Foreword

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

VTS series products support control a variety of motors, support connect a variety of encoders, and support multiple communications. VTS series products is divided into the following models:

VTS500: AFE and inverter

VTS400: Multi-functional AC Drive.

VTS300: High Performance Universal AC drive..

VTS100: Economic Universal AC Drive.

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 user.

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 the company is subject to change without notice.

Abundant and Flexible Function

System control mode

- Position loop.
- Speed loop.
- Torque loop.

Speed reference source

- Modbus communication.
- Keypad.
- Analog input.
- Multi-step speed reference.
- External digital inputs UP/DN.
- Process close loop PID reference.
- Main speed reference and auxiliary speed reference calculation.
- Simple PLC .
- High speed pulse.
- CAN, PROFIBUS DP, PROFINET, EtherCAT, etc.

Run command reference source

- Modbus communication.
- Keypad.
- External digital input.
- CAN, PROFIBUS DP, PROFINET, EtherCAT.

Pulse input

- Orthogonal pulse.
- Pulse + Direction.
- Single-phase pulse.

LED Keypad and LCD Keypad

- Modbus-RTU communication.
- The Keypad and control board can be connected by standard network cable.
- The Keypad has the function parameters upload and download.
- A password can be set on the keypad and/or the keys can be locked to avoid the non−professional personnel from changing the parameters by mistake.

Communication mode

- Modbus-RTU, CAN, PROFIBUS DP, PROFINET, EtherCAT
- Host controller has the functions of parameters upload and download.

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 drives is used to control the operation of three-phase motors. It cannot be used to control single-phase motors or for other purposes, otherwise it may cause drive fault or fire. ● This series of drives cannot be easily applied to applications such as medical devices that are directly related to personal safety. ● This series of drives is manufactured under a strict quality management system. If a drive fault occurs, it can 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 the electrical control cabinet, the electrical control cabinet shall be equipped with 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 danger 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 "+/P" and "PB". 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 motor must be firmly grounded.

WARNING

- The three-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 danger 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, 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 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 electrolytic capacitor from injuring people.
- Please designate qualified electrical engineers to do the maintenance, inspection or replacement of parts.

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.

CONTENTS

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 versions and hardware versions.

VTS 400 – 4T 22K 1 B – 1 1 0 0

Vector and torque technology platform

100	Economic universal series
300	High performance universal series
400	High performance multi-functional series
500	AFE and inverter series

2S	2 phase 200V
2T	3 phase 200V
4T	3 phase 400V

22K	Rated power 22kW

1	LED keypad
2	LCD keypad

None	No built-in brake chopper
B	Built-in brake chopper

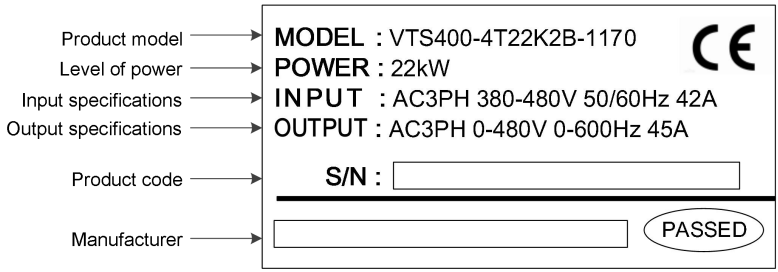
0	Not select
1	2nd SinCos encoder module

3rd slot: motor encoder card	
0	Not select
1	**TTL encoder** + 2nd TTL encoder + pulse reference + encoder signal output + PT100/KTY84
2	**ReSolver** + 2nd TTL encoder + pulse reference + encoder signal output, PT100/KTY84
3	**SinCos encoder** + 2nd TTL encoder + pulse reference + encoder signal output + PT100/KTY84
4	**SinCos encoder** + PT100/KTY84
7	**TTL encoder** + 2nd TTL encoder + pulse reference, + encoder signal output + PT100/KTY84
8	**HTL encoder** + pulse input + encoder signal output

2nd slot: communication card	
0	Not select
1	**Modbus-RTU / CANopen** + AI + AO
2	**EtherCAT** + Modbus-RTU + STO
3	**PROFIBUS DP** + Modbus-RTU + STO
4	**PROFINET** + Modbus-RTU + STO + AI
5	**EtherCAT** + Modbus-RTU + STO + AI
6	**PROFINET** + PT100*2 + STO + AI
7	**PROFINET** + Modbus-RTU/CAN + STO + AI

1st slot: digital inputs and outputs card	
0	Not select
1	Digital inputs and outputs card

1.2 Nameplate Description



1.3 Ratings

■ VTS□□□-4T□□K□□-□□□□

Rated Power (kW)		5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110
Applicable motor (kW)		5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110
Output	Voltage (V)	Three-phase 0 to rated input voltage												
	Rated current (A)	13	17	24	30	39	45	60	75	91	112	150	176	210
	Maximum current (A)	23	31	43	54	70	81	108	135	164	202	270	317	378
	Overload capability	150% for 60s, 180% for 10s, 200% for 0.5s, interval: 10 minutes (Inverse time characteristic)												
Input	Rated voltage / frequency	Three-phase 380V/480V; 50Hz/60Hz												
	Allowable voltage	323V ~ 528V; voltage imbalance ≤3%; allowable frequency fluctuation: ±5%												
	Rated current (A)	15	19	26	33	37	42	57	69	89	106	139	164	196
Built-in DC reactor		No				Built-in as standard			Built-in as standard					
Built-in Brake chopper		Built-in as standard							Built-in as optional					
Protection level		IP20												
Cooling mode		Force air cooling												

Rated Power (kW)		132	160	185	200	220	250	280	315	355	400	450	500
Applicable motor (kW)		132	160	185	200	220	250	280	315	355	400	450	500
Output	Voltage (V)	Three-phase 0 to rated input voltage											
	Rated current (A)	253	304	350	380	426	470	520	600	650	690	775	860
	Maximum current (A)	455	547	630	684	765	846	936	1080	1170	1242	1395	1548
	Overload capability	150% for 60s, 180% for 10s, 200% for 0.5s, interval: 10 minutes (Inverse time characteristic)											
Input	Rated voltage / frequency	Three-phase 380V/480V; 50Hz/60Hz											
	Allowable voltage	323V ~ 528V; voltage imbalance ≤3%; allowable frequency fluctuation: ±5%											
	Rated current (A)	240	287	326	352	385	437	491	580	624	670	775	840
Built-in DC reactor		Built-in as standard											
Built-in Brake chopper		No (External if required)											
Protection level		IP20											
Cooling mode		Force air cooling											

1.4 Technical Specifications

Control characteristics	Control mode	Sensor-less control	Sensor control
	Applicable motor type	Synchronous motor, asynchronous motor	
	Maximum speed	600Hz, **Note**: Higher frequency products are customizable.	
	Starting torque	● Asynchronous motor: 200% of rated torque at 0.25Hz ● Synchronous motor: 150% of rated torque at 1.5% of rated speed	200% of rated torque at 0 speed
	Speed regulation range	1:200	1:5000
	Steady speed precision	± 0.5%	± 0.02%
	Torque control	Y	Y
	Torque control precision	±5%	±3%
	Torque response time	<20ms	<10ms
	Positioning control	N	Y
	Positioning precision	N	±1 pulse
Product function	Key function	Speed loop, torque loop, position loop, orientation control, current limit, torque limit, motor auto tune, inertia auto tune, deep flux−weakening control, over−voltage control, under−voltage control, motor flying start, droop control, oscillation suppression, random carrier frequency, master follower control, etc.	
	Speed reference source	Modbus communication, keypad, external digital input, analog input AI1/AI2/AI3, high speed pulse input, simple PLC, PID, CAN, PROFIBUS DP, PROFINET, EtherCAT, etc.	
	Dynamic brake	Brake chopper action voltage: 650 ~ 750V. The brake chopper can be built-in for 110kW and below equipment ● 5.5~30kW: brake chopper is built- in as standard. ● 37~110kW: brake chopper is built- in as optional.	
	Communication	Built-in Modbus-RTU communication, the maximum distance up to 500 meters. It can switch to CAN by jumper. EtherCAT, PROFIBUS DP and PROFINET are optional.	
	Keypad	LED keypad and LCD Keypad are available. The keypad can be used as a remote-control box by a net cable.	
	Common DC bus	75kW~160kW: required pre-charge circuit to realized common DC bus Other power level drive: support common DC bus directly	
	Independent air duct	All series product adopts independent duct design	
Protection function	Power supply under-voltage, over-current protection, over-voltage protection, auto-tune fault, module protection, heat-sink overtemperature 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 overtemperature, communication fault, hardware overload protection, etc.		

Efficiency	At rating condition: ● 5.5 kW 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, no oil mist, no steam, no dripping.
	Ambient temperature	● −10～+40℃ ● Derate the rated 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	● 0～2000 meters ● Derate the rated 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		
		Power (kW) (10% ED)	Resistance value(Ω)	Minimum resistance (Ω)
VTS400-4T5.5K2B-****	Built-in as standard	1.1	50	45
VTS400-4T7.5K2B-****		1.5	40	30
VTS400-4T11K2B-****		2.2	35	25
VTS400-4T15K2B-****		3.0	35	25
VTS400-4T18.5K2B-****		4.0	35	25
VTS400-4T22K2B-****		4.8	30	20
VTS400-4T30K2B-****		6.0	25	15
VTS400-4T37K2B-****	Built-in as optional	9.6	25	15
VTS400-4T45K2B-****		9.6	25	15
VTS400-4T55K2B-****		12.0	25	15
VTS400-4T75K2B-****		15.0	12	7.5
VTS400-4T90K2B-****		18.0	12	7.5
VTS400-4T110K2B-****		22.0	12	7.5
VTS400-4T132K2-****	Need external brake chopper	The power is about 20% of drive rated power	Determine the resistance value should according the external brake chopper	
VTS400-4T160K2-****				
VTS400-4T185K2-****				
VTS400-4T200K2-****				
VTS400-4T220K2-****				
VTS400-4T250K2-****				
VTS400-4T280K2-****				
VTS400-4T315K2-****				
VTS400-4T355K2-****				
VTS400-4T400K2-****				
VTS400-4T450K2-****				
VTS400-4T500K2-****				

Note:

- 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 larger. Please determine the appropriate brake resistor power according to the actual situation.
- The selection of brake resistor and brake chopper is related to system inertia, deceleration time, descent distance, time (i.e. potential energy). To select the model according to the actual situation. If the system inertia is larger, the deceleration time is shorter, and the braking is more frequent, the brake resistor needs higher power and smaller resistance value.
- It is require external brake chopper for the drive power higher than 132kW.

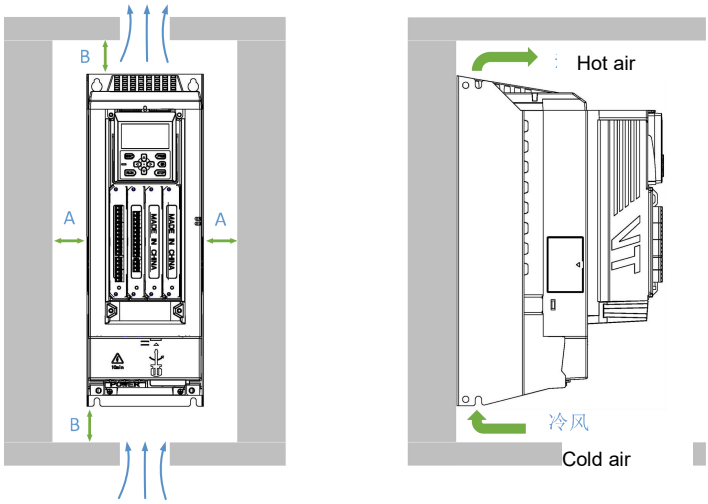
Chapter 2 Mechanical Installation

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 Space

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.



Power	Dimension A	Dimension B
5.5 … 7.5kW	A ≥ 30mm	B ≥ 150mm
≥ 11kW	A ≥ 100mm	B≥ 200mm

Figure 2−1 Mounting direction and space

2.3 Outline and Mounting Dimensions

■ Product outline

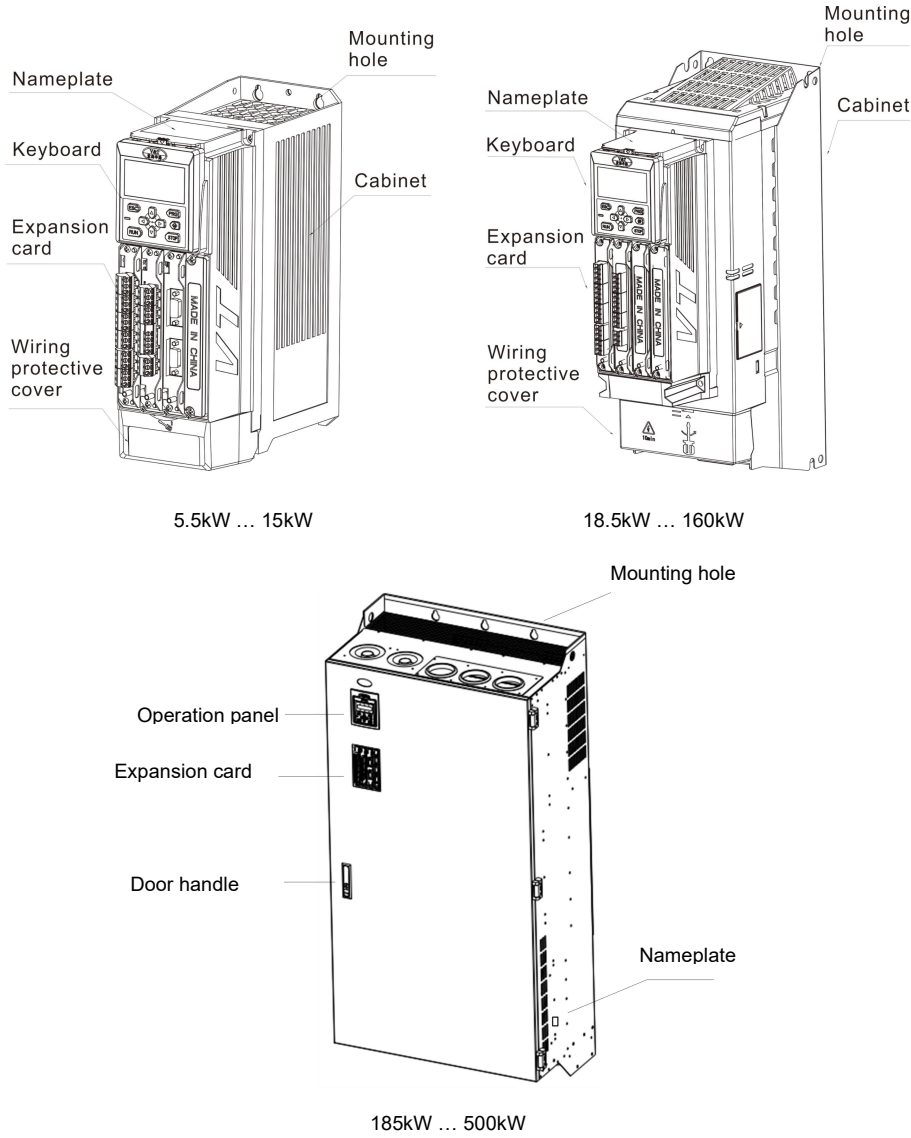
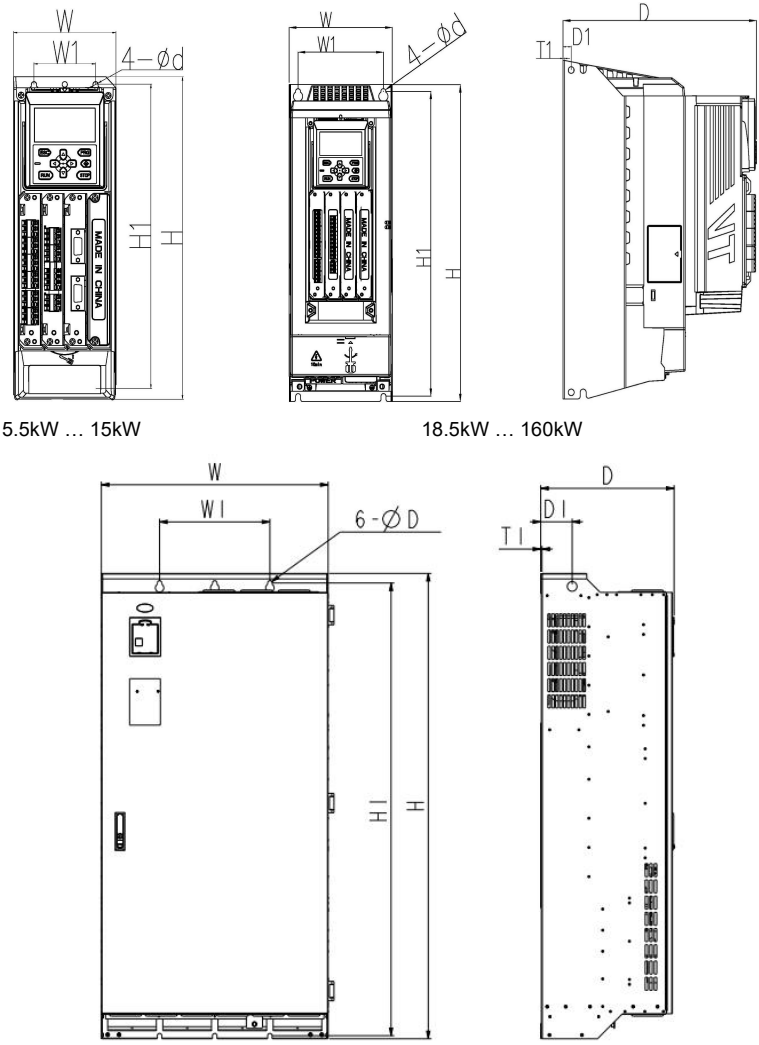


Figure 2−2 Product outline and component name

■ Mounting Dimensions



5.5kW … 15kW

18.5kW … 160kW

185kW … 500kW

Figure 2−3 Mounting dimensions

Product mounting dimensions

Voltage	Model	Outline and mounting dimension (mm)							Weight (KG)
		W	H	D	W1	H1	T1	ød	
400V	VTS400-4T5.5K2B-****	100	291	220	60	275	4.5	5	3.5
	VTS400-4T7.5K2B-****								
	VTS400-4T11K2B-****								
	VTS400-4T15K2B-****								
	VTS400-4T18.5K2B-****	145	412	260	120	396	1.0	7	9.5
	VTS400-4T22K2B-****								
	VTS400-4T30K2B-****								
	VTS400-4T37K2 (B)-****	210	498	290	150	478	3.0	10	20.5
	VTS400-4T45K2 (B)-****								
	VTS400-4T55K2 (B)-****								
	VTS400-4T75K2 (B)-****	290	705	285	240	683	3.0	10	48.5
	VTS400-4T90K2 (B)-****								
	VTS400-4T110K2 (B)-****								
	VTS400-4T132K2-****	315	970	325	250	946	3.0	12	78.2
	VTS400-4T160K2-****								
	VTS400-4T185K2-****	420	1080	325	340	1050	3.5	14	99
	VTS400-4T200K2-****								
	VTS400-4T220K2-****								
	VTS400-4T250K2-****	512	1320	355	376	1286	4	16	The base can be customized with different weights
	VTS400-4T280K2-****								
	VTS400-4T315K2-****								
	VTS400-4T355K2-****	699	1432	407	340	1395	4	14	
	VTS400-4T400K2-****								
	VTS400-4T450K2-****								
	VTS400-4T500K2-****								

■ **The base dimensions for VTS400−4T250K2−**** … VTS400−4T315K2−**** (The base is optional)**

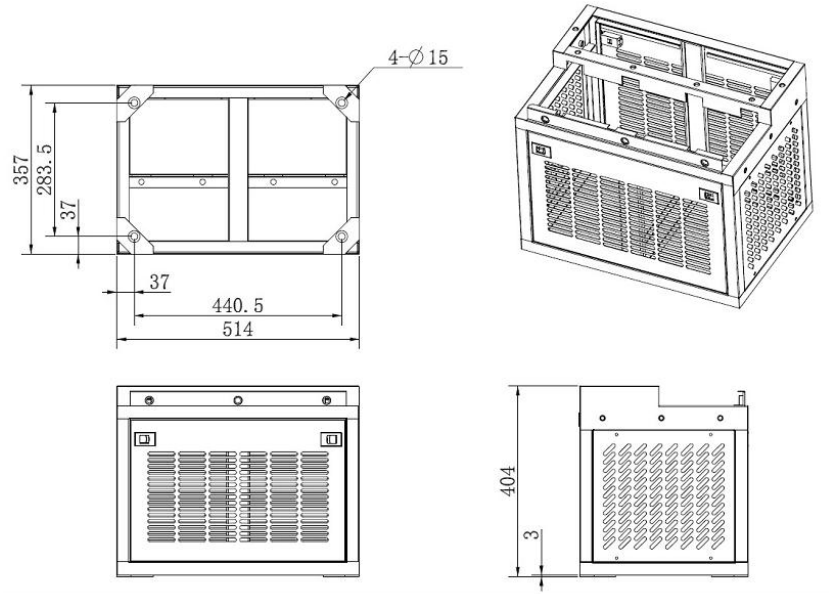


Figure 2−4 Base dimensions (250kW … 315kW)

■ **The base dimensions for VTS400−4T355K2−**** … VTS400−4T500K2−**** (The base is optional, bom: IA4T500K1BDZ)**

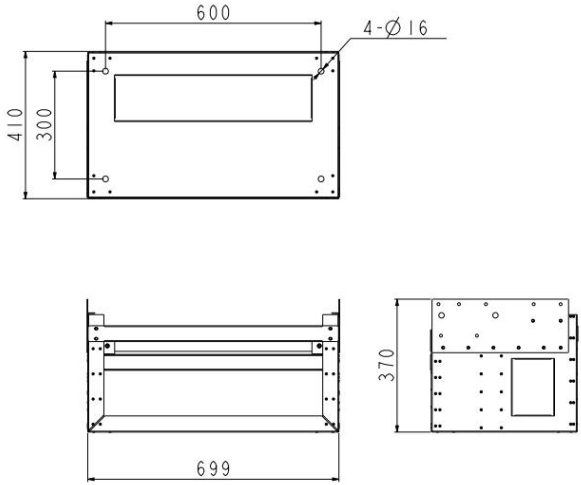
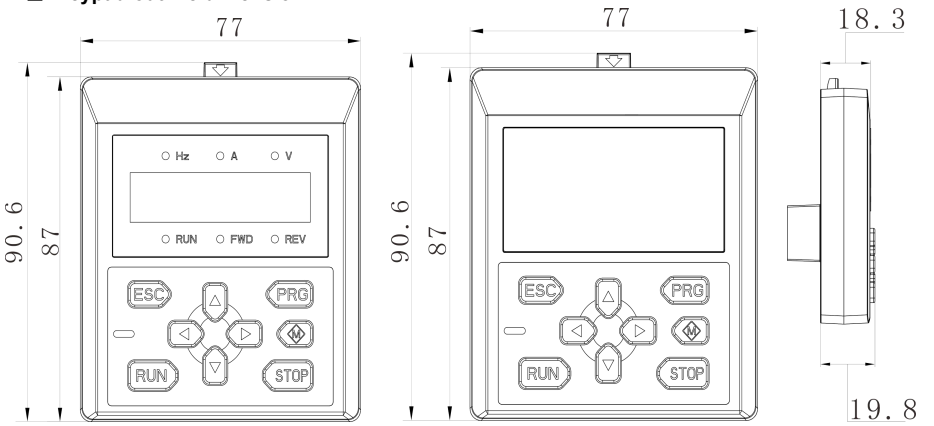


Figure 2−5 Base dimensions (355kW … 500kW)

2.4 Keypad Outline Dimension

■ **Keypad outline dimension**



Keypad (VTS-DP01) Keypad (VTS-DP02) Side of the Keypad

Figure 2-6 Keypad outline dimension

■ **Direct install a keypad to an external electric control cabinet**

The Keypad can be led to an external electric control cabinet directly for installation. The back-mounting dimensions of the keypad are as follows:

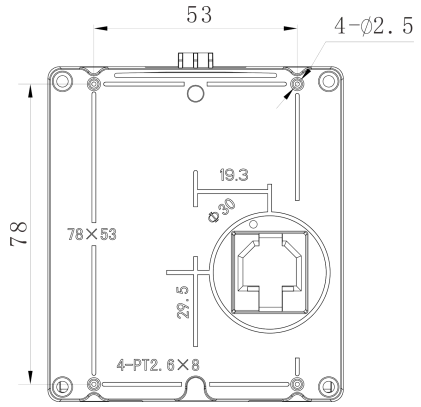


Figure 2-7 Appearance of backside and installation dimensions

■ Install a keypad pallet to an external electric control cabinet

VTS−DP05 is a mounting accessory can help the keypad installed on the external control cabinet. The outline and dimensions are as follows:

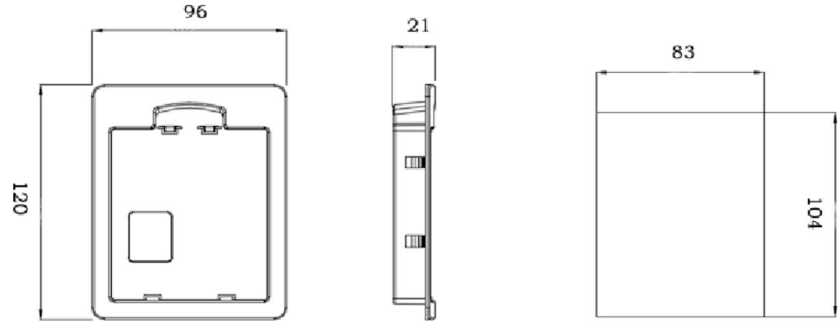


Figure 2-8 Keypad pallet outline and mounting dimension

2.5 Keypad and Drive Installation

■ Remove the Keypad

As shown in the Figure 2−9, push down the tab on the top of the keypad, then pull the keypad forward and remove it from the drive.

■ Install the Keypad

As shown in the Figure 2−10, put the bottom of the keypad into position first, then carefully push on the top of the keypad until the hook clicks into place.

Do not install the keypad in any other direction; otherwise, the keypad will have poor contact.

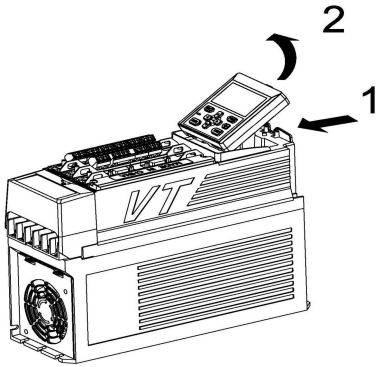


Figure 2−9 Remove the Keypad

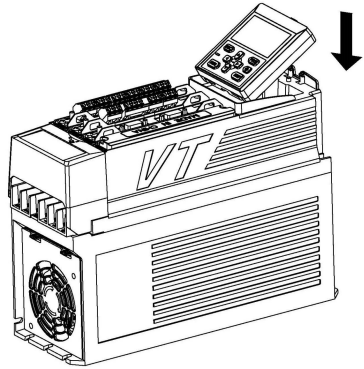


Figure 2−10 Install the Keypad

■ Remove the card from the slot.

As shown in the Figure 2－11. ① Loosen the fixing screws at both ends of the cards. ② Remove the screws and place them properly to avoid loss. ③ Slowly apply force and pull out the card from the slot.

■ Install the card to the slot.

① There are 4 slots, confirm which slot that the card should be installed. Do not install to wrong slot. ② Carefully align the pins of the card with the sockets of the slot. ③ Slowly insert the card into the card slot. ④ Tighten the fixing screws at both ends of the card.

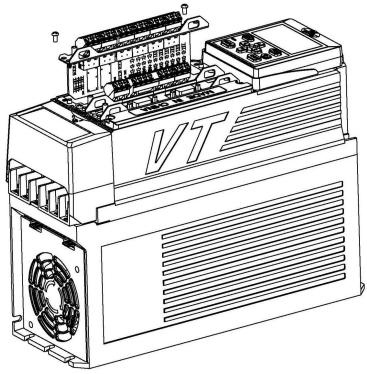


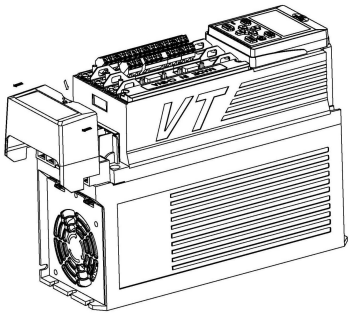
Figure 2−11 Remove and install the card

■ Remove the safety cover

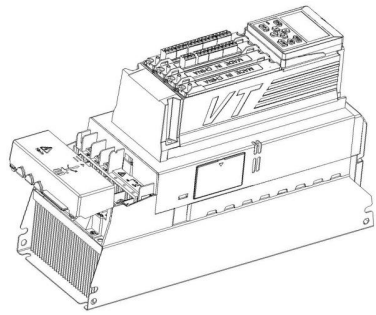
When it is necessary to connect the cable to the main circuit terminals, please remove the safety cover. Gently pry the gap above the safety cover, and then pull the safety cover. Then the safety cover is removed.

■ Install the safety cover

When finish the cable connection, align the safety cover with the enclosure guide rail slot and press it down. Then the safety cover is installed.



5.5kW~15kW



18.5kW~55kW

Figure 2−12 Remove and install the safety cover

Chapter 3 Electrical Installation

3.1 Peripheral Devices Connection

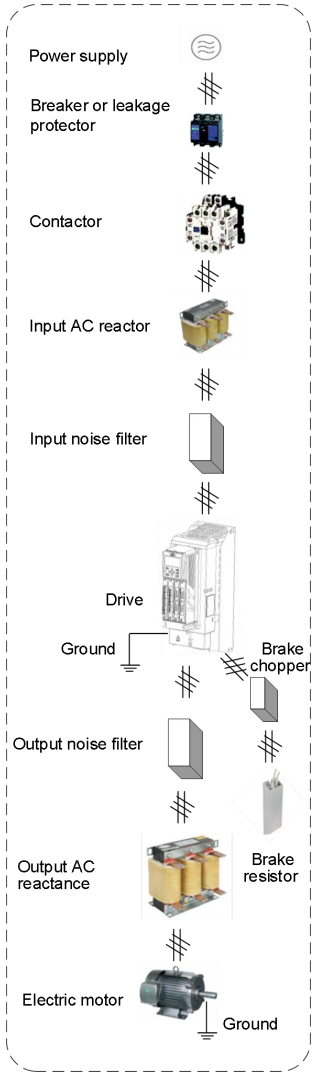


Figure 3−1 Connection diagram of the product and peripheral devices

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, S, T, +/P, –/N, PB, U, V, W			PE ⏚		
			Terminal screw	Tightening torque (N·m)	Cable (mm2)	Terminal screw	Tightening torque (N·m)	Cable (mm2)
VTS400−4T5.5K2B−****	32	25	M5	2.5～3.0	6	M5	2.5～3.0	6
VTS400−4T7.5K2B−****	40	16						
VTS400−4T11K2B−****	63	25						
VTS400−4T15K2B−****	63	32						
VTS400−4T18.5K2B−****	100	63	M6	4.0～5.0	10	M6	4.0～5.0	10
VTS400−4T22K2B−****	100	100			16			16
VTS400−4T30K2B−****	125	100			25			25
VTS400−4T37K2 (B)−****	160	100	M8	9.0～10.0	25	M6	4.0～5.0	16
VTS400−4T45K2 (B)−****	200	125			35			16
VTS400−4T55K2 (B)−****	315	250			50			25
VTS400−4T75K2 (B)−****	315	250	M8	9.0～10.0	50	M8	9.0～10.0	25
VTS400−4T90K2 (B)−****	350	330			70			35
VTS400−4T110K2 (B)−****	350	330			100			50
VTS400−4T132K2−****	400	330	M10	17.6～22.5	150	M8	9.0～10.0	75
VTS400−4T160K2−****	500	400			185			100
VTS400−4T185K2−****	630	500	M12	31.4～39.2	240	M8	9.0～10.0	60x2
VTS400−4T200K2−****	630	500			240			60x2
VTS400−4T220K2−****	800	630			150x2			75x2
VTS400−4T250K2−****	1000	630	M12	31.4～39.2	185x2	M10	17.6～22.5	100x2
VTS400−4T280K2−****	1000	630			185x2			100x2
VTS400−4T315K2−****	1000	800			250x2			125x2
VTS400−4T355K2−****	1200	800	M16	61.0～80.0	325x2	M10	17.6～22.5	150x2
VTS400−4T400K2−****	1500	1000			325x2			150x2
VTS400−4T450K2−****	2000	1500			350x2			175x2
VTS400−4T500K2−****	2000	1500			350x2			175x2

3.4 Terminal Configuration

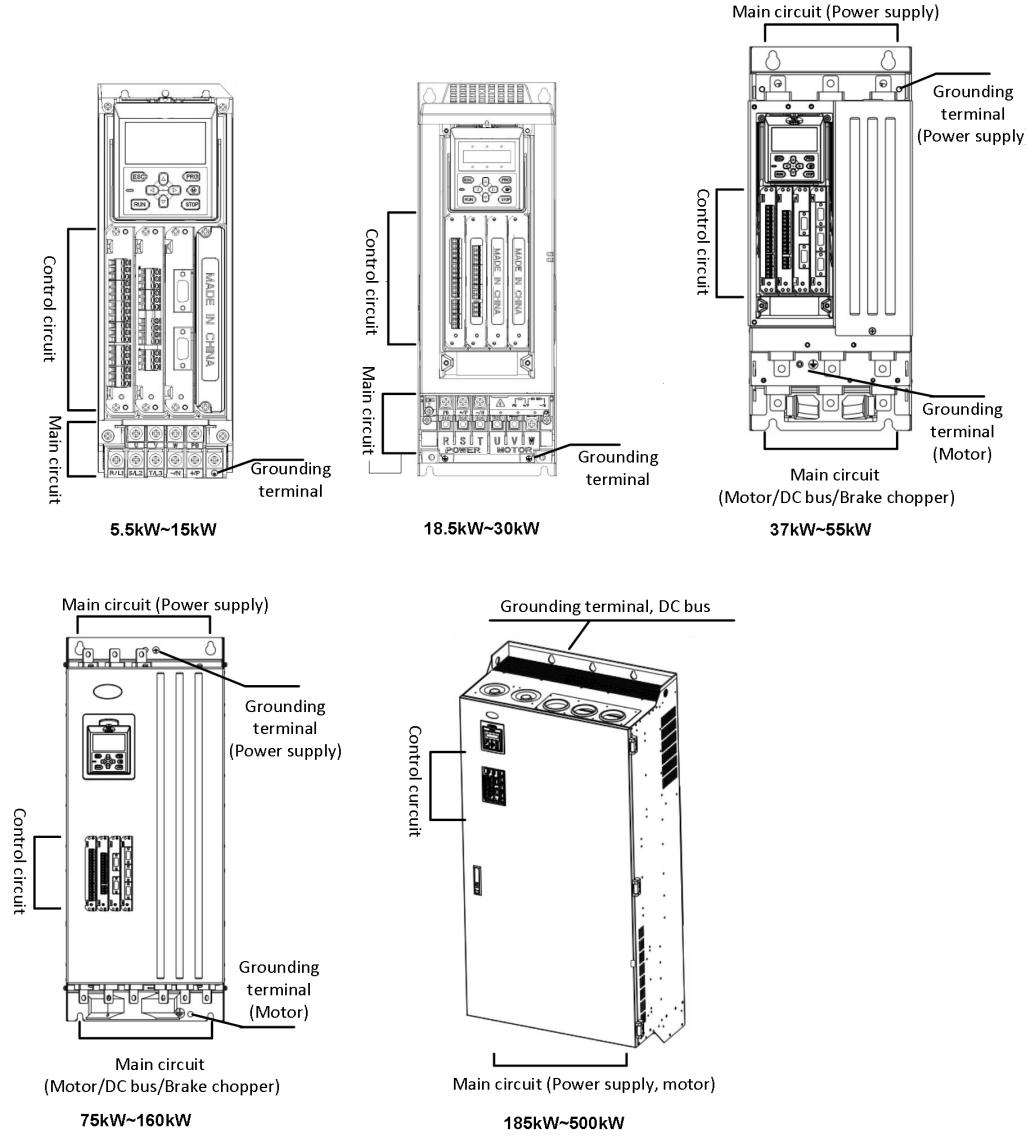
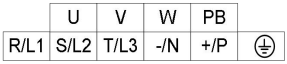


Figure 3−2 Terminal configuration

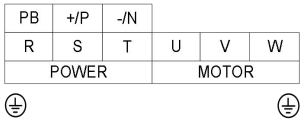
3.5 Main Circuit Description and Wiring

◆ 5.5~15kW, brake chopper is built-in as standard



Terminal symbol	Terminal name and function description
R、S、T	Three-phase AC power supply input terminals
+/P、PB	Brake resistor connection terminals
+/P、-/N	DC power input terminals DC input terminals of external brake chopper
U、V、W	Three-phase AC output terminals, motor wiring side
⏚	Grounding terminal PE

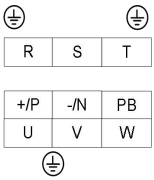
◆ 18.5~30 kW, brake chopper is built-in as standard



Terminal symbol	Terminal name and function description
R、S、T	Three-phase AC power supply input terminal
+/P、PB	Brake resistor connection terminal
+/P、-/N	DC power input terminals DC input terminals of external brake chopper
U、V、W	Three-phase AC output terminals, motor wiring side
⏚	Grounding terminal PE

◆ 37~110kW, brake chopper is built-in as optional.

Note: 75kW …160kW: cannot common DC bus directly, require external pre-charge circuit.



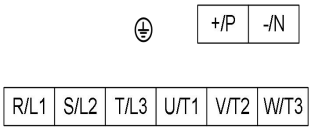
Terminal symbol	Terminal name and function description
R、S、T	Three-phase AC power supply input terminals
+/P、PB	Braking resistor connection terminals
+/P、-/N	DC power input terminals DC input terminals of external brake chopper
U、V、W	Three-phase AC output terminals, motor wiring side
⏚	Grounding terminal PE

◆ 132~160kW, brake chopper cannot be built-in. Select an external brake chopper if required.

Note: 75kW …160kW: cannot common DC bus directly, require external pre-charge circuit.

Terminal symbol	Terminal name and function description
R/L1、S/L2、T/L3	Three-phase AC power supply input terminals
+/P、-/N	DC power input terminals DC input terminals of external brake unit
U/T1、V/T2、W/T3	Three-phase AC output terminals, motor wiring side
⏚	Grounding terminal PE

◆ 185~500kW, brake chopper cannot be built-in. Select an external brake chopper if required.



Terminal symbol	Terminal name and function description
R/L1、S/L2、T/L3	Three-phase AC power supply input terminal
+/P、-/N	DC power input terminal DC input terminal of external braking unit
U/T1、V/T2、W/T3	Three-phase AC output terminal, motor wiring side
⏚	Grounding terminal PE

◆ Main circuit terminal wiring diagram

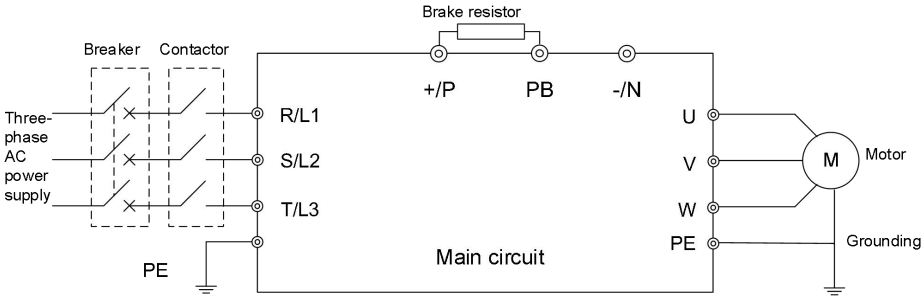


Figure 3−3 Main circuit terminal wiring diagram

Note: For the power higher than 132kW products cannot built-in brake chopper and without "PB" terminal.

3.6 Attention for Main Circuit Wiring

3.6.1 Power Supply

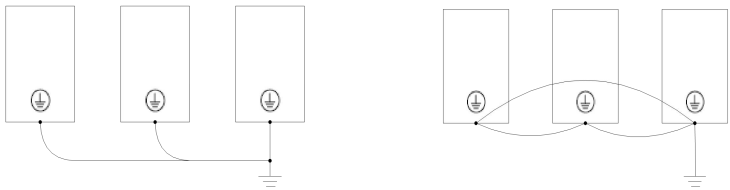
- Do not connect the power supply cable to the output terminal; it can cause damage to the internal components of the drive.
- For input side over-current protection and maintenance conveniently, the drive should connected to the power supply through a breaker or RCCB and contactor.
- Please confirm 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

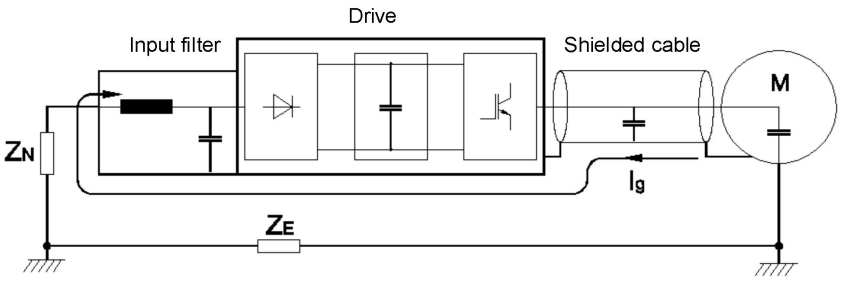


Figure3−5 Noise current illustration

- 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.

