Foreword

First of all, thank you for purchasing the VA series products of SHENZHEN V&T TECHNOLOGIES CO., LTD.

VA series products support control a variety of motors, support connect a variety of encoders, and support multiple communications. VA series products is divided into the VA-H and VA-SZ model, the differences are as follows:

Model		VA-H-4T**G	VA-SZ-4T**G-TSET
Motor encoder	5V Incremental pulse encoder	√	√
	Resolver	√	√
	Sin-cos encoder	×	√
2nd encoder		√	×
Pulse input （5V differential type）		√	√
Encoder output		√	√
Modbus-RTU		√	√
EtherCAT		×	√

This manual is used for the model selection, installation, parameter setting, commissioning and fault diagnosis of the AC drive.

To guarantee safe operation of the equipment, please read this manual carefully before connecting power to the AC drive. Keep this manual at hand and distribute it to all users for reference.

When using the drive together with optional accessories, also read the option manual. Note that this manual and the option manual should be delivered to the end users.

If you have any questions, please consult our technical support personnel or distributors for help.

Due to continuous improvement of products, the information provided by our company is subject to change without notice.

Safety Precautions

DANGER: **Dangerous warning** warns of high voltage which can cause physical injury and/or damage to the equipment, even could be lethal. Extreme care is necessary at all times when working with or adjacent to the drive.

WARNING: **General warning** warns about conditions, other than those caused by electricity, which can result in physical injury and/or damage to the product.

■ USE

DANGER
● This series of drive is used to control the operation of three-phase motor. It cannot be used to control single-phase motor or for other purpose, otherwise it may cause drive fault or fire. ● This series of drive cannot be easily applied to applications such as medical device that are directly related to personal safety. ● This series of drive is manufactured under a strict quality management system. If a drive fault occurs, it may cause a major accident or loss, safety measures such as redundancy or bypass need to be set, just in case.

■ Arrival Inspection

WARNING
● The drive cannot be installed if the drive is damaged or missing parts, otherwise an accident may occur.

■ Installation

WARNING
● When handling and installing, please hold the bottom of the product. Do not hold the enclosure only, otherwise, your feet may be injured and/or the drive may be damaged. ● The drive should be mounted on the fire-retardant surface such as metal, and keep away from flammable objects and heat producer. ● Do not drop drilling residue into the drive during installation work. Otherwise the drive may be damaged and/or trip on a fault. ● When the drive is installed in an electrical control cabinet, the electrical control cabinet shall be equipped with a fan and ventilation port. In addition, air-cooling duct shall be constructed in the cabinet to facilitate heat dissipation.

■ Wiring

DANGER

- Wiring must be performed by a qualified electrical engineer, otherwise there is a risk of electric shock or damage to the drive.
- Must cut off the power before wiring; otherwise, there is a risk of electric shock or fire.
- The grounding terminal PE must be grounded reliably, otherwise, the drive enclosure may become live.
- Do not touch the main circuit terminals. The main circuit terminals wiring of the drive must not be contacted to the enclosure, otherwise, risk of electric shock may occur.
- The connection terminals of the brake resistor are "+2/B1" and "B2" . Do not connect to other terminals; otherwise, risk of fire may occur.
- The leakage current of the drive is higher than 3.5mA, and the specific value is determined by the conditions of use. For safety, the drive and the motor must be firmly grounded.

WARNING

- The threep0-phase power supply cannot be connected to the output terminals U, V, W; otherwise, the drive will be damaged.
- It is absolutely prohibited to connect a capacitor or phase lead LC/RC noise filter to the output terminal of the drive, otherwise the internal components of the drive will be damaged.
- Please confirm the number of power phases and rated input voltage match the nameplate, otherwise the drive may be damaged.
- The withstand voltage test cannot be performed to the drive; otherwise the drive may be damaged.
- The main circuit terminal wiring and control circuit terminal wiring of the drive should be arranged separately or vertically, otherwise the control signal will be interfered.
- For the cable of the main circuit terminal, use the cable lug with an insulating sleeve.
- The sectional area of input and output cables selecting should according to the drive rated current.
- When the cable length between the drive and the motor exceeds 100 meters, it is recommended to use an output reactor to avoid over−current fault caused by excessive distributed capacitance.
- The terminal connection of the main circuit must be reliable; otherwise, it may cause fire and/or short circuit.

■ Operation

DANGER
● Only after the drive wiring is completed and covered well, the drive can be powered up. It is forbidden to remove the cover when the power is on; otherwise, there is a risk of electric shock. ● Before running, confirm that the mechanical installation is reliable; otherwise, it may cause physical injury and/or damage to the equipment. ● Before running, must confirm all personnel are in safe position, otherwise, it may cause physical injury and/or damage to the equipment. ● If automatic fault reset or automatic start after next time powered up function is active, safety isolation measures should be taken for mechanical equipment, otherwise, it may cause physical injury and/or damage to the equipment. ● After the drive is powered, even if it is in the stop status, the terminals of the drive are still charged. It is forbidden to touch the terminals, otherwise it may cause electric shock. ● Before reset the drive, confirm the run command has been switch off, otherwise it may cause physical injury and/or damage to the equipment.
WARNING
● Do not start or stop the drive by turning the power supply on or off; otherwise, the drive may be damaged. ● Before start, please confirm whether the motor and machinery are within the allowable range of use, otherwise the equipment may be damaged. ● Before start, please set the motor parameters correctly and start motor parameters auto−tune, otherwise, if the default parameter values are not match the motor will cause over−current fault or motor vibration, even damage to the equipment. ● Do not touch heat sink and brake resistor, otherwise there is a danger of burns and/or electric shock. ● When the drive is used on a lifting machine, such as crane, escalator, elevator, please also configure a mechanical brake. ● Do not change the drive parameters at will. Most of the parameters' default value can meet the operation requirements. Just need to change some necessary parameters, and arbitrarily modify the parameters may cause damage to the mechanical equipment. Only some necessary parameters need to be set. Modify the parameters at will may result in damage to the mechanical equipment.

■ Maintenance and Inspection

 **DANGER**
● Do not touch the terminals of the drive while the power is on, otherwise there is a danger of electric shock. ● Make sure cut off the power supply before remove the cover. ● Wait at least 10 minutes after cut off the power, or confirm that the charging CHARGE indicator is off before performing maintenance and inspection to prevent the residual voltage of the main circuit capacitor from injuring people. ● Please designate qualified electrical engineers to do the maintenance, inspection and replace parts for the drive.
 **WARNING**
● There are CMOS large-scale integrated circuits on the circuit board. Do not touch the PCB with your hands to prevent static electricity from damaging the circuit board.

■ Others

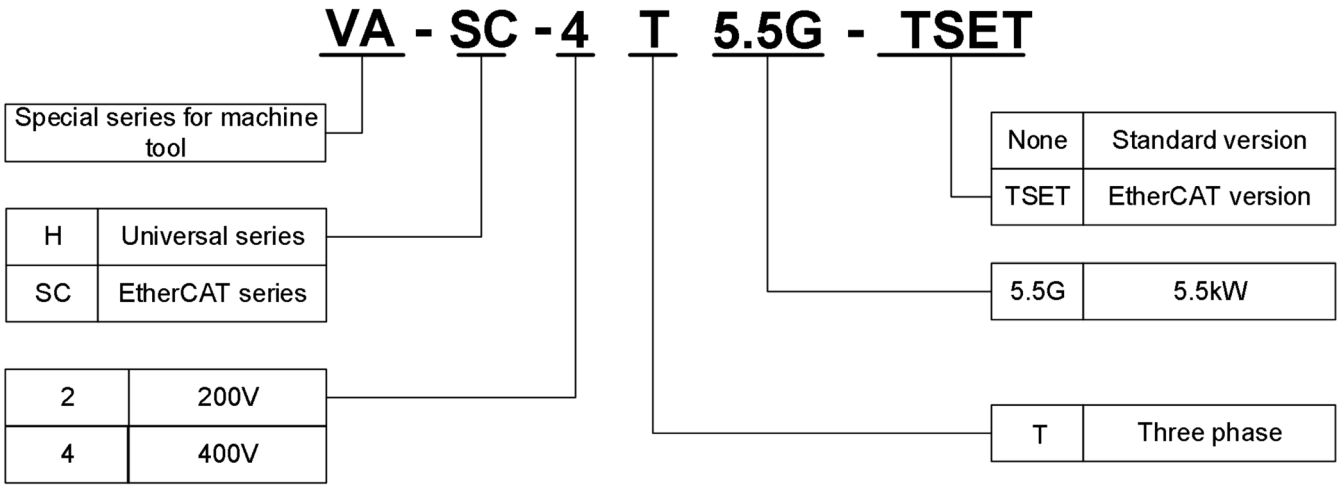
 **DANGER**
● It is forbidden to modify the drive hardware; otherwise, it will cause personal injury. ● The power of interphone used when close to the drive shall not exceed 8W. ● It is forbidden to use the screws not provided by the manufacturer or specified by the manufacturer, otherwise the structural parts of the drive or the circuit will be damaged due to factors such as too long or too large screws.

C O N T E N T S

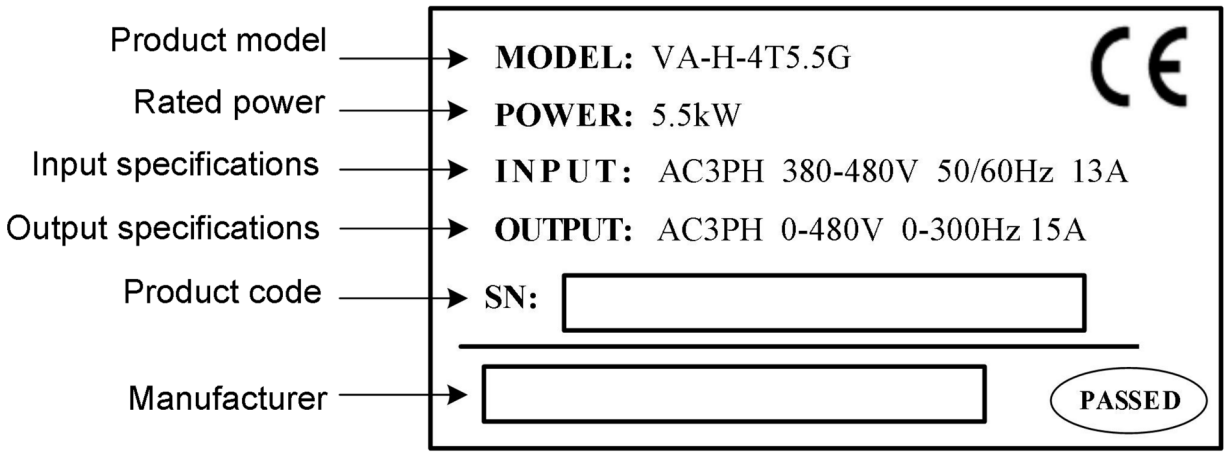
Chapter 1 Product Information

1.1 Model Description

The model field on the drive nameplate uses numbers and letters to indicate information such as product series, input voltage, power, software version and hardware version.



1.2 Nameplate Description



1.3 Ratings

■ VA−H−4T□□□G / VA−SC−4T□□□G−TSET

Rated power (kW)		3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110	132	160
Applicable motor (kW)		3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110	132	160
Output	Voltage (V)	Three−phase 0 to rated input voltage															
	Rated current (A)	9	13	17	24	30	39	45	60	75	91	112	150	176	210	253	304
	Max. current（A）	16	23	31	43	54	70	81	108	135	164	202	270	317	378	400	547
	Overload capability	150% for 60s, 180% for 10s, 200% for 0.5s, interval: 10 minutes (Inverse time characteristic)															
Input	Allowable voltage	3 phase 380V～480V；50Hz/60Hz															
	Rated current (A)	323V ... 528V; voltage imbalance ≤3%; allowable frequency fluctuation: ±5%															
	Allowable voltage	10	15	19	26	33	43	50	66	83	100	123	165	160*	196*	232*	282*
Brake chopper		Built−in as standard					Built−in as option							External			
Protection level		IP20															
Cooling mode		Force air cooling															

1.4 Technical Specifications

Control characteristics	Control mode	Sensor less vector control	Sensor vector control
	Starting torque	180% of rated torque at 0.2% of rated speed	180% of rated torque at 0 speed
	Speed regulation range	1:200	1:5000
	Steady speed precision	± 0.5%	± 0.02%
Product function	Key function	Speed loop, torque loop, position loop, orientation control, current limit, motor auto tune, inertia auto tune, deep flux-weakening control, over - voltage control, under-voltage control, motor flying start, etc.	
	Speed reference source	Modbus communication, keypad, external digital input, analog input AI1/AI2/AI3, pulse input, simple PLC, PID, etc.	
	Dynamic brake	Brake chopper action voltage: 650 ... 750V. The brake chopper of products 3.7kW to 75kW can be built-in: ● 3.7...15kW: brake chopper is built-in as standard. ● 18.5...75kW: brake chopper is built-in as option.	
	Communication	Built-in Modbus-RTU communication, the max. distance up to 500 meters.	
	Keypad	LED keypad and LCD keypad are available. The keypad can be used as remote-control box by a net cable.	
	Common DC bus	Full series product support common DC bus directly.	
	Independent air duct	All series product adopts independent duct design.	
Protection	Power supply under-voltage, over-current protection, over-voltage protection, auto-tune fault, module protection, heat-sink over-temperature protection, drive overload protection, motor overload protection, peripheral protection, current abnormal detection, output short-circuit to ground protection, EEPROM abnormal detection, temperature sampling disconnection, encoder disconnection, analog input abnormal detection, motor over-temperature, communication fault, hardware overload protection, etc.		
Efficiency	At rating condition: ● 0.75kW to 7.5kW: ≥93% ; ● 11kW to 45kW: ≥95%; ● 55kW and higher power class: ≥98%		
Environment	Operating site	● Install vertically in a well-ventilated electrical cabinet. Horizontal or other installation methods are not allowed. ● The cooling medium is air. ● Installed in an environment free from direct sunlight, dust, corrosive gases, flammable gases, oil mist, steam, dripping.	
	Ambient temperature	● -10 ... +40℃. Derate the output current by 1% for each 1 °C to install the drive in ambient temperature between 40 to 50 °C.	
	Humidity	5 ... 95%, no condensation is allowed.	
	Altitude	● 0 ... 4000 meters. Derate the output current by 1% for each 100 meters to install the drive in altitudes between 1000 to 4000 meters.	
	Vibration	● 3.5 m/s^2, 2 ... 9Hz; ● 10 m/s^2, 9 ... 200Hz; ● 15 m/s^2, 200 ... 500Hz	
	Storage temperature	-40 ... +70℃.	

1.5 Brake Resistor

Drive model	Brake chopper	Brake resistor				Braking torque %
		Power (kW) (10% ED)	Resistance value (Ω)	Minimum resistance (Ω)	Qty.	
VA-H-4T3.7G / VA-SC-4T3.7G-TSET	Built-in as standard	550W	150Ω	66.7Ω	1	135
VA-H-4T5.5G / VA-SC-4T5.5G-TSET		800W	100Ω	66.7Ω	1	135
VA-H-4T7.5G / VA-SC-4T7.5G-TSET		1070W	75Ω	66.7Ω	1	130
VA-H-4T11G / VA-SC-4T11G-TSET		1600W	50Ω	40Ω	1	135
VA-H-4T15G / VA-SC-4T15G-TSET		2000W	40Ω	25Ω	1	125
VA-H-4T18.5G / VA-SC-4T18.5G-TSET	Built-in as option	4800W	32Ω	20Ω	1	125
VA-H-4T22G / VA-SC-4T22G-TSET		4800W	27.2Ω	20Ω	1	125
VA-H-4T30G / VA-SC-4T30G-TSET		6000W	20Ω	14Ω	1	125
VA-H-4T37G / VA-SC-4T37G-TSET		9600W	16Ω	14Ω	1	125
VA-H-4T45G / VA-SC-4T45G-TSET		9600W	13.6Ω	10Ω	1	125
VA-H-4T55G / VA-SC-4T55G-TSET		6000W	20Ω	7Ω	2	135
VA-H-4T75G / VA-SC-4T75G-TSET		9600W	13.6Ω	5Ω	2	145

Notes:

- The resistance value of brake resistor must be higher than the minimum resistance value of the above table; otherwise, the built-in brake chopper will be damaged.
- The higher power of the brake resistor, the better. The brake resistor power in the table is calculated with the braking duration within 30s. If the braking duration is longer, the brake resistor power must be higher. Please select the appropriate brake resistor power according to the actual situation.
- The selection of brake resistor and brake chopper should according to system inertia, deceleration time, descent distance and time (i.e. potential energy), etc. If there is a large inertia in the system, requires a short deceleration time, and braking works very frequently, the brake resistor needs higher power and smaller resistance value.
- The connection mode for multiple braking resistors is parallel connection. For example, VA-H-4T55G, the braking resistor is suggest to select two 6000W 20Ωbraking resistor in parallel connection, amount to braking resistor is 12000W, 10Ω.
- It is require external brake chopper for the drive power higher than 90kW.

Chapter 2 Mechanical Installation

2.1 Installation Environment

- Install the drive in an area without dust, metal powder, oil, water, or other unwanted materials.
- Install the drive in an area without oil mist, corrosive gas, or flammable gas, explosive gas.
- Install the drive in an area without radioactive or flammable materials; keep wood and other flammable materials away from the drive.
- Install the drive in an area without harmful gas or fluids.
- Install the drive in an area without salt.
- Install the drive in an area without direct sunlight.
- Do not leave drilling residues inside the drive when installation.
- Install the drive vertically for sufficient airflow to cool the drive in the electric control cabinet, use a cooling fan or air conditioner to keep the internal air temperature in the permitted range.
- It is recommended to install the heat sink outside the cabinet for harsh installation environments.

2.2 Installation Direction and Clearances

As shown in the following figure, install the drive vertically for sufficient airflow to cool the drive. Make sure that there is sufficient space for wiring and airflow to cool the drive.

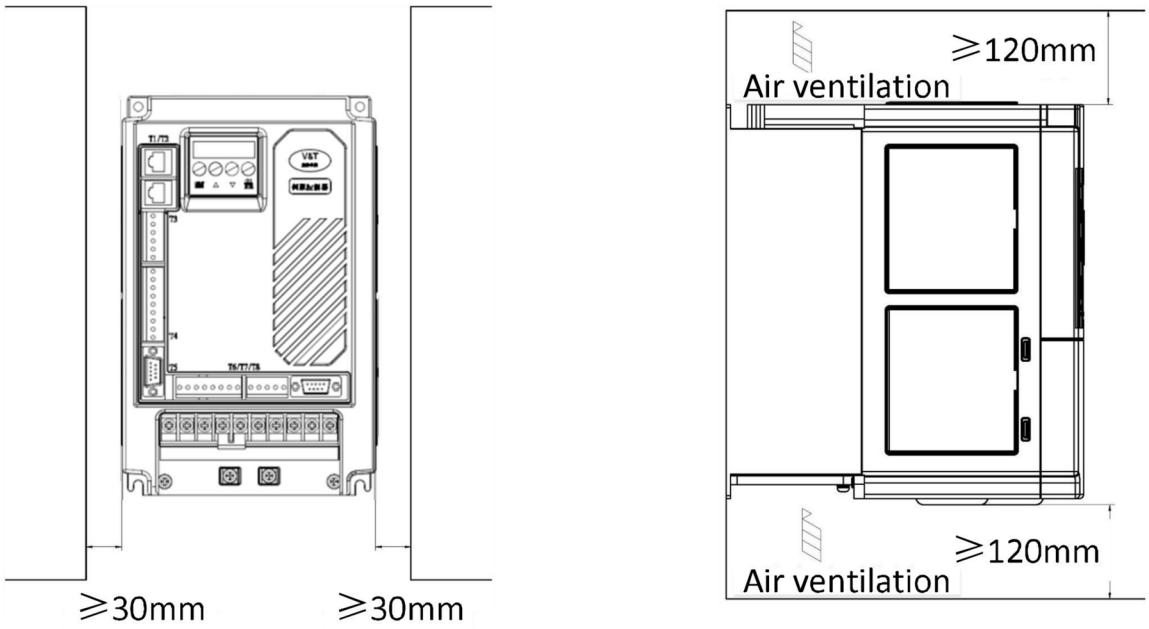


Figure2−1 VA−H(SZ)−4T7.5G(−TSET) and below power class

Note: When the 7.5kW and below power class drives are installed side by side in the control cabinet, please remove the upper dust guard and the lower leading board.

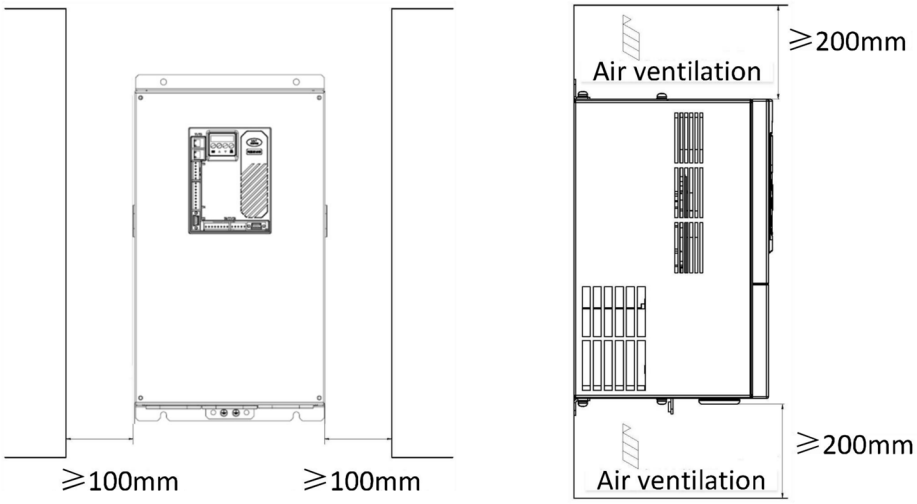


Figure 2-2 VA-H(SZ)-4T11G(-TSET) and above power class

2.3 Installation Dimensions and Weight

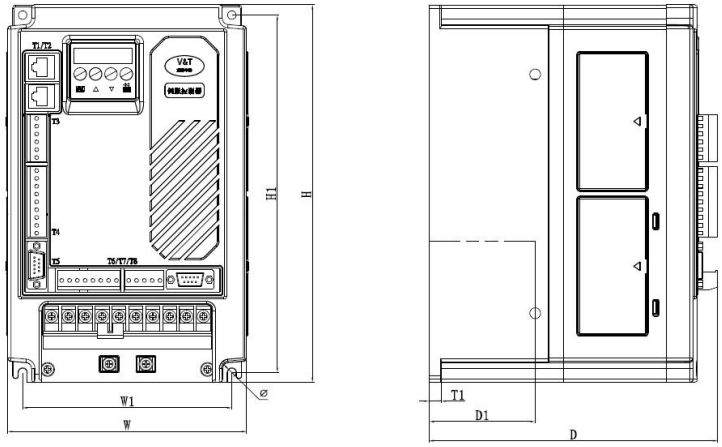


Figure 2-3 VA-H-4T7.5G / VA-SZ-4T7.5G-TSET and below power class

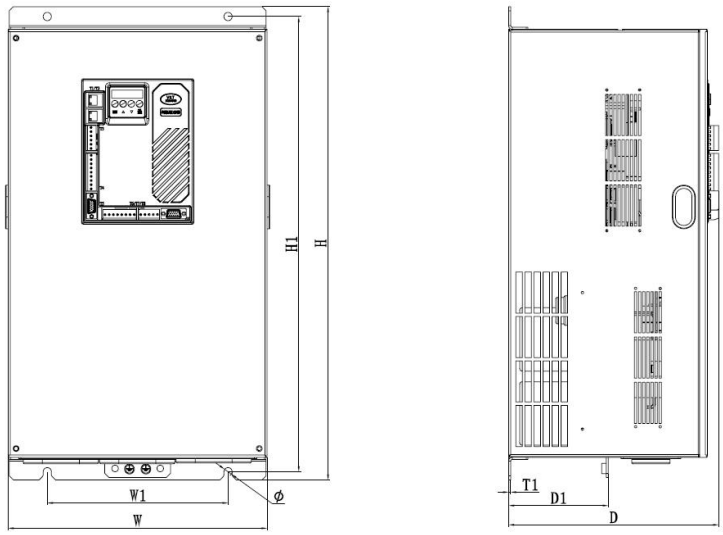


Figure 2-4 VA-H-4T11G / VA-SZ-4T11G-TSET and above power class

Voltage	Drive model	Dimensions （mm）								Approximate Weight(kg)
		W	H	D	W1	H1	D1	T1	Installation hole d	
400V	VA-H-4T3.7G VA-SC-4T3.7G-TSET	155	249	197.7	136	232	69	8	5.5	3.3
	VA-H-4T5.5G VA-SC-4T5.5G-TSET									
	VA-H-4T7.5G VA-SC-4T7.5G-TSET									
	VA-H-4T11G VA-SC-4T11G-TSET	210	337	230	150	324	107.5	2.5	7	8.5
	VA-H-4T15G VA-SC-4T15G-TSET									
	VA-H-4T18.5G VA-SC-4T18.5G-TSET	285	440	250	200	425	107.5	2.5	7	17
	VA-H-4T22G VA-SC-4T22G-TSET									
	VA-H-4T30G VA-SC-4T30G-TSET									
	VA-H-4T37G VA-SC-4T37G-TSET	315	575	247	220	553	123.5	2.5	10	25
	VA-H-4T45G VA-SC-4T45G-TSET									
	VA-H-4T55G VA-SC-4T55G-TSET	400	615	275	270	590	123.5	3.0	10	35
	VA-H-4T75G VA-SC-4T75G-TSET									
	VA-H-4T90G VA-SC-4T90G-TSET	465	745	335	343	715	156	3.0	12	55
	VA-H-4T110G VA-SC-4T110G-TSET									
	VA-H-4T132G VA-SC-4T132G-TSET	540	890	395	370	855	205.5	4.0	14	85
	VA-H-4T160G VA-SC-4T160G-TSET									

2.4 Each Part Name

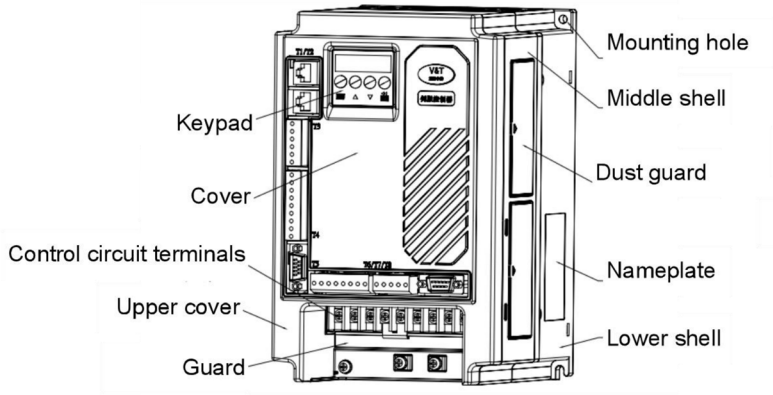


Figure 2-5 Power class ⩽ 7.5kW

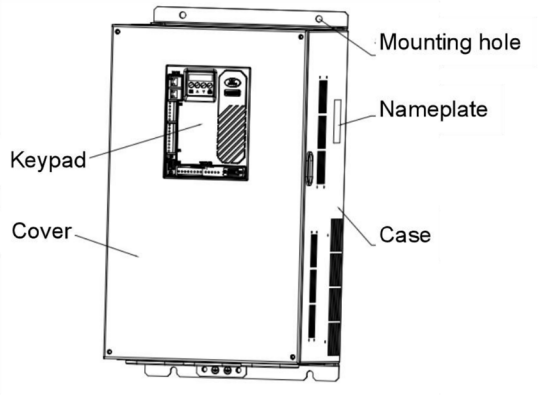


Figure 2-6 Power class ⩾ 11kW

2.5 Remove and Install the Front Cover

2.5.1 Remove and Install the Cover (Products power ⩽ 7.5kW)

◆ **Remove the cover**

As shown in the following lest Figure:

① Press the left and right sides of the cover forcefully in direction 1.

