DC bus positive and negative terminals	Common DC bus input point
(+) , PB	Braking resistor connection terminals	Braking resistor connection points of 110 kW and below
U , V , W	Driver output terminals	Connecting a three-phase motor
⏚	Grounding terminal	Grounding terminal

Wiring precautions:

Input power supply L , N or R , S , T:

The input side wiring of the driver has no phase sequence requirement.

DC bus (+), (-):

Note that residual voltage may remain on the (+) and (-) terminals of the DC bus immediately after a power outage. Wait until the power indicator light on the driver board goes out and confirm that the power has been off for at least 10 minutes before proceeding with any wiring operations; otherwise, there is a risk of electric shock.

The wiring length for the braking unit should not exceed 10 meters. Twisted-pair cable or tightly parallel two-wire wiring should be used.

Do not connect the braking resistor directly to the DC bus, as this may damage the driver or even cause a fire.

Braking resistor connection terminals P(+) , PB

When selecting a braking resistor, refer to the recommended values, and the wiring distance should be less than 5m . Otherwise, it may damage the driver.

Driver output side U , V , W:

Capacitors or surge absorbers must not be connected to the output side of the driver, otherwise the driver will frequently trigger protection or even be damaged.

When the motor cable is too long, electrical resonance is easily generated due to the influence of distributed capacitance, which can lead to insulation failure of the motor or generate a large leakage current that triggers the overcurrent protection of the driver. When the motor cable length is greater than 100m , an AC output reactor must be installed near the driver.

Grounding terminal ⏚PE:

The terminals must be reliably grounded, and the resistance of the grounding wire must be less than 0.1 Ω. Otherwise, it may cause abnormal operation or even damage to the equipment.

The grounding terminal ⏚ and the neutral wire N terminal of the power supply should not be shared.

3.2.5 Control terminals and wiring

The wiring terminal and connector layout diagram of the main control board front view is as follows:

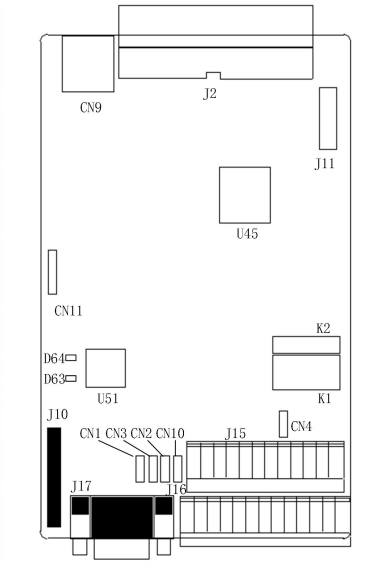


Figure 3-5 . Wiring terminal and connector layout diagram of the main control board (front view)

Terminal and connector layout instructions:

J2 is the connection terminal between the control board and the driver board ; CN9 is the keyboard network port connection terminal ; J11 is the emulator program burning port ; CN11 is the serial port burning port ; J10 is the CAN card connector ; J17 is the resolver connector ; and D63 and D64 are resolver fault indicator lights .

The CN4 connector is shown below. The DI terminal power supply uses the NPN mode internal power supply by default.

CN 1 , CN3, CN2, and CN 10 is as follows:

CN1 is for AI3 voltage or current detection, default voltage setting.

CN3 is the output of AO1 , default voltage setting.

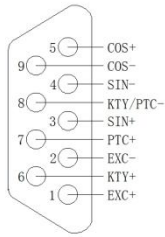
CN2 is the AO2 output, default voltage setting.

CN10 is a resistor connection terminal for 485 communication termination. It is in the OFF position by default and not connected. It is used by the terminal machine in multi-machine communication.

The layout of terminals J15 and J16 is as follows:

	COM	DI1	DI2	DI3	DI4	DI5	COM	+24V	OP	T/A	T/B	T/C
GND	AI1	AI2	AI3	GND	+15V	+10V	AO1	AO2	485+	485-	R/A	R/C

J17 terminal is the resolver connector; PG6 card control terminals and wiring:

Pin Number	Pin Definitions	Function Description	DB9 Upper Terminal Distribution
1	EXC+	Rotary transformer excitation positive	
2	EXC-	Rotary transformer excitation negative	
3	SIN+	Rotary transformer feedback SIN positive	
4	SIN-	Rotary transformer feedback SIN negative	
5	COS+	Rotary transformer feedback COS positive	
6	KTY+	KTY resistor +	
7	PTC+	PTC resistance positive	
8	KTY/PTC-	KTY/PTC resistors -	
9	COS-	Rotary transformer feedback COS negative	
Metal casing	GND	Shielding layer	

Fault description of resolver fault indicator light:

Fault indicator light		Fault status	Causes and solutions to the malfunction
D63	D64		
OFF	OFF	Normal	None
Light	OFF	Phase-locked loop lost lock	The focus of the investigation was on the rotary transformer, which was found to be caused by excessive phase lag .
OFF	Light	The amplitude of the sine and cosine signals exceeds the limit.	Caused by EMC interference, 1) check if the resolver shielding layer is effectively grounded, 2) check if the whole machine is grounded, 3) add a filter kit to the RST input terminal , 4) winding an amorphous magnetic ring for more than 3 turns or a ferrite magnetic ring for more than 6 turns on the resolver line near the whole machine can generally solve the problem effectively .

Fault indicator light		Fault status	Causes and solutions to the malfunction
D63	D64		
Light	Light	The amplitude of the sine and cosine signals is too small.	Check if the resolver cable is connected incorrectly or has a broken wire. If there are no problems, check if the resolver is compatible .

Control terminal function description:

Table 3-3 ES300 Driver Control Terminal Function Description

Category	Terminal Symbol	Terminal Name	Function Description
Power supply	+10V-GND	External + 10V power supply	Provides + 10V power, maximum output current: 10 mA It is generally used as an external power supply for potentiometers, with a resistance range of 1 ~ 5 kΩ .
	+15V	External + 1.5V power supply	It provides a + 1.5V power supply, with a maximum output current of 10mA . It is generally used as a power supply for pressure sensors.
	24V-COM	External + 24V power supply	It provides + 24V power and is generally used as a power supply for digital input/output terminals and external sensors. Maximum output current: 200mA
Analog input	AI1-GND	Analog input terminal 1	1. Input voltage range: DC0~10V 2. Input impedance: 100K Ω
	AI2-GND	Analog input terminal 2	
	AI3-GND	Analog input terminal 3	1. Input range: 0~15V/0~20mA, 16-bit resolution, calibration accuracy 0.5%, the 0~15V or 0~20mA input is determined by the DIP switch AI3 on the control board; 2. Input impedance: 100kΩ for voltage input and 500Ω for current input.
Digital input	DI1-COM	Number input 1	1. Optocoupler isolated, compatible with bipolar input, switchable via DI DIP switch, factory defaults to NPN mode. 2. Input impedance: 3.3 kΩ 3. Voltage range for level input: 9~30V
	DI2-COM	Number input 2	
	DI3-COM	Number input 3	
	DI4-COM	Number input 4	
	DI5-COM	Number input 5	
	OP	Digital input external 24V power supply	The DI circuit can be powered by an external 24V power supply via a jumper cap.

Category	Terminal Symbol	Terminal Name	Function Description
Analog output	AO1-GND	Analog output 1	The voltage or current output is determined by the DIP switches AO1 and AO2 on the control board. Output voltage range: 0~10V ; Output current range: 0~20mA
	AO2 -GND	Analog output 2	
Communication interface	485+/485-	Modbus communication interface	The Modbus communication interface allows you to select whether a communication matching resistor is required via a DIP switch 485.
Relay output 1	T/AT/B	Normally closed terminal	Contact driving capability: AC250V , 3A , COS φ =0.4 . DC30V , 1A
	T/AT/C	Normally open terminal	
Relay output 2	R/A- R/C	Normally open terminal	Contact driving capability: AC250V , 3A , COS φ =0.4 . DC30V , 1A
Keyboard extension cable interface	CN9	External keyboard interface	External keyboard and parameter copy keyboard interface, remove the bidirectional RJ45 connector, and a standard network cable can be used for external extension.

Signal input terminal wiring instructions:

AI analog input terminal:

Because weak analog voltage signals are particularly susceptible to external interference, shielded cables are generally required, and the wiring distance should be as short as possible, not exceeding 20m , as shown in the diagram below. In situations where analog signals are severely interfered with, filter capacitors or ferrite cores need to be added to the analog signal source side.

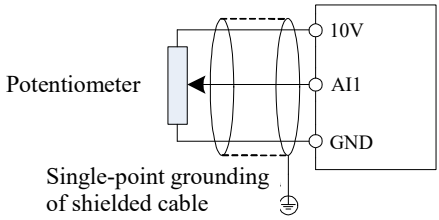


Figure 3-6 . Schematic diagram of analog input terminal wiring

DI digital input terminals:

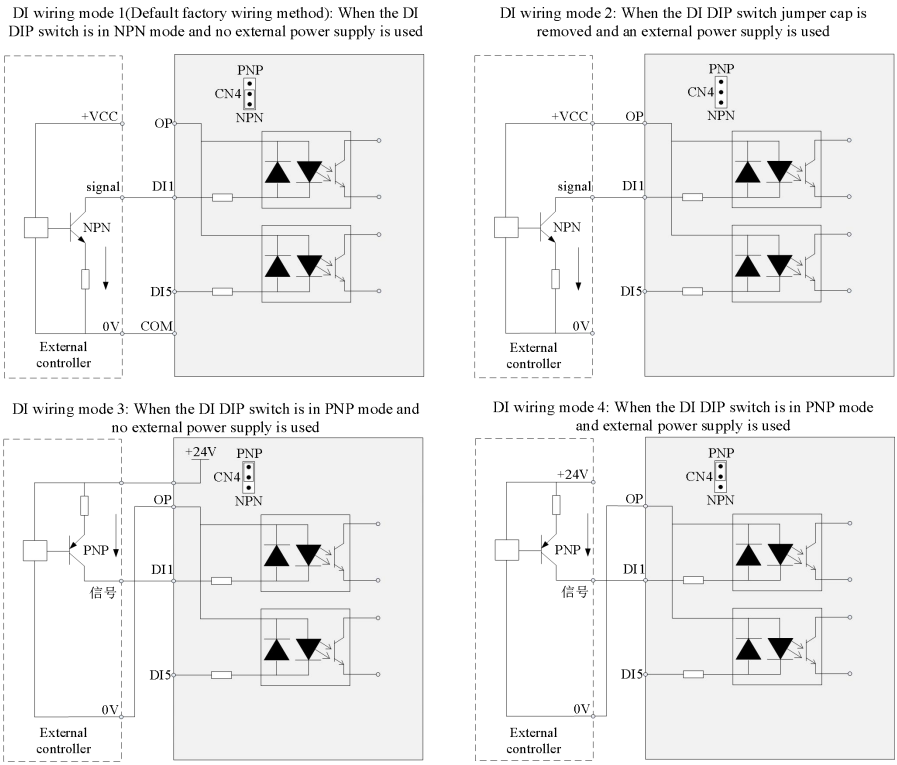


Figure 3-7 . Wiring diagrams for digital input terminals in four different modes

Shielded cables are generally required, and the wiring distance should be as short as possible, not exceeding 20 meters.

When using an active driving method, necessary filtering measures must be taken to address crosstalk in the power supply.

Contact control method is recommended.

When using multiple servo drivers with DI terminals connected in a leaky wiring configuration, as shown in Figure 3-8 , the DI terminals of multiple servo drivers cannot be directly connected in parallel, otherwise it will cause DI malfunction. A diode needs to be connected in series at the anode of the DI terminal (anode connected to DI). The diode must meet the requirements of IF>40mA and VR>40V.

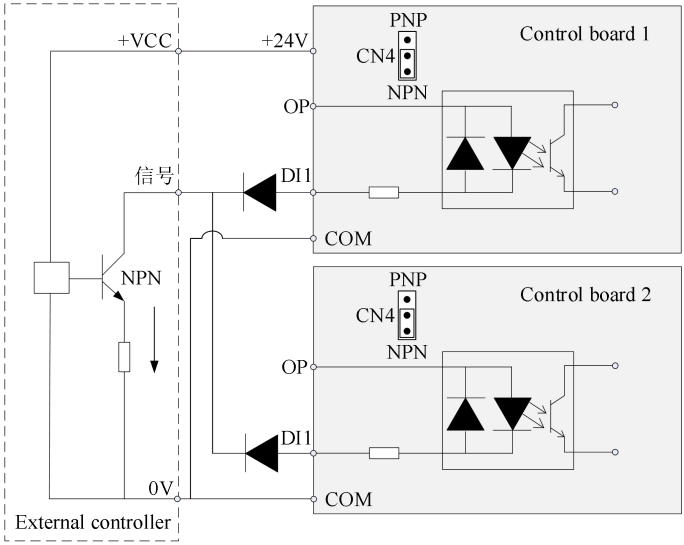


Figure 3-8 . Parallel connection of DI terminals for multiple servo drivers using a leaky wiring method

Chapter 4 Operation and Display

4.1 Introduction to Operation and Display Interface

The control panel allows for the modification of driver parameters, monitoring of driver operating status, and control of driver operation (start and stop). Its appearance and functions are shown in the figure below.

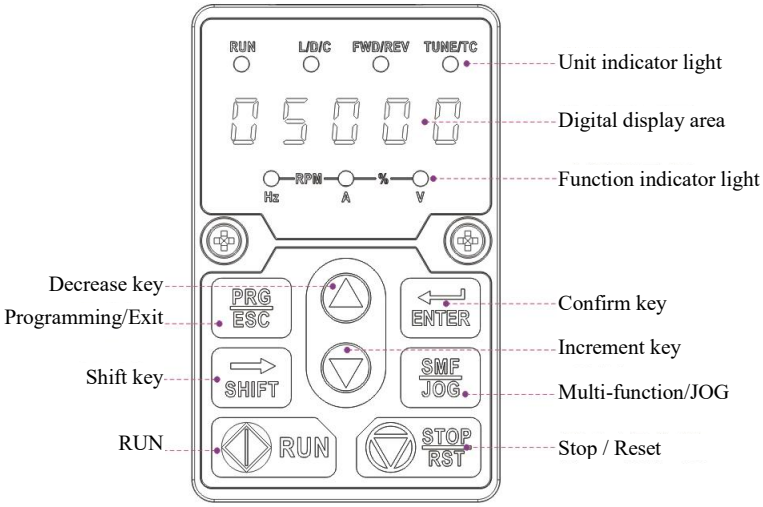


Figure 4-1 . Schematic diagram of the operation panel

4.1.1 Indicator Light Description

Indicator Lights		Name	Description	Color
Unit indicator light	Hz	Frequency unit	Light – Current parameter is frequency value	Green
	A	Unit of electric current	Light – Current parameter is current value	Green
	V	Voltage unit	Light – Current parameter is voltage value	Green
	RPM(Hz+A)	Unit of rotational speed	Light – Current parameter is the engine speed value	Green
	%(Hz+V)	Percentage	Light – Current parameter is a percentage value	Green

Indicator Lights		Name	Description	Color
Function indicator light	RUN	Operating status indicator	Light – the driver is running. OFF – The driver is in a stopped state. Flash – The driver is in sleep mode	Green
	L/D/C	Control mode indicator light	OFF – The driver is in keyboard control mode. Light – The driver is in terminal control mode. Flash – The driver is in remote communication control mode.	Red
	FWD/REV	Running direction indicator	OFF - Forward Rotation State Light - Reverse state Flash – The target frequency is opposite to the actual frequency or is in a reverse operation prohibited state.	Red
	TUNE/TC	Tuning/torque control/fault indicator	Light – Torque Control Flash – Tuning/Fault Status	Red

4.1.2 Keyboard Button Description

Table 4-2 Keyboard Function Table

Button	Name	Function
PRG /ESC	Programming key/Exit	Entering or exiting from the first-level menu, or returning to the parent menu.
ENTER	Confirm button	Enter the menu screen step by step, set parameters and confirm.
∧	Increment key (+)	Increment of data or function code
∨	Decrease key (-)	Decreasing of data or function code
→ SHIFT	shift key	In the shutdown and operation display interfaces, you can cycle through the displayed parameters. See F7-29 and F7-30 for specific display meanings. When modifying parameters, you can select the digit to be modified.
RUN	Run key	In keyboard operation mode, it is used to perform operations.
STOP/RST	Stop / Reset	When running, press this. The key can be used to stop operation; in the event of a fault alarm, it can be used to reset operation. The characteristics of this key are restricted by function code F7-27.
SMF/JOG	Press the run key/arrow keys	F7-28 is set to 0 as the jog button, and F7-28 is set to 1 as the direction button; pressing this button reverses the direction.