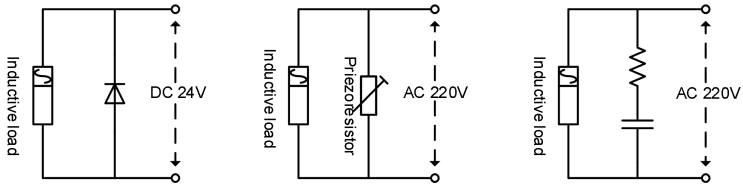


Figure 3−6 Application of inductive load surge suppressor

3.7 Control Circuit Description

The VTS series drive has 4 slots:

The slot 1 supports digital inputs and digital outputs card.

The slot 2 supports the communication cards.

The slot 3 supports the encoder cards.

The slot 4 supports the secondary development cards.

The location of slots are shown as below.

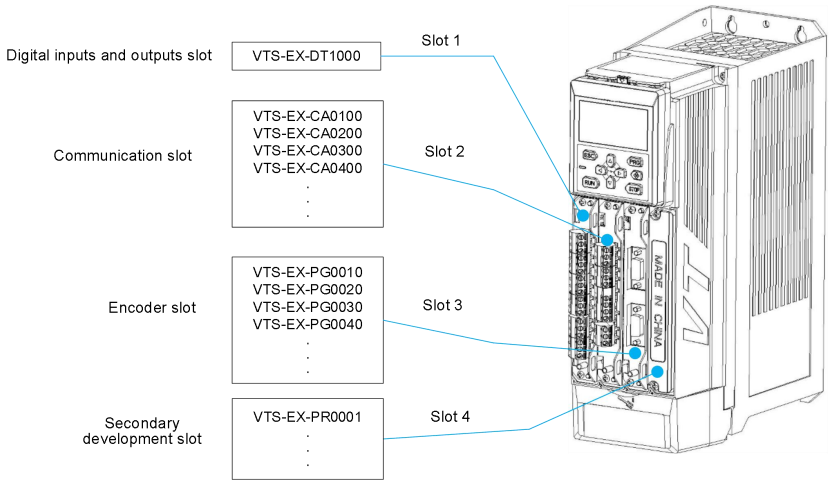


Figure 3−7 Control circuit slot location

3.8 Digital Inputs and Outputs Card

3.8.1 Description

The VTS-EX-DT1000 card can be inserted into the first slot, it had has 6 digital inputs, 2 digital outputs and 2 relay outputs. As shown in the following figure.

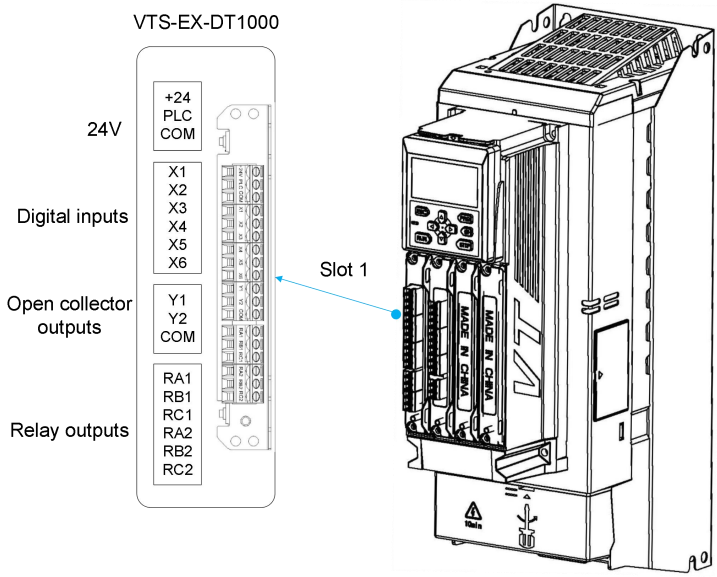


Figure 3−8 Digital inputs and outputs card

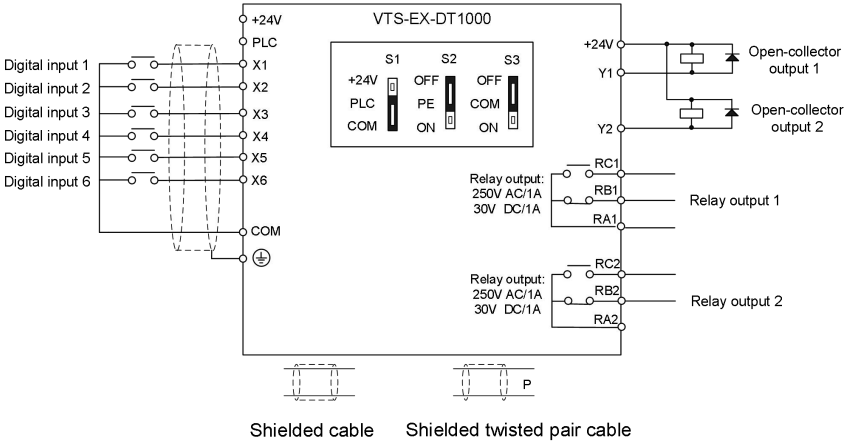
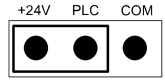
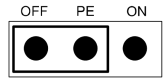
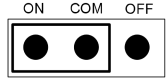


Figure 3−9 Digital inputs and outputs card connection

3.8.2 Technical Specifications

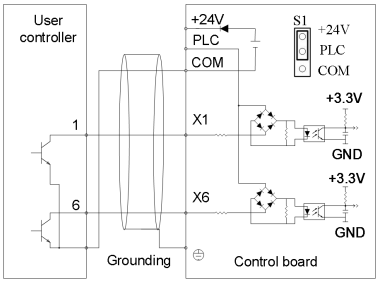
Terminal	Symbol	Function description	Technical specifications
Digital inputs and outputs card: VTS-EX-DT1000			
Digital inputs	+24V	+24V	24V±10%, internal isolated with GND Maximum output current: 200mA
	PLC	Power supply of digital inputs	Short to +24V on the circuit board by default
	X1 ... X6	Digital input 1 ... 6	Input specification: 24VDC, 5mA Frequency range: 0-1KHz Voltage range: 24V ± 20%
	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	RA1－RB1: Normally closed RA1－RC1: Normally open Contact capacity: 250VAC/1A, 30VDC/1A
	RA2/RB2/RC2	Relay output 2	RA2－RB2: Normally closed RA2－RC2: Normally open Contact capacity: 250VAC/1A, 30VDC/1A

3.8.3 Jumper Description

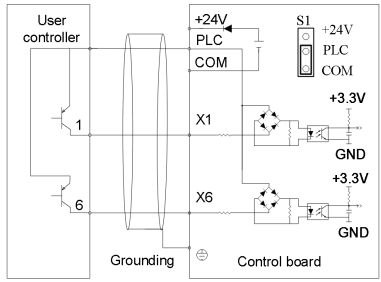
Module	Jumper	Pin symbol	Function description	Default jumper position
VTS-EX-DT1000	S1	24V PLC COM	+24V–PLC: use internal +24V power supply COM–PLC: PLC pulls low level	
	S2	OFF PE ON	OFF–PE: Grounding ON–PE: Not grounding Generally, the default is OFF to prevent crosstalk	
	S3	ON COM OFF	ON–COM: Digital inputs common end (COM) and digital outputs common end (COM) are connected together OFF–COM: Digital inputs common end (COM) and digital outputs common end (COM) are disconnected.	

3.8.4 Digital Inputs Wiring Mode

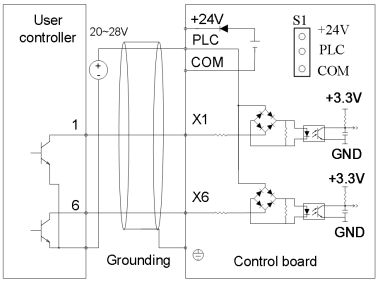
■ Internal +24V power supply, NPN sinking mode
Note: Short +24V and PLC of jumper S1



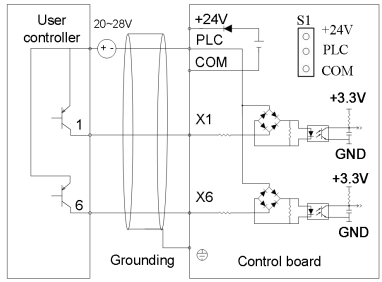
■ Internal +24V power supply, PNP sourcing mode
Note: Short COM and PLC of jumper S1



■ External +24V power supply, NPN sinking mode
Note: Remove the jumper S1 short-circuit stick

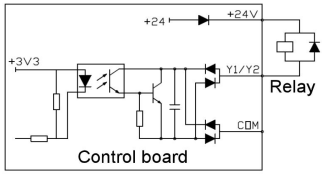


■ External +24V power supply, PNP sourcing mode
Note: Remove the jumper S1 short-circuit stick

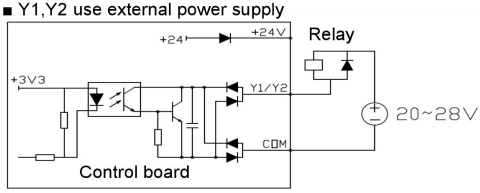


3.8.3 Digital Outputs and Relay Outputs Wiring Mode

■ Y1,Y2 use internal +24V power supply

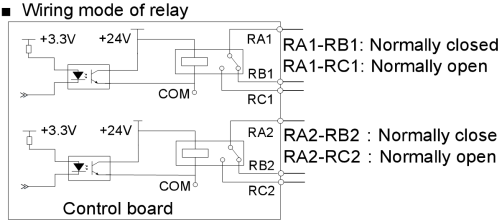


■ Y1,Y2 use external power supply



Note:Please make sure that the polarity of the external diode is correct.

■ Wiring mode of relay



3.9 Communication Cards

3.9.1 Description

The VTS-EX-CA0100 … VTS-EX-CA0700 cards can be inserted into the second slot. Different cards have different functions and communication modes, should be select according to actual requirements, as shown in the following table.

Card mode	Function
VTS-EX-CA0100	CAN/Modbus-RTU (1), analog inputs (3), analog outputs (2), relay output (1)
VTS-EX-CA0200	EtherCAT, STO, Modbus-RTU
VTS-EX-CA0300	PROFIBUS-DP, STO, Modbus-RTU
VTS-EX-CA0400	PROFINET, STO, Modbus-RTU, analog input (1)
VTS-EX-CA0500	EtherCAT, STO, Modbus-RTU, analog input (1)
VTS-EX-CA0600	PROFINET, STO, analog input (1), PT1001 (2)
VTS-EX-CA0700	PROFINET, STO, analog input (1), CAN/ Modbus-RTU

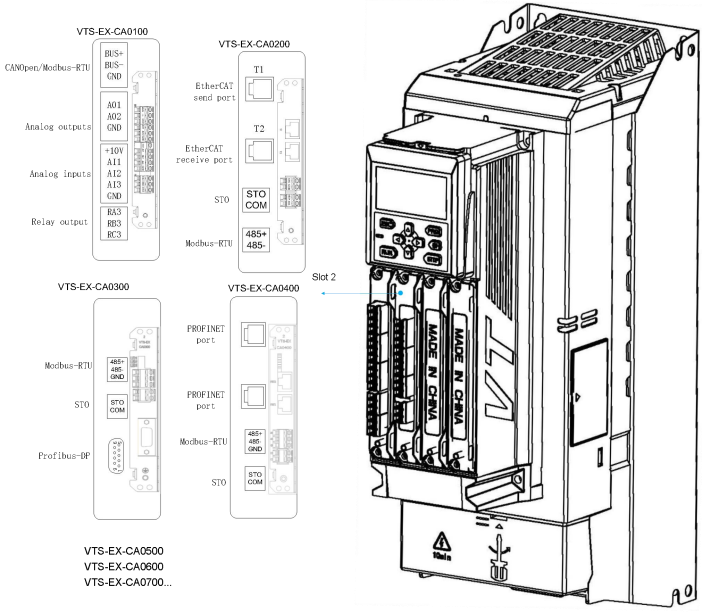


Figure 3-10 Communication cards

3.8.1 Technical Specifications

Terminal	Symbol	Function description	Technical specifications
Communication Module: VTS-EX-CA0100			
Modbus /CAN	BUS+	RS485+ or CANH	Select Modbus or CAN by jumper. Modbus: ●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. ●Max. distance is 500m with shielded twisted pair cable CAN: Maximum speed 1Mbps
	BUS-	RS485- or CANL	
	GND	Modbus/CAN GND	Internal isolated with COM
Analog Inputs	+10V	Analog input reference voltage	10V ±3%, internal isolated with COM Maximum output current: 10mA
	AI1	Analog input 1	-10V~10V: Input impedance 20kΩ , max. voltage: ±15V 0~20mA: Input impedance 500Ω , max. current: 30mA Resolution: 12 bits (0.025%)
	AI2	Analog input 2	
	AI3	Analog input 3	
	GND	Analog GND	The interior isolated from COM
Analog outputs	AO1	Analog output 1	Select analog voltage or current output by jumper 0～20mA: Output allowable impedance 200 to 500 Ω 0～10V: Output allowable impedance ≥10kΩ
	AO2	Analog output 2	
	GND	Analog GND	The interior isolated from COM
Relay output	RA3/RB3/RC3	Relay output 3	RA3－RB3: Normally closed RA3－RC3: Normally open Contact capacity: 250VAC/1A,30VDC/1A
Communication Module: VTS-EX-CA0200			
EtherCAT	T1	EtherCAT send port	Transmission speed: 2*100Mbit/S (High Speed Ethernet, full duplex mode) Each EtherCAT segment can accommodate 65,535 nodes
	T2	EtherCAT receive port	
STO	STO	Safe torque off	When STO function is used, connect the Opto-Coupler of this input circuit to OFF. The STO function works within 5ms after input, and the motor output torque is turned off.
	COM		
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 ● Max. distance is 500m with shielded twisted pair cable
	485-	RS485 negative end	
Communication Module: VTS-EX-CA0300			
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. ● Max. distance is 500m with shielded twisted pair cable
	485-	RS485 negative end	
	GND	Modbus gnd	

Terminal	Symbol	Function description	Technical specifications
STO	STO	Safe torque off	When STO function is used, connect the Opto-Coupler of this input circuit to OFF. The STO function works within 5ms after input, and the motor output torque is turned off.
	CM		
PROFIBUS DP	Refer to the PROFIBUS DP description	Data A	Data positive +
		RTS	Request to send
		GND	5V power supply GND
		+5V	5V power supply
		Data B	Data negative -

3.9.2 AI, AO and Relay Wiring

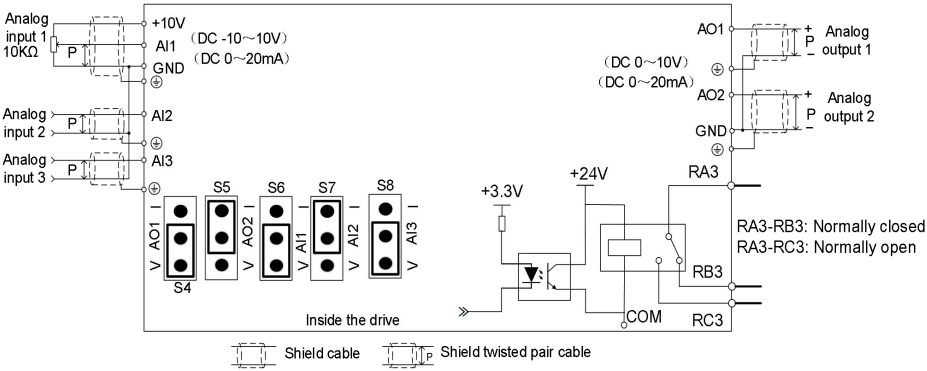


Figure 3-10 AI, AO and Relay Wiring

3.9.3 Modbus/CAN Communication Networking

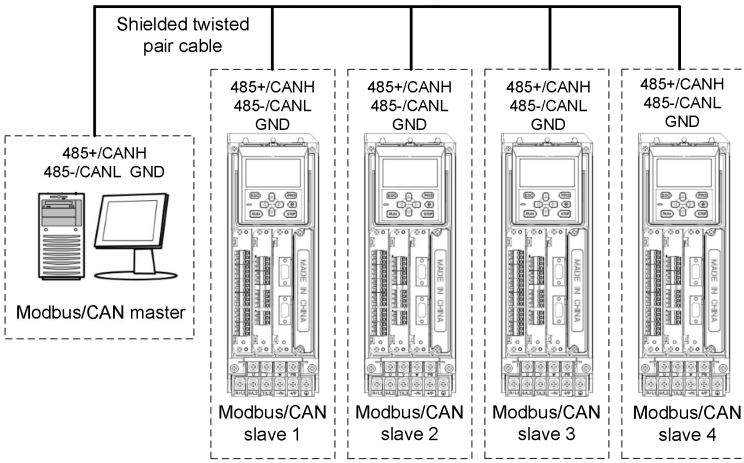


Figure 3−11 Modbus/CAN network connection mode

3.9.4 EtherCAT Communication Networking

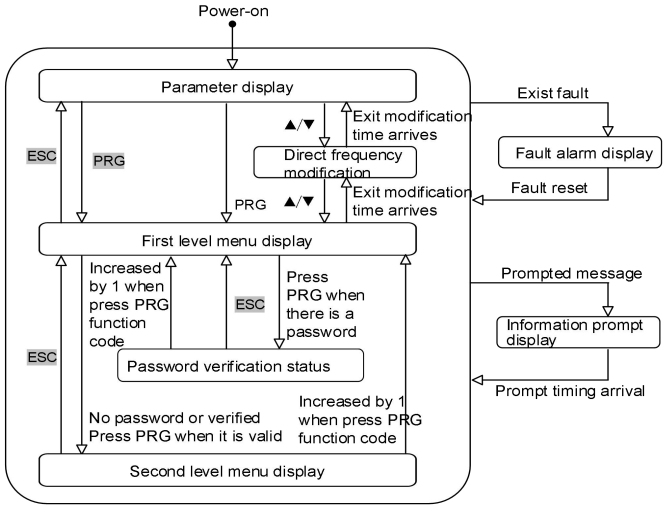
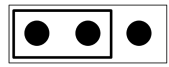
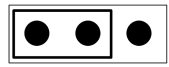
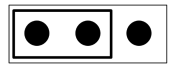
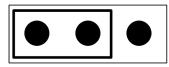
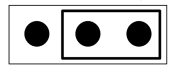
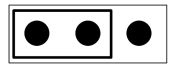
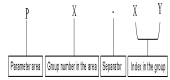
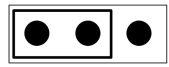
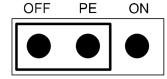
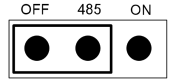
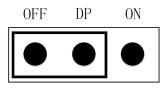
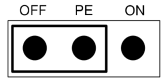
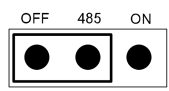
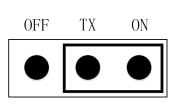
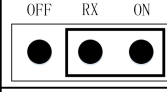
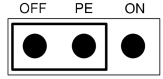


Figure 3−12 EtherCAT network connection mode

3.9.5 Jumper

Communication Module	Jumper	Pin Symbol	Function description	Default jumper position
VTS-EX-CA0100	S1	CAN BUS+ 485	CAN–BUS+: CAN communication 485–BUS+: Modbus communication	
	S2	CAN BUS– 485	CAN–BUS–: CAN communication 485–BUS–: Modbus communication	
	S3	ON 485 OFF	485–ON: Connect the termination resistor(100Ω) 485–OFF: Disconnect the termination resistor	
	S4	V AO1 I	V–AO1: AO1 output is voltage (0~10V) I–AO1: AO1 output is current (0~20mA)	
	S5	V AO2 I	V–AO2: AO2 output is voltage (0~10V) I–AO2: AO2 output is current (0~20mA)	
	S6	V AI1 I	V–AI1: AI1 input is voltage (–10~10V) I–AI1: AI1 input is current (0/4mA ~20mA)	
	S7	V AI2 I	V–AI2: AI2 input is voltage (–10~10V) I–AI2: AI2 input is current (0/4mA ~20mA)	
	S8	V AI3 I	V–AI3: AI3 input is voltage (–10~10V) I–AI3: AI3 input is current (0/4mA ~20mA)	
	S9	OFF PE ON	OFF–PE: Not grounding ON–PE: Grounding	
VTS-EX-CA0200	S1	OFF PE ON	OFF–PE: Not grounding ON–PE: Grounding Generally, the default is OFF to prevent crosstalk	
	S2	OFF 485 ON	485–ON: Connect the termination resistor(100Ω) 485–OFF: Disconnect the termination resistor	

VTS–EX–CA0300	S1	ON DP OFF	DP–ON: Connect the termination resistor(220Ω) DP–OFF: Disconnect the termination resistor	
	S2	ON PE– OFF	OFF–PE: Not grounding ON–PE: Grounding Generally, the default is OFF to prevent crosstalk	
	S3	ON 485 OFF	485–ON: Connect the termination resistor(100Ω) 485–OFF: Disconnect the termination resistor	
	S4	ON TX OFF	TX –ON: TX is connected to drive control board TX –OFF: TX is connected to extension board	
	S5	ON RX OFF	RX –ON: RX is connected to drive control board RX –OFF: RX is connected to extension board	
	S6	ON OFF	ON: 1 OFF: 0	
	S7	ON PE OFF	OFF–PE: Not grounding ON–PE: Grounding Generally, the default is OFF to prevent crosstalk	

3.10 Encoder Module

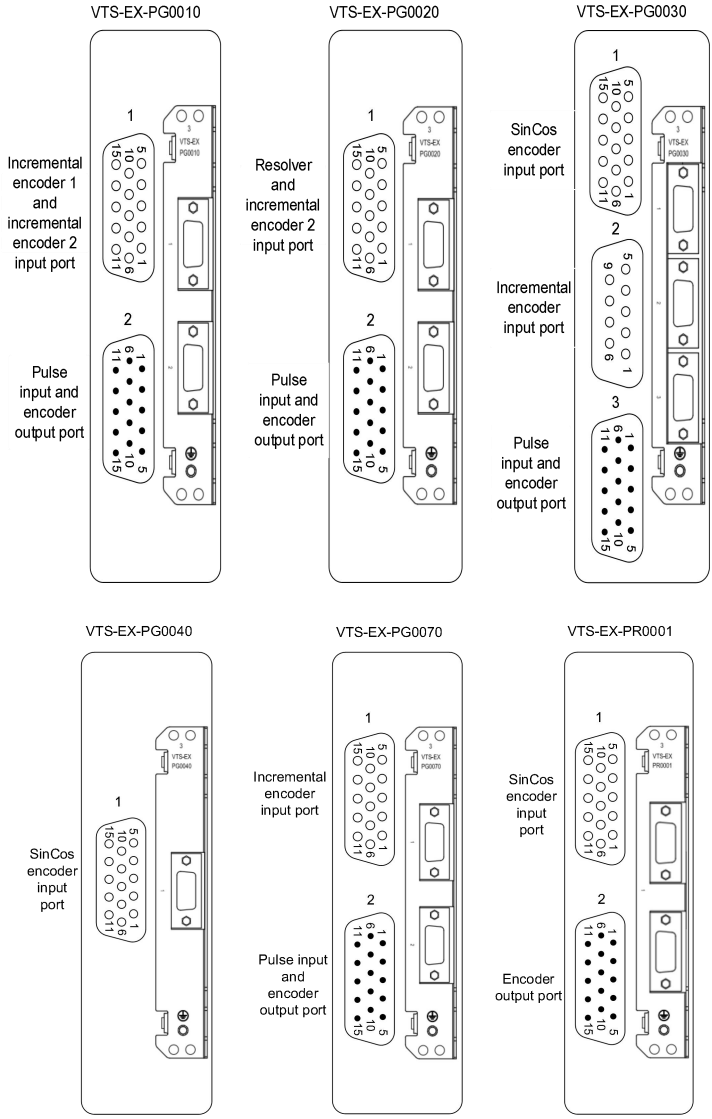


Figure 3−13 Encoder module

3.10.1 Description

Port classification	Terminal No.	Terminal name	Technical specifications
Encoder Module: VTS−EX−PG0010			
Port 1: Dual incremental encoder input port (15pin female)	1	A1+	Encoder 1 signal input A+
	2	A1−	Encoder 1 signal input A−
	3	A2+	Encoder 2 signal input A+
	4	A2−	Encoder 2 signal input A−
	5	+5V	+5V power supply
	6	B1+	Encoder 1 signal input B+
	7	B1−	Encoder 1 signal input B−
	8	B2+	Encoder 2 signal input B+
	9	Z2+	Encoder 2 signal input Z+
	10	(PT100&KTY84) / T	Temperature sensor signal input
	11	Z1−	Encoder 1 signal input Z−
	12	Z1+	Encoder 1 signal input Z+
	13	B2−	Encoder 2 signal input B−
	14	Z2−	Encoder 2 signal input Z−
	15	GND	Gnd of power supply
Port 2: Pulse input and encoder output port (15pin male)	1	RA+	Pulse input A+ / Direction input A+
	2	RA−	Pulse input A- / Direction input A-
	3	+5V	+5V power supply
	4	GND	Gnd of power supply
	5	OA+	Encoder feedback output OA+
	6	RB−	Pulse input B- / Direction input B-
	7	RB+	Pulse input B+ / Direction input B+
	8	R+24V	24Vpower supply
	9	NC	/
	10	OB+	Encoder feedback output OB+
	11	RZ−	Z signal input negative end
	12	RZ+	Z signal input positive end
	13	NC	/
	14	OB−	Encoder feedback output OB−
	15	OA−	Encoder feedback output OA−

Port classification	Terminal No.	Terminal name	Technical specifications
Encoder Module: VTS-EX-PG0020			
Port 1: Resolver and incremental encoder input port (15pin female)	1	SIN+	Resolver signal input SIN+
	2	SIN-	Resolver signal input SIN-
	3	A2+	Encoder 2 signal input A+
	4	A2-	Encoder 2 signal input A-
	5	+5V1	+5V power supply
	6	COS+	Resolver signal input COS+
	7	REF+	Resolver signal input REF+
	8	B2+	Encoder 2 signal input B+
	9	Z2+	Encoder 2 signal input Z+
	10	(PT100&KTY84) / T	Temperature sensor signal input
	11	COS-	Resolver signal input COS-
	12	REF-	Resolver signal input REF-
	13	B2-	Encoder 2 signal input B-
	14	Z2-	Encoder 2 signal input Z-
	15	GND	+5V power supply
Port 2: Pulse input and encoder output port (15pin male)	1	RA+	Pulse input A+ / Direction input A+
	2	RA-	Pulse input A- / Direction input A-
	3	+5V1	+5V power supply
	4	GND	Gnd of power supply
	5	OA+	Encoder feedback output OA+
	6	RB-	Pulse input B- / Direction input B-
	7	RB+	Pulse input B+ / Direction input B+
	8	R+24V	+24 power supply
	9	NC	/
	10	OB+	Encoder feedback output OB+
	11	RZ-	Z signal input negative end
	12	RZ+	signal input positive end
	13	NC	/
	14	OB-	Encoder feedback output OB-
	15	OA-	Encoder feedback output OA-

Port classification	Terminal No.	Terminal name	Technical specifications
Encoder Module: VTS–EX–PG0030			
Port 1: SinCos encoder signal input port (15pin, female)	1	SA–	SinCos encoder signal SA–
	2	SA+	SinCos encoder signal SA+
	3	SB–	SinCos encoder signal SB–
	4	SB+	SinCos encoder signal SB+
	5	+5V1	+5Vpower supply
	6	SC–	SinCos encoder signal SC–
	7	SD–	SinCos encoder signal SD–
	8	/	/
	9	/	/
	10	(PT100&KTY84) / T	Temperature sensor signal input
	11	SC+	SinCos encoder signal SC+
	12	SD+	SinCos encoder signal SD+
	13	/	/
	14	/	/
	15	GND	Gnd of +5V
Port 2: Incremental encoder signal input port (9pin, female)	1	A2+	Encoder 2 signal input A+
	2	B2+	Encoder 2 signal input B+
	3	Z2+	Encoder 2 signal input Z+
	4	+5V	+5V power
	5	/	/
	6	A2–	Encoder 2 signal input A–
	7	B2–	Encoder 2 signal input B–
	8	Z2–	Encoder 2 signal input Z–
	9	GND	Gnd of power supply
Port 3: Pulse input and encoder output port (15pin male)	1	RA+	Pulse input A+ / Direction input A+
	2	RA–	Pulse input A- / Direction input A-
	3	+5V	+5Vpower supply
	4	GND	Gnd of power supply
	5	OA+	Encoder feedback output OA+
	6	RB–	Pulse input B- / Direction input B-
	7	RB+	Pulse input B+ / Direction input B+
	8	R+24V	+24Vpower supply
	9	/	/
	10	OB+	Encoder feedback output OB+
	11	RZ–	Z signal input negative end
	12	RZ+	Z signal input positive end
	13	/	/
	14	OB–	Encoder feedback output OB–
	15	OA–	Encoder feedback output OA–

Port classification	Terminal No.	Terminal name	Technical specifications
VTS-EX-PG0040			
Port 1: SinCos encoder input port (15pin female)	1	SA-	SinCos encoder signal SA-
	2	SA+	SinCos encoder signal SA+
	3	SB-	SinCos encoder signal SB-
	4	SB+	SinCos encoder signal SB+
	5	+5V	+5V power supply
	6	SC-	SinCos encoder signal SC-
	7	SD-	SinCos encoder signal SD-
	8	NC	/
	9	NC	/
	10	(PT100&KTY84)/T	Temperature sensor interface
	11	SC+	SinCos encoder signal SC+
	12	SD+	SinCos encoder signal SD+
	13	NC	/
	14	NC	/
	15	GND	Gnd of power supply

Port classification	Terminal No.	Terminal name	Technical specifications
VTS-EX-PG0070			
Port 1: Dual incremental encoder input port (15pin female)	1	A1+	Encoder 1 signal input A+
	2	A1−	Encoder 1 signal input A−
	3	A2+	Encoder 2 signal input A+
	4	A2−	Encoder 2 signal input A−
	5	+5V	+5V power supply
	6	B1+	Encoder 1 signal input B+
	7	B1−	Encoder 1 signal input B−
	8	B2+	Encoder 2 signal input B+
	9	Z2+	Encoder 2 signal input Z+
	10	(PT100&KTY84)/T	Temperature sensor signal input
	11	Z1−	Encoder 1 signal input Z−
	12	Z1+	Encoder 1 signal input Z+
	13	B2−	Encoder 2 signal input B−
	14	Z2−	Encoder 2 signal input Z−
	15	GND	Gnd of power supply
Port 2: Pulse input and encoder output port (15pin male)	1	RA+	Pulse input A+ /direction input A+
	2	RA−	Pulse input A- / direction input A-
	3	+5V	+5V power supply
	4	GND	Gnd of power supply
	5	OA+	Encoder feedback output OA+
	6	RB−	Pulse input B- / direction input B-
	7	RB+	Pulse input B+ / direction input B+
	8	R+24V	24Vpower supply
	9	OZ+	Encoder feedback output OZ+
	10	OB+	Encoder feedback output OB+
	11	RZ−	Z signal input negative end
	12	RZ+	Z signal input positive end
	13	OZ−	Encoder feedback output OZ−
	14	OB−	Encoder feedback output OB−
	15	OA−	Encoder feedback output OA−

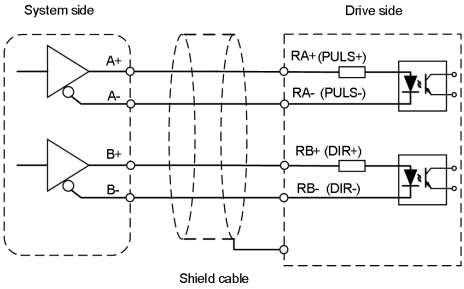
Port classification	Terminal No.	Terminal name	Technical specifications
VTS-EX-PR0001			
Port 1: SinCos encoder input port (15pin female)	1	SA-	SinCos encoder signal SA-
	2	SA+	SinCos encoder signal SA+
	3	SB-	SinCos encoder signal SB-
	4	SB+	SinCos encoder signal SB+
	5	+5V1	+5V power supply
	6	SC-	SinCos encoder signal SC-
	7	/	/
	8	/	/
	9	/	/
	10	/	/
	11	SC+	SinCos encoder signal SC+
	12	/	/
	13	/	/
	14	/	/
	15	GND	+5V power supply
Port 2: Encoder output port (15pin male)	1	/	/
	2	/	/
	3	+5V	+5V power supply
	4	GND	Gnd of power suppl
	5	OA+	Encoder feedback output OA+
	6	/	/
	7	/	/
	8	/	/
	9	OZ+	Encoder feedback output OZ+
	10	OB+	Encoder feedback output OB+
	11	/	/
	12	/	/
	13	OZ-	Encoder feedback output OZ-
	14	OB-	Encoder feedback output OB-
	15	OA-	Encoder feedback output OA-

Note: When users use double encoder modules PG0010, PG0020 or PG0070 for dual closed-loop applications, user can order dual encoder one port to two port cable.

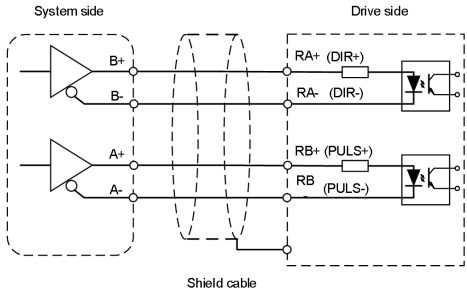
Note: when using the above encoder modules, please use appropriate shielded twisted pair cable and grounding. The grounding wire must be connected to the grounding terminal on the modules upper side. It is forbidden to ground on the self-tapping screw use for fixing module.

3.10.2 Encoder Module Wiring

- Differential pulse drive mode, A+, A- are pulse input, and B+,B- is direction input.

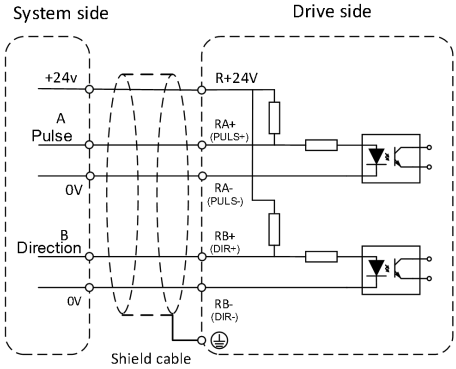


Pulse + Direction

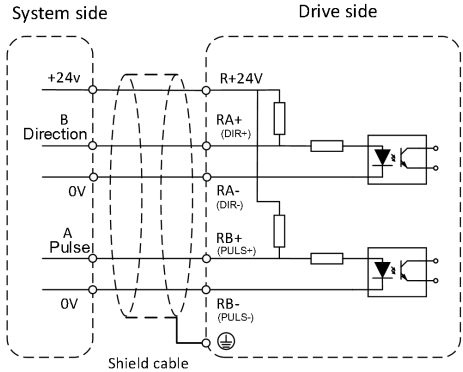


Direction + Pulse

- Single phase pulse drive mode

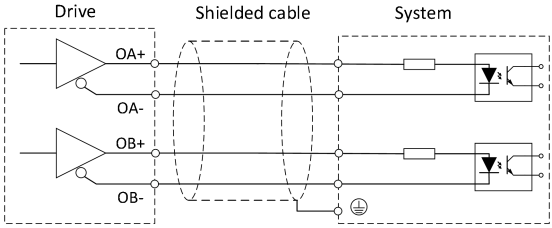


Pulse + Direction

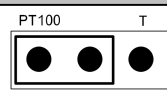
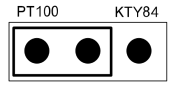
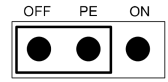
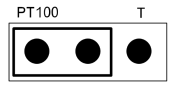
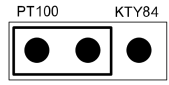
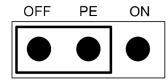
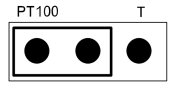
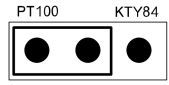
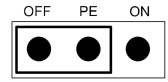
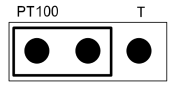
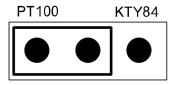
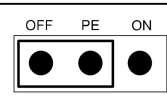


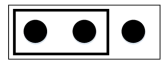
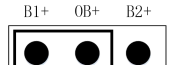
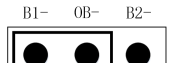
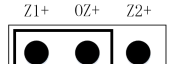
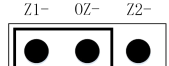
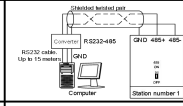
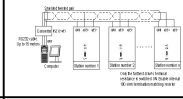
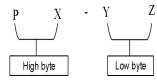
Direction + Pulse

- Encoder output wiring mode



3.10.3 Jumper

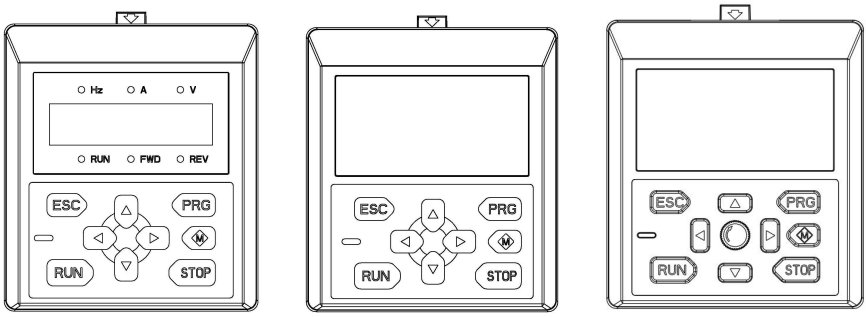
Encoder Module	Jumper	Pin symbol	Function description	Default position
VTS-EX-PG0010	S1	PT100&KTY84 / (None) T	(PT100&KTY84)—/ : select PT100or KTY84 temperature sensor T–/: select T type temperature sensor	
	S2	PT100 / KTY84	PT100—/: select PT100 temperature sensor KTY84—/: select KTY84 temperature sensor	
	S3	OFF PE ON	OFF-PE: Grounding ON-PE: Not grounding Generally, the default is off to prevent crosstalk	
VTS-EX-PG0020	S1	PT100&KTY84 / T	(PT100&KTY84)—/ : select PT100or KTY84 temperature sensor T–/: select T type temperature sensor	
	S2	KTY84 / PT100	PT100—/: select PT100 temperature sensor KTY84—/: select KTY84 temperature sensor	
	S3	OFF PE ON	OFF-PE: Grounding ON-PE: Not grounding Generally, the default is off to prevent crosstalk	
VTS-EX-PG0030	S1	PT100&KTY84 / T	(PT100&KTY84)—/ : select PT100or KTY84 temperature sensor T–/: select T type temperature sensor	
	S2	PT100 / KTY84	PT100—/: select PT100 temperature sensor KTY84—/: select KTY84 temperature sensor	
	S3	OFF PE ON	OFF-PE: Grounding ON-PE: Not grounding Generally, the default is off to prevent crosstalk	
VTS-EX-PG0040	S1	PT100&KTY84 / T	(PT100&KTY84)—/ : select PT100or KTY84 temperature sensor T–/: select T type temperature sensor	
	S2	KTY84 / PT100	PT100—/: select PT100 temperature sensor KTY84—/: select KTY84 temperature sensor	
	S3	ON PE OFF	OFF-PE: Grounding ON-PE: Not grounding Generally, the default is off to prevent crosstalk	

VTS−EX−PG0070	S1	A1+	A1+—OA+: Output encoder 1 signal A1+ A2+—OA+: Output encoder 2 signal A2+ OA + signal corresponding to DB head pin 5	
		OA+		
		A2+		
	S2	A1−	A1−—OA−: Output encoder 1 signal A1- A2−—OA−: Output encoder 2 signal A2- OA− signal corresponding to DB head pin 15	
		OA−		
		A2−		
	S3	B1+	B1+—OB+: Output encoder 1 signal B1+ B2+—OB+: Output encoder 2 signal B2+ OB+ signal corresponding to DB head pin 10	
		OB+		
		B2+		
	S4	B1−	B1−—OB−: Output encoder 1 signal B1- B2−—OB−: Output encoder 2 signal B2- OB− signal corresponding to DB head pin 14	
		OB−		
		B2−		
	S5	Z1+	Z1+—OZ+: Output encoder 1 signal Z1+ Z2+—OZ+: Output encoder 2 signal Z2+ OZ+ signal corresponding to DB head pin 9	
		OZ+		
		Z2+		
	S6	Z1−	Z1−—OZ−: Output encoder 1 signal Z1- Z2−—OZ−: Output encoder 2 signal Z2- OZ- signal corresponding to DB head pin 13	
		OZ−		
		Z2−		
	S7	PT100&KTY84	(PT100&KTY84)—/ : select PT100 or KTY84 temperature sensor PTC−/: select PTC type temperature sensor	
		/		
		PTC		
	S8	KTY84	PT100—/: select PT100 temperature sensor KTY84—/: select KTY84 temperature sensor	
		/		
		PT100		
	S9	OFF	OFF-PE: Not grounding ON-PE: Grounding Generally, the default is off to prevent crosstalk	
		PE		
		ON		

Chapter 4 Keypad Operation

4.1 Keypad Model

Use a Keypad to start/stop the drive, read status data and change parameters values. The drive works with either of two different Keypad types.