② Lift the cover in direction 2.

◆ **Install the cover**

After finish the wiring of main circuit and control circuit, install the cover as shown in the following right Figure:

① Insert the upper claw grab of the cover into the groove of the product body in direction 1.

② Press the lower part in direction 2, until hear the "crack" sound to ensure the hooks on the left and right sides are fully inserted into the case.

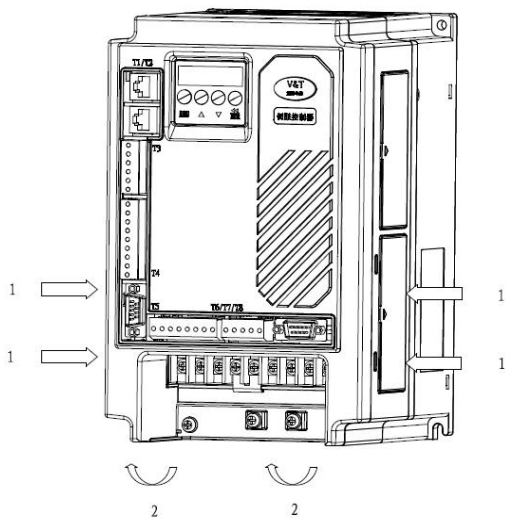


Figure 2-7 Remove the cover

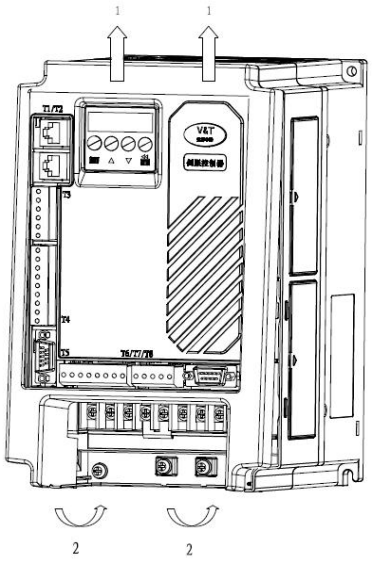


Figure 2-8 Install the cover

◆ **Install and remove the surface shell**

① Press all the hooks of the surface shell in the direction 1 in Figure 2−9 to separate the hooks of the surface shell from the groove of the upper cover.

② Pull the surface shell outward in the direction 2 to remove the surface shell.

③ As shown in Figure 2-10, align the surface shell with the upper cover clamp and press down on the surface shell with force in direction 1. Ensure that all hooks on the surface shell are inserted into the slots of the upper cover.

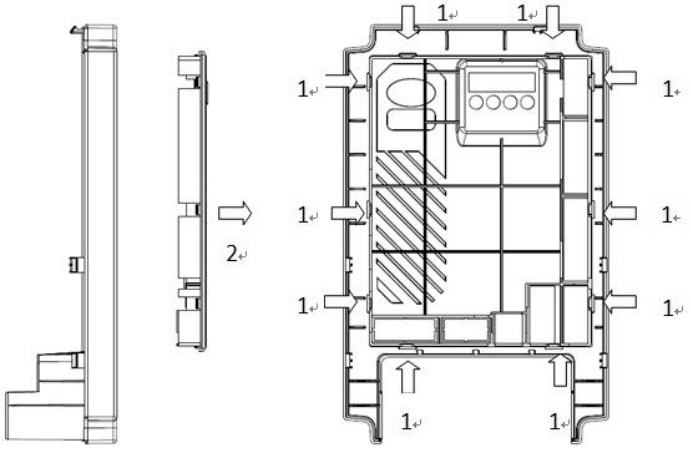


Figure 2−9 Remove the surface

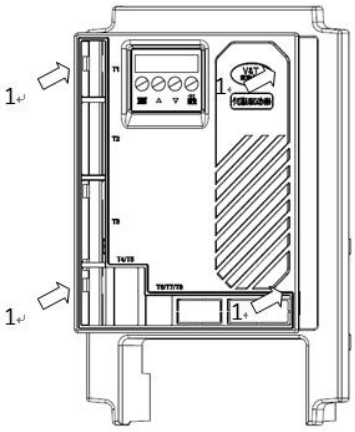


Figure 2−10 Install the surface

2.5.2 Remove and Install the Cover (Products power 11kW … 75kW)

◆ **Remove the cover.**

① Remove the mounting screws on the cover.

② Lift the cover in direction 1 as shown in the Figure2−10.

◆ **Install the cover**

After finish the wiring of main circuit and control circuit, install the cover as shown in the following right Figure:

After the wiring of the main circuit terminals and control circuit terminals is completed:

① Cramp the cover as shown in the Figure2−11.

② Then tighten the cover screws.

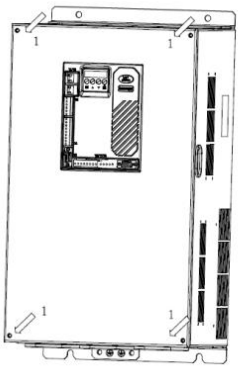


Figure 2−10 Remove the cover

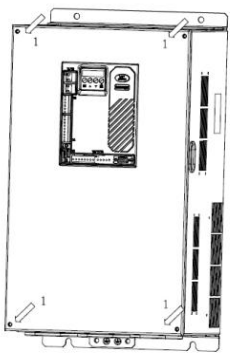


Figure 2−11 Install the cover

2.5.3 Open and close the Cover (Products power ⩾ 90kW)

◆ **Open the door**

① Press the latch follow the direction 1 in the Figure2−12.

② Open the door follow the direction 2.

◆ **Close the door**

After the connection of main circuit terminals and control circuit terminals is completed:

① Close the door follow the direction 1 in Figure2−13.

② Press down the latch follow direction 2 to close and lock the door.

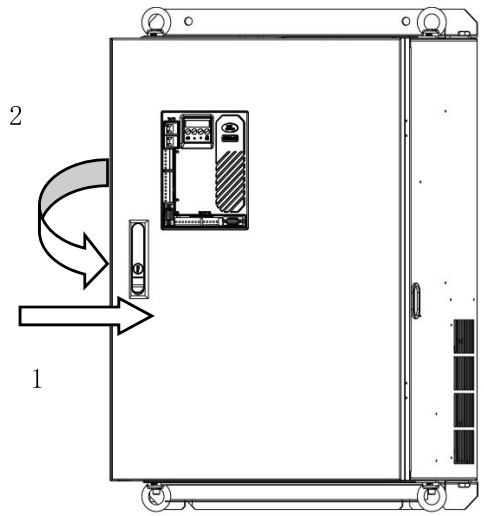


Figure 2−12 Open the door

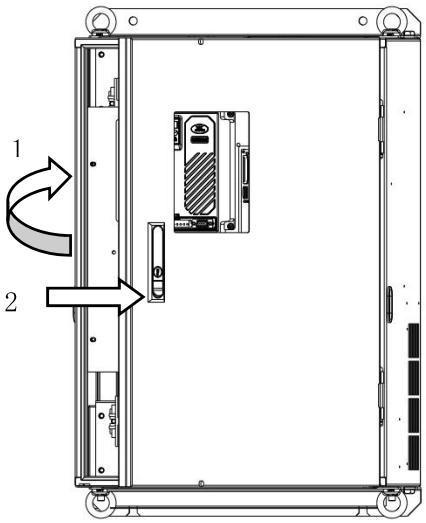


Figure 2−13 Close the door

Chapter 3 Electrical Installation

3.1 Peripheral Devices Connection

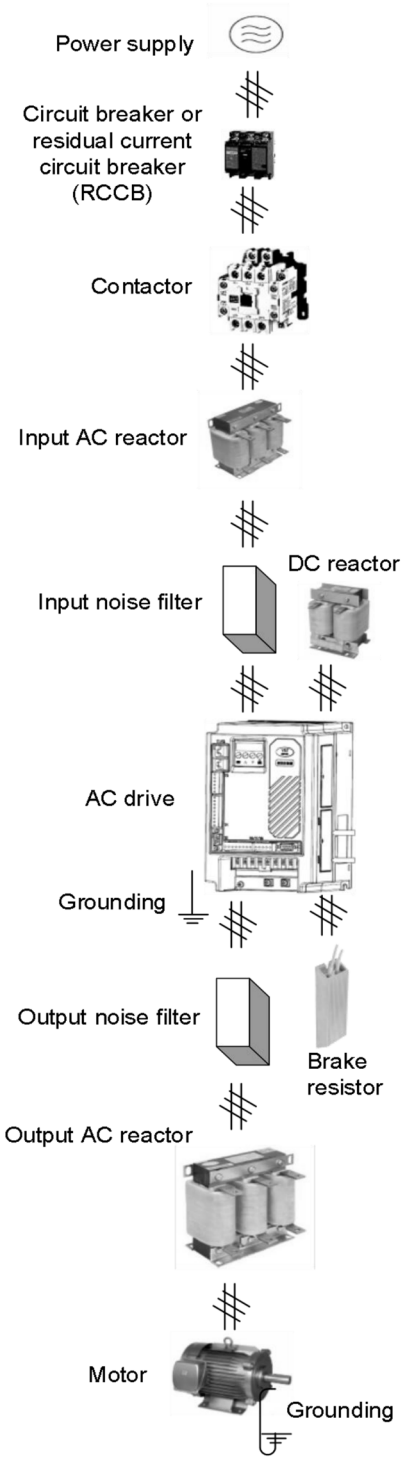


Figure 3−1 Connection diagram of the product and peripheral devices

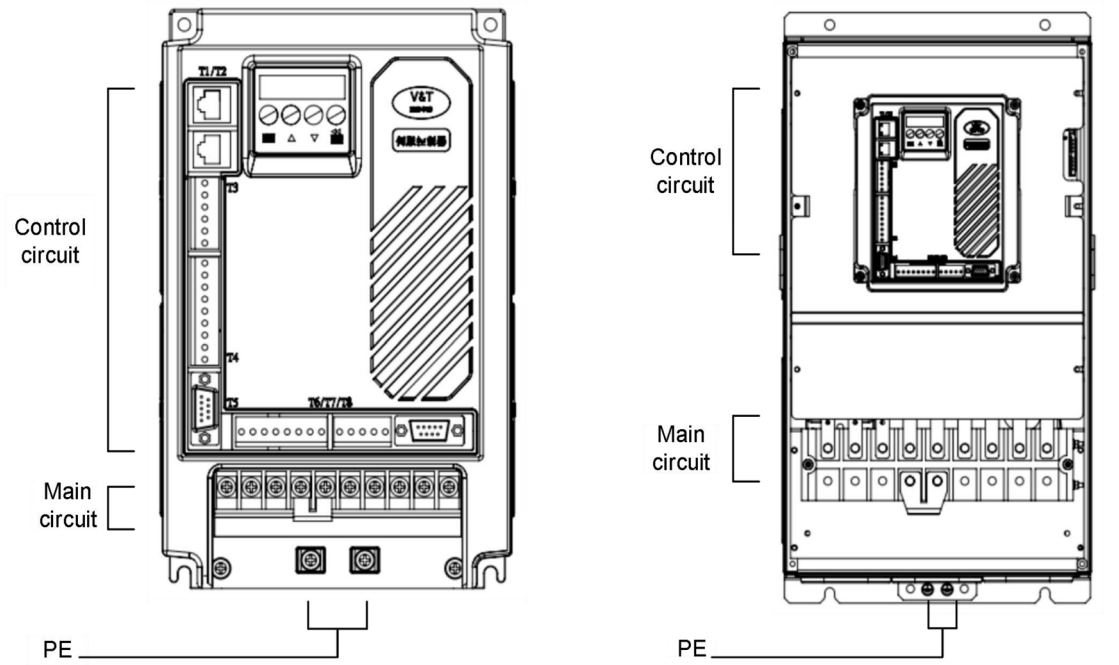
3.2 Peripheral Devices Description

Device	Model selection reference
Circuit breaker	The circuit breaker capacity should be 1.5 to 2 times of the drive rated current. The time characteristics of the circuit breaker must fully consider the time characteristics of the drive overload protection.
RCCB (Residual current circuit breaker)	The drive output is high-frequency pulse so as generates leakage current to ground. When a RCCB is installed at the input end, please use a specialized RCCB.It is suggested to choose type B RCCB and set the leakage current higher than 300mA.
Contactor	Frequent contactor action will cause drive failure, the maximum frequency for the open and close the contactor shall not exceed 10 times/min. When use a brake resistor, in order to avoid the brake resistor over-temperature and be damaged, a thermal protection relay with brake resistor over – temperature detection should be installed to disconnect the contactor of power supply.
Input AC reactor or DC reactor	1. The power supply capacity is more than 600kVA or 10 times of the drive capacity. 2. If there is a switch-type reactive compensation capacitor or a thyristor phase-controlled load on the same power supply node. There will be a large peak current flowing into the input power circuit, which will cause damage to the rectifier. 3. When the voltage imbalance of drive's three-phase power supply exceeds 3%, it may cause interference to the system or cause damage to the rectifier. 4. The input power factor of the drive is required higher than 90%, and the input AC reactor can improve the power factor of the input side. 5. Improve the input side of the high-order harmonic; prevent distortion of voltage waveform from causing damage to other equipment. 6. Improve the impact of high order harmonics on the input side of the drive and reduce external conducted and radiated interference. When exists the above situations, an AC reactor at the drive input side or a DC reactor should be installed.
Input noise filter	It can reduce the interference from power supply to the drive and improve the anti-interference ability of the drive. It can reduce the external conduction and radiation interference of the drive.
Thermal protection relay	Although the drive has its own motor overload protection function, when a drive drives two or more motors or drives a multi-poles motor, a thermal protection relay shall be installed between the drive and each motor.
Output noise filter	It can reduce the external conduction and radiation interference of the drive.
Output AC reactor	When the cable from the drive to the motor exceeds 100 meters, an AC output reactor should be installed to suppress high – frequency oscillation, avoid motor insulation damage, prevent excessive leakage current and drive protection.

3.3 Peripheral Devices Models

Drive model	Circuit breaker (A)	Contactor (A)	R/L1, S/L2, T/L3, ⊕1, ⊕2/B1, B2, Θ, U/T1, V/T2, W/T3			Grounding PE ⏚		
			Terminal screw	Tightening torque (N·m)	Cable (mm2)	Terminal screw	Tightening torque (N·m)	Cable (mm2)
VA-H-4T3.7G VA-SC-4T3.7G-TSET	25	16	M4	1.2 ... 1.5	4	M4	1.2 ... 1.5	4
VA-H-4T5.5G VA-SC-4T5.5G-TSET	32	25	M4	1.2 ... 1.5	6	M4	1.2 ... 1.5	6
VA-H-4T7.5G VA-SC-4T7.5G-TSET	40	32	M4	1.2 ... 1.5	6	M4	1.2 ... 1.5	6
VA-H-4T11G VA-SC-4T11G-TSET	63	40	M5	2.5 ... 3.0	6	M5	2.5 ... 3.0	6
VA-H-4T15G VA-SC-4T15G-TSET	63	63	M5	2.5 ... 3.0	6	M5	2.5 ... 3.0	6
VA-H-4T18.5G VA-SC-4T18.5G-TSET	100	63	M6	4.0 ... 5.0	10	M6	4.0 ... 5.0	10
VA-H-4T22G VA-SC-4T22G-TSET	100	100	M6	4.0 ... 5.0	16	M6	4.0 ... 5.0	16
VA-H-4T30G VA-SC-4T30G-TSET	125	100	M6	4.0 ... 5.0	25	M6	4.0 ... 5.0	16
VA-H-4T37G VA-SC-4T37G-TSET	160	100	M8	9.0 ... 10.0	25	M8	9.0 ... 10.0	16
VA-H-4T45G VA-SC-4T45G-TSET	200	125	M8	9.0 ... 10.0	35	M8	9.0 ... 10.0	16
VA-H-4T55G VA-SC-4T55G-TSET	315	250	M10	17.6 ... 22.5	50	M10	14.0 ... 15.0	25
VA-H-4T75G VA-SC-4T75G-TSET	350	330	M10	17.6 ... 22.5	60	M10	14.0 ... 15.0	35
VA-H-4T90G VA-SC-4T90G-TSET	315	250	M10	17.6 ... 22.50	70	M10	14.0 ... 15.0	35
VA-H-4T110G VA-SC-4T110G-TSET	350	330	M10	17.6 ... 22.5	100	M10	14.0 ... 15.0	50
VA-H-4T132G VA-SC-4T132G-TSET	400	330	M12	31.4 ... 39.2	150	M12	17.6 ... 22.5	75
VA-H-4T160G VA-SC-4T160G-TSET	500	400	M12	31.4 ... 39.2	185	M12	17.6 ... 22.5	50×2

3.4 Terminal Configuration



VA−H−4T7.5G/ VA−SC−4T7.5G-TSET and below power

VA−H−4T11G/ VA−SC−4T11G-TSET and below power

Figure 3−2 Terminal Configuration

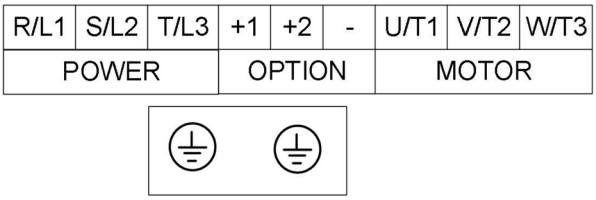
3.5 Main Circuit Terminal Description

◆ VA−H−4T3.7G ... VA−H−4T15G, VA−SC−4T3.7G−TSET ... VA−SZ−4T15G−TSET:

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

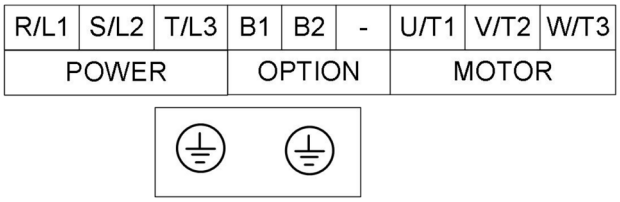
Terminal Symbol	Description
R/L1、S/L2、T/L3	Three-phase AC input
+1、+2/B1	DC reactor connecting terminal, short circuited with copper bus by default
+2/B1、B2	Connecting terminal of brake resistor
+2/B1、—	DC power input terminal; DC input terminal of external brake chopper
U/T1、V/T2、W/T3	Three−phase AC output terminal
⏚	Grounding terminal PE

◆ VA-H-4T18.5G ... VA-H-4T75G, VA-SC-4T18.5G-TSET ... VA-SZ-4T75G-TSET: not select built-in brake chopper:



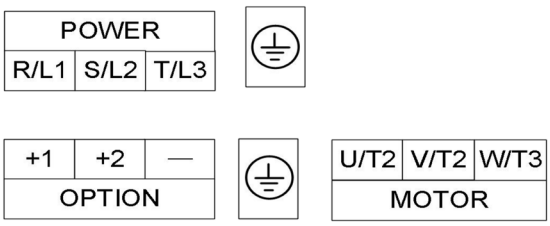
Terminal Symbol	Description
R/L1、S/L2、T/L3	Three-phase AC input
+1、+2	DC reactor connecting terminals, short circuited with copper bus by default
+2、—	DC power input terminal, DC input terminal of external brake chopper
U/T1、V/T2、W/T3	Three-phase AC output terminal
⏚	Grounding terminal PE

◆ VA-H-4T18.5G ... VA-H-4T75G / VA-SC-4T18.5G-TSET ... VA-SZ-4T75G-TSET: select built-in brake chopper:



Terminal Symbol	Description
R/L1、S/L2、T/L3	Three-phase AC input
B1、B2	Brake resistor connecting terminals
B1、—	DC power input terminal, DC input terminal of external brake chopper
U/T1、V/T2、W/T3	Three-phase AC output terminal
⏚	Grounding terminal PE

◆ VA-H-4T90G, VA-SC-4T90G-TSET and above power class



Terminal Symbol	Description
R/L1、S/L2、T/L3	Three-phase AC input
+1、+2	DC reactor connecting terminal The drive will no display after power on if not connect the DC reactor.
+2、—	DC power input terminal, DC input terminal of external brake chopper.
U/T1、V/T2、W/T3	Three-phase AC output terminal
⏚	Grounding terminal PE

3.6 Attention for Main Circuit Wiring

3.6.1 Power Supply

- Do not connect the power supply cable to the output terminal; it can cause damage to the internal components of the drive.
- For input side over-current protection and maintenance conveniently, the drive should connected to the power supply through a breaker or RCCB and contactor.
- Please confirm whether the number of power phases and rated voltage are consistent with the nameplate of the product, otherwise the drive may be damaged.

3.6.2 Motor

- Do not connect terminals to the ground terminal. If you connect these terminals to earth ground, it can cause damage to the drive or serious injury or death.
- Avoid output cables (U/V/W) short circuit or short circuit to enclosure, otherwise there is a risk of electric shock.
- It is strictly forbidden to connect a capacitor or phase lead LC/RC noise filter to the output of the drive, otherwise the drive will be damaged.
- When a contactor is installed between the drive and the motor, the switching action of the output contactor cannot be performed (ON or OFF) during the operation of the drive, otherwise a large current will flow into the drive to and the drive will trip on a fault, even cause damage to the drive.
- Cable length between drive and motor: When the cable between the drive and the motor is too long, the high-order harmonic leakage current at the output will adversely affect the drive and peripheral devices. It is recommended to install an output AC reactor when the motor cable exceeds 100 meters, and contact the manufacturer to inquire whether the carrier frequency needs to be modified.

3.6.3 Grounding

- The drive generates leakage current, and the larger the carrier frequency, the more the leakage current. The leakage current of the drive is higher than 3.5mA. The leakage current is determined by the conditions of use. To ensure safety, the drive and motor must be grounded.
- The grounding resistance should be less than 10 Ω. For the wire diameter requirements of the grounding cable, please refer to "3.3 Peripheral Devices Models".
- Do not share the grounding wire with welding machines and other power equipment.
- When using two or more drives, the grounding wire should not form a loop.

Correct Wrong

Figure 3-4 Grounding wiring

3.6.4 Countermeasures for Conduction and Radiation Interference

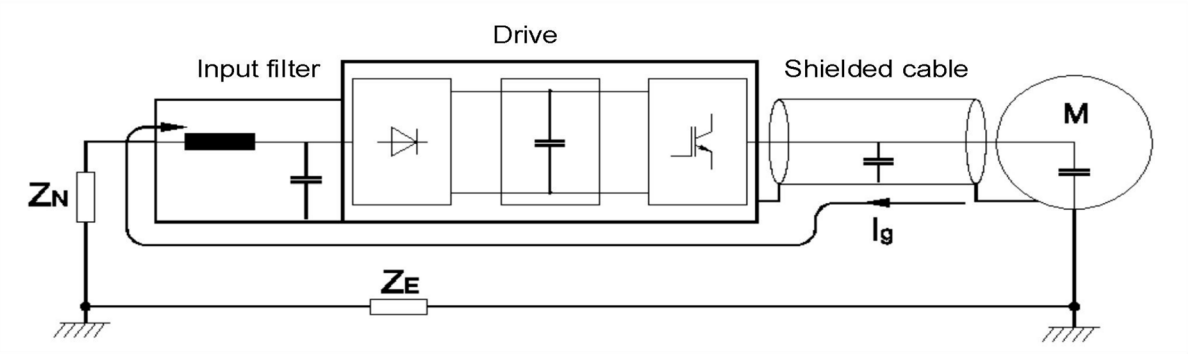


Figure3−4 Noise current illustration

- If an input noise filter is installed, the wiring from the filter to the input power supply of the drive should be as short as possible.
- The outer casing of the filter and the mounting cabinet should be reliably connected over a large area to reduce the return impedance of the noise current Ig.
- The cable distance between the drive and the motor should be as short as possible, and the motor cable should use 4−core cable. One end of the ground cable is grounded to the drive side, the other end is connected to the motor enclosure, and the motor cable is inserted into a metal tube.
- The input power cable and output motor cable should be as far away as possible.
- The susceptible equipment and signal cables should be installed as far away as possible from the drive.
- Critical signal cables should use shielded cables. It is recommended that the shield layer be grounded by a 360−degree grounding method and inserted into the metal tube. Keep away from the input power cable and output motor cable. If a signal cable must cross the input power cable or the output motor cable, they should be orthogonal.
- When the frequency reference source is analog input (voltage or current signal), use a double−stranded shielded cable and connect the shield layer to the grounding terminal PE of the drive. The signal cable length must less than 50 meters.
- The wiring of the control circuit relay output signal and other control circuit signal should be separate.
- It is strictly forbidden to short−circuit the shield layer with other signal cables and equipment.
- When the drive is connected to an inductive load device (magnetic contactor, relay, solenoid valve, etc.), be sure to use a surge suppressor on the load device coil as shown below.