4.2 Organization of Driver Function Codes

The meanings of the function code groups of the ES300 driver are shown in the table below:

Function Code Group	Function Description	Description
F0~F9	Basic function parameter group	Basic parameters, terminal functions, keyboard display, fault parameters, and other functions;
FA~FP	Enhanced function parameter group	Modbus parameter settings, user function code customization, initialization and other functions;
A0~A4	Special machine function selection group	Choose to use different professional drive features;
U0~U1	Parameter Viewing Group	U0 is the driver parameter viewing group, and U1 is the servo oil pump parameter reference group, which makes it easy to view the relevant output status.

4.3 Instructions for viewing and modifying function codes

The ES300 driver function code parameters adopt a three-level menu structure, which can be viewed and modified through the operation panel. The three levels of menu are: Function Parameter Group (Level I menu) → Function Code (Level II menu) → Function Code Setting Value (Level III menu). The operation flow is shown in Figure 4-2 . When in the status parameter interface, you can use the “>>” key to view different status parameters.

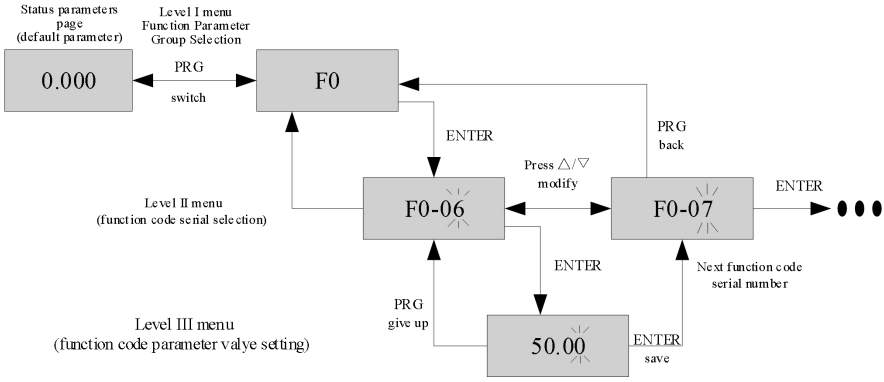


Figure 4-2 . Flowchart of three-level menu operation

Note: When operating within a three-level menu, press the PRG key or ENTER key will return to the second-level menu. However, pressing ENTER key will save the current parameter modify value and move to the next function code; while pressing PRG key is to discard the current parameter modifications.

Example: Change function code F0-04 from 0.00Hz to 5.00Hz .

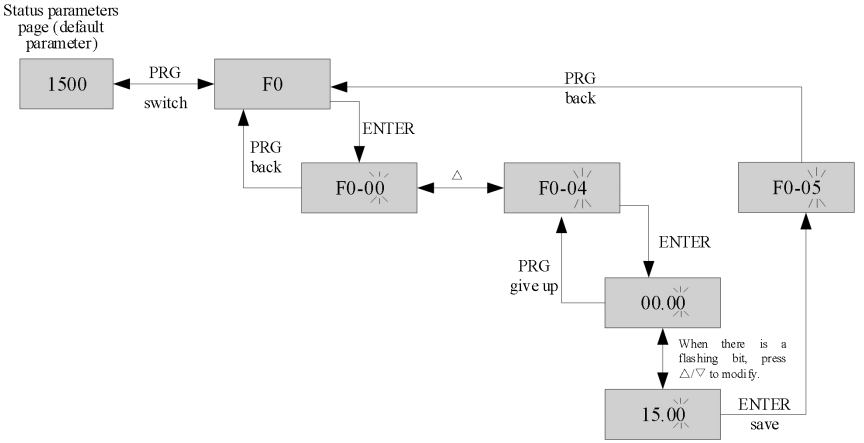


Figure 4-3 . Parameter setting operation flowchart

In the third-level menu state, if the parameter does not flash, it means that the function code parameter value cannot be modified. Possible reasons:

1) This function code represents a parameter that cannot be modified, such as actual detection parameters or runtime record parameters.

2) This function code cannot be modified while the system is running; it can only be modified after the system is stopped.

4.4 Password settings

The drive provides a user password protection function. When FP-00 is set to a non-zero value, it represents the user password. Password protection is activated after returning to the status parameter interface. At this time, pressing the PRG key will display “-----”, showing only the status parameters. You must press the key on the “-----” interface, and the panel will display “00000”. Only after correctly entering the user password can you enter the normal menu to view and set function codes. Otherwise, the panel will display “-----”, and you will not be able to access the function codes.

To disable password protection, you must follow the steps above to log in with a password and set FP-00 to 0.

4.5 Driver start/stop control

4.5.1 Selection of Start/Stop Signal Source

The start/stop control commands for the drive have three sources: panel control, terminal control, and communication control, which can be selected through function parameter F0-02.

	Command sSource Settings		Factory Value: 0	Illustrate
F0-02	Set range	0	Control panel command channel (LED off)	Press the RUN or STOP button to start or stop the machine.
		1	Terminal command channel (LED on)	The DI terminal needs to be defined as the start/stop command terminal.
		2	Serial port command channel (LED flashing)	Use MODBUS-RTU protocol or CAN bus

1) Panel start/stop control

By operating the keyboard, setting function code F0-02 to 0 enables panel start/stop control. Pressing the "RUN" key on the keyboard starts the drive (the RUN indicator light illuminates). While the drive is running, pressing the "STOP" key on the keyboard stops the drive (the RUN indicator light turns off).

Note: Some driver operations can only be performed on the panel: motor parameter self-learning and AI analog quantity zero drift self-learning.

2) Terminal start/stop control

Terminal start/stop control is suitable for applications where sampling toggle switches and electromagnetic switches are used for system start/stop, and is also suitable for electrical designs where the controller controls the driver operation with dry contact signals.

Function codes F4-00 ~ F4-04 determine the input port for the start/stop control signal.

Example: The requirement is to use a toggle switch as the start/stop switch for the drive, with the forward run switch signal connected to port DI1 and the reverse run switch signal connected to port DI2. The usage and setting method is shown in the figure below.

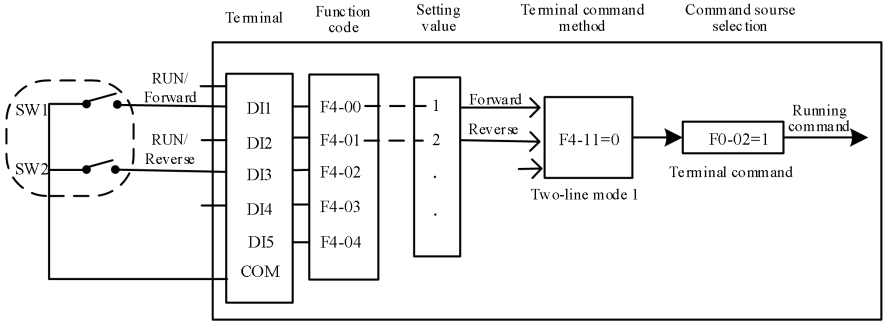


Figure 4-4 . Schematic diagram of terminal control start/ stop

Note: In hydraulic mode, the oil pump is enabled using the DI1 terminal and set to the #1 forward operation function.

3) Communication start/stop control

This application uses RS485 communication to control the drive. Selecting communication mode as the control command source (F0-02=2) allows for communication-based start and stop control of the drive. The relevant function codes for communication settings are shown in the following figure:

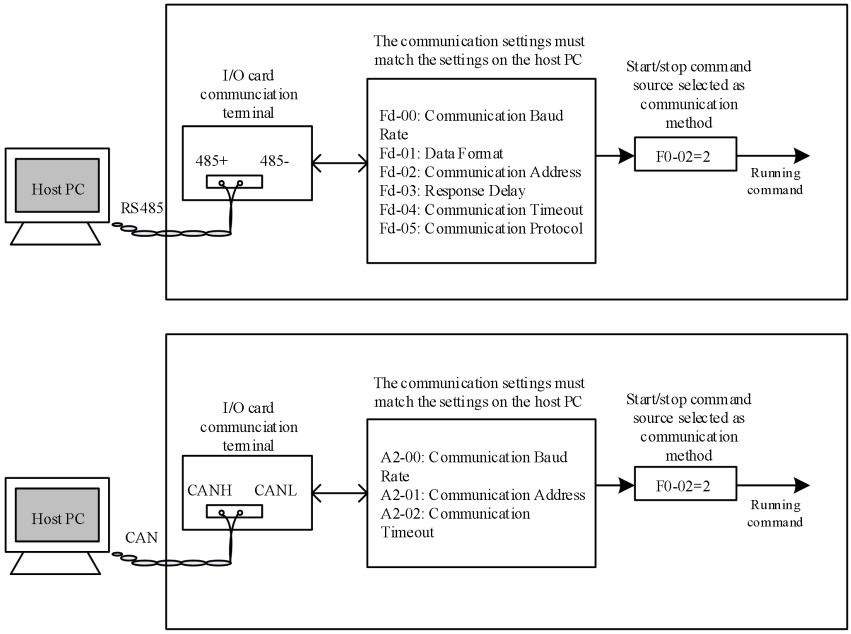


Figure 4-5 . Schematic diagram of communication control start/ stop

4.6 Driver operating frequency control

The ES300 has two control modes: speed mode and hydraulic mode. These can be switched using function code A3-00.

In speed mode, there are six frequency setting methods: digital setting (UP/DN power failure does not remember), digital setting (UP/DN power failure remember), AI1, AI2, AI3, and communication setting, etc. You can select one of them through F0-03.

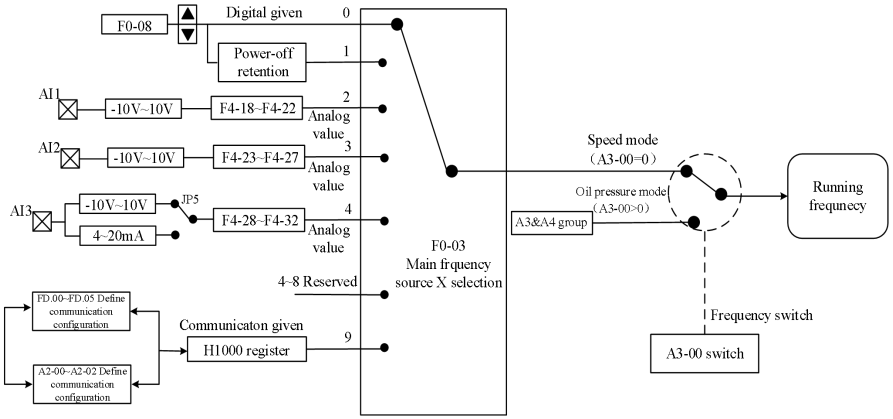


Figure 4-6 . Frequency setting method

The diagram above shows the relevant function codes for each frequency source setting. You can refer to the detailed description of the corresponding function code when setting it.

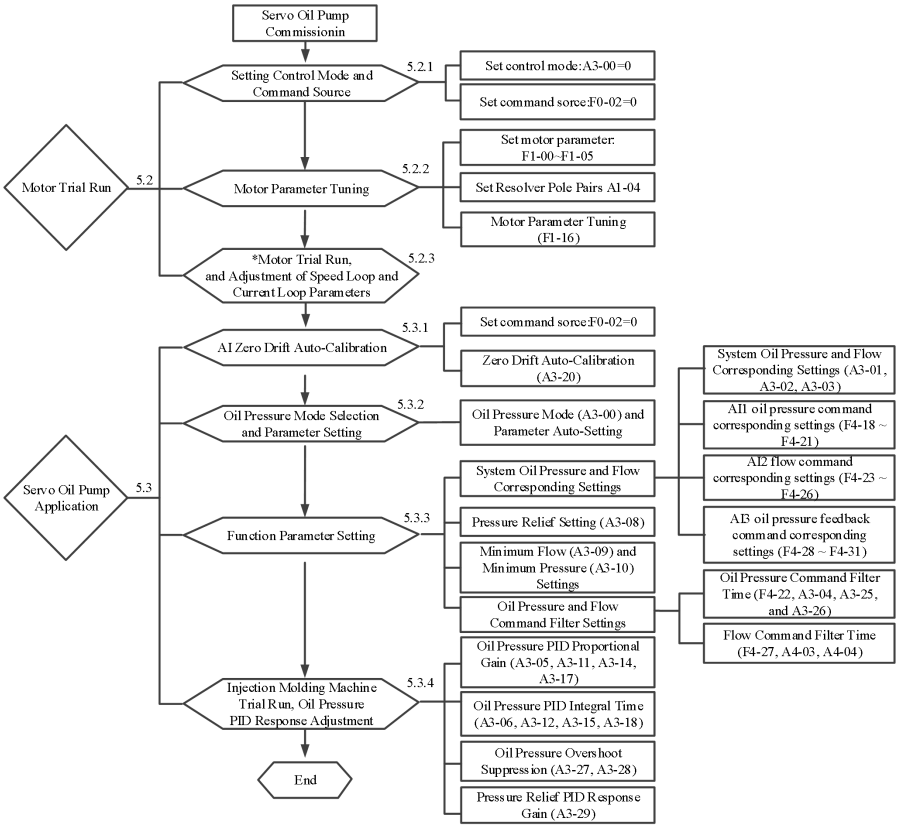
4.7 Setting the motor rotation direction

The ES300 reset to factory settings, setting the motor parameters, after completing the motor self-learning, press the RUN button to drive the motor in the forward direction. If the rotation direction is opposite to the direction required by the device, please disconnect the power (please note that you need to wait for the main capacitor of the driver to discharge completely), swap any two of the wirings on the UVW output lines of the driver, and then perform motor self-learning and test run to eliminate the problem of rotation direction.

Chapter 5 Quick Debugging of Servo Oil Pump

5.1 Servo Oil Pump Debugging Flowchart

Servo oil pump commissioning mainly involves three aspects: motor self-learning, motor trial operation, and servo oil pressure commissioning. The detailed commissioning process is shown in the following figure:



5.2 Motor Trial Run

5.2.1 Trial Operation Procedures

Step	Setting parameters	Parameter Description	Description
1) Set control mode	A3-00=0	Non-hydraulic control mode	Set the drive to non-hydraulic control mode: A3-00="0".
2) Set control mode	F0-02=0	Operation panel control method	At this time, the "LOCAL/REMOT" light on the panel is off.

Step	Setting parameters	Parameter Description	Description
3) Motor parameter self-learning	F1 and A1 group parameters	Motor and encoder parameters	See section 5.2.2 for motor parameter self-learning.
4) Trial operation	F0-08=5.00Hz	Set the trial operation frequency	Operate using the control panel, and monitor whether the output current is normal and whether the motor runs smoothly. See Section 5.2.3 for trial operation checks.

Please ensure that the relief valve is fully opened to ensure that the trial run is without load.

5.2.2 Motor parameter setting and self-learning

1) Parameter settings

The ES300-1 series drive uses closed-loop vector control to drive the servo oil pump. Vector control operation is highly dependent on accurate motor parameters. To ensure good drive performance and operating efficiency, please strictly follow the nameplate parameters of the motor that is compatible with the drive standard. The required motor parameters are as follows:

Motor parameters	Parameter Description	Description
F1-00	Motor type selection	0: Asynchronous motor; 1: Variable frequency asynchronous motor; 2: Synchronous motor.
F1-01~F1-05	Motor rated power / voltage / current / frequency / speed	
A1-04	Number of pole pairs of rotary encoder	Number of pole pairs of rotary encoder
F1-15	back electromotive force	1: Can be obtained directly from the motor manufacturer's manual. 2: If the motor manufacturer cannot obtain the information, dynamic self-learning must be performed to obtain it.
F1-16	Motor self-learning mode selection	There are two self-learning methods: static and dynamic.

2) Motor parameter self-learning

Identification Method	Function Code Settings	Usage
No operation	F1-16=0	After the motor parameters have been learned, the F1-16 parameter value will automatically be restored to “0”.
Static self-learning 1	F1-16=1	This method is used when the back electromotive force of the motor is known. During the self-learning process, the motor will run at low speed, which can be done without opening the overflow valve.

Identification Method	Function Code Settings	Usage
Dynamic self-learning	F1-16=2 or 5	When the back electromotive force of the motor is unknown, the motor runs at high speed during the self-learning process, and the overflow valve must be opened. On-load tuning will affect the accuracy of the motor parameter self-learning and affect the system control effect. When set to 2, the high-speed rotation direction of the motor is clockwise facing the motor shaft; when set to 5, the high-speed rotation direction of the motor is counterclockwise facing the motor shaft.
Static self-learning 2	F1-16=3	When the motor back EMF is known and the motor is used under heavy load, the motor will run at low speed during the self-learning process, which can be performed without opening the overflow valve. Note: If the resolver encoder and motor wiring are correct and the driver alarms "Err43" during static self-learning 1 or dynamic self-learning, please use this mode for learning.
Dynamic self-learning	F1-16=4 or 6	It learns parameters such as motor back EMF and encoder angle in a relatively short time, but the learning accuracy is slightly lower. It is only used to verify whether the motor is demagnetized. During the self-learning process, the motor runs at high speed, and the overflow valve must be opened. When set to 4, the high-speed rotation direction of the motor is clockwise facing the motor shaft; when set to 6, the high-speed rotation direction of the motor is counterclockwise facing the motor shaft.