LED Keypad (VTS−DP01) LCD Keypad (VTS−DP02) LCD Keypad (VTS−DP04)

Figure4−1 Keypad model

The keypad has the following features:

- Set parameters − the parameters can be change by keypad.
- Motor parameters auto tune − use the keypad to set the motor parameters auto−tune mode and start auto−tune.
- Monitoring function − use the keypad to monitor the parameters value, running state, fault record, etc.
- Start and stop the drive when the run command source is keypad.
- Reset faults after fault report.
- Copy function − parameters value can be copied to the keypad memory for later transfer to other drives or for backup.
- The keypad can be used to reset the parameters to default values.
- Check which parameters are different from the default values, it is convenient to check whether the parameters are changed correctly.
- Remote control box − the keypad can be used as remote−control box functions via net cable.
- External installing pallet − external installing pallet is available; it is convenient to help the keypad be installed on the electrical cabinet.
- The keypad and drive can be disconnected and connected at any time.
- Chinese and English Language are available for the LCD keypad.

4.2 Keypad Keys

Key	Name	Function
	Program Key	1. Enter the sub−menu. 2. Enter the parameter setting menu. 3. Data storage confirmation.
	Escape Key	1. Return to the previous menu. 2. Abandon the modification of the data.
	Increase / Decrease Key	1. Change the speed reference in monitoring state when speed reference channel is keypad. 2. Change the parameters group number or parameter numbers in parameters display menu. 3. Change the parameter's value in parameter's value setting menu.
	Shift Right / Shift Left Key	1. Switch display monitored value in turn in monitoring menu. 2. Change the parameter group No. or parameter No. in parameters display menu. 3. Change the current edit bit in parameter's value setting menu.
	Run Key	1. Press RUN key to start the motor when run command is keypad. 2. Press RUN key to start motor data identification after setting motor data identification function.
	Stop / Reset Key	1. Press STOP key to stop the motor when run command selection is keypad. 2. Press STOP key to reset the fault when the drive has fault. 3. Press M key and STOP key at the same time to stop the drive by coast to stop immediately.
	Multifunctional Key	1. Press M key and STOP key at the same time to stop the drive by coast to stop immediately.

4.3 Keypad Indicator

VTS−DP01 indicator description:

Indicator status			Color	Description
Unit indicator	Hz	Frequency indicator	Green	On: Current displayed parameter is running frequency Flash: Current displayed parameter is setting frequency
	A	Current indicator	Green	On: Current displayed parameter is output current
	V	Voltage indicator	Green	On: Current displayed parameter is voltage
	HZ+A	Rotating speed indicator	Green	On: Current displayed parameter is rotating speed Flash: Current displayed parameter is setting rotating speed
	HZ+V	Percentage % indicator	Green	On: The current display parameter is percentage
	A+V	Time indicator	Green	On: The current display parameter is time
Status indicator	RUN	Running indicator	Red	On: Running status Off: Stop status
	FWD	Forward indicator	Red	On: In stop status, receive a run forward command In running status, in forward running status OFF: Changing from forward to reverse running or in stop status.
	REV	Reverse indicator	Red	ON: In stop status, receive a run reverse command In running status, in reverse running status OFF: Changing from reverse to forward running or in stop status.
	/	Fault indicator	/	All the status indicators are in flash: Fault status

VTS−DP02 indicator description: VTS-DP02 with a status indicator to indicate the drive in running status, stop status, or fault status.

Indicator status	Description
OFF	Stop state
Green, keep on	Running state
Red, keep on	Fault state

4.4 LCD Keypad Interface

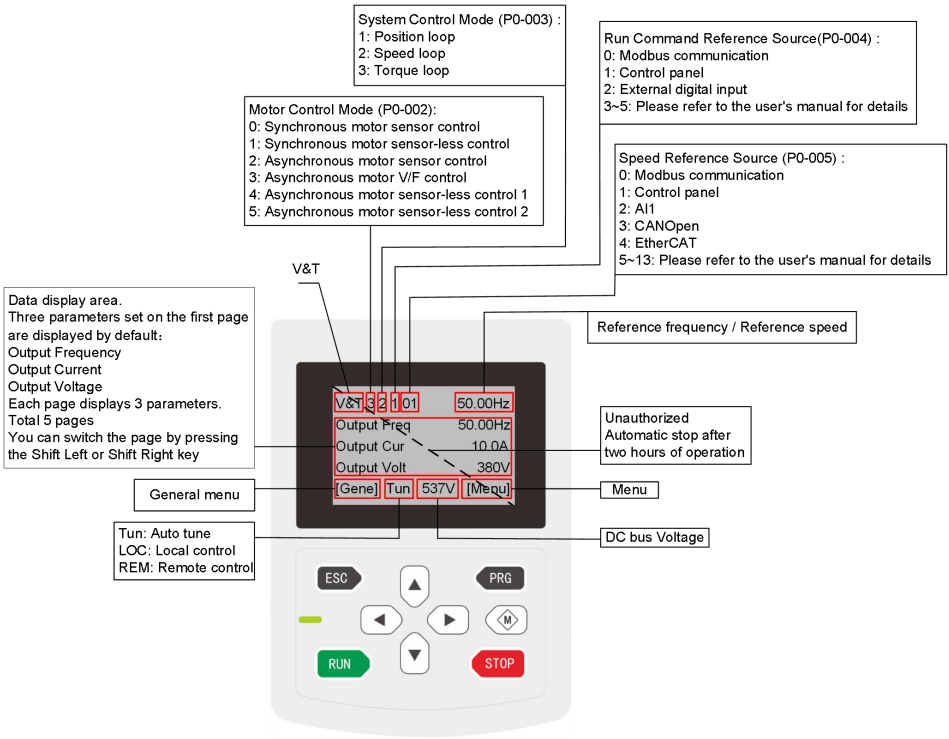
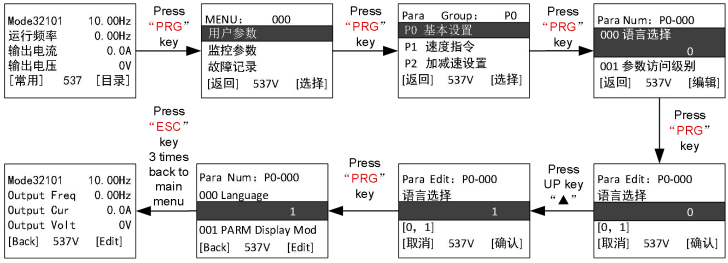


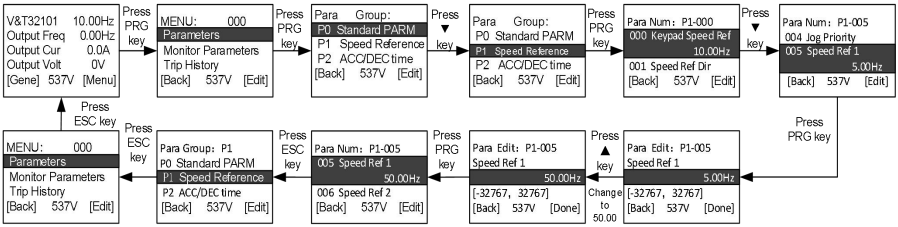
Figure 4–2 Description of LCD Keypad display interface

4.5 LCD Keypad Operation

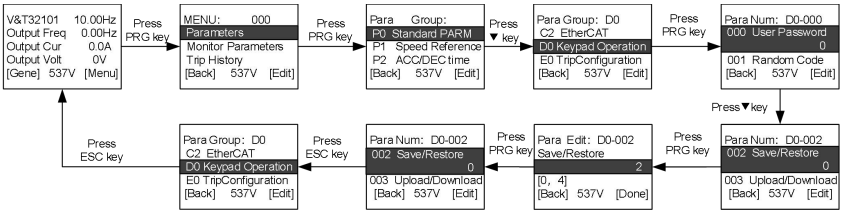
■ *Change display language. (Set P0−000 = 1: display language is English)*



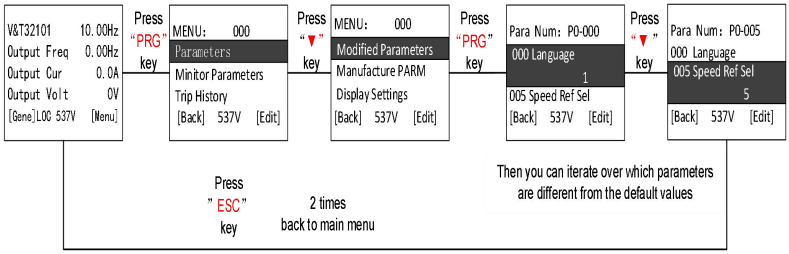
■ *Change a parameter, set P1−005 to 50.00.*



■ *Reset to Default Value, Set D0 −002 to 2.*

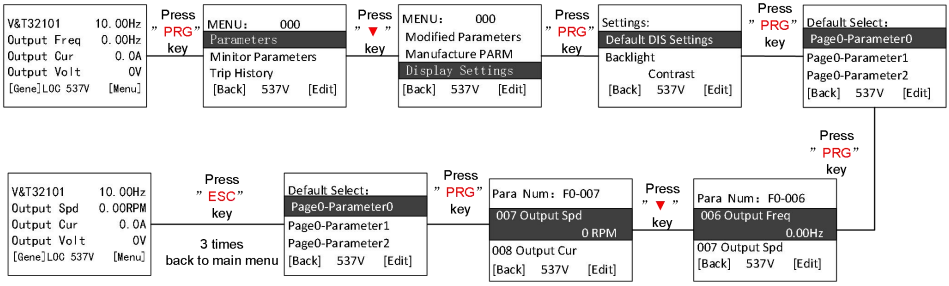


■ *Check which parameters is changed*

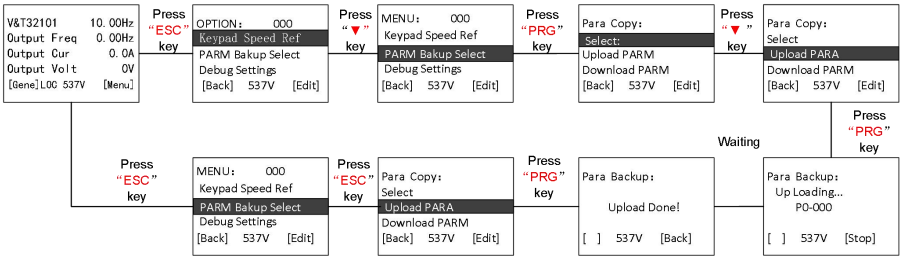


■ *Change the monitoring parameters in default pages?*

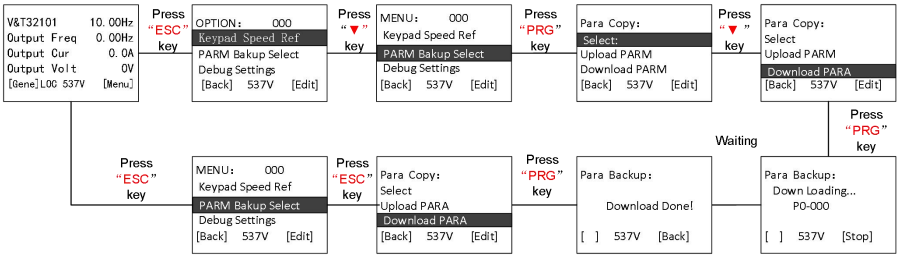
There are 5−page parameters can be display on the main menu mode and three parameters cab be selected to display on every page. Each page can be switchover by right key (►) or left key (◄) on the keypad.For example, if I want to display output speed on the first position of first page:



■ *Back up parameters to LCD keypad*



■ *Download parameters from LCD keypad*



4.6 LED Keypad Operation

4.6.1 Display Status Classification

The keypad display status is divided into five types:

No.	Name of status	Meaning
1	Parameter display status	The default display interface during standby. The display parameters can be switched by the left shift key "◂" or the right shift key "▸".
2	Fault and alarm display status	This state is entered directly when the drive has a fault alarm.
3	First level menu display status	Press the PRG key in the first menu state to enter directly.
4	Secondary menu editing status	Press the PRG key to enter in the first menu display state.
5	Modify parameter status	After entering the current user parameters, when the current edit bit is flashing, you can use the ▲, ▼ keys to modify the parameter value.

4.6.2 Display Status and Operation Process

Automatic switch the status.

After 30 seconds without key operation, it automatically returns to the stop parameter display state or the operation parameter display state.

After 1 minute without key operation, clear the PX−YZ menu editing status and return to P0−000.

If there is password setting or key lock setting, the password protection and keypad lock status will be automatically entered after 5 minutes without button operation.

Display status and operation flow

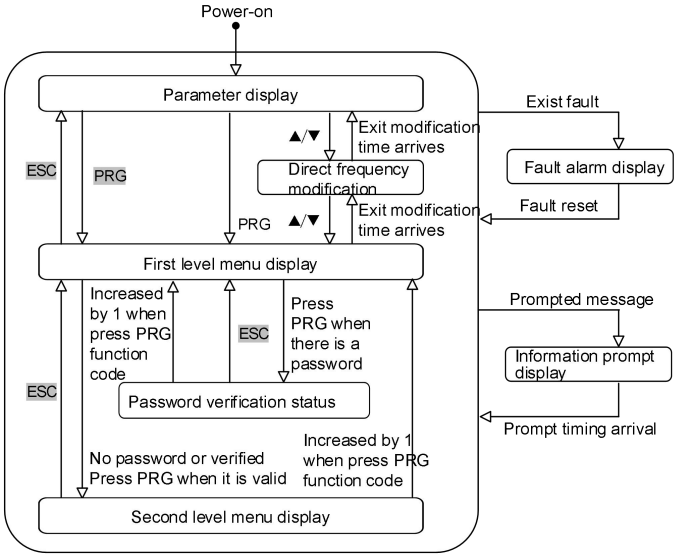
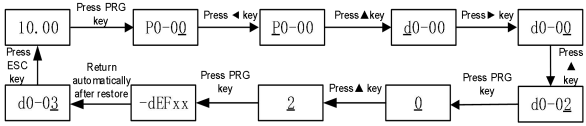


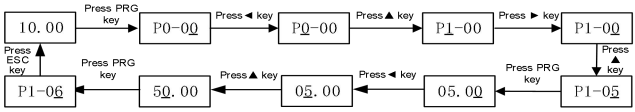
Figure 4−3 Status Display and Operation Flow

4.6.3 LED Keypad Operation

■ *Reset to Default Value, Set d0−002 to 2*



■ *Change parameter: set P1−005 to 50.00.*



4.7 Password Setting

◆ Set password

Enter d0−00 and set the same parameters (non−zero values) twice in succession. After "P−SEt" is displayed, the password is set successfully

◆ Verify password

① Press ESC+▶+▼ at the same time till the keypad display unLoC to unlock .

②Enter d0−00, enter the password correctly, all parameters can be seen.

◆ Clear password

After the verification password is passed, enter d0−00 and set 00000 twice in succession. After the display of "P−CLA", the password is successfully cleared

◆ Methods for password protection take effect

① Press the ESC+PRG +▲ key at the same time to display "P−LoC", then the keypad is locked.

② No key operation for 5 minutes.

③ Power on again.

4.7.1 Lock and Unlock the keypad Keys

◆ The keys on the keypad can be locked, the locking range is defined by the parameter d0−007.

0: All keys are effective.

1: All keys are locked, have no effective.

2: All keys are locked except the RUN and STOP keys.

◆ Methods for key locking to take effect.

1. Press the ESC+PRG +▲ key at the same time to display "loc−1"(select to lock all keys) or "Loc−1" (RUN, STOP is not locked, other keys are locked), then the keypad keys is locked.
2. No key operation for 5 minutes.

◆ Press ESC+▶+▼ at the same time to unlock the keys locking.

4.8 Menu Mode

Two level menu style is adopted in menu display. The first level menu is parameter index, and the second level menu is parameter value.

4.8.1 First Level Menu

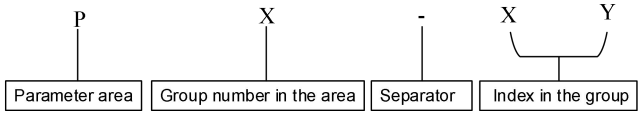


Figure 4-4 The Format of the First Level Menu

- The structure of the first level menu

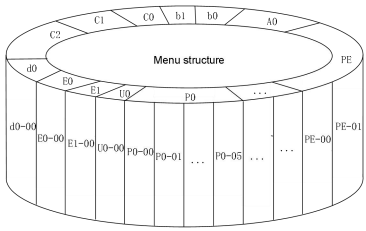


Figure 4-5 The structure of the first level menu

4.8.2The Second Level Menu

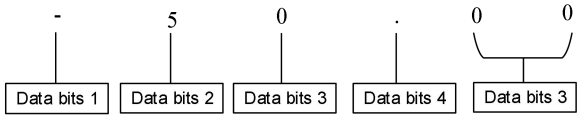


Figure 4-6 The Format of the second level menu

- Format of second level menu data display / setting

  Decimalism display/setting:

  The data bits 1 − 5 can be displayed/set with symbols of 0, 1, ...9

  When the display data is greater than 5 digits, the truncation method is used.

  For example, when the data is −12345, the operation panel displays "−1234.".

  Hexadecimal display/setting:

  The data bits 1 − 4 can be displayed/set with symbols of 0, 1, ...9,A, B, C, D, E, F.

4.8.3LED Keypad Parameter Access Level

Parameter access level	Option	Parameter visible range
0	Basic menu	Show all parameters
1	Non-factory value menu	Only show modified and read-only parameters

4.8.4 LED Keypad Display Symbols

In addition to the parameter the first and second level menus, some prompt characters will also be displayed in the keypad in the table below:

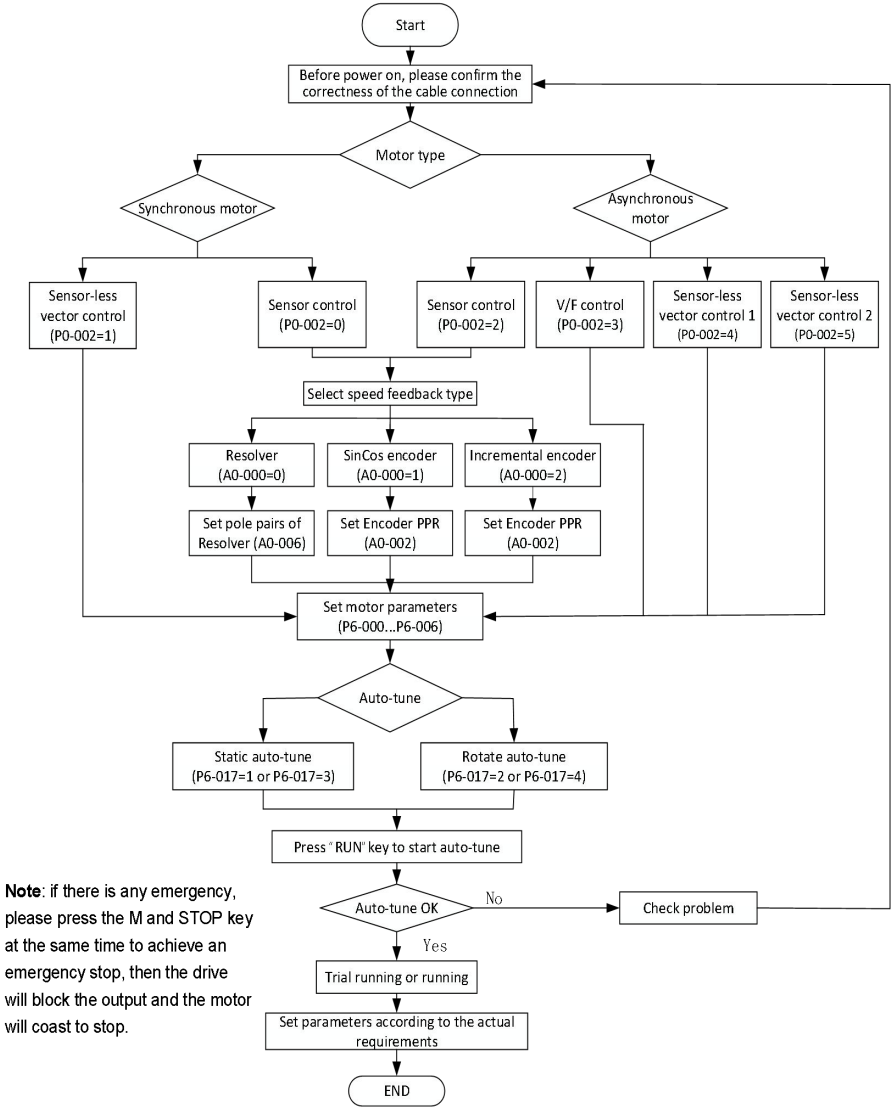
Symbol	Meaning	Symbol	Meaning
8.8.8.8.8.	When the drive is powered up, it display for a short time before communication is normal.	-DEFT	Restore default value operation
E-XXX	Means the drive trips on a fault.	DEFXX	Restoring default value, XX represents progress, display range 00 to 99
--dc-	Drive DC braking	P-CLA	Password has cleared
ATUnE	Auto-tune	P-SEt	The password has been set successfully
LodXX	Parameters are uploaded to the keypad. XX stands for progress, showing from 00-99.	P-LoC	Password protection has taken effect.
CPyXX	Parameters are downloaded to the drive. XX stands for progress, showing from 00-99.	unLoc	Keypad has unlocked.
pGood	Successful copy of parameters.	Loc-1	All Keys are locked.
EWRFH	Parameter failed to upload to keypad.	Loc-2	Keys are locked except RUN and STOP keys.
EEFSH	Parameter failed to download to drive.		
E-CPy	Parameter download to drive out of range.		
CoErr	Communication error of keypad and drive.		

4.8.5 Recognition of LED display symbols

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

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

4.9 First Commissioning and Auto Tune



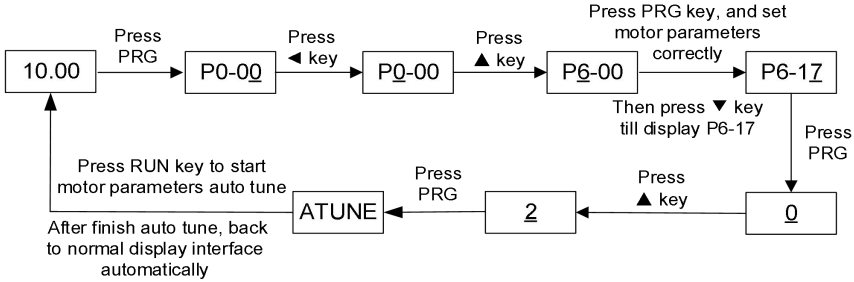
Note: if there is any emergency, please press the M and STOP key at the same time to achieve an emergency stop, then the drive will block the output and the motor will coast to stop.

Figure 4–7 Auto–tune for the first time

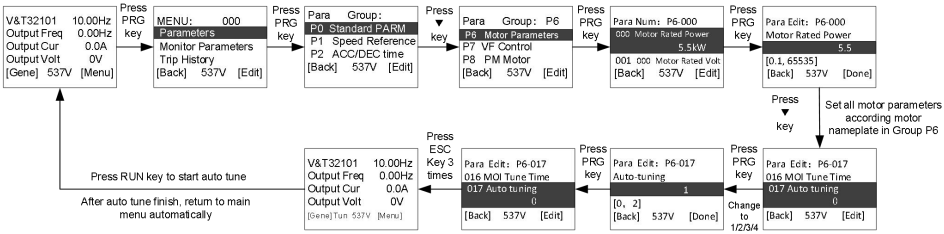
Auto-tune selection:

P6-017	Asynchronous motor	Synchronous motor
0	No action	No action
1	Static auto tune	Static auto tune 1
2	Rotate auto tune	Rotate auto tune 1
3		Static auto tune 2
4		Rotate auto tune 2

Auto tune steps for LED keypad:



Auto tune steps for LCD keypad:



Notes:

- If the drive trips a fault after auto tune, it means the auto tune has failed. It is necessary to re check the cable connection, parameter settings and analyze the cause of failure before start auto tune again.
- When start motor rotate auto tune, the motor speed will accelerate to 70% of motor rated speed, please pay attention to the safety.
- When start motor rotate auto tune, please set appropriate acceleration and deceleration time.
- Must set to rotate tune for sensor control to get the encoder other information, such as encoder direction, position of the rotor poles, etc. Before starting auto tune, please ensure the correctness of the wiring and the setting of the necessary parameters for the encoder.

Chapter 5 Parameters list

Parameter groups

Group area	Group	Group description
Group P	P0	Basic parameters
	P1	Speed reference
	P2	Acceleration and deceleration time
	P3	Digital inputs and outputs
	P4	Analog inputs and outputs
	P5	Start and stop
	P6	Motor parameters
	P7	V/F control
	P8	Synchronous motor sensor−less control
	P9	Vector control
	PA	Torque control
	PB(Pb)	Advanced control parameters
	PC	PID control parameters

Group area	Group	Group description
Group A	A0	Encode parameters
Group B (b)	B0 (b0)	Position control
	B1 (b1)	Pulse input and output
Group C	C0	Modbus
	C1	CAN / PROFIBUS−DP / ROFINET
	C2	EtherCAT
Group D (d)	D0 (d0)	Keypad parameters
Group E	E0	Protection configuration
Group F	F0	Status monitoring parameters
	F1	Software version
	F2	Product bar code
	F3	Trip history

Description of each meaning in the parameter list

Item	Explanation
Parameter	Indicates the number of the parameter, such as P0−000. **Notes**: ➢ The parameter display on the LED keypad is 4 digits, such as P1−23. ➢ The parameter display on the LCD keypad is 5 digits, such as P1−023, the default display mode of this manual is the LCD keypad display mode.
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.
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. Text with shadow and underlined means that this function is not supported.
Description	Describe the parameters and values.

5.1 Basic Parameters (P0)

Parameter	Name	Default	Range	Unit	Attribute
P0-000	Language	0	0 ... 1	/	×
	Selects the language of the parameter interface and other displayed information when viewed on the LCD keypad. ● **0: Chinese** ● **1: English** **Notes**: ➢ The parameter is only effective for LCD keypad. ➢ This parameter only can be changed manually and cannot be restored by parameter D0-002				
P0-001	Parameters display mode	0	0 ... 5	/	○
	Selects parameters display mode by LED keypad. ● **0: Display all the parameters.** ● **1: Only display the modified parameters.** ● **2** ... **5**: Reserved. **Note**: The parameter is only effective for LED keypad.				
P0-002	Motor control mode	3	0 ... 5	/	×
	Selects the motor control mode. ● **0: Synchronous motor sensor vector control.** The drive controls a synchronous motor in sensor vector control mode. In this control mode, torque control, speed control and position control are available and 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, torque control and speed control are available. 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, torque control, speed control and position control are available and 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 parameters and encoder phase direction. ● **3: Asynchronous motor V/F control** The drive controls an asynchronous motor in VF control mode. V/F control is generally applicable to control asynchronous motors without encoder speed feedback and not sufficient data to set the motor parameters. VF control also applicable to the applications such as multi-motor applications, the motor rated current is				

Parameter	Name	Default	Range	Unit	Attribute
	less than 1/6 of the drive rated current, the drive is used with no motor connected and variable frequency power supply, etc. ● **4: Asynchronous motor sensor less voltage vector control** The drive controls an asynchronous motor in sensor less voltage 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, it has higher speed control performance than V/F control. ● **5: Asynchronous motor sensor less current vector control** The drive controls an asynchronous motor in sensor less current 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, it has higher speed control performance and torque accuracy than sensor less voltage type vector control. **Note**: The motor control mode setting should according to the motor type and if exist a speed feedback signal from the motor.				
P0–003	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 P0−005. 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 control mode is only available in sensor control (P0−002 = 0 or 2), has no effect when sensor less control. ➢ Torque control is available in vector control, has no effect when VF control (P0−002 = 3).				
P0–004	Run command selection	1	0 ... 5	/	×
	Selects the source of run command. ● **0: Modbus communication**				

Parameter	Name	Default	Range	Unit	Attribute
	Start and stop through Modbus communication (The Modbus address of the control word is 0x8000; please refer to Appendix A for more information). ● **1: Keypad** Start and stop through RUN key and STOP key on the keypad. ● **2: External digital input terminal** Start and stop through digital input, refer to parameters P3−001 ... P3−007 and P3−016 for more information. ● **3: EtherCAT** Start and stop through EtherCAT communication. ● **4: CAN** Start and stop through CAN communication. ● **5: PROFIBUS−DP/PROFINET** Start and stop through PROFIBUS−DP/ PROFINET communication.				
P0–005	Speed reference selection	1	0 ... 14	/	×
	Selects the source of speed (frequency) reference. ● **0: Modbus** The speed (frequency) reference is given to the drive through Modbus (The Modbus address of the Modbus communication speed reference is 0x8001; please refer to Appendix A for more information). ● **1: Keypad** The speed (frequency) reference is given by through ∨ and ∧ key on the keypad or parameter P1−000 to change the speed (or frequency) reference. Please refer to parameter P1−000 for more information. ● **2: AI1** The speed (frequency) reference is given through analog input AI1. 10V/20 mA = maximum speed P0−012. ● **3: CAN** The speed (frequency) reference is given to the drive through CAN communication. ● **4: EtherCAT** The speed (frequency) reference is given to the drive through EtherCAT communication. ● **5: PID** The speed (frequency) reference is given through PID controller. Refer to group PC for more information. ● **6: AI2** The speed (frequency) reference is given through analog input AI2. 10V/20 mA = maximum speed P0−012. ● **7: AI3** The speed (frequency) reference is given through analog input AI3. 10V = maximum speed P0−012. ● **8: 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; refer to parameters P1−033 … P1−069 for more information. ● **9: Multi−step speed (frequency) reference** The speed (frequency) reference is given through predefined constant speeds (frequency). It is possible to				

Parameter	Name	Default	Range	Unit	Attribute
	define up to 16 predefined speeds (frequency) that can be quickly activated through digital inputs, refer to parameters P1−005 … P1−020 and P3−001 ... P3−007for more information. ● **10: Digital input terminal UP/DN** The digital input(s) is used to increase and decrease speed reference. Please refer to parameter P1−021 for more information. ● **11: Pulse input** The speed (frequency) reference is given through pulse input. ● **12: Pulse input 2** The speed (frequency) reference is defined by parameters B0−038 … B0−046. Refer to B0−038 … B0−046 for more information. ● **13: PROFIBUS−DP/PROFINET** The speed (frequency) reference is given through PROFIBUS−DP or PROFINET. ● **14: Potentiometer on VTS-DP04 LCD keypad** The speed (frequency) reference is given through potentiometer on the keypad of VTS-DP04.				
P0−006	Speed unit	0	0 ... 1	/	×
	The speed unit and upper limit are defined by parameters P0−006 and P0−007. When P0−006 = 0 and P0−007 = 0, the maximum speed range is 0.00 … 655.35 Hz. When P0−006 = 0 and P0−007 = 1, the maximum speed range is 0.0 … 6553.5 Hz. When P0−006 = 0 and P0−007 = 2, the maximum speed range is 0… 65535 Hz. When P0−006 = 1, the maximum speed range is 0… 65535 RPM ● **0: Motor speed in Hz** ● **1: Motor speed in rpm** **Notes**: The parameter only can be changed manually and cannot be restored by parameter D0−002.				
P0−007	Frequency display units	0	0 ... 2	/	×
	Defines the frequency display units when P0−006 = 0. Refer to parameter P0−006 for more information. ● **0: 0.01Hz.** ● **1: 0.1Hz.** ● **2: 1Hz.** **Notes**: ➢ The parameter is only effective when P0−006 = 0. ➢ The parameter only can be changed manually and cannot be restored by parameter D0−002.				
P0−008	Forward speed limit selection	0	0 ... 3	/	×
	Selects the source of the maximum allowed forward speed for the drive. ● **0: Parameter P0−010** The parameter P0−010 is used as forward speed limit. 100.0% corresponds to the maximum speed P0−012. ● **1: AI1**				

Parameter	Name	Default	Range	Unit	Attribute
	AI1 voltage/current is converted to a forward running speed limit value. Maximum AI1 input corresponds to the maximum speed P0−012. ● **2: AI2** Same as AI1. ● **3: AI3** Same as AI1.				
P0−009	**Reverse speed limit selection**	0	0 ... 3	/	×
	Selects the source of the maximum allowed reverse speed for the drive. ● **0: Parameter P0−011** The parameter P0−011 is used as reverse speed limit. 100.0% corresponds to the maximum speed P0−012. ● **1: AI1** AI1 voltage/current is converted to a reverse running speed limit value. Maximum AI1 input corresponds to the maximum speed P0−012. ● **2: AI2** Same as AI1. ● **3: AI3** Same as AI1.				
P0−010	**Forward speed limit**	100.0	0.0 ... 100.0	%	○
	Effective when P0−008 = 0, 100% corresponds to the maximum speed P0−012.				
P0−011	**Reverse speed limit**	100.0	0.0 ... 100.0	%	○
	Effective when P0−009 = 0, 100% corresponds to the maximum speed P0−012.				
P0−012	**Maximum speed**	50.00	P0−013 ... 655.35	Hz	×
		1500	P0−013 ... 65535	RPM	
	Defines the allowed maximum speed. The range and unit is defined by the parameters P0−006 and P0−007. ① When P0−006 = 0 and P0−007 = 0, setting range is P0–013 minimum speed … 655.35 Hz. ② When P0−006 = 0 and P0−007 = 1, setting range is P0–013 minimum speed … 6553.5 Hz. ③ When P0−006 = 0 and P0−007 = 2, setting range is P0–013 minimum speed … 65535 Hz. ④ When P0−006 = 1, no matter what P0-007 is, setting range is P0–013 minimum speed … 65535 RPM. **Note**: The lower limit is limited by the minimum speed (parameter P0−013).				
P0−013	**Minimum speed**	0.00	0 ... P0−012	Hz	×
		0	0 ... P0−012	RPM	
	Defines the allowed minimum speed. The range and unit is defined by the parameters P0−006 and P0−007. ① When P0−006 = 0 and P0−007 = 0, setting range is 0.00 Hz … P0–012 maximum speed. ② When P0−006 = 0 and P0−007 = 1, setting range is 0.0 Hz… P0–012 maximum speed ③ When P0−006 = 0 and P0−007 = 2, setting range is 0 Hz…P0–012 maximum speed. ④ When P0−006 = 1, no matter what P0-007 is, setting range is 0 RPM…P0–012 maximum speed.				

Parameter	Name	Default	Range	Unit	Attribute
	Note: The upper limit is limited by the maximum speed (parameter P0-012).				
P0-014	Forward current limit selection	0	0 ... 3	/	×
	Selects the source of the forward maximum allowed motor current. ● **0: Parameter P0-016** The parameter P0-016 is used as forward maximum allowed motor current. 100.0% corresponds to the minimum of motor rated current (parameter P6-004) and drive rated output current (defined by the drive model). ● **1: AI1** AI1 is used as forward maximum allowed motor current. Maximum AI1 input corresponds to 2-times minimum of motor rated current (parameter P6-004) and drive rated output current (defined by the drive model). ● **2: AI2** Same as AI1. ● **3: AI3** Same as AI1.				
P0-015	Reverse current limit selection	0	0 ... 3	/	×
	Selects the source of the reverse maximum allowed motor current. ● **0: Parameter P0-017** The parameter P0-017 is used as reverse maximum allowed motor current. 100.0% corresponds to the minimum of motor rated current (parameter P6-004) and drive rated output current (defined by the drive model). ● **1: AI1** AI1 is used as reverse maximum allowed motor current. Maximum AI1 input corresponds to 2-times minimum of motor rated current (parameter P6-004) and drive rated output current (defined by the drive model). ● **2: AI2** Same as AI1. ● **3: AI3** Same as AI1.				
P0-016	Forward current limit	150.0	0.0 ... 300.0	%	○
	Effective when parameter P0-014 = 0. The parameter P0-016 is used as forward maximum allowed motor current. 100.0% corresponds to the minimum of motor rated current (parameter P6-004) and drive rated output current (defined by the drive model).				
P0-017	Reverse current limit	150.0	0.0 ... 300.0	%	○
	Effective when parameter P0-015 = 0. The parameter P0-017 is used as reverse maximum allowed motor current.				