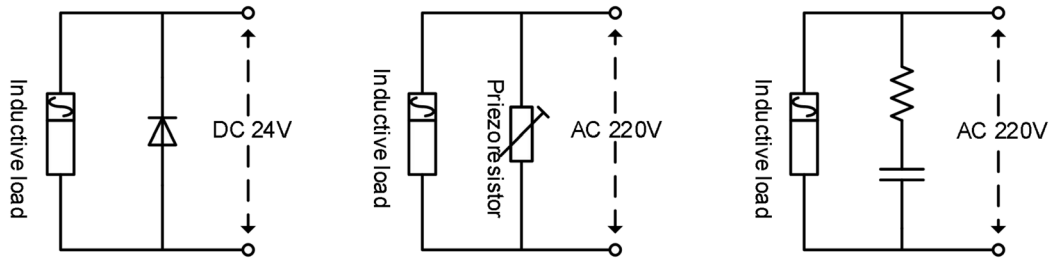


Figure 3−5 Application of inductive load surge suppressor

3.7 Terminal Wiring 1

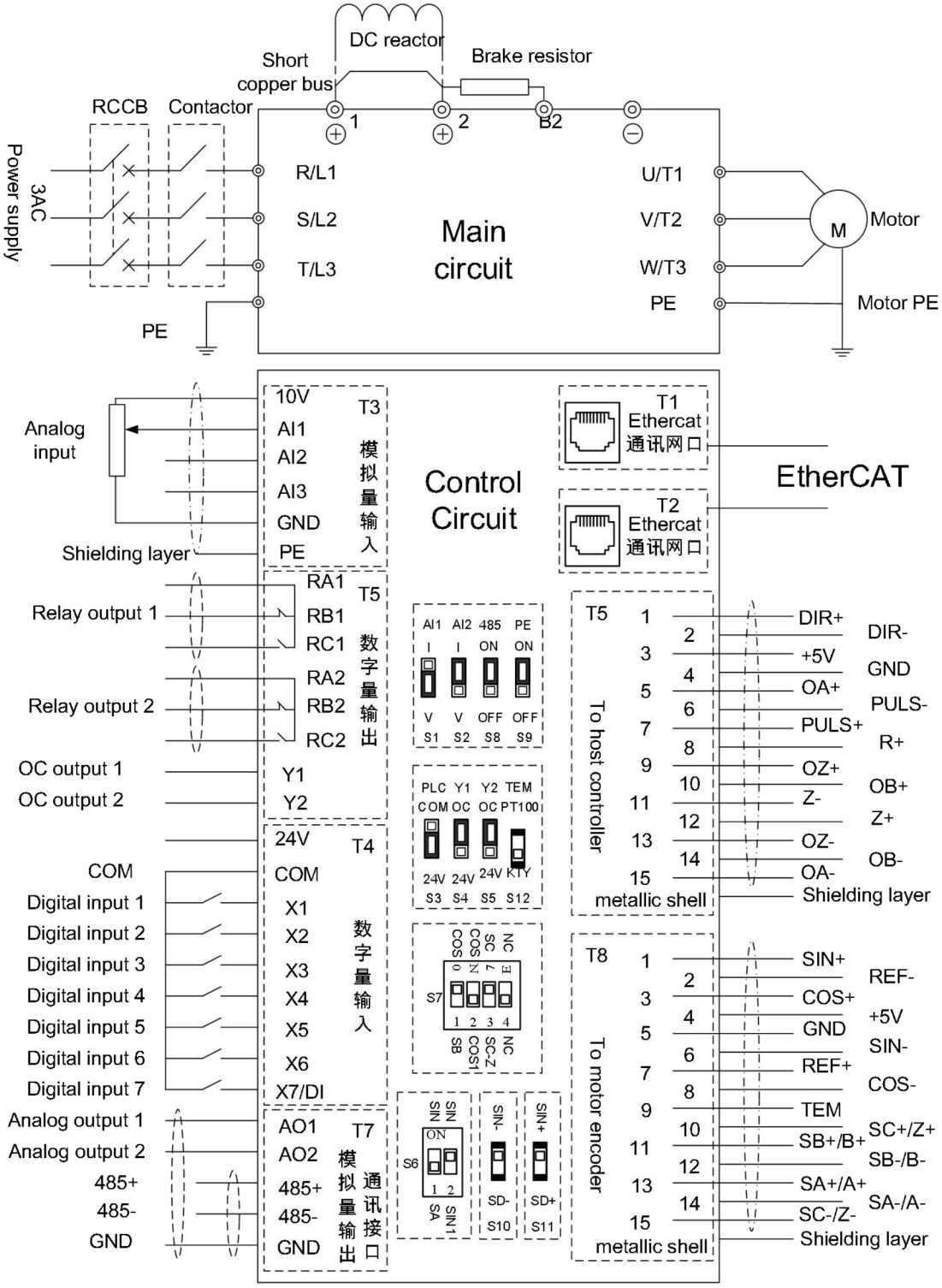
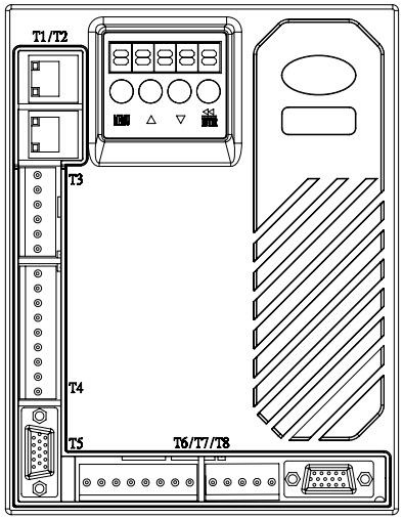
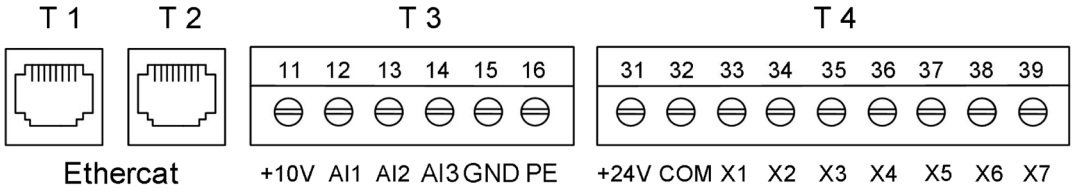


Figure3−6 Terminal wiring diagram (take VA−H−4T5.5G as an example)

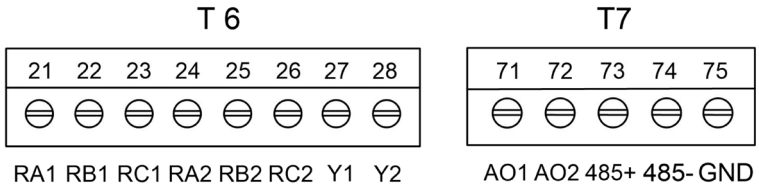
3.8 Control Circuit Terminals



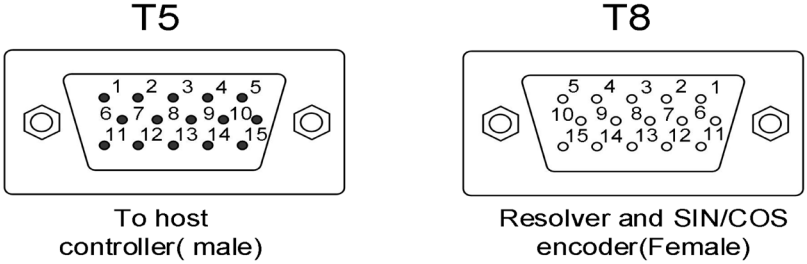
■ T1/T2/T3/T4 terminals



■ T6/T7 terminals



■ T5/T8 terminals



3.9 Control Circuit Description

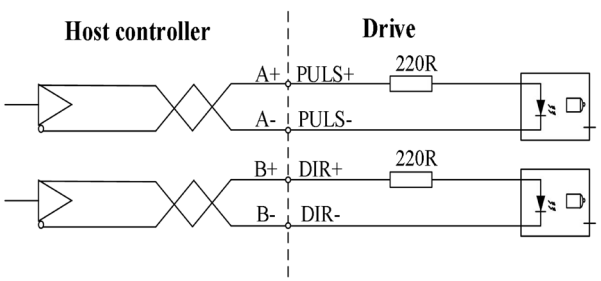
Type	Symbol	Function description	Technical specifications
Modbus	485+	RS485 positive end	● Baud rate: 4800/9600/19200/38400/57600/57600bps ● Up to 32 units are connected in parallel. ● If more than 32 units are used, repeaters are required.
	485−	RS485 negative end	
	GND	Modbus ground terminal	
Digital inputs	+24V	+24V	24V±10%, internal isolated with GND. Maximum output current: 200mA
	PLC	Power supply of DI	Short to +24V by default
	X1 ... X7	Digital inputs 1 ... 7	Input specification: 24VDC ± 20%, 5mA Frequency range: 0 … 1KHz
	COM	Digital inputs common	The interior isolated from GND
Digital outputs	Y1	Open collector output 1	Voltage range: 24V±20% Maximum output current: 50mA
	Y2	Open collector output 2	
	COM	Y1 and Y2 common	The interior isolated from GND
Relay outputs	RA1/RB1/RC1	Relay output 1	RA—RB: Normally closed RA—RC: Normally open Contact capacity: 250VAC/1A, 30VDC/1A
	RA2/RB2/RC2	Relay output 2	RA—RB: Normally closed RA—RC: Normally open Contact capacity: 250VAC/1A, 30VDC/1A
Analog inputs	+10V	AI reference voltage	10V ±3%, internal isolated with COM Maximum output current: 10mA
	AI1	Analog input 1	0V...10V: Input impedance 20kΩ , max. voltage: ±15V 0...20mA: Input impedance 500Ω , max. current: 30mA Resolution: 12 bits (0.025%) **Note**: select current input or voltage input by jumper.
	AI2	Analog input 2	
	AI3	Analog input 3	−10V...10V: Input impedance 20kΩ , max. voltage: ±15V Resolution: 12 bits (0.025%)
	GND	Analog GND	The interior isolated from COM
Analog outputs	AO1	Analog output 1	-10 ... 10V: Output allowable impedance ≥10kΩ Output accuracy: 2%, resolution: 10 bits (0.1%) With short-circuit protection function.
	AO2	Analog output 2	
	GND	Analog ground terminal	The interior isolated from COM

Host controller and encoder input interface

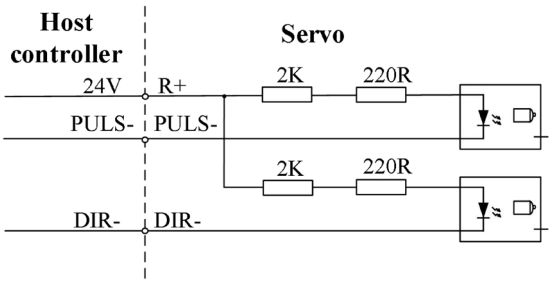
Type	Pin	Name	Description
Resolver and Sin/Cos encoder input	1	SIN+	Resolver signal SIN+
	2	REF-	Resolver signal REF-
	3	COS+	Resolver signal COS+
	4	+5V	+5V power supply
	5	GND	+5V power supply GND
	6	SIN−	Resolver signal SIN−
	7	REF+	Resolver signal REF+
	8	COS−	Resolver signal COS-
	9	TEM	Temperature sensor (KTY−84 / PTC by jumper)
	10	SC+/Z+	Sine cosine encoder signal SZ+ / incremental encoder Z-
	11	SB+/B+	Sine cosine encoder signal SB+ / incremental encoder B-
	12	SB−/B−	Sine cosine encoder signal SB- / incremental encoder B-
	13	SA+/A+	Sine cosine encoder signal SA+ / incremental encoder A+
	14	SA−/A−	Sine cosine encoder signal SA- / incremental encoder A-
	15	SC−/Z−	Sine cosine encoder signal SC- / incremental encoder Z-
Host controller signal input	1	DIR+	Direction input DIR+
	2	DIR−	Direction input DIR-
	3	+5V	+5V power supply
	4	GND	GND
	5	OA+	Encoder feedback output OA+
	6	PULS−	Pulse input -
	7	PULS+	Pulse input +
	8	R+	When single end pulse connection, PULS+ and DIR+ are pulled to R+ by a resistor
	9	OZ+	Encoder feedback output OZ+
	10	OB+	Encoder feedback output OB+
	11	Z−	Z signal input Z1
	12	Z+	Z signal input Z+
	13	OZ−	Encoder feedback output OZ-
	14	OB−	Encoder feedback output OB-
	15	OA−	Encoder feedback output OA-

3.10 Pulse Input Wiring Method

■ Differential pulse input wiring

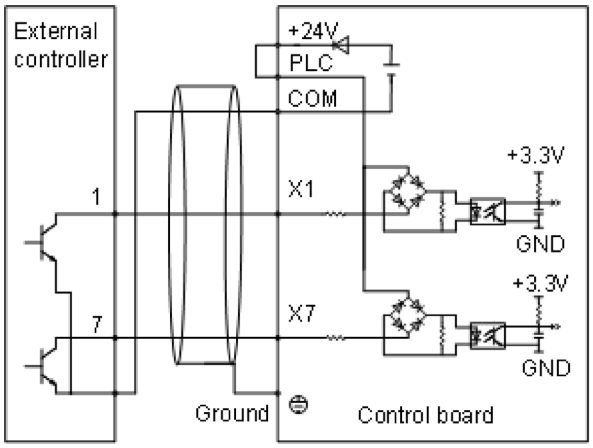


■ Single end pulse input wiring

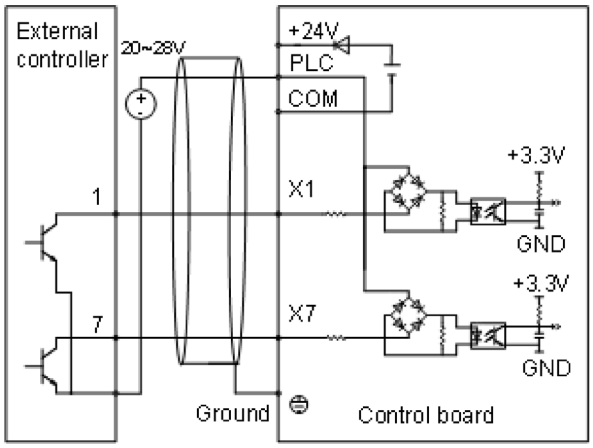


3.11 Digital Inputs and Outputs

■ Apply internal +24V power supply
NPN sink current wiring mode

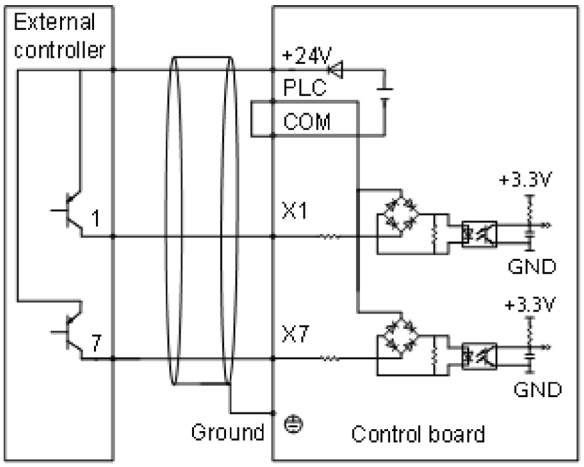


■ Apply external power supply
NPN sink current wiring mode



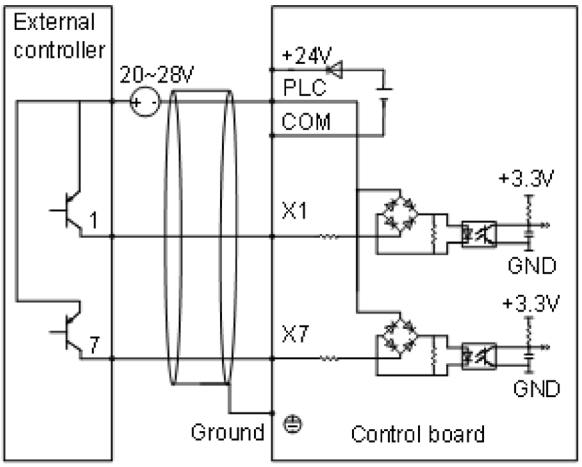
Note: Must remove +24V and PLC short cable

■ Apply internal +24V power supply
PNP sourcing current wiring mode



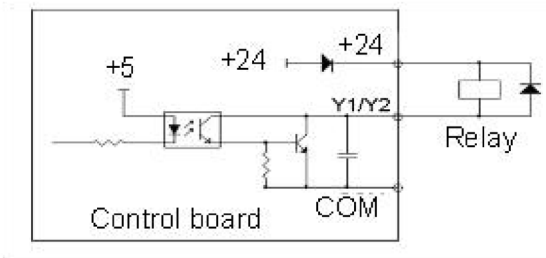
Note: Must remove +24V and PLC short cable
and short PLC and COM

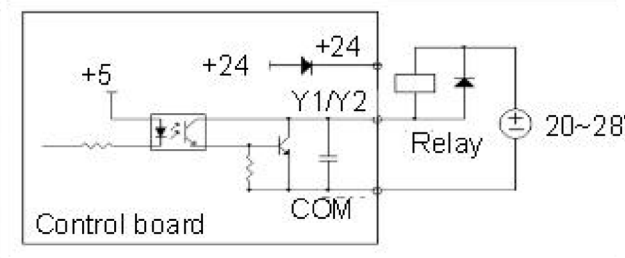
■ Apply external power supply
PNP sourcing current wiring mode



Note: Must remove +24V and PLC short cable

■ The wiring modes of the multi−function output terminals apply internal +24V and external power supply





Note: The external diode must be ensured the polarity is correct, otherwise, Y1/Y2 terminal will be damaged.

3.12 Control Circuit Peripheral Devices

Terminal number	Terminal screw	Tightening torque (N·m)	Cable mm²	Cable type
+10V, AI1, AI2, AI3, 485+, 485−, AO1, AO2, GND	M3	0.5 ... 0.6	0.75	Shielded twisted pair cable
+24V, PLC, X1, X2, X3, X4, X5, X6, X7/DI, COM, Y1, Y2, COM, RA, RB, RC, RA1, RC1, RA2, RC2	M3	0.5 ... 0.6	0.75	Shielded cable

3.13 Jumper Description

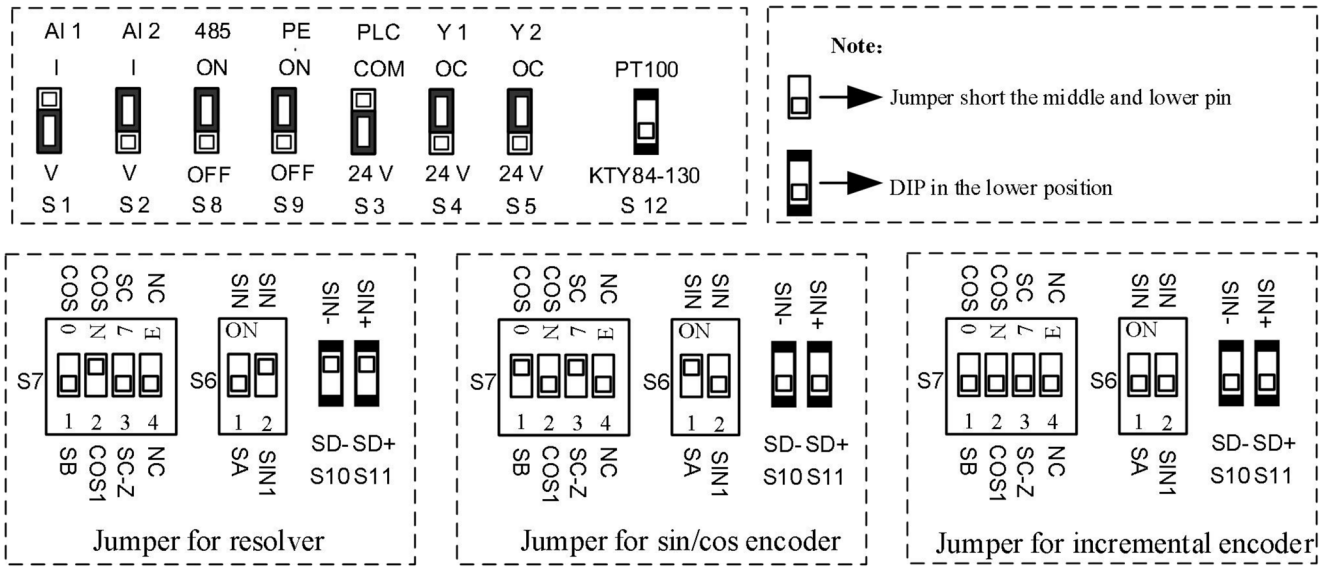


Figure 3−7 Jumper and DIP switch

Jumper	Description	Default
S1	AI1 jumper. V = voltage input 0...10V, I = current input 0/4mA ...20mA	V
S2	AI2 jumper. V = voltage input 0...10V, I = current input 0/4mA ...20mA	I
S3	PLC jumper. COM = PLC and COM shorted, 24V = PLC and +24V shorted	24V
S4	Y1 jumper. OC = short to OC, 24V = short to +24V	OC
S5	Y2 jumper: OC = short to OC, 24V = short to +24V	OC
S6	Select different type encoder signal input by the combination of S7, S10, and S11, as shown in the above figure for details.	
S7		
S10		
S11		
S8	RS485 100Ω termination resistor selection. ON = select, OFF = not select	OFF
S9	GND and COM terminals. ON = connect to PE, OFF = not connect to PE	ON
S12	Motor temperature sensor selection, reserved.	KTY84-130

Chapter 4 Keypad Operation

4.1 Keypad

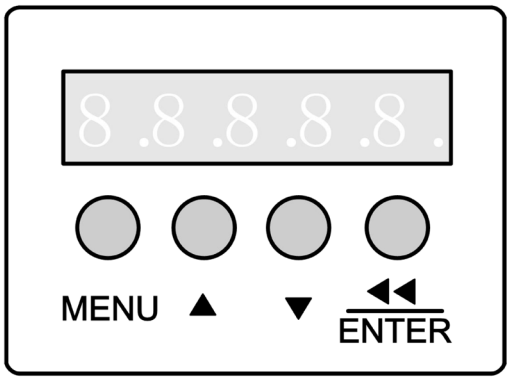


Figure4-1 Keypad

4.2 Keypad Keys

Key	Name	Function
MENU	Menu	1. Return to the previous menu. 2. Abandon the modification of the data. 3. Sequential loop switching between different menus
▲	Increase Key	1. Under the first level menu, the parameter PX.YZ is incremented by the current editing bit. 2. Under the secondary menu, the parameter data is incremented by the current editing position. 3. In the running state, when the speed command reference is keypad, the reference speed is incremented by the current bit. 4. On the default display interface, sequentially scroll up to the monitoring values corresponding to the C0.** group monitoring parameters.
▼	Decrease Key	1. Under the first level menu, the parameter PX.YZ is decreases by the current editing bit. 2. Under the secondary menu, the parameter data is decreases by the current editing position. 3. In the running state, when the speed command reference is keypad, the reference speed is decreases by the current bit. 4. On the default display interface, sequentially scroll down to the monitoring values corresponding to the C0.** group monitoring parameters.
◀◀ ENTER	Enter	Shift/Confirm key: 1. Long press to enter the next menu. 2. Long press to enter the parameter settings. 3. Long press data storage confirmation. 4. Rotate sequentially from right to left.

4.3 Menu Mode

4.3.1 The structure of the first level menu

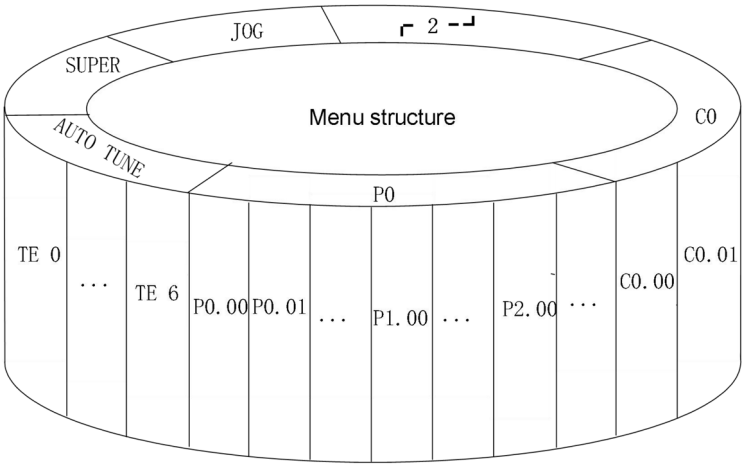


Figure 4–5 The structure of the first level menu

4.3.2 Recognition of LED display symbols

The corresponding relationship between LED display symbols and characters/numbers:

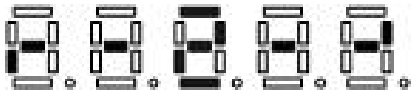
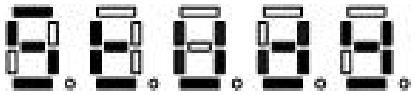
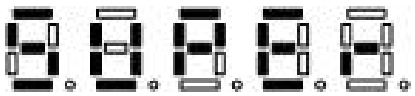
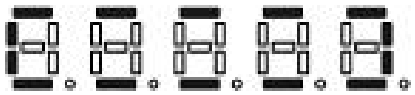
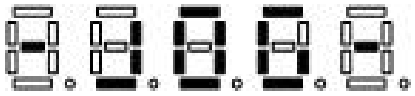
LED	Meaning	LED	Meaning	LED	Meaning	LED	Meaning
0	0	9	9	H	H	T	T
1	1	A	A	J	J	t	t
2	2	B	B	j	j	U	U
3	3	C	C	L	L	u	u
4	4	c	c	N	N	y	y
5	5	d	d	n	n	–	–
6	6	E	E	o	o	•	.
7	7	F	F	p	p		
8	8	G	G	r	r		

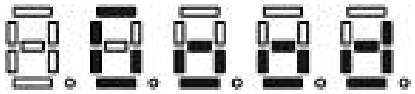
4.4 Keypad Display and Operation

4.4.1 Display Status Classification

Item	Status name	Meaning
1	Stop parameter display status	The default display interface during standby is the current system working mode.
2	Running parameter display status	default display parameters can be set in P0.17. The display status of operating parameters can be switched through the ∧ and ∨ keys
3	Fault and alarm status	When the drive has a fault, it directly enters this state, all the indicators are flashing.
4	First menu display mode	Long press <</ENTER key to enter this display mode
5	Second menu display mode	Long press <</ENTER key to enter this display mode
6	Parameter modification status	After entering the parameter modification status, when the current editing bit flashes, the parameter value can be modified by ∧ and ∨ keys.
7	Monitoring status	During stop or running status, user can enter group C0 to view the drive running state.