The self-learning steps for motor parameters are as follows:

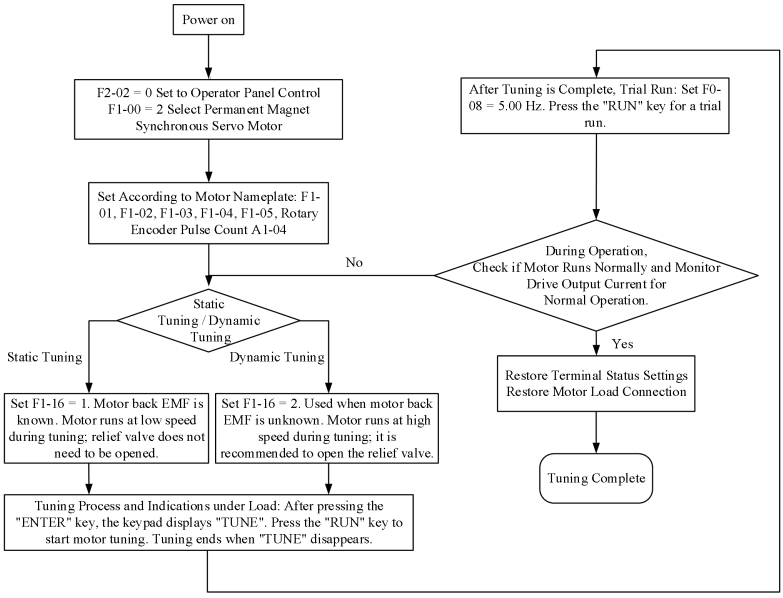


Figure 5-2 Schematic diagram of motor parameter self-learning

5.2.3 Trial operation inspection

1) After the self-learning is completed, set F0-08=5.00Hz for low-speed trial operation and observe whether the driver's operating current is small and stable.

2) If the operating current is high, please check whether the motor parameters (F1 group), resolver PG card type (A1-00) and rotary encoder pole pair number (A1-04) settings are correct. If there are any changes, relearn and run at low speed to check if it is normal.

3) After the self-learning operation is normal, check whether the drive running direction is correct. If it is not correct, please reverse the wiring of any two phases of the motor (UVW) and perform the motor parameter self-learning again.

4) If the motor vibrates or makes a low-pitched sound during operation, please reduce the speed loop and current loop appropriately. For example, decrease the values of F2-00, F2-03, F2-13, F2-14, F2-15, and F2-16, and increase the values of F2-01 and F2-04.

5) If the motor speed is unstable during operation, please appropriately increase the speed loop and current loop. For example, increase the values of F2-00, F2-03, F2-13, F2-14, F2-15, and F2-16, and decrease the values of F2-01 and F2-04.

Remark:

●Please ensure that the relief valve is fully opened to ensure that the trial run is without load.

●For detailed parameters of the speed loop and current loop, please refer to function codes in group F2;

●The speed loop and current loop responses directly affect pressure stability. If conditions permit, please set a strong speed loop and current loop response.

5.3 Servo oil pump application debugging

5.3.1 AI Zero Drift Automatic Correction

Calibration steps	Setting Parameters	Parameter Description	Illustrate
1) Setting the command source method	F0-02=0	Operation panel control method	At this time, the "LOCAL/REMOT" light on the panel is off.
2) AI zero-drift automatic correction	A3-20=1	AI zero-drift automatic correction	The keyboard displays "Alcod". Press the RUN key and the AI zero drift will automatically complete the correction.

Remark:

●Manual calibration can also be performed: with the driver disabled, check the values of the three AI channels U1-04, U1-05, and U1-06, add a margin of 10mV to the maximum value found, and write it into function codes F4-18, F4-23, and F4-28 respectively.

●After the AI zero-drift automatic correction operation is completed, the value of parameter A3-20 will automatically return to “0”.

5.3.2 Hydraulic mode selection and parameter settings

Hydraulic Control Method Selection	Function Code Settings	Instructions for Use
Non-hydraulic control mode	A3-00=0	Speed Mode
Drive hydraulic control mode 1	A3-00=1	The host computer's CAN communication channel provides hydraulic pressure and flow commands, while the AI3 analog channel provides hydraulic pressure feedback commands, enabling the driver to control hydraulic pressure.
Drive hydraulic control mode 2	A3-00=2	The AI1 analog channel provides hydraulic pressure commands, the AI2 analog channel provides flow commands, and the AI3 analog channel provides hydraulic pressure feedback commands. The drive performs hydraulic pressure control.
CAN hydraulic mode (dedicated)	A3-00=3	In the host computer's CAN hydraulic control mode, the parameters of the A3 group servo oil pump control group are invalid.
Reserved	A3-00=4	Reserved
CAN hydraulic mode (dedicated mode 2)	A3-00=5	Customized working methods

When switching from non-hydraulic mode (A3-00=0) to hydraulic mode (A3-00≠0), the relevant parameters will be automatically set, as detailed in the table below.

Modifying the following parameters in hydraulic control mode will result in a power-off memory (the automatic settings will be restored when the drive is powered on again). If you switch from hydraulic control mode to non-hydraulic control mode, the following parameters will be restored to their values before switching to hydraulic control mode.

Function Code	Function Code Explanation	Setting
F0-01	Control method	1 (Vector control method)
F0-02	Command source	1 (Terminal command source)
F0-03	Frequency source	If A3-00 = “2”, then F0-03 = “3” (AI2 is the frequency source); If A3-00 = “1” or “3”, then F0-03 = “9” (communication given as frequency source).
F0-07	Frequency source selection	0 (No auxiliary frequency source)
F0-17	Acceleration time	0.0s
F0-18	Deceleration time	0.0s
F1-00	Motor type selection	2 (Synchronous motor)

Function Code	Function Code Explanation	Setting
F4-00	DI1 terminal function selection	1 (Running Enable)
F4-01	DI2 terminal function selection	48 (Servo oil pump PID selection terminal 1)
F4-02	DI3 Input Function Selection	53 (Select terminal 1 from pump address)
F4-03	DI4 Input Function Selection	9 (Fault Reset)
F4-04	DI5 Input Function Selection	50 (CAN communication enabled)
F5-01	Control board relays (T/A1-T / B1-T/C1) Output Selection	2 (Fault Output)
F5-02	Control board relays (T/A2-T / C2) Output Selection	23 (Dual displacement piston pump swashplate switching NO)
F5-03	Control board relays (T/A3-T / C3) Output Selection	24 (Pressure control status output NC)

5.3.3 Hydraulic function parameter settings

System oil pressure and flow rate settings

1) System flow and pressure settings

Related Function Codes	Parameter Description	Illustrate
A3-01	Maximum speed	Set the maximum operating speed of the motor, which is the motor speed corresponding to 100% of the flow command;
A3-02	System hydraulic pressure	Set the system's maximum pressure, 0 to maximum oil pressure (A3-03).
A3-03	Maximum oil pressure	Set the pressure range of the pressure sensor to correspond to a 0-10Vdc output type pressure sensor.

2) AI1 hydraulic command corresponding settings

Related Function Codes	Parameter Description	Illustrate
F4-18	AI1 minimum input	Minimum voltage input for hydraulic pressure command, corresponding to AI1 zero drift.
F4-19	AI1 minimum input corresponding settings	Minimum hydraulic pressure command, default is 0.0%, i.e., zero pressure.
F4-20	AI1 Maximum Input	The maximum voltage input for hydraulic pressure command is typically 10V.
F4-21	AI1 maximum input corresponding settings	Maximum oil pressure command, 100.0% corresponds to the system oil pressure (A3-02).

Used to set the correspondence between AI1 oil pressure command 0V~10V (or other ranges) and system oil pressure (A3-02);

3) AI2 traffic command corresponding settings

Related Function Codes	Parameter Description	Illustrate
F4-23	AI2 minimum input	Minimum voltage input for flow command, corresponding to AI1 zero drift
F4-24	AI2 minimum input corresponding settings	Minimum data usage command, defaults to 0.0%, which means zero data usage;
F4-25	AI2 maximum input	The maximum voltage input for hydraulic pressure command is typically 10V.
F4-26	AI2 maximum input corresponding settings	Maximum hydraulic pressure command, default 100.0% corresponds to maximum speed (A3-01).

Used to set the correspondence between AI2 flow command 0V~10V (or other ranges) and 0rpm~maximum speed (A3-01);

4) AI3 hydraulic feedback corresponding settings

Related Function Codes	Parameter Description	Illustrate
F4-28	AI3 minimum input	Oil pressure feedback minimum voltage input, corresponding to AI3 zero drift
F4-29	AI3 minimum input corresponding settings	Minimum data usage command, defaults to 0.0%, which means zero data usage;
F4-30	AI3 Maximum Input	The maximum voltage input for hydraulic pressure command is typically 10V.
F4-31	AI3 maximum input corresponding settings	Maximum hydraulic pressure command, default 100.0% corresponds to maximum speed (A3-03).

Used to set the correspondence between the AI3 oil pressure feedback 0V~10V (or other ranges) and the pressure sensor range 0kg/cm~maximum oil pressure (A3-03);

5) Pressure relief setting (parameter number: A3-08)

Related Function Codes	Parameter Description	Illustrate
A3-08	Maximum reverse speed	The maximum reverse speed during depressurization is set as a percentage of the maximum rotational speed (A3-01). This setting determines the maximum reverse speed of the motor. A higher setting results in faster pressure relief, but too high a setting can cause the oil pump to reverse and generate noise; a lower setting results in slower pressure relief.

6. Low current and low pressure settings (parameter numbers: A3-09, A3-10):

Because of internal leakage in the oil pump, when the system does not give flow and pressure commands, the hydraulic oil in the oil circuit will flow back to the oil tank, causing air to enter the oil circuit, resulting in system noise and instability. Therefore, a certain underflow and underpressure are required.

Related Function Codes	Parameter Description	Illustrate
A3-09	Bottom flow	The setting range is 0.0% ~ 50.0%, corresponding to the percentage setting of the maximum speed (A3-01).
A3-10	Bottom pressure	Setting range: 0.0 kg/cm ~ 50.0 kg/cm

7) Oil pressure and flow command filtering time

Hydraulic pressure command filtering time (parameter numbers: F4-22, A3-04, A3-25, A3-26)

Related Function Codes	Parameter Description	Illustrate
F4-22	AI1 Input Sampling Filter	0.000s~10.000s
A3-04	Hydraulic pressure command ramp time	0.000s~2.000s
A3-25	Given oil pressure rise S filter time	0.000s~1.000s
A3-26	Given oil pressure drop S filter time	0.000s~1.000s
A4-10	The injection oil pressure rises to a filter time S, and the filter takes effect when DI48# is 1 and 49# is 0.	1~1.000S
A4-11	The injection oil pressure drops by a filter time S, and the filter takes effect when DI48# is 1 and 49# is 0.	1~1.000S
A4-14	Injection given oil pressure rise time	0~2.000s
A4-15	Injection given oil pressure drop time	0~2.000s

Reducing the filter time results in a faster oil pressure response and a larger overshoot, while reducing the filter time slows down the response and reduces the overshoot.

Flow command filtering time (parameter number: F4-27, A4-04)

Related Function Codes	Parameter Description	Illustrate
F4-27	AI2 input sampling filter	0.000s~10.000s
A4-03	Flow rise filtering time	1~1.000S
A4-04	Flow drop filter time	1~1.000S
A4-12	The injection flow rate rise filter time takes effect when DI48# is 1 and DI49# is 0.	0.001~5.000s
A4-13	The injection flow rate decrease filter time takes effect when DI48# is 1 and DI49# is 0.	0.001~5.000s

Reducing the filtering time results in a faster oil pressure response but also a greater operational shock; conversely, a slower response leads to a smoother operation.

5.3.4 Adjustment of Hydraulic Pressure PID Response

Hydraulic PID mode selection

1) Hydraulic PID Mode 1: DI selects the PID group mode

The driver provides four PID controllers, selected based on the combination of input terminals 48#DI2

and 49#DI3, as follows:

DI3 (49#DI Input Function)	DI2 (48#DI Input Function)	PID Group
0	0	Group 1 PIDs: A3-05, A3-06, A3-07
0	1	Group 2 PIDs: A3-11, A3-12, A3-13
1	0	Group 3 PIDs: A3-14, A3-15, A3-16
1	1	Group 4 PIDs: A3-17, A3-18, A3-19

The larger the proportional gain Kp, the smaller the integral time Ki, and the larger the derivative time Kd, the faster the response. However, an overly fast response can easily cause overshoot, resulting in system oscillation and instability.

Conversely, the smaller the proportional gain Kp, the larger the integral time Ki, and the smaller the derivative time Kd, the slower the response. A slow response can easily lead to decreased efficiency and product instability.

2) Hydraulic pressure PID proportional gain (parameter numbers: A3-05, A3-11, A3-14, A3-17)

A higher proportional gain results in a faster pressure response, but too high a gain can cause system oscillations; conversely, a lower proportional gain results in a slower pressure response. As shown in the figure below:

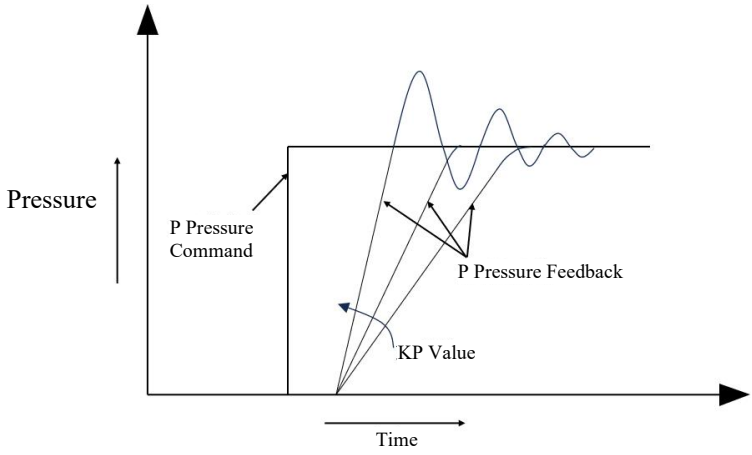


Figure 5-3 Oil pressure PID proportional gain

3) Hydraulic pressure PID integral time (parameter numbers: A3-06, A3-12, A3-15, A3-18)

A shorter integration time results in a faster pressure response, but it can easily lead to overshoot, and too strong an integration time can cause system oscillations; conversely, a longer integration time results in a slower pressure response, and too weak an integration time can lead to pressure instability. As shown in the figure below:

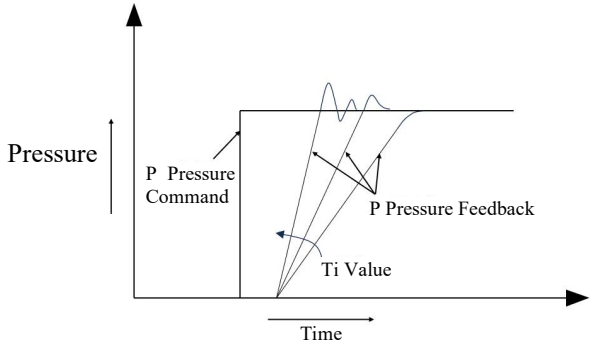


Figure 5-4 Oil pressure PID integral time

4) Oil pressure overshoot suppression (parameter numbers: A3-27/A4-16, A3-28/A4-17)

Suitable for suppressing overshoot at relatively high speeds:

Overshoot suppression detection level (A3-27/A4-16): The larger this value is, the later the pressure suppression overshoot takes effect, the worse the overshoot suppression effect becomes, and the larger the overshoot will be; conversely, the suppression takes effect quickly, the suppression effect is good, and the overshoot is smaller.

Overshoot suppression coefficient (A3-28/A4-17): The larger this value is, the better the pressure overshoot suppression effect. Too large a value will cause the pressure curve to be uneven and will be folded. Conversely, the suppression effect is worse and the overshoot is larger.

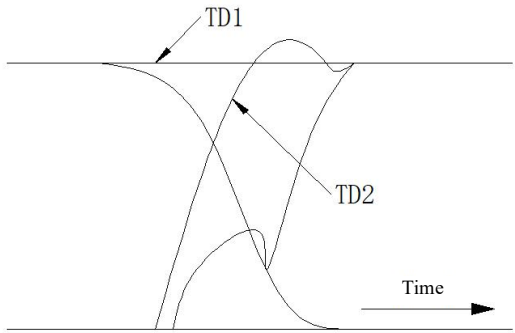


Figure 5-5 Suppression of oil pressure overshoot

5) Hydraulic ring PID response gain (parameter number: A3-29)

The hydraulic ring gain is used to adjust the response of the entire hydraulic ring control. The greater the hydraulic ring gain, the stronger the response of the entire hydraulic ring, but too strong a response will cause system oscillation. Conversely, the smaller the hydraulic ring gain, the slower the response of the entire hydraulic ring.