Parameter	Name	Default	Range	Unit	Attribute
	100.0% corresponds to the minimum of motor rated current (parameter P6−004) and drive rated output current (defined by the drive model).				
P0−018	User macro	0	0 ... 3	/	×
	In most cases, the default value is appropriate. Other options are customized parameters for customers. ● **0: Standard macro.** ● **1 … 3: reserved.**				
P0−019	Forward torque limit	180.0	−300.0 ... 300.0	%	○
	Effective when parameter P0−021 = 0. The parameter P0−019 is used as forward torque limit when parameter P0−021 = 0. 100.0% corresponds to the motor rated torque.				
P0−020	Reverse torque limit	180.0	−300.0 ... 300.0	%	○
	Effective when parameter P0−022 = 0. The parameter P0−020 is used as reverse torque limit when parameter P0−022 = 0. 100.0% corresponds to the motor rated torque.				
P0−021	Forward torque limit selection	0	0 ... 3	/	×
	Selects the source of the forward torque limit for the drive. ● **0: Parameter P0−019** The parameter P0−019 is used as forward torque limit. 100.0% corresponds to the motor rated torque. ● **1: AI1** AI1 is used as forward torque limit. Maximum AI1 input corresponds to 2−times the motor rated torque. ● **2: AI2** Same as AI1. ● **3: AI3** Same as AI1.				
P0−022	Reverse torque limit selection	0	0 ... 3	/	×
	Selects the source of the reverse torque limit for the drive. ● **0: Parameter P0−020** The parameter P0−020 is used as reverse torque limit. 100.0% corresponds to the motor rated torque. ● **1: AI1** AI1 is used as reverse torque limit. Maximum AI1 input corresponds to 2−times the motor rated torque. ● **2: AI2** Same as AI1. ● **3: AI3**				

<table>
<tr><th>Parameter</th><th>Name</th><th>Default</th><th>Range</th><th>Unit</th><th>Attribute</th></tr>
<tr><td></td><td colspan="5">Same as AI1.</td></tr>
<tr><td>P0-023</td><td>Control location mode selection</td><td>0</td><td>0 ... 1</td><td>/</td><td>×</td></tr>
<tr><td></td><td colspan="5">Selects the control location mode.
● 0: Control location mode 1
Run command is defined by parameter P0-004 and speed reference is defined by parameter P0-005, in this control location mode, the parameters P0-024 … P0-027 have no effect.
● 1: Control location mode 2
There are three control location in this control location mode: LOCAL control location, EXTERNAL 1 control location and EXTERNAL 2 control location, the control location can be switched by digital inputs.
Run command is defined by keypad, parameters P0-024 and P0-026; speed reference is defined by parameters P0-005, P0-025 and P0-027.
For example: digital input X3 is used to select EXTERNAL 1 control location and digital input X4 is used to select EXTERNAL 2 control location.
Parameters setting: P3-003 = 64, P3-004 = 65.
<table>
<tr><th>X4 state</th><th>X3 state</th><th>Run command selection</th><th>Speed reference selection</th></tr>
<tr><td>0</td><td>0</td><td>Keypad</td><td>Parameter P0-005</td></tr>
<tr><td>0</td><td>1</td><td>Source selected by P0-024</td><td>Source selected by P0-025</td></tr>
<tr><td>1</td><td>0</td><td>Source selected by P0-026</td><td>Source selected by P0-027</td></tr>
<tr><td>1</td><td>1</td><td>Source selected by P0-026</td><td>Source selected by P0-027</td></tr>
</table></td></tr>
<tr><td>P0-024</td><td>External 1 selection</td><td>2</td><td>0 ... 5</td><td>/</td><td>×</td></tr>
<tr><td></td><td colspan="5">Refer to parameter P0-004.</td></tr>
<tr><td>P0-025</td><td>External reference 1 selection</td><td>2</td><td>0 ... 14</td><td>/</td><td>×</td></tr>
<tr><td></td><td colspan="5">Refer to parameter P0-005.</td></tr>
<tr><td>P0-026</td><td>External 2 selection</td><td>2</td><td>0 ... 5</td><td>/</td><td>×</td></tr>
<tr><td></td><td colspan="5">Refer to parameter P0-004.</td></tr>
<tr><td>P0-027</td><td>External reference 2 selection</td><td>6</td><td>0 ... 14</td><td>/</td><td>×</td></tr>
<tr><td></td><td colspan="5">Refer to parameter P0-005.</td></tr>
</table>

5.2 Speed Reference (P1)

<table>
<tr><th>Parameter</th><th>Name</th><th>Default</th><th>Range</th><th>Unit</th><th>Attribute</th></tr>
<tr><td rowspan="2">P1-000</td><td rowspan="2">Keypad speed reference</td><td>10.00</td><td>-327.67 ... 327.67</td><td>Hz</td><td rowspan="2">○</td></tr>
<tr><td>300</td><td>-32767 ... 32767</td><td>rpm</td></tr>
<tr><td></td><td colspan="5">Defines the speed reference when P0-005 = 1.
<table>
<tr><th>P0-006</th><th>P0-007</th><th>Range</th></tr>
<tr><td>0</td><td>0</td><td>-P0–012 maximum speed … 0.00 Hz … P0–012 maximum speed</td></tr>
<tr><td>0</td><td>1</td><td>-P0–012 maximum speed … 0.0 Hz… P0–012 maximum speed</td></tr>
<tr><td>0</td><td>2</td><td>-P0–012 maximum speed … 0 Hz…P0–012 maximum speed</td></tr>
<tr><td>1</td><td>/</td><td>-P0–012 maximum speed … 0 RPM…P0–012 maximum speed</td></tr>
</table>
Note: The range is limited by maximum speed P0-012 and the unit is defined by the parameters P0-006 and P0-007. Refer to parameters P0-006 and P0-007 for more information.</td></tr>
<tr><td>P1-001</td><td>Speed reference invert</td><td>0</td><td>0 ... 1</td><td>/</td><td>×</td></tr>
<tr><td></td><td colspan="5">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.</td></tr>
<tr><td>P1-002</td><td>Run reverse selection</td><td>0</td><td>0 ... 1</td><td>/</td><td>×</td></tr>
<tr><td></td><td colspan="5">Selects whether to allow the motor to rotate in reverse direction. Disable reverse operation in some applications where reverse rotation is dangerous or the equipment will be damaged.
When P1-002 = 1 and the speed reference is a reverse value, the actual running speed is zero.
● 0: Run reverse is allowed.
● 1: Run reverse is not allow.</td></tr>
<tr><td rowspan="2">P1-003</td><td rowspan="2">Jog speed reference</td><td>5.00</td><td>0.00 ... 655.35</td><td>Hz</td><td rowspan="2">×</td></tr>
<tr><td>150</td><td>0 ... 65535</td><td>rpm</td></tr>
<tr><td></td><td colspan="5">The parameter defines the jogging speed when the jogging function is in use. Jogging function can be activated by digital inputs only when the parameter P0-004 is 2 (Start and Stop by digital input).
For example, digital input X3 is used to activate forward jogging and X4 is used to activate reverse jogging, set the parameters:
P0-004 = 2, P3-003 = 31, P3-004 = 32.
Note: The range is limited by maximum speed P0-012 and the unit is defined by the parameters P0-006 and P0-007. Refer to parameter P0-006 for more information.
<table>
<tr><th>X4</th><th>X3</th><th>Jogging direction</th><th>Jogging speed</th></tr>
<tr><td>0</td><td>0</td><td>STOP</td><td>STOP</td></tr>
<tr><td>0</td><td>1</td><td>FWD</td><td>P1-003</td></tr>
<tr><td>1</td><td>0</td><td>REV</td><td>P1-003</td></tr>
<tr><td>1</td><td>1</td><td>REV</td><td>P1-003</td></tr>
</table></td></tr>
<tr><td>P1-004</td><td>Jog speed priority</td><td>0</td><td>0 ... 1</td><td>/</td><td>×</td></tr>
<tr><td></td><td colspan="5">● 0: Jogging function has higher priority.
● 1: Jogging function has lower priority.</td></tr>
</table>

Parameter	Name	Default	Range	Unit	Attribute
P1−005	Constant speed reference 1	5.00	−327.67 ... 327.67	Hz	○
		150	−32767 ... 32767	rpm	
P1−006	Constant speed reference 2	8.00	−327.67 ... 327.67	Hz	○
		240	−32767 ... 32767	rpm	
P1−007	Constant speed reference 3	10.00	−327.67 ... 327.67	Hz	○
		300	−32767 ... 32767	rpm	
P1−008	Constant speed reference 4	15.00	−327.67 ... 327.67	Hz	○
		450	−32767 ... 32767	rpm	
P1−009	Constant speed reference 5	18.00	−327.67 ... 327.67	Hz	○
		540	−32767 ... 32767	rpm	
P1−010	Constant speed reference 6	20.00	−327.67 ... 327.67	Hz	○
		600	−32767 ... 32767	rpm	
P1−011	Constant speed reference 7	25.00	−327.67 ... 327.67	Hz	○
		750	−32767 ... 32767	rpm	
P1−012	Constant speed reference 8	28.00	−327.67 ... 327.67	Hz	○
		840	−32767 ... 32767	rpm	
P1−013	Constant speed reference 9	30.00	−327.67 ... 327.67	Hz	○
		900	−32767 ... 32767	rpm	
P1−014	Constant speed reference 10	35.00	−327.67 ... 327.67	Hz	○
		1050	−32767 ... 32767	rpm	
P1−015	Constant speed reference 11	38.00	−327.67 ... 327.67	Hz	○
		1140	−32767 ... 32767	rpm	
P1−016	Constant speed reference 12	40.00	−327.67 ... 327.67	Hz	○
		1200	−32767 ... 32767	rpm	
P1−017	Constant speed reference 13	42.00	−327.67 ... 327.67	Hz	○
		1260	−32767 ... 32767	rpm	
P1−018	Constant speed reference 14	45.00	−327.67 ... 327.67	Hz	○
		1350	−32767 ... 32767	rpm	
P1−019	Constant speed reference 15	48.00	−327.67 ... 327.67	Hz	○
		1440	−32767 ... 32767	rpm	
P1−020	Constant speed reference 16	50.00	−327.67 ... 327.67	Hz	○
		1500	−32767 ... 32767	rpm	
When P0−005 = 8 or 9, it is possible to predefine 15 constant speeds in parameters P1−005 … P1−020. Constant speeds are selected through digital inputs. For example, digital inputs X3, X4, X5 and X6 are used to activate constant speeds, set P3−003 = 16, P3−004 = 17, P3−005 = 18, P3−006 = 19, the speed reference as follows (0 indicates digital input OFF or not selected, 1 indicates digital input ON):					

Parameter	Name	Default	Range	Unit	Attribute

X6	X5	X4	X3	Speed reference active
0	0	0	0	Constant speed reference 1 (P1−005)
0	0	0	1	Constant speed reference 2 (P1−006)
0	0	1	0	Constant speed reference 3 (P1−007)
0	0	1	1	Constant speed reference 4 (P1−008)
0	1	0	0	Constant speed reference 5 (P1−009)
0	1	0	1	Constant speed reference 6 (P1−010)
0	1	1	0	Constant speed reference 7 (P1−011)
0	1	1	1	Constant speed reference 8 (P1−012)
1	0	0	0	Constant speed reference 9 (P1−013)
1	0	0	1	Constant speed reference 10 (P1−014)
1	0	1	0	Constant speed reference 11 (P1−015)
1	0	1	1	Constant speed reference 12 (P1−016)
1	1	0	0	Constant speed reference 13 (P1−017)
1	1	0	1	Constant speed reference 14 (P1−018)
1	1	1	0	Constant speed reference 15 (P1−019)
1	1	1	1	Constant speed reference 16 (P1−020)

Note: The range of parameters P1−005 … P1−020 are limited by maximum speed (defined by parameter P0−012) and the unit is defined by the parameters P0−006 and P0−007. Refer to the parameter P0−006 for more information.

P1−021	UP/DN function selection	0000	0000 ... FFFF	/	○

Defines the mode of speed (frequency) reference increase and decrease by digital inputs.

bit1...bit0: UP/DN mode selection

- **00: UP/DN mode 1**.

  The speed reference increase and decrease by the state of digital inputs. For example, digital input X3 is used to increase the speed reference and X4 is used to decrease the speed reference.

  Set P3−003 = 27, P3−004 = 28, then:

  ① If X3 = ON, the reference increases from initial value until reaches the maximum speed P0−012.

  ② If X4 = ON, the reference decreases until reaches the lower limit P1−023.

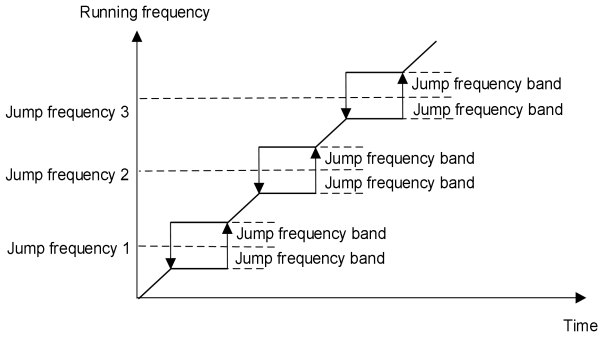
- **01: UP/DN mode 2**.

  The speed reference increase and decrease by the rising edge of digital inputs. For example, digital input X3 is used to increase the speed reference and X4 is used to decrease the speed reference, set P3−003 = 27, P3−004 = 28, then:

  ① If X3: OFF —> ON, reference increase from initial value ,the increased value is defined by parameter P1−024 for each rising edge . The reference will increase once at each rising edge until reaches the maximum speed P0−012.

  ② If X4: OFF —> ON, reference decrease, the decreased value is defined by parameter P1−024 for each rising edge. The reference value will decrease once at each rising edge until reaches the

Parameter	Name	Default	Range	Unit	Attribute
	lower limit P1−023. ● **10: UP/DN mode 3**. This mode is only available in running state. The speed increase by a digital input, the speed decrease by stop command. For example, digital input X3 is used to increase the speed and X1 is used to start the motor, set P3−001 = 03, P3−003 = 27, then: ① If X1 = ON and X3 = ON, actual speed increase, the actual speed increases from initial value until reaches the maximum speed P0−012. ② If X1 = OFF and X3 = OFF, actual speed decrease until stop. If in deceleration process, then X1 = ON, the actual speed will be keep at the current speed. **bit2...bit3: Reserved.** **bit4: UP/DN initial value selection**. ● **0**: P1−022 is used as initial value for the UP/DN mode. ● **1**: AI1 is used as initial value for the UP/DN mode. **bit5...bit7**: Reserved. **bit8...bit9: UP/DN minimum speed** ● **00**: Zero speed. ● **01**: UP/DN minimum speed P1−023. ● **10**: UP/DN adjustment can reverse the direction. **bit10...bit11**: Reserved. **bit12...bit13: UP/DN adjustment in stop state** ● **00**: Clear the adjusted value in stop state, UP/DN adjustment is disabled in stop state. ● **01**: Keep the adjusted value in stop state, but UP/DN adjustment is disabled in stop state. ● **10**: Keep the adjusted value in stop state, UP/DN adjustment is enabled in stop state. **bit14: Save after power off** ● **0**: Clear the adjusted value after power off. ● **1**: Save the adjusted value after power off. **bit15**: Reserved				
P1−022	UP/DN initial value	10.00 300	0.00 ... 655.35 0 ... 65535	Hz rpm	○
	Defines the initial value for the UP/DN mode when bit4 of P1−021 is zero. **Note**: The range is limited by maximum speed P0−012 and the unit is defined by the parameters P0−006 and P0−007. Refer to parameter P0−006 for more information.				
P1−023	UP/DN minimum speed	5.00	0.00 ... 655.35	Hz	○
	Defines the UP/DN minimum speed. UP/DN function cannot adjust the frequency lower than this value. **Note**: The range is limited by maximum speed P0−012 and the unit is defined by the parameters P0−006 and P0−007. Refer to parameter P0−006 for more information.				
P1−024	UP/DN adjust step length	1.00 30	0.00 ... 655.35 0 ... 65535	Hz rpm	○
	Defines the step length for each UP/DN adjust value.				

Parameter	Name	Default	Range	Unit	Attribute
	Note: The range is limited by maximum speed P0−012 and the unit is defined by the parameters P0−006 and P0−007. Refer to parameter P0−006 for more information.				
P1−025	UP/DN adjust rate	0.100	0.000 ... 32.000	s	○
	Defines the UP/DN adjust time interval.				
P1−026	Keypad UP/DN step length	1.00	0.00 ... 655.35	Hz	○
		30	0 ... 65535	rpm	○
	Note: The range is limited by maximum speed P0−012 and the unit is defined by the parameters P0−006 and P0−007. Refer to parameter P0−006 for more information.				
P1−027	Keypad UP/DN minimum speed	0	0 ... 2	/	×
	● **0: Keypad UP/DN can adjust to reverse direction** ● **1: Zero speed** ● **2: Parameter P1−023**				
P1−028	Speed reference selection 2	1	0 ... 14	/	×
	Speed reference 2 is activated by a digital input. For example, if digital input X3 is used to activate speed reference 2, set P3−003 = 49, then: ● If X3 is OFF, source selected by P0−005. ● If X3 is ON then source selected by parameter P1−028. For the selection information, refer to parameter P0−005 for more information. ● For the selections, same as P0−005, refer to parameter P0−005 for more information.				
P1−029	Jump frequency 1	0.00	0.00 ... 655.35	Hz	×
P1−030	Jump frequency 2	0.00	0.00 ... 655.35	Hz	×
P1−031	Jump frequency 3	0.00	0.00 ... 655.35	Hz	×
P1−032	Jump frequency band	0.00	0.00 ... 655.35	Hz	×
The jump frequency function is available for applications where it is necessary to avoid certain motor speeds or speed bands because of e.g. mechanical resonance problems.  					
P1−033	Simple PLC operation mode	0	0 ... 3	/	×
	● **0: Stop after one process operation.** ● **1: Keep the final speed running after one process operation.**				

Parameter	Name	Default	Range	Unit	Attribute
	● **2: Cycle operation.** ● **3: Cycle operation and stop after the number of cycles reach the pre−defined value (defined by parameter P1−069).**				
P1−034	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.				
P1−035	The 1st step speed reference selection	0	0 ... 5	/	×
	Defines the 1st step speed reference channel: ● **0: Parameter P1−005** ● **1: Modbus** ● **2: Parameter P1−000** ● **3: AI1** ● **4: AI2** ● **5: AI3**				
P1−036	The 1st step run time	0.0	0.0 ... 6553.5	s(h)	○
	Defines the first step run time. The first step speed reference is defined by parameter P1−035, and the first step acceleration and deceleration time are defined by parameter P1−037.				
P1−037	The 1st step ACC/DEC time selection	0	0 ... 3	/	×
	Selects the first step active acceleration/deceleration time pair. ● **0: Acceleration time 0 and deceleration time 0 are used (P2−001 and P2−002).** ● **1: Acceleration time 1 and deceleration time 1 are used (P2−003 and P2−004).** ● **2: Acceleration time 2 and deceleration time 2 are used (P2−005 and P2−006).** ● **3: Acceleration time 3 and deceleration time 3 are used (P2−007 and P2−008).**				
P1−038	The 2nd step run time	0.0	0.0 ... 6553.5	s(h)	○
P1−039	The 2nd step ACC/DEC time selection	0	0 ... 3	/	×
P1−040	The 3rd step run time	0.0	0.0 ... 6553.5	s(h)	○
P1−041	The 3rd step ACC/DEC time selection	0	0 ... 3	/	×
P1−042	The 4th step run time	0.0	0.0 ... 6553.5	s(h)	○
P1−043	The 4th step ACC/DEC time selection	0	0 ... 3	/	×
P1−044	The 5th step run time	0.0	0.0 ... 6553.5	s(h)	○
P1−045	The 5th step ACC/DEC time selection	0	0 ... 3	/	×
P1−046	The 6th step run time	0.0	0.0 ... 6553.5	s(h)	○
P1−047	The 6th step ACC/DEC time selection	0	0 ... 3	/	×

Parameter	Name	Default	Range	Unit	Attribute
P1－048	The 7th step run time	0.0	0.0 ... 6553.5	s(h)	○
P1－049	The 7th step ACC/DEC time selection	0	0 ... 3	/	×
P1－050	The 8th step run time	0.0	0.0 ... 6553.5	s(h)	○
P1－051	The 8th step ACC/DEC time selection	0	0 ... 3	/	×
P1－052	The 9th step run time	0.0	0.0 ... 6553.5	s(h)	○
P1－053	The 9th step ACC/DEC selection	0	0 ... 3	/	×
P1－054	The 10th step run time	0.0	0.0 ... 6553.5	s(h)	○
P1－055	The 10th step ACC/DEC time selection	0	0 ... 3	/	×
P1－056	The 11th step run time	0.0	0.0 ... 6553.5	s(h)	○
P1－057	The 11th step ACC/DEC time selection	0	0 ... 3	/	×
P1－058	The 12th step run time	0.0	0.0 ... 6553.5	s(h)	○
P1－059	The 12th step ACC/DEC time selection	0	0 ... 3	/	×
P1－060	The 13th step run time	0.0	0.0 ... 6553.5	s(h)	○
P1－061	The 13th step ACC/DEC time selection	0	0 ... 3	/	×
P1－062	The 14th step run time	0.0	0.0 ... 6553.5	s(h)	○
P1－063	The 14th step ACC/DEC time selection	0	0 ... 3	/	×
P1－064	The 15th step run time	0.0	0.0 ... 6553.5	s(h)	○
P1－065	The 15th step ACC/DEC time selection	0	0 ... 3	/	×
P1－066	The 16th step run time	0.0	0.0 ... 6553.5	s(h)	○
P1－067	The 16th step ACC/DEC time selection	0	0 ... 3	/	×
See parameters P1−036 and P1−037.					
P1－068	Simple PLC run time unit	0	0 ... 1	/	×
	Defines the simple PLC run time unit. ● **0: Simple PLC run time in second.** ● **1: Simple PLC run time in hour.**				
P1－069	Simple PLC cycle times	1	1 ... 65535	/	×
	Defines the number of cycle operation when parameter P1−033 = 3. The drive will stop automatically after the cycles are finished.				

5.3 ACC/DEC Time (P2)

Parameter	Name	Default	Range	Unit	Attribute
P2−000	ACC and DEC mode selection	0	0 ... 2	/	×

Three user−selectable acceleration and deceleration modes are available.

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.

- **0: Linear ramp.**

  Selects acceleration and deceleration time pairs in the drive through digital inputs.

  For example, digital inputs X3 and X4 are used to select the acceleration and deceleration time pairs, set P3−003 = 22, P3−004 = 23.

X4 state	X3 state	Acceleration time	Acceleration time
0	0	P2−001	P2−002
0	1	P2−003	P2−004
1	0	P2−005	P2−006
1	1	P2−007	P2−008

- **1: Two linear ramp.**

  Actual speed < value of P2−017, the acceleration time is P2−001, the deceleration time is P2−002.

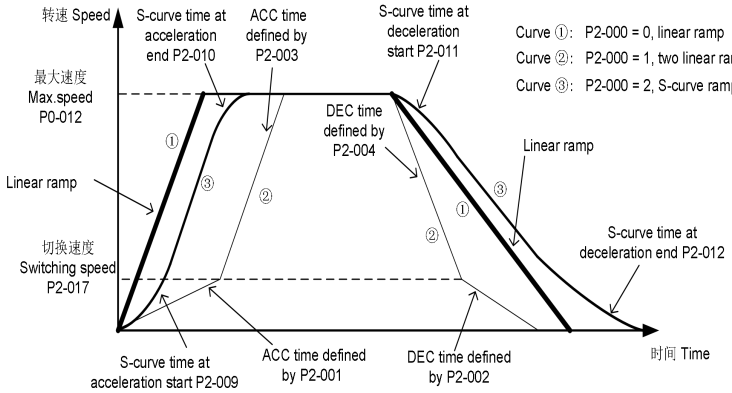
  Actual speed ≥value of P2−017, the acceleration time is P2−003, the deceleration time is P2−004.

- **2: S curve ramp.**

  When the setting acceleration / deceleration time higher than the S−curve time:

  Total acceleration time = setting acceleration time + (P2−009 + P2−010)/2.

  Total deceleration time = setting deceleration time + (P2−011 + P2−012)/2.



P2−001	Acceleration time 0	Model dependent	0.00 ... 655.35	s	○
P2−002	Deceleration time 0	Model dependent	0.00 ... 655.35	s	○
P2−003	Acceleration time 1	Model dependent	0.00 ... 655.35	s	○
P2−004	Deceleration time 1	Model dependent	0.00 ... 655.35	s	○
P2−005	Acceleration time 2	Model dependent	0.00 ... 655.35	s	○
P2−006	Deceleration time 2	Model dependent	0.00 ... 655.35	s	○
P2−007	Acceleration time 3	Model dependent	0.00 ... 655.35	s	○
P2−008	Deceleration time 3	Model dependent	0.00 ... 655.35	s	○
P2−009	S−curve time at acceleration start	Model dependent	0.00 ... 655.35	s	○
P2−010	S−curve time at acceleration end	Model dependent	0.00 ... 655.35	s	○
P2−011	S−curve time at deceleration start	Model dependent	0.00 ... 655.35	s	○
P2−012	S−curve time at deceleration end	Model dependent	0.00 ... 655.35	s	○
P2−013	Acceleration and deceleration time multiple	0	0 ... 2	/	×
	The parameter P2−013 defines the actual acceleration and deceleration time units. ● **0: *1** ● **1: *10** ● **2: *0.1**				
The actual acceleration time = P2−001 * P2−013. The acceleration time i.e. the time required for the speed to change from zero to the maximum speed P0−012. The actual deceleration time = P2−002 * value of P2−013. The deceleration time i.e. the time required for the speed to change from the maximum speed (parameter P0−012) to zero. **Notes**: ➢ If a short deceleration time is needed, the drive should be equipped with an electric braking option e.g. with a brake chopper and a brake resistor. ➢ The default acceleration and deceleration time (P2−001 … P2−008) depend on the power as follows: 5.5 kW ... 15kW: 5.0s. 18.5 kW ... 30kW: 10.0s. 37kW: 15.0s. 45kW: 25.0s. 55kW: 30.0s. 75 kW ... 93kW: 40.0s. 110kW: 45.0s. 132 kW ... 250kW: 50.0s. 280 kW ... 400kW: 60.0s. 450 kW ... 560kW: 70.0s. 630kW: 80.0s.					
P2−014	Emergency stop deceleration time	Model dependent	0.00 ... 655.35	s	○
	Defines the deceleration time when the drive receives an emergency stop command from a digital input.				
P2−015	Jog operation acceleration time	Model dependent	0.00 ... 655.35	s	○
P2−016	Jog operation deceleration time	Model dependent	0.00 ... 655.35	s	○
	P2−015 is used to define the acceleration time when the jogging function is activated. P2−016 is used to define the deceleration time when the jogging function is activated.				
P2−017	ACC/DEC time switching speed	0.00	0 ... 655.35	Hz	×
		0	0 ... 65535	rpm	
	Actual speed < value of P2−017, the acceleration time is P2−001, the deceleration time is P2−002. Actual speed ≥value of P2−017, the acceleration time is P2−003, the deceleration time is P2−004. See the selection "1" in parameter P2−000 for more information.				

5.4 Digital Inputs and Outputs (P3)

Parameter	Name	Default	Range	Unit	Attribute
P3-000	Digital inputs filter time	10	0 ... 1000	ms	○
	Defines a filtering time for digital inputs.				
P3-001	X1 input function	3	0 ... 63	/	×
P3-002	X2 input function	4	0 ... 63	/	×
P3-003	X3 input function	0	0 ... 63	/	×
P3-004	X4 input function	0	0 ... 63	/	×
P3-005	X5 input function	0	0 ... 63	/	×
P3-006	X6 input function	0	0 ... 63	/	×
P3-007	X7 input function	0	0 ... 63	/	×
	Note: Parameters P3-007 is reserved for VTS series products.				

Users can set a value for each digital input to achieve the corresponding function of the value.

- **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 when P0-004 = 2. For example, if digital input X1 is used to start and stop the drive, set P0-004 = 2, P3-001=1. Then start and stop through digital input X1, 0 = stop, 1 = start.

- **2: RUN direction invert**

  The signal is used to invert the run command direction. The signal can invert all the run command direction; include keypad, digital input and communication.

  0 = the motor operates in the rotate direction that keep consistent with the speed reference and run command.

  1 = the motor operates in the rotate direction that opposite to the speed reference and run command.

  Note: In general, this signal is used in conjunction with selection "1". For example, use X1 to start and X2 to invert the run direction:

  ① Set P0-004 = 2, P3-001 = 1, P3-002 = 2.

  ② Speed reference is a positive value

X2: invert direction	X1: start	Running direction
0	0	Stop
0	1	Forward
1	0	Stop
1	1	Reverse

- **3: Forward**

  Forward run command input when P0-004 = 2.

- **4: Reverse**

  Revsese run command input when P0-004 = 2. In general, this signal is used in conjunction with selection "3". For example, use X1 to start in forward direction and X2 to start in reverse direction:

  ① Set P0-004 = 2, P3-001 = 3, P3-002 = 4.

  ② Speed reference is a positive value

X2: reverse	X1: forward	Running direction
0	0	Stop
0	1	Forward
1	0	Reverse
1	1	Stop

Note: Other start mode refer to parameter P3-016 for more information.

Parameter	Name	Default	Range	Unit	Attribute

- **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: Spindle positioning**

  When P0−004 = 2, the signal is used to start positioning according to the positioning method, refer to parameters in group B0 for more details.

- **8: Switch to position loop**

  When the signal is ON, the system control mode (P0−003) is changed to position loop.

- **9: Enable zero servo function**

  When the signal is ON, the drive enters to zero servo operation.

- **10: Clear input pulses**

  When the signal is ON, the input pulses is cleared.

- **11: Change run command to Modbus communication**

  The run command is changed to Modbus communication when the signal rising edge: 0—> 1.

- **12: Change run command to keypad**

  The run command is changed to keypad when the signal rising edge: 0—> 1.

- **13: Change run command to digital input**

  The run command is changed to digital input when the signal rising edge: 0—> 1.

- **14: Reserved**

- **15: Emergency stop**

  The drive immediately stops according to the stop mode after receiving an emergency stop signal.

- **16: Constant speed reference input 1**

- **17: Constant speed reference input 2**

- **18: Constant speed reference input 3**

- **19: Constant speed reference input 4**

  When P0−005 = 9, it is possible to predefine 15 constant speeds in parameters P1−005 ... P1−020. Constant speeds are selected through digital inputs. The digital input functions 16 to 18 are used to select the predefined speeds, refer to parameters P1−005 ... P1−020 for more information.

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

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

- **21: 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.

- **22: Multi−step ACC/DEC time input 1**

- **23: Multi−step ACC/DEC time input 2**

  It is possible to predefine 4 pairs acceleration and deceleration time in parameters P2−001 … P2−008. The acceleration and deceleration time are selected through digital inputs. The digital input functions "22" and "23" are used to select the predefined ACC/DEC time. Refer to parameters P2−000 … P2−008 for more information.

Parameter	Name	Default	Range	Unit	Attribute

- **24: Process PID integration pause**

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

- **25: Process PID parameters switching**

  Select the second group PID parameters. 0 = Select the first group PID parameters. 1 = Select the second group PID parameters. Refer to parameter PC−030 for more information.

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

  The PID controller speed output is forced to the value of parameter PC−040.

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

  When P0−005 = 10, 1 = Speed reference increase by a digital input. Refer to parameter P1−021 for more information.

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

  When P0−005 = 10, 1 = Speed reference decrease by a digital input. Refer to parameter P1−021 for more information.

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

  When P0−005 = 10, 1 = reset the value adjusted by UP/DN to zero and the speed reference is changed to UP/DN initial value (defined by parameter P1−022).

- **30: UP/DN adjust to reverse direction**

  When P0−005 = 10, 1 = the minimum speed for UP/DN is zero, and cannot invert the running direction.

- **31: Forward jogging**

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

  Note: Jogging function is only effective when P0−004 = 2.

- **32: Reverse jogging**

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

  Note: Jogging function is only effective when P0−004 = 2.

- **33: Three−wire control mode**

  Refer to parameter P3−016 for more information.

- **34: Orientation position capture mode**

  The orientation position can be determined by two methods: manual setting and terminal acquisition.

  Manual setting: In stop state, manually rotate the motor shaft to the desired orientation position, read the encoder position value, and set it to the corresponding orientation position parameters. When orientation is active, the motor shaft will be positioned to the set position.

  Terminal acquisition: In stop state, set a digital input function to "34". When the terminal is ON, the drive will read the current position and set into corresponding position parameter automaticly.

- **35: Orientation position reference 1**
- **36: Orientation position reference 2**
- **37: Orientation position reference 3**

  It is possible to predefine 8 orientation positions in parameters B0−016, B0−022 … B0−028 and the orientation positions can be selected by digital inputs. Refer to parameter B0−016, B0−022 … B0−028 for more information.

- **38: Run is prohibited**

Parameter	Name	Default	Range	Unit	Attribute

1 = drive start command is inhibited; switching the signal ON while the drive is running will coast to stop immediately. The drive is allowed to start only when this signal is OFF.

- **39: Encoder 2 is used as position loop encoder**

  Select the position loop encoder. 0 = encoder 1, 1 = encoder 2.

- **40: Activate torque control**

  Activate torque control through a digital input. 1 = torque control. 0 = speed control.

  Note: The function has no effect under VF control.

- **41: Orientation after receiving a stop command**

  When the signal is ON, the drive will start orientation after receiving a stop command, after the orientation is completed, block the output.

- **42: Feed position acquisition (rising edge)**

  When the signal is ON, collect the current encoder position and save to parameters B0-047, B0-048, B0-049 and B0-050.

- **43: Feed input**

  When the signal is ON, start feed input.

- **44: Feed return**

  When the signal is ON, start feed return.

- **45: Coast to stop**

  The drive immediately coast to stop after receive an emergency stop signal from digital input.

- **46: Pulse output switching**

- **47: PID speed reference is changed to open loop main reference**

  When the signal is ON and speed reference is PID (P0−005 = 5), PID speed reference is changed to open loop main reference.

- **48: Force to master mode**

  When the drive in follower mode (C0−039 = 2, 3, 4, 5, 6), follower mode can be temporarily disabled through a digital input when the digital input function is set to "48". For example, P3−003 = 48, then X3 = 0 follower mode, X3 = 1 master mode. Refer to parameter C0−039 for more information.

- **49: Change speed reference source to parameter P1−028**

  Select the second speed reference source. 0 = selected by P0−005. 1 = selected by P1−028.

- **50: Acceleration and deceleration is prohibited**

  When the signal is ON, the current output speed is locked (keep at current running speed); acceleration and deceleration is disabled, even if the reference speed and running speed are inconsistent, except a stop command comes.

- **51: Change speed reference to maximum speed**

  Speed reference is changed to maximum speed when the signal is ON.

- **52: Change speed reference to jogging speed**

  Speed reference is changed to jog speed when the signal is ON.

- **53: Change speed reference to constant speed reference 1**

  Speed reference is changed to constant speed reference 1 (P1−005) when the signal is ON.

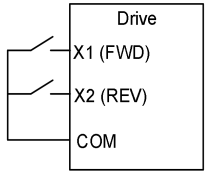
Parameter	Name	Default	Range	Unit	Attribute
• **54: Change speed reference to AI1** Speed reference is changed to AI1 when the signal is ON. • **55: Change speed reference to AI2** Speed reference is changed to AI2 when the signal is ON. • **56: Change speed reference to AI3** Speed reference is changed to AI3 when the signal is ON. • **57: Run is prohibited 1** 1 = drive start command is inhibited, switching the signal ON while the drive is running will stop according the stop mode (defined by parameter P5−008). The drive is allowed to start only when this signal is OFF. • **58: Run forward is prohibited 1** 1 = drive forward start command is inhibited, switching the signal ON while the drive is forward running will stop according the stop mode (defined by parameter P5−008). The drive is allowed to forward start only when this signal is OFF. Nevertheless, does not affect reverse start command. • **59: Run reverse is prohibited 1** 1 = drive reverse start command is inhibited, switching the signal ON while the drive is reverse running will stop according the stop mode (defined by parameter P5−008). The drive is allowed to reverse start only when this signal is OFF. Nevertheless, does not affect forward start command. • **60: Run is prohibited 2** 1 = drive start command is inhibited, switching the signal ON while the drive is running will coast to stop immediately. The drive is allowed to start only when this signal is OFF. • **61: Run forward is prohibited 2** 1 = drive forward start command is inhibited, switching the signal ON while the drive is forward running will coast to stop immediately. The drive is allowed to forward start only when this signal is OFF. Nevertheless, does not affect reverse start command. • **62: Run reverse is prohibited 2** 1 = drive reverse start command is inhibited, switching the signal ON while the drive is reverse running will coast to stop immediately. The drive is allowed to reverse start only when this signal is OFF. Nevertheless, does not affect forward start command. • **63: Touch input for EtherCAT** Only available when using the Ethercat communication Touch Probe Function function • **64: External 1 selection.** 1 = Activate EXTERNAL 1. Please refer to parameters P0−023 … P0−027 for more information. • **65: External 2 selection.** 1 = Activate EXTERNAL 2. Please refer to parameters P0−023 … P0−027 for more information. • **66...79: Reserved.**					
P3−008	**Digital input invert**	0000	0000 ... 03FF	/	×

<table>
<tr><th>Parameter</th><th>Name</th><th>Default</th><th>Range</th><th>Unit</th><th>Attribute</th></tr>
<tr><td></td><td>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 in hexadecimal.
<table>
<tr><td>Item</td><td>Reserved</td><td>AI3</td><td>AI2</td><td>AI1</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><td>0</td><td>0</td><td>0</td></tr>
<tr><td>bit</td><td>bit15 to bit10</td><td>bit9</td><td>bit8</td><td>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><td></td><td></td><td></td><td></td></tr>
<tr><td>P3-009</td><td>XI / VXI effectiveness selection</td><td>0</td><td>0 ... 2</td><td>/</td><td>×</td></tr>
<tr><td></td><td>We can define 5 virtual digital inputs through communication; virtual digital inputs can achieve the same functions as the actual digital inputs. We can also define the effective range.
• 0: Only the actual digital inputs are effective (X1…X7).
• 1: Both actual digital inputs and virtual digital inputs are effective (X1…X7, VX1…VX5).
• 2: Only virtual digital inputs VXI are effective (VX1…VX5).</td><td></td><td></td><td></td><td></td></tr>
<tr><td>P3-010</td><td>VXI virtual terminal reference</td><td>0000</td><td>0000 ... 001F</td><td>/</td><td>×</td></tr>
<tr><td></td><td>Defines whether the virtual digital inputs is ON or OFF.
<table>
<tr><td>Item</td><td>Reserved</td><td>X5</td><td>X4</td><td>X3</td><td>X2</td><td>X1</td></tr>
<tr><td>Default</td><td>0000 0000 000</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Bit</td><td>bit15 to bit5</td><td>bit4</td><td>bit3</td><td>bit2</td><td>bit1</td><td>bit0</td></tr>
</table>
• 0: Virtual digital input OFF.
• 1: Virtual digital input ON.</td><td></td><td></td><td></td><td></td></tr>
<tr><td>P3-011</td><td>Virtual terminal VX1 function selection</td><td>0</td><td>0 ... 63</td><td>/</td><td>×</td></tr>
<tr><td>P3-012</td><td>Virtual terminal VX2 function selection</td><td>0</td><td>0 ... 63</td><td>/</td><td>×</td></tr>
<tr><td>P3-013</td><td>Virtual terminal VX3 function selection</td><td>0</td><td>0 ... 63</td><td>/</td><td>×</td></tr>
<tr><td>P3-014</td><td>Virtual terminal VX4 function selection</td><td>0</td><td>0 ... 63</td><td>/</td><td>×</td></tr>
<tr><td>P3-015</td><td>Virtual terminal VX5 function selection</td><td>0</td><td>0 ... 63</td><td>/</td><td>×</td></tr>
<tr><td colspan="6">Parameters P3-011 … P3-015 are the function selection of VX1 … VX5, same as X1 … X7, see P3-001 … P3-007 for the selections.</td></tr>
<tr><td>P3-016</td><td>Two-wire / three-wire control mode selection</td><td>0</td><td>0 ... 3</td><td>/</td><td>×</td></tr>
</table>

Parameter	Name	Default	Range	Unit	Attribute

Selects the drive start and stop mode through digital inputs when P0−004 = 2.

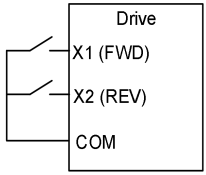
- **0: Two wire control 1.** E.g. : Start, stop and direction commands through digital inputs X1 and X2.



X2:REV	X1: FWD	Start and stop
0	0	Stop
0	1	Forward
1	0	Reverse
1	1	Stop

Parameters setting:
P0−004 = 2
P3−001 = 03
P3−002 = 04

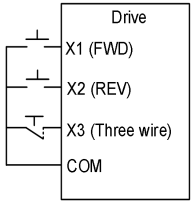
- **1: Two wire control 2.** E.g. : Start, stop and direction commands through digital inputs X1 and X2.



X2:REV	X1: FWD	Start and stop
0	0	Stop
0	1	Forward
1	0	Stop
1	1	Reverse

Parameters setting:
P0−004 = 2
P3−001 = 03
P3−002 = 04

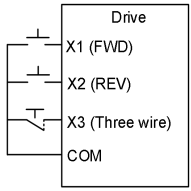
- **2: Three wire control 1.** E.g.: Pulse start forward through X1, 0->1: start forward. Pulse start reverse through X2, 0->1: start reverse. Pulse stop through digital input X3: 1->0: stop.



X3: Three-wire	X2: REV	X1: FWD	Start and stop
0	-	-	Stop
1	0	0	Hold
1	0	0—>1	Forward
1	0—>1	0	Reverse
1	1	1	Hold

Parameter settings:
P0−004 = 2
P3−001 = 03
P3−002 = 04
P3−003 = 33

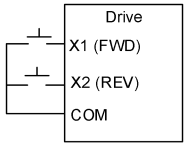
- **3: Three wire control 2.** E.g.: Pulse start forward through X1, 0->1: start forward. Pulse start reverse through X2, 0->1: start reverse. Pulse stop through digital input X3: 1->0: stop.



X3: Three-wire	X2: REV	X1: FWD	Start and stop
0	-	-	Stop
1	0	0	Hold
1	0	0—>1	Forward
1	0—>1	0	Reverse
1	1	1	Reverse

Parameter settings:
P0−004 = 2
P3−001 = 03
P3−002 = 04
P3−003 = 33

- **4: Two wire control 3.** E.g.: Pulse start through X1, 0->1: start. Stop through X2, 1 = stop. **Note**: if X2 0 = stop is required, set the digital input invert in P3−008.



X2: REV	X1: FWD	Start and stop
0	0	Hold
0	0—>1	Start
1	0	Stop
1	1	Stop

Parameter settings:
P0−004 = 2
P3−001 = 03
P3−002 = 04

Parameter	Name	Default	Range	Unit	Attribute
P3-017	Reserved	0	0 ... 65535	/	×
P3-018	Reserved	0	0 ... 65535	/	×
P3-019	Digital output terminal filter time	0	0 ... 500	ms	×
	Defines a filtering time for digital outputs.				
P3-020	Y1 terminal output function selection	3	0 ... 99	/	○
P3-021	Y2 terminal output function selection	9	0 ... 99	/	○
P3-022	Relay 1 output function selection	15	0 ... 99	/	○
P3-023	Relay 2 output function selection	0	0 ... 99	/	○
P3-024	Relay 3 output function selection	0	0 ... 99	/	○

Parameters P3-020 … P3-024 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: Speed reach maximum speed**

  The signal is enabled if the actual speed reaches or higher than the maximum speed.
- **5: Speed reach minimum speed**

  The signal is enabled if the actual speed reaches or lower than the minimum speed.
- **6: Acceleration**

  The signal is enabled when the drive in accelerating process.
- **7: Deceleration**

  The signal is enabled when the drive in decelerating process.
- **8: Zero speed**

  The signal is enabled when the actual speed reaches the zero speed.
- **9: Speed reach reference speed**

  The signal is enabled when the actual speed reaches the reference speed.
- **10: Position reach reference position**

  When the position deviation between the actual position and the set position is less than the value of parameter B0-011 and the duration reach the time defined by parameter B0-029, the signal is enabled.
- **11: Orientation complete**

  The signal output is enabled after the orientation is completed in position loop mode.
- **12: Brake chopper is working**

  The signal output is enabled when the built-in brake chopper is working.
- **13: Authorized**

  When the drive is in the authorized state, it outputs a signal.

Parameter	Name	Default	Range	Unit	Attribute

- **14: Application fault output**

  Output a signal when there is an application fault. Application faults refer to fault code in F3−050.

- **15: Fault output**

  When the drive is in the stop status due to fault output, the signal is enabled.

- **16: Communication control**

  Output a signal under communication control.

- **17: Simple PLC every step operation has been completed**

  When the simple PLC completes each step, it outputs a signal with a signal width of 500ms.

- **18: Simple PLC all steps operation has been completed**

  When the simple PLC runs for one cycle, it outputs a signal with a signal width of 500ms.

- **19: Reserved**

- **20: RUN output but not jogging**

  The signal is in running state but not in jogging state.