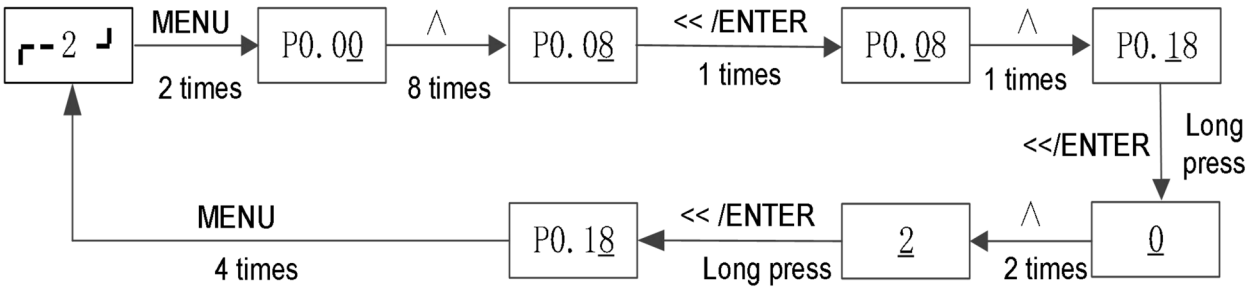
4.4.2 LED Display Description

LED display	Actual	Description
	--2-	System control mode display in standby mode: 1: Indicates in position loop. 2: Indicates in speed loop. 3: Indicates in torque loop.
	study	Auto tune mode. In this display state, long press<</ENTER key enter motor parameters tune mode.
	SUPER	Reserved by manufacture
		Motor parameter auto tuning state. In this display state long press <</ENTER key to stop the tuning.
	JOG	Jogging function. In this display state long press <</ENTER to start or stop jog running.
	TE 0	Motor parameters auto tune mode selection. After selecting the tune mode long press <</ENTER key to start motor parameters auto tune. The selection of auto tune modes are as follows: TE 0: No action TE 1：Static auto tune TE 2：Static auto tune + current loop PI auto tune

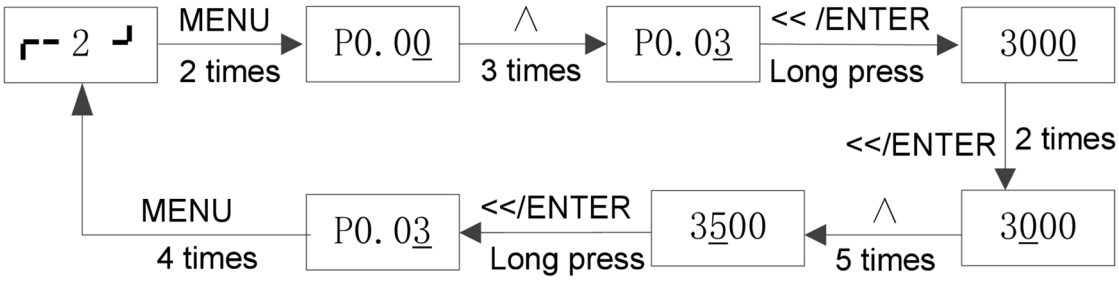
LED display	Actual	Description
		TE 3：Rotate auto tune TE 4：Rotate auto tune + current loop PI auto tune TE 5：Rotate auto tune + motor encoder auto tune TE 6：Rotate auto tune + current loop PI auto tune + motor encoder auto tune
	GOOD	Auto tune is completed, and if the auto tune fails, a fault will report.
	P0.00	Parameters.
	C0.00	Motoring parameters
	FAIL	Auto tune fault

4.5 Keypad Operation Examples

4.5.1 Reset to default (P0.18 = 2)



4.5.2 Change a parameter (P0.03 = 3500)



4.6 First Commissioning and Auto Tune

4.6.1 Required parameter settings

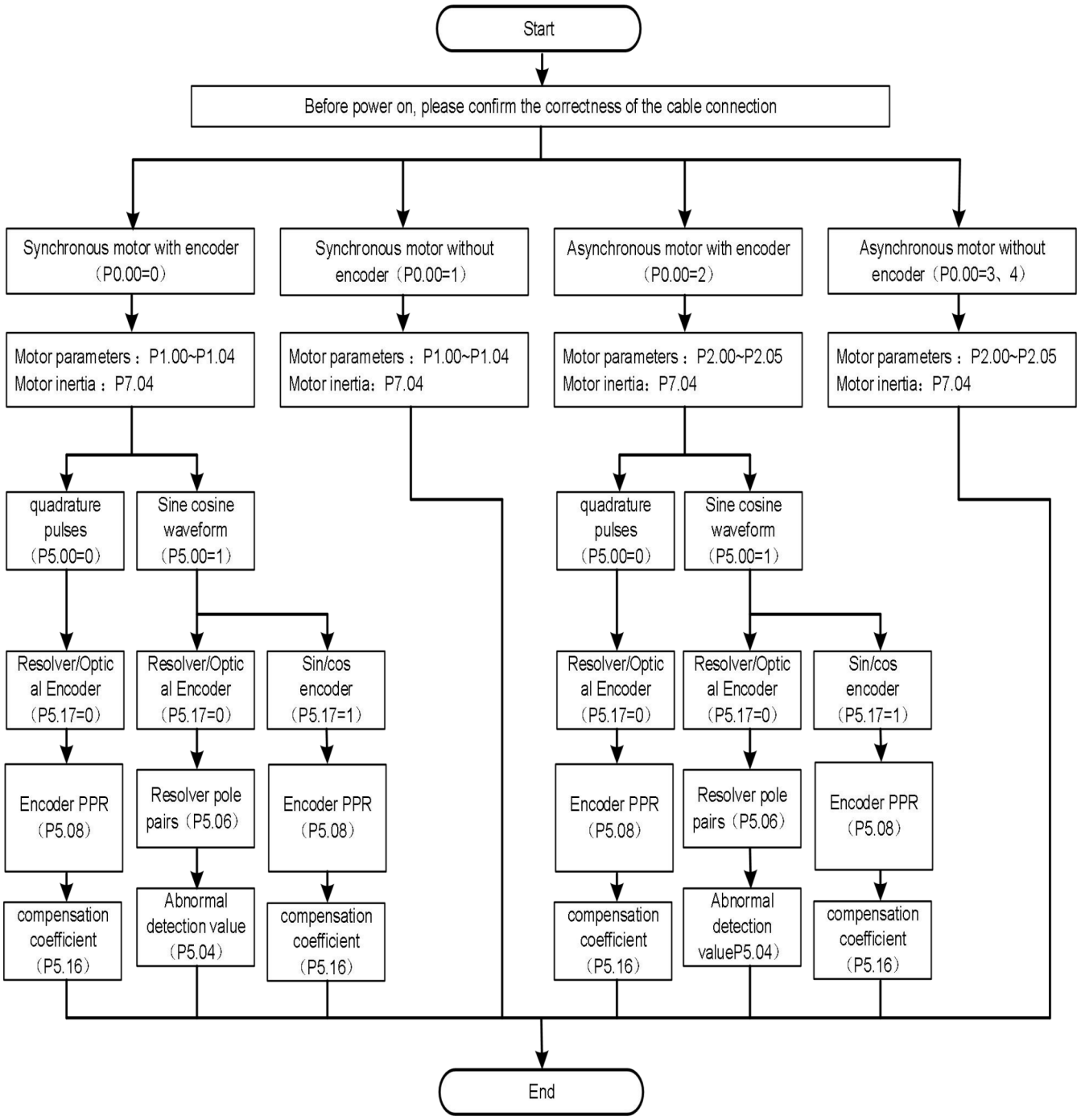
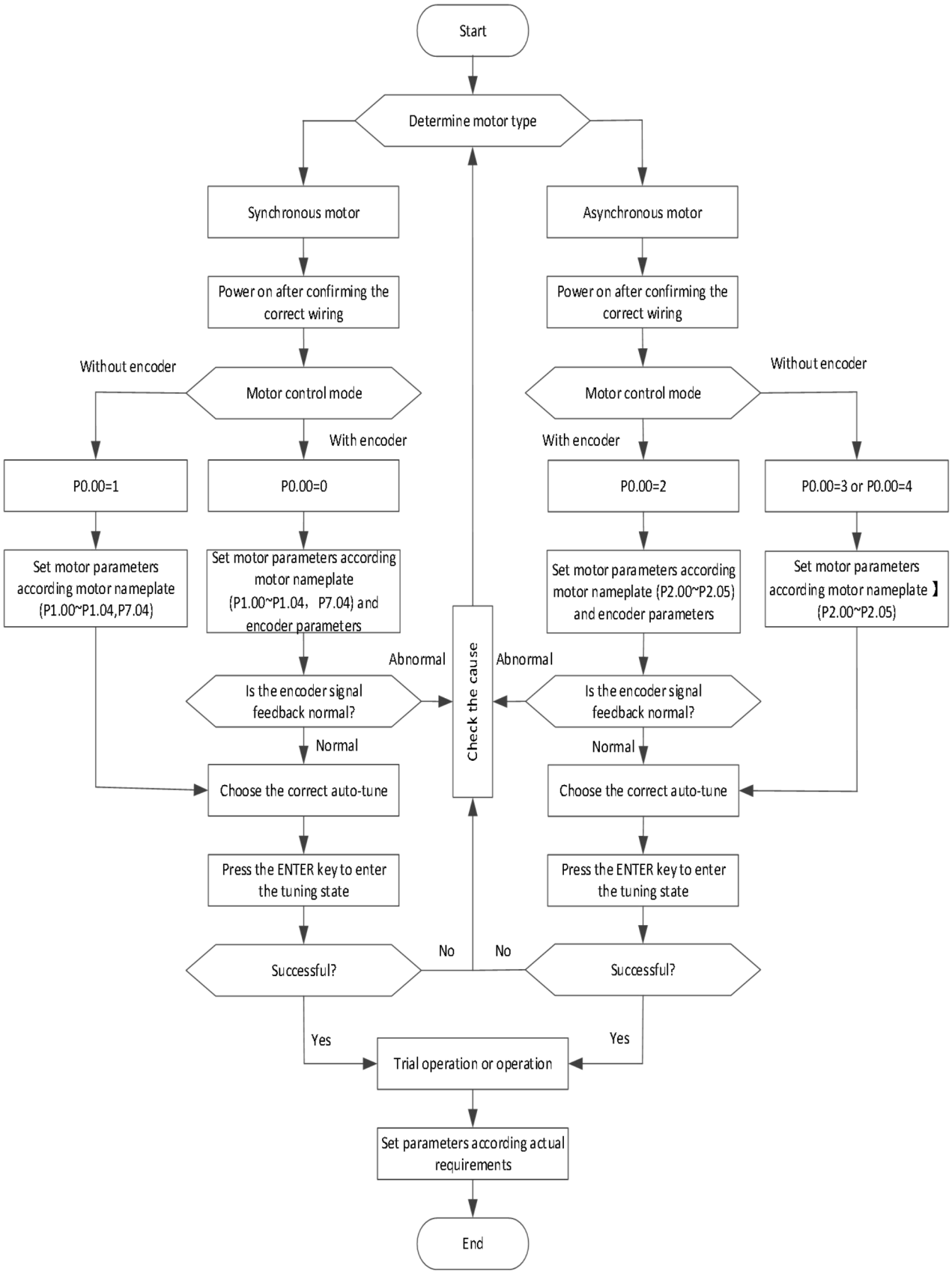


Figure 4-7 Auto-tune for the first time

4.6.2 Auto Tune and Trial Operation



Auto tune steps:

① Long press MENU key until display study.

② Long press ENTER key until display TE 0.

③ Press the ∧ or ∨ keys to select the following auto tune mode.

④ Long press ENTER key to start the auto tune operation.

Auto tune modes: TE 0: No action

TE 1: Static auto tune

TE 2: Static auto tune + current loop PI auto tune

TE 3: Rotate auto tune

TE 4: Rotate auto tune + current loop PI auto tune

TE 5: Rotate auto tune + motor encoder auto tune

TE 6: Rotate auto tune + current loop PI auto tune + motor encoder auto tune

Note:

① TE 1, TE 2, TE 3 and TE 4 can be used for all motor control mode. It is recommended to select TE 2 tune mode motor sensor-less control mode and not allows forward and reverse rotating and TE 4 tune mode for motor sensor-less control mode and allows forward and reverse rotating.

② TE 5 and TE 6 tune modes can be used for motor control with encoder speed feedback (P0.00 = 0/2). It is recommended to select TE 6 auto tune mode for motor sensor control mode.

③ During the tuning process of TE 3, TE 4, TE 5, and TE 6, the motor will rotate, please pay attention to safety. Before rotate tuning, please check whether the device allows forward and reverse rotating.

④ The acceleration and deceleration time during the tuning process of asynchronous motors is the acceleration and deceleration time of the speed loop. Therefore, it is not advisable to set P7.02 and P7.03 too small or too long for asynchronous motor auto tune.

⑤ If the fault code Err X is displayed after auto tune, it indicates that auto tune has failed, and it is necessary to recheck the wiring and parameter settings for auto tune.

Trial operation:

① Press the "MENU" key 5 times on the default power-on interface "-2-" to enter the "– JOG –" interface.

② Long press the "ENTER " key 1 time to enter the default speed interface "100" for trial operation.

③ Long press the "ENTER " key 1 time on this interface to start trial operation. At this time, the keypad automatically display the actual current.

④ Press the ∧ or ∨ keys on this interface to change the motor speed.

⑤ Long press the "ENTER " key again to stop trial operation.

Chapter 5 Parameter List

Description of each meaning in the parameter list

Item	Explanation
Para.	Parameter. Indicates the number of the parameter, such as P0.00.
Name	The name of parameter, which explains the parameter's meanings.
Default	The parameter value after reset the default value
Range	Allowable setting range.
Unit	V: voltage; A: current; °C: degrees Celsius; Ω: ohm; rpm: rev/min; %: percentage; bps: baud rate; Hz, kHz: frequency; mH: milli−henry; kW: power; ms, s, min, h, kh: time; /: no unit.
Attr.	Attribute. ○: The parameter can be changed while the drive is running. ×: The parameter only can be changed in stop status. *: The parameter is a read−only parameter and cannot be changed.
Description	Describe the parameters and values.

5.1 Parameters List

Para.	Name	Default	Range	Unit	Atrr.
P0.00	Motor control mode	1	0 ... 4	/	×

Selects the motor control mode according to the motor type and if exist a speed feedback from the motor.

- **0: Synchronous motor sensor vector control.**
  The drive controls a synchronous motor in sensor vector control mode. In this control mode, a speed feedback signal (encoder or resolver) from the motor is necessary. The motor parameters, encoder parameters need to be set correctly and rotate auto tune is required to obtain other motor parameters, encoder phase direction and rotor magnetic pole position, etc.
- **1: Synchronous motor sensor less vector control**
  The drive controls a synchronous motor in sensor less vector control mode. In this control mode, the motor parameters need to be set correctly and auto tune is required to obtain other motor parameters.
- **2: Asynchronous motor sensor vector control**
  The drive controls an asynchronous motor in vector control mode. In this control mode, a speed feedback signal (encoder or resolver) from the motor is necessary. The motor parameters and encoder parameters need to be set correctly and rotate auto tune is required to obtain other motor and encoder parameters.
- **3: Asynchronous motor sensor less vector control 1**
  The drive controls an asynchronous motor in sensor less vector control mode. In this control mode, a feedback signal from the motor is not necessary. This control mode is sensitive to motor parameters, need to input motor parameters correctly and auto tune is required.
- **4: Asynchronous motor sensor less vector control 2**
  The drive controls an asynchronous motor in sensor less vector control mode. In this control mode, a feedback signal from the motor is not necessary. This control mode is sensitive to motor parameters, need to input motor parameters correctly and auto tune is required.

Para.	Name	Default	Range	Unit	Atrr.
P0.01	System control mode	2	1 ... 3	/	×
	Selects the system control mode. ● **1: Position loop** The drive controls the motor running in position loop mode. Applicable to orientation and pulse train input position control applications. ● **2: Speed loop** The drive controls the motor running in speed loop mode. The speed (or frequency) reference is defined by parameter P0.05. The motor follows a speed reference given to the drive. Speed loop can operate without a speed feedback signal, or with an encoder or resolver for better speed control accuracy. ● **3: Torque loop** The drive controls the motor torque in torque loop mode. Motor torque follows a torque reference given to the drive. Torque control is possible without feedback, but is much more dynamic and accurate when used in conjunction with a feedback device such as an encoder or a resolver. Torque loop mode applicable to applications such as winders, unwinders, conveyors and where a particular tension needs to be maintained in the mechanical system. When there is no more material and the machine suddenly has no load, the motor speed will continue to increase until the speed limit. **Notes**: Position loop is only available in sensor control (P0.00 = 0 or 2), has no effect when sensor less control.				
P0.02	User macro	0	0 ... 4	/	×
	In most cases, the default value is appropriate. Other options are customized parameters for customers. ● **0: Standard macro** ● **1 … 4: Reserved**				
P0.03	Maximum speed	0	0 ... 30000	RPM	×
	Maximum speed allowed for motor operation.				
P0.04	Run command selection	2	0 ... 3	/	○
	● **0: Modbus communication** ● **1: Keypad** ● **2: External digital input terminal** ● **3: EtherCAT**				
P0. 05	Speed reference selection	1	0 ... 10	/	×
	Selects the source of speed (frequency) reference. ● **0: Modbus** ● **1: Keypad** ● **2: AI1.** 10V/20 mA = maximum speed.. ● **3: AI2.** 10V/20 mA = maximum speed. ● **4: AI3**. 10V = maximum speed. ● **5: Digital input terminal UP/DN.** The digital input(s) is used to increase and decrease speed reference. ● **6: Multi−step speed (frequency) reference**. The speed (frequency) reference is given through predefined constant speeds (frequency). It is possible to define up to 16 predefined speeds (frequency) that can be quickly activated through digital inputs.				

Para.	Name	Default	Range	Unit	Atrr.
	● **7: Pulse input** ● **8: PID** The speed (frequency) reference is given through PID controller. ● **9: Simple PLC** The speed (frequency) reference is given through simple PLC logic, multi constant speeds can be predefined and an operation time can be defined for each constant speed. ● **10:EtherCAT**				
P0.06	Keypad speed reference	0	-3000 ... 3000	rpm	○
	Speed reference when P0.05=1.				
P0. 07	UP/DN initial value	100	-3000 ... 3000	rpm	○
P0. 08	UP/DN adjust speed rate	1.0	1.0 ... 6553.5	/	○
P0. 09	UP/DN adjust speed function selection	0	0000 ... 1111	/	○
	Ones position: UP/DN adjust in stop state 0: Allowed 1: Not allowed Tens position: UP/DN adjust value clear in stop state 0: Not clear 1:Clear Hundreds position: UP/DN adjust value save 0: Save after power off 1:Not save after power off				
P0.10	Speed reference invert	0	0 ... 1	/	○
	Inverts the speed reference value. ● **0: Maintain the speed reference direction** Speed reference direction is not inverted. ● **1: Invert the speed reference direction** The speed reference direction is inverted.				
P0.11	Torque limit selection	0	0 ... 3	/	×
	Selects the source of the maximum allowed torque. ● **0: Parameter** The parameters P0.13 and P0.14 are used as maximum allowed torque. ● **1: AI1** AI1 is used as forward maximum allowed torque. ● **2: AI2**. Same as AI1. ● **3: AI3.** Same as AI1.				
P0.12	Output power correction coefficient	100	0 ... 200	/	○
	When there is a difference between the output power and the expected value, the parameter can used to adjust the display value.				
P0.13	Forward torque limit	150.0	0 ... 300.0	%	○
	Effective when parameter P0.11 = 0. The parameter P0.13 is used as forward torque limit when parameter P0.11= 0.				

Para.	Name	Default	Range	Unit	Atrr.
	100.0% corresponds to the motor rated torque.				
P0.14	Reverse torque limit	150.0	0 ... 300.0	%	○
	Effective when parameter P0.11 = 0. The parameter P0.14 is used as reverse torque limit when parameter P0.11 = 0. 100.0% corresponds to the motor rated torque.				
P0.15	Torque reference selection	0	0 ... 3	/	×
	0：Modbus-RTU 1：AI1 2：AI2 3：AI3				
P0.16	Stop mode	0	0 ... 1	/	×
	0: Coast to stop 1: Ramp stop				
P0.17	Key default	1	0 ... C0.xx	/	○
	This parameter is used to set the default monitoring value selection. The parameters value 0 … ** correspond to the parameter of C0.00~C0.**. Example: If this parameter is set to 2, the default monitoring the output current, which is the value of the parameter C0.02.				
P0.18	Reset to default	0	0 ... 2	/	○
	0: No action 1: Save all parameters to EEPROM 1: Reset all parameters to default				
P0.19	Power on auto start	0	0 ... 1	/	○
	0: Not auto start 1: Auto start. When automatic restart function is active and the start signal is valid, the drive will start automatically without the need for the personal to intervene. **Note**: Generally, it is not recommended to activate the automatic restart function. Because the motor will start automatically after powered. If the device is not ready or other unqualified operators are unclear about the situation, it may cause an accident.				
P0.20	Speed lower limit selection	0	0 ... 1	/	○
P0.21	Speed lower limit	1000	0 ... 3000	rpm	○
The parameters P0.20 and P0.21 are used to set the speed lower limit. P0.20 = 0: Disabled P0.20 = 1: Enabled. When the drive speed reference is less than the speed lower limit value (P0.21), the drive speed reference is limit to speed lower limit value (P0.21).					
P0.22	Output power filtering coefficient	20	1 ... 600	/	○
	When the output power display value of the drive fluctuates significantly, adjusting this parameter can stabilize				

Para.	Name	Default	Range	Unit	Atrr.
	the power display. The higher the value setting, the more stable the power display.				
P0.23	Motor overload protection time	600	10 ... 65535	S	○
	The motor overload protection time is set to prevent the motor from being damaged due to long-term operation in an overload state. After reaching the overload protection value, the drive trip on motor overload fault and stops output.				
P0.24	Motor over temperature value	100	40～200	℃	○
	This parameter is used to set the maximum temperature allowed for motor operation. When the motor temperature detection value is greater than the motor over temperature value, the drive trip on motor over temperature fault and stops output to protect the motor from damage due to overheating.				
P0.25	Motor temperature sensor type	0	0～1	/	○
	0：KTY84−130 1：PT100 (reserved)				
P0.26	Over voltage control selection	1	0～1	/	○
P0.27	Over voltage control value	730.0	0.0～6553.5	V	○
The parameter P0.26 and P0.27 are used to set the over voltage control function. P0.26 = 0: Inactive over voltage control function P0.26 = 1: Active over voltage control function					
P0.28	Random super password	Random	0～9999	/	○
P0.29	Authorization code	Random	0～9999	/	×
Parameters P0.28 and P0.29 are reserved.					
.P0.30	Over current control selection	0	0 … 1	/	×
P0.31	Over current control value	100	0 … 100	/	×
The parameter P0.30 and P0.31 are used to set the over current control function. P0.30 = 0: Inactive over current control function P0.30 = 1: Active over current control function P0.31 100 % = drive maximum current					
P0.32	Under voltage recovery auto start function selection	0	0～2	/	○
P0.33	Under voltage control start value	0.0	0.0～800.0	V	○
P0.34	Under voltage control holding value	0.0	0.0～1000.0	V	○
P0.35	Under voltage control minimum speed	0.0	0～30000	RPM	○
The parameters P0.32 … P0.34 are used to set the under voltage control function. ● **P0.32 = 0: Coast to stop, display under voltage fault** ● **P0.32 = 1: Stop by stop mode and not automatically start.** Stop by stop mode and not automatically start, even if the start signal is active. Need to trigger the start signal again to start to run. ● **P0.32 = 2: Stop by stop mode and automatically start.** Stop by stop mode and automatically start if the start signal is active.					
P0.36	Software compiled time(year)				

Para.	Name	Default	Range	Unit	Atrr.
P0.37	Software compiled time(month, date)				
P0.38	Software compiled time(hour, minute)				
The parameters P0.36 … P0.38 are the software-compiled time.					
P0.39	EtherCAT speed reference unit	0	0~1	/	
	0：RPM 1：Pulse/S				
P0.40	EtherCAT position feedback proportional coefficient				
	Reserved				
P0.41	EtherCAT position reference smoothing cycle	1.000	0.001~65.535	ms	○
P0.42	The EtherCAT clock is synchronized with the drive	0	0~1	/	○
	• **0: Synchronization not allowed** • **1: Synchronization allowed**				
P0.43	EtherCAT pulse speed gear ratio numerator	1	1~65535	/	○
P0.44	EtherCAT pulse speed gear ratio denominator	1	1~65535	/	○
Group P1 Synchronous Motor Parameters					
P1.00	Motor rated power	18.2	0.1～300.0	kW	○
P1.01	Motor rated voltage	380	0～1400	V	○
P1.02	Motor rated speed	3000	0～30000	rpm	○
P1.03	Motor rated current	36.0	0.1～1000.0	A	○
P1.04	Motor pole pairs	4	1～99	/	×
Parameters P2.00 … P1.04 define the motor parameters, must be equal to the value on the motor nameplate.					
P1.05	Stator phase resistance	0.3	0.001～4.000	Ω	×
P1.06	Motor flux linkage	250	1～4000	mWb	×
P1.07	D-axis inductance	3.2	0.00～80.00	mH	
P1.08	Q-axis inductance	3.4	0.00～80.00	mH	
P1.09	Torque boost	300	0～300	%	
P1.10	Maximum D-axis current	15.0	0.0～1000.0	A	○
The parameters P1.05 … P1.10 are the main motor parameters that affect control the motor. Except P1.09, which is manually set, all other parameters in this group are automatically saved in the driver after auto tune by the motor.					
P1.11	Start mode	1	0～2	/	○
	The parameter is used to set the start mode of synchronous motor sensor less control • **0: Start from zero speed** Start from zero speed, due to the lack of speed and magnetic pole position feedback, it is impossible to determine the initial magnetic pole position during this startup mode, so slight reverse rotation may occur randomly during startup. If the motor does not allow reverse rotation or the requirement is relatively strict, please select high frequency injection start mode. • **1: Flying start** The drive will automatically identify the motor speed and rotating direction and directly start from the				

Para.	Name	Default	Range	Unit	Atrr.
	identified speed. The current and voltage are smooth without any impact during the start. ● **2: High frequency injection start** After receive a start signal, the drive first injects high frequency signals to identify the initial magnetic pole position of the motor, and then starts it smoothly. It is applicable when the equipment requires that reverse rotation is not allowed during the startup.				
P1.12	MTPA	0	0～1	/	×
	Maximum torque per ampere ● **0: MTPA function is inactive.** **1: MTPA function is active.**				
P1.13	Saliency ratio	0	0～1	/	○
	This parameter is used to set the selection of motor saliency ratio, usually set according to the type of motor saliency ratio before the motor auto tune. 0: Saliency rate greater than 1. 1: The saliency rate is less than 1.				
P1.14	Initial position identification signal strength	4	2～6	1	○
	The initial position identification signal strength refers to the identification strength when the synchronous sensor-less start mode is position identification (P1.11=2). The smaller the setting, the stronger the noise generated by the driver during the initial position identification; The higher the setting, the smaller the noise generated during initial position identification.				
Group P2 Asynchronous Motor Parameters					
P2.00	Motor rated voltage	380	0～1400	V	○
P2.01	Motor rated power	18.2	0.1～300.0	kW	○
P2.02	Motor rated frequency	18.2	0.1～300.0	kW	○
P2.03	Motor pole pairs	4	1～99	/	×
P2.04	Motor rated speed	3000	0～30000	rpm	○
P2.05	Motor rated current	8.0	0.5～6553.5	A	○
P2.06	Motor no-load current	5.0	0.5～6553.5	A	○
P2.07	Stator resistance	1.000	0.002～65.535	Ω	○
P2.08	Stator leakage inductance	6.00	0.02～655.35	H	○
P2.09	Rotor resistance	0.6	0.002～65.535	Ω	○
P2.10	Mutual inductance	90.00	0.02～655.35	H	○
P2.11	Motor full resistance	1.000	0.002～65.535	Ω	○
P2.12	Oscillation suppression selection	1	0～1	/	○
	● **0: Oscillation suppression is disabled** ● **1: Oscillation suppression is enabled**				
P2.13	Oscillation suppression factor	50	0～100	/	○
	Only when the motor oscillates significantly, it is necessary to appropriately increase the gain. The higher the factor, the more obvious the suppression effect on oscillation.				
P2.14	Start mode	0	0～2	/	○
	● **0: Normal start**				

Para.	Name	Default	Range	Unit	Atrr.
	The drive start to run from the start frequency (parameter P2.15) for the time defined by parameter P2.16, and then accelerate to the reference speed. ● **1: Start after DC injection** DC current (parameter P2.19) is injected to the motor after the frequency is lower than the DC braking frequency (P2.20) for the time defined by parameter P2.21. After the DC injection is completed, start to run from the start frequency (parameter P2.15) for the time defined by parameter P2.16, then accelerate to reference speed. ● **2: Flying start** The drive injects AC current (parameter P2.17) into the motor for the time defined by parameter P2.18 to identify the motor flying speed and start from the identified speed. The current and voltage are smooth without any impact during the start.				
P2.15	Start frequency	0.50	0.00～60.00	HZ	○
P2.16	Start frequency holding time	0.0	0.0～3600.0	S	○
P2.17	Flying start speed searching current	25.0	0.1～100.0	%	○
P2.18	Flying start speed searching time	0.5	0.2～200.0	S	○
P2.19	DC braking current	0.0	0.0～200.0	%	○
P2.20	DC braking frequency	0.00	0.00～300.00	Hz	○
P2.21	DC braking time	0.00	0.00～30.00	S	○
P2.22	Slip compensation gain	100.0	0.00～300.0	%	○
P2.23	Slip compensation limit during power generating state	300	0～65535	RPM	○
P2.24	Slip compensation limit during motoring state	600	0～65535	RPM	○
Group P3 digital inputs and outputs					
P3.00	Two-wire / three-wire control mode selection	0	0 ... 3	/	×
	● **0: Two wire control 1** ● **1: Two wire control 2** ● **2: Three wire control 1** ● **3: Three wire control 2**				
P3.01	X1 input function	0	0 ... 30	/	×
P3.02	X2 input function	0	0 ... 30	/	×
P3.03	X3 input function	0	0 ... 30	/	×
P3.04	X4 input function	0	0 ... 30	/	×
P3.05	X5 input function	0	0 ... 30	/	×
P3.06	X6 input function	0	0 ... 30	/	×
P3.07	X7 input function	0	0 ... 30	/	×
The parameters P3.01 … P3.07 are used to set the digital input functions. ● **0: No function** The digital input ON or OFF only displays the terminal status but does not trigger any functions. ● **1: RUN** Run command input. ● **2: RUN direction invert**					

Para.	Name	Default	Range	Unit	Atrr.