When the hydraulic system has a large inertia or the oil pipe is long and thin, this gain generally needs to be reduced.

5.3.5 Pressure Holding Stability Adjustment

If large fluctuations in the holding pressure are found during the debugging process, please enhance the low-speed loop response to improve pressure stability. That is, appropriately increase or decrease the parameter value, and pay attention to the appropriate adjustment range, otherwise the motor control will oscillate.

Chapter 6: Fault Diagnosis and Countermeasures

6.1 Fault alarms and countermeasures

If a fault occurs during system operation, the driver will immediately protect the motor and stop output, and the corresponding driver fault relay contacts will activate. The driver panel will display the fault code. The corresponding fault types and common solutions are detailed in the table below. The information listed in the table is for reference only; please do not attempt to repair or modify the system yourself. If you are unable to resolve the fault, please seek technical support from our company or your product distributor.

Table 6-1 Fault alarms and countermeasures

Fault Name	Panel Display	Troubleshooting	Troubleshooting Strategies
Overcurrent during acceleration	Err02	1) There is a ground fault or short circuit in the driver output circuit. 2) Incorrect motor parameters 3) Acceleration time is too short 4) V/F torque boost or inappropriate curve 5) Input voltage is too low 6) Start the rotating motor 7) Sudden load increase during acceleration 8) The driver selection is too small.	1) Troubleshoot external faults 2) Check parameters and identify parameters. 3) Increase acceleration time 4) Adjust V/F to increase torque or curve 5) Adjust the voltage to the normal range. 6) Select speed tracking start or wait for the motor to stop before starting. 7) Cancel sudden load increases 8) Select a driver with a higher power rating.
Overcurrent during deceleration	Err03	1) There is a ground fault or short circuit in the driver output circuit. 2) Incorrect motor parameters 3) The deceleration time is too short 4) Input voltage is too low 5) Sudden load during deceleration 6) No braking unit and braking resistor 7) Excessive flux braking gain	1) Troubleshooting external faults 2) Motor parameter identification 3) Increase deceleration time 4) Adjust the voltage to the normal range. 5) Cancel sudden load increase 6) Add braking unit and resistor 7) Reduce magnetic flux braking gain

Fault Name	Panel Display	Troubleshooting	Troubleshooting Strategies
Overcurrent during constant speed operation	Err04	1) There is a ground fault or short circuit in the driver output circuit. 2) Incorrect motor parameters 3) Input voltage is too low 4) Is there a sudden increase in load during operation? 5) The driver selection is too small.	1) Troubleshooting external faults 2) Check parameters and identify parameters 3) Adjust the voltage to the normal range. 4) Cancel sudden load increase 5) Select a driver with a higher power rating
Overvoltage during acceleration	Err05	1) Input voltage too high 2) During acceleration, an external force drives the motor to run. 3) Acceleration time is too short 4) No braking unit and braking resistor 5) Incorrect motor parameters	1) Adjust the voltage to the normal range. 2) Cancel additional power or add braking resistor 3) Increase acceleration time 4) Add braking unit and resistor 5) Check parameters and identify parameters
Overvoltage during deceleration	Err06	1) Input voltage too high 2) During deceleration, an external force drives the motor to run. 3) The deceleration time is too short 4) No braking unit and braking resistor	1) Adjust the voltage to the normal range. 2) Cancel additional power or add braking resistor 3) Increase deceleration time 4) Add braking unit and resistor
Overvoltage during constant speed operation	Err07	1) Input voltage too high 2) During acceleration, an external force drives the motor to run.	1) Adjust the voltage to the normal range. 2) Cancel additional power or add braking resistor
Soft start resistor overload	Err08	1) Soft start relay failure	1) Check if the soft start signal is normal; 2) Check if the soft start relay is working properly .
Undervoltage fault	Err09	1) Momentary power outage 2) The driver input voltage is not within the specified range. 3) Abnormal bus voltage 4) The rectifier bridge and buffer resistor are not functioning properly. 5) Driver board malfunction 6) Control board malfunction	1) Reset fault 2) Adjust the voltage to the normal range 3) Seeking technical support

Fault Name	Panel Display	Troubleshooting	Troubleshooting Strategies
Drive overload fault	Err10	1) Is the load too large or is the motor stalled? 2) The driver selection is too small.	1) Reduce the load and check the condition of the motor and machinery. 2) Select a driver with a higher power rating
Input phase loss fault	Err12	1) Three-phase input power supply is abnormal. 2) Driver board malfunction 3) Lightning protection board malfunction 4) Main control board malfunction	1) Check and eliminate problems in the external lines. 2) Seeking technical support
Output phase loss fault	Err13	1) The driver to motor lead wire is faulty. 2) The three-phase output of the driver is unbalanced when the motor is running. 3) Driver board malfunction 4) Module exception	1) Troubleshooting external faults 2) Check if the three-phase windings of the motor are normal and troubleshoot the problem. 3) Seeking technical support
Module overheating	Err14	1) High ambient temperature 2) Duct blockage 3) Fan Damage 4) Module thermistor damaged 5) Inverter module damaged	1) Lower the ambient temperature 2) Clean the air duct 3) Replace the fan 4) Replace the thermistor 5) Replace inverter module
External faults	Err15	1) Input an external normally open or normally closed fault signal via the multi-function DI terminal.	1) Fault Reset
Modbus fault	Err16	1) Is the host computer working? 2) Is the communication connection normal? 3) Is the communication parameter group F8 correct?	1) Check the wiring of the host computer, etc. 2) Check communication wiring 3) Check F8 group parameters
Contactor failure	Err17	1) Check if the driver board and power supply are working properly; 2) Check if the contactor is working properly.	1) Replace the driver board or power board; 2) Replace the contactor; 3) Seeking technical support
Current detection Fault	Err18	1) Are the internal wiring connections of the VFD loose? 2) Is the current sensing device functioning properly? 3) Is the main control board or driver board functioning properly?	1) Check wiring 2) Seeking technical support

Fault Name	Panel Display	Troubleshooting	Troubleshooting Strategies
Motor tuning Fault	Err19	1) Check whether the motor parameters are set according to the markings on the motor nameplate; 2) Did the motor parameter tuning process time out?	1) Set the motor parameters correctly; 2) Check the leads from the VFD to the motor;
Radiator temperature sensor malfunction	Err20	1) Check if both ends of the ribbon cable are loose; 2) The radiator temperature sensor is damaged.	1) Re-plug the ribbon cable; 2) Check the temperature sensor cable; 3) Seek technical support .
EEPROM failure	Err21	Main control board malfunction.	1) Replace the main control board; 2) Seek technical support.
short circuit to ground Fault	Err23	Motor short circuit to ground	Replace cable or motor
Runtime reached	Err26	1) Check if F7-09 (cumulative running time) is greater than or equal to F8-17 (set running time arrival time).	1) Set F8-17 to a larger value or set it to 0; 2) Seek technical support.
Business operation time arrives	Err27	1) Check if FA-08 (cumulative business operation time) is greater than or equal to FA-01/03/05/07 (set business operation time).	1) Obtain the runtime protection password FA-00/02/04/06 from the supplier, and add FA-01/03/05/07. 2) Seek technical support.
Wave-by-wave current limiting Fault	Err40	1) Check the driver output circuit for grounding or short circuits; 2) Were the motor parameters correctly tuned? 3) Is the acceleration/deceleration time too short? 4) Check if the driver input voltage is too low; 5) Is there any load being added during operation? 6) Whether it is equipped with a braking unit and a braking resistor;	1) Troubleshoot external faults; 2) Perform motor parameter tuning; 3) Increase acceleration/deceleration time; 4) Adjust the input voltage to the normal range; 5) Cancel sudden load increases; 6) Add a braking unit and braking resistor; 7) Reduce the load; 8) Increase the drive capacity class; 9) Seek technical support.

Fault Name	Panel Display	Troubleshooting	Troubleshooting Strategies
CAN communication interruption fault	Err42	1) Check if the CAN communication parameter settings are correct (A2-00, A2-01). 2) Check that the CAN communication line connections are good; 3) Check if the CAN+/CAN- wires are reversed; 4) Is the CAN communication conforming to the specifications, or is it too long or too thin?	1) Set the correct communication parameters; 2) Reinforce the CAN communication line; 3) Correct incorrect wiring; 4) Replace with a communication cable that meets the required specifications; 5) Seek technical support.
Motor parameter identification encoder Fault	Err43	1) Check if the encoder model matches; 2) Check the encoder wiring and installation for errors; 3) Check if the motor parameters are set correctly; 4) Does the problem persist after replacing the PG card?	3) Select the matching encoder; 4) Eliminate wiring errors; 5) Reinstall the encoder correctly; 6) Replace the PG card; 7) Seek technical support.
Excessive speed deviation fault	Err44	1) Check the encoder installation and ensure the wiring is secure. 2) Check if the motor power cable is loose; 3) Does the problem persist after replacing the PG card?	1) Re-secure the wiring or motor power cable; 2) Replace the PG card; 3) Seek technical support.
Motor overheating fault	Err45	1) Check if there are any errors in the wiring of the motor overheat protection PTC; 2) Check if the motor temperature is overheating; 3) Does a fault report occur after shorting the PTC-P and PTC-N terminals? 4) Does it work normally after replacing the terminal block?	1) Eliminate wiring errors; 2) Reduce motor load, add cooling fans, and increase motor capacity; 3) Replace the terminal block; 4) Seek technical support.
Oil pressure sensor Fault	Err46	1) Check if there are any errors in the oil pressure sensor wiring; 2) Check if the power supply to the oil pressure sensor is normal; 3) Check if the oil pressure sensor output is normal; 4) Does it work normally after replacing the terminal block?	1) Eliminate wiring errors; 2) Troubleshoot the power supply failure; 3) Replace the oil pressure sensor; 4) Replace the terminal block; 5) Seek technical support.

Fault Name	Panel Display	Troubleshooting	Troubleshooting Strategies
Slave failure during multi-pump confluence	Er47	Check if the slave device reports a fault.	1.Investigate the cause of the slave device malfunction and resolve slave failure. 2.Seek technical support.
CAN address conflict when multiple pumps are combined	Er48	Are the CAN station addresses set to be the same?	1) Check the address of each CAN station. If there are any CAN addresses that are the same, reset them. 2) Seeking technical support
Resolver PG wire breakage fault	Err49	1) Check if the PG card and resolver connector are detached; 2) Check that the connection between the resolver and the PG card is correct; 3) Try replacing the PG card to see if it works properly.	1) Eliminate wiring errors; 2) Troubleshoot PG card malfunction; 3) Seek technical support.
Multi-pump confluence and multi-master fault	Err 52	Check if multiple hosts exist in multi-pump mode.	1) Check for incorrect parameter settings; 2) Seek technical support.
Parameter recovery error	Err58	1) Check if it's a new machine or new software; 2) Check if user parameters have been stored .	1) User parameters have not been stored yet; 2) After correctly setting the parameters, save the user parameters (FP-04 Enter password, FP-05 == 1 Save user parameters); 3) Seek technical support.
Back EMF tuning fault	Err59	1) Check if the motor parameters for group F1 are set correctly; 2) Replace with a motor of the same type for testing to confirm whether the motor has been demagnetized.	1) Set the correct motor parameters. 2) Replace the motor and contact the manufacturer for assistance in finding the cause of the demagnetization. 3) Seek technical support.
Brake pipe long-term braking protection fault	Err61	1) Check if the bus voltage is higher than the braking voltage for an extended period of time; 2) Is the braking protection time setting too short?	1) Try braking with the braking unit; 2) Increase the braking protection time and observe whether the braking resistor is overheating. If it is overheating, a higher power braking resistor needs to be replaced. 3) Seeking technical support

Fault Name	Panel Display	Troubleshooting	Troubleshooting Strategies
Reverse running time reached	Err63	1) Check if the traffic drop time setting is too short; 2) Is the hydraulic pressure command descent time too short?	1) Increase the flow rate drop time; 2) Increase the descent time of the hydraulic pressure command; 3) Seek technical support.
Pressure sensor voltage out of range	Err65	Check that the AI3 voltage is greater than the set value of A3-57 or less than the set value of A3-58.	1) Check if the parameter settings are correct; 2) Check if there are any abnormalities in the AI3 wiring .
Overspeed malfunction (overspeed)	Err66	1) Check the encoder installation and ensure the wiring is secure. 2) Check if the motor power cable is loose; 3) Does the problem persist after replacing the PG card?	1) Re-secure the wiring or motor power cable; 2) Replace the PG card; 3) Seek technical support.

6.2 Common Faults and Troubleshooting Methods

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

Serial NO.	Fault Phenomenon	Possible Reasons	Solution
1	No display after power-on	1) The servo driver input power is not available. 2) The 8-core ribbon cable connecting the driver board and the control board has poor contact. 3) Damage to internal components of the servo driver.	1) Check the input power supply. 2) Re-plug the 8-core ribbon cable. 3) Seek manufacturer services.
2	Power-on display HC	1) The 4-core ribbon cable connecting the driver board and the control board has poor contact. 2) Other components of the servo driver are damaged.	1) Re-plug the 4-core ribbon cable. 2) Seek manufacturer services.
3	Power-on display shows “Err 23” alarm.	1) The motor or output line is short-circuited to ground. 2) The servo driver is damaged.	1) Use a megohmmeter to measure the insulation of the motor and output wires. 2) Seek manufacturer services.

Serial NO.	Fault Phenomenon	Possible Reasons	Solution
4	The servo drive displays “normal” upon power-up, but after running, it displays “HC” and immediately stops.	The fan is damaged or stalled.	Replace the fan.
5	Frequent Err14 (module overheating) fault reports	1) The carrier frequency setting is too high. 2) The fan is damaged or the air duct is blocked. 3) Damage to internal components of the servo driver (thermocouple or other).	1) Reduce carrier frequency (F0-15) 2) Replace the fan and clean the air duct. 3) Seek manufacturer services.
6	The motor does not turn after the servo driver is running.	1) The motor is damaged or stalled. 2) Incorrect parameter settings (mainly for F1 group motor parameters)	1) Replace the motor or eliminate mechanical faults. 2) Check and reset the parameters of group F1.
7	DI terminal failure.	1) Incorrect parameter settings. 2) The 24V / OP DIP switch is set incorrectly . 3) Control board malfunction.	1) Check and reset the relevant parameters of group F4 . 2) Reconnect the wiring. 3) Seek manufacturer services.
8	During closed-loop vector control, the motor speed cannot be increased.	1) The encoder is damaged or the wiring is incorrect. 2) Damage to internal components of the servo driver.	1) Replace the encoder and reconfirm the wiring. 2) Seeking services.
9	The servo driver frequently reports overcurrent and overvoltage faults.	1) Incorrect motor parameter settings. 2) The acceleration / deceleration times are inappropriate. 3) Load fluctuations.	1) Reset the parameters of group F1 or perform motor tuning. 2) Set appropriate acceleration and deceleration times. 3) Seek manufacturer services.
10	Powering on (or running) reports Err 17	1) The soft starter contactor did not engage.	1) Check if the contactor cable is loose; 2) Check if the contactor is faulty; 3) Check if there is a fault in the 24V power supply to the contactor; 4) Seek manufacturer services.

Appendix A Motor Selection Reference Table

This chapter provides guidance on selecting servo motors. If you have any questions, please seek technical support from your product distributor.