- **21: Stop status output continuously for a period of time**

  This signal is output after the drive switch off the output, and the holding time of this signal is determined by the value of parameter P3−033.

- **22...50: Reserved**

- **51: Frequency reach output (FAR)**

  The signal is enabled when the deviation between the output frequency and the reference frequency is within the detection width setting range; Please refer to P3−027 parameter for more information.

- **52: Frequency level detection 1 output (FDT1)**

  When the output frequency is higher than FDT1 upper limit (P3−029), the signal is enabled. When the output frequency is less than FDT1 lower limit (P3−030), the signal is disabled. Refer to parameters P3−029 … P3−030 for details.

- **53: Frequency level detection 2 output (FDT2)**

  When the output frequency is higher than FDT2 upper limit (P3−031), the signal is enabled. When the output frequency is less than FDT2 lower limit (P3−032), the signal is disabled. Refer to parameters P3−031 … P3−032 for details.

- **54: Non−fault output**

  Output a signal when the drive has no fault.

- **55: Torque reach output**

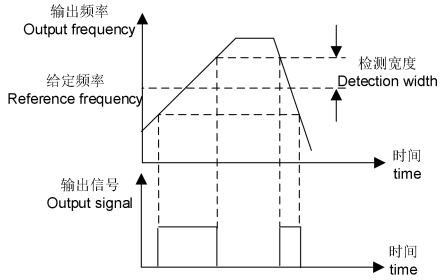
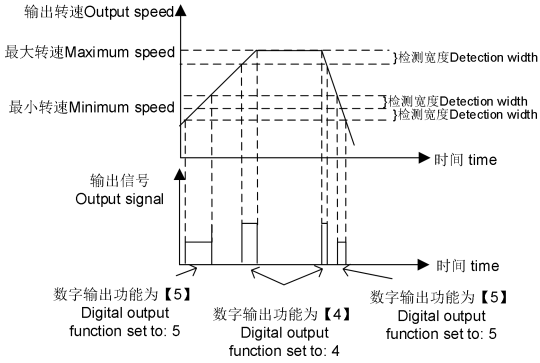
  When the output torque exceeds the value of parameter P3−034 and lasts longer than P3−035 setting, the signal is enabled. When the output torque is lower than P3−034 setting, the signal is disabled. Refer to parameters P3−034 … P3−036 for details.

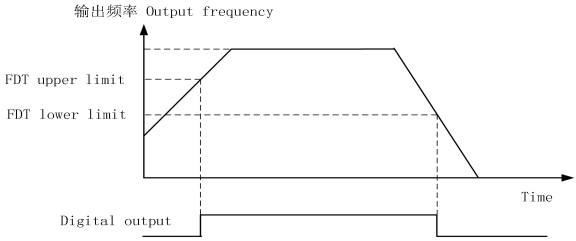
- **56: Current reach output**

  When the output current exceeds the value of parameter P3−037 and lasts longer than P3−038 setting, the signal is enabled. When the output current is lower than P3−037 setting, the signal is disabled. Refer to parameters P3−037 … P3−039 for details.

- **57: Motor pre−overload output**

<table>
<tr><th>Parameter</th><th>Name</th><th>Default</th><th>Range</th><th>Unit</th><th>Attribute</th></tr>
<tr><td></td><td colspan="5">When both the ones and tens position of the parameter E0−031 are 1, when the output current continuously exceeds the motor pre overload protection value (E0−032) and the time exceeds the motor pre overload detection time (E0−033) during operation, the output signal is enabled.
● 58: Feed complete
Output a signal when a single feed cycle is completed, and the output is disabled when the next feed cycle starts.
● 59: Position out of tolerance
In position loop mode, the signal is enabled when a position out of tolerance action occurs. Please refer to parameter B0−059 for details.
● 60: High speed pulse output.
Note: This selection is only available in V9 series products.
The output pulse signal is only supported by Y2 terminal, and the maximum frequency of the output pulse is 50 Khz. Please refer to parameters B1−009...B1−012 for details.
● 61...99: Reserved</td></tr>
<tr><td>P3−025</td><td>Digital output invert</td><td>0000</td><td>0000 ... 001F</td><td>/</td><td>×</td></tr>
<tr><td></td><td colspan="5"><table><tr><td>Item</td><td>Reserved</td><td>RA3</td><td>RA2</td><td>RA1</td><td>Y2</td><td>Y1</td></tr><tr><td>Default</td><td>0000 0000 000</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>Bit</td><td>bit15 … 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>P3−026</td><td>Virtual terminal output reference</td><td>0000</td><td>0000 ... 001F</td><td>/</td><td>×</td></tr>
<tr><td></td><td colspan="5"><table><tr><td>Item</td><td>Reserved</td><td>RA3</td><td>RA2</td><td>RA1</td><td>Y2</td><td>Y1</td></tr><tr><td>Default</td><td>0000 0000 000</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>Bit</td><td>bit15 … bit5</td><td>bit4</td><td>bit3</td><td>bit2</td><td>bit1</td><td>bit0</td></tr></table>● 0: Virtual terminal output is OFF
● 1: Virtual terminal output is ON</td></tr>
<tr><td>P3−027</td><td>Frequency reach detect width</td><td>2.00</td><td>0.00 ... 655.35</td><td>Hz</td><td>○</td></tr>
<tr><td></td><td colspan="5">This parameter is used to detect the deviation between output frequency and reference frequency. If a output terminal function is set to “51: Frequency reach output”, the deviation between the output frequency and the reference frequency if is in the range of P3−027 setting, the output is enabled, as shown in the below figure.</td></tr>
</table>

Parameter	Name	Default	Range	Unit	Attribute
					
P3-028	Speed reach detection width	5	1 ... 65535	rpm	○
	This parameter is used to detect the deviation between output speed and reference speed. If a digital / relay output terminal function is set to "4: Speed reach maximum speed" or "5: Speed reach minimum speed", if the deviation between the output speed and the maximum / minimum speed is in the range of P3-028 setting, the output is enabled, as shown in the following figure. 				
P3-029	FDT1 upper limit	3.00	0.00 ... 655.35	Hz	○
P3-030	FDT1 lower limit	2.50	0.00 ... 655.35	Hz	○
P3-031	FDT2 upper limit	3.50	0.00 ... 655.35	Hz	○
P3-032	FDT2 lower limit	3.00	0.00 ... 655.35	Hz	○

Parameter	Name	Default	Range	Unit	Attribute
FDT function is used for detecting whether the output frequency in within the setting range. If a digital / relay output function is set to "52" (Frequency level detection 1 output) or "53" (Frequency level detection 2 output), the digital / relay output will be enabled if the output frequency is in the FDT range.  					
P3-033	Stop status output continuous time	2.00	0.00 ... 655.35	s	○
	When a digital output or relay output function is set to "21", this signal output is enabled after the drive switch off the output, and the signal last for the time defined by parameter P3-033. Refer to the selection "21" in parameters P3-020 … P3-024 for more information.				
P3-034	Torque reach detection value	0.0	0.0 ... 6553.5	%	○
P3-035	Torque reach detection delay time	0.010	0.000 ... 65.535	s	○
P3-036	Torque reach detection range	0.0	0.0 ... 6553.5	%	○
The difference between actual torque and torque reach detection value (P3-034) is lower than the value of P3-036, and remains for the duration of torque reach detection delay time (P3-035) the output is enabled. Refer to the selection "55" in parameters P3-020 … P3-024 for more information.					
P3-037	Current reach detection value	0.0	0.0 ... 6553.5	A	○
P3-038	Current reach detection delay time	0.010	0.000 ... 65.535	s	○
P3-039	Current reach detection range	0.0	0.0 ... 6553.5	%	○
The difference between actual current and current reach detection value (P3-037) is lower than the value of P3-039, and remains for the duration of current reach detection delay time (P3-038) the output is enabled. Refer to the selection "56" in parameters P3-020 … P3-024 for more information.					
P3-040	Fault output signal type	0000	0000 ... 0111	/	×
	Reserved.				

5.5 Analog Input and Output (P4)

Parameter	Name	Default	Range	Unit	Attribute
P4−000	AI1 filter time coefficient	20.0	0.0 ... 1000.0	ms	○
	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.				
P4−001	AI1 zero offset	0.00	−200.00 ... 200.00	%	○
	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. **Note**: The parameter F0−023 is the AI1 scaled value, F0−024 is the AI2 scaled value and F0−025 is the AI3 scaled value.				
P4−002	AI1 gain	100.00	0.00 ... 200.00	%	○
	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 P4−002 = 10/8 * 100.00 = 125.00%				
P4−003	AI2 filter time coefficient	20.0	0.0 ... 1000.0	ms	○
	See parameter P4−000.				
P4−004	AI2 zero offset	0.00	−200.00 ... 200.00	%	○
	See parameter P4−001.				
P4−005	AI2 gain	100.00	0.00 ... 200.00	%	○
	See parameter P4−002.				
P4−006	AI3 filter time coefficient	20.0	0.0 ... 1000.0	ms	○
	See parameter P4−000.				
P4−007	AI3 zero offset	0.00	−200.00 ... 200.00	%	○
	See parameter P4−001.				
P4−008	AI3 gain	100.00	0.00 ... 200.00	%	○
	See parameter P4−002.				

Parameter	Name	Default	Range	Unit	Attribute
P4−009	Analog input curve selection	4000	0000 ... 5999	/	×

One position: AI1 curve selection

- **0: Point−slope mode (P4−001 to P4−002)**

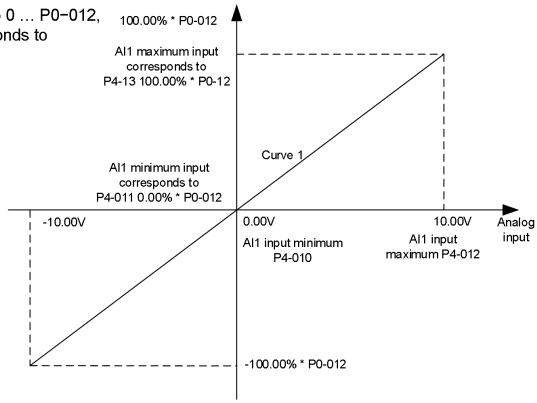
  In this mode, parameters P4−001 … P4−002 for AI1 are effective.

Example 1

Analog input 0 … 10V corresponds to 0 … P0−012, or analog input −10V … 10V corresponds to −P0−012 … P0−012,

Setting:
P4-009=0000
P4-001=0.00
P4-002=100.00
P4-010=0.00
P4-011=0.00
P4-012=10.00
P4-013=100.00

Note: first input the minimum analog input to set the analog zero offset, and then give the maximum analog input to set the analog gain

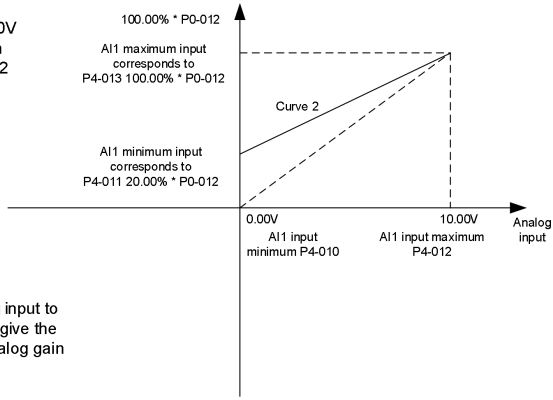


Example 2:

Assume that the analog input 0 ⋯ 10V corresponds to 20% of the maximum speed ... the maximum speed P0-012

P4-009=000
P4-001=0.00
P4-002=100.00
P4-010=0.00
P4-011=20.00
P4-012=10.00
P4-013=100.00

Note: first input the minimum analog input to set the analog zero offset, and then give the maximum analog input to set the analog gain

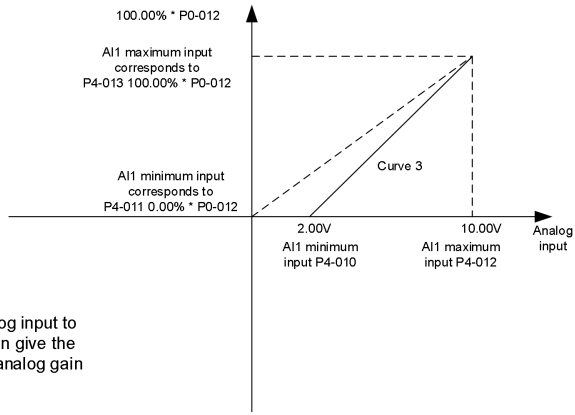


Parameter	Name	Default	Range	Unit	Attribute

Example 3:

Assume that the analog input
2 ⋯ 10V corresponds to
0 ... maximum speed P0-012

P4-009=000
P4-001=0.00
P4-002=100.00
P4-010=2.00
P4-011=0.00
P4-012=10.00
P4-013=100.00

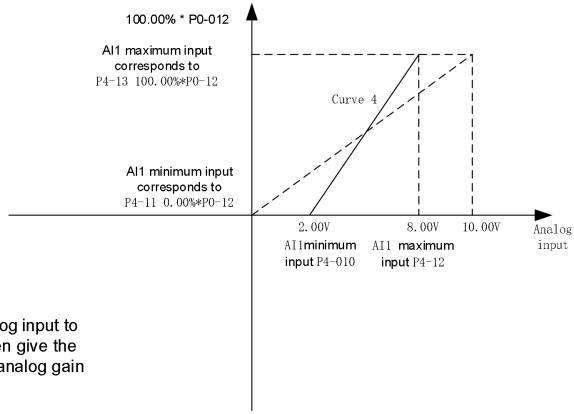


Note: first input the minimum analog input to set the analog zero offset, and then give the maximum analog input to set the analog gain

Example 4:

Assume that the analog input
2 ⋯ 8V corresponds to
0 ... maximum speed P0-012

P4-009=000
P4-001=0.00
P4-002=100.00
P4-010=2.00
P4-011=0.00
P4-012=8.00
P4-013=100.00



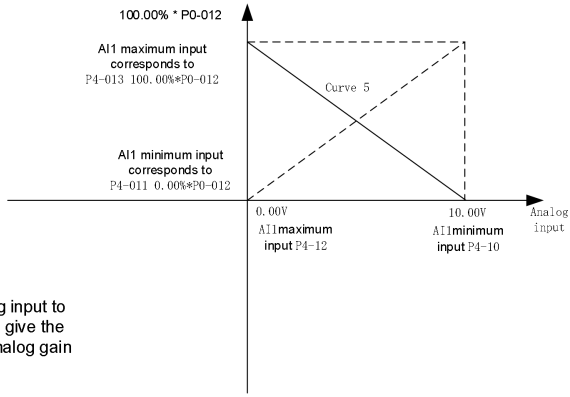
Note: first input the minimum analog input to set the analog zero offset, and then give the maximum analog input to set the analog gain

Parameter	Name	Default	Range	Unit	Attribute

Example 5:

Assume that the analog input 0 ⋯ 10V corresponds to maximum speed P0-012 ⋯ 0

P4-009=000
P4-001=0.00
P4-002=100.00
P4-010=10.00
P4-011=0.00
P4-012=0.00
P4-013=100.00



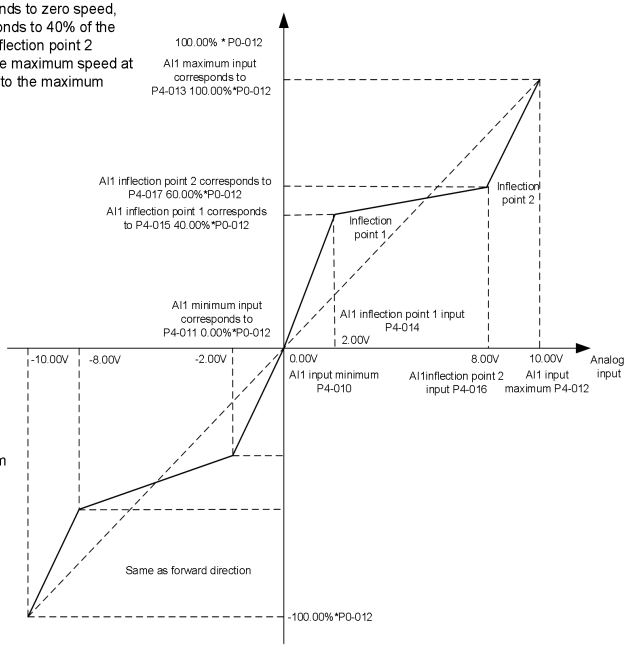
Note: first input the minimum analog input to set the analog zero offset, and then give the maximum analog input to set the analog gain

- **1: Multi-point mode (P4-010 to P4-017)**

  In this mode, parameters P4-010 … P4-017 are effective.

Assume that 0v corresponds to zero speed, inflection point 1 corresponds to 40% of the maximum speed at 2v, inflection point 2 corresponds to 60% of the maximum speed at 8v, and 10v corresponds to the maximum speed P0-012.

P4-009=001
P4-001=0.00
P4-002=100.00
P4-010=0.00
P4-011=0.00
P4-012=10.00
P4-013=100.00
P4-014=2.00
P4-015=40.00
P4-016=8.00
P4-017=60.00



Note: first input the minimum analog input to set the analog zero offset, and then give the maximum analog input to set the analog gain

Parameter	Name	Default	Range	Unit	Attribute
	Tens position: AI2 curve selection ● 0: Point−slope mode (P4−004 to P4−005), same as AI1. ● 1: Multi−point mode (P4−018 to P4−025) , same as AI1. **Hundreds position: AI3 curve selection** ● 0: Point−slope mode (P4−007 to P4−008) , same as AI1. ● 1: Multi−point mode (P4−026 to P4−033) , same as AI1. **Thousands position: negative analog input** ● 0: AI1 … AI3 all support positive and negative voltage. ● 1: AI1 input only support positive voltage, AI2 and AI3 input support positive and negative voltage. If AI1 receive a negative value, it will be considered as zero. ● 2: AI2 input only support positive voltage, AI1 and AI3 input support positive and negative voltage. If AI2 receive a negative value, it will be considered as zero. ● 3: AI3 input only support positive voltage, AI1 and AI2 input support positive and negative voltage. If AI3 receive a negative value, it will be considered as zero. ● 4: AI1 and AI2 input only support positive voltage, AI3 input support positive and negative voltage. If AI1 and AI2 receive a negative value, it will be considered as zero. ● 5: AI1, AI2 and AI3 all only support positive voltage. If AI1, AI2 and AI3 receive a negative value, it will be considered as zero.				
P4−010	**AI1 minimum input value**	0.00	−10.00 ... 10.00	V	×
P4−011	**Percentage corresponding to AI1 minimum input**	0.00	−100.00 ... 100.00	%	×
P4−012	**AI1 maximum input value**	10.00	−10.00 ... 10.00	V	×
P4−013	**Percentage corresponding to AI1 maximum input**	100.00	−100.00 ... 100.00	%	×

Parameters P4−010 … P4−013 are effective when ones position of parameter P4−009= "1". Whether the analog input is current (0…20mA) or voltage (0…10V) (select by jumper), expressed in voltage, 0…10V.

For example, 0…10V corresponds to 0…1500 rpm by default, require 2…10V corresponds 0…1500 rpm, set P4−010 = 2.00:

① Set the A1 jumper to the V side(default).

② P0−005 = 2(AI1 used as speed reference).

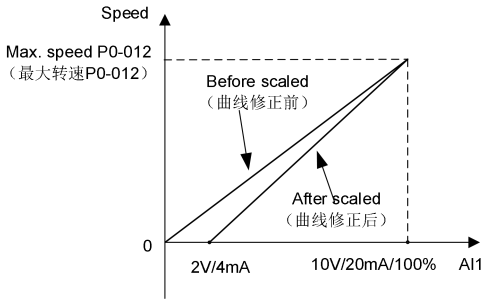
③ P4−009 = 4000 (default, AI1 no negative value).

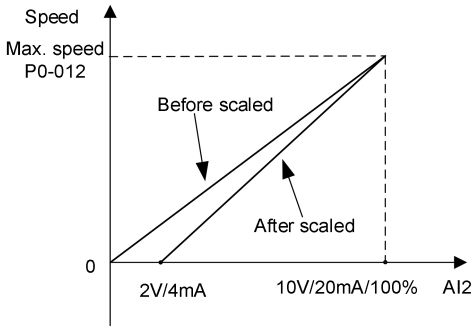
④ **P4−010= 2.00** (AI1 min. input).

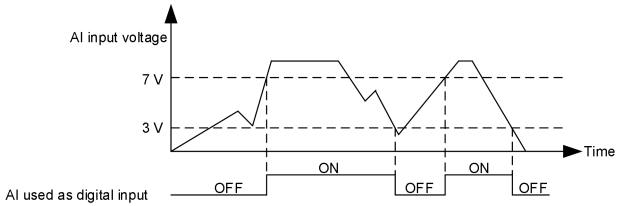
⑤ P4−011 = 0.00 (default, mimimum speed is 0).

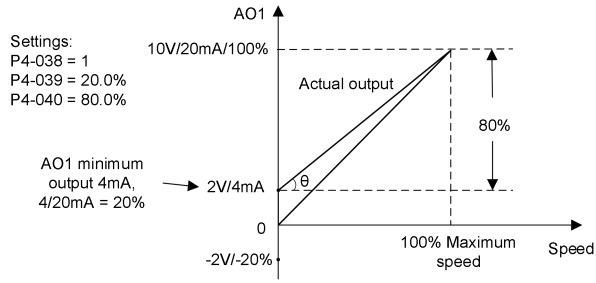
⑥ P4−012 = 10.00 (default, AI1 max input 10V).

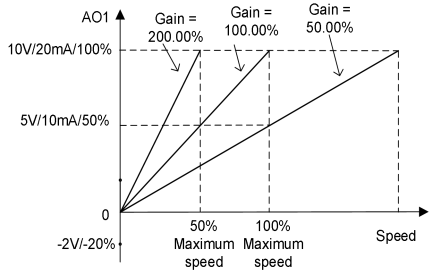
⑦ P4−013 = 100.00 (default, maximum speed is 1500).

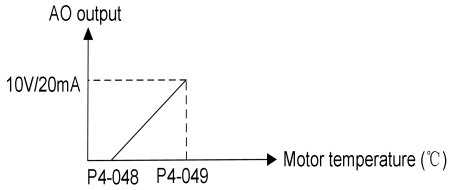
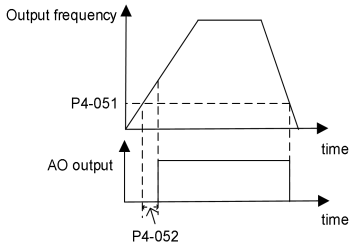
Parameter	Name	Default	Range	Unit	Attribute
					
P4-014	AI1 inflection 1 input	2.00	−10.00 ... 10.00	V	×
P4-015	Percentage corresponding to AI1 inflection 1 input	40.00	−100.00 ... 100.00	%	×
P4-016	AI1 inflection 2 input	8.00	−10.00 ... 10.00	V	×
P4-017	Percentage corresponding to AI1 inflection 2 input	60.00	−100.00 ... 100.00	%	×
Parameters P4−014 … P4−017 see selection ones position = "1" in the parameter P4−009.					
P4-018	AI2 minimum input value	0.00	−10.00 ... 10.00	V	×
P4-019	Percentage corresponding to AI2 minimum input	0.00	−100.00 ... 100.00	%	×
P4-020	AI2 maximum input value	10.00	−10.00 ... 10.00	V	×
P4-021	Percentage corresponding to AI2 maximum input	100.00	−100.00 ... 100.00	%	×
	Parameters P4−018 … P4−021 are effective when tens position of parameter P4−009= "1". Whether the analog input is current (0…20mA) or voltage (0…10V) (select by jumper), expressed in voltage, 0…10V. For example, 0…20mA corresponds to 0…1500 rpm by default, require 4…20mA corresponds 0…1500 rpm, set P4−018 = 2.00: ① Set the AI2 jumper to the I side(default). ② P0−005 = 6 (AI2 used as speed reference). ③ P4−009 = 4000 (default, AI2 no negative value). ④ **P4−018 = 2.00** (AI2 min. input is 4mA = 2V display). ⑤ P4−019 = 0.00 (default, mimimum speed is 0). ⑥ P4−020 = 10.00 (default, AI2 max input is 20mA = 10V display). ⑦ P4−021 = 100.00 (default, maximum speed is 1500).				

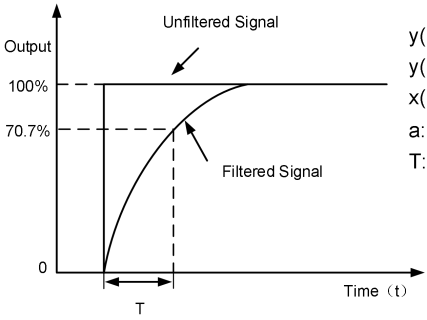
Parameter	Name	Default	Range	Unit	Attribute
					
P4-022	AI2 inflection 1 input	2.00	−10.00 ... 10.00	V	×
P4-023	Percentage corresponding to AI2 inflection 1 input	40.00	−100.00 ... 100.00	%	×
P4-024	AI2 inflection 2 input	8.00	−10.00 ... 10.00	V	×
P4-025	Percentage corresponding to AI2 inflection 2 input	60.00	−100.00 ... 100.00	%	×
Parameters P4−022 … P4−025 see selection tens position = "1" in the parameter P4−009.					
P4-026	AI3 minimum input value	0.00	−10.00 ... 10.00	V	×
P4-027	Percentage corresponding to AI3 minimum input	0.00	−100.00 ... 100.00	%	×
P4-028	AI3 maximum input value	10.00	−10.00 ... 10.00	V	×
P4-029	Percentage corresponding to AI3 maximum input	100.00	−100.00 ... 100.00	%	×
Parameters P4−026 … P4−029 are effective when hundreds position of parameter P4−009= "1".					
P4-030	AI3 inflection 1 input	2.00	−10.00 ... 10.00	V	×
P4-031	Percentage corresponding to AI3 inflection 1 input	40.00	−100.00 ... 100.00	%	×
P4-032	AI3 inflection 2 input	8.00	−10.00 ... 10.00	V	×
P4-033	Percentage corresponding to AI3 inflection 2 input	60.00	−100.00 ... 100.00	%	×
See selection hundreds position = "1" in the parameter P4−009.					
P4-034	Analog input AI1 to AI3 as digital input enable	0	0 ... 999	/	×
P4-035	AI1 used as digital input function selection	0	0 ... 63	/	×
P4-036	AI2 used as digital input function selection	0	0 ... 63	/	×
P4-037	AI3 used as digital input function selection	0	0 ... 63	/	×

Parameter	Name	Default	Range	Unit	Attribute
	AI1, AI2 and AI3 can be configured as digital inputs through parameter P4−034. When analog inputs AI1 / AI2 / AI3 are used as digital inputs, the functions are same as digital inpus X1 … X7. When analog inputs AI1 / AI2 / AI3 are used as digital inputs, the digital input is ON when the analog input voltage higher than 7V and it is OFF when the analog input voltage less than 3V. Analog input volage ＞7V: ON (positive logic) Analog input volage ＜3V: OFF (positive logic)  **P4−034 ones position: AI1 used as digital input enable** ● 0: AI1 is used as analog input ● 1: AI1 is used as digital input **P4−034 tens position: AI2 used as digital input enable** ● 0: AI2 is used as analog input ● 1: AI2 is used as digital input **P4−034 hundreds position: AI3 used as digital input enable** ● 0: AI3 is used as analog input ● 1: AI3 is used as digital input **Note**: When analog inputs AI1 / AI2 / AI3 are used as digital inputs, the common end must be independent, cannot share the common with digital inputs X1 … X7.				
P4−038	**AO1 analog output function selection**	0	0 ... 15	/	○
	The parameter P4−038 / P4−041 are used to set the AO1 / AO2 output function. ● **0: Reference speed.** 10V/20mA = Maximum speed P0−012. ● **1: Running speed.** 10V/20mA = Maximum speed P0−012. ● **2: Reserved** ● **3: Current**. 10V/20mA = Motor rated current P6−004 * 2. ● **4: DC bus voltage**.10V/20mA = 1400V. ● **5: Reserved** ● **6: Ramp speed**. 10V/20mA = Maximum speed P0−012. ● **7: Communication output.** The value of communication address 0x8006, 10V/20mA =10000. ● **8: Motor temperature.** 0V/0mA = temperature value in parameter P4−048, 10V/20mA = temperature value in parameter P4−049.				

Parameter	Name	Default	Range	Unit	Attribute
	• **9: Output AI1**. 0V/0mA … 10V/20mA corresponds to AI1 0V/0mA … 10V/20mA. • **10: Output AI2.** 0V/0mA … 10V/20mA corresponds to AI2 0V/0mA … 10V/20mA. • **11: Output AI3.** 0V/0mA … 10V/20mA corresponds to AI3 0V … 10V. • **12: Torque.** 10V/20mA = Motor rated torque * 2. • **13: Communication output 2.** The value of communication address 0x8007. 10V/20mA =10000. • **14: Output power.** 10V/20mA = Motor rated power. • **15: Reserved**				
P4−039	AO1 zero offset	0.00	−100.00 ... 100.00	%	○
	Defines the minimum value of the analog output signal AO1. The parameters P4−039 and P4−040 will change the AO1 output timely. AO1 and AO2 are identical. Take AO1 as an example: If maximum speed is 1500 rpm, AO1 is used to output actual running speed: The requirements is **AO1 output 4…20mA corresponds to 0 … 1500 RPM**, then set the parameters as follow: P3−038 = 1 P3−039 = 20.00% P3−040 = 80.00% The AO1 characteristics curve is as shown in the following figure. 				
P4−040	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 P0−012 when AO1 output function is actual speed under default parameters. If 10V/20 mA = 200% of maximum speed P0−012, then set P4−040 = 200.00.				

Parameter	Name	Default	Range	Unit	Attribute
					
P4-041	AO2 analog output function selection	0	0 ... 15	/	○
P4-042	AO2 zero offset	0.00	−100.00 ... 100.00	%	○
P4-043	AO2 gain	100.00	0.00 ... 200.00	%	○
Parameters P4−041 … P4−043 please see parameters P4−038 … P4−040.					
P4-044	AI disconnection detection value	1.500	0.000 ... 10.000	V	○
	When the AI detection function is activated (parameter P4−047), the analog input voltage is lower than the value of parameter P4−044, and stays continuously for the defined detection time (P4−046), the drive trips on a fault and the motor coasts to stop.				
P4-045	AI out of range detection value	12.000	0.000 ... 15.000	V	○
P4-046	AI disconnection detection time	3	0 ... 65535	S	○
P4-047	AI disconnection and out of range detection enable	0	0...3	/	○
When the AI detection function is activated (parameter P4−047) and the analog input voltage is higher than the value of parameter P4−045 for the time P4−046, the drive trips on a fault and the motor coasts to stop. ● **0: AI1 ... AI3 disconnection and out of range detection are prohibited.** AI1, AI2 and AI3 disconnection and out of range detection function are disabled. ● **1: Enables AI1 disconnection and out of range detection.** AI1 disconnection and out of range detection function is activated. ● **2: Enables AI2 disconnection and out of range detection.** AI2 disconnection and out of range detection function is activated. ● **3: Enables AI3 disconnection and out of range detection.** AI3 disconnection and out of range detection function is activated.					
P4-048	AO output temperature start value	0	−40 ... 140	℃	○
P4-049	AO output temperature end value	130	0 ... 140	℃	○

<table>
<tr><th>Parameter</th><th>Name</th><th>Default</th><th>Range</th><th>Unit</th><th>Attribute</th></tr>
<tr><td colspan="6">See the selection of parameter P4−038 = "8".
When it is necessary to output the motor temperature through analog output terminal:
We should define the temperature value (defined by parameter P4−048) at 0V/0mA (minimum analog output).
In addition, we should define the temperature value (defined by parameter P4−049) at 10V/20mA (maximum analog output).
 
</td></tr>
<tr><td>P4−050</td><td>Analog input one−button measurement</td><td>0</td><td>0 ... 65535</td><td>/</td><td>○</td></tr>
<tr><td></td><td colspan="5">The parameter is used to measure the minimum and maximum value of analog inputs.
Ones position: AI1
● 1: AI1 one−button measure minimum input.
When start the measurement, please confirm the current AI1 input is in the minimum input.
● 2: AI1 one−button measure maximum input.
When start the measurement, please confirm the current AI1 input is in the maximum input.
Tens position: AI2
● 1: AI2 one−button measure minimum input. See selection = "1" in ones position.
● 2: AI2 one−button measure maximum input. See selection = "2" in ones position.
Hundreds position: AI3
● 1: AI3 one−button measure minimum input. See selection = "1" in ones position.
● 2: AI3 one−button measure maximum input. See selection = "2" in ones position.
Note: After the measurement is complete, the value reverts back to 0 automatically.</td></tr>
<tr><td>P4−051</td><td>AO output motor current minimum frequency</td><td>0.0</td><td>0.0 ... 50.0</td><td>Hz</td><td>○</td></tr>
<tr><td>P4−052</td><td>AO output current delay time</td><td>0</td><td>0 ... 2000</td><td>ms</td><td>○</td></tr>
<tr><td colspan="6">When the AO output function is set to "3" (current):
If the actual frequency is lower than the value of P4−051, the AO output voltage is forced to zero.
If the actual frequency is higher than the value of P4−051 and continuously for the delay time (defined by parameter P4−052), the AO output voltage according to actual current signal.
 
</td></tr>
</table>

Parameter	Name	Default	Range	Unit	Attribute
P4−053	AI zero speed offset	10	10 ... 1000	RPM	○
	If an analog input is used as speed reference and the speed reference is lower than the value of P4−053, the speed reference is forced to zero speed. This function is very useful in applications where zero drift is avoided or where it is desired not to operate at too low speed.				
P4−054	AO1 filter factor	200	0 ... 1000	/	○
P4−055	AO2 filter factor	200	0 ... 1000	/	○
	Defines a first order low−pass filter for analog outputs. The higher the filter factor setting, the slower the dynamic response of the analog output; Conversely, the lower the filter factor setting, the faster the dynamic response of the analog output, but there may be fluctuations due to unstable output.  y(n)=ax(n)+(1-a)y(n-1) y(n): filtered signal x(n):unfiltered signal a: filter time constant，a=1/T T:filter time				
P4−056	AO zero offset mode	1	0 ... 1	/	○
	Define whether the analog output zero offset is on the Y−axis or X−axis. The examples in this manual are based on the Offset in Y−axis. ● **0: Offset in X−axis.** ● **1: Offset in Y−axis.**				

5.6 Start and Stop (P5)

Parameter	Name	Default	Range	Unit	Attribute
P5−000	Asynchronous motor sensor−less control start mode	0	0 ... 2	/	×

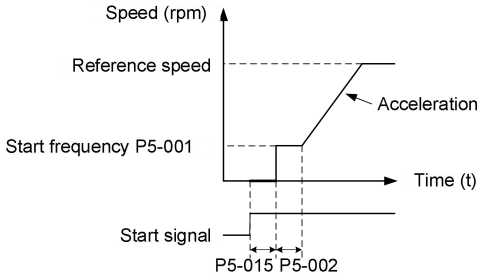
- **0: Normal start**

  For VF control, the drive start to run from the start frequency (parameter P5−001) for the time defined by parameter P5−002, and then accelerate to the reference speed.

  For vector control, the drive pre−magnetizes the motor before start. The pre−magnetizing time is defined by parameter P5−003, and then accelerate to reference speed from zero speed. If the motor is in free rotating (flying) state, the motor will be decelerated to low speed before the acceleration.

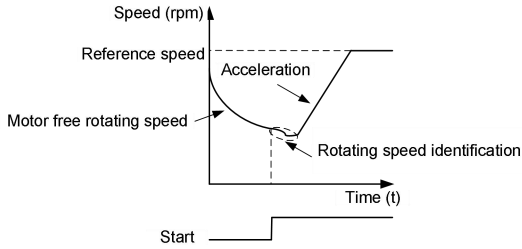
- **1: Start after DC injection** (only effective when VF control)

  DC current (parameter P5−004) is injected to the motor for the time defined by parameter P5−005. After the DC injection is completed, start to run from the start frequency (parameter P5−001) for the time defined by parameter P5−002, then accelerate to reference speed.



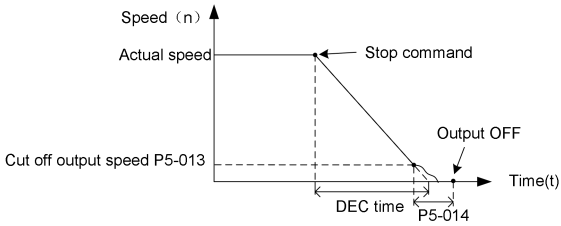
- **2: Flying start**

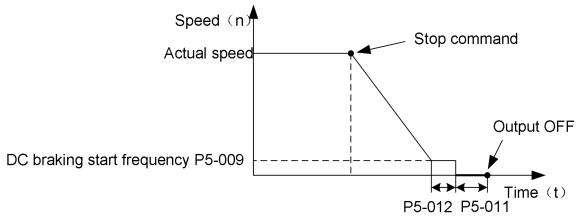
  The drive injects AC current (parameter P5−006) into the motor to identify the motor flying speed and start from the identified speed, and the start direction is defined by parameter P5−007. The current and voltage are smooth without any impact during the start.



Notes:

- The start mode for synchronous motor sensor−less control is defined by parameter P8−000.
- The parameter P5−017 is run signal delay time. After receiving a start command, the drive will not start until the delay time defined by parameter P5−017 has elapsed.

Parameter	Name	Default	Range	Unit	Attribute
P5−001	Start frequency	0.50	0.00 ... 30.00	Hz	×
P5−002	Start frequency holding time	0.0	0.0 ... 300.0	s	○
The parameters P5−001 and P5−002 are effective only when VF control, see selections of parameter P5−000 = "0" and "1".					
P5−003	Pre−magnetization time	0.3	0.0 ... 300.0	s	○
Effective only under vector control, see selection of parameter P5−000 = "0".					
P5−004	DC inject current	50.0	0.0 ... 120.0	%	○
P5−005	DC inject time	0.0	0.0 ... 300.0	s	○
The parameters P5−004 and P5−005 are effective only under VF control. 100% corresponds to the motor rated current. See selection of parameter P5−000 = "1".					
P5−006	Flying start measuring current	4.5	1.0 ... 6553.5	A	×
P5−007	Flying start direction	0	0 ... 2	/	×
	When P5−000 = 2, the drive injects AC current (parameter P5−006) into the motor to identify the motor flying speed and start from the identified speed, and the start direction is defined by parameter P5−007. ● **0: From motor forward rotating direction.** ● **1: From motor reverse rotating direction.** ● **2: From current motor flying direction.**				
P5−008	Stop mode	0	0 ... 2	/	×
	Selects the stop mode applied when the run signal is switched off. ● **0: Deceleration to stop** Stop the drive along the deceleration ramp. When the actual motor speed is less than the value of "P5−013" for the time defined by parameter "P5−014", the drive cut off the motor power supply.  ● **1: Coast to stop** Stop by cutting of the motor power supply. The motor coast to stop and rotates freely to zero speed. ● **2: Deceleration to stop + DC braking** First, decelerate to stop according to deceleration time, when the output frequency is lower than DC braking start frequency (parameter P5−009), inject the DC braking current (parameter P5−010), for the DC braking time (parameter P5−011), the drive cut off the motor supply. **Note**: P5−008 = 2 only effective when asynchronous motor VF control.				

Parameter	Name	Default	Range	Unit	Attribute
					
P5−009	DC braking start frequency	0.50	0.00 ... 30.00	Hz	×
P5−010	DC braking current	50.0	0.0 ... 120.0	%	○
P5−011	DC braking time	5.0	0.0 ... 300.0	s	○
Parameters P5−009 … P5−011 are for DC braking logic. See selection "2" in parameter P5−008.					
P5−012	DC current ramp−up time	500	0 ... 65535	ms	○
	DC current ramp−up time, both DC injection and DC braking are available.				
P5−013	Cut off output speed	60	1 ... 65535	rpm	○
P5−014	Cut off output delay time	0.5	0.0 ... 60.0	S	○
	Parameters P5−013 and P5−014 are for cut off the output delay time. See selection "1" in parameter P5−008.				
P5−015	Run signal delay time	0.000	0.000 ... 10.000	S	×
	When the drive receive a start signal for the time difined by parameter P5−015, and then start according the start mode (parameter P5−000). See parameter P5−000.				