The signal is used to invert the run command direction.

- **3: Forward**

  Forward run command

- **4: Reverse**

  Reverse run command

- **5: External fault input**

  External fault is given through digital input. 0 = No external fault. 1 = Fault trip and motor coasts to stop.

- **6: Fault reset**

  The signal resets the drive after a fault trip if the cause of the fault no longer exists.

- **7: Constant speed reference input 1**
- **8: Constant speed reference input 2**
- **9: Constant speed reference input 3**
- **10: Constant speed reference input 4**
- **11: Spindle positioning**

  The signal is used to start positioning according to the positioning method.

- **12: Switch to position loop**

  When the signal is ON, the system control loop is changed to position loop.

- **13: Process PID integration pause**

  The process PID integration is stop when the signal is ON.

- **14: Process PID parameters switching**

  Select the second group PID parameters. 0 = Select the first group PID parameters. 1 = Select the second group PID parameters.

- **15: Process PID output is forced to constant speed reference.**

  The PID controller speed output is forced to a constant speed.

- **16: Clear the accumulated time of Simple PLC**

  The counter of Simple PLC is reset to zero when the signal is ON.

- **17: Reset Simple PLC step**

  The counter PLC_T2 is reset to zero and stop counting; the simple PLC is reset to the first step.

  Note: If all the step run time is zero, the drive will run at the speed reference 1 after reset.

- **18: UP, speed reference increase input**

  1 = Speed reference increase.

- **19: DN, speed reference decrease input**

  1 = Speed reference decrease.

- **20: Clear the terminal UP/DN value**

  1 = reset the value adjusted by UP/DN to zero and the speed reference is changed to UP/DN initial value.

- **21: Forward jogging**

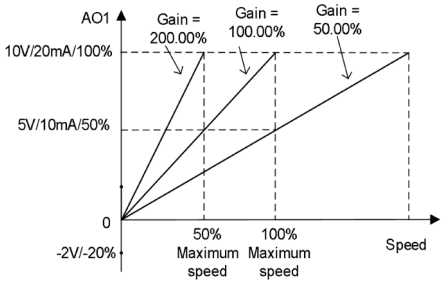
  Forward jogging is active when the signal is ON. 0 = inactive. 1 = active.

- **22: Reverse jogging**

  Reverse jogging is active when the signal is ON. 0 = inactive. 1 = active.

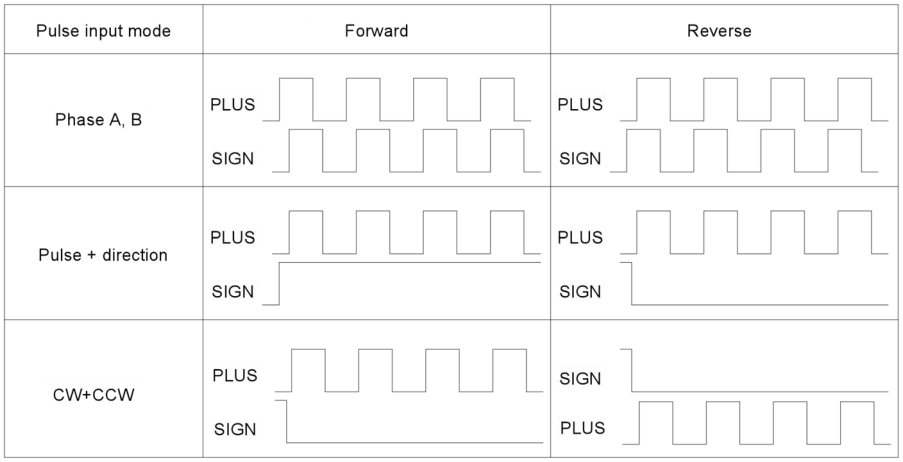
Para.	Name	Default	Range	Unit	Atrr.
● **23: Three−wire control mode** Refer to parameter P3.00 for more information. ● **24: Enabling zero servo function** When the signal is ON, the drive enters to zero servo operation. ● **25: Emergency stop** The drive immediately stops according to the stop mode after receive an emergency stop signal from digital input. ● **26: Orientation position reference 1** ● **27: Orientation position reference 2** ● **28: Orientation position reference 3** ● **29: Orientation position capture mode** The orientation position can be determined by two methods: manual setting and terminal acquisition. ● **30: UP/DN adjust speed cannot change to reverse direction**					
P3.08	Y1 terminal output function selection	0	0 ... 16	/	○
P3.09	Y2 terminal output function selection	0	0 ... 16	/	○
P3.10	Relay 1 output function selection	0	0 ... 16	/	○
P3.11	Relay 2 output function selection	0	0 ... 16	/	○
P3.12	Relay 3 output function selection	0	0 ... 16	/	○
Parameters P3.08 … P3.12 are the digital and relay output function selection. ● **0: No function** ● **1: Ready.** When the power−on−self−test of is normal after power on and the drive has no fault. ● **2: Pre−charge OK.** The drive is normally powered, the main circuit pre−charge relay or contactor signal is enabled. ● **3: RUN.** The signal is enabled when the drive is running. ● **4: Reach maximum speed.** The signal is enabled if the actual speed reaches or higher than the maximum speed. ● **5: Reach minimum speed.** The signal is enabled if the actual speed reaches or lower than the minimum speed. ● **6: Brake chopper is working.** The signal output is enabled when the built−in brake chopper is in the working state. ● **7: Acceleration.** The signal is enabled when the drive in accelerating process. ● **8: Deceleration.** The signal is enabled when the drive in decelerating process. ● **9: Fault output.** Output a signal when the drive is in stop status due to fault output ● **10: Orientation complete.** The **signal** output is enabled after the orientation is completed in position loop mode. ● **11: Speed arrive.** The signal output is enabled when the actual speed reach the reference speed. ● **12: Speed loop/ position loop switching state** ● **13: Simple PLC every step operation has been completed.** It outputs a signal with a signal width of 500ms. ● **14: Simple PLC all steps operation has been completed.** It outputs a signal with a signal width of 500ms. ● **15: Communication control.** Output a signal under communication control. ● **16: Zero speed.** The signal is enabled when the actual speed reaches the zero speed. ● **17: Position reach reference position.** Output a signal when the actual position reach the set position.					
P3.13	Digital input invert	0000	0000 ... 127	/	×

<table>
<tr><th>Para.</th><th>Name</th><th>Default</th><th>Range</th><th>Unit</th><th>Atrr.</th></tr>
<tr><td></td><td colspan="5">The parameter is used to activate the inversion of digital inputs. The corresponding relationship of binary and digital inputs are shown in the following table. The value display on keyboard is a decimal value.
<table>
<tr><td>Item</td><td>Reserved</td><td>X7</td><td>X6</td><td>X5</td><td>X4</td><td>X3</td><td>X2</td><td>X1</td></tr>
<tr><td>Default</td><td>0000 00</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>bit</td><td>bit15 to bit7</td><td>bit6</td><td>bit5</td><td>bit4</td><td>bit3</td><td>bit2</td><td>bit1</td><td>bit0</td></tr>
</table>
● 0: No inversion
● 1: Inversion active</td></tr>
<tr><td>P3.14</td><td>Digital inputs filtering</td><td>0</td><td>0 ... 10</td><td>/</td><td>×</td></tr>
<tr><td></td><td colspan="5">Defines a filtering time for digital inputs.</td></tr>
<tr><td>P3.15</td><td>Switch to position loop with enable signal</td><td>0</td><td>0～1</td><td>/</td><td>○</td></tr>
<tr><td></td><td colspan="5">0: Without enable signal
1: With enable signal</td></tr>
<tr><td>P3.16</td><td>Speed reach detect width</td><td>5</td><td>1 ... 65535</td><td>rpm</td><td>○</td></tr>
<tr><td colspan="6">Group P4 Analog inputs and outputs</td></tr>
<tr><td>P4.00</td><td>AI1 filter time coefficient</td><td>0.5</td><td>0.0 ... 1000.0</td><td>ms</td><td>○</td></tr>
<tr><td></td><td colspan="5">Defines the analog input AI1 filtering time. The higher setting value, the smoother the analog input command, and the slower the command response, which can prevent analog input signal fluctuations caused by interference.</td></tr>
<tr><td>P4.01</td><td>AI1 zero offset</td><td>0.00</td><td>−200.00 ... 200.00</td><td>%</td><td>○</td></tr>
<tr><td></td><td colspan="5">Defines the minimum value for analog input AI1. 100.0% corresponds to 10.00V (20mA).
When there is a zero bias in the analog input from the AI1 port, resulting in the input value (such as speed reference, torque reference, PID reference or PID feedback) not being 0, this parameter can be used to modify the corresponding reference value to 0.
When used as a reference, the value corresponds to the reference minimum setting.</td></tr>
<tr><td>P4.02</td><td>AI1 gain</td><td>100.00</td><td>0.00 ... 200.00</td><td>%</td><td>○</td></tr>
<tr><td></td><td colspan="5">The correspondence between the AI1 analog input value and the specified reference can be adjusted through the AI1 gain. 100.0% corresponds to 10.00V (20mA).
For example, default 10V = 1500 rpm, if 8V = 1500 rpm, set P4.02 = 10/8 * 100.00 = 125.00%</td></tr>
<tr><td>P4.03</td><td>AI2 filter time coefficient</td><td>20.0</td><td>0.0 ... 1000.0</td><td>ms</td><td>○</td></tr>
<tr><td>P4.04</td><td>AI2 zero offset</td><td>0.00</td><td>−200.00 ... 200.00</td><td>%</td><td>○</td></tr>
<tr><td>P4.05</td><td>AI2 gain</td><td>100.00</td><td>0.00 ... 200.00</td><td>%</td><td>○</td></tr>
<tr><td colspan="6">Refer to parameters P4.00 … P4.02.</td></tr>
<tr><td>P4.06</td><td>Reserved</td><td></td><td></td><td></td><td></td></tr>
<tr><td>P4.07</td><td>AI3 filter time coefficient</td><td>20.0</td><td>0.0 ... 1000.0</td><td>ms</td><td>○</td></tr>
<tr><td>P4.08</td><td>AI3 zero offset</td><td>0.00</td><td>−200.00 ... 200.00</td><td>%</td><td>○</td></tr>
<tr><td>P4.09</td><td>AI3 gain</td><td>100.00</td><td>0.00 ... 200.00</td><td>%</td><td>○</td></tr>
<tr><td colspan="6">Refer to parameters P4.00 … P4.02.</td></tr>
<tr><td>P4.10</td><td>AO1 analog output function selection</td><td>0</td><td>0 ... 15</td><td>/</td><td>○</td></tr>
<tr><td></td><td colspan="5">● 0: Reference speed. 10V/20mA = Maximum speed P0.03.</td></tr>
</table>

Para.	Name	Default	Range	Unit	Atrr.
	● **1: Running speed.** 10V/20mA = Maximum speed P0.03. ● **2: Q-axis current command.** 10V/20mA = Motor maximum current. ● **3: Q-axis current feedback.** 10V/20mA = Motor maximum current. ● **4: DC bus voltage.**10V/20mA = 1400V. ● **5 … 20: Reserved**				
P4.11	AO1 zero offset	0.00	−100.00 ... 100.00	%	○
	Defines the minimum value of the analog output signal AO1.				
P4.12	AO1 gain	100.00	0.00 ... 200.00	%	○
	Scales the analog output AO1 signal. If the value is 100.00%, the reference value of the drive signal corresponds to 10V/20 mA. For example, 10V/20mA = maximum speed when AO1 output function is actual speed under default parameters. If 10V/20 mA = 200% of maximum speed, then set to 200.00.  				
P4.13	AO2 analog output function selection	0	0 ... 15	/	○
P4.14	AO2 zero offset	0.00	−100.00 ... 100.00	%	○
P4.15	AO2 gain	100.00	0.00 ... 200.00	%	○
Parameters P4.13 … P4.15 please see parameters P4.10 … P4.12.					
Group P5 Encoder parameters					
P5.00	Motor encoder signal type selection	2	0 ... 2	/	×
	Selects the encoder type when a speed feedback signal (encoder or resolver) from the motor. ● **0: Square wave (Quadrature pulse encoder)** Incremental encoder is used as motor speed feedback. Support differential type TTL encoder. ● **1: Sinusoidal wave (Resolver or Sin/Cos encoder)** Resolver or Sin/Cos encoder is used as motor speed feedback. The default ratio of resolver is about 0.5. If the ratio is about 0.25, please specify it when ordering. The resolver pole pairs must be divisible by motor pole pairs. For example. If motor pole pairs is 6, then the resolver pole pairs can be 1, 2, 3 and 6, cannot select other pole pairs resolver.				
P5.01	Sine signal zero offset	0	−32768 ... 32767	/	×
P5.02	Cosine signal zero offset	0	−32768 ... 32767	/	×
Synchronous motor sine / cosine signal zero offset is obtained after synchronous motor rotate auto tune					
P5.03	Resolver signal amplitude correction	16209	0 ... 65535	/	×
	When the resolver signal amplitude received deviates significantly from the ideal value, this parameter can be modified. Generally, it is not necessary to change this parameter.				
P5.04	Resolver signal alarm value	14384	0 ... 65535	/	×

Para.	Name	Default	Range	Unit	Atrr.
	When the measured sine / cosine signal is lower than the alarm value (P5.04), the drive trips on a fault "Err 7". When a resolver (or SinCos encoder) is used for motor speed feedback, check if the resolver (or SinCos encoder) is properly installed or correct wiring. **Note**: When the resolver installation is not good, it will cause the signal feedback too low, may cause the drive trips on a fault.				
P5.05	Synchronous motor initial angle	0	0 ... 65535	/	×
	Synchronous motor initial angle is obtained after synchronous motor rotate auto tune.				
P5.06	Resolver pole pairs	1	1 ... 65535	/	×
	Defines the number of pole pairs of the resolver. The resolver pole pairs must be divisible by motor pole pairs. For example. If the pole pairs of motor is 6, then the pole pairs of resolver can be 1, 2, 3 and 6, do not select other pole pairs resolver.				
P5.07	Resolver phase sequence	0	0 ... 1	/	×
	When the encoder phase sequence is incorrect. This parameter is used to exchange the phase sequence of the encoder feedback signal. 0: Not change. 1: Change. **Note**: If the encoder phase sequence is incorrect after the motor auto tune when the motor control model is sensor control, please change this parameter manually.				
P5.08	TTL / Sin/Cos encoder PPR	1024	1 ... 65535	ppr	×
	When the first encoder is a photoelectric encoder, this parameter is the PPR of the first photoelectric encoder; When the encoder is a sine cosine encoder, this parameter is the number of teeth for the sine cosine encoder.				
P5.09	TTL encoder gear ratio numerator	1	1 ... 65535	/	×
P5.10	TTL encoder gear ratio denominator	1	1 ... 65535	/	×
P5.11	TTL encoder direction	0	0 ... 1	/	×
The parameters P5.09 … P5.11 are the parameters for the first encoder.					
P5.12	The 2nd TTL encoder PPR	1024	1 ... 65535	ppr	
P5.13	The 2nd TTL encoder gear ratio numerator	1	1 ... 65535	/	×
P5.14	The 2nd TTL encoder gear ratio denominator	1	1 ... 65535	/	×
P5.15	The 2nd TTL encoder direction	0	0 ... 1	/	×
The parameters P5.12 … P5.15 are the parameters for the second encoder.					
P5.16	SinCos compensation coefficient	4000	4000 ... 12000	/	×
P5.17	Motor encoder type selection	0	0～1	1	○
	● 0: Resolver or incremental encoder ● 1:Sin/Cos encoder				
P5.18	SA signal offset	-1321	-32767~32767	1	○
P5.19	SB signal offset	-1171	-32767~32767	1	○
Group P6 Pulse input and output					
P6.00	Pulse input mode	0	0 ... 2	/	×

Para.	Name	Default	Range	Unit	Atrr.
	Selects pulse input mode from the host controller. ● **0: Quadrature pulse** ● **1: A pulse + B direction** ● **2: CW + CCW**				



P6.01	**Pulse input direction invert**	0	0 ... 1	/	×
	0: Not invert **1: Invert**				
P6.02	**Speed control pulse input gear ratio numerator**	1	1 ... 65535	/	○
P6.03	**Speed control pulse input gear ratio denominator**	1	1 ... 65535	/	○

P6.02 and P6.03 are used to define the pulse input gear ratio in speed control mode.

Let **n** represents motor speed.

Let **C** represents motor encoder pulse per revolution (for incremental encoder).

Let **F** represents pulse input frequency.

Let G_1 represents gear ratio.

Then: $n=B\times60\times F\times G_1/(C\times4)$ &

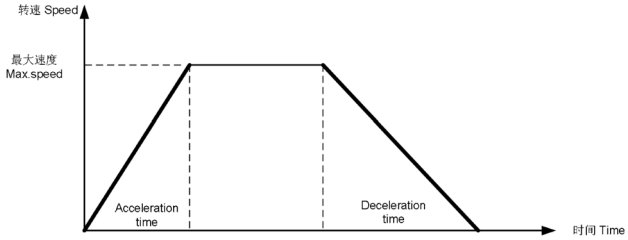
G_1= P6.02:P6.03

For example: the pulse input is 500Khz from host controller, the motor encoder PPR is 2500, then:

$n =60\times F\times G_1/(C\times4)=60\times500000\times G_1/(2500\times4) = 3000 * G1$

When P6.02:P6.03=1:1, n=3000 (ppr)

P6.04	**Speed control pulse input filter**	10	0 ... 65535	/	○
	Defines the pulse input filter constant. Higher filter will make the input smoother, but will increase response time. Lower filter will make the response faster, but may cause speed instability.				
P6.05	**Encoder output pulses per revolution**	1024	4 ... 65535	ppr	×
P6.06	**Encoder output pulses phase Z offset**	0	0 ... 65535	/	×
P6.07	**Encoder output selection**	0	0 ... 2	/	×
	● **0: TTL encoder 1 direct output** ● **1: TTL Encoder 2 direct output** ● **2: Sinusoidal wave**				

Para.	Name	Default	Range	Unit	Atrr.
Group P7 Speed Loop Parameters					
P7.00	Speed loop gain	40.0	0.0～1000.0	Hz	○
P7.01	Speed loop integral time	10.0	0.0～6553.5	mS	○
P7.02	Acceleration time	5.00	0.00～120.00	S	○
P7.03	Deceleration time	5.00	0.00～120.00	S	○
If the speed reference increases / decreases faster than the set acceleration/deceleration rate, the motor speed will follow the acceleration / deceleration rate. If the speed reference increases / decreases slower than the set acceleration / deceleration rate, the motor speed will follow the reference signal. If the acceleration / deceleration time is set too short, the drive will automatically prolong the acceleration / deceleration time in order not to exceed the maximum current, maximum torque, maximum voltage, etc.  					
P7.04	Motor inertia	200	1～65535	kg*m*m *10000	○
	The larger the motor inertia setting, the faster the speed response. However, excessive motor inertia can cause vibration. In closed-loop control mode, the motor inertia can be obtained through the inertia auto-tune. However, when the motor shaft is loaded, the motor inertia auto-tune cannot be performed, otherwise the machine may be damaged or the motor inertia obtained from inertia auto tune may be inaccurate. **Note**: Generally, it is set based on the inertia provided by the motor, or the user does not need to adjust this parameter. If the speed loop gain is insufficient, this value can be used to enhance the speed loop gain.				
P7.05	Flux-weakening gain	300	0～800	/	○
	Defines the field weakening gain when the motor speed running in field weakening state				
P7.06	Speed command filtering time constant	0	0～100	mS	○
	The higher the value setting, the smoother the speed command and the slower the speed command response.				
P7.07	Speed feedback filtering times	15	1～200	/	○
	The higher the value setting, the smoother the speed feedback signal.				
P7.08	Acceleration time 1	5.00	0.00～120.00	S	○
P7.09	Deceleration time 1	5.00	0.00～120.00	S	○
P7.10	Acceleration time 2	5.00	0.00～120.00	S	○
P7.11	Deceleration time 2	5.00	0.00～120.00	S	○
P7.12	Acceleration time 3	5.00	0.00～120.00	S	○

Para.	Name	Default	Range	Unit	Atrr.
P7.13	Deceleration time 3	5.00	0.00～120.00	S	○
	Group P8 Current Loop Parameters				
P8.00	Voltage utilization rate	95	84～120	%	○
	The maximum allowed voltage utilization for the motor control. Do not change this value without consulting technical support. Higher values may result in control instability or over-current trip.				
P8.01	Current loop gain	5.0	0.0～100.0	V/A	○
P8.02	Current loop integral time constant	10.0	0.0～6553.5	ms	○
The parameters P8.01 …P8.02 define the current regulator Kp and Ki. Usually the value can be obtained after auto-tune. Refer to parameters P8.06 … P8.08 for more details.					
P8.03	Debug mode control word	0	0～65535	1	○
P8.04	Debug input 1	0	0～65535	1	○
P8.05	Debug input 2	0	0～65535	1	○
The parameter P8.03 … P8.05 are the reserved parameters.					
P8.06	High speed current loop gain	5.0	0.0～200.0	V/A	○
P8.07	High speed current loop integral time constant	10.0	0.0～6553.5	Ms	○
P8.08	High speed current loop PI selection	0	0～1	/	○
The parameters P8.06 …P8.07 define the high speed current regulator Kp and Ki. Usually the value can be obtained after auto-tune. ● **P8.08 = 0: Current regulator Kp (P8.01) and Ki (P8.02) is effective in the entire speed range.** ● **P8.08 = 1: Current regulator Kp and Ki are changed to the parameters P8.06 and P8.07 at high speed.**					
P8.09	High speed current loop PI strength	100	50～150	/	○
	Decoupling gain of current regulator. The higher the setting, the stronger the PI strength of the high-speed current loop.				
P8.10	Decoupling compensation gain	50	0～100	/	○
	Group P9 Position loop parameters				
P9.00	Position loop gain	5.0	0.0~6553.5	/	○
	Position loop gain directly influences the response level of the position loop. If the mechanical system does not vibrate or produce noises, you can increase the value of position loop gain so that the response level can be increased and positioning time can be shortened.				
P9.01	Position loop maximum speed	1500	0~65535	/	○
	Defines the maximum output speed when working in the position loop. When the speed reference is higher than the value of P9.01, the actual speed will be limited to the value of P9.01.				
P9.02	Position loop acceleration time	0.00	0.00~655.35	S	○
P9.03	Position loop deceleration time	0.00	0.00~655.35	S	○
The position loop acceleration time is the time from zero speed accelerate to the position loop maximum speed when working in the position control mode. The position loop deceleration time is the time from position loop maximum speed decelerate to zero speed when working in the position control mode.					