Electro-Hydraulic Servo Complete Set Models	Driver Model	Motor Model	Rated Power	Rated Current	Rated Torque	Rated Rotation Speed	Rated Frequency	Kt
			(kW)	(A)	(Nm)	(rpm)	(Hz)	Hot State
ES318S55-011B-17F	ES300-4T011B	ES18S55-17F-4JR1	9.8	18.5	55	1700	113.3	2.97
ES318S65-011B-17F	ES300-4T011B	ES18S65-17F-4JR1	11.5	21.3	65	1700	113.3	3.05
ES318S70-015B-17F	ES300-4T015B	ES18S70-17F-4JR1	12.5	22.5	70	1700	113.3	3.1
ES318S80-015B-17F	ES300-4T015B	ES18S80-17F-4JR1	15	28.3	84	1700	113.3	2.97
ES318S90-015B-17F	ES300-4T015B	ES18S90-17F-4JR1	16	29.5	90	1700	113.3	3.05
ES318S105-018B-17F	ES300-4T018B	ES18S105-17F-4JR1	18.7	35.3	105	1700	113.3	2.97
ES318S110-018B-17F	ES300-4T018B	ES18S110-17F-4JR1	19.6	35.7	110	1700	113.3	3.08
ES318S130-022B-17F	ES300-4T022B	ES18S130-17F-4JR1	23	44.8	129	1700	113.3	2.88
ES318S140-030B-17F	ES300-4T030B-T	ES18S140-17F-4JR1	25	46	140	1700	113.3	3.04
ES318S155-030B-17F	ES300-4T030B-T	ES18S155-17F-4JR1	27.8	53.3	156	1700	113.3	2.93
ES318S160-030B-17F	ES300-4T030B-T	ES18S160-17F-4JR1	29	53.5	163	1700	113.3	3.05
ES318S180-037B-17F	ES300-4T037B-T	ES18S180-17F-4JR1	31.3	61.5	176	1700	113.3	2.86
ES318S190-030B-17F	ES300-4T030B-T	ES18S190-17F-4JR1	33.8	59.7	190	1700	113.3	3.18
ES318S200-037B-17F	ES300-4T037B-T	ES18S200-17F-4JR1	36.5	70	205	1700	113.3	2.93
ES325S225-037B-17F	ES300-4T037B-T	ES25S225-17F-4JR1	38.8	74	218	1700	113.3	2.95
ES325S250-045B-17F	ES300-4T045B-T	ES25S250-17F-4JR1	44	83.5	247	1700	113.3	2.96
ES325S300-055B-17F	ES300-4T055B-T	ES25S300-17F-4JR1	50.2	95	282	1700	113.3	2.97

Electro-Hydraulic Servo Complete Set Models	Driver Model	Motor Model	Rated Power	Rated Current	Rated Torque	Rated Rotation Speed	Rated Frequency	Kt
			(kW)	(A)	(Nm)	(rpm)	(Hz)	Hot State
ES325S340-055B-17F	ES300-4T055B-T	ES25S340-17F-4JR1	59.8	110	336	1700	113.3	3.05
ES325S370-075B-17F	ES300-4T075B-T	ES25S370-17F-4JR1	64.6	126	363	1700	113.3	2.88
ES325S440-075B-17F	ES300-4T075B-T	ES25S440-17F-4JR1	76	146	427	1700	113.3	2.92
ES325S500-093B-17F	ES300-4T093B-T	ES25S500-17F-4JR1	86.3	168	485	1700	113.3	2.89
ES325S560-093B-17F	ES300-4T093B-T	ES25S560-17F-4JR1	96.1	183	540	1700	113.3	2.95
ES335S630-110B-17F	ES300-4T110B-T	ES35S630-17F-4JR1	112	206	630	1700	170	3.05
ES335S630-132-20F	ES300-4T132	ES35S630-20F-4JR1	130	229	622	2000	200	2.72

Appendix B Optional Card

1. Mechanical Installation of CAN Card

Installation Method

1) Please install with the VFD completely powered off;

2) Open the terminal cover;

3) Align the CAN expansion card with the expansion card interface and positioning hole of the VFD control board;

4) Secure with screws.

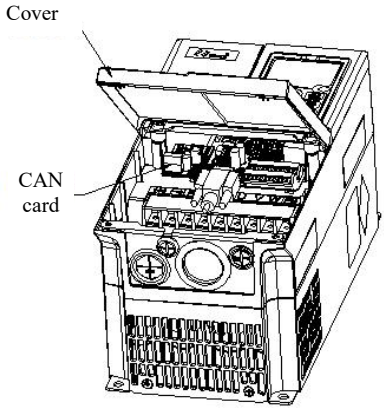


Figure B-1. CAN Card Installation Method

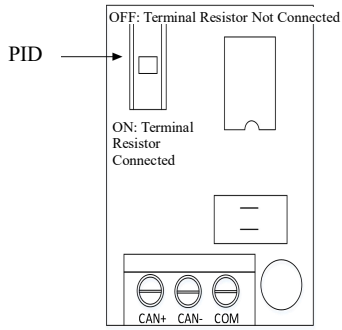


Figure B-2. Schematic diagram of CS680-CAN card

2. CAN Card Terminal Function Description

Terminal Markings	Function	Response Speed	Remark
CAN+	High-level CAN bus	0~500 kbps	——
CAN-	Low-level CAN bus	0~500 kbps	——
COM	Common terminal		——
Remark: 1. The CN2 DIP switch is used for terminating resistor matching (120Ω). Switching to OFF: no terminating resistor is connected; switching to ON: terminating resistor is connected. The factory default is no terminating resistor is connected.			

Appendix C Functional Parameter Table

Function Code	Name	Setting Range	Mini Unit	Factory Value	Change	COMM Address
Group U0 - Driver Parameter Viewing Group						
U0-00	Operating frequency	0.00Hz to maximum frequency (F0-10)	-	-	●	7000
U0-01	Set frequency	0.00Hz to maximum frequency (F0-10)	-	-	●	7001
U0-02	bus voltage	0V~830V	-	-	●	7002
U0-03	Output voltage	0V~Rated voltage of motor (F1-02)	-	-	●	7003
U0-04	Output current	0.1A~6553.5A	-	-	●	7004
U0-05	Output power	0.4kW~1000.0kW	-	-	●	7005
U0-06	Output torque	0.0%~500.0%	-	-	●	7006
U0-07	Local DI/output relay status		-	-	●	7007
U0-08	Extended DI/output relay status		-	-	●	7008
U0-09	AI1 voltage (after correction)	-10.00V~10.000V	-	-	●	7009
U0-10	AI2 voltage (after correction)	-10.00V~10.000V	-	-	●	700A
U0-11	AI3 voltage (after correction)	-10.00V~10.000V	-	-	●	700B
U0-30	AI1 voltage (before calibration)	-10.00V~10.000V	-	-	●	701E
U0-31	AI2 voltage (before calibration)	-10.00V~10.000V	-	-	●	701F
U0-32	AI3 voltage (before calibration)	-10.00V~10.000V	-	-	●	7020
U0-34	AO1 output voltage	0.000V~10.000V	-	-	●	7022
U0-35	AO2 output voltage	0.000V~10.000V	-	-	●	7023
Group U1 - Driver Oil Pump Parameter Viewing Group						
U1-00	Real-time angle	0.0°~359.9°	-	-	●	7100

Function Code	Name	Setting Range	Mini Unit	Factory Value	Change	COMM Address
U1-01	Given oil pressure	0.0kg~System hydraulic pressure (A3-02)	-	-	●	7101
U1-02	Feedback oil pressure	0.0kg~Maximum hydraulic pressure (A3-03)	-	-	●	7102
U1-03	Motor operating speed	-9999rpm~30000rpm	-	-	●	7103
U1-04	AI1 analog voltage	-10.00V~10.000V	-	-	●	7104
U1-05	AI2 analog voltage	-10.00V~10.000V	-	-	●	7105
U1-06	AI3 analog voltage	-10.00V~10.000V	-	-	●	7106
U1-07	AI1 analog zero drift	-10.00V~10.000V	-	-	●	7107
U1-08	AI2 analog zero drift	-10.00V~10.000V	-	-	●	7108
U1-09	AI3 analog zero drift	-10.00V~10.000V	-	-	●	7109
U1-10	Given flow	0.00Hz~maximum frequency (F0-10)	-	-	●	710A
U1-11	Resolver signal interference level	0~1000 (resolver broken wire)	-	-	●	710B
U1-12	Upper computer hydraulic pressure command	0.0kg~System hydraulic pressure (A3-02)	-	-	●	710C
U1-13	CAN communication interference status	0~128 (128 indicates disconnection)	-	-	●	710D
U1-14	CAN transmit count	0~65535	-	-	●	710E
U1-15	Number of CAN receivers	0~65535	-	-	●	710F
U1-16	CAN buffer utilization	0~1.00%	-	-	●	7110

Function Code	Name	Setting Range	Mini Unit	Factory Value	Change	COMM Address
Group A0 - Weak magnetic and SVC Control Group						
A0-00	Weak magnetic control method	0: Weak magnetic method 0 1: Weak magnetic method 1 2: Weak magnetic method 2 3: Weak magnetic method 3	1	3	★	A000
A0-01	Weak magnetic current coefficient	0~500	1	10	★	A001
A0-02	Synchronous machine field weakening depth	0~50%	1%	3%	★	A002
A0-03	Synchronous machine maximum output adjustment	20%~300%	1%	100%	★	A003
A0-04	Synchronous machine calculates excitation current and adjusts gain	40%~200%	1%	115%	★	A004
A0-08	Maximum ouput current	40%~210%	1%	200%	☆	A008
A0-17	Overload protection mode	0: Overload protection mode1 1: Overload protection mode2 2: Overload protection mode3	1	1	☆	A011
A0-19	Carrier frequency limitation	0: Disable 1: Enable	1	1	☆	A013
Group A1 - PG Card Group						
A1-00	Rotation PG card type	0: Rotating PG6 card 1: Rotating PG4 card 2: Standard ABZ encoder	1	0	★	A100
A1-02	Encoder installation angle	0.0°~359.9°	0.1°	0.0°	☆	A102
A1-03	Speed feedback inversion	0: Consistent 1: On the contrary	1	0	★	A103

Function Code	Name	Setting Range	Mini Unit	Factory Value	Change	COMM Address
A1-04	Number of pole pairs of a rotary transformer	1~50	1	1	★	A104
A1-05	Resolver wire breakage fault detection time	0.000: Detection invalid 0.001s~60.000s	0.001s	1.500s	☆	A105
A1-06	Encoder line count	0~65535	1	1024	★	A106
Group A2 - CAN Communication Group						
A2-00	Baud rate selection	0:20K 1:50K 2:125K 3:250K 4:500K 5:1M	1	3	☆	A200
A2-01	CAN communication address	1~15	1	1	☆	A201
A2-02	CAN continuous communication time	0.0s (Invalid) 0.1s~600.0s	0.1s	0.5s	☆	A202
A2-03	CAN multi-pump mode	0: Broadcast Mode 1: Multi-master mode	1	0	☆	A203
A2-04	CAN slave address 1	0~65535	1	0	☆	A204
A2-05	CAN slave address 2	0~65535	1	0	☆	A205
A2-06	CAN slave address 3	0~65535	1	0	☆	A206
A2-07	CAN slave address 4	0~65535	1	0	☆	A207
Group A3 - Servo Oil Pump Control Group						
A3-00	Hydraulic control mode	0: Non-hydraulic control mode 1: Drive hydraulic control mode 1 (CAN input) 2: Drive hydraulic control mode 2 (analog channel given) 3: CAN hydraulic mode (dedicated) 4~6: Reserved	1	0	★	A300

Function Code	Name	Setting Range	Mini Unit	Factory Value	Change	COMM Address
A3-01	Maximum speed	The lower limit of the maximum frequency corresponds to a rotational speed of approximately 30,000 rpm.	1rmp	2000rmp	★	A301
A3-02	System hydraulic pressure	0.0 kg/cm²~Maximum oil pressure (A3-03)	0.0 kg/cm²	140.0 kg/cm²	☆	A302
A3-03	Maximum oil pressure	System oil pressure A3-02~500.0kg/cm²	0.1 kg/cm²	250.0 kg/cm²	☆	A303
A3-04	First set of hydraulic command rise time	0.000s~2.000s	0.001s	0.020s	☆	A304
A3-05	Hydraulic control Kp1	0.0~800.0	0.1	210.0	☆	A305
A3-06	Hydraulic control Ti1	0.001s~10.000s	0.001s	0.100s	☆	A306
A3-07	Hydraulic control Td1	0.000s~1.000s	0.001s	0.000s	☆	A307
A3-08	Maximum reverse speed	0.0%~100.0%	0.1%	10.0%	☆	A308
A3-09	Undercurrent	0.0%~50.0%	0.1%	0.0 %	☆	A309
A3-10	Bottom pressure	0.0 kg/cm²~50.0 kg/cm²	0.1 kg/cm²	0.0 kg/cm²	☆	A30A
A3-11	Hydraulic control Kp2	0.0~800.0	0.1	210.0	☆	A30B
A3-12	Hydraulic control Ti2	0.001s~10.000s	0.001s	0.100s	☆	A30C
A3-13	Hydraulic control Td2	0.000s~1.000s	0.001s	0.000s	☆	A30D
A3-14	Hydraulic control Kp3	0.0~800.0	0.1	210.0	☆	A30E
A3-15	Hydraulic control Ti3	0.001s~10.000s	0.001s	0.100s	☆	A30F
A3-16	Hydraulic control Td3	0.000s~1.000s	0.001s	0.000s	☆	A310
A3-17	Hydraulic control Kp4	0.0~800.0	0.1	210.0	☆	A311
A3-18	Hydraulic control Ti4	0.001s~10.000s	0.001s	0.100s	☆	A312
A3-19	Hydraulic control Td4	0.000s~1.000s	0.001s	0.000s	☆	A313

Function Code	Name	Setting Range	Mini Unit	Factory Value	Change	COMM Address
A3-20	AI zero-drift automatic correction	0: Invalid 1: Enabled	0	0	☆	A314
A3-21	Oil pressure sensor fault detection time	0.000s: Detection invalid 0.001s~60.000s	0.001s	0.500s	☆	A315
A3-22	Pressure control state output maximum speed setting	0.0%~100.0%	0.1%	10.0%	☆	A316
A3-23	Pressure control state output minimum oil pressure setting	0.0%~100.0%	0.1%	60.0 %	☆	A317
A3-24	Pressure control status output delay time	0.000 s~10.000s	0.001s	0.100s	☆	A318
A3-25	The first set of oil pressure commands rises to the S-filter time.	0.001s~1 0.000s	0.001s	0.005s	☆	A319
A3-26	The first set of oil pressure commands decreases, and the S-filter time is used.	0.001s~1.000s	0.001s	0.005s	☆	A31A
A3-27	First group of oil pressure overshoot suppression detection levels	0~2000	1	700	☆	A31B
A3-28	First group of oil pressure overshoot suppression coefficients	0~3.000	0.001	0.200	☆	A31C
A3-29	Oil pressure ring gain coefficient	0.20~5.00	0.01	1.00	☆	A31D
A3-30	Pressure mode switching speed mode torque limit	50.0%~250.0%	0.1%	160.0%	☆	A31E

Function Code	Name	Setting Range	Mini Unit	Factory Value	Change	COMM Address
A3-31	First set of hydraulic command delay time	0.000s~0.500s	0.001s	0.000s	☆	A31F
A3-32	Slave minimum input	-10 0.0%~A3-34	0.1%	0.0%	☆	A320
A3-33	Slave minimum input corresponds to	-100.0%~A3-3 5	0.1%	0.0%	☆	A321
A3-34	Input from the middle point of the machine	A3-32~A3-36	0.1%	0.0%	☆	A322
A3-35	Input the corresponding data at the midpoint of the slave device.	A3-33~A3-37	0.1%	0.0%	☆	A323
A3-36	Slave maximum input	A3-34~100.0%	0.1%	100.0%	☆	A324
A3-37	Slave maximum input corresponds to	A3-35~100.0%	0.1%	100.0%	☆	A325
A3-38	The multi-pump master unit determines whether to send slave speed enable.	0: Prohibit slave speed enable 1: Enable slave speed	1	0	★	A326
A3-39	Multi-pump confluence pressure holding control gain	20~800	1	100	☆	A327
A3-40	Multi-pump injection to reduce PI and eliminate pressure deviation	0.0~50.0kg	0.1kg	5.0kg	☆	A328
A3-41	Multi-pump injection for PI reduction and vibration reduction: lower flow rate limit	0~30000rpm	1rpm	0rpm	☆	A329

Function Code	Name	Setting Range	Mini Unit	Factory Value	Change	COMM Address
A3-42	Multi-pump injection, PI reduction, de-vibration, flow rate detection time	0.200~2.000s	0.001s	0.400s	☆	A32A
A3-43	Pressure deviation when the pump is not operating in multi-pump CAN communication mode	0~50.0kg	0.1kg	5.0kg	☆	A32B
A3-44	In multi-pump CAN communication mode, the lower limit of the flow rate when the pump is not in operation	-100.0%~100.0%	0.0%	0	☆	A32C
A3-45	Time judgment based on pump stop command at no speed	0.010 ~5.000s	0.001s	1.000s	☆	A32D
A3-46	Time to stop and decelerate from pump no-speed command	0.001~5.000s	0.001s	0.200s	☆	A32E
A3-47	Valve pressure relief delay	0.001~5.000s	0.001s	0.100s	☆	A32F
A3-48	Exit valve pressure relief delay	0.001~5.000s	0.001s	0.100s	☆	A330
A3-49	Lower limit of valve pressure relief deviation	0.0~A3-02 (System oil pressure)	0.1kg	0.0kg	☆	A331
A3-50	Start valve pressure relief pressure setting lower limit	0.0~A3-02 (System oil pressure)	0.1kg	0.0kg	☆	A332
A3-51	Pressure sensor fault detection current lower limit	0%~300% (Motor rated current F1-03)	1%	80%	☆	A333