5.7 Motor Parameters (P6)

Parameter	Name	Default	Range	Unit	Attribute
P6-000	Motor rated power	Model dependent	0.1 ... 6553.5	kW	×
	Defines the motor rated power. Must be equal to the value on the motor nameplate.				
P6-001	Motor rated voltage	380	1 ... 65535	V	×
	Defines the motor rated voltage. Must be equal to the value on the motor nameplate.				
P6-002	Motor rated frequency	50.0	0.1 ... 6553.5	Hz	×
	Defines the motor rated frequency. Must be equal to the value on the motor nameplate. **Note**: The parameter is only used for asynchronous motor.				
P6-003	Motor rated speed	Model dependent	0 ... 65535	rpm	×
	Defines the motor rated speed. Must be equal to the value on the motor nameplate.				
P6-004	Motor rated current	Model dependent	0.0 ... 6553.5	A	×
	Defines the motor rated current. Must be equal to the value on the motor nameplate.				
P6-005	Motor pole pairs	2	1 ... 200	/	×
	Defines the motor pole pairs. Must be equal to the value on the motor nameplate.				
P6-006	Motor inertia	Model dependent	0.001 ... 65.535	kg. m^2*10	×
	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.				
P6-007	Motor no-load current	Auto-tune	0.0 ... 6553.5	A	×
	Parameters P6-007 to P6-013 are the main motor parameters that affect the vector control mode. They are automatically obtained after auto-tune and stored in the memory until the next manual modification or auto-tune. **Note**: The parameter is only used for asynchronous motor.				
P6-008	Stator resistance	Auto-tune	0.000 ... 65.535	Ω	×
	Parameters are automatically obtained after auto tune.				
P6-009	Rotor resistance	Auto-tune	0.000 ... 65.535	Ω	×
	Note: The parameter is only used for asynchronous motor.				
P6-010	D-axis inductance (PMSM) Stator leakage inductance (ACIM)	Auto-tune	0.00 ... 655.35	mH	×
	For synchronous motor is D-axis inductance, for asynchronous motor is stator leakage inductance.				
P6-011	Q-axis inductance (PMSM) Mutual inductance (ACIM)	Auto-tune	0.00 ... 655.35	mH	×
	Note: For synchronous motor is Q-axis inductance, for asynchronous motor is mutual inductance.				
P6-012	Motor flux linkage	Auto-tune	0.000 ... 65.535	mWb	×
	Note: The parameter is only used for synchronous motor.				
P6-013	Maximum D-axis current	Auto-tune	0.0 ... 6553.5	A	×

Parameter	Name	Default	Range	Unit	Attribute
	Note: The parameter is only used for synchronous motor.				
P6-014	Inertia auto tune selection	0	0 ... 1	/	×
	Inertia auto tune function only enabled for sensor vector control, it can't be realized under sensor-less control ● **0: No action** ● **1: Inertia tune** Under closed-loop vector control, when the parameter is set to "1" and the "RUN" key is pressed, will start motor inertia auto-tune according to the inertia auto tune parameters set in P6-015 and P6-016. **Notes**: ➢ Before inertia auto-tune, it is necessary to ensure that the motor can operate normally after motor parameters auto-tune, and check the forward and reverse rotating are allowed on the motor shaft side. ➢ After start inertia auto-tune, the motor will rotate for the set number of turns P6-015 within the time period P6-16 and then stop.				
P6-015	No. of motor rotation for inertia auto tune	1	1 ... 10	/	×
	See parameter P6-014 for more information.				
P6-016	Inertia auto tune time	0.1	0.1 ... 300.0	s	×
	See parameter P6-014 for more information.				
P6-017	Motor parameters auto tune selection	0	0 ... 2 / 0 ... 4	/	×
	The range is 0 … 2 for asynchronous motor and 0 … 2 for synchronous. **For asynchronous motor**: ● 0: No action ● 1: Static tune ● 2: Rotate tune **For synchronous motor**: ● 0: No action ● 1: Static tune 1 ● 2: Rotate tune 1 ● 3: Static tune 2 ● 4: Rotate tune 2 **Notes**: ➢ The static auto-tune can be used when the motor is loaded and it is not possible to remove the load from the motor shaft. ➢ The motor must be free from load for the rotate auto-tune. A rotate auto-tune first performs a static auto-tune, and start rotating the motor at 70% of rated speed in the forward direction for several seconds, please be careful. ➢ If there is any emergency, press the M and STOP keys simultaneously to stop the drive in coast to stop mode.				

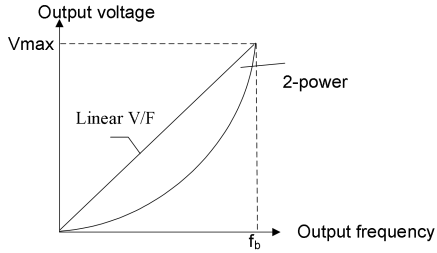
5.8 V/F Control (P7)

Parameter	Name	Default	Range	Unit	Attribute
P7−000	V/F curve selection	0	0 ... 2	/	×

Proper curve should be selected according to the actual situation.

- **0: Linear VF curve**

  Applicable to the constant torque load situation.

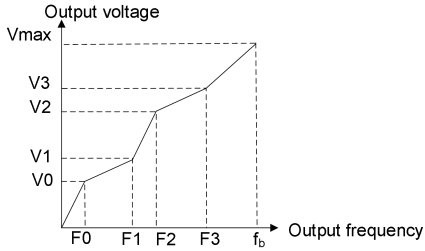


- **1: Multi−point V/F curve**

  Multi−point VF curve setting by user, applicable to sectional constant torque load.

  F0<F1<F2<F3<fb fb is the motor rated frequency

  V0≤V1≤V2≤V3≤100% V0, V1, V2, V3 are the percentage of motor rated voltage P6−001



- **2: Power of 2 V/F curve**

  Applicable to the variable torque loads such as fan and pump.

  See the selection "0" for the curve.

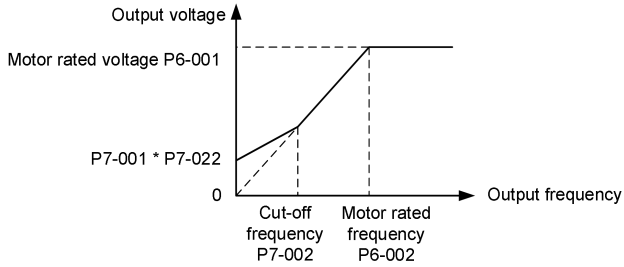
P7−001	Low frequency torque boost	0.0	0.0 ... 30.0	%	×
P7−002	Torque boost cut−off frequency	10.0	1.0 ... 50.0	Hz	×

The parameters P7−001 and P7−002 are use to set at a required value for the motor to run reliably at low speed.

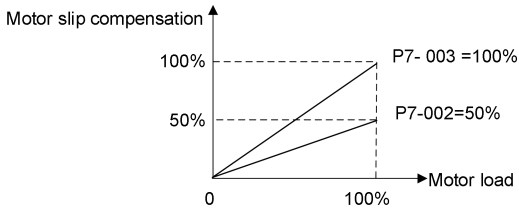
However, excessive value can cause the motor over−current and/or overheat.

100% of P7−001 corresponds to the motor rated voltage.

- **P7−001 = 0: Auto torque boost**
- **P7−001 = 0.1...30.0: Manual torque boost**



Note: The parameters P7−001 and P7−002 are effective only in V/F control (P0−003 = 3)

P7−003	V/F control slip compensation gain	100.0	0.0...300.0	%	○
	The function is used to keep the motor speed constant if load fluctuation or under heavy load in VF control. 100% means full slip gain; 0% means no slip gain. 				
P7−004	Multi−point V/F frequency 1	10.0	0.1 ... 6553.5	Hz	×
P7−005	Multi−point V/F voltage 1	20.0	0.1 ... 100.0	%	×
P7−006	Multi−point V/F frequency 2	20.0	0.1 ... 6553.5	Hz	×
P7−007	Multi−point V/F voltage 2	40.0	0.1 ... 100.0	%	×
P7−008	Multi−point V/F frequency 3	30.0	0.1 ... 6553.5	Hz	×
P7−009	Multi−point V/F voltage 3	60.0	0.1 ... 100.0	%	×
P7−010	Multi−point V/F frequency 4	50.0	0.1 ... 6553.5	Hz	×
P7−011	Multi−point V/F voltage 4	100.0	0.1 ... 100.0	%	×
Parameters P7−004 … P7−011 are effective when parameter P7−000 = "1". See the selection "1" in parameter P7−000.					
P7−012 ... P7−016	Reserved	0	0 ... 65535	/	×

P7−017	Oscillation suppression enable	1	0 ... 1	/	×
	● 0: Oscillation suppression is disabled ● 1: Oscillation suppression is enabled				
P7−018	Oscillation suppression mode selection	0	0 ... 2	/	×
	● 0: Mode 0 ● 1: Mode 1 ● 2: Mode 2 ● 3: Mode 3				
P7−019	Oscillation suppression factor	40	0 ... 200	/	×
	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.				
P7−020	Oscillation suppression gain	100	0 ... 500	%	○
	The higher the parameter setting, the stronger the Oscillation suppression effect.				
P7−021	Slip compensation under regeneration	1	0 ... 1	/	○
	● 0: Slip compensation under regeneration is not effective ● 1: Slip compensation under regeneration is effective				
P7−022	Torque boost coefficient	100	0 ... 600	%	○
	The parameter is used with parameter P7−001, this parameter is multiplied by P7-001 to obtain the final torque boost. 100% corresponds to the setting value of P7−001.				

5.9 PMSM Sensor−less Control (P8)

Parameter	Name	Default	Range	Unit	Attribute
P8−000	Synchronous motor sensor−less control start mode	0	0 ... 2	/	×

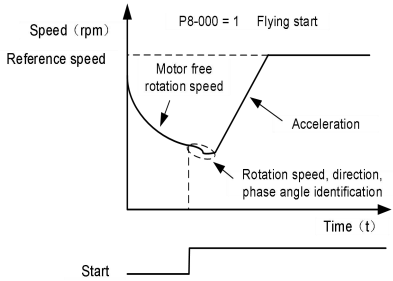
The parameter is used to set the start mode of synchronous motor sensor less control

- **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**

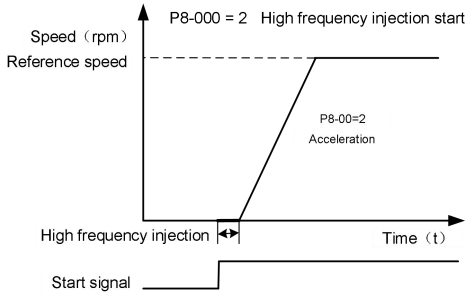
  The drive will automatically identify the motor speed and rotating direction and directly start from the identified speed. The current and voltage are smooth without any impact during the start.

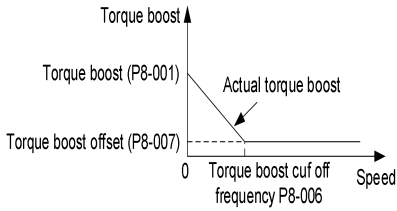


- **2: High frequency injection start**

  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.

Note: About the start mode of asynchronous motor, refer to the parameter P5−000.



P8−001	Synchronous motor torque boost coefficient	30.0	0.0 ... 50.0	%	×
	100% corresponds to motor rated current. The motor torque boost is defined by parameters P8−001, P8−006 and P8−007. The actual torque boost curve is shown in the figure. The value of torque boost cut off frequency should not set too small for occasions with heavy load. If the value is too small, it may lead to stall operation after start; If the value setting too high, the output current may increase even cause overcurrent trip.  				
P8−002	High frequency voltage injection gain	3.00	0.10 ... 60.00	%	×
	The parameter is effective when P8−000 = 2. The injection gain represents the intensity of the injection.				
P8−003	Synchronous motor start compensation coefficient	1.5	0.0 ... 3.0	%	×
	Reserved.				
P8−004	MTPA enable	0	0 ... 1	/	×
	Maximum torque per ampere ● **0: MTPA function is inactive.** ● **1: MTPA function is active.**				
P8−005	Inductance tune pulse width	0	0 ... 65535	/	○
	This parameter is obtained by auto−tune and does not need to be modified manually.				
P8−006	PM torque boost cut off frequency	30.0	10.0 ... 50.0	%	×
	See parameter P8−001. 100% corresponding to the motor rated speed (P6−003).				
P8−007	PM torque boost offset	0.0	0.0 ... 60.0	%	×
	Minimum limit value of torque boost. If it is a non−zero value, the minimum torque boost is limit by this parameter throughout the speed range.				

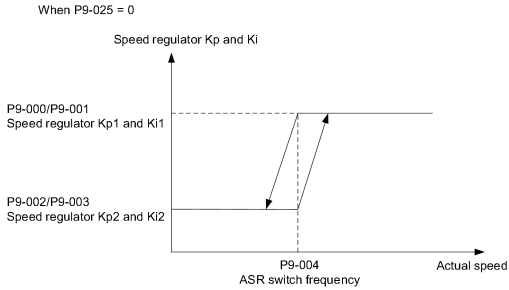
5.10 Vector Control (P9)

Parameter	Name	Default	Range	Unit	Attribute
P9−000	Speed regulator Kp 1	40.0	0.0 ... 6553.5	Hz	○
P9−001	Speed regulator Ki 1	60.0	0.0 ... 6553.5	ms	○
P9−002	Speed regulator Kp 2	40.0	0.0 ... 6553.5	Hz	○
P9−003	Speed regulator Ki 2	60.0	0.0 ... 6553.5	ms	○
P9−004	ASR switch frequency 0	5.0	0.0 ... 6553.5	Hz	○

Speed regulator Kp should be adjust according to rotating inertia of machines connecting with motor. For machines with large rotating inertia, please increase Kp value; for machines with small rotating inertia, please decrease Kp value. When Kp is greater than inertia, although the control response become quickly, but may cause speed oscillation. Reversely, if Kp setting is smaller than inertia, the control response will get slower and the time taken to adjust the speed to the stable value will longer.

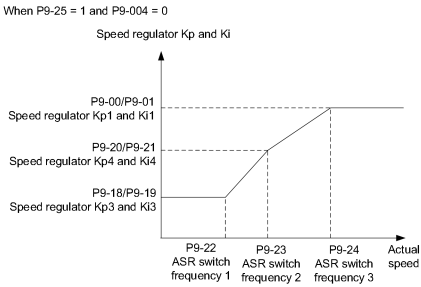
Speed regulator Ki defines the rate at which the speed controller output changes. The shorter the Ki setting, the faster the system responses. Too short Ki value may cause the system unstable.

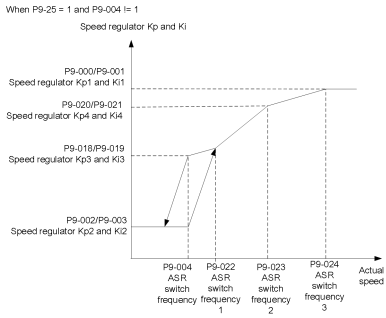
- **When parameter P9−025 = 0**, the speed regulator Kp and Ki are defined by parameters P9−001 … P9−005.

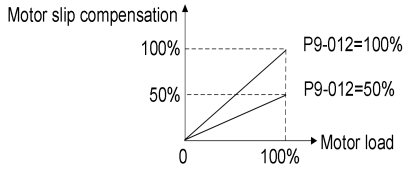


Note: When parameter P9−004 = 0, only speed regulator Kp1 and Ki1 are effective. (P9−000 and P9−001).

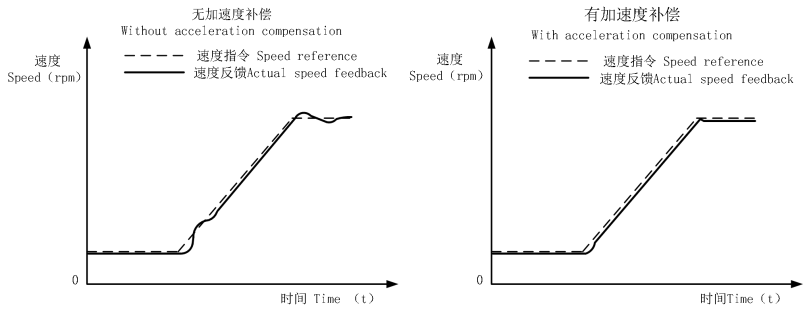
- **When parameter P9−025 = 1**, the speed regulator Kp and Ki are defined by parameters P9−000 … P9−004 and P9−018 … P9−024.





P9−005	Speed regulator output filter coefficient	1.0	0.0 ... 5.0	/	○
	Defines speed regulator output filter, The higher the parameter setting, the smoother the speed loop output, and the slower the response to sudden speed changes.				
P9−006	Current regulator Kp	0.10	0.00 ... 655.35	V/A	○
P9−007	Current regulator Ki	10.0	0.0 ... 6553.5	ms	○
P9−008	High speed current regulator Kp	0,10	0.00 ... 655.35	V/A	○
P9−009	High speed current regulator Ki	10.0	0.0 ... 6553.5	ms	○
P9−010	High speed current regulator PI switch enable	1	0 ... 1	/	○
The parameters P9−006 …P9−010 define the current regulator Kp and Ki. Vector control will control the motor output current and keep track the current. Usually the value can be obtained after auto−tune. • **P9−010 = 0: Current regulator Kp (P9−007) and Ki (P9−008) is effective in the entire speed range.** • **P9−010 = 1: Current regulator Kp and Ki are changed to the parameters P9−008 and P9−009 at high speed.**					
P9−011	High speed current regulator PI coefficient	100	50 ... 200	%	○
	The higher the parameter setting, the stronger the high−speed current regulator PI is.				
P9−012	Asynchronous motor slip compensation gain	100.0	0.0 ... 300.0	%	○
	The function is used to keep the motor speed constant if load fluctuation or under heavy load.  **Note**: Only valid under sensor/sensor−less vector control.				
P9−013	ACI slip limit (motoring status)	600	0 ... 900	rpm	×
	The parameter P9−013 limits the maximum slip compensation of the motor in motoring state.				
P9−014	ACI slip limit (regenerating status)	300	0 ... 900	rpm	×
	The parameter P9−014 limits the maximum slip compensation of the motor in regenerating state.				
P9−015	Field weakening gain	300	0 ... 1000	/	×
	Defines the field weakening gain when the motor speed running in field weakening state.				
P9−016	U phase current zero offset	5086	−32768 ... 32767	/	×
P9−017	V phase current zero offset	5092	−32768 ... 32767	/	×
The parameters P9−016 and P9−017 are reserved.					
P9−018	Speed regulator Kp 3	40.0	0.0 ... 6553.5	Hz	○
P9−019	Speed regulator Ki 3	60.0	0.0 ... 6553.5	/	○
P9−020	Speed regulator Kp 4	40.0	0.0 ... 6553.5	Hz	○
P9−021	Speed regulator Ki 4	60.0	0.0 ... 6553.5	/	○
P9−022	ASR switch frequency 1	0	0 ... 65535	rpm	○
P9−023	ASR switch frequency 2	0	0 ... 65535	rpm	○

P9-024	ASR switch frequency 3	0	0 ... 65535	rpm	○
P9-025	ASR switch enable	0	0 ... 1	/	×
When parameter P9-025 = 0, the speed regulator Kp and Ki are defined by parameters P9-001 … P9-005. **When parameter P9-025 = 1**, the speed regulator Kp and Ki are defined by parameters P9-000 … P9-004 and P9-018 … P9-024. See the parameter P9-000 for more information.					
P9-026	Current regulator decoupling gain	0	0 ... 100	%	○
	Decoupling gain of current regulator.				
P9-027	Field-weakening integration time	100	0 ... 100	/	×
	Defines the field-weakening integration time, together with parameter P9-015, constitute a PI regulator for field-weakening control.				
P9-028	Acceleration compensation	0.00	0.00 ... 655.35	s	×
	Defines the derivation time for acceleration compensation. In order to compensate inertia during acceleration, a derivative of the reference is added to the output of the speed regulator. As shown in the figure below, a large inertia load changes without compensation or with compensation during acceleration along a slope.				
P9-029	Speed regulator Ki delay time	0	0 ... 65535	ms	○
	When the operation time exceeds the delay time (P9-029), the speed loop integration begins to take effect.				
P9-030	Observer optimization	0	0 ... 1	/	×
	• **0: Inactive.** • **1: Active.**				
P9-031	Field-weakening voltage filtering coefficient	0.000	0.000 ... 1.000	/	×
	For the high speed applications, when the DC bus voltage fluctuates, set appropriate filter time to make the motor speed control more stable.				



5.11 Torque Control (PA)

Parameter	Name	Default	Range	Unit	Attribute
PA-000	Torque reference and direction selection	0000	0000 ... 0047	/	×

One position: Torque reference source selection

- 0: Modbus
- 1: Parameter PA-002
- 2: CAN
- 3: EtherCAT
- 4: AI1
- 5: AI2
- 6: AI3
- 7: PROFIBUS DP

Tens position: Torque direction

- 0: Follow the torque reference direction
- 1: Invert the torque reference direction.
- 2: Follow the RUN command direction

  Example: When P0-004 = 2, digital input X1 and X2 are used as forward and reverse input. Set P3-001 = 03 and P3-002 = 04, then:

  If X1 = 1 and X2 = 0, torque direction is positive (FWD).

  If X1= 0 and X2 = 1, torque direction is negative (REV).
- 3: Opposite to the RUN command direction.

  Example: When P0-004 = 2, digital input X1 and X2 are used as forward and reverse input. Set P3-001 = 03 and P3-002 = 04, then:

  If X1 = 1 and X2 = 0, torque direction is negative (REV).

  If X1= 0 and X2 = 1, torque direction is positive (FWD).
- 4: Follow or Invert torque reference direction by digital input.

  Example: When P0-004 = 2, digital input X1 and X2 are used as forward and reverse input. Set P3-001 = 03 and P3-002 = 04, then:

  If X1 = 1 and X2 = 0, torque direction follow the torque reference direction.

  If X1 = 0 and X2 = 1, torque direction is opposite to the torque reference direction.
- 5: Torque reference direction is defined by communication.

  ① When P0-004 = 0:

  If bit1 of address 0x8000 is 0, torque direction follow the torque reference direction.

  If bit1 of address 0x8000 is 1, torque direction is opposite to the torque reference direction.

  ② When P0-004 = 4:

  If bit1 of receive message 1 is 0, torque direction follow the torque reference direction.

  If bit1 of receive message 1 is 1, torque direction is opposite to the torque reference direction.

  ③ When P0-004 = 5:

  If bit1 of PZD1 is 0, torque direction follows the torque reference direction.

  If bit1 of PZD1 is 1, torque direction is opposite to the torque reference direction.

Parameter	Name	Default	Range	Unit	Attribute
PA−001	AI maximum input corresponding torque	100.0	−300.0 ... 300.0	%	○
	100.0 % = 100.0% of motor rated torque.				
PA−002	Torque reference value	0.0	−300.0 ... 300.0	%	○
	Torque reference when ones position of PA−000 is [1]. 100.0% = 100.0% of motor rated torque.				
PA−003	Torque acceleration time	0.00	0.00 ... 655.35	s	○
PA−004	Torque deceleration time	0.00	0.00 ... 655.35	s	○
Torque acceleration time: The accelerate time that the torque from zero accelerate to maximum torque. Torque deceleration time: The decelerate time that the torque from maximum torque decelerate to zero					
PA−005	Torque control forward max. speed selection	0	0 ... 3	/	○
	PA−005 and PA−006 are used to set the forward/reverse maximum speed limit in torque control. In torque control mode, when the torque command is higher than the load, the motor speed will accelerate to the maximum speed limit to prevent the motor continues acceleration. • **0: Parameter setting (PA−007)** • **1: AI1** • **2: AI2** • **3: AI3**				
PA−006	Torque control reverse max. speed selection	0	0 ... 3	/	○
	• **0: Parameter setting (PA−008)** • **1: AI1** • **2: AI2** • **3: AI3**				
PA−007	Torque control forward max. speed	100.0	0.0 ... 100.0	%	○
	Forward maximum speed when PA−005 = 0. 100.0% = Maximum speed P0−012.				
PA−008	Torque control reverse max. speed	100.0	0.0 ... 100.0	%	○
	Reverse maximum speed when PA−006 = 0. 100.0% = Maximum speed P0−012.				
PA−009	Torque control stop mode	0	0 ... 2	/	×
	Selects stop mode for torque control. • **0: Coast to stop** • **1...2: Reserved**				
PA−010	Torque control start compensation	5.0	0.0 ... 10.0	/	○
	This parameter is effective in the current type open loop vector control mode of asynchronous motors and is used to compensate for the stator resistance of asynchronous motors. This parameter can effectively prevent the asynchronous motor from stalling when starting at low frequency. **Note**: Only effective when parameter P0−002 = 5.				
PA−011	Speed control torque feed forward enable	0	0 ... 1	/	○
	• **0: Disable** • **1: Enable** The drive operates under speed control, but a torque value can be added to the output of the speed controller. This can be used to improve the regulation of systems where the speed loop gains need to be low for stability.				

5.12 Advanced Parameter (PB)

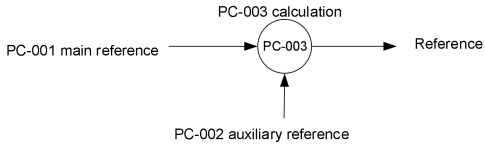
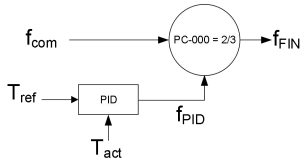
Parameter	Name	Default	Range	Unit	Attribute
PB-000	Carrier frequency	0.75 … 2.2kW: 8	1 ... 16	kHz	×
		3.7 … 11kW: 6	1 ... 16		
		15kW: 6	1 ... 12		
		18.5 … 30kW: 4	1 ... 12		
		37 … 45kW: 4	1 ... 8		
		55kW: 3	1 ... 6		
		75 … 90kW: 3	1 ... 5		
		110 … 160kW: 2	1 ... 4		
		185 … 500kW: 2	1 ... 2		
	Carrier frequency has an important impact on operations of drive and motor. When carrier frequency increases, the motor loss, motor temperature rising and motor noise will be decreased. If carrier frequency decreases, the drive temperature rising, the leakage current of motor and external radiation interference will be decreased. **Warning**: Generally, users are not recommended to change this parameter, as it may cause accidental damage.				
PB-001	Carrier frequency automatic adjustment	0	0 ... 2	/	×
	• **0: Carrier frequency automatic adjustment function is disabled.** • **1: Carrier frequency is adjusted automatically according to temperature.** • **2: Random carrier frequency.** **Note**: Only effective when P0-002 = 3 (V/F control mode).				
PB-002	Carrier frequency random depth	0	0 ... 10	/	×
	• **0: No adjustment** • **1...10: Carrier frequency random depth**				
PB-003	Voltage utilization	100	50 ... 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.				
PB-004	DC over voltage control enable	1	0 ... 1	/	×
PB-005	DC over voltage control voltage	700	300 ... 800	V	×
PB-006	DC over voltage control Kp	200	0 ... 65535	/	×
PB-007	DC over voltage control Ki	1000	0 ... 65535	/	×

Parameter	Name	Default	Range	Unit	Attribute
• **PB−004 = 0: Disable DC over voltage control** • **PB−004 = 1: Enable DC over voltage control** If the DC bus voltage reaches or exceeds the value defined by parameter PB−005, the drive decreases the braking torque, prolong deceleration time even controlling the motor speed higher than the reference speed. When the DC bus voltage is lower than the value defined by parameter PB−005, restore to normal operation. DC over voltage control use PI regulation, proportional gain and integration time are defined parameters PB−006 and PB−007. **Note**: If an external brake chopper or a brake resistor (if built−in brake chopper) is connected to the drive, must set PB−004 = 0.					
PB−008	Dynamic braking enable	0	0 ... 1	/	×
PB−009	Dynamic braking voltage	680	300 ... 760	V	×
The parameter of PB−008 enables the dynamic braking function. • **PB−008 = 0: Dynamic braking is disabled** • **PB−008 = 1: Dynamic braking is enabled.** The brake chopper working voltage is defined by parameter PB−009. For large rotating inertia applications and when rapid stop by braking is required, select matched brake chopper, brake resistor and set PB−008 to 1. **Note**: If an external brake chopper is installed, should set PB−008 = 1 too.					
PB−010	Flux braking enable	1	0 ... 1	/	×
PB−011	Flux braking control Kp	100	0 ... 65535	%	○
PB−012	Flux braking control Ki	50	0 ... 65535	/	×
• **PB−010 = 0: Disable** • **PB−010 = 1: Enable** When the motor decreases, the motor can be rapidly decelerated if magnetic flux braking is selected. The energy of the mechanical system is changed to thermal energy in the motor during the braking process. However, if the function is activated, the output current will become higher. Flux braking use PI regulation, proportional gain and integration time are defined by parameters PB−011 and PB−012.					
PB−013	DC under voltage control	0	0 ... 1	/	○
PB−014	DC under voltage control voltage	460	0 ... 65535	V	○
PB−015	DC under voltage control Kp	200	0 ... 65535	/	○
PB−016	DC under voltage control Ki	1000	0 ... 65535	/	○
• **PB−013 = 0: Disable** • **PB−013 = 1: Enable** The function of DC under voltage control is use to decrease the motor speed, the load inertial energy feedback to DC bus to keep DC voltage higher than the under voltage, avoid trip by under voltage. When the DC bus voltage is lower than the value defined by parameter PB−014, the drive decrease the motor speed to keep the DC voltage higher than the under voltage value (defined by parameter PB−014); During the control process, if the DC bus voltage returns to normal, the drive returns to normal operation mode. DC under voltage use PI regulation, proportional gain and integration time are defined by parameters PB−015 and PB−016.					

Parameter	Name	Default	Range	Unit	Attribute
PB-017	Automatic restart	0	0 ... 1	/	×
PB-018	Automatic restart delay time	0	0 ... 65535	s	×
• **PB-017 = 0: Disable** • **PB-017 = 1: Enable** When automatic restart function is active and the start signal is valid, if the drive is powered up and last the time defined by parameter PB-018, the drive will start automatically without the need for the personal to intervene. This function should be used judiciously. **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.					
PB-019	Output voltage correction factor	2000	100 ... 65535	/	×
PB-020	Maximum sampling output voltage	115	115 ... 65535	/	×
PB-021	UV line voltage zero offset	12187	0 ... 32767	/	×
PB-022	UW line voltage zero offset	12222	0 ... 32767	/	×
PB-023	Load type	0	0 ... 1	/	×
	• **PB-023 = 0: G type, constant torque / heavy load application** • **PB-023 = 1: L type, variable torque / light load application**				
PB-024	Dead-time compensation prediction	1200	0 ... 65535	/	×
PB-025	Dead-time compensation	100	0 ... 200	%	×
The parameters PB-024 and PB-025 generally do not require modification, only when there are special requirements for the output voltage waveform under specific circumstances, or when abnormal fluctuations in the motor occur due to output voltage waveform, commissioning can be through the guidance of the manufacturer.					
PB-026	Reserved				
PB-027	Reserved				
PB-028	Reserved				
PB-029	Reserved				
PB-030	Drooping rate	0.00	0.00 ... 100.00	%	
	When several drives drive one load, the function can distribute the load automatically between drives and make them work cooperatively. For example, for assembly line, this function can be used to balance loads, allocate loads between drives at different power levels in proportion to the power, and thus ensure the assembly line operate properly. Each drive adjusts output speed automatically according to its load condition and drooping rate setting.				
PB-031	Brake chopper continuous working fault time	0.00	0.00 ... 600.00	s	×
	When the continuous brake chopper working time is longer than the value of PB-031, the drive trips on a fault. When the set value is 0.00s, it indicates that the protection function is turned off.				
PB-032	PM motor sensor control over speed protection	0	0 ... 1	/	×
PB-033	PM motor sensor control over speed detect time	0.050	0.050 ... 0.500	s	○

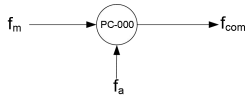
Parameter	Name	Default	Range	Unit	Attribute
• **PB−032 = 0: Inactive.** • **PB−032 = 1: Active.** When PB−032=1 and P0−002=0 (synchronous motor closed−loop vector control), the drive trips on a fault when motor over speed for the time defined by parameter PB−033.					
PB−034	Input phase loss	1	0 ... 1	/	×
	Activates/deactivates input phase loss detection. • **0: Inactive.** • **1: Active.** The drive trips on a fault if detects missing power supply voltage phase.				
PB−035	Output phase loss	0	0 ... 1	/	×
	Activates/deactivates motor phase loss detection. • **0: Inactive.** • **1: Active.** The drive trips on a fault if detects any of the motor phases is not connected.				

5.13 Process PID Control (PC)

Parameter	Name	Default	Range	Unit	Attribute
PC−000	Process open loop and process close loop calculation formula	0	0 ... 3	/	×
	The parameters in group PC are effective when P0−005 = 5 [PID]. ● **0: Speed reference is open loop main reference and auxiliary reference calculation.** Refer to PC−003 for more information. The reference is defined by main reference, auxiliary reference and calculation, is shown below:  ● **1: Speed reference is PID** The Frequency reference is defined by process PID output. Refer to PC−004 for more information. ● **2: Speed reference is open loop main reference and auxiliary reference calculation + PID.** ● **3: Speed reference is open loop main reference and auxiliary reference calculation – PID.**  				
PC−001	Open loop main reference selection	0	0 ... 11	/	○
	See parameter P0−005 for more information.				
PC−002	Limit selection and auxiliary reference selection	0000	0000 ... 1113	/	○
	Ones position: Auxiliary reference channel selection: ● 0: None ● 1: AI1 ● 2: AI2 ● 3: AI3 **Tens position: Auxiliary reference maximum limit selection** ● 0: Auxiliary reference 100% = maximum speed P0−012. ● 1: Auxiliary reference 100% = main reference. **Hundreds position: Main reference limit selection** ● 0: Both positive and negative values are valid. ● 1: Take positive values only. **Thousands position: PID output limit selection** ● **0:** PID output upper limit and lower limit (PC−017 and PC−018), 100.00 % = maximum speed P0−012. ● 1: PID output upper limit and lower limit (PC−017 and PC−018), 100.00 % = main reference.				

Parameter	Name	Default	Range	Unit	Attribute
PC－003	Open loop main reference and auxiliary reference calculation formula	0	0 ... 5	/	○

The main reference value fm can be added with an auxiliary reference value fa, and it results process open loop reference fcom. Such calculations as "add", "subtract", "bias", "max" and "min" are available for main reference value fm and auxiliary reference value fa.

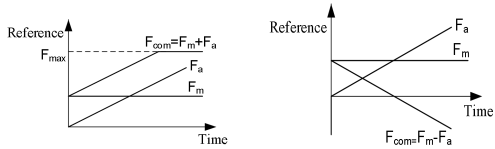


- **0: Main + Auxiliary**

  The auxiliary frequency reference value is superimposed on the main reference, the function is "add".

- **1: Main – Auxiliary**

  The auxiliary frequency reference value is superimposed on the main reference, the function is "subtract".

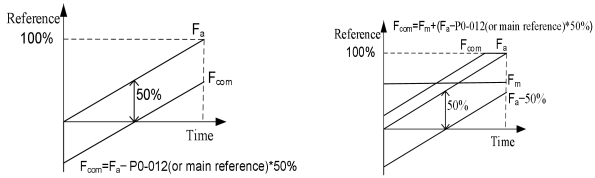


- **2: Auxiliary−50%**

  The auxiliary reference value subtracts the bias equal to 50% of the auxiliary reference full range value. The main reference value is disable at this calculation formula.

- **3: Main + Auxiliary−50%**

  Main reference + auxiliary reference−50%: The auxiliary reference value subtracts the bias equal to 50% of the auxiliary reference full range value and then superimposes on the main reference.

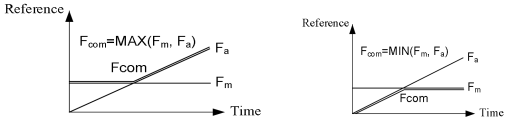


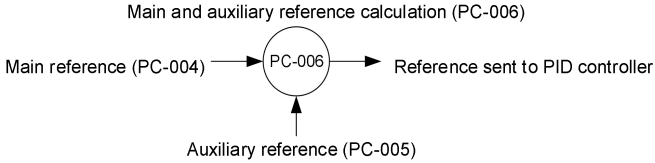
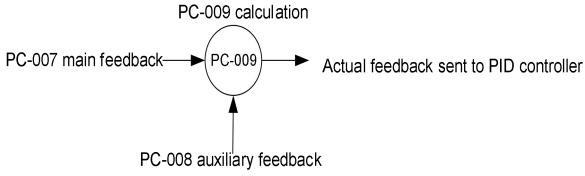
- **4: Take maximum value**

  Get the maximum value of the main reference fm and the auxiliary reference fa.

- **5: Take minimum value**

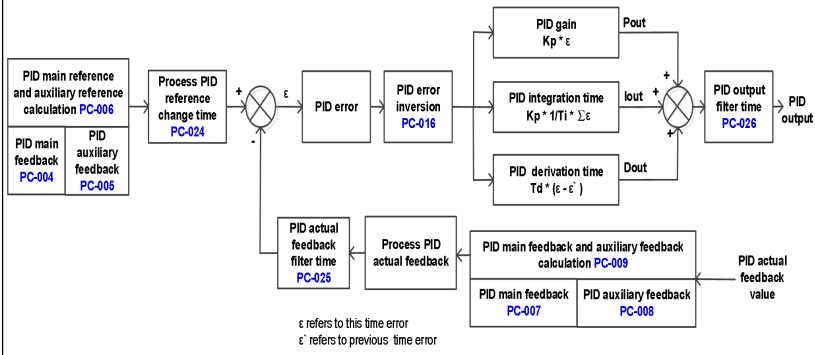
  Get the minimum value of the main reference fm and the auxiliary reference fa.



Parameter	Name	Default	Range	Unit	Attribute
PC-004	PID main reference selection	1	0 ... 3	/	○
	Defines the main reference source selection. The PID reference is defined by main reference, auxiliary reference and calculation.  ● **0: Parameter setting (PC-010)** ● **1: AI1** ● **2: AI2** ● **3: AI3**				
PC-005	PID auxiliary reference selection	0	0 ... 3	/	○
	Defines the auxiliary reference source selection. Refer to parameter PC-004 for more information. ● **0: None** ● **1: AI1** ● **2: AI2** ● **3: AI3**				
PC-006	PID main reference and auxiliary reference calculation	0	0 ... 5	/	○
	Defines the PID main reference (PC-004) and auxiliary reference (PC-005) calculation. ● **0: Main + Auxiliary.** ● **1: Main – Auxiliary.** ● **2: Auxiliary-50%.** ● **3: Main + Auxiliary-50%.** ● **4: Take maximum value.** ● **5: Take minimum value**. Refer to parameters PC-003 and PC-004 for more selection and calculation information.				
PC-007	PID main feedback selection	2	0 ... 3	/	○
	Defines the main feedback source selection. The PID actual feedback is defined by main feedback, auxiliary feedback and calculation.  ● **0: None** ● **1: AI1** ● **2: AI2** ● **3: AI3**				

Parameter	Name	Default	Range	Unit	Attribute
PC−008	PID auxiliary feedback selection	0	0 ... 3	/	○
	Defines the feedback reference source selection. ● 0: None ● 1: AI1 ● 2: AI2 ● 3: AI3				
PC−009	PID main feedback and auxiliary feedback calculation	0	0 ... 5	/	○
	Defines the PID main feedback (PC−007) and auxiliary feedback (PC−008) calculation. ● 0: Main + Auxiliary. ● 1: Main – Auxiliary. ● 2: Auxiliary−50%. ● 3: Main + Auxiliary−50%. ● 4: Take maximum value. ● 5: Take minimum value. Refer to parameter PC−003 for more selection and calculation information.				
PC−010	PID reference	20.00	−100.00 ... 100.00	%	○
	Defines the PID reference value when PC−004 = 0. 100.00% = 100.00% feedback value.				
PC−011	Proportional gain P1	10.00	0.00 ... 655.35	/	○

As shown in the PID schematic block diagram, the proportional gain part output of PID Pout = Kp * ε.



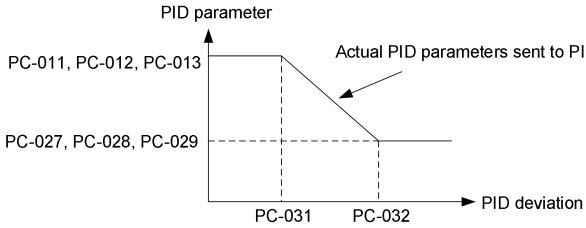
Assuming that the error is 30% and the maximum speed is 1500rpm, the following table lists the relationship between Kp output and error.

PID Gain	Gain part output Pout	Calculation process
1.0(Default)	450 rpm	1.0 * 1500 * 30%
0.5	225 rpm	0.5 * 1500 * 30%
2.0	900 rpm	2.0 * 1500 * 30%
20.0	1500(Max speed)	20.0 * 1500 * 30%

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.

Parameter	Name	Default	Range	Unit	Attribute
PC−012	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.				
PC−013	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.				
PC−014	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.				
PC−015	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 PC−015, the output will be updated. Setting the deviation limit needs to take the system control precision and stability into consideration.				
PC−016	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.				
PC−017	PID output upper limit	100.00	PC−018 ... 100.00	%	○
	Defines the PID output upper limit. When thousands position of PC−002 is 0, the PID output upper limit is limited to PC−017* maximum speed P0−012. When thousands position of PC−002 is 1, the PID output upper limit is limited to PC−017* main reference.				
PC−018	PID output lower limit	0.00	−100.00 ... PC−017	%	○
	Defines the PID output lower limit. When thousands position of PC−002 is 0, the PID output lower limit is limited to PC−017* maximum speed P0−012. When thousands position of PC−002 is 1, the PID output lower limit is limited to PC−017* main reference.				
PC−019	PID feedback disconnection detect threshold	0.00	0.00 ... 100.00	%	○
PC−020	PID feedback disconnection detect time	0.0	0.0 ... 6553.5	s	○
Parameters PC−019 and PC−020 are used to set the PID feedback disconnection function. • **PC−019 = 0.00: PID feedback disconnection detection is disabled.** • **PC−019 = 0.01...100.00: PID feedback disconnection detection is enabled.** When PC−019 is a non−zero value, if the PID feedback is lower than the value of PC−019 for the detect time defined by PC−020. The drive trips on a fault.					