Para.	Name	Default	Range	Unit	Atrr.
P9.04	Position arrival detection window	5	0~65535	/	○
	Reserved				
P9.05	Position loop pulse input gear ratio numerator	1	1~65535	/	○
P9.06	Position loop pulse input gear ratio denominator	1	1~65535	/	○
The parameters P9.05 and P9.06 are used to define the pulse input gear ratio in position loop. Let : **G** represents gear ratio, **G** = P9.05/P9.06. **N** represents motor number of rotations. **C** represents motor encoder pulse per revolution (for incremental encoder). **P** represents input pulses. Then：P×G=N×C×4 Example: AB phase input pulses is 10000, require to rotate the motor for 2 revolutions and the motor encoder PPR is 2500: **N=2, C=2500, P=10000.** **G= N×C×4/P=2×2500×4/10000 = 2/1** **Then: P9.05 = 2 and P9.06 = 1.**					
P9.07	Position feedforward gain	0.00	0～200.00	/	○
	The higher the setting value, the faster the response time of the position loop, but setting it too high can easily cause oscillation.				
P9.08	Position feedforward filtering time	0.000	0～2.000	s	○
	The higher the setting value, the higher the cutoff frequency of the position feedforward low-pass filter.				
P9.09	Position loop command filtering time	0	0～65535	/	○
	Defines the position loop command filtering time. The higher the setting, the smoother the position command, the longer the position command delay, but the input pulse will not lost.				
P9.10	Position loop output filtering time	0.000	0.000～65.535	s	○
	Defines the position loop output filtering time. The higher the setting, the smoother the position loop output.				
P9.11	Position loop feedback encoder selection	0	0～1	/	○
	● **0**: Motor encoder ● **1**:The second encoder				
P9.12	Position loop reference selection	0	0~1	/	○
	● **0**：Pulse reference ● **1**：EtherCAT reference				
Group PA Orientation parameters					
PA.00	Reserved				
PA.01	Orientation position 1	0	0～65535	1	○
PA.02	Orientation start speed	0	0～65535	1	○
	● **0: Direct orientation, orientating from current speed** ① If actual speed ≤ position loop maximum speed (P9.01), orientating from the current speed. ② If actual speed ＞ position loop maximum speed (P9.01), decelerate to the position loop maximum speed				

Para.	Name	Default	Range	Unit	Atrr.
	(P9.01) before start the orientation. ● **1 ... 65535: Orientation start speed.** ① If actual speed ≤ orientation start speed (PA.02), orientating from the current speed. ② If actual speed ＞ orientation start speed (PA.02), decelerate to the orientation start speed (PA.02) before start the orientation.				
PA.03	Orientation deceleration time	2.00	0.00～655.35	S	○
	The time from position loop maximum speed (P9.01) to 0 during orientating process.				
PA.04	Orientation gain	5.0	0.0～6553.5	0.1	○
	Orientation gain directly influences the response level when orientating. If the mechanical system does not vibrate or produce noises, can increase the gain so that the system rigidity				
PA.05	Direct orientation maximum speed	500	0～1500	rpm	○
	Defines the maximum output speed when working in the position control mode. When the speed reference is higher than the value of PA.05, the actual speed will be limited to the value of PA.05. If the running speed when starting the orientation action is less than the value of PA.05, plan the speed curve according to the shortest distance.				
PA.06	Orientation direction	0	0～65535	/	○
	● **0: Motor running rotation** ● **1: Forward** ● **2: Reverse**				
PA.07	Orientation position 2	0	0～65535	/	○
PA.08	Orientation position 3	0	0～65535	/	○
PA.09	Orientation position 4	0	0～65535	/	○
PA.10	Orientation position 5	0	0～65535	/	○
PA.11	Orientation position 6	0	0～65535	/	○
PA.12	Orientation position 7	0	0～65535	/	○
PA.13	Orientation position 8	0	0～65535	1	○

Para.	Name	Default	Range	Unit	Atrr.

It is possible to predefine 8 orientation position reference and selected by digital inputs. For example, X3, X4 and X5 are used to select the predefine reference, set P3.03 = 26, P3.04 = 27, P3.05 = 28, then:

Orientation position reference	X5	X4	X3
Orientation position 1 (PA.01)	0	0	0
Orientation position 2 (PA.07)	0	0	1
Orientation position 3 (PA.08)	0	1	0
Orientation position 4 (PA.09)	0	1	1
Orientation position 5 (PA.10)	1	0	0
Orientation position 6 (PA.11)	1	0	1
Orientation position 7 (PA.12)	1	1	0
Orientation position 8 (PA.13)	1	1	1

PA.14	Signal output delay after orientation is completed	1	0～65535	ms	
	The parameter defined the delay time of the output signal after the orientation is completed.				
PA.15	Number of motor rotation of inertia auto tune	1	0～20	/	○
PA.16	Inertia auto tune time	0.2	0.0～10.0	S	○
PA.17	Inertia auto tune selection	0	0～65535	/	○

The parameters PA.15 … PA.17 are used for the auto-tune of the motor's inertia, and it is necessary to ensure that the motor can operate normally before start motor inertia auto tune.

The operation steps for motor inertia auto tune are as follows: first

① Set the parameters PA.15 and PA.16

② Set PA.17 = 6666

③ long press and the ENTER key to start the motor inertia auto tune.

Note:

① Before start inertia auto tune, it is necessary to start motor auto tune first. Please ensure that the trial run the motor can rotate normally before starting motor inertia auto tune.

② Before motor inertia auto tune, it is necessary to ensure that the equipment can quickly rotate forward and rotate reverse.

③ Special attention should be paid to, the parameters obtained from inertia auto tune will not be automatically saved, must manually set P0.18=1 to save the parameters.

PA.18	Speed feedforward (effective in position loop)	0.00	0.00～250.00	%	○
PA.19	Speed feedforward filtering (effective in position loop)	0.0	0.0～100.0	s	○
	Group PB Modbus Communication				
PB.00	Modbus address	1	1 ... 255	/	○
	Defines the Modbus address. Two units with the same address are not allowed on-line.				
PB.01	Modbus baud rate	3	0 ... 5	/	○
	● **0: 4800bps**				

Para.	Name	Default	Range	Unit	Atrr.
	● **1: 9600 bps** ● **2: 19200 bps** ● **3: 38400 bps** ● **4: 57600 bps** ● **5: 115200 bps**				
PB.02	Reserved				
PB.03	Modbus−RTU data format	0000	0000 ... 0121	/	○
	One position: Data bits ● 0: 8 data bits ● 1: 7 data bits **Tens position: Parity** ● 0: No parity ● 1: Odd parity ● 2: Even parity **Hundreds position: Stop bit (s)** ● 0: 1 stops bit ● 1: 2 stops bits				
PB.04	Communication break detect time	0	0 ... 65535	/	○
	● 0 = Disable communicating break detection function. ● 1 … 65535: Enable communicating break detection function. The drive trips on a fault if the Modbus communication break lasts longer than the time defined by parameter.				
PB.05	Communication response delay	0	0 ... 65535	ms	○
	Defines the Modbus communication response time.				
	Group PC Simple PLC logic				
PC.00	Simple PLC operation mode	0	0 ... 3	/	×
	● **0: Stop after one process operation** ● **1: Keep the final speed running after one process operation** ● **2: Cycle operation** ● **3: Cycle operation and stop after the number of cycles reach the pre−defined value**				
PC.01	Simple PLC power−off save selection	0000	0000 ... FFFF	/	×
	One position: Power−off save selection ● 0: Reset after power off ● 1: Save after power off **Tens position: Stop status save selection** ● 0: Reset in stop state ● 1: Save in stop state				
PC.02	The 1st step speed reference selection	0	0 ... 5	/	×
	● **0: Multi step speed 1 (PC.03)** ● **1: Modbus** ● **2: Keypad speed reference (P0.06)** ● **3: AI1** ● **4: AI2** ● **5: AI3**				

Para.	Name	Default	Range	Unit	Atrr.
PC.03	Multi step speed 1	0	−32768～32767	rpm	○
PC.04	Multi step speed 2	0	−32768～32767	rpm	○
PC.05	Multi step speed 3	0	−32768～32767	rpm	○
PC.06	Multi step speed 4	0	−32768～32767	rpm	○
PC.07	Multi step speed 5	0	−32768～32767	rpm	○
PC.08	Multi step speed 6	0	−32768～32767	rpm	○
PC.09	Multi step speed 7	0	−32768～32767	rpm	○
PC.10	Multi step speed 8	0	−32768～32767	rpm	○
PC.11	Multi step speed 9	0	−32768～32767	rpm	○
PC.12	Multi step speed 10	0	−32768～32767	rpm	○
PC.13	Multi step speed 11	0	−32768～32767	rpm	○
PC.14	Multi step speed 12	0	−32768～32767	rpm	○
PC.15	Multi step speed 13	0	−32768～32767	rpm	○
PC.16	Multi step speed 14	0	−32768～32767	rpm	○
PC.17	Multi step speed 15	0	−32768～32767	rpm	○
PC.18	Multi step speed 16	0	−32768～32767	rpm	○
The parameters PC.03 … PC.18 are the parameters for multi speeds.					
PC.19	The 1st step run time	0	0 ... 3	/	×
PC.20	The 1st step ACC/DEC time selection	0.0	0.0 ... 6553.5	s(h)	○
PC.21	The 2nd step run time	0	0 ... 3	/	×
PC.22	The 2nd step ACC/DEC time selection	0.0	0.0 ... 6553.5	s(h)	○
PC.23	The 3rd step run time	0	0 ... 3	/	×
PC.24	The 3rd step ACC/DEC time selection	0.0	0.0 ... 6553.5	s(h)	○
PC.25	The 4th step run time	0	0 ... 3	/	×
PC.26	The 4th step ACC/DEC time selection	0.0	0.0 ... 6553.5	s(h)	○
PC.27	The 5th step run time	0	0 ... 3	/	×
PC.28	The 5th step ACC/DEC time selection	0.0	0.0 ... 6553.5	s(h)	○
PC.29	The 6th step run time	0	0 ... 3	/	×
PC.30	The 6th step ACC/DEC time selection	0.0	0.0 ... 6553.5	s(h)	○
PC.31	The 7th step run time	0	0 ... 3	/	×
PC.32	The 7th step ACC/DEC time selection	0	0 ... 3	/	×
PC.33	The 8th step run time	0.0	0.0 ... 6553.5	s(h)	○
PC.34	The 8th step ACC/DEC time selection	0	0 ... 3	/	×
PC.35	The 9th step run time	0.0	0.0 ... 6553.5	s(h)	○
PC.36	The 9th step ACC/DEC selection	0	0 ... 3	/	×

Para.	Name	Default	Range	Unit	Atrr.
PC.37	The 10th step run time	0.0	0.0 ... 6553.5	s(h)	○
PC.38	The 10th step ACC/DEC time selection	0	0 ... 3	/	×
PC.39	The 11th step run time	0.0	0.0 ... 6553.5	s(h)	○
PC.40	The 11th step ACC/DEC time selection	0	0 ... 3	/	×
PC.41	The 12th step run time	0.0	0.0 ... 6553.5	s(h)	○
PC.42	The 12th step ACC/DEC time selection	0	0 ... 3	/	×
PC.43	The 13th step run time	0.0	0.0 ... 6553.5	s(h)	○
PC.44	The 13th step ACC/DEC time selection	0	0 ... 3	/	×
PC.45	The 14th step run time	0.0	0.0 ... 6553.5	s(h)	○
PC.46	The 14th step ACC/DEC time selection	0	0 ... 3	/	×
PC.47	The 15th step run time	0.0	0.0 ... 6553.5	s(h)	○
PC.48	The 15th step ACC/DEC time selection	0	0 ... 3	/	×
PC.49	The 16th step run time	0.0	0.0 ... 6553.5	s(h)	○
PC.50	The 16th step ACC/DEC time selection	0	0 ... 3	/	×
The parameters PC.19 … PC.50 correspond to the operating time and acceleration/deceleration of 16 speeds for PC.03 … PC.18. The operating time unit can be defined by parameter PC.51. The corresponding acceleration and deceleration time are defined for every step speed is as follows: **0**: Acceleration time/deceleration time (P7.02, P7.03) **1**: Acceleration time 1/deceleration time 1 (P7.08, P7.09) **2**: Acceleration time 2/deceleration time 2 (P7.10, P7.11) **3**: Acceleration time 3/deceleration time 3 (P7.12, P7.13)					
PC.51	Simple PLC run time unit	0	0 ... 1	/	×
	● **0: Simple PLC run time in second** ● **1: Simple PLC run time in hour.**				
PC.52	Simple PLC cycle times	1	1 ... 65535	/	×
	Defines the number of cycle operation when parameter PC.00 = 3. The drive will stop automatically after the cycles are finished.				
PC.53	Jogging speed	100	−8000～8000	rpm	○
PC.54	Jogging acceleration time	5.00	0.00～120.00	s	○
PC.55	Jogging deceleration time	5.00	0.00～120.00	s	○
The parameters PC.53 … PC.55 are used for jogging function. The jogging function are only can be active when run command is external digital input (P0.04=1). Start forward and reverse jogging by external digital inputs. Jogging acceleration time refers to the time accelerate from zero speed to maximum speed. Jogging deceleration time refers to the time decelerate from maximum speed to zero speed.					
Group PD Process PID Parameters					
PD.00	Process PID function selection	0	0 ... 1	/	○

Para.	Name	Default	Range	Unit	Atrr.
	● 0: Inactive ● 1: Active				
PD.01	PID reference source selection	0	0 ... 3	/	○
	● 0: Parameter setting ● 1: AI1 ● 2: AI2 ● 3: AI3				
PD.02	PID feedback source election	1	0 ... 3	/	○
	● 0: Parameter setting ● 1: AI1 ● 2: AI2 ● 3: AI3				
PD.03	PID reference	20.00	0.00 ... 100.00	%	○
	Defines the PID reference value when PD.01 = 0. 100.00% = 100.00% feedback value.				
PD.04	Proportional gain P1	10.00	0.00 ... 655.35	/	○
	The proportional gain part output of PID Pout = Kp * ε. The Gain part is to react and adjust the error immediately in proportion. The larger the gain Kp, the stronger the adjustment effect. However, excessive adjustment is easy to cause output oscillation, and Kp cannot eliminate the error.				
PD.05	Integration time I1	5.00	0.00 ... 655.35	s	○
	The integration part output of PID Iout = Kp * 1/Ti * ∑ε. The integration time defines the rate at which the PID controller output changes when the error value is constant. The shorter the integration time, the faster the continuous error value is corrected. Too short an integration time makes the control unstable.				
PD.06	Derivative time D1	0.00	0.00 ... 655.35	s	○
	The derivation part output of PID Dout = Td * (ε – ε`). Derivative action boosts the PID controller output if the error value changes. The longer the derivation time, the more the PID controller output is boosted during the change. If the derivation time is set to zero, the controller works as a PI controller, otherwise as a PID controller. The derivation makes the control more responsive for disturbances.				
PD.07	Sampling time	1	1 ... 65535	2ms	○
	Defines the sampling time of the feedback signal. The lower the value is, the faster system response to the deviation between the reference and the feedback, but if the sampling time is too fast, the associate requirement for the system PID regulation will be higher, which may result in system vibration.				
PD.08	PID deviation limit	0.10	0.00 ... 655.35	%	○
	Defines a certain deviation between the feedback and the reference to stop the internal PID regulation and maintain stable output. Only when the deviation between the feedback and the reference exceeds the deviation limit of PD.08, the output will be updated. Setting the deviation limit needs to take the system control precision and stability into consideration.				
PD.09	PID adjustment polarity selection	0	0 ... 1	/	×
	● **0: Positive polarity** When the PID feedback is higher than the PID reference, decrease the PID output. ● **1: Negative polarity** When the PID feedback is higher than the PID reference, increase the PID output.				
PD.10	PID output upper limit	100.00	PD.11 ... 100.00	%	○
	Defines the PID output upper limit. The PID output upper limit is limited to PD.10* maximum speed P0.03.				
PD.11	PID output lower limit	0.00	−100.00 ... PD.10	%	○

Para.	Name	Default	Range	Unit	Atrr.
	Defines the PID output lower limit. The PID output lower limit is limited to PD.11* maximum speed P0.03.				
PD.12	PID feedback disconnection detection threshold	0.00	0.00 ... 100.00	%	○
PD.13	PID feedback disconnection detection time	0.0	0.0 ... 6553.5	s	○
• **PD.12 = 0.00: PID feedback disconnection detection is disabled.** • **PD.12 = 0.01...100.00: PID feedback disconnection detection is enabled.** When PD.12 is a non−zero value, when the PID feedback is lower than the value of PD.12 for the detection time defined by parameter PD.13. The drive trips on a fault.					
PD.14	PID adjustment selection	0	000 ... 111	/	×
	Ones position: Integration pause through digital input. • 0: Invalid • 1: Valid **Tens position: Integration stop when the output reaches the limit value** • 0: Stop • 1: Not stop **Hundreds position: PID output change to FWD / REV direction** • 0: Not allowed • 1: Allowed				
PD.15	PID reference feedback range	1000	1 ... 65535	/	×
	The parameter of PID reference feedback range is used for PID reference display and PID feedback display. 100.00% of the reference and feedback = PID reference feedback range PD.15.				
PD.16	Differential limitation	5.00	0.00 ... 100.00	%	○
	In PID regulators, differential action is relatively sensitive and prone to system oscillation. This parameter limits the differential value to PD.16.				
PD.17	PID reference change time	0.00	0.00 ... 655.35	s	○
	Defines the time required for the PID reference value change from 0.0% to 100.0% (PID reference ramp time). When a reference PID value changes, the reference does not immediately respond, but changes linearly according to the time (defined by parameter PD.17) to prevent the reference sudden changes.				
PD.18	PID feedback filter time	0.00	0.00 ... 655.35	s	○
	Defines the filter time constant for PID feedback signal, which can reduce the influence of interference signals on the PID feedback.				
PD.19	PID output filter time	0.00	0.00 ... 655.35	s	○
	Defines the filter time constant for PID output.				
PD.20	Proportional gain P2	20.00	0.00 ... 655.35	/	○
PD.21	Integration time I2	1.00	0.00 ... 655.35	s	○
PD.22	Derivative time D2	0.00	0.00 ... 655.35	s	○
PD.20 … PD.22 are the second group PID parameters, refer to PD.04 … PD.06 for more information.					
PD.23	PID parameter switching condition	0	0 ... 2	/	○
PD.24	PID parameter switching deviation 1	20.00	0.00 ... 100.00	%	○
PD.25	PID parameter switching deviation 2	80.00	0.00 ... 100.00	%	○
In some applications, a group of PID parameters (Proportional gain, Integration time, Derivative time) cannot meet the entire process control requirements.. • **PD.23 = 0: Not select.** The first group PID parameters (PD.04…PD.06) are effective.					

Para.	Name	Default	Range	Unit	Atrr.

- **PD.23 = 1: Digital input**

  When a digital input terminal function is set to [14]:

  ① When the digital input = 0: The first group PID parameters (PD.04…PD.06) are effective.

  ② When the digital input = 1: The second group PID parameters (PD.20…PD.22) are effective.

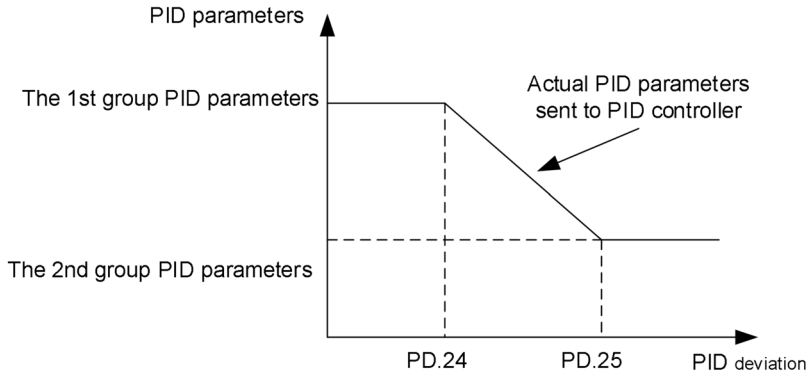
- **PD.23 = 2: According the deviation**

  PID deviation (PID error) = abs (PID reference − PID feedback).

  ① If PID deviation < PD.24, the first group PID parameters (PD.04…PD.06) are effective.

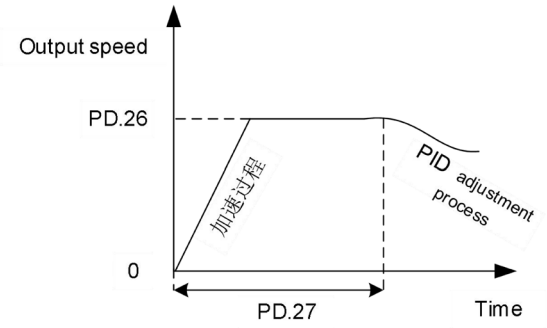
  ② If PID deviation > PD.25, the second group PID parameters (PD.20…PD.22) are effective.

  ③ PD.24 < PID deviation < PD.25, the PID parameter for PID controller changes linearly according to the first group and the second group PID parameters.



PD.26	PID initial value	0.00	0.00 ... 100.00	%	○
PD.27	PID initial value hold time	0.00	0.00 ... 655.35	s	○

When receive a start signal if the speed reference is PID, the speed first operates at a constant speed (defined by parameter PD.26) for the time defined by parameter PD.27 then enter to the normal PID adjustment process.



PD.28	Output deviation FWD max. value	20.00	0.01 ... 100.00	%	○
PD.29	Output deviation REV max. value	20.00	0.01 ... 100.00	%	○

PD.28 is used to define the PID maximum output deviation within 2ms in forward running direction.

PD.29 is used to define the PID maximum output deviation within 2ms in reverse running direction.

The two parameters are used to suppress excessive changes in PID output.

PD.30	PID calculation in stop status	0	0 ... 1	/	×
	• **0: PID continue calculation in stop status.** • **1: PID stop calculation in stop status.**				

Para.	Name	Default	Range	Unit	Atrr.
PD.31	PID feedback out of range value	100.00	0.00 ... 100.00	%	○
PD.32	PID feedback out of range detection time	0	0 ... 65535	s	○
If the PID feedback value is higher than the value defined by PD.31 for the time defined by PD.32, the drive will trips on a fault. **Note**: When PD.32 = 0, PID feedback out of range detection is disabled.					
PD.33	PID switching speed	0.00	0.00 ... 100.00	%	○
	100.00% corresponds to maximum speed. This function is available for some applications when the process PID may not meet requirements and it is necessary to change to a constant speed by a digital input. When the digital input function is set to【15】: When the digital input = 1, the speed reference is changed to a constant speed (PD.33). When the digital input = 0, the speed reference is changed to PID regulation.				
Group C0 Monitoring parameters					
C0.00	Reference speed		0 ... 27648	rpm	*
C0.01	Actual speed				*
C0.02	Actual current				*
C0.03	DC bus voltage				*
C0.04	IBGT temperature				*
C0.05	Motor temperature				*
C0.06	System status				*
C0.07	Fault code in decimal value				*
C0.08	Fault code in binary value				*
C0.09	Debug output 1				*
C0.10	Debug output 2				*
C0.11	AI1 input				*
C0.12	AI2 input				*
C0.13	AI3 input				*
C0.14	PID speed reference				*
C0.15	Output frequency				*
C0.16	Output current				*
C0.17	Output torque				*
C0.18	Output power				*
C0.19	Output voltage				*
C0.20	Reference torque (reserved)				*
C0.21	Running state (reserved)				*
C0.22	Speed reference from host controller (reserved)				*
C0.23	Digital inputs status				*
C0.24	Digital outputs status				*

Para.	Name	Default	Range	Unit	Atrr.
C0.25	The first encoder Z signal position				*
C0.26	The first encoder position				*
C0.27	Pulse input counter low four bits				*
C0.28	Pulse input counter high four bits				*
C0.29	The second encoder Z signal position				*
C0.30	The second encoder position				*
C0.31	Encoder gear ratio 0				*
C0.32	Encoder gear ratio 1				*
C0.33	Encoder gear ratio 2				*
C0.34	Encoder gear ratio 3				*
C0.35	Encoder gear ratio 4				*
C0.36	Position following error				*
C0.37	Software version				*
C0.38	Drive rated power				*
C0.39	Barcode information 0				*
C0.40	Barcode information 1				*
C0.41	Barcode information 2				*
C0.42	Barcode information 3				*
C0.43	PID reference				*
C0.44	PID feedback				*
C0.45	The 1st fault code				*
C0.46	The 2nd fault code				*
C0.47	The 3rd fault code				*
C0.48	The 4th fault code				*
C0.49	The 5th fault code				*
C0.50	The 1st fault current				*
C0.51	The 1st fault DC voltage				*
C0.52	Simple PLC current steps				*
C0.53	Simple PLC current cycles				*
C0.54	Time 1				*
C0.55	Current step running time				*
C0.56	EtherCAT command word				*
C0.57	EtherCAT connection status				*
C0.58	EtherCAT control mode				*
C0.59	Number of synchronization cycles				*
C0.60	Z position for orientation				*
C0.61	Torque reference by EtherCAT				*
C0.62	Application software version				*

Para.	Name	Default	Range	Unit	Atrr.
C0.63	Auto tune fault code				*

Chapter 6 Diagnostics

6.1 Fault Indications

This chapter lists all the faults messages including the possible causes and corrective actions. If the drive faults, the drive output is disabled so that the drive stops controlling the motor, and the following fault code will be displayed on the keypad, the fault contact output operates too.

For damages on units or questions that can't be resolved, please contact with local distributors/agents, service centers or manufacturer for solutions.

Keypad display	C0.07	C0.08	Fault Name	Possible causes	Corrective actions
Err 1	1	1	External fault	Digital input fault is "ON"	Check the corresponding digital input
Err 2	2	2	Drive overload	Power supply voltage too low	Check the power supply voltage
				Start when the motor is spinning	Restart after the motor at standstill
				Overloading for a long time	Reduce overload time and reduce load
				Drive power selection is too small	Replace with a suitable drive
Err 3	3	4	Motor overload	Power supply voltage too low	Check the power supply voltage
				Motor stall or load suddenly changed	Check motor load and drive ratings
				V/F curve setting are not correct	Adjust V/F curve and torque boost
Err 4	4	8	IGBT over temperature	Ambient over-temperature	Check ambient conditions
				Fan failure	Check air flow and fan operation
				Blockage of air duct	Check heatsink fins for dust pick-up
				Output current too high	Check the load and parameter Check motor power and drive power
				Temperature detect circuit failure	Seek for technical support
Err 5	5	16	Rectifier bridge over temperature	Ambient over-temperature	Check ambient conditions
				Fan failure	Check air flow and fan operation
				Blockage of air duct	Check heatsink fins for dust pick-up
				Output current too high	Check the load and parameter
				Temperature detect circuit failure	Seek for technical support
Err 6	6	32	Motor over temperature	Motor temperature too high	Improve ventilation and heat dissipation
				Thermistor resistance is abnormal	Check the thermistor
				Setting motor sensor protection threshold is improper	Check the parameter setting
Err 7	7	64	Encoder fault	Encoder connection is incorrect	Change encoder wiring
				The encoder has no signal output	Check the encoder and power supply
				Encoder parameters are not correctly	Check the encoder parameters
Err-08	8	128	Over current	Power supply too low	Check the power supply voltage
				Load inertia is too high	Extended acceleration time
				Motor parameters are not correctly	Set motor parameters correctly
				Ramp-up time was set too short	Extended acceleration time

Keypad display	C0.07	C0.08	Fault Name	Possible causes	Corrective actions
				The drive power mismatch	Replace with a suitable drive
				Current controller not correctly set	Set current controller parameters correctly
Err 09	9	256	Module protection	Module failure	Seek for technical support
				U, V, W short-circuited to ground	Check whether the output wiring is short-circuited to ground
				Built-in brake chopper abnormal	Seek for technical support
				Rectifier or module overheated	Seek for technical support
				The pre-charged contactor closes abnormally (≥185kW)	Check the input power supply
				Poor contact of the internal connectors	Ask professional technicians for maintenance
Err 10	10	512	Over voltage	Motor short circuit to ground	Check the motor and motor wiring
				Start when the motor is spinning	Restart after the motor at standstill
				Load inertia is too large	Use appropriate dynamic braking unit
				Deceleration time is too short	Extend the deceleration time
				The input voltage is too high	Check the input power supply
Err 11	11	1024	Under voltage	The input voltage is too low	Check the input power supply
				Abnormal switching power supply	Seek for technical support
Err 12	12	2048	Pre-charge contactor abnormal	Pre-charge contactor abnormal	Pre-charge contactor abnormal
Err 13	13	4096	EEPROM abnormal	EEPROM read/write abnormal	Seek for technical support
Err 14	14	8192	Unauthorized	Unauthorized	Seek for technical support
Err 15	15	16384	PID feedback disconnection	PID feedback disconnection detection setting is wrong or PID feedback disconnection	Check PID feedback disconnection value and detection time. Check the PID feedback cable
Err 16	16	32768	PID feedback out of range	PID feedback exceeds the acceptable range	Check whether the actual feedback value exceeds the set acceptable range
Err 17	17	0	Communication time out	Incorrect baud rate, address setting	Check the parameter setting
				Communication timeout	Check the Modbus timeout time
				Cable break	Check the communication wiring
Err 18	18	0	Encoder 1 direction is opposite to encoder 2	Encoder 1 direction is opposite to encoder 2	Check the encoder 1 and 2 direction
FALL	0	0	Auto tune fault	Auto tune fault	Check the motor parameters Check the motor cable

Appendix A Modbus Communication

1 Support Protocol

Support Modbus protocol, RTU format, Broadcast address is 0, slave address is "1−247", and "248−255" for reservation.