Function Code	Name	Setting Range	Mini Unit	Factory Value	Change	COMM Address
A3-52	Pressure sensor fault detection speed limit	0%~100% (Maximum speed A3-01)	1%	50%	☆	A334
A3-53	Second group of high-speed flow descent time	0.001~5.000 s	0.001s	0.100s	☆	A335
A3-54	Second group of high-speed flow Judgment value	0~100.0%	0.1%	100.0%	☆	A336
A3-55	Stop valve pressure relief deviation	0.0 kg / cm²~A3-02	0.1 kg/cm²	0.0 kg/cm²	☆	A337
A3-56	Torque limit in zero torque mode	0~250.0%	0.1%	0.0%	☆	A338
A3-57	Pressure sensor detection upper limit(Err 46)	-0.100~11.000V	0.001V	11.000V	☆	A339
A3-58	Pressure sensor detection lower limit(Err 46)	-0.100~11.000V	0.001V	-0.100V	☆	A33A
A3-59	Pressure sensor malfunction detection time (Err 46)	0.000s~60.000 s	0.001s	0.000s	☆	A33B
A3-60	Pressure holding parameter switching enable	0: Pressure holding parameter switching is not enabled. 1: Pressure holding parameter switching enabled	1	0	☆	A33C
A3-61	Pressure holding parameter switching threshold	0.0~500.0kg	0.1kg	20.0kg	☆	A33D
A3-62	Pressure holding oil ring Kp coefficient	0.2~5.0	0.1	1.0	☆	A33E
A3-63	Pressure holding oil ring Ki coefficient	0.2~5.0	0.1	1.0	☆	A33F
A3-64	Pressure holding speed ring Kp coefficient	0.2~5.0	0.1	1.5	☆	A340

Function Code	Name	Setting Range	Mini Unit	Factory Value	Change	COMM Address
A3-65	Pressure holding speed ring Ki coefficient	0.2~5.0	0.1	1.5	☆	A341
A3-66	Speed command filter bandwidth	0Hz~1500Hz	1	0	☆	A342
Group A4 - Hydraulic Pressure Control Optimization Group						
A4-00	Speed display filter time	0~5.000S	0.001s	0.040s	☆	A400
A4-01	Current display filter time	0~5.000S	0.001s	0.100s	☆	A401
A4-02	The first set of hydraulic pressure commands descending time	0.001s~2.000s	0.001s	0.020s	☆	A402
A4-03	First set of flow command rise time	0~5.000s	0.001s	0.050s	☆	A403
A4-04	The first set of flow command descent time	0~5.000s	0.001s	0.050s	☆	A404
A4-06	Flow leakage compensation value reserved	0.0%~50.0%	0.1%	0.0%	☆	A406
A4-07	Feedback pressure deburring filter	0: Disable 1: Enable	1	0	★	A407
A4-08	Minimum pressure for reverse pressure relief	0.0kg/cm²~A3-02	0.1 kg/cm²	0.0 kg/cm²	☆	A408
A4-09	Reverse pressure relief long-term operation protection time	0.001s~5.000s	0.001s	0.000s	☆	A409
A4-10	The second set of oil pressure commands rises S filter time	0.001s~1.000s	0.001s	0.005s	☆	A40A
A4-11	The second set of oil pressure commands decreases, and the S-filter time is used.	0.001s~1.000s	0.001s	0.005s	☆	A40B

Function Code	Name	Setting Range	Mini Unit	Factory Value	Change	COMM Address
A4-12	The second set of flow commands rise time	0.001~5.000s	0.001s	0.0005s	☆	A40C
A4-13	The second set of flow command descent time	0.001~5.000s	0.001s	0.005s	☆	A40D
A4-14	The second set of hydraulic pressure commands rise time	0~2.000s	0.001s	0.020s	☆	A40E
A4-15	The second set of hydraulic command descent time	0~2.000s	0.001s	0.020s	☆	A40F
A4-16	The second set of hydraulic pressure overshoot suppression detection level	0~2000	1	200	☆	A410
A4-17	The second group of hydraulic pressure overshoot suppression control coefficient	0~3.000s	0.001s	0.200s	☆	A411
A4-18	The second set of hydraulic pressure commands is delayed late time	0~0.500s	0.001s	0.000s	☆	A412
A4-21	Flow command	0.0~100.0% (100% corresponds to the speed set in A3-01)	0.1%	0	☆	A415
A4-22	Oil pressure suppression cancels oil pressure deviation	0.0~A3-02	0.1 kg/cm²	10.0 kg/cm²	☆	A416
A4-23	Maximum integral limit deviation	0.0kg/cm²~A3-02	0.1 kg/cm²	45.0 kg/cm²	☆	A417
A4-24	Integral limiting mode selection	0~1	1	1	☆	A418

Function Code	Name	Setting Range	Mini Unit	Factory Value	Change	COMM Address
A4-25	Pressure ring output upper limit increase	0~50.0	0.1s	1.0	☆	A419
A4-26	Hydraulic PID algorithm selection	0~3	1	4	★	A41A
A4-27	Pressure overshoot suppression enable	0: Disable 1: Enable	1	0	☆	A41B
A4-28	Pressure jitter suppression parameter 1	0~100	1	3	☆	A41C
A4-29	First group of impact overshoot suppression thresholds	0~100.0%	0.1%	70.0%	☆	A41D
A4-30	First group of impact overshoot suppression coefficients Kd	0~1.00	0.01	0.4	☆	A41E
A4-31	Second group of impact overshoot suppression thresholds	0~100.0%	0.1%	70.0%	☆	A41F
A4-32	Second group of impact overshoot suppression coefficients Kd	0~1.00	0.01	0.4	☆	A420
A4-37	Pressure jitter suppression parameter 2	0~65535	1	16000	☆	A425
A4-38	Pressure jitter suppression parameter 3	0~65535	1	10000	☆	A426
A4-39	Pressure jitter suppression parameter 4	0~5000	1	0	☆	A427

<table>
<tr><th>Function Code</th><th>Name</th><th>Setting Range</th><th>Mini Unit</th><th>Factory Value</th><th>Change</th><th>COMM Address</th></tr>
<tr><td colspan="7">Group A5 - Multi-speed group</td></tr>
<tr><td>A5-00</td><td>Multi-speed Set Point 1</td><td rowspan="16">Set A3-00 = 0 (speed mode).
F0.03 = 6 (multi-speed),
The speed can be selected using four terminals: #12, #13, #14, and #15.
<table><tr><td></td><td colspan="4">Terminal status</td></tr><tr><td></td><td>15#</td><td>14#</td><td>13#</td><td>12#</td></tr><tr><td>A5-00</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>A5-01</td><td>0</td><td>0</td><td>0</td><td>1</td></tr><tr><td>A5-02</td><td>0</td><td>0</td><td>1</td><td>0</td></tr><tr><td>A5-03</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>A5-04</td><td>0</td><td>1</td><td>0</td><td>0</td></tr><tr><td>A5-05</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>A5-06</td><td>0</td><td>1</td><td>1</td><td>0</td></tr><tr><td>A5-07</td><td>0</td><td>1</td><td>1</td><td>1</td></tr><tr><td>A5-08</td><td>1</td><td>0</td><td>0</td><td>0</td></tr><tr><td>A5-09</td><td>1</td><td>0</td><td>0</td><td>1</td></tr><tr><td>A5-10</td><td>1</td><td>0</td><td>1</td><td>0</td></tr><tr><td>A5-11</td><td>1</td><td>0</td><td>1</td><td>1</td></tr><tr><td>A5-12</td><td>1</td><td>1</td><td>0</td><td>0</td></tr><tr><td>A5-13</td><td>1</td><td>1</td><td>0</td><td>1</td></tr><tr><td>A5-14</td><td>1</td><td>1</td><td>1</td><td>0</td></tr><tr><td>A5-15</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table></td><td>1rpm</td><td>100rpm</td><td>☆</td><td>A500</td></tr>
<tr><td>A5-01</td><td>Multi-speed Set Point 2</td><td>1rpm</td><td>100rpm</td><td>☆</td><td>A501</td></tr>
<tr><td>A5-02</td><td>Multi-speed Set Point 3</td><td>1rpm</td><td>100rpm</td><td>☆</td><td>A502</td></tr>
<tr><td>A5-03</td><td>Multi-speed Set Point 4</td><td>1rpm</td><td>100rpm</td><td>☆</td><td>A503</td></tr>
<tr><td>A5-04</td><td>Multi-speed Set Point 5</td><td>1rpm</td><td>100rpm</td><td>☆</td><td>A504</td></tr>
<tr><td>A5-05</td><td>Multi-speed Set Point 6</td><td>1rpm</td><td>100rpm</td><td>☆</td><td>A505</td></tr>
<tr><td>A5-06</td><td>Multi-speed Set point 7</td><td>1rpm</td><td>100rpm</td><td>☆</td><td>A506</td></tr>
<tr><td>A5-07</td><td>Multi-speed Set Point 8</td><td>1rpm</td><td>100rpm</td><td>☆</td><td>A507</td></tr>
<tr><td>A5-08</td><td>Multi-speedSet Point 9</td><td>1rpm</td><td>100rpm</td><td>☆</td><td>A508</td></tr>
<tr><td>A5-09</td><td>Multi-speed Set Point 10</td><td>1rpm</td><td>100rpm</td><td>☆</td><td>A509</td></tr>
<tr><td>A5-10</td><td>Multi-speed Set Point 11</td><td>1rpm</td><td>100rpm</td><td>☆</td><td>A50A</td></tr>
<tr><td>A5-11</td><td>Multi-speed Set Point 12</td><td>1rpm</td><td>100rpm</td><td>☆</td><td>A50B</td></tr>
<tr><td>A5-12</td><td>Multi-speed Set Point 13</td><td>1rpm</td><td>100rpm</td><td>☆</td><td>A50C</td></tr>
<tr><td>A5-13</td><td>Multi-speed Set Point 14</td><td>1rpm</td><td>100rpm</td><td>☆</td><td>A50D</td></tr>
<tr><td>A5-14</td><td>Multi-speed Set Point 15</td><td rowspan="2">Setting range: 0 rpm ~ maximum speed (A3-01)</td><td>1rpm</td><td>100rpm</td><td>☆</td><td>A50E</td></tr>
<tr><td>A5-15</td><td>Multi-speed Set Point 16</td><td>1rpm</td><td>100rpm</td><td>☆</td><td>A50F</td></tr>
<tr><td colspan="7">F0 Group - Basic Functions Group</td></tr>
<tr><td>F0-00</td><td>Model display</td><td>1: Type G (Heavy-duty type)
2: Reserved</td><td>1</td><td>Related to the model</td><td>●</td><td>F000</td></tr>
<tr><td>F0-01</td><td>Control method</td><td>0: Reserved
1: Vector control with speed sensor (VC)
2: V/F control</td><td>1</td><td>1</td><td>★</td><td>F001</td></tr>
</table>

Function Code	Name	Setting Range	Mini Unit	Factory Value	Change	COMM Address
F0-02	Command source selection	0: Operation panel operation command channel (LED off) 1: Terminal command channel (LED lit) 2: Serial port command channel (LED flashing)	1	0	☆	F002
F0-03	Main frequency source X selection	0: Digital setting UP, DOWN adjustment (not memorized) 1: Digital setting UP, DOWN adjustment (memory) 2:AI1 3:AI2 4:AI3 5:Reserved 6: Multi-speed 7: Reserved 8: Reserved 9: Communication given	1	0	★	F003
F0-08	Preset frequency	0.00Hz~Maximum frequency F0-10	0.01Hz	5.00Hz	☆	F008
F0-09	Direction of movement	0: Same direction 1: Opposite direction	1	0	☆	F009
F0-10	Maximum frequency	50.00Hz~300.00Hz	1	133.33Hz	★	F00A
F0-11	Upper limit frequency source	0: F0-12 settings 2: AI2 3: AI3 4: Reserved 5: Communication provisions	1	0	★	F00B
F0-12	Upper limit frequency	Lower limit frequency (F0-14)~Maximum frequency (F0-10)	0.01Hz	133.33Hz	☆	F00C
F0-13	Upper limit frequency offset	0.00Hz~Maximum frequency (F0-10)	0.01Hz	0.00Hz	☆	F00D
F0-14	Lower limit frequency	0.00Hz~Upper limit frequency (F0-12)	0.01Hz	0.00Hz	☆	F00E
F0-15	Carrier frequency	0.5 kHz~8.0 kHz	0.1kHz	Related to the model	☆	F00F

Function Code	Name	Setting Range	Mini Unit	Factory Value	Change	COMM Address
F0-16	Carrier frequency adjustment selection	0: No adjustment 1: Adjustment	1	0	☆	F010
F0-17	Acceleration time 1	0.0s~6500.0s	0.1s	20.0s	☆	F011
F0-18	Deceleration time 1	0.0s~6500.0s	0.1s	20.0s	☆	F012
F0-19	Driver rated current	0.1A~650.0A	0.1A	Related to the model	☆	F013
F1 Group - Motor Parameters						
F1-00	Motor type selection	0: Ordinary asynchronous motor 1: Variable frequency asynchronous motor 2: Permanent magnet synchronous servo motor	1	2	★	F100
F1-01	Rated power	0.4kW~1000.0kW	0.1kW	Model confirmed	★	F101
F1-02	Rated voltage	0V~800V	1V	Model confirmed	★	F102
F1-03	Rated current	0.01A~650.00A	0.01A	Model confirmed	★	F103
F1-04	Rated frequency	0.00~Maximum frequency (F0-10)	0.01Hz	Model confirmed	★	F104
F1-05	Rated speed	0rpm~20000rpm	1rpm	Model confirmed	★	F105
F1-11	D-axis inductance	0~65535	1	Model confirmed	★	F10B
F1-12	Q-axis inductor	0~65535	1	Model confirmed	★	F10C
F1-13	Stator resistance	0~65535	1	Model confirmed	★	F10D
F1-14	Unit	0~65535	1	Model confirmed	★	F10E
F1-15	Back electromotive force	0~65535V	1	Model confirmed	★	F10F

Function Code	Name	Setting Range	Mini Unit	Factory Value	Change	COMM Address
F1-16	Self-learning selection	0: No action 1: No-load static self-learning 2: No-load dynamic self-learning, high-speed rotation in the opposite direction 3: Loaded static self-learning1 4: No-load rapid dynamic self-learning, high-speed rotation in the opposite direction 5: No-load dynamic self-learning, high-speed rotation in the positive direction 6: No-load rapid dynamic self-learning, high-speed rotation in the positive direction 7: Loaded static self-learning2	1	0	★	F110
F2 Group - Vector Control Parameters						
F2-00	Speed loop proportional gain 1	1~400	1	4 0	☆	F200
F2-01	Velocity loop integral time 1	0.01s~10.00s	0.01s	0.30s	☆	F201
F2-02	Switching frequency 1	0.00~F2-05	0.01Hz	5.00Hz	☆	F202
F2-03	Speed loop proportional gain 2	1~400	1	4 0	☆	F203
F2-04	Velocity loop integral time 2	0.01s~10.00s	0.01s	0.30s	☆	F204
F2-05	Switching frequency 2	F2-02~Maximum frequency	0.01Hz	10.00Hz	☆	F205
F2-06	Slip compensation coefficient	50%~200%	1%	100%	☆	F206
F2-07	Speed feedback filtering time	0.5ms~10.0ms	0.1ms	1.0ms	☆	F207
F2-08	Torque control	0: Invalid 1: Valid	1	0	☆	F208

Function Code	Name	Setting Range	Mini Unit	Factory Value	Change	COMM Address
F2-09	Torque upper limit source	0: F2-10 1: AI1 2: AI2 3: AI3 4: Reserved 5: Communication given (Analog input range corresponds to F2-10)	1	0	☆	F209
F2-10	Upper limit of torque	0.0%~250.0%	0.1%	200.0%	☆	F20A
F2 - 11	Torque filter bandwidth	0Hz~1500Hz	1Hz	500Hz	☆	F20B
F2-13	M-axis current loop proportional gain	0.2~5.0	0.1	0.7	★	F20D
F2-14	M-axis current loop integral gain	0.2~5.0	0.1	0.7	★	F20E
F2-15	T- axis current loop proportional gain	0.2~5.0	0.1	1.0	★	F20F
F2-16	T- axis current loop integral gain	0.2~5.0	0.1	1.0	★	F210
F2-17	M-axis current loop adjustment	0.2~5.0	0.1	1.0	★	F21 1
F2-18	T-axis current loop adjustment	0.2~5.0	0.1	1.0	★	F21 2
F2-25	Overvoltage modulation coefficient	100%~120%	1%	11 5%	☆	F219
F2-26	Bus voltage filtering	0.000~0.100	0.001	0.000	☆	F21A
F2-28	Speed loop control method	0: Position deviation 1: Speed deviation	1	0	★	F21 C
F2-29	Voltage feedforward compensation method	0: Invalid 1: Method 1 2: Method 2 3: Method 3	1	3	★	F21D