Parameter	Name	Default	Range	Unit	Attribute
PC−021	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: Do not stop **Hundreds position: PID output change to FWD / REV direction** ● 0: Not allowed ● 1: Allowed				
PC−022	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 (PC−022).				
PC−023	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 PC−023.				
PC−024	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 (PC−024) to prevent the reference sudden changes.				
PC−025	PID feedback filter time	0.00	0.00 ... 655.35	s	○
	Defines the filter time constant for PID feedback, which can reduce the influence of interference signals on the PID feedback.				
PC−026	PID output filter time	0.00	0.00 ... 655.35	s	○
	Defines the filter time constant for PID output.				
PC−027	Proportional gain P2	20.00	0.00 ... 655.35	/	○
PC−028	Integration time I2	1.00	0.00 ... 655.35	s	○
PC−029	Derivative time D2	0.00	0.00 ... 655.35	s	○
PC−030	PID parameter switching condition	0	0 ... 2	/	○
PC−031	PID parameter switching deviation 1	20.00	0.00 ... 100.00	%	○
PC−032	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. The parameters PC−027 to PC−029 are the second PID parameters for PID control. Selects the first group PID parameters (PC−011…PC−013) or the second group PID parameters (PC−027…PC−029) is defined by parameter PC−030. ● **PC−030 = 0: Not select.** The first group PID parameters (PC−011…PC−013) are effective. ● **PC−030 = 1: Digital input**					

Parameter	Name	Default	Range	Unit	Attribute
When a digital input terminal function is set to [25]: ① When the digital input = 0: The first group PID parameters (PC−011…PC−013) are effective. ② When the digital input = 1: The second group PID parameters (PC−027…PC−029) are effective. ● **PC−030 = 2: According the deviation** PID deviation (PID error) = abs (PID reference − PID feedback). ① If PID deviation < PC−031, the first group PID parameters (PC−011…PC−013) are effective. ② If PID deviation > PC−032, the second group PID parameters (PC−027…PC−029) are effective. ③ PC−031 < PID deviation < PC−032, the PID parameter for PID controller changes linearly according to the first group and the second group PID parameters.  					
PC−033	PID initial value	0.00	0.00 ... 100.00	%	○
PC−034	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 PC−033) for the time defined by parameter PC−034, then enter to the normal PID adjustment process.					
PC−035	Output deviation FWD max. value	20.00	0.01 ... 100.00	%	○
PC−036	Output deviation REV max. value	20.00	0.01 ... 100.00	%	○
PC−035 is used to define the PID maximum output deviation within 4ms for forward direction. PC−036 is used to define the PID maximum output deviation within 4ms for reverse direction.					
PC−037	PID operation in stop status	0	0 ... 1	/	×
	● **0: PID continue calculation in stop status.** ● **1: PID stop calculation in stop status.**				
PC−038	PID feedback out of range value	100.00	50.00 ... 100.00	%	○
PC−039	PID feedback out of range detection time	0	0 ... 65535	s	○
If the PID feedback value is higher than the value defined by PC−038 for the time defined by PC−039, the drive will trips on a fault "PID feedback out of range". **Note**: When PC−039 = 0, PID feedback out of range detection is disabled.					
PC−040	PID switching speed	0.00	0.00 ... 100.00	%	○
	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 [26]: When the digital input = 1, the speed reference is changed to a constant speed (PC−040). When the digital input = 0, the speed reference is changed to PID regulation. 100.00% corresponds to maximum speed P0−012.				

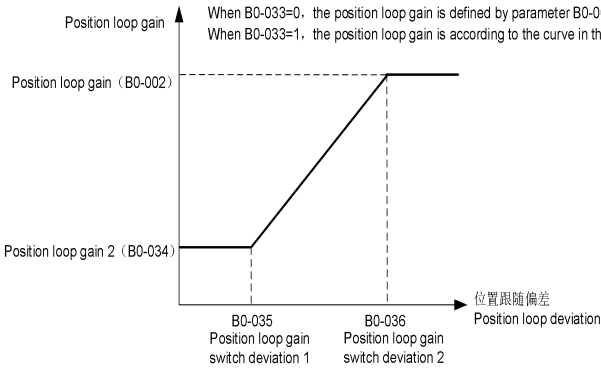
5.14 Encoder Parameters (A0)

Parameter	Name	Default	Range	Unit	Attribute
A0-000	Encoder type selection	2	0 ... 2	/	×
	Selects the encoder type when a speed feedback signal (encoder or resolver) from the motor. ● **0: Resolver** Resolver is used for 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, other pole pairs should not be selected. ● **1: SinCos encoder** SinCos encoder is used for motor speed feedback. **Note:** SinCos encoder is not supported in V9. ● **2: Incremental encoder** Incremental encoder is used for motor speed feedback. Support open collector, voltage type, push pull (complementary) type HTL and differential type TTL encoder.				
A0-001	Speed feedback filter coefficient	20	1 ... 500	/	×
	Defines the speed feedback signal filtering time constant.				
A0-002	Encoder 1 pulses per revolution	1024	1 ... 65535	ppr	×
A0-003	Encoder 1 direction	0	0 ... 1	/	×
A0-004	Encoder 1 electronic gear ratio numerator	1	1 ... 65535	/	×
A0-005	Encoder 1 electronic gear ratio denominator	1	1 ... 65535	/	×
A0-002 is used to define the encoder pulses per revolution when A0-000 = 1/2. The value setting should read the correct value from the encoder. A0-003 is the encoder direction; This value can be obtained by motor parameters rotate auto tune. If cannot start motor parameter rotate auto tune (P6-017), this parameter can be changed manually. A0-004 and A0-005 are used to define the ratio between motor shaft and encoder. **Note**: Parameters A0-002 … A0-005 are only available for incremental and SinCos encoder.					
A0-006	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.				
A0-007	SinCos signal alarm value	10000	0 ... 65535	/	×
	When the measured sine / cosine signal (F0-075) is lower than the alarm value (A0-007), the drive trips on a fault "E-dL1". When a resolver (or SinCos encoder) is used for motor speed feedback, check the value of F0-075 if the resolver is properly installed or correct wiring. **Note**: When the resolver installation is not good, it will cause the value of parameter F0-075 too low, may cause the drive trips on a fault.				

A0-008	SinCos encoder type	0	0 ... 1	/	×
	• 0: Without CD signal • 1: With CD signal				
A0-009	Incremental encoder start mode	0	0 ... 1	/	×
	• 0: Open loop start • 1: Start with initial position identification				
A0-010	SinCos compensation coefficient	4000	4000 ... 12000	/	×
	Defines sine and cosine signal compensation coefficient.				
A0-011	Synchronous motor initial angle	0	0 ... 65535	/	×
	Synchronous motor initial angle is obtained after synchronous motor rotate auto tune.				
A0-012	Sine signal zero offset	0	−32768 ... 32767	/	×
	Synchronous motor sine signal zero offset is obtained after synchronous motor rotate auto tune.				
A0-013	Cosine signal zero offset	0	−32768 ... 32767	/	×
	Synchronous motor cosine signal zero offset is obtained after synchronous motor rotate auto tune.				
A0-014	Sine cosine signal amplitude correction	16384	0 ... 65535	/	×
	When the sine and cosine signal amplitude received deviates significantly from the ideal value, this parameter can be modified. Generally, for standard Sin/Cos encoders, it is not necessary to change this parameter. In special cases, please contact the manufacturer.				
A0-015	Resolver excitation amplitude coefficient	6999	3499 ... 8399	/	×
	When the amplitude deviation of the excitation signal of the resolver is large, this parameter can be modified for correction, generally it is not necessary to modify it.				
A0-016	C signal zero offset	0	−32768 ... 32767	/	×
A0-017	D signal zero offset	0	−32768 ... 32767	/	×
A0-018	CD signal amplitude correction	16384	0 ... 65535	/	×
A0-019	CD signal phase	0	0 ... 1	/	×
A0-020	Encoder 2 pulses per revolution	1024	1 ... 65535	ppr	×
A0-021	Encoder 2 direction	0	0 ... 1	/	×
A0-022	PM motor incremental encoder find Z signal frequency	1.0	0.1 ... 5.0	/	×
	PM motor incremental encoder find Z signal frequency.				
A0-023	Encoder input filter setting	0007	0000 ... 0FFF	/	×
	The value of this parameter is displayed as a hexadecimal number and the actual function is used in binary. • **Ones position: Filtering of B signal** The sampling frequency of input TI1 and the digital filter bandwidth applicable to TI1 can be defined. The digital filter consists of event counters, and every N events are considered a valid edge. 0000: No filter, samping at fDTS 1000: fSAMPLING=fDTS/8, N=6 0001: fSAMPLING=fCK_INT, N=2 1001: fSAMPLING=fDTS/8, N=8 0010: fSAMPLING=fCK_INT, N=4 1010: fSAMPLING=fDTS/16, N=5 0011: fSAMPLING=fCK_INT, N=8 1011: fSAMPLING=fDTS/16, N=6 0100: fSAMPLING=fDTS/2, N=6 1100: fSAMPLING=fDTS/16, N=8				

	0101: fSAMPLING=fDTS/2, N=8 1101: fSAMPLING=fDTS/32, N=5 0110: fSAMPLING=fDTS/4, N=6 1110: fSAMPLING=fDTS/32, N=6 0111: fSAMPLING=fDTS/4, N=8 1111: fSAMPLING=fDTS/32, N=8 ● **Tens position: Filtering of A signal** See selection "Ones position". ● **Hundreds position: Filtering of Z signal** See selection "Ones position".				
A0-024	**SinCos encoder decoding switch enable**	0	0 ... 1	/	×
	● **0: Not switch** ● **1: Switch**				

5.15 Position Controller (B0)

Parameter	Name	Default	Range	Unit	Attribute
B0－000	Position loop encoder selection	0	0 ... 1	/	×
	● **0: Encoder 1 (Motor shaft)** The first encoder refers to the motor shaft encoder selected by parameter A0−000. ● **1: Encoder 2 (Spindle shaft)**				
B0－001	Position loop reference selection	0	0 ... 1	/	×
	● **0: Pulse input** ● **1: EtherCAT**				
B0－002	Position loop gain P 1	5.0	0.0 ... 6553.5	1/s	○
	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. Two position loop gains in total are available. ● **When B0−033 = 0, only position loop gain B0－002 is effective.** ● **When B0−033 = 1, position loop gain is defined by parameters B0−002, B0−034, B0−035 and B0−036.**  				
B0－003	Position loop maximum speed	1500	0 ... 65535	rpm	×
	Defines the maximum output speed when working in the position control mode. When the speed reference is higher than the value of B0−003, the actual speed will be limited to the value of B0−003.				
B0－004	Position loop acceleration time	0.00	0.00 ... 655.35	s	×
B0－005	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.					

Parameter	Name	Default	Range	Unit	Attribute
B0－006	Position loop gear ratio numerator 1	1	1 ... 65535	/	×
B0－007	Position loop gear ratio denominator 1	1	1 ... 65535	/	×

The parameters B0−007 and B0−008 are used to define the pulse input gear ratio in position loop (P0−003).

Let **B** represents the pulse input frequency multiplier.

When pulse input type is AB phase, then **B** = 4.

When pulse input type is pulse + direction (or direction + pulse), then **B** = 2.

When pulse input type is single−phase pulse, then **B** = 1.

Let **n** represents motor speed.

Let **N** represents motor number of rotations.

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

Let **F** represents input pulses frequency.

Let **P** represents input pulses.

Let **G** represents gear ratio.

- **When the speed feedback signal is incremental encoder(defined by parameter A0−000)**

The relationship between the speed and input pulses:

n=B×60×F×G/(C×4) & G1= B0－006:B0－007

Example: the pulse input is 50Khz from host controller, the motor encoder PPR is 2500:

n =B×60×F×G/(C×4)=B×60×50000×G/(2500×4)

When B0－006:B0－007=1:2, n=B×60×50000×0.5/(2500×4)(ppr)

The relationship between the position and input pulses:

B×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/(B×P)=2×2500×4/(B×10000)= 20000 / 40000 = 1/2

Then: B0－006 = 1 and B0－007 = 2.

- **When the speed feedback signal is resolver (defined by parameter A0−000)**

The relationship between the speed and input pulses:

n=B×60×F×G/65536 and G=B0－006/B0－007

Example: input pulses is 10000, require to rotate the motor for 2 revolutions and the motor encoder is resolver, then:

n=B×60×F×G1/65536 =B×60×50000×G1/65536

when G = B0－006:B0－007=4:1

Then n = 1×60×50000×4/65536 PPR

The relationship between the position and input pulses:

B×P×G=N×65536

Example: input pulses is 10000, require to rotate the motor for 2 revolutions and the motor encoder is resolver, then: **N=2, P=10000**

G= N×65536/(B×P)=2×65536/(B×10000)

Then G = B0－006:B0－007 =8192:625

Parameter	Name	Default	Range	Unit	Attribute
B0－008	Position loop feed forward gain	0.00	0.00 ... 200.00	%	○
B0－009	Position loop feed forward filter time	0.000	0.000 ... 2.000	s	○
With position loop feed forward gain, the responsiveness level can be increased. If the position loop feed forward gain is too big, motor speed can have overshoots. You can slowly adjust the position loop feed forward gain. The effect of feed forward function is not obvious if the position loop gain is too big.					
B0－010	Position reference filter	0	0 ... 65535	/	×
	Defines the filter time constant of position reference. If filter constant setting too big will reduces the position dynamic response, but will not cause a loss of pulses.				
B0－011	Position reach detect width	50	0 ... 65535	pulse	○
	When the deviation between the actual position and the reference position is less than value of parameter B0－011 (Position reach detect width) and continues to reach the set time of B0－029 (Position reach detect time), the position reach signal output is ON.				
B0－012	Speed feed forward gain in position control	0.00	0.00 ... 250.00	%	○
B0－013	Speed feed forward filter time in position control	0.00	0.00 ... 100.00	s	○
Parameter B0－012 is used to define the feed forward gain of speed control in position loop. Parameter B0－013 is used to define the feed forward filter time of speed control in position loop.					
B0－014	Digital input switch to position loop with enable signal	0	0 ... 1	/	×
	Selects digital input switch to position loop whether with enable signal. For example, digital input X3 is used to switch to position loop from speed loop, set P3－003 = 8. ● **0: Without enabled signal.** ● **1: With enabled signal.**				
B0－015	Switching mode from speed loop to position loop	0	0 ... 1	/	○
	Defines the switching mode from speed loop to position loop. ● **0: Switch to position loop at the speed defined by parameter P3－028.** In speed loop mode, when the drive receives a command of switching to position loop, the drive will switch to position loop after the speed is decelerated to the value defined by parameter P3－028. ● **1: Switch to position loop directly.** In speed loop mode, when the drive receives a command of switch to position loop, switch to position loop directly.				
B0－016	Orientation position references 1	0	0 ... 65535	pulse	○
	Defines the orientation position references, see parameter B0－028 for more information.				
B0－017	Orientation start speed	300	0 ... 65535	rpm	○
	● **0: Direct orientation, orientating from current speed** If the motor running speed is lower than the position loop maximum speed (B0－003), orientating from the current speed; If the motor running speed is higher than the position loop maximum speed (B0－003), decelerate to the position loop maximum speed (B0－003) before start the orientation. ● **1...65535: Orientation start speed.** If the motor running speed is lower than or equal to the orientation start speed (B0－017), orientating				

Parameter	Name	Default	Range	Unit	Attribute
	from the current speed. If the motor running speed is higher than the value of parameter B0−017, decelerate to the orientation start speed (B0−017) before start the orientation.				
B0−018	Orientation deceleration time	2.00	0.00 ... 655.35	s	○
	The time from position loop maximum speed (B0−003) to 0 during orientating process.				
B0−019	Orientation gain	5.0	0.0 ... 6553.5	/	○
	Orientation gain directly influences the response level when orientating. If the mechanical system does not vibrate or produce noises, you can increase the gain so that the system rigidity can be increased.				
B0−020	Direct orientation enable speed	500	0 ... 1500	rpm	○
	If a motor running speed is lower than the value of B0−020, the direct orientation function is enabled and allow shortest distance orientating. **Note**: When parameter B0−020 setting too high, there may be overshoot and shock due to the planned distance too short.				
B0−021	Orientation direction	0	0 ... 2	/	○
	• **0: Motor running rotation** • **1: Forward** • **2: Reverse**				
B0−022	Orientation position references 2	0	0 ... 65535	pulse	○
B0−023	Orientation position references 3	0	0 ... 65535	pulse	○
B0−024	Orientation position references 4	0	0 ... 65535	pulse	○
B0−025	Orientation position references 5	0	0 ... 65535	pulse	○
B0−026	Orientation position references 6	0	0 ... 65535	pulse	○
B0−027	Orientation position references 7	0	0 ... 65535	pulse	○
B0−028	Orientation position references 8	0	0 ... 65535	pulse	○

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 P3−003 = 35, P3−004 = 36, P3−005 = 37, then:

Note: The encoder PPR limits the range of B−016, B−022 … B−028.

Orientation position reference	X5	X4	X3
Orientation position references 1 (B0−016)	0	0	0
Orientation position references 2 (B0−022)	0	0	1
Orientation position references 3 (B0−023)	0	1	0
Orientation position references 4 (B0−024)	0	1	1
Orientation position references 5 (B0−025)	1	0	0
Orientation position references 6 (B0−026)	1	0	1
Orientation position references 7 (B0−027)	1	1	0
Orientation position references 8 (B0−028)	1	1	1

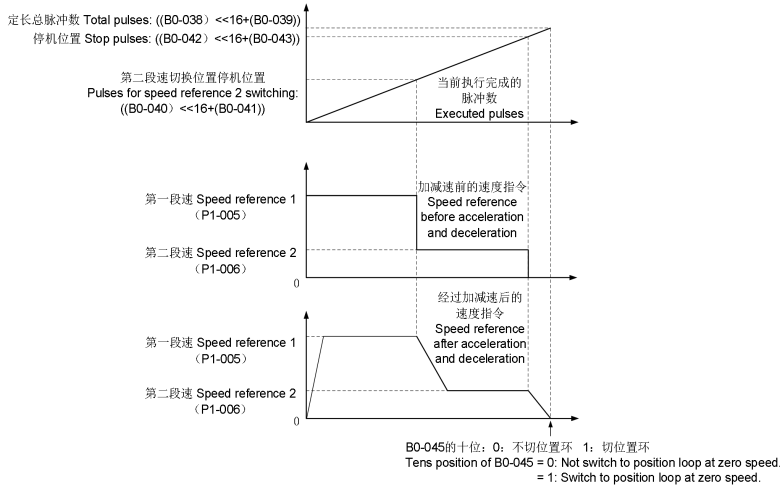
B0−029	Position reach detection time	1	0 ... 65535	ms	×
	When the deviation between the actual position and the reference position is less than B−011 (Position reach detection width) and continues to reach the set time of B−029 (Position reach detection time), the position reach signal output is ON.				

Parameter	Name	Default	Range	Unit	Attribute
B0－030	Gear ratio filter coefficient	5	1 ... 65535	/	○
	The parameters B0−030…B0−032 are used for use two encoders. Reserved in V9.				
B0－031	Position control gear ratio numerator 2	1	1 ... 65535	/	×
B0－032	Position control gear ratio denominator 2	1	1 ... 65535	/	×
B0－033	Position loop gain switching mode	0	0...1	/	×
B0－034	Position loop gain P 2	5.0	0.0 ... 6553.5	/	○
B0－035	Position loop gain switching deviation 1	0	1 ... 65535	/	×
B0－036	Position loop gain switching deviation 2	0	1 ... 65535	/	×
Position loop gain 2 can be defined and active by parameters B0−033 … B0−036, refer to B0−002 for more information.					
B0－037	Auto switch encoder	0	0 ... 1		
	● **0: Auto switch encoder is not allowed** ● **1: Auto switch encoder is allowed**				
B0－038	Total pulses high order byte of simple positioning	0	0...65535	/	○
B0－039	Total pulses lower order byte of simple positioning	0	0...65535	/	○

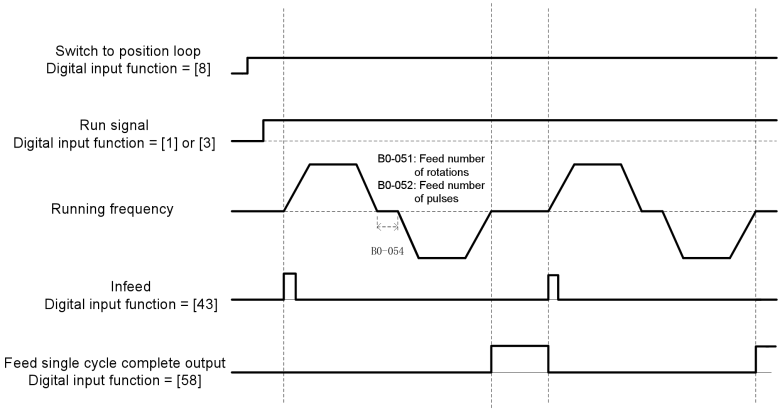
Defines the total pulses high order byte. The relationship between the total pulses and the value of B0−038 and B0−039 is as follows:

Total pulses = (B0−038<<<16) + B0−039.

When speed reference source is [12] (P0−005 = 12), the speed reference is defined by parameters B0−038…B0−046, use this function to achieve simple positioning function under speed loop. The speed reference is defined by the total pulses (B0−038 and B0−039), the executed pulses (B0−040 and B0−041), the stop pulses (B0−042 and B0−043), the speed reference 1(P1−005) and speed reference 2 (P1−006). The actual speed reference is shown in the following figure:



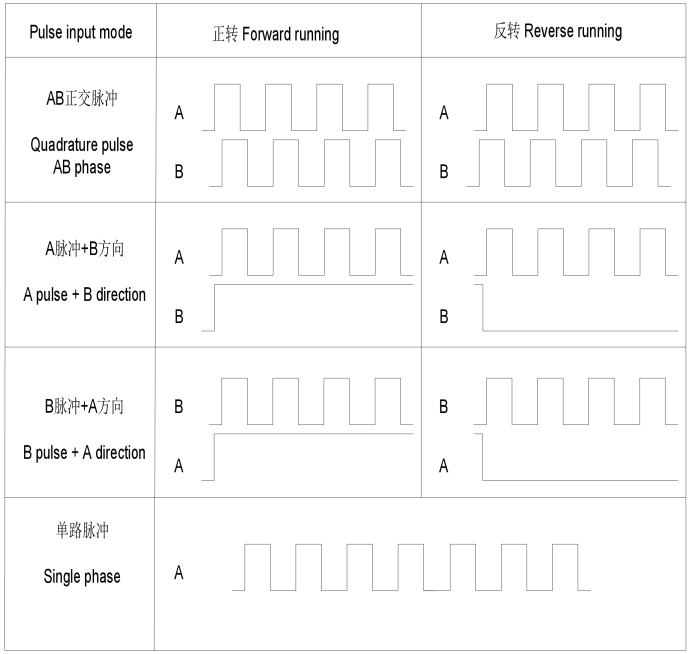
Parameter	Name	Default	Range	Unit	Attribute
B0-040	Executed pulses high order byte of speed reference 2	0	0...65535	/	○
B0-041	Executed pulses low order byte of speed reference 2	0	0...65535	/	○
When executed pulses reaches the pulses defined by parameters B0-040 and B0-041, the speed reference change to speed reference 2. Executed pulse of speed reference 2 = (B0-040<<<16)+B0-041					
B0-042	Stop pulses high order byte	0	0...65535	/	○
B0-043	Stop pulses lower order byte	0	0...65535	/	○
	The stop pulses is defined by the value of B0-042 and B0-043 is as follows: Stop pulses = (B0-042<<<16)+B0-043				
B0-044	Pulse reference source				
	• **0: Pulse input.** • **1: The first encoder.** • **2: The second encoder.**				
B0-045	Simple positioning control function	0000	0000...0011	/	×
	Ones position: Automatically adjust the stop pulses • 0: Stop pulses not automatically adjusted. • 1: Stop pulses automatically adjusted. **Tens position: zero speed switching position loop** • 0: No automatic switch to position loop at zero speed. • 1: Automatic switch to position loop at zero speed.				
B0-046	Simple positioning arrive delay time	1	1...65534	s	×
B0-047	Initial position 0	0000	0000...FFFF	/	○
B0-048	Initial position 1	0000	0000 ... FFFF	/	○
B0-049	Initial position 2	0000	0000 ... FFFF	/	○
B0-050	Initial position 3	0000	0000 ... FFFF	/	○
B0-047 … B0-050 are used to set the feed initial position, representing bit63 ... bit48, bit47 ... bit32, bit31 ... bit16, and bit15 ... bit0, respectively. The specific calculation formula is as follows: Feed initial position=(B0-047<<48)+(B0-048<<32)+(B0-049<<16)+(B0-050) When running to the initial position, when a rising edge from a digital input (set the digital input terminal function to 42) comes, it triggers the acquisition of the current position and automatically save the position values to the parameters B0-047 ... B0-050.					
B0-051	Feed number of rotations	0000	0000 ... 65535	/	○
B0-052	Feed number of pulses	0000	0000 ... 65535	/	○
	The parameter B0-051 and B0-052 define the feed number of rotations and pulses. The relationship is as follows: Feed number of pulses for single cycle feed = (B0-051) * motor encoder PPR + (B0-52)				

Parameter	Name	Default	Range	Unit	Attribute
B0-053	Feed direction	0	0 ... 1	/	
	• 0: Forward • 1: Reverse				
B0-054	Forward feed to reverse delay time	0.0	0.0 ... 6553.5	s	
	Defines the delay time from forward feed completed to reverse, as shown in the following figure:  				
B0-055	Feed control word maintain	0000	0000 ... 0001		
	• 0: Not maintain at stop state Not **maintain** current feed control word after stop. • 1: Maintain at stop state Maintain current feed control word during stop state.				
B0-056	Excessive position comparison value high order byte	0	0 ... 65535	/	○
B0-057	Excessive position comparison value low order byte	0	0 ... 65535	/	○
B0-058	Excessive position deviation delay time	1.00	0.01 ... 600.00	s	○
B0-059	Excessive position deviation action selection	0000	0000 ... 0111	/	○

5.16 Pulse Input and Output (B1)

Parameter	Name	Default	Range	Unit	Attribute
B1-000	Pulse input mode	0	0 ... 2	/	×

Selects pulse input mode from the host controller.



- **0: Quadrature pulse**

  Quadrature pulse input from A and B.

- **1: A pulse + B direction**

  A is used as pulse input, B is used as direction input.

- **2: B pulse + A direction**

  B is used as pulse input, A is used as direction input.

- **3. Single-phase pulse**

  A is used as pulse input.

Notes:

- For V9, quadrature pulse input from X6 (B) and X7 (A) digital input terminal.
- For V9, since digital input X6 (B) and X7 (B) default are used as digital inputs do not have pulse input function, if X6 and X7 are required as pulse input functions, please confirm with the manufacturer before ordering.

B1-001	Pulse input direction invert	0	0 ... 1	/	×

	Selects the inversion of the pulse input. **0: OFF** **1: ON**				
B1−002	Speed control pulse input gear ratio numerator	1	1 ... 65535	/	○
B1−003	Speed control pulse input gear ratio denominator	1	1 ... 65535	/	○

B1−002 and B1−003 are used to define the pulse input gear ratio in speed control mode.

Let **B** represents the pulse input frequency multiplier.

When pulse input type is AB phase (B1−000 = 0), then **B** = 4.

When pulse input type is pulse + direction (or direction + pulse) (B1−000 = 1/2), then **B** = 2.

When pulse input type is single−phase pulse (B1−000 = 3), then **B** = 1.

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.

- **When motor speed feedback is incremental encoder (defined by parameter A0−000)**

$$n=B\times60\times F\times G_1/(C\times4) \quad \& \quad G_1= B1-002:B1-003$$

For example: the pulse input is 50Khz from host controller, the motor encoder PPR is 2500, then:

$$n =B\times60\times F\times G_1/(C\times4)=B\times60\times50000\times G_1/(2500\times4)$$

$$\text{When B1-002:B1-003=2:1, } n=B\times60\times50000\times2/(2500\times4)\text{(ppr)}$$

- **When motor speed feedback is resolver or SinCos encoder (defined by parameter A0−000)**

$$n=B\times60\times F\times G_1/65536 \quad \& \quad G_1= B1-002:B1-003$$

For example: the pulse input is 50Khz from host controller, the motor encoder is resolver, then

$$n=B\times60\times F\times G_1/65536 =B\times60\times50000\times G_1/65536$$

$$\text{when B1-002:B1-003=2:1, } n=B\times60\times50000\times2/65536 \text{ (ppr)}$$

- **When the motor control without encoder (defined by parameter P0−002)**

$$n=B\times60\times F\times G_1/1000 \quad \& \quad G_1= B1-002:B1-003$$

B1−004	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.				
B1−005	Encoder output pulses per revolution	1024	4 ... 65535	ppr	×
B1−006	Reserved	0	0 ... 65535	/	×
B1−007	Encoder selection for output	0	0 ... 1	/	×
	Defines which encoder is used for output ● **0: Encoder 1 (Motor shaft)** ● **1: Encoder 2 (Spindle shaft)**				
B1−008	Pulse input filter configuration	0	0 ... 002F	/	×
	Defines the sampling frequency of TI1 and the bandwidth of the digital filter applicable to TI1. The digital filter is composed of an event counter, and every N event are regarded as a valid edge. 0000: No filter, sampling according to f_{DTS} frequency 0001: $f_{SAMPLING}=f_{CK\_INT}$, N=2 0010: $f_{SAMPLING}=f_{CK\_INT}$, N=4 0011: $f_{SAMPLING}=f_{CK\_INT}$, N=8				

	0100: $f_{SAMPLING}=f_{DTS}/2$, N=6 0101: $f_{SAMPLING}=f_{DTS}/2$, N=8 0110: $f_{SAMPLING}=f_{DTS}/4$, N=6 0111: $f_{SAMPLING}=f_{DTS}/4$, N=8 1000: $f_{SAMPLING}=f_{DTS}/8$, N=6 1001: $f_{SAMPLING}=f_{DTS}/8$, N=8 1010: $f_{SAMPLING}=f_{DTS}/16$, N=5 1011: $f_{SAMPLING}=f_{DTS}/16$, N=6 1100: $f_{SAMPLING}=f_{DTS}/16$, N=8 1101: $f_{SAMPLING}=f_{DTS}/32$, N=5 1110: $f_{SAMPLING}=f_{DTS}/32$, N=6 1111: $f_{SAMPLING}=f_{DTS}/32$, N=8				
B1−009	Y2 pulse output source selection	0	0 ... 4	/	×
B1−010	Y2 minimum output frequency	0.00	0.0 ... 50.00	Khz	×
B1−011	Y2 maximum output frequency	10.00	0.01 ... 50.00	Khz	×
B1−012	Constant Y2 pulse output frequency	1.000	0.001 ... 50.000	Khz	×

Note: Parameters B1−009 … B1−012 are used for V9 series products, have no effective in VTS series products.

These parameters are used to to select Y2 high−speed pulse output source when Y2 is use as high−speed pulse output terminal.

- **B1−009 = 0: Running speed.**

  The speed range from 0 … P0−012 corresponds to parameter B1−010 … B1−011.
- **B1−009 = 1: AI1**

  The analog input AI1 range from 0 … 10V/20mA corresponds to parameter B1−010 … B1−011.
- **B1−009 = 2: AI2**

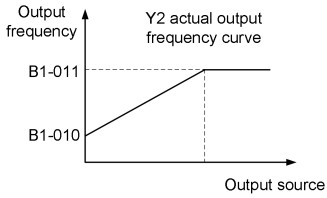
  The analog input AI2 range from 0 … 10V/20mA corresponds to parameter B1−010 … B1−011.
- **B1−009 = 3: AI3**

  The analog input AI3 range from 0 … 10V corresponds to parameter B1−010 … B1−011.

B1−012 is used to define the Y2 constant pulse output frequency when Y2 is use as high−speed pulse output terminal. The function can be active by a digital input terminal.

For example, if digital input X3 is used to active the Y2 constant pulse output frequency, set digital input X3 terminal function to "60" (P3−003 = 60):

- **When X3 = 0, Y2 output pulse frequency source selected by parameter B1−009.**



- **When X3 = 1, Y2 output pulse frequency defined by parameter B1−012.**

5.17 Modbus (C0)

Parameter	Name	Default	Range	Unit	Attribute
C0−000	Modbus address	1	1 ... 255	/	○
	Defines the Modbus address. Two units with the same address are not allowed on−line.				
C0−001	Modbus baud rate	3	0 ... 5	/	○
	Selects the Modbus baud rate. ● **0: 4800bps** ● **1: 9600 bps** ● **2: 19200 bps** ● **3: 38400 bps** ● **4: 57600 bps** ● **5: 115200 bps**				
C0−002	Modbus−RTU data format	0000	0000 ... 0121	/	○
	Sets the Modbus−RTU data format. **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 stop bit ● 1: 2 stop bits				
C0−003	Communication response delay	0	0 ... 65535	/	○
	Defines the Modbus communication response time. Note that if the value of C0−003 is higher than the value of C0−004 (when C0−004 is a non−zero value), the drive trips on a fault even communication is normal.				
C0−004	Communication break detect time	0	0 ... 65535	/	○
	The drive trips on a fault if the Modbus communication break lasts longer than the time defined by parameter C0−004. Note that if C0−004 = 0 will disable the communication loss detection.				
C0−005	Data save to memory	0	0 ... 1	/	○
	● **0: Parameters modified through Modbus communication are not save to memory after power off.** ● **1: Parameters modified through Modbus communication not save to memory after power off.** **Note**: The life of memory is about 100000 times, if change parameter frequently via communication, please do not set C0−005 to 1, otherwise, the memory service life will be reduced quickly.				
C0−006	Communication break detection start delay time	0	0 ... 65535	/	○
	After the drive is powered, the communication break detect function is disabled (but communication itself can be active) for the time set by parameter C0−006. After the delay time, the communication break time count starts according parameter C0−004 (if non−zero value).				

Parameter	Name	Default	Range	Unit	Attribute
C0-007	User address 0	0000	0000 ... FFFF	/	○
C0-008	Mapping address 0	0000	0000 ... FFFF	/	○
C0-009	User address 1	0000	0000 ... FFFF	/	○
C0-010	Mapping address 1	0000	0000 ... FFFF	/	○
C0-011	User address 2	0000	0000 ... FFFF	/	○
C0-012	Mapping address 2	0000	0000 ... FFFF	/	○
C0-013	User address 3	0000	0000 ... FFFF	/	○
C0-014	Mapping address 3	0000	0000 ... FFFF	/	○
C0-015	User address 4	0000	0000 ... FFFF	/	○
C0-016	Mapping address 4	0000	0000 ... FFFF	/	○
C0-017	User address 5	0000	0000 ... FFFF	/	○
C0-018	Mapping address 5	0000	0000 ... FFFF	/	○
C0-019	User address 6	0000	0000 ... FFFF	/	○
C0-020	Mapping address 6	0000	0000 ... FFFF	/	○
C0-021	User address 7	0000	0000 ... FFFF	/	○
C0-022	Mapping address 7	0000	0000 ... FFFF	/	○
C0-023	User address 8	0000	0000 ... FFFF	/	○
C0-024	Mapping address 8	0000	0000 ... FFFF	/	○
C0-025	User address 9	0000	0000 ... FFFF	/	○
C0-026	Mapping address 9	0000	0000 ... FFFF	/	○
C0-027	User address 10	0000	0000 ... FFFF	/	○
C0-028	Mapping address 10	0000	0000 ... FFFF	/	○
C0-029	User address 11	0000	0000 ... FFFF	/	○
C0-030	Mapping address 11	0000	0000 ... FFFF	/	○
C0-031	User address 12	0000	0000 ... FFFF	/	○
C0-032	Mapping address 12	0000	0000 ... FFFF	/	○
C0-033	User address 13	0000	0000 ... FFFF	/	○
C0-034	Mapping address 13	0000	0000 ... FFFF	/	○
C0-035	User address 14	0000	0000 ... FFFF	/	○
C0-036	Mapping address 14	0000	0000 ... FFFF	/	○

There are 14 pairs addresses in hexadecimal. The user can change the Modbus communication address according to the actual communication requirements. Such as: place multiple discontinuous addresses to one continuous address, so that the addresses be read continuously by Modbus 0x03 command and written continuously by Modbus 0x10 command, which can reduce communication commands. When the address of the host controller is different from the drive, this function can be used to enable direct communication between the host controller and the drive.

For example, the host controller writes the speed by address 0x2000, reads the speed by address 0x3000. The Modbus address of the drive for speed reference is 0x8001, the Modbus address of the drive for running speed is 0x6041, and they cannot communicate directly with each other because of the different communication addresses. Address mapping allows direct communication between them without changing software of the host controller or VFD:

C0−007 = 2000 (User address), C0−008 = 8001 (Mapping address),

C0−009 = 3000 (User address), C0−010 = 6041 (Mapping address).

Parameter	Name	Default	Range	Unit	Attribute
C0－037	Communication frequency reference ratio numerator	1	1 ... 65535	/	○
C0－038	Communication frequency reference ratio denominator	1	1 ... 65535	/	○
The parameter C0−037 and C0−038 are used to set the communication data factor receive from the host controller. Actual communication speed reference = communication speed reference * C0−037 / C0−038					
C0－039	Master follower mode selection	0000	0000 ... 1006	/	○

Sets the master and follower mode when two motors require following function via Modbus communication.

Ones position: Master and follower selection.

- **0: Normal mode**

  Modbus default mode. Please keep this value as default when does not require two motors master−follower following through Modbus communication.

- **1: Master mode**

  In this mode, the drive as master and actively sends data to the follower.

- **2: Follower operates in speed following mode** (**Note**: Effective when P0−003 = 2 and P0−005 = 0).

  The follower operates in speed control, the speed output follows the master speed, the resulting result is directly executed without the acceleration and deceleration process:

  Follower speed output = Speed from master *C0−37/C0−38 + C0−043.

- **3: Follower operates in current following mode** (**Note**: Effective when P0−003 = 2 and P0−005 = 0).

  The follower operates in speed control, the speed output follows the master speed and current, the resulting result is directly executed without the acceleration and deceleration process:

  Follower speed output = Speed from master + PID(master current, follower current)

- **4: Follower operates in torque following mode (Note**: Effective when P0−003 = 3 and P0−002 != 3).

  The follower operates in torque control mode and the torque reference follows the master torque, the speed limit follows the master speed.

  Follower torque reference = Torque from master Follower speed limit = Speed from master

- **5: Follower operates in current loop following mode (Note**: Effective when P0−003 = 3 & P0−002 != 3).

  The follower operates in current loop following mode. Current loop reference follows the master current loop output. In this control mode, without the participation of the speed loop, the speed can not be controlled. Therefore, the speed will continue to increase until the motor torque balance is achieved. Applicable to the applications that the motor shafts of the master and the follower are rigidly coupled by gearing, chain, etc.

  Follower current loop reference = Master current loop output

- **6: Follower operates in speed following mode** (**Note**: Effective when P0−003 = 2 and P0−005 = 0).

  The follower operates in speed control, the speed reference follows the master speedx, the resulting result is just a reference speed, the acceleration and deceleration process are is required:

  Follower speed rererence = Speed from master *C0−37/C0−38 + C0−043.

Notes:

- For follower, if start command need follow the master, please set P0−004 = 0.
- If the parameter C0−039 is set to follower mode, follower mode can be temporarily disabled through a

Parameter	Name	Default	Range	Unit	Attribute
	digital input when the digital input function is set to "48". For example, P3−003 = 48, then X3 = 0 follower mode, X3 = 1 master mode. ➢ For follower mode, the results in selection "2" (C0−039 = 2) are directly output without a accelerating and decelerating process, while the results in selection "6" (C0−039 = 6) require a accelerating and decelerating process.				
C0−040	Follower follow proportional gain	0.100	0.000 ... 60.000	/	○
C0−041	Follower follow integration time	0.010	0.000 ... 60.000	s	○
C0−042	Follower follow adjust upper limit	100	0 ... 400	rpm	○
When C0−039 = 3: The proportional gain of the PID controller is defined by parameter C0−040. The integration time of the PID controller is defined by parameter C0−041. The upper limit of the PID output is defined by parameter C0−042.					
C0−043	Follower follow torque / frequency offset	0.00	−50.00 ... 50.00	%	○
	When parameter C0−039 = 4 or 5, C0−043 is torque offset. When parameter C0−039 = 2 or 5, C0−043 is frequency offset.				
C0−044	Send / Received speed	0	−32767 ... 32767	Rpm	*
C0−045	Send / Received torque	0.00	−300.00 ... 300.00	%	*
C0−046	Send / Received flag	0x0000	0x0000 ... 0xFFFF	/	*
The parameters C0−044 … C0−046 are read only parameters. Data between master and slave communication.					