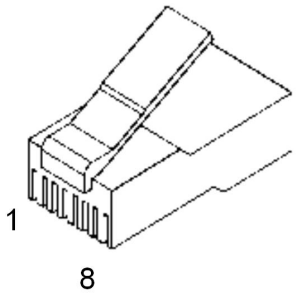
2 Interface Mode

RS485: Asynchronous, half duplex, LSB sending priority. Low byte is after the high byte.

Communication port A (RJ45) default data format: 8−N−1, 38400 bps

Communication port B (terminal RS485+/−) default data format: 8−N−1,38400 bps.

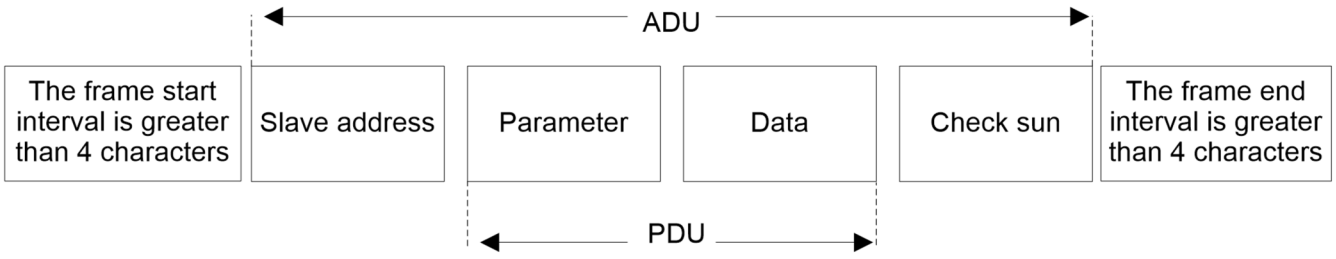
It is recommended to adopt EIA/TIA T568B, the lead of port A is defined as:



Attached Figure 1 RJ45 interface

Port A pin	1	2	3	4	5	6	7	8
Port A signal	+5V	GND	485+	485−	485+	485−	GND	+5V
EIA/TIA T568A	White green	Green	White orange	Blue	White blue	Orange	White brown	Brown
EIA/TIA T568B	White orange	Orange	White green	Blue	White blue	Green	White brown	Brown

3 Protocol Format



Attached Figure 2 Protocol format

The ADU (Application Data Unit) check sum is the CRC16 checksum of the first three parts of the ADU obtained by exchanging the high and low bytes.

4 Function Interpretation

■ Function **0x03 reads parameters**.

PDU Part Contents	Data Length (Byte)	Range
Request:		
Function code	1	0x03
Register start address	2	0x0000 ... 0xFFFF
Registers No.	2	0x0001 ... 0x0010
Response:		
Function code	1	0x03
Read bytes	1	2* Registers No.
Read contents	2* Registers No.	

■ Function **0x06 writes single parameter** or control word

PDU Part Contents	Data Length (Byte)	Range
Request:		
Function code	1	0x06
Register address	2	0x0000 ... 0xFFFF
Register data	2	0x0000 ... 0xFFFF
Response:		
Function code	1	0x06
Register address	2	0x0000 ... 0xFFFF
Register data	2	0x0000 … 0xFFFF

■ Function **0x10 writes multiple parameters** or control word

PDU Part Contents	Data Length (Byte)	Range
Request:		
Function code	1	0x10
Register start address	2	0x0000 … 0xFFFF
Registers No.	2	0x0001 … 0x0010
Bytes of register contents	1	2* Registers No.
Register contents	2* Registers No.	
Response:		
Function code	1	0x10
Register start address	2	0x0000 … 0xFFFF
Registers No.	2	0x0001 … 0x0100

Notes:

- Function 0x10 can write up to 16 consecutive address parameters at a time
- The parameters' value changed by communication will not saved to memory after power-off.

5 Register Address

Address Space	Meaning
Control word register	0x8000
Speed reference register	0x8001
Status word register address	0x810B.
Fault word register address	0x0003

5.1 Control word register (Address: 0x8000)

Bit	Function	Bit	Function
0	0: Stop 1: Start	8	0: No action 1: Relay1 – ON
1	Reserved	9	0: No action 1: Relay2 – ON
2	0: No action 1: Reset	10	0: No action 1: Relay3 – ON
3	Reserved	11	0: No action 1: PID switch to constant speed
4	Reserved	12	Reserved
5	Reserved	13	Reserved
6	0: No action 1: Y1 output ON	14	Reserved
7	0: No action 1: Y2 output ON	15	Reserved

5.2 Status word register (Address 0x810B)

Bit	Function	Bit	Function
Bit 0	0: Stop 1: Running	Bit4	0: Key is not locked 1: Key is locked
Bit1	Reserved	Bit6 bit5	0: Run command is keypad 1: Run command is digital input 2: Run command is communication
Bit2	Reserved	bit7	Reserved
Bit3	0: Forward running 1: Reverse running	Bit15 … bit 8	Fault code 0: Normal and faultless 0 … 255: Fault code

5.3 Fault word register address (Address 0x0003)

Bit	Function	Bit	Function
0	External fault	8	Module protection
1	Drive over load	9	Over voltage
2	Motor over load	10	Under voltage
3	IGBT over temperature	11	Pre-charge contactor abnormal
4	Rectifier bridge over temperature	12	EEPROM abnormal
5	Motor over temperature	13	
6	Encoder break	14	
7	Over current	15	

6 Modbus Communication Example

Run (The following is Hexadecimal data):					
	Address	Function code	Register address	Register contents	Checksum
Request	01	06	8000	0001	61CA
Response	01	06	8000	0001	61CA
Stop (The following is Hexadecimal data):					
	Address	Function code	Register address	Register contents	Checksum
Request	01	06	8000	0000	A00A
Response	01	06	8000	0000	A00A

Run and set speed reference to 50.00Hz (The following is Hexadecimal data):							
	Address	Function code	Register address	Number	Bytes	Register contents	Check sum
Request	01	10	8000	0002	04	0001 1388	CEFF
Response	01	10	8000	0004	–	–	E80A

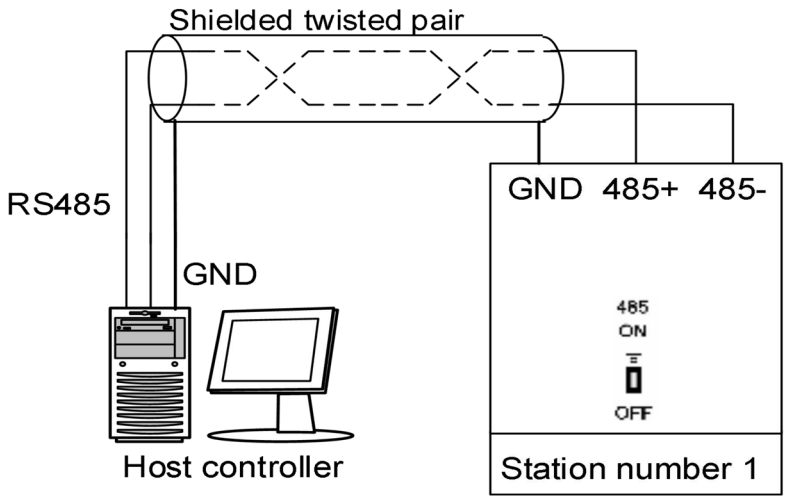
Note: The parameters modified by communication will not be saved after power off. If you need to save them, perform a save operation (P0.18 = 1) before power off.

7 CRC16 Function

```
unsigned int crc16 (unsigned char *data, unsigned char length)
{
    unsigned int i, crc_result=0xffff;
    while (length--)
    {
        crc_result^=*data++;
        for (i=0;i<8;i++)
        {
            if (crc_result&0x01)
                crc_result= (crc_result>>1)^0xa001;
            else
                crc_result=crc_result>>1;
        }
    }
    return   (crc_result= ( (crc_result&0xff)<<8)| (crc_result>>8));//交换 CRC16 校验和高低字节
}
```

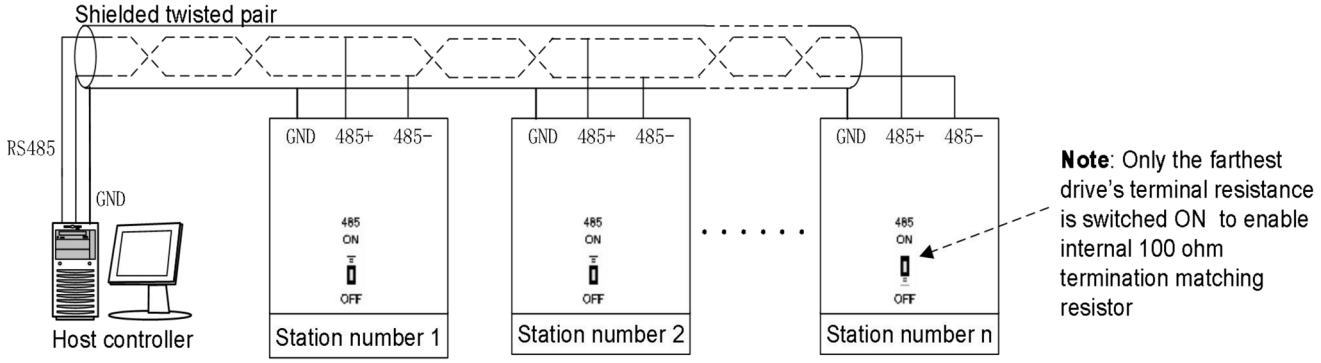
8 Network Construction

■ The Modbus connection for one drive



Appendix Figure 3 The connection of one drive

■ The Modbus connection for drives



Appendix Figure 4 The connection for multiple drives

Appendix B Register Address

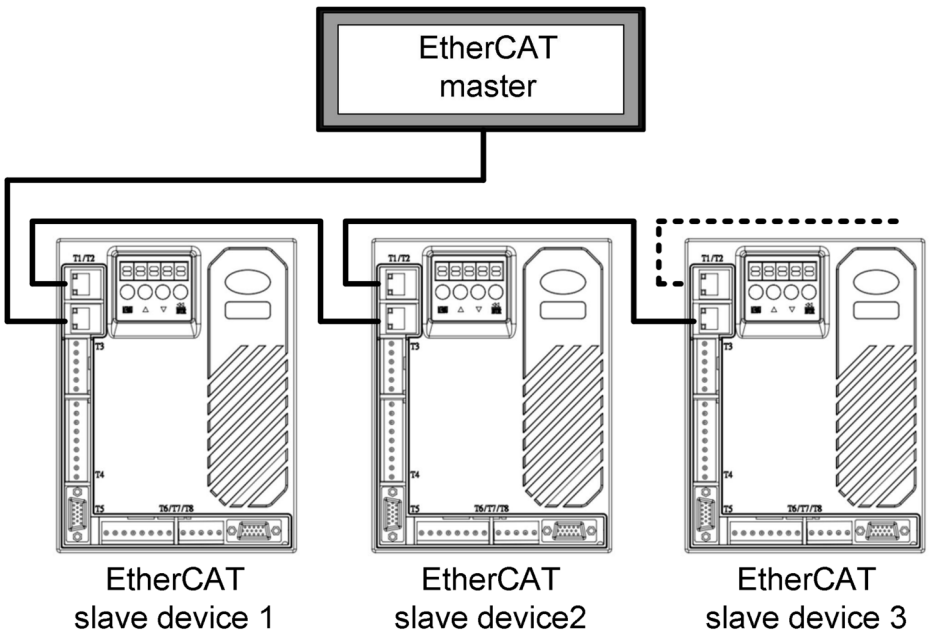
Parameter	Address in decimal	Address in hexadecimal	Parameter	Address in decimal	Address in hexadecimal	Parameter	Address in decimal	Address in hexadecimal
P0.00	88	58	P5.03	66	42	PC.33	275	113
P0.01	14	E	P5.04	69	45	PC.34	276	114
P0.02	19	13	P5.05	79	4F	PC.35	277	115
P0.03	10	A	P5.06	80	50	PC.36	278	116
P0.04	103	67	P5.07	105	69	PC.37	279	117
P0.05	114	72	P5.08	310	136	PC.38	280	118
P0.06	113	71	P5.09	311	137	PC.39	281	119
P0.07	354	162	P5.10	312	138	PC.40	282	11A
P0.08	355	163	P5.11	316	13C	PC.41	283	11B
P0.09	356	164	P5.12	317	13D	PC.42	284	11C
P0.10	47	2F	P5.13	318	13E	PC.43	285	11D
P0.11	30	1E	P5.14	319	13F	PC.44	286	11E
P0.12	155	9B	P5.15	320	140	PC.45	287	11F
P0.13	27	1B	P5.16	432	1B0	PC.46	288	120
P0.14	28	1C	P5.17	435	1B3	PC.47	289	121
P0.15	29	1D	P5.18	440	1B8	PC.48	290	122
P0.16	115	73	P5.19	441	1B9	PC.49	291	123
P0.17	112	70	P6.00	324	144	PC.50	292	124
P0.18	180	B4	P6.01	334	14E	PC.51	293	125
P0.19	119	77	P6.02	335	14F	PC.52	299	12B
P0.20	157	9D	P6.03	336	150	PC.53	360	168
P0.21	158	9E	P6.04	337	151	PC.54	361	169
P0.22	159	9F	P6.05	322	142	PC.55	362	16A
P0.23	93	5D	P6.06	323	143	PD.00	203	CB
P0.24	101	65	P6.07	325	145	PD.01	226	E2
P0.25	153	99	P7.00	53	35	PD.02	227	E3
P0.26	16	10	P7.01	54	36	PD.03	202	CA
P0.27	17	11	P7.02	20	14	PD.04	181	B5
P0.28	308	134	P7.03	21	15	PD.05	182	B6
P0.29	343	157	P7.04	100	64	PD.06	183	B7
P0.30	414	19E	P7.05	83	53	PD.07	205	CD
P0.31	416	1A0	P7.06	18	12	PD.08	204	CC
P0.32	358	166	P7.07	326	146	PD.09	220	DC
P0.33	417	1A1	P7.08	255	FF	PD.10	221	DD
P0.34	418	1A2	P7.09	256	100	PD.11	222	DE
P0.35	419	1A3	P7.10	257	101	PD.12	223	DF
P0.36	150	96	P7.11	258	102	PD.13	224	E0
P0.37	151	97	P7.12	259	103	PD.14	225	E1
P0.38	152	98	P7.13	260	104	PD.15	230	E6
P0.39	422	1A6	P8.00	85	55	PD.16	231	E7
P0.40	423	1A7	P8.01	95	5F	PD.17	232	E8
P0.41	424	1A8	P8.02	96	60	PD.18	233	E9

Parameter	Address in decimal	Address in hexadecimal	Parameter	Address in decimal	Address in hexadecimal	Parameter	Address in decimal	Address in hexadecimal
P0.42	429	1AD	P8.03	62	3E	PD.19	234	EA
P0.43	437	1B5	P8.04	67	43	PD.20	235	EB
P0.44	438	1B6	P8.05	68	44	PD.21	236	EC
P1.00	99	63	P8.06	407	197	PD.22	237	ED
P1.01	104	68	P8.07	408	198	PD.23	238	EE
P1.02	90	5A	P8.08	409	199	PD.24	239	EF
P1.03	65	41	P8.09	415	19F	PD.25	240	F0
P1.04	56	38	P9.00	327	147	PD.26	241	F1
P1.05	57	39	P9.01	328	148	PD.27	242	F2
P1.06	59	3B	P9.02	329	149	PD.28	243	F3
P1.07	86	56	P9.03	330	14A	PD.29	244	F4
P1.08	87	57	P9.04	333	14D	PD.30	245	F5
P1.09	89	59	P9.05	338	152	PD.31	249	F9
P1.10	84	54	P9.06	339	153	PD.32	250	FA
P1.11	91	5B	P9.07	376	178	PD.33	251	FB
P1.12	123	7B	P9.08	381	17D	C0.00	129	81
P1.13	128	80	P9.09	383	17F	C0.01	5	5
P1.14	156	9C	P9.10	399	18F	C0.02	4	4
P2.00	160	A0	P9.11	321	141	C0.03	6	6
P2.01	161	A1	P9.12	344	158	C0.04	7	7
P2.02	162	A2	PA.00	219	DB	C0.05	9	9
P2.03	163	A3	PA.01	331	14B	C0.06	2	2
P2.04	164	A4	PA.02	332	14C	C0.07	111	6F
P2.05	165	A5	PA.03	340	154	C0.08	3	3
P2.06	166	A6	PA.04	341	155	C0.09	81	51
P2.07	167	A7	PA.05	368	170	C0.10	82	52
P2.08	168	A8	PA.06	367	16F	C0.11	198	C6
P2.09	169	A9	PA.07	369	171	C0.12	199	C7
P2.10	170	AA	PA.08	370	172	C0.13	200	C8
P2.11	309	199	PA.09	371	173	C0.14	201	C9
P2.12	171	AB	PA.10	372	174	C0.15	189	BD
P2.13	172	AC	PA.11	373	175	C0.16	190	BE
P2.14	301	191	PA.12	374	176	C0.17	191	BF
P2.15	302	192	PA.13	375	177	C0.18	192	C0
P2.16	303	193	PA.14	401	191	C0.19	193	C1
P2.17	173	AD	PA.15	346	15A	C0.20	194	C2
P2.18	300	190	PA.16	347	15B	C0.21	195	C3
P2.19	304	194	PA.17	348	15C	C0.22	187	BB
P2.20	305	195	PA.18	349	15D	C0.23	206	CE
P2.21	306	196	PA.19	430	1AE	C0.24	208	D0
P2.22	307	197	PB.00	1	1	C0.25	211	D3
P2.23	420	1A4	PB.01	125	7D	C0.26	342	156
P2.24	421	1A5	PB.02	127	7F	C0.27	209	D1
P3.00	353	161	PB.03	229	E5	C0.28	210	D2

Parameter	Address in decimal	Address in hexadecimal	Parameter	Address in decimal	Address in hexadecimal	Parameter	Address in decimal	Address in hexadecimal
P3.01	40	28	PB.04	228	E4	C0.29	217	D9
P3.02	41	29	PB.05	403	193	C0.30	216	D8
P3.03	42	2A	PC.00	294	126	C0.31	212	D4
P3.04	43	2B	PC.01	295	127	C0.32	213	D5
P3.05	44	2C	PC.02	296	128	C0.33	214	D6
P3.06	45	2D	PC.03	136	88	C0.34	215	D7
P3.07	46	2E	PC.04	137	89	C0.35	216	D8
P3.08	106	6A	PC.05	138	8A	C0.36	382	17E
P3.09	107	6B	PC.06	139	8B	C0.37	510	1FE
P3.10	108	6C	PC.07	140	8C	C0.38	121	79
P3.11	109	6D	PC.08	141	8D	C0.39	377	179
P3.12	110	6E	PC.09	142	8E	C0.40	378	17A
P3.13	126	7E	PC.10	143	8F	C0.41	379	17B
P3.14	248	F8	PC.11	144	90	C0.42	380	17C
P3.15	400	190	PC.12	145	91	C0.43	246	F6
P3.16	402	192	PC.13	146	92	C0.44	247	F7
P4.00	32	20	PC.14	147	93	C0.45	174	AE
P4.01	33	21	PC.15	148	94	C0.46	175	AF
P4.02	116	74	PC.16	149	95	C0.47	176	B0
P4.03	35	23	PC.17	154	9A	C0.48	177	B1
P4.04	36	24	PC.18	297	129	C0.49	178	B2
P4.05	117	75	PC.19	261	105	C0.50	252	FC
P4.06	37	25	PC.20	262	106	C0.51	253	FD
P4.07	38	26	PC.21	263	107	C0.52	298	12A
P4.08	39	27	PC.22	264	108	C0.53	365	16D
P4.09	118	76	PC.23	265	109	C0.54	363	16B
P4.10	134	86	PC.24	266	10A	C0.55	364	16C
P4.11	130	82	PC.25	267	10B	C0.56	425	1A9
P4.12	131	83	PC.26	268	10C	C0.57	426	1AA
P4.13	135	87	PC.27	269	10D	C0.58	427	1AB
P4.14	132	84	PC.28	270	10E	C0.59	428	1AC
P4.15	133	85	PC.29	271	10F	C0.60	436	1B4
P5.00	313	139	PC.30	272	110	C0.61	439	1B7
P5.01	60	3C	PC.31	273	111	C0.62	391	187
P5.02	61	3D	PC.32	274	112	C0.63	442	1BA

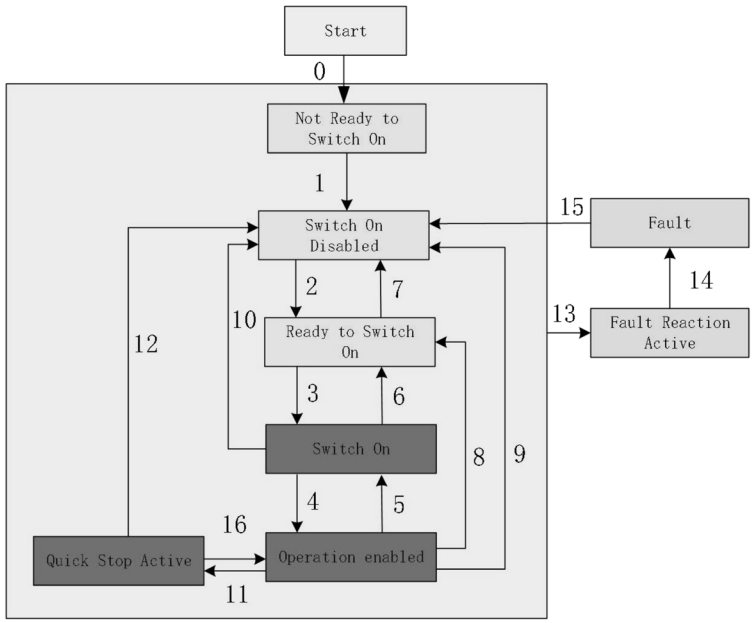
Appendix C EtherCAT

1 EtherCAT Topology



2 CiA402 State Transitions

EtherCAT CiA402 State Transitions is used to describe the state and state transitions of slave device. Usually, the master initiates a request to slave device for state transitions, and responded by the slave device. The state transitions shown below as FSA specified for CiA402.



State	Description
Not Ready to Switch On	Drive is initializing.
Switch On Disable	The drive has no fault or error, and the parameters can be set.
Ready to Switch On	The drive is ready, and the parameters can be set, ready to enter the Switch On state.
Switch On	The drive is ready, waiting to enable
Operation Enable	The drive enabled and runs normally.
Quick Stop Active	Stop by drive pre-set stop mode.
Fault Reaction Active	Coast to stop by fault.
Fault	Fault state, drive display fault code, can be reset by the control word 6040H = 0x80.

CiA 402 finite state automation (FSA)

3 Control Word 6040H

Index	Object Name	Control Word					Object type	VAR	Data type	Uint16
6040h	Access	RW	Mapping	YES	Related mode	All	Allowed values	0~65535	Preset value	0

The control word 6040H bits are defined as follows:

Bit	Name	Description
0	Switch on	The drive ready
1	Enable voltage	The main circuit is powered up
2	Quick stop	Quick stop
3	Enable operation	The drive is enabled
4~6	Operation mode specific	Related to the drive operation mode
7	Fault reset	Fault reset
8	Halt	Unsupported for the time being
9	Reserved	Reserved bit
10	Positioning command	The drive performs an internal positioning function, which has the highest priority in non-torque loop mode, and is 0 for any other modes.
11~15	Manufacturer specific	Factory custom-defined, not defined

Bits 0 … bit 3 and bit 7 (Bits for state control)

Command	Bits of the *controlword*					Transitions
	Bit 7	Bit 3	Bit 2	Bit 1	Bit 0	
Shutdown	0	X	1	1	0	2,6,8
Switch on	0	0	1	1	1	3
Switch on + enable operation	0	1	1	1	1	3 + 4 (NOTE)
Disable voltage	0	X	X	0	X	7,9,10,12
Quick stop	0	X	0	1	X	7,10,11
Disable operation	0	0	1	1	1	5
Enable operation	0	1	1	1	1	4,16
Fault reset	↑	X	X	X	X	15
NOTE Automatic transition to Enable operation state after executing SWITCHED ON state functionality.						

Bits 4 … bit6 and bit 8 (Bits related to control mode)

Bit	Operation mode		
	Profile Position Mode	Profile velocity Mode	Homing mode
4	New set-point	Reserved	Homing operation start
5	Change set immediately	Reserved	
6	abs/rel	Reserved	
8	Halt		

4 Status Word 6041H

Index 6041H	Object Name	Status Word					Object type	VAR	Data type	Uint16
	Access	RO	Mapping	TPDO	Related mode	All	Allowed values	0~65535	Preset value	0

Status bits are defined as follows:

Bit	Name	Description
0	Ready to switch on	The drive without fault
1	Switched on	Waiting for the drive to enable
2	Operation enabled	The drive operation
3	Fault	The drive trips on a fault
4	Voltage enabled	Bit 4 = 1, it indicates the power supply of the main circuit is normal.
5	Quick stop	Quick stop
6	Switch on disabled	The drive is ready
7	Warming	Bit 7 = 1, it indicates that the drive has an alarm.
8	Manufacture specific	Bit8 = 0: the spindle speed ≠ 0. Bit 8 = 1: Spindle speed = 0.
9	Remote	Remote control
10	Target reached	Target reached. In different modes has different meanings. In PP mode, bit10 = 1: the position reaching the reference position. in CSV mode, bit10 = 1: the speed reaches the reference speed. In CSP mode, bit10 = 1: the position has reached.
11	Internal limit active	Reserved.
12~13	Operation mode specific	Related to drive mode
14~15	Manufacture specific	undefinition

Bit0 … bit3, bit5 and bit6：

Statusword	PDS FSA state
xxxx xxxx x0xx 0000_b	Not ready to switch on
xxxx xxxx x1xx 0000_b	Switch on disabled
xxxx xxxx x01x 0001_b	Ready to switch on
xxxx xxxx x01x 0011_b	Switched on
xxxx xxxx x01x 0111_b	Operation enabled
xxxx xxxx x00x 0111_b	Quick stop active
xxxx xxxx x0xx 1111_b	Fault reaction active
xxxx xxxx x0xx 1000_b	Fault

Bit12 and bit13: In different modes, the PP mode is defined as follows:

Bit	Operation mode
	pp
12	Set-point Acknowledge
13	Following error

5 Drive Operation Mode

◆ Supported drive modes (6502H)

This object provides information on the supported drive modes.