Function Code	Name	Setting Range	Mini Unit	Factory Value	Change	COMM Address
F3 Group - VF Control Parameter						
F4 Group - Input Terminals						
F4-00	DI1 terminal function selection	0: No function 1: Forward rotation enable 2: Reverse enable 3: Three-wire operation control 4: Forward jog enable 5: Reverse Jog enable 6~7: Reserved 8: Free parking 9: Fault reset 10: Reserved 11: Normally open input for external faults. 12: Multi-speed selection speed terminal 1 13: Multi-speed selection speed terminal 2 14: Multi-speed selection speed terminal 3 15: Multi-speed selection speed terminal 4 16~32: Reserved 33: External fault normally closed input 34~47: Reserved 48: Servo oil pump PID selection terminal 1 49: Servo oil pump PID selection terminal 2 50: CAN communication enable 51: Enable slave device to act as master device 52: Pressure switch to speed mode terminal 1 53: Select terminal 1 from pump address 54: Select terminal 2 from pump address 55: Injection molding to pressure holding terminal	1	1	★	F400
F4-01	DI2 terminal function selection		1	0	★	F401
F4-02	DI3 terminal function selection		1	0	★	F402
F4-03	DI4 terminal function selection		1	9	★	F403

Function Code	Name	Setting Range	Mini Unit	Factory Value	Change	COMM Address
F4-04	DI5 terminal function selection	56: Fault reset terminal 2 (overcurrent fault cannot be reset) 57: Pressure switch to speed mode terminal 2	1	0	★	F404
F4-15	DI terminal filtering time	1~10	1	4	☆	F40F
F4-16	Terminal command method	0: Two-line type 1 1: Two-line type 2 2: Three-line type 1 3: Three-line type 2	1	0	★	F410
F4-17	Terminal UP/DOWN rate	0.01Hz~650.00Hz	0.01Hz	1.00Hz	☆	F411
F4-18	AI1 minimum input	-11.00V~11.00V	0.01V	0.02V	☆	F412
F4-19	AI1 minimum input corresponding settings	-100.0%~100.0%	0.1%	0.0%	☆	F413
F4-20	AI1 maximum input	-11.00V~11.00V	0.01V	10.00V	☆	F414
F4-21	AI1 maximum input corresponding settings	-100.0%~100.0%	0.1%	100.0%	☆	F415
F4-22	AI1 Input Filtering Time	0.000s~10.000s	0.001s	0.010s	☆	F416
F4-23	AI2 minimum input	-11.00V~11.00V	0.01V	0.02V	☆	F417
F4-24	AI2 minimum input corresponding settings	-100.0%~100.0%	0.1%	0.0%	☆	F418
F4-25	AI2 maximum input	-11.00V~11.00V	0.01V	10.00V	☆	F419
F4-26	AI2 maximum input corresponding settings	-100.0%~100.0%	0.1%	100.0%	☆	F41A
F4-27	AI2 input filtering time	0.000s~10.000s	0.0 0 1s	0.005s	☆	F41B

Function Code	Name	Setting Range	Mini Unit	Factory Value	Change	COMM Address
F4-28	AI3 minimum input	-11.00V~11.00V	0.01V	0.02V	☆	F41C
F4-29	AI3 minimum input corresponding settings	-100.0%~100.0%	0.1%	0.0%	☆	F41D
F4-30	AI3 maximum Input	-11.00V~11.00V	0.01V	10.00V	☆	F41E
F4-31	AI3 maximum input corresponding settings	-100.0%~100.0%	0.1%	100.0%	☆	F41F
F4-32	AI3 Input Filtering Time	0.000s~1.000s	0.001s	0.000s	☆	F420
F4-43	A I1 calibration curve parameter 1	-9.999~9.999V	0.001V	2.000V	☆	F42B
F4-44	A I1 calibration curve parameters 2	-9.999~9.999V	0.001V	2.000V	☆	F42C
F4-45	A I1 calibration curve parameters 3	-9.999~9.999V	0.001V	8.000V	☆	F42D
F4-46	A I1 calibration curve parameters 4	-9.999~9.999V	0.001V	8.000V	☆	F42E
F4-47	A I2 correction curve parameters 1	-9.999~9.999V	0.001V	2.000V	☆	F42F
F4-48	A I2 correction curve parameters 2	-9.999~9.999V	0.001V	2.000V	☆	F430
F4-49	A I2 correction curve parameters 3	-9.999~9.999V	0.001V	8.000V	☆	F431
F4-50	A I2 correction curve parameters 4	-9.999~9.999V	0.001V	8.000V	☆	F432
F4-51	A I3 calibration curve parameters 1	-9.999~9.999V	0.001V	2.000V	☆	F433
F4-52	A I3 calibration curve parameters 2	-9.999~9.999V	0.001V	2.000V	☆	F434

Function Code	Name	Setting Range	Mini Unit	Factory Value	Change	COMM Address
F4-53	A I3 calibration curve parameters 3	-9.999~9.999V	0.001V	8.000V	☆	F435
F4-54	A I3 calibration curve parameters 4	-9.999~9.999V	0.001V	8.000V	☆	F436
F5 Group - Output Terminals						
F5-01	Control board relay (T/AT/BT/C) output selection (RELAY1)	0: No output 1: Servo drive is running 2: Fault output 3~5: Reserved 6: Motor overload warning 7: Drive overload warning 8~11: Reserved 12: Running time reached 13~14: Reserved 15: Ready to run 16~19: Reserved 20: Communication settings 21~22: Reserved 23: Dual-displacement plunger pump swashplate switching 1 24: Pressure control status output 25: Slave pump alarm output 26: Dual-displacement piston pump swashplate switching 2 27: Bus voltage establishment 28: Business operation time arrives 29: Business operation time is less than 24 hours 30: Maximum reverse speed DO output	1	2	☆	F501
F5-03	Control board relay (R/A-R/C) output selection (RELAY2)		1	0	☆	F503

Function Code	Name	Setting Range	Mini Unit	Factory Value	Change	COMM Address
F5-10	AO1 output selection	0: Operating frequency 1: Set frequency 2: Output current 3: Output torque 4: Output power 5: Output voltage 6: Reserved 7: AI1 8: AI2 9: AI3 10: Feedback speed (hydraulic mode) 11: Feedback pressure (hydraulic mode) 12~16: Reserved	1	10	☆	F50A
F5-11	AO2 output selection		1	11	☆	F50B
F5-14	AO1 zero bias coefficient	-100.0%~100%	0.1%	0.0%	☆	F50E
F5-15	AO1 gain	-10.00~10.00	0.01	1.00	☆	F50F
F5-16	AO2 zero bias coefficient	-100.0%~100%	0.1%	0.0%	☆	F510
F5-17	AO2 gain	-10.00~10.00	0.01	1.00	☆	F511
Group F6 (Start/Stop Control)						
F6-10	Shutdown methods	0: Deceleration stop 1: Free stop	1	0	☆	F6-10
F7 Group - Keyboard Display						
F7-02	STOP/RESET function	0: Only valid when using keyboard controls. 1: The stop or reset function is effective under all control modes. 2: When using terminal control: The STOP button fault reset function is effective. 3: When using terminal control: The STOP button's stop function and fault reset function are both effective.	1	2	☆	F702
F7-04	LED operating parameters	1~65535	1	16405	☆	F704

Function Code	Name	Setting Range	Mini Unit	Factory Value	Change	COMM Address
F7-05	LED stop display parameters	1~65535	1	1027	☆	F705
F7-06	Load speed display coefficient	0.0001~6.5000	0.0001	1.0000	☆	F706
F7-07	Radiator temperature 1	0.0 ℃~100 ℃	1℃	-	●	F707
F7-09	Cumulative running time	0h~65535h	1	-	●	F709
F7-10	Software version number 1	-	-	-	●	F70A
F7-11	Software version number 2	-	-	-	●	F70B
F7-12	Software temporary version number 1	-	-	-	●	F70C
F7-13	Software temporary version number 2	-	-	-	●	F70D
F8 Group - Accessibility						
F8-17	Set the run arrival time	0h~65535h	1h	0	☆	F811
F8-18	Start Protection Selection	0: Startup without protection 1: Start protection	1	0	☆	F812
F8-22	Power-on short circuit detection	0: No detection 1: Detection	1	1	☆	F816
F8-23	Set the running time to select the action.	0: Continue running 1: The machine stopped and reported error code 26.	1	0	☆	F817
F8-24	Software undervoltage point	AC 148.5~321.7V (AC voltage input, multiply by $\sqrt{2}$ to convert to bus voltage)	0.1V	247.5V	☆	F818
F8-25	Allowable opening time of braking unit	0.1s~3600.0s	0.1s	5.0s	☆	F819
F9 Group - Faults and Protection						
F9-00	Motor overload protection selection	0: Prohibited 1: Allowed	1	0	☆	F900

Function Code	Name	Setting Range	Mini Unit	Factory Value	Change	COMM Address
F9-01	Motor overload protection gain	0.20~10.00	0.01	2.00	☆	F901
F9-02	Overspeed fault diagnosis time	0.0~20.0	0.1s	1.0s	☆	F902
F9-06	NTC fault detection enable	0 : Disable 1: Enable	1	1	☆	F906
F9-07	Fan control	0: Fan running during operation 1: Temperature control fan operation	1	1	☆	F907
F9-08	Brake pipe braking voltage	650.0V~800.0V	0.1V	700.0V	☆	F908
F9-12	Input phase loss protection selection	0: Prohibited 1: Allowed	1	1	☆	F90C
F9-13	Output phase loss protection selection	0: Prohibited 1: Allowed	1	1	☆	F90D
F9-14	Speed deviation setting	0.50Hz~50.00Hz	0.01Hz	20.00Hz	☆	F90E
F9-15	Flying vehicle fault diagnosis time	0.1s~20.0s	0.1s	10.0s	☆	F90F
F9-16	Motor temperature protection enable	0: Prohibited 1: Allowed	1	1	☆	F910
F9-17	Method of motor protcetion	0: PTC 1: KTY 2: PTC and KTY jointly protect	1	2	☆	F911
F9-18	First type of failure	0: No fault 1: Reserved 2: Accelerated overcurrent (ERR02) 3: Deceleration overcurrent (ERR03) 4: Constant speed overcurrent (ERR04) 5: Accelerated overvoltage (ERR05) 6: Deceleration overvoltage (ERR06)	1	0	☆	F912

Function Code	Name	Setting Range	Mini Unit	Factory Value	Change	COMM Address
F9-19	Second type of failure	7: Constant speed overvoltage (ERR07) 8: Soft start resistor overload (ERR08) 9: Undervoltage fault (ERR09) 10: Drive overload (ERR10) 11: Reserved 12: Input phase loss (ERR12) 13: Output phase loss (ERR13) 14: Radiator overheating (ERR14) 15: External input fault (ERR15) 16: Serial communication failure (ERR16) 17: Contactor failure (ERR17) 18: Current detection fault (ERR18) 19: Motor tuning fault (ERR19) 20: Radiator temperature sensor failure (ERR20) 21: EEPROM read failure (ERR21) 22: Phase-to-phase short circuit (ERR22) 23: Short circuit to ground fault (ERR23) 24~25: Reserved 26: Runtime reached (ERR 26) 27: Business Run Time Arrives (ERR 27) 28~39: Reserved 40: Wave-by-wave current limiting fault (ERR4 0) 41: Reserved 42: CAN communication failure (ERR42) 43: Resolver tuning fault (ERR43)	1	0	☆	F913

Function Code	Name	Setting Range	Mini Unit	Factory Value	Change	COMM Address
F9-20	Third type of fault	44: Speed deviation protection fault (ERR44) 45: Motor overheating fault (ERR45) 46: Oil pressure sensor failure (ERR46) 47: Slave Fault Warning (ERR47) 48: CAN address conflict 49: Resolver PG open circuit fault (ERR49) 52: Multiple pumps merging and multiple master fault (Err52) 58: User parameter recovery failure (Err58) 59: Back EMF Abnormal Fault (Err59) 60: Reserved 61: Brake pipe braking time too long protection (Err61) 63: Reverse run time reached (ERR63) 65: Pressure sensor voltage out of range (ERR 65) 66: Overspeeding fault (overspeed) (ERR66)	1	0	☆	F914
F9-21	Frequency during fault	-	0.01Hz	-	●	F915
F9-22	Current during fault	-	0A	-	●	F916
F9-23	Bus voltage during fault	-	0.1V	-	●	F917
F9-24	Input terminal status during fault	-	1	-	●	F918
F9-25	terminal status during fault	-	1	-	●	F919
F9-26	Fault subtypes	-	1	-	●	F91A
FA Group - Business Timer Function						
FA-00	First running time protection password	0~65535	1	0	☆	FA00

Function Code	Name	Setting Range	Mini Unit	Factory Value	Change	COMM Address
FA-01	First running timer running time	0h~FA-03	1h	0	☆	FA01
FA-02	Second runtime protection password	0~65535	1	0	☆	FA02
FA-03	Second running timer operation time	FA-01~FA-05	1h	0	☆	FA03
FA-04	Third runtime protection password	0~65535	1	0	☆	FA04
FA-05	Third running timer operation time	FA-03~FA-07	1h	0	☆	FA05
FA-06	Fourth runtime protection password	0~65535	1	0	●	FA06
FA-07	Fourth, the timed running time.	FA-05~65535h	1h	0	●	FA07
FA-08	Cumulative business operating time (hours)	0~65535h	1	0	☆	FA08
FA-09	Cumulative business operation time (seconds)	0~65535s	1s	0	☆	FA09
Up to four business timer segments are supported, with the following timer settings: FA-01 < FA-03 < FA-05 < FA-07. Each segment has independent password protection. Timer calculation starts from the first segment. If the timer is set to zero, the corresponding segment's timer function is invalid. If multiple timer segments complete, the driver will report a “Business Timer Achieved Alarm (ERR28)”. The timer function must be cleared or the timer duration increased to resolve the issue. The timer's runtime can be viewed using function code FA-08; no password is required.						
Fb Group - Motor Temperature Protection						
Fb-03	KTY temperature	0~200℃	1℃	0	●	FB03
Fb-05	KTY alarm point	40~200℃	1℃	130℃	★	FB05
Fb-06	Temperature channel sampling reverse enable	0: Disable 1: KTY and PTC temperature channels are reversed.	0	0	☆	FB06
FC Group (Reserved)						

Function Code	Name	Setting Range	Mini Unit	Factory Value	Change	COMM Address
Fd Group - Modbus communication parameters						
Fd-00	Baud rate	0: 300 BPS 1: 600 BPS 2: 1200 BPS 3: 2400 BPS 4: 4800 BPS 5: 9600 BPS 6: 19200 BPS 7: 38400 BPS	1	5	☆	FD00
Fd-01	Data format	0: No checksum <8,N,2> 1: Even parity <8,E,1> 2: Odd parity <8,0,1>	1	0	☆	FD01
Fd-02	Local address	1~247 (0 is the broadcast address)	1	1	☆	FD02
Fd-03	Response delay	0ms~20ms	1	2ms	☆	FD03
Fd-04	Timeout	0.0s (Invalid) 0.1s~60.0s	0.1s	0.0s	☆	FD04
Fd-05	Communication Protocol	0: Standard MODBUS protocol, used for reading and writing parameters and controlling operation with the host computer. 1: A proprietary protocol for use with back-end oscilloscopes.	1	0	☆	FD05
FE Group (Optimization of control parameters)						
FE-04	Wave-by-wave current limiting function selection	0: Disable 1: Enable	1	1	★	FE04
FP group - User password, parameter initialization						
FP-00	User password	0~65535	1	0	☆	1F00

Function Code	Name	Setting Range	Mini Unit	Factory Value	Change	COMM Address
FP-01	Parameter initialization	0: No operation 1: Restore factory settings 2: Clear fault information 3: Restore user parameters 4: Restore system to factory settings (A2-01 does not require this step) 5: Restore all parameters to factory settings (only FF, FP, and FA group parameters are not restored; please make sure to back up the parameters). 6: Restore factory settings (including motor parameters)	1	0	☆	1F01
FP-02	Motor model	0~65535	1	0	☆	1F02
FP-04	User storage operation password settings	0~65535	1	0	☆	1F04
FP-05	User storage mode	0: No operation 1: Store user parameters	1	0	☆	1F05
FP-06	Panel display device specifications	0~65535	1	0	☆	1F06
FP-07	User-customized parameter encoding	0~65535	1	0	☆	1F07
FP-08	User parameter macro definition	0~3	1	0	★	1F08
FP-09	Hydraulic press CAN station parameter settings	0~9	1	0	★	1F09

Appendix D Modbus Communication Protocol

The ES300 series VFD provides RS232/RS485 communication interfaces and supports the Modbus communication protocol. Users can achieve centralized control via a computer or PLC, set VFD operation commands, modify or read function code parameters, and read the VFD's working status and fault information using this communication protocol.

1. Protocol Content

This serial communication protocol defines the information content and usage format for transmission in serial communication. This includes: the host polling (or broadcast) format; the host's encoding method, including the function code for requested actions, transmitted data, and error checking. The slave's response uses the same structure, including action confirmation, return data, and error checking. If the slave encounters an error while receiving information or cannot complete the action requested by the host, it will organize a fault message as a response to send back to the host.

2. Application Method

The VFD is connected to a “single-master, multi-slave” PC/PLC control network equipped with an RS232/RS485 bus.

3. Bus Structure

(1) Interface Method

RS232/RS485 hardware interface

(2) Transmission Method

Asynchronous serial, half-duplex transmission. At the same time, only the master or one slave can transmit data; the other must receive data. During asynchronous serial communication, data is sent frame by frame in the form of messages.

(3) Topology Structure

Single-master, multi-slave system. The slave address setting range is 1 to 247, with 0 being the broadcast communication address. Slave addresses in the network must be unique.

4. Protocol Description

The ES300 series VFD communication protocol is an asynchronous serial master-slave Modbus communication protocol. Only one device (the master) on the network can initiate the protocol (called a "query/command"). Other devices (slaves) can only respond to the master's "query/command" by providing data or performing actions according to the master's “query/command”. Here, the master refers to a personal computer (PC), industrial control device, or programmable logic controller (PLC), etc., and the slave refers to the ES300 VFD. The master can communicate with a specific slave individually or broadcast information to all downstream slaves. For a master "query/command"

addressed to a specific slave, the slave must return information (called a response). For broadcast messages from the master, slaves do not need to send a response back to the master.

5. Communication Frame Structure

The Modbus protocol communication data format for the ES300 series VFD is as follows.

RTU mode is used. Message transmission must begin with a pause of at least 3.5 character times. This is easiest to implement with varying character times under the network baud rate (as shown by T1-T2-T3-T4 in the figure below). The first field transmitted is the device address. Usable transmission characters are hexadecimal 0...9, A...F. Network devices continuously monitor the network bus, including during pause intervals. When the first field (address field) is received, each device decodes it to determine if the message is intended for it. A pause of at least 3.5 character times after the last transmitted character marks the end of the message. A new message can start after this pause.

The entire message frame must be transmitted as a continuous stream. If a pause of more than 1.5 character times occurs before the frame is complete, the receiving device will flush the incomplete message and assume the next byte is the address field of a new message. Similarly, if a new message starts less than 3.5 character times after the previous message, the receiving device will consider it a continuation of the previous message. This will lead to an error because the value in the final CRC field cannot be correct.

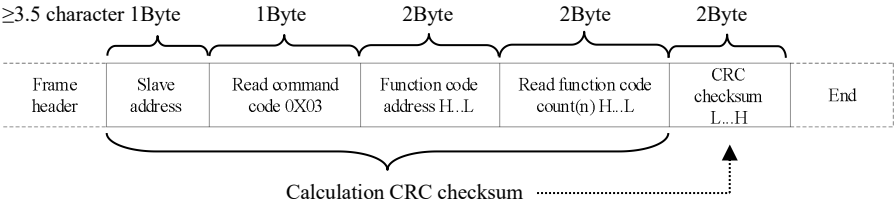
RTU Frame Format:

<table>
<tr><td>Frame header START</td><td>3.5 character times</td></tr>
<tr><td>Slave address ADR</td><td>Communication address:1~247(set by FD-02)</td></tr>
<tr><td>Command code CMD</td><td>03: Read slave parameters, 06: Write slave parameters</td></tr>
<tr><td>DATA(N-1)</td><td rowspan="4">Dta content:
Function code parameter address, number of function code parameters, function code parameter values, ect.</td></tr>
<tr><td>DATA(N-2)</td></tr>
<tr><td>……</td></tr>
<tr><td>DATA0</td></tr>
<tr><td>CRC CHK low byte</td><td rowspan="2">Check value: CRC16 checksum. Transmitted with low byte first, highbyte second. For the calculation method, please refer to the CRC check explanation in this section.</td></tr>
<tr><td>CRC CHK high byte</td></tr>
<tr><td>END</td><td>3.5 character times</td></tr>
</table>

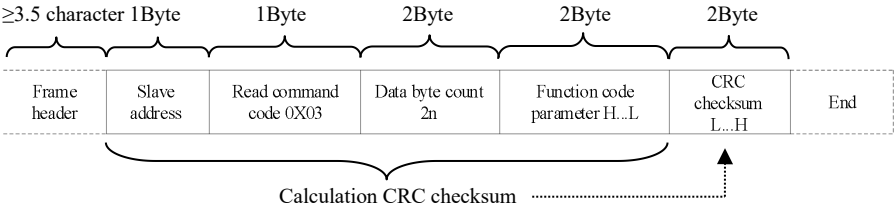
Command Instructions (CMD) and Data Description (DATA)

Command Code: 03H, Read N words (Word), Max 12 words, N=1~12. Specific format is as follows:

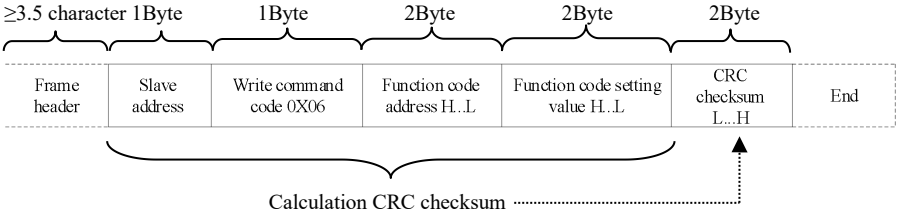
Master Read Command Frame:



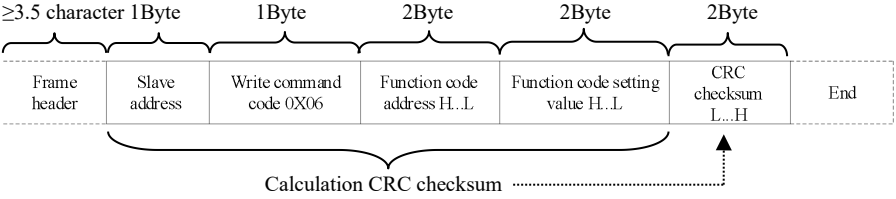
Slave Read Response Frame:



Master Write Command Frame

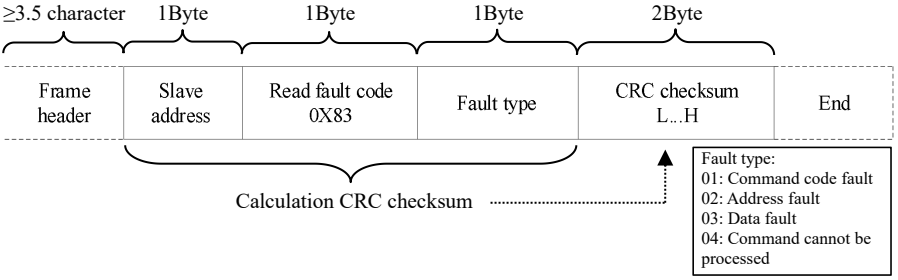


Slave Write Response Frame

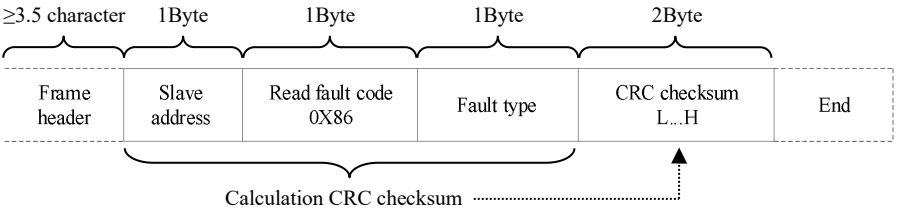


If the slave detects a communication frame error or another reason causing read/write failure, it will respond with an error frame.

Slave Read Error Response Frame



Slave Write Error Response Frame



Example: Read two consecutive parameter contents starting from F0-03 for a VFD with slave address FD-02 = 01.

Master Sends Frame:

Frame header ≥3.5 character	Slave address 0X01	Read command code 0X03	Function code address 0XF0 0X03	Read function code count 0X00 0X02	CRC checksum 0X07 0X0B	End

Slave Response Frame:

Frame header ≥3.5 character	Slave address 0X01	Read command code 0X03	Data byte count 0X04	F0-03 parameter value 0X00 0X00	F0-04 parameter value 0X00 0X00	CRC checksum 0XFA 0X33	End

Note:If the write command is unsuccessful, the reason for failure will be returned.

6.Check Method (CRC Check Method)

CRC (Cyclical Redundancy Check) uses the RTU frame format. The message includes an error detection field based on the CRC method. The CRC field checks the entire message content. The CRC field is two bytes long and contains a 16-bit binary value. It is calculated by the transmitting device and added to the message. The receiving device recalculates the CRC of the received message and compares it with the value in the received CRC field. If the two CRC values are not equal, a transmission error has occurred.

CRC starts by loading a register with 0xFFFF. Then, a process calls each consecutive 8-bit byte in the message to process with the current register value. Only the 8 bits of data in each character are valid for

CRC; start bits, stop bits, and parity bits are invalid.

During CRC generation, each 8-bit character is exclusively ORed (XOR) with the register content. The result is shifted towards the Least Significant Bit (LSB), with the Most Significant Bit (MSB) filled with 0. The LSB is extracted and checked. If the LSB is 1, the register is exclusively ORed with a preset value (0xA001). If the LSB is 0, no XOR is performed. This process is repeated 8 times. After completing the 8th bit, the next 8-bit byte is XORed with the register's current value. The final value in the register is the CRC value after processing all bytes in the message.

When adding the CRC to the message, the low byte is added first, followed by the high byte. A simplified CRC function is as follows:

```
unsigned int crc_chk_value（unsigned char *data_value,unsigned char length）{
        unsigned int crc_value=0xFFFF;
        int I;
        while（length--）        {
            crc_value^=*data_value++;
            for（i=0;i<8;i++）        {
                if（crc_value&0x0001）        {
                    crc_value=（crc_value>>1）^0xa001;
                }
                else
                {
                    crc_value=crc_value>>1;
                }
            }
        }
        return（crc_value）;
}
```

7. Communication Parameter Address Definition

This section covers the communication content used to control the inverter's operation, inverter status, and related parameter settings.

Read/Write Function Code Parameters (Some function codes cannot be changed, only for factory use or monitoring):

Function code parameter address indication rules:

The parameter address is represented by the function code group number and parameter number:

High byte: F0~FF (F group), A0~AF (A group), 70~7F (U group)

Low byte: 00~FF

Example: F0-11, address represented as F00B.

Note:

FF group: Parameters cannot be read or changed.

U group: Parameters can only be read, not changed.

Some parameters cannot be changed while the inverter is running. Some parameters cannot be changed regardless of the inverter state. When changing function code parameters, also pay attention to the parameter's range, unit, and related instructions.

Function Code Group	Communication Access Address	Communication Modify RAM Function Code Address (Write Only)
F0~FE Group	0xF000~0xFEFF	0x0000~0x0EFF
A0~AC Group	0xA000~0xACFF	0x4000~0x4CFF
U0, U1 Group	0x70xx, 0x71xx	

Note additionally: Because frequent EEPROM storage reduces its lifespan, some function codes do not need to be stored in communication mode; changing the value in RAM is sufficient.

For F group parameters, to achieve this function, simply change the high byte of the function code address from F to 0.

For A group parameters, to achieve this function, simply change the high byte of the function code address from A to 4.

Corresponding function code addresses are represented as follows:

High byte: 00~0F (F group), 40~4F (A group) Low byte: 00~FF

Example: Function code F0-11 is not stored to EEPROM, address represented as 000B.

This address can only be used for writing to RAM, not for reading. Reading is an invalid address.

Stop/Run Parameter Section:

Address	Parameter Description	Address	Parameter Description
0x1000	1000:*Communication setvalue (-10000~10000) (Decimal) (Unit:0.01%), readable and writable	0x100E	Reserved
		0x100F	Load speed (Unit: 0.01Hz), read-only
0x1001	Running frequency (Unit:0.01Hz), read-only	0x1010	Reserved
0x1002	Bus voltage (Unit:0.1V), read-only	0x1011	Reserved
0x1003	Output voltage (Unit:1V), read-only	0x1012	Reserved

Address	Parameter Description	Address	Parameter Description
0x1004	Output current (Unit:0.1A), read-only	0x1013	Real-time angle (Unit:0.1°), read-only
0x1005	Output power (Unit:0.1kW), read-only	0x1014	Given oil pressure (Unit: 0.1kg), read-only
0x1006	Reserved	0x1015	Feedback oil pressure (Unit: 0.1kg), read-only
0x1007	Reserved	0x1016	Motor running speed (Unit: rpm), read-only
0x1008	DI input flag (Unit: 1), read-only	0x1017	Given flow speed (Unit: rpm), read-only
0x1009	DO input flag (Unit: 1), read-only	0x1018	Feedback flow speed (Unit: rpm), read-only
0x100A	AI1 voltage (Unit: 0.001V), read-only	0x1019	AI1 raw voltage (Unit: 0.001V), read-only
0x100B	AI2 voltage (Unit: 0.001V), read-only	0x101A	AI2 raw voltage (Unit: 0.001V), read-only
0x100C	AI3 voltage (Unit: 0.001V), read-only	0x101B	AI3 raw voltage (Unit: 0.001V), read-only
0x100D	Reserved		

Example 1:

Read the operating frequency of the first device: 0x01 0x03 0x10 0x01 0x00 0x01 0xD1 0x0A

0x10 0x01 (1001) Operating frequency address, 0x00 0x01 (0001) A data value

0xD1 0x0A (D10A) CRC check value

Example 2: Simultaneously read the bus voltage, output voltage, and output current of the first device: 0x01 0x03 0x10 0x02 0x00 0x03 CRC check value, the data meaning is similar to Example 1

Note: The communication settings are percentages of relative values; 10000 corresponds to 100.00%, and -10000 corresponds to -100.00%.

For data in frequency units, this percentage is a percentage relative to the maximum frequency (F0-10);

Note: DO output terminal need select 20 function (communication control)

AOoutput terminal need select function (communication control output)

Type	Command Address	Command Content	
Control command input (write only)	0x2000	0001: Forward run 0003: Forward jog 0005: Free stop 0007: Fault reset	0002: Reverse run 0004: Reverse jog 0006: Decel stop

Type	Command Address	Command Content
Status read (read only)	0x3000	0001: Forward run 0002: Reverse run 0003: Stop
Digital output terminal control (write only)	0x6000	BIT0: RELAY1 outputcontrol BIT1: Reserved BIT2: RELAY2 outputcontrol
Analog output AO1 control (write only)	0x7000	0~7FFF represents 0%~100%
VFD fault address	0x8000	0000: No fault 0001: Reserved 0002: Accel overcurrent 0003: Decel overcurrent 0004: Constant speed overcurrent 0005: Accel overvoltage 0006: Decel overvoltage 0007: Constant speed overvoltage 0008: Reserved 0009: Undervoltage fault 000A: Driver overload 000B: Reserved 000C: Input phase loss 000D: Output phase loss 000E: Heatsink overtemp 000F: External input fault 0010: Serial comm fault 0011: Contactor fault 0012: Current detection fault 0013: Motor tuning fault 0014: Reserved 0015: EEPROM read and write error 0016: Reserved 0017: Ground short circuit fault 0018: Reserved 0019: Reserved 001A: Runtime reached 001B: Commercial runtime reached 001C: Reserved 001D: Reserved 001E: Reserved 001F: Reserved 0020: Reserved 0021: Reserved 0022: Reserved 0023: Reserved 0024: Reserved 0025: Reserved 0026: Reserved 0027: Reserved 0028: Wave-by-wave current limit fault 0029: Reserved 002A: CAN comm fault 002B: Resolver tuning fault 002C: Speed deviation protection fault 002D: Motor overtemp fault 002E: Oil pump sensor fault 002F: Slave fault warning

When a communication fault occurs, the return address for read faults is 83XX, for write faults is 8.

CHANGSHA SUNYE ELECTRIC CO.,LTD.

HotLine: 0731-89932666 400-0755-731

Address: No.669, Xinsheng Road, Yuelu District, Changsha City, China.

Website: www.cssunye.com