Object name	Supported Drive Modes					Object type	VAR	Data type	Uint32
Access	RO	Mapping	TPDO	Related mode	All	Allowed values	0~4294967295	Preset value	0x381

The object 6502H reflects the operating mode supported by the drive:

Bit	Description	Support: 0 = not support, 1 = support
0	PP (Profile Position Mode)	1
1 … 6	NA	0
7	CSP: Cyclic Sync Position Mode	1
8	CSV: Cyclic Sync Velocity Mode	1
9	CST: Cyclic Sync Torque Mode	1
10 … 31	Reserved	0

◆ Modes of operation (6060H)

The object 6060H is used to set operation mode.

Object name	Modes of Operation					Object type	VAR	Data type	Int8
Access	RW	Mapping	YES	Related mode	All	Allowed values	0~7	Preset value	0

Currently, the drive provides the following 4 operation modes:

Value of 6060H	Mode
1	Profile Position Mode
8	Cyclic Synchronous Position Mode
9	Cyclic Synchronous Velocity Mode
10	Cyclic Synchronous Torque Mode

◆ Modes of Operation Display (6061H)

The object 6061H displays current operation mode of the drive.

Object name	Modes of Operation Display					Object type	VAR	Data type	Int8
Access	RO	Mapping	TPDO	Related mode	All	Allowed values	0~7	Preset value	0

The value definition of object 6061H is same as Mode of Operation (0x6060).

Value of 6061H	Corresponding mode
1	Profile Position Mode
8	Cyclic Synchronous Position Mode
9	Cyclic Synchronous Velocity Mode
10	Cyclic Synchronous Torque Mode

◆ **Related drive parameters**

Parameter	Name	Range	Description
P0.04	Run command selection	0 … 3	3: EtherCAT
P0.05	Speed reference selection	0 … 10	10: EtherCAT
P0.39	EtherCAT speed reference unit	0: RPM 1: PULSE/S	Set according to the requirements
P0.41	EtherCAT position reference smoothing cycle	1~65535 us	
P0.42	The EtherCAT clock synchronize with the drive	0: Synchronization not allowed 1: Synchronization allowed	
P0.43	EtherCAT pulse input gear ratio numerator (speed control)	1~65535	
P0.44	EtherCAT pulse input gear ratio denominator (speed control)	1~65535	
P9.12	Position loop reference selection	0: Pulse input 1: EtherCAT	1: EtherCAT

5.5 Profile Position Mode

5.5.1 Description

Profile Position Mode is a point-to-point operating mode using set-points which consist of velocity, acceleration, deceleration, and target position. Once all these parameters of the drive have been set by master, the drive buffers the commands and begins executing the set-point. When using a set of set-points method, a new set-point can be sent to the drive while a previously sent set-point is still executing.

This mode is mostly used for point-to-point positioning operation, and the operation curve is planned by the drive itself. The drive automatically completes position, speed and torque control.

5.5.2 Setting steps

(1) Set the drive parameter: P0.04 = 3 (EtherCAT).

(2) Set the drive parameter: P9.12 = 1 (EtherCAT).

(3) Set [6060H: Mode of Operation] = 1 [Profile Position Mode].

(4) Set [6081H: Profile Velocity] = Current step position command constant running speed (unit: RPM); the value should not higher than the parameter P9.01 (Position loop max. speed); (internal limit the value ≥ 1rpm).

(5) Set [6083H: Profile acceleration] = position loop acceleration time (unit: 0.01S, the time from 0 rpm to P9.01), corresponds to the drive internal parameter P9.02, range 0.00 … 655.35.
Set [6084H: Profile deceleration] = position loop deceleration time (unit: 0.01S, the time from the P9.01 to 0 rpm), corresponds to the drive internal parameter P9.03, range 0.00~655.35.

(6) Set position loop gear ratio [P9.05: numerator] and [P9.06: denominator].

Note: The gear ratio is effective when update position is relative position and ineffective when update position is absolute position.

(7) Set [607AH: Target Position] = the target position (unit: pulse).

(8) Set bit4 [reset to zero], bit5 [Update Mode], bit6[Position Type] of [6040H: Control Word]. E.g., write control word 6040H = 0xnF (E.g., 0x0F, 0x2F, 0x4F, 0x6F).

(9) The bit12 of 6041H = 0: the drive can receive new target position. Then set bit4 of 6040H triggers the target position to take effect, namely, write control word 6040H=0x (n + 1) F (E.g., 0x1F, 0x3F, 0x5F, 0x7F).

The new values of 6081H, 6083H and 6084H will take effect when the rising edge of bit4 of 6040H = 0—>1 .

The target position 607AH is a relative position or absolute position is defined by the bit6 of 6040H. The update mode defined by the bit5 of 6040H. As shown in the following table:

Position type (bit6 0f 6040H)	Update mode (bit5 of 6040h)	6040H	607AH description
0	0	0x0F→0x1F	Absolute position, not immediate update
0	1	0x2F→0x3F	Absolute position, updated immediately
1	0	0x4F→0x5F	Relative position, not immediately update
1	1	0x0F→0x1F	Relative position, updated immediately

Note: When 6040h = 0xnF is enabled and the status word bit12 of 6041h = 0, the update request is

executed, otherwise the position update request is not executed by the drive.

(10) Query the actual position feedback through 6064H (Position Actual Value).

(11) Obtain the drive status feedback through 6041H (Status Word).

5.5.3 Other objects

(1) Obtain the position target value (unit: pulse) through [6062H: Position demand value].

(2) Obtain the deviation between the target position and actual position (unit: pulse) through [60F4H: Following error actual value].

5.5.4 List of related objects

Index	Name	Type	Attr
6040H	Control Word	U INTEGER16	RW
6041H	Status word	U INTEGER16	RO
6060H	Mode of operation	INTEGER16	RW
6061H	Modes of operation display	INTEGER16	RO
6062H	Position demand value	INTEGER32	RO
6064H	Position actual value	INTEGER32	RO
607AH	Target Position	INTEGER32	RW
6081H	Profile velocity	U INTEGER32	RW
6083H	Profile acceleration	U INTEGER32	RW
6084H	Profile deceleration	U INTEGER32	RW
60F4H	Following error actual value	INTEGER32	RO

Note: Refer to the CiA DS402 standard for the detailed description of each object.

5.5.5 Control Word (0x6040) of Profile Position Mode

Object name	Control Word					Object type	VAR	Data type	Uint16
Access	RW	Mapping	YES	Related mode	All	Allowed values	0~65535	Preset value	0

Description of the special control bit of 0x6040 in Profile Position Mode			
Bit	Bit 6	Bit 5	Bit 4
Name	Position command type	Position command update mode	Enable the new position command (Effective when rising or falling edge)
Value	0: The target position of 607AH is an absolute position command 1: The target position 607AH is a relative position instruction	0: Not updated immediately 1: Update immediately	0 → 1: Pre-enabled a new position command. Whether the new position command is success enabled depends on the drive state. Simultaneously trigger the values of 6081H, 6083H, and 6084H to take effect. 1→0: Pre-set bit12 of 6041H to 0. Whether the reset is successful depends on the drive state.

5.5.6 Status word (0x6041) of Profile Position Mode

Object name	Status Word					Object type	VAR	Data type	Uint16
Access	RO	Mapping	TPDO	Related mode	All	Allowed values	0~65535	Preset value	0

Description of the special control bit of 0x6041 in Profile Position Mode			
Bit	Bit 13	Bit 12	Bit 10
Name	Position deviation state	Receive new position command	Target position reached
Value	0: The position deviation is within the range (6065H) 1: Position deviation out of range (6065H)	0: The drive can receive new position command 1: The drive cannot receive new position command	0: Target position is not reached 1: Target position is reached

5.5.7 Application examples

（1） Set the drive parameter P0.04 = 3 (Run command: EtherCAT).

(2) Set the drive parameter P9.12 = 1

（3）Set 6060H = 1, select Profile Position Mode.

（4）Set 607AH = 10000 (e.g., 10000 pulse), set the position value.

（5）Set 6081H = 200 (such as 200 RPM), set the position command constant running speed (unit: RPM).

（6）Set 6083h = 100 (e.g., 1.00 seconds), set the planned acceleration time (unit: 0.01 seconds). Set 6084h=100 (e.g., 1.00 seconds), set the planned deceleration time (unit: 0.01 seconds).

（7） After the above parameters are set, then enable the drive: 6040H=0x0F.

（8） Set bit6 (position command type) and bit5 (update mode) of 6040H according to the requirement, clear bit4 of 6040H and enable. Such as set 6040H = 0x2F (absolute position, and update immediately).

（9）Wait for 6041H. Bit 12 = 0 (the drive can receive new position command), then set bit4 of 6040H, that is to say set 6040H = 0x3F. The drive starts executing a new position command.

（10） Query bit10 of 6041H to see if the target position is reached after 10ms delay.

5.6 Cyclic Synchronous Position Mode

Cyclic Synchronous Position Mode is similar to the principle of position interpolation mode, the curve planning and interpolation of position command are completed by the master, the drive only do position follow.

The interpolation cycle defines the time interval when the Target Position update, and in this mode, the interpolation cycle is the same as that of the EtherCAT synchronization cycle.

① Setting steps

(1) Set the drive parameter P0.04 = 3 (Run command: EtherCAT).

(2) Set the drive parameter P9.12 = 1 (Position loop reference selection).

(3) Set [6060H: Mode of operation] = 8 (Cyclic Synchronous Position Mode).

(4) Set the drive parameters [P0.41: EtherCAT position reference smoothing cycle] should set the same position interpolation period of the master.

(5) Set the drive position loop gear ratio parameters [P9.05: gear ratio numerator] and [P9.06: gear ratio denominator].

(6) Set [6040H: Control Word] = 0x0F to enable drive and trigger the target position to take effect.

(7) Set [607AH: Target Position] as the target position (unit: pulse).

(8) Query [6064H: Position Actual Value] query the actual position feedback.

(9) Query [6041H: Status Word] to obtain the drive status feedback.

② Other objects

(1) Query [6062H: Position demand value] to obtain the position target position (unit: pulse).

(2) Query [60F4H: Following error actual value] to obtain the following error between position command and feedback (unit: pulse).

③ List of related objects

Index	Name	Type	Attr
6040H	Control Word	U INTEGER16	RW
6041H	Status word	U INTEGER16	RO
6060H	Mode of operation	INTEGER16	RW
6061H	Modes of operation display	INTEGER16	RO
6062H	Position demand value	INTEGER32	RO
6064H	Position actual value	INTEGER32	RO
607AH	Target Position	INTEGER32	RW
60F4H	Following error actual value	INTEGER32	RO

Note: Refer to the CiA DS402 standard for a detailed description of each object

④ Application examples

(1) Set the drive parameter P0.04 = 3 (EtherCAT).

(2) Set the drive parameterP9.12= 1 (EtherCAT).

(3) Set [6060H: Mode of operation] = 8 (Cyclic Synchronous Position Mode).

(4) Set [6040H: Control Word] = 0x0F to enable the drive.

(5) Set [607AH: Target Position] as the target position (absolute position) successively.

◆ **Cyclic Synchronous Velocity Mode**

In Cyclic Synchronous Velocity Mode, the speed command curve planning is completed by the master station, and the drive executes the speed reference from the master station in real time The interpolation cycle defines the time interval of the target speed (Target Velocity) updates, and in this mode the interpolation cycle is the same as the synchronization cycle of the EtherCAT.

① Setting steps

(1) Set the drive parameter P0.04 = 3 (Run command: EtherCAT).

(2) Set the drive parameter P0.05 = 10 (Speed reference: EtherCAT).

(3) Set the drive parameter P0.39= 0 (0: RPM, 1: pulse / s). If P0.39 = 1, require set the EtherCAT pulse input gear ratio [P0.43: gear ratio numerator] and P0.44: gear ratio denominator].

(4) Set [6060H: Mode of operation] = 9 (Cyclic Synchronous Velocity Mode).

(5) Set【 P0.41: EtherCAT position reference cycle 】to be the same as the main station position interpolation cycle.

(6) Set the drive acceleration time P7.02 and deceleration time P7.03 (unit: in 0.01 seconds).

(7) Set the [6040H: Control Word] to enable the drive (enable when set to 0x0F).

(8) Set [60FFH: Target Velocity] as the target rotation speed (unit: RPM).

(9) Query [606CH: Velocity Actual Value] query the actual speed feedback.

(10) Query [6041H: Status Word] to obtain the drive status feedback.

② Other objects

(1) Query [6078H: Current actual value] to obtain the actual current (unit: 0.1A).

③ List of related objects

Index	Name	Type	Attr
6040H	Control Word	U INTEGER16	RW
6041H	Status word	U INTEGER16	RO
6060H	Mode of operation	INTEGER16	RW
6061H	Modes of operation display	INTEGER16	RO
60FFH	Target velocity	INTEGER32	RW
606CH	Velocity Actual Value	INTEGER32	RO
6078H	Current actual value	INTEGER 16	RO

Note: Refer to the CiA DS402 standard for a detailed description of each object.

④ Application examples

(1) Set the drive parameter P0.04 = 3 (Run command: EtherCAT).

(2) Set the drive parameter P0.05 = 4 (Speed reference: EtherCAT).

(3) Set the drive parameter P0.39= 0 (EtherCAT speed unit).

(4) Set 6060H = 9 (Mode of operation = Cyclic Synchronous Velocity Mode).

(5) Set 6040H = 0x0F (Control Word, 0x0F = enable the drive).

(6) Set 60FFH = Target velocity (unit: RPM).

5.8 Cyclic Synchronous Torque Mode

In Cyclic Synchronous Torque Mode, the master planning reference curve, and the drive (slave device) operation in torque loop mode, torque reference sent from the master in real time.

The interpolation period defines the time interval update for the Target Torque. In this mode, the interpolation period is the same as the synchronization period of the EtherCAT.

Note: The stop mode of Cyclic Synchronous Torque Mode is coast to stop.

① Setting steps

(1) Set the drive parameter P0.04 = 3 (Run command: EtherCAT).

(2) Set 6060H = 10 (Mode of operation = Cyclic Synchronous Torque Mode).

(4) Set P0.41 (EtherCAT position reference smoothing cycle) is the same as the position insertion cycle of the master.

(5) Set the maximum speed P0.03 of the drive.

(6) Set the 6040H = 0x0F to enable the drive (Control Word, 0x0F = enable the drive).

(7) Set 6071H = Target Torque (unit: 0.1% rated torque), and the actual torque reference can be viewed on monitored parameter C0.61 of the drive.

(8) Query [606CH: Velocity Actual Value] query the actual speed feedback.

(9) Query [6041H: Status Word] to obtain the drive status feedback.

② Other objects

(1) Query [6078H: Current actual value] to obtain the actual current (unit: 0.1A).

(2) Query [6074H: Torque demand value] to obtain the torque reference (unit: 0.1% of rated torque).

(3) Query [6077H: Torque actual value] to obtain the actual torque output (unit: 0.1% of rated torque).

③ List of related objects

Index	Name	Type	Attr
6040H	Control Word	U INTEGER16	RW
6041H	Status word	U INTEGER16	RO
6060H	Mode of operation	INTEGER16	RW
6061H	Modes of operation display	INTEGER16	RO
6071H	Target Torque	INTEGER 16	RW
6074H	Torque demand value	INTEGER 16	RO
6077H	Torque actual value	INTEGER 16	RO
6078H	Current actual value	INTEGER 16	RO

Note: Refer to the CiA DS402 standard for a detailed description of each object.

④ Application examples

(1) Set the drive parameter P0.04 = 3 (Run command: EtherCAT).

(2) Set 6060H = 10 (Mode of operation = Cyclic Synchronous Torque Mode).

(3) Set the 6040H = 0x0F to enable the drive (Control Word, 0x0F = enable the drive).

(4) Set 6071H = Target Torque (unit: 0.1% rated torque).

5.9 Touch Probe Function

Touch Probe is a latching function to capture the position value of the encoder by sensing the edge-triggered encoder Z signal and the capture result is stored at 0x60BA.

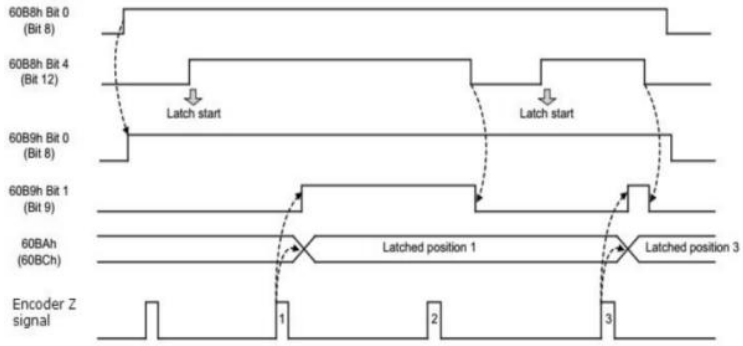
① List of related objects

Index	Name	Type	Attr
60B8H	Touch probe function	U INTEGER16	RW
60B9H	Touch Probe Status word	U INTEGER16	R O
60BAH	Probe 1 positive edge value (Encoder zero signal)	INTEGER 32	RO

② The control word 60B8h and the state word 60B9h description

Bi t	0x60B8	0x60B9
0	Touch probe 1 enable	Touch probe 1 enabled
1	Touch probe 1 continuous mode(reserved)	Touch probe 1 positive edge value stored
2	Touch probe 1 zero pulse	Touch probe 1 negative edge value stored
3		
4	Enable sampling at positive edge of touch probe 1	
5	Enable sampling at negative edge of touch probe 1	
6		
7		
8	Touch probe 2 enable	Touch probe 2 enabled
9	Touch probe 2 continuous mode	Touch probe 2 positive edge value stored
10	Touch probe 2 zero pulse	Touch probe 2 negative edge value stored
11		
12	Enable sampling at positive edge of touch probe 2	
13	Enable sampling at negative edge of touch probe 2	
14		
15		

The timing diagram of the control word 0x60B8 and the state word 0x60B9 is as follows:



③ Application example (Single trigger mode)

Acquisition Z position during operation:

(1) Set 6060h = 9 (Mode of operation = Cyclic Synchronous Velocity Mode).

(2) Set 60FFh = 200 (Target velocity is 200 RPM).

(3) Set 6040h = 0x0F (Control Word = 0x0F to enable the drive).

(4) Set 60B8h = 0x01 (Touch probe function = 0x01 to enable Touch probe function).

(5) Set 60B8h = 0x11 (Touch probe function = 0x11, latch start Touch probe function).

(6) Query 60B9h (Touch Probe Status word), bit1 = 1, indicating the completion of the capture.

(7) Query 60BAh (Probe1 positive edge value) to obtain the actual value of Z position.

(8) Set 60B8h = 0x00: (Touch probe function = 0x00, touch probe function capture is completed).

5.10 Drive internal position positioning function

The drive has a built-in position control function. When the drive in enabling state, set the bit10 of 6040h to 1 to active the built-in position function. Refer to parameter group PA for more details. The parameter PA.01 is used to set offset value relative to the encoder Z position, which has the highest execution priority in non-torque mode and invalid function in torque loop mode.

① Setting steps

(1) Set the drive parameter P0.04 = 3 (Run command: EtherCAT).

(2) Set 6060H (Mode of operation] to non-torque mode: 8 or 9.

(3) Set PA.01 (Orientation position references 1), relative to the Z position (unit: pulse).

(4) Set PA.02 (Orientation start speed), PA.03（Orientation deceleration time) and PA.04 (Orientation gain].

(5) Set 6040h (Control Word) Positioning operation command (execute Orientation function when set to 0x40F), this command can also be executed in CSP and CSV mode.

(6) Query 606Ch (Velocity Actual Value) query the actual speed feedback.

(7) Query 6041H (Status Word) to get the drive status feedback; after sending 0x40F positioning command, delay 10ms (ensure the drive is executing the positioning command) and query the bit10 of 6041H, then the value of bit10 of 6041h is the positioning completion flag.

② Other objects

(1) Query [6078H: Current actual value] to obtain the actual current (unit: 0.1A).

(2) Query [6064H: Position Actual Value] query the actual position of the motor feedback.

(3) Query [6062H: Position demand value] to obtain the target position (unit: pulse).

(4) Query [60F4H: Following error actual value] to obtain the deviation between position command and actual position feedback (unit: pulse).

③ List of related objects

Index	Name	Type	Attr
6040H	Control Word	U INTEGER16	RW
6041H	Status word	U INTEGER16	RO
6060H	Mode of operation	INTEGER16	RW
6061H	Modes of operation display	INTEGER16	RO
6062H	Position demand value	INTEGER32	RO
6064H	Position actual value	INTEGER32	RO
606CH	Velocity Actual Value	INTEGER 32	RW
6078H	Current actual value	INTEGER 16	RO
60F4H	Following error actual value	INTEGER32	RO

Note: Refer to the CiA DS402 standard for the detailed description of each object.

④ Application examples

(1) Set the drive parameter P0.04 = 3 (Run command: EtherCAT).

(2) Set 6060h = 9 (Mode of operation = Cyclic Synchronous Velocity Mode).

(3) Set the 6040h (Control Word) = 0x40F to enable the drive.

The bit10 (Target reach) of the status word 6041h is reset to 0 after start the drive internal positioning function. The bit10 (Target reach) of the status word 6041h is set to 1 after the position is reached. Note that after sending the 0x40F command; please waiting for 10ms (or longer) to ensure that the driver has executed the positioning function before taking the status value of bit 10.

6 Error Object

The following table is the fault corresponding to the display value of object 603FH when using EtherCAT. First, check the bit3 of 0x6041 if the drive has a fault. When bit3 of 0x6041 is 1 (with a fault), check the parameters C0.07 and C0.08, fault code or 0x603F values in the table below for more details.

Keypad display	C0.07	C0.08	0x603F value	Fault Name	Possible causes	Corrective actions
Err 1	1	1	0x7500	External fault	Digital input fault is "ON"	Check the corresponding digital input
Err 2	2	2	0x3230	Drive overload	Power supply voltage too low	Check the power supply voltage
					Start when the motor is spinning	Restart after the motor at standstill
					Overloading for a long time	Reduce overload time and reduce load
					Drive power selection is too small	Replace with a suitable drive
Err 3	3	4	0x3230	Motor overload	Power supply voltage too low	Check the power supply voltage
					Motor stall or load suddenly changed	Check motor load and drive ratings
					V/F curve setting are not correct	Adjust V/F curve and torque boost
Err 4	4	8	0x4210	IGBT over temperature	Ambient over-temperature	Check ambient conditions
					Fan failure	Check air flow and fan operation
					Blockage of air duct	Check heatsink fins for dust pick-up
					Output current too high	Check the load and parameter Check motor power and drive power
					Temperature detect circuit failure	Seek for technical support
Err 5	5	16	0x4210	Rectifier bridge over temperature	Ambient over-temperature	Check ambient conditions
					Fan failure	Check air flow and fan operation
					Blockage of air duct	Check heatsink fins for dust pick-up
					Output current too high	Check the load and parameter
					Temperature detect circuit failure	Seek for technical support
Err 6	6	32	0x3330	Motor over temperature	Motor temperature too high	Improve ventilation and heat dissipation
					Thermistor resistance is abnormal	Check the thermistor
					Setting motor sensor protection threshold is improper	Check the parameter setting
Err 7	7	64	0x7305	Encoder fault	Encoder connection is incorrect	Change encoder wiring
					The encoder has no signal output	Check the encoder and power supply
					Encoder parameters are not correctly	Check the encoder parameters
Err-08	8	128	0x2311	Over current	Power supply too low	Check the power supply voltage
					Load inertia is too high	Extended acceleration time
					Motor parameters are not correctly	Set motor parameters correctly
					Ramp-up time was set too short	Extended acceleration time
					The drive power mismatch	Replace with a suitable drive
					Current controller not correctly set	Set current loop parameters correctly

Keypad display	C0.07	C0.08	0x603F value	Fault Name	Possible causes	Corrective actions
Err 09	9	256	0x2312	Module protection	Module failure	Seek for technical support
					U, V, W short-circuited to ground	Check whether the output wiring is short-circuited to ground
					Built-in brake chopper abnormal	Seek for technical support
					Rectifier or module overheated	Seek for technical support
					The pre-charged contactor closes abnormally (≥185kW)	Check the input power supply
					Poor contact of the internal connectors	Ask professional technicians for maintenance
Err 10	10	512	0x3210	Over voltage	Motor short circuit to ground	Check the motor and motor wiring
					Start when the motor is spinning	Restart after the motor at standstill
					Load inertia is too large	Use appropriate dynamic braking unit
					Deceleration time is too short	Extend the deceleration time
					The input voltage is too high	Check the input power supply
Err 11	11	1024	0x3220	Under voltage	The input voltage is too low	Check the input power supply
					Abnormal switching power supply	Seek for technical support
Err 12	12	2048	0xff00	Pre-charge contactor abnormal	Pre-charge contactor abnormal	Pre-charge contactor abnormal
Err 13	13	4096	0x5530	EEPROM abnormal	EEPROM read/write abnormal	Seek for technical support
Err 14	14	8192	0xff00	Unauthorized	Unauthorized	Seek for technical support
Err 15	15	16384	0xff00	PID feedback disconnection	PID feedback disconnection detection setting is wrong or PID feedback disconnection	Check PID feedback disconnection value and detection time. Check the PID feedback cable
Err 16	16	32768	0xff00	PID feedback out of range	PID feedback exceeds the acceptable range	Check if the actual feedback exceeds the set acceptable range
Err 17	17	0	/	Communication time out	Incorrect baud rate, address	Check the parameter setting
					Communication timeout	Check the Modbus timeout time
					Cable break	Check the communication wiring
Err 18	18	0	/	Encoder 1 direction is opposite to encoder 2	Encoder 1 direction is opposite to encoder 2	Check the encoder 1 and 2 direction
FALL	0	0	/	Auto tune fault	Auto tune fault	Check the motor parameters Check the motor cable

Note: When the drive trips on a fault, the drive keypad will display "Err **". When the corresponding fault descriptions in parameters C0.07 and C0.08 are not the same, it indicates that there are multiple faults at the same time.

Example: When C0.07 = 2 and C0.08 = 134. C0.07 = 2, the drive trips on overload fault. C0.08 = 134 trips on multiple faults. At this point, it can be considered that C0.08 = 134 = 2 + 4 + 128, indicating that the drive trips on overload fault, motor overload fault and overcurrent fault.