5.18 CAN (C1)

Parameter	Name	Default	Range	Unit	Attribute
C1-000	CAN / PROFIBUS-DP / PROFINET address	2	0 ... 127	/	○
C1-001	CAN baud rate	0	0 ... 4	/	○
	• **0: CAN is disabled** • **1: 125kbps** • **2: 250kbps** • **3: 500kbps** • **4: 1000kbps**				
C1-002	CAN communication fault detection time	2.0	0.0 ... 6553.5	s	×
C1-003	CAN command smoothing cycle	5000	1 ... 65535	us	×
C1-004	Reserved	0	0 ... 65535	/	×
C1-005	Reserved	0	0 ... 65535	/	×
C1-006	Slave number	0	0 ... 30	/	×
	When C1-000=1 and C1-008 = 2, the parameter is valid				
C1-007	PROFIBUS DP and PROFINET selection	0	0 ... 3	/	×
	• **0: Disable** • **1: PROFIBUS DP is enabled** • **2: PROFINET is enabled** • **3: PROFINET is enabled and convert to CAN.**				
C1-008	CANopen selection	0	0 ... 2	/	×
	• **0: CANopen** • **1: CAN bus** • **2: CAN bus, and receive the command from PROFINET convert to CAN** **Notes**: ➢ A Controller Area Network (CAN) refers to a network of independent controllers. It is a serial communications protocol that efficiently supports distributed real-time control with a very high level of security. ➢ CANopen is an application layer protocol based on CAN-BUS. CANopen defines a set of rules on the basis of CAN-Bus, the information exchanged is transmitted on the CAN bus. The CAN-Bus defines the physical layer and link layer, while CANopen defines the application layer on the basis of can-bus, and specifies the conventions used by users, software and network terminals for information exchange.				
C1-009	CAN message frame format	0	0 ... 1	/	×
	• **0: Standard frame** • **1: Extended frame**				
C1-010	Send message ID1 low order byte	100	0000 ... FFFF	/	×
C1-011	Send message ID1 high order byte	0	0000 ... 1FFF	/	×
C1-012	Send message ID2 low order byte	200	0000 ... FFFF	/	×
C1-013	Send message ID2 high order byte	0	0000 ... 1FFF	/	×

C1-014	Send message ID3 low order byte	300	0000 ... FFFF	/	×
C1-015	Send message ID3 high order byte	0	0000 ... 1FFF	/	×
C1-016	Receive message ID1 low order byte	180	0000 ... FFFF	/	×
C1-017	Receive message ID1 high order byte	0	0000 ... 1FFF	/	×
C1-018	Receive message ID2 low order byte	280	0000 ... FFFF	/	×
C1-019	Receive message ID2 high order byte	0	0000 ... 1FFF	/	×
C1-020	Receive message enable	1	0 ... 11	/	×
	Ones position: ● 0: Disables receive message 1 ● 1: Enables receive message 1 **Tens position:** ● 0: Disables receive message 2 ● 1: Enables receive message 2				
C1-021	Send message 1 period	50	0 ... 65535	/	×
	Defines the sending period of message 1. 0 = disable message 1 sending function.				
C1-022	Send message 2 period	100	0 ... 65535	/	×
	Defines the sending period of message 2. 0 = disable message 2 sending function.				
C1-023	Send message 3 period	0	0 ... 65535	/	×
	Defines the sending period of message 3. 0 = disable message 3sending function.				
C1-024	Send message 1 parameter 3 address	6008	0000 ... FFFF	/	×
C1-025	Send message 1 parameter 4 address	6005	0000 ... FFFF	/	×
C1-026	Send message 2 parameter 1 address	6007	0000 ... FFFF	/	×
C1-027	Send message 2 parameter 2 address	600A	0000 ... FFFF	/	×
C1-028	Send message 2 parameter 3 address	6009	0000 ... FFFF	/	×
C1-029	Send message 2 parameter 4 address	6016	0000 ... FFFF	/	×
C1-030	Send message 3 parameter 1 address	0	0000 ... FFFF	/	×
C1-031	Send message 3 parameter 2 address	0	0000 ... FFFF	/	×
C1-032	Send message 3 parameter 3 address	0	0000 ... FFFF	/	×
C1-033	Send message 3 parameter 4 address	0	0000 ... FFFF	/	×
C1-034	Receive message 1 parameter 3 address	0A02	0000 ... FFFF	/	×
C1-035	Receive message 1 parameter 4 address	0	0000 ... FFFF	/	×
C1-036	Receive message 2 parameter 1 address	0	0000 ... FFFF	/	×
C1-037	Receive message 2 parameter 2 address	0	0000 ... FFFF	/	×
C1-038	Receive message 2 parameter 3 address	0	0000 ... FFFF	/	×
C1-039	Receive message 2 parameter 4 address	0	0000 ... FFFF	/	×
C1-040	Send message 1 parameter 1 address	0	0000 ... FFFF	/	×
C1-041	Send message 1 parameter 2 address	0	0000 ... FFFF	/	×
C1-042	Receive message 1 parameter 1 address	0	0000 ... FFFF	/	×
C1-043	Receive message 1 parameter 2 address	0	0000 ... FFFF	/	×

5.19 EtherCAT (C2)

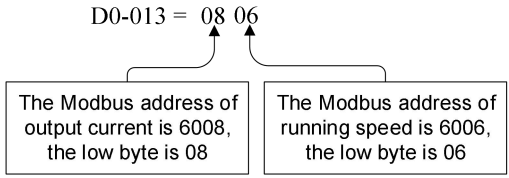
Parameter	Name	Default	Range	Unit	Attribute
C2-000	EtherCAT speed reference unit	1	0 ... 1	/	○
	• 0: rpm • 1: pulse/s				
C2-001	EtherCAT position reference smoothing cycle	1000	1 ... 65535	us	×
C2-002	The EtherCAT clock is synchronized with the drive	0	0 ... 1	/	○
	• 0: Synchronization not allowed • 1: Synchronization allowed				
C2-003	EtherCAT pulse input gear ratio numerator (speed control)	1	1 ... 65535	/	×
C2-004	EtherCAT pulse input gear ratio denominator (speed control)	1	1 ... 65535	/	×
C2-005	EtherCAT communication enable	0	0 ... 1	/	○
	• 0: EtherCAT Communication is disabled • 1: EtherCAT Communication is enabled				
C2-006	EtherCAT position loop reference mode	0	0 ... 3	/	○
	• 0: Target position shall be a relative value. • 1: Target position shall be an absolute value.				
C2-007	Address 0x6007 mapping selection	0	0 ... 99	/	○
C2-008	Transfer parameter address 1	0	0 ... 99	/	×
	Used to select the content of object 0x210B				
C2-009	Transfer parameter address 2	0	0 ... 99	/	×
	Used to select the content of object 0x210C				
C2-010	Transfer parameter address 3	0	0 ... 99	/	×
	Used to select the content of object 0x210D				
C2-011	Transfer parameter address 4	0	0 ... 99	/	×
	Used to select the content of object 0x210E				
C2-012	Transfer parameter address 5	0	0 ... 99	/	×
	Used to select the content of object 0x210F				
C2-013	EtherCAT position feedback compensation mode	0	0 ... 2	/	×
	• 0: Compensate EtherCAT position feedback by counter • 1: Compensate EtherCAT position feedback by time duty cycle • 2: No compensation				
C2-014	EtherCAT feedback speed gear ratio numerator	1	1 ... 65535	/	×
C2-015	EtherCAT feedback speed gear ratio denominator	1	1 ... 65535	/	×
C2-016	EtherCAT slave address	0	0 ... 65535	/	×
	When the Ethercat master station selects a fixed address to obtain the slave address, this parameter needs to be set.				
C2-017	ECT connection timeout	10	1～65535	ms	×

C2-018	Probe mode	0	0～1	/	○
	● 0: Only encoder Z signal triggering is supported ● 1: Support encoder Z signal triggering or digital input triggering (terminal function is set to "63")				

5.20 Keypad Parameters (D0)

Parameter	Name	Default	Range	Unit	Attribute
D0-000	User password	0	0 ... 65535	/	○
	In order to prevent the irrelevant personnel from querying and changing the parameters, and protect your know-how, it is possible to restrict access to the parameters by setting user password. ● **Setting password**: Enter new user password (non-zero values) through parameter D0-000, and press PRG key for confirmation. Repeat this operation once again, and then the password is set successfully. ● **Change password:** Enter correct password through parameter D0-000, then enters parameter-editing status. Set D0-000=***** (new password) and press PRG key for confirmation. Set the same password again, the new password is successfully set. ● **Clear password:** Enter correct user password to enter the parameter editing status, check if d0-000 is 00000. Press PRG key for confirmation, and set D0-000=00000 again, then the password is cleared. **Note:** Make password take effect methods ➢ Press the ESC + PRG + ▲(UP) key at the same time. ➢ No key operation for 5 minutes. ➢ Repower on.				
D0-001	Random code	0	0 ... 10000	/	×
	Used by the manufacturer to check parameters under special circumstances.				
D0-002	Parameter restore	0	0 ... 4	/	×
	● **0: Disabled** ● **1: Save all the parameters to memory.** The parameters modified through communication will not be saved (will be restored to their original values) by default after power off. If you need to save them after power off, you need to D0-002 = 1 to store values manually. ● **2: All parameter values are restored to default values except parameters in Group P6.** ● **3: All parameter values are restored to default values except parameters in Group P6 and F.** ● **4: All parameter values are restored to default values except parameters in Group F.** **Note**: After the operation is completed, the value will automatically revert to 0.				
D0-003	Parameters upload and download function	0	0 ... 11	/	×
	Ones position: Upload parameter values to keypad ● 0: Enabled ● 1: Disabled **Tens position: Download parameter values to drive** ● 0: Enabled ● 1: Disabled **Note**: ➢ Only effective for LED keypad. ➢ The parameters upload and download function (D0-004) can be disabled by parameter D0-003.				

Parameter	Name	Default	Range	Unit	Attribute
D0-004	Parameters upload and download	0	0 ... 20	/	×
	• **00: No action** • **01: Save parameter values to keypad.** • **11: Download parameter values to drive**. **Notes:** ➢ Only effective for LED keypad ➢ After the operation is completed, the value will automatically revert to 0.				
D0-005	M Key function selection	0000	0000 ... FFFF	/	×
	• Press and hold the M key and ▼(DOWN) key for 3s at the same time to achieve **switching between remote control and keypad control**. In addition, the speed reference command is changed to keypad too, only valid in the speed loop. • **Press M and STOP keys at the same time an immediately cut off the drive output**. **Note**: M + STOP key can immediately cut off the drive output is very usefull when commissioning.				
D0-006	Reserved	0	0 ... 65535	/	×
	Reserved				
D0-007	Keypad lock Key function selection	0	0 ... 2	/	○
	• **0: Unlock** • **1: Lock all keys** • **2: Lock all keys except RUN key and STOP key**				
D0-008	Password protection range	0	0 ... 2	/	×
	Defines the protect method when the user password (d0-000) is effective. After modification, the parameter is effective after repower on. • **0: After the user password take effect, all editable parameters are invisible.** • **1: After the user password take effect, parameter groups defined by parameters D0-009 … D-010 are invisible.** • **2: After the user password take effect, all the parameters are read-only and cannot be changed.**				
D0-009	Hidden parameter group selection	0000	0000 ... FFFF	/	×
	Selects the parameter groups hidden for P0, P1, P2, P3, P4, P5, P6, P7, P8, P9, PA, PB, PC, A0, B0 and B1, 0 = visible, 1 = invisible. bit0: P0 bit1: P1 bit2: P2 bit3: P3 bit4: P4 bit5: P5 bit6: P6 bit7: P7 bit8: P8 bit9: P9 bit10: PA bit11: PB bit12: PC bit13: A0 bit14: B0 bit15: B1				
D0-010	Hidden parameter group selection	0000	0000 ... FFFF	/	×
	Selects the parameter groups hidden for C0, C1, C2, D0, E0, F0, F1, F2, and F3. 0 = visible, 1 = invisible. bit0: C0 bit1: C1 bit2: C2 bit3: D0 bit4: E0 bit5: F0 bit6: F1 bit7: F2 bit8: F7 bit9…bit15: reserved				

Parameter	Name	Default	Range	Unit	Attribute
D0-011	LCD backlight setting	0	0 ... 2	/	×
	Selects the backlight display mode. ● **0: Turn off the backlight after 30s of inactivity** ● **1: Always turn on the backlight** ● **2: Always turn off the backlight**				
D0-012	LCD contrast setting	24	14 ... 34	/	×
	Defines contrast setting for LCD keypad.				
D0-013	Keypad default display setting 0	0806	0000 ... FFFF	/	○
	All the status monitoring parameters in Group F0 has a unique keypad display address. The keypad address is the low btye of the Modbus address. For example, the Modbus address of output current is 0x6008 (The Modbus address of F0-008 is shown in the right column of the parameter list, please refer to parameter F0-008 for more information); the low byte is 08, so the display address of the keypad is "08".  ● For LED keypad, we can define 5 parameters to be monitored on the main menu of the keypad, use shift right or shift left key to cyclic switching. ● For LCD keypad, we can define 3 parameters to be monitored for each page; total 5 pages can define 15 parameters to be monitored on the main menu of the keypad. Use shift right or shift left key to cyclic switching the pages. The parameters D0-013 … D0-020 are used to select which parameters are displayed on the keypad for easy monitoring. Take D0-013 as an example. If we want to set the output frequency, output current and output voltage on the page 1 of LCD keypad, then set D0-013 = 0806, D0-014 = **0A. Then the first monitored parameter on page 1 of the LCD keypad is output frequency, the second monitored parameter on page 1 of the LCD keypad is output current and the third monitored parameter on page 1 of the LCD keypad is output voltage.				

Parameter	Name	Default	Range	Unit	Attribute

LED	Tens position and Ones position	The 1st monitored parameter
	Thousands position and Hundreds position	The 2nd monitored parameter
LCD	Tens position and Ones position	The 1st page the 1st monitored parameter
	Thousands position and Hundreds position	The 1st page the 2nd monitored parameter

D0-014	**Keypad default display setting 1**	000A	0000 ... FFFF	/	○

LED	Tens position and Ones position	The 3rd monitored parameter
	Thousands position and Hundreds position	The 4th monitored parameter
LCD	Tens position and Ones position	The 1st page the 3rd monitored parameter
	Thousands position and Hundreds position	The 2nd page the 1st monitored parameter

D0-015	**Keypad default display setting 2**	0705	0000 ... FFFF	/	○

LED	Tens position and Ones position	The 5th monitored parameter
	Thousands position and Hundreds position	Reserved
LCD	Tens position and Ones position	The 2nd page the 2nd monitored parameter
	Thousands position and Hundreds position	The 2nd page the 3rd monitored parameter

D0-016	**Keypad default display setting 3**	1514	0000 ... FFFF	/	○

LCD	Tens position and Ones position	The 3rd page the 1st monitored parameter
	Thousands position and Hundreds position	The 3rd page the 2nd monitored parameter

D0-017	**Keypad default display setting 4**	1716	0000 ... FFFF	/	○

LCD	Tens position and Ones position	The 3rd page the 3rd monitored parameter
	Thousands position and Hundreds position	The 4th page the 1st monitored parameter

D0-018	**Keypad default display setting 5**	1918	0000 ... FFFF	/	○

LCD	Tens position and Ones position	The 4th page the 2nd monitored parameter
	Thousands position and Hundreds position	The 4th page the 3rd monitored parameter

Parameter	Name	Default	Range	Unit	Attribute
D0-019	Keypad default display setting 6	1211	0000 ... FFFF	/	○
	LCD: Tens position and Ones position — The 5th page the 1st monitored parameter LCD: Thousands position and Hundreds position — The 5th page the 2nd monitored parameter				
D0-020	Keypad default display setting 7	0013	0000 ... FFFF	/	○
	LCD: Tens position and Ones position — The 5th page the 3rd monitored parameter LCD: Thousands position and Hundreds position — Reserved				
D0-021	Calibration coefficient	100.0	50.0 ... 150.0	%	○
	Reserved.				
D0-022	User-define display parameter selection	0	0 ... 75	/	○
	Selects the drive variable scaled into a desired user-define value.				
D0-023	User-define display parameter percentage	100.0	0.0 ... 200.0	%	○
	Defines scaling factor for user-define value (source selected by parameter D0-022).				
D0-024	Power correction factor	100	30 ... 200	%	○
	Defines scaling factor for output power of the drive.				
D0-025	LED keypad display setting 1 in stop state	1700	0000 ... FFFF	/	○
	LED: Tens position and Ones position — The 1st monitored parameter LED: Thousands position and Hundreds position — The 2nd monitored parameter				
D0-026	LED keypad display setting 2 in stop state	1918	0000 ... FFFF	/	○
	LED: Tens position and Ones position — The 3rd monitored parameter LED: Thousands position and Hundreds position — The 4th monitored parameter				
D0-027	LED keypad display setting 3 in stop state	0005	0000 ... FFFF	/	○
	LED: Tens position and Ones position — The 5th monitored parameter LED: Thousands position and Hundreds position — Reserved				
D0-028	VTS-DP04 potentiometer filter	0.0	0000 ... FFFF	/	○
D0-029	VTS-DP04 potentiometer zero offset	0.0	-1000.0~1000.0	/	○
D0-030	VTS-DP04 potentiometer gain	100.00	0.00~200.00	/	○
Parameters D0-028 …D0-030 are used for the VTS-DP04 keypad.					

5.21 Protection Configuration (E0)

Parameter	Name	Default	Range	Unit	Attribute
E0-000	Fault configuration 1	0000	0000 ... FFFF	/	×
E0-001	Fault configuration 2	0000	0000 ... FFFF	/	×
Parameters from E0-000 to E0-007 are key parameters for faults. In special cases, permission and guidance from the manufacturer must be obtained. bit0 … bit 15, fault type corresponding to each binary bit: Parameter E0-000: bit0: External fault bit1: IGBT overload bit2: Motor overload bit3: IGBT over temperature bit4: Motor over temperature bit5: Encoder fault bit6: Over current bit7: Module protection bit8: Over voltage bit9: Under voltage bit10: Encoder CD phase bit11: Output phase loss bit12: EEPROM fault bit13: Unauthorized bit14: PID feedback break bit15: PID feedback too high Parameter E0-001: bit0: ECT break bit1: CAN break bit2: ECT not support bit3: Rectifier over temperature bit4: Pre-charge fault bit5: Modbus timeout bit6: Encoder phase fault bit7: Analog input break bit8: Analog input too high bit9: Current detect fault bit10: Encoder Z fault bit11: Motor stall bit12: Brake chopper fault bit13: Over speed fault bit14:APP fault bit15: Input phase loss • **0: Fault is not shielded** • **1: Fault is shielded**				
E0-002	Fault display configuration 1	0000	0000 ... FFFF	/	×
E0-003	Fault display configuration 2	0000	0000 ... FFFF	/	×
Fault display configuration. bit0 … bit 15, fault type corresponding to each binary bit, please refer to parameters E0-000 and E0-002 for more information: • **0: Fault displayed on the keypad.** • **1: Fault displayed on the keypad is shielded.**					
E0-004	Fault lock configuration 1	FDFF	0000 ... FFFF	/	×
E0-005	Fault lock configuration 2	FFFF	0000 ... FFFF	/	×
Fault lock configuration. bit0 … bit 15, fault type corresponding to each binary bit, please refer to parameters E0-000 and E0-002 for more information: • **0: Fault Lock is disabled** • **1: Fault Lock is enabled**					
E0-006	Fault trip configuration 1	0DE0	0000 ... FFFF	/	×
E0-007	Fault trip configuration 2	0DE0	0000 ... FFFF	/	×
Fault trip, motor coast to stop. bit0 … bit 15, fault type corresponding to each binary bit, please refer to parameters E0-000 and E0-002 for more information: • **0: Coast to stop** • **1: Not coast to stop**					

Parameter	Name	Default	Range	Unit	Attribute
E0-008	No. of automatic reset attempts	0	0 ... 65535	/	×
E0-009	Automatic reset delay time	10.0	5.0 ... 6553.5	s	×
E0-008 is used to define the maximum number of automatic resets. ● **E0-008 = 0: Automatic reset function is inactive.** ● **E0-008 = 1 ... 65535: the number of automatic reset times.** E0-009 is used to define the time that the drive will wait after a fault (or a previous reset attempt) before attempting an automatic reset. **Note**: The parameter E0-008 and E0-009 should be use with parameters E0-023, E0-024 and E0-025.					
E0-010	Motor overload protection mode	0	0 ... 65535	/	×
	Reserved.				
E0-011	Motor overload protection coefficient	1.0	0.5 ... 3.0	/	×
	The motor overload protection coefficient is the protection time constant set to prevent the motor from being damaged due to long-term operation of the motor in an overload state. When the overload protection point is reached, the drive trips on a fault and stops output. It can be set according to the actual overload capacity of the motor and the overload capacity of the drive.				
E0-012	Motor temperature sensor	0	0 ... 6	/	×
	Selects motor temperature sensor. ● **0: No motor temperature sensor** ● **1: PT100** For the control board with resolver (default control board for the power ≥ 11kW), when PT100 is used as motor temperature sensor, set to "1". ● **2: KTY84-130** For the control board with resolver (default control board for the power ≥ 11kW), when KTY84-130 is used as motor temperature sensor, set to "2". ● **3: PTC(reserved)** ● **4: AI2 use as KTY84 signal input (reserved)** ● **5: AI3 use as PT100 signal input** For the control board without resolver (default control board for the power ≤ 7.5kW), when PT100 is used as motor temperature sensor, set to "5". Note that set the AI3 jumper and AI3 DIP correctly. Note: This selection ● **6: AI3 use as KTY84-130 input** For the control board without resolver (default control board for the power ≤ 7.5kW), when KTY84-130 is used as motor temperature sensor, set to "6". Note that the AI3 jumper and the AI3 DIP should be set correctly. **Notes**: ➢ When a motor temperature sensor is used to detect motor temperature, please confirm the drive mode selected support the motor temperature sensor input. ➢ When using a motor temperature sensor to detect motor temperature, please note that E0-019 (Motor				

Parameter	Name	Default	Range	Unit	Attribute
	over temperature value) is set to the appropriate value.				
E0−013	Over speed detect value	0.0	0.0 ... 200.0	%	×
E0−014	Over speed detect time	0.100	0.000 ... 30.000	s	○
When the speed of the motor continues to exceed the over speed detect value (defined by parameter E0−013) for the time defined by parameter E0−014, the drive trips on a fault (F3−050 = 1).					
E0−015	Speed error detect value	0.00	0.00 ... 650.00	Hz	×
E0−016	Speed error detect time	0.100	0.000 ... 30.000	s	○
When the speed error of the motor continues to exceed the speed error detect value (defined by parameter E0−015) for the time defined by parameter E0−016, the drive trips on a fault (F3−050 = 2).					
E0−017	Zero current detect value	0.0	0.0 ... 200.0	%	×
E0−018	Zero current detect time	1.000	0.000 ... 30.000	s	○
When the output current of the motor continues to exceed the zero current detect value (defined by parameter E0−017) for the time defined by parameter E0−018, the drive trips on a fault (F3−050 = 3). **Note**: Zero current detect function is invalid when the drive is stopped.					
E0−019	Motor over temperature value	140	0 ... 140	℃	×
E0−020	Motor temperature correction value	0	−200 ... 200	℃	×
When the motor temperature exceeds the motor over temperature value (E0−019), the drive trips on a fault and stops output to protect the motor from overheating and damage. When there is a deviation between the measured temperature and actual motor temperature, using parameter E0−020 to correct the measured temperature to be consistent with the actual temperature.					
E0−021	Fan running mode	0	0 ... 2	/	○
	• **0: Fan is running when the drive in running state.** • **1: Fan is running after the drive is powered up.** • **2: Fan is running according the IGBT temperature.** The cooling fan is running when the temperature is higher than 40℃ and stop when the temperature is lower than 35℃. **Notes**: ➢ No matter select which mode, the fan is running when the temperature is higher than 40℃ and stop when the temperature is lower than 35℃. ➢ The parameter has no effective in V9 series product that the cooling fan are controlled by hardware.				
E0−022	Automatic reset configuration 1	0000	0000 ... FFFF	/	○
E0−023	Automatic reset configuration 2	0000	0000 ... FFFF	/	○
E0−024	Automatic reset enables	0	0 ... 1	/	×

Parameter	Name	Default	Range	Unit	Attribute

- **E0−024 = 0: Disables automatic reset.**

  Automatic reset function is inactive.

- **E0−024 = 1: Enables automatic reset.**

  The fault automatic reset function takes effect. When there is a fault can be automatic reset (defined by parameter E0−022 and E0−023), the fault will be automatically reset within the allowable automatic reset times (defined by parameter E0−008).

Parameter E0−022	Corresponding faults	Parameter E0−023	Corresponding faults
bit0	**External fault**	bit0	ECT break
bit1	**IGBT overload**	bit1	CAN break
bit2	**Motor overload**	bit2	ECT not support
bit3	IGBT over temperature	bit3	Rectifier over temperature
bit4	**Motor over temperature**	bit4	Pre−charge fault
bit5	Encoder fault	bit5	Modbus timeout
bit6	**Over current**	bit6	Encoder phase fault
bit7	Module protection	**bit7**	**Analog input break**
bit8	**Over voltage**	**bit8**	**Analog input too high**
bit9	**Under voltage**	bit9	Current detect fault
bit10	Encoder CD phase	bit10	Encoder Z fault
bit11	Output phase loss	bit11	Motor stall
bit12	EEPROM fault	bit12	Brake chopper fault
bit13	Unauthorized	bit13	Over speed fault
bit14	PID feedback break	bit14	APP fault
bit15	PID feedback too high	bit15	Input phase loss

Note: Currently, automatic resets are possible only for certain fault types and when the automatic reset function is activated for that fault type: external fault, IGBT overload, motor overload, motor over temperature, over current, over voltage, under voltage, Analog input break, Analog input too high. Automatic reset function has no effect for other faults.

E0−025	**Continuous fault detection time**	0	0 ... 65535	/	○
	Defined the minimum interval for automatic reset. If a fault automatic reset action is performed and a continuous fault occurs within this time, the fault cannot be reset by automatic reset function.				
E0−026	**Hardware version**	1	0 ... 1	/	○
	Reserved for manufacture.				
E0−027	**Stall protection enable**	0	0 ... 1	/	×
E0−028	**Stall frequency limit**	0.5	0.5 ... 50.0	Hz	×
E0−029	**Stall time**	1	0 ... 3000	s	×

Parameter E0−027 is used to activates or deactivates the motor stall protection.

- **E−027 = 0: Stall protection is disabled.**
- **E−027 = 1: Stall protection is enabled.**

Parameter	Name	Default	Range	Unit	Attribute
It is possible to adjust the torque and speed when the motor in stall condition. When the following conditions are met simultaneously, the drive trips on a fault. ① Parameter E0−027 = 1. ② The output current continuously exceeds 95% of the maximum torque limit. ③ The reference frequency is above the level set by parameter E0−028. ④ The output frequency is below the level set by parameter E0−028. ⑤ The conditions above have been valid longer than the time set by parameter E0−029.					
E0−030	Fault retention after power−off	0	0 ... 1	/	○
	● **0: Fault is not locked.** If cut off the power supply of the drive with a fault, the fault will be reset the next time the drive is powered up. ● **1: Fault is locked.** If cut off the power supply of the drive with a fault, the trip does or occur the next time the drive is powered up, must RESET before start.				
E0−031	Motor pre−overload selection	0000	0000 ... 1111	/	○
E0−032	Motor pre−overload detect value	120.00	0.05 ... 600.00	%	○
E0−033	Motor pre−overload detect time	10	1 ... 65530	S	○

E0−031 ones position: Activates/deactivates pre−overload detection function

- **0: Inactive**

  Motor pre−overload detect function deactivated.

- **1: Active**

  Motor pre−overload detect function activated. When the output current continuously exceeds the motor pre overload detect value (E0−032) for the time defined by parameter (E0−033), the motor pre−overload alarm signal can be output by digital output (the digital output function = [57]).

  If hundreds position of E0−031 = 1, the drive trips on a fault too.

E0−031 tens position: Pre−overload detection during acceleration

- **0: Detect only at constant speed**

  The motor pre−overload detection is only active only when the drive running at steady speed.

- **1: Always detect**

  The motor pre−overload detection is active when the drive in running status.

E0−031 hundreds position: Pre−overload fault / alarm selection

- **0: Generate an alarm signal but without trip.**

  The drive generates an alarm signal but without trip when the output current continuously exceeds the motor pre overload detect value (parameter E0−032).

- **1: The drive trips on a fault.**

  The drive trips on a fault when the output current continuously exceeds the motor pre overload detect value (parameter E0−032).

Parameter	Name	Default	Range	Unit	Attribute
E0-031 thousands position: pre-overload output signal cleared selection ● 0: Cleared in stop status. ● 1: Cleared after the load falls below the pre-overload level.					

5.22 Status Monitoring Parameters (F0)

Parameter	Name	Range	Unit	Modbus address in HEX
F0-000	Reference frequency	-327.67 ... 327.67	Hz	6000
F0-001	Reference speed	-32767 ... 32767	rpm	6001
F0-002	Reference torque	-6553.5 ... 6553.5	%	6002
F0-000 shows the reference frequency. F0-001 shows the reference speed. F0-002 shows the reference torque.				
F0-003	Reference position high order byte	0 ... 65535	pulse	6003
F0-004	Reference position low order byte	0 ... 65535	pulse	6004
Parameters F0-003 and F0-004 are used to show the reference position.				
F0-005	DC bus voltage	0 ... 65535	V	6005
F0-006	Running frequency	-327.67 ... 327.67	Hz	6006
F0-007	Running speed	-32767 ... 32767	rpm	6007
F0-008	Output current	-3276.7 ... 3276.7	A	6008
F0-009	Output torque	0.0 ... 6553.5	%	6009
F0-010	Output voltage	0 ... 65535	V	600A
F0-011	Output power	-3276.8 ... 3276.7	kW	600B
F0-005 shows the measured DC bus voltage. F0-006 shows the running frequency. F0-007 shows the running speed. F0-008 shows the measured motor current. F0-009 shows the the calculated motor torque. F0-010 shows the calculated motor voltage. F0-011 shows the calculated output power.				
F0-012	System status	0000 ... FFFF	/	600C

Shows the drive status word 1.(parameter F0-104 shows the status word 2, please refer to F0-104 for more information)

Bit 0	Ready	Bit 8	Actual speed reach reference speed
Bit 1	Pre-charge OK	Bit 9	Actual position reach reference position
Bit 2	Running	Bit 10	Orientation complete
Bit 3	Speed reach upper limit	Bit 11	Brake chopper working
Bit 4	Speed reach lower limit	Bit 12	authorized
Bit 5	Accelerating	Bit 13	S curve shape finish
Bit 6	Decelerating	Bit 14	Super user
Bit 7	Zero speed	Bit 15	Emergency stop

Parameter	Name	Range	Unit	Modbus address in HEX
F0-013	Drive fault display 1	0000 ... FFFF	/	600D
F0-014	Drive fault display 2	0000 ... FFFF	/	600E

F0-013 and F0-014 when the corresponding bit=1, it indicates the drive has a fault in the corresponding bit.

Parameter F0-013	Corresponding faults	Parameter F0-014	Corresponding faults
Bit 0	External fault	Bit 0	ECT break
Bit 1	IGBT overload	Bit 1	CAN break
Bit 2	Motor overload	Bit 2	ECT not support
Bit 3	IGBT over temperature	Bit 3	Rectifier over temperature
Bit 4	Motor over temperature	Bit 4	Pre-charge fault
Bit 5	Encoder fault	Bit 5	Modbus timeout
Bit 6	Over current	Bit 6	Encoder phase fault
Bit 7	Module protection	Bit 7	Analog input break
Bit 8	Over voltage	Bit 8	Analog input too high
Bit 9	Under voltage	Bit 9	Current detect fault
Bit 10	Encoder CD phase	Bit 10	Encoder1 Z fault
Bit 11	Output phase loss	Bit 11	Motor stall
Bit 12	EEPROM fault	Bit 12	Brake chopper fault
Bit 13	Unauthorized	Bit 13	Over speed fault
Bit 14	PID feedback break	Bit 14	APP fault
Bit 15	PID feedback too high	Bit 15	Input phase loss

F0-015	Drive fault Code	0 ... 65535	/	600F

Shows the fault code when the drive trips on a fault. When F0-015 = 0, means no fault.

Value of F0-015	Fault name	Value of F0-015	Fault name
1	External fault	17	ECT break
2	IGBT overload	18	CAN brea
3	Motor overload	19	ECT not support
4	IGBT over temperatur	20	Rectifier over temperature
5	Motor over temperature	21	Pre-charge fault
6	Encoder fault	22	Modbus timeout
7	Over current	23	Encoder phase fault
8	Module protection	24	Analog input break
9	Over voltage	25	Analog input too high
10	Under voltage	26	Current detect fault
11	Encoder CD phase loss	27	Encoder1 Z fault
12	Output phase loss	28	Motor stall
13	EEPROM fault	29	Brake chopper fault
14	Unauthorized	30	Over speed fault
15	PID feedback break	31	Application fault
16	PID feedback too high	32	Input phase loss

Parameter	Name	Range	Unit	Modbus address in HEX
F0−016	Current position high order byte	0 ... 65535	pulse	6010
F0−017	Current position low order byte	0 ... 65535	pulse	6011
F0−016 and F0−017 are used to show the current position high order byte and low order byte.				
F0−018	Position following error	−32768 ... 32767	pulse	6012
	Shows the deviation between the current position feedback and the current position reference.			
F0−019	Mechanical position 1	0 ... 65535	pulse	6013
	Shows the encoder 1 position (selected by parameter A0−000)			
F0−020	Digital inputs status	0000 ... FFFF	/	6014
	Status of digital inputs. **Example**: 0000001 = X1 is ON, X7…X2 are OFF. The corresponding relationship of each bit is as follows: bit0: X1 bit1: X2 bit2: X3 bit3: X4 bit4:X5 bit5: X6 bit6: X7 bit7: AI1 bit8: AI2 bit9: AI3 bit10: virtual X1 bit11: virtual X2 bit12: virtual X3 bit13: virtual X4 bit14: virtual X5 bit15: reserved			
F0−021	Digital outputs status	0000 ... FFFF	/	6015
	Status of digital outputs and relay outputs. **Example:** 10000 = Relay 3 is energized, Relay 1 and Relay 2 are de−energised, Y1 and Y2 are OFF. The corresponding relationship of each bit is as follows: bit0: Y1 bit1: Y2 bit2: Relay1 bit3: Relay2 bit4: Relay3 bit5 … bit15: reserved			
F0−022	IGBT temperature	−1000 ... 10000	℃	6016
	Shows the measured IGBT temperature.			
F0−023	AI1 input value	−32.767 ... 32.767	V	6017
F0−024	AI2 input value	−32.767 ... 32.767	V	6018
F0−025	AI3 input value	−32.767 ... 32.767	V	6019
Parameters F0−023, F0−024 and F0−025 are used to display the value of analog input AI1, AI2 and AI3 after scaling. 10.00 = 10..00V/20mA.				
F0−026	PID reference	0.00 ... 655.35	%	601A
F0−027	PID feedback	0.00 ... 655.35	%	601B
F0−026 shows the process PID reference. 100.00 = maximum speed P0−012. F0−027 shows the process PID feedback. 100.00 = maximum speed P0−012.				
F0−028	Simple PLC_T1	0 ... 65535	s	601C
F0−029	Simple PLC_T2	0.0 ... 6553.5	s	601D
F0−030	Simple PLC current cycle times	0 ... 65535	/	601E
F0−031	Simple PLC current step	0 ... 65535	/	601F
Parameters F0−028 … F0−031 are used to show the simple PLC logic status display.				

Parameter	Name	Range	Unit	Modbus address in HEX
F0-032	Keypad UP/DN adjustment value	-327.67 ... 32767	Hz	6020
		-32767 ... 32767	rpm	
	Shows Keypad UP/DN adjustment value.			
F0-033	Terminal UP/DN adjustment value	-327.67 ... 32767	Hz	6021
		-32767 ... 32767	rpm	
	Shows terminal UP/DN adjustment value.			
F0-034	Accumulative power-on time (hours)	0 ... 65535	h	6022
F0-035	Accumulative power -on time (minutes)	0 ... 65535	min	6023
F0-034 and F0-035 are used to show accumulative power-on time. Total power-on time = F0-035 + F0-035/60.				
F0-036	Accumulative running time (hours)	0 ... 65535	h	6024
F0-037	Accumulative running time (minutes)	0 ... 65535	min	6025
F0-034 and F0-035 are used to show accumulative running time. Total running time = F0-036 + F0-037/60.				
F0-038	CPU utilization	0.0 ... 6553.5	%	6026
	Shows CPU utilization.			
F0-039	Pulse input low order byte	-32767 ... 32767	pulse	6027
F0-040	Pulse input high order byte	-32767 ... 32767	pulse	6028
F0-039 and F0-040 are used to show pulse input low order byte and high order byte.				
F0-041	Motor temperature	-40 ... 140	℃	6029
	Shows measured motor temperature by motor sensor.			
F0-042	EtherCAT control word	0000 ... FFFF	/	602A
	Shows the current EtherCAT control word from host controller.			
F0-043	EtherCAT status word	0000 ... FFFF	/	602B
	Shows the current EtherCAT status word.			
F0-044	EtherCAT operation mode	0000 ... FFFF	/	602C
	Shows the current EtherCAT operation mode.			
F0-045	EtherCAT synchronization cycle number	0 ... 65535	/	602D
	Shows the current EtherCAT synchronization cycle number.			
F0-046	Encoder phase Z position	0 ... 65535	/	602E
	Shows the encoder phase Z signal position.			
F0-047	EtherCAT torque reference	0 ... 65535	/	602F
	Shows EtherCAT torque reference.			
F0-048	AI1 sampling value	-32.767 ... 32.767	V	6030
F0-049	AI2 sampling value	-32.767 ... 32.767	V	6031
F0-050	AI3 sampling value	-32.767 ... 32.767	V	6032
Parameters F0-048 … F0-050 are used to display the value of actual analog input value AI1, AI2 and AI3 before scaling.				

<table>
<tr><th>Parameter</th><th>Name</th><th>Range</th><th>Unit</th><th>Modbus address in HEX</th></tr>
<tr><td>F0-051</td><td>User define display value</td><td>0 ... 65535</td><td>/</td><td>6033</td></tr>
<tr><td colspan="5">Shows the user define display value. The value is defined by parameter D0-022 and D0-023.</td></tr>
<tr><td>F0-052</td><td>Accumulative power consumption low order byte</td><td>0.0 ... 6553.5</td><td>kW.h</td><td>6034</td></tr>
<tr><td>F0-053</td><td>Accumulative power consumption high order byte</td><td>0 ... 65535</td><td>kW.h</td><td>6035</td></tr>
<tr><td colspan="5">F0-052 and F0-053 are used to show the accumulative power consumption low order byte and high order byte.</td></tr>
<tr><td>F0-054</td><td>Accumulative power generation low order byte</td><td>0 ... 6553.5</td><td>kW.h</td><td>6036</td></tr>
<tr><td>F0-055</td><td>Accumulative power generation high order byte</td><td>0 ... 65535</td><td>kW.h</td><td>6037</td></tr>
<tr><td colspan="5">F0-054 and F0-055 are used to show the accumulative power generation low order byte and high order byte.</td></tr>
<tr><td>F0-056</td><td>Home position 1</td><td>0 ... 65535</td><td>/</td><td>6038</td></tr>
<tr><td colspan="5">Shows the home position for encoder 1 (encoder signal phase Z position).</td></tr>
<tr><td>F0-057</td><td>Home position 2</td><td>0 ... 65535</td><td>/</td><td>6039</td></tr>
<tr><td colspan="5">Shows the home position for encoder 2. (encoder signal phase Z position)</td></tr>
<tr><td>F0-058</td><td>Mechanical position 2</td><td>0 ... 65535</td><td>/</td><td>603A</td></tr>
<tr><td colspan="5">Shows the encoder 2 position.</td></tr>
<tr><td>F0-059</td><td>Encoder 2 corresponds to motor rotation speed</td><td>-32767 ... 32767</td><td>/</td><td>603B</td></tr>
<tr><td colspan="5">Shows encoder 2 corresponds to motor rotation speed.</td></tr>
<tr><td>F0-060</td><td>System status 1</td><td>0 ... 65535</td><td>/</td><td>603C</td></tr>
<tr><td colspan="5">Shows system status word 1.
<table>
<tr><td>bit0</td><td>Running</td><td>bit4</td><td>Keypad is locked</td></tr>
<tr><td>bit1</td><td>reserved</td><td>bit6 ... bit5</td><td>Running command reference
00: keypad 01: digital input
10: RS485 11: other</td></tr>
<tr><td>bit2</td><td>reserved</td><td>bit15 ... bit7</td><td>reserved</td></tr>
<tr><td>bit3</td><td>Reverse running</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>F0-061</td><td>Modbus speed reference</td><td>-32767 ... 32767</td><td>/</td><td>603D</td></tr>
<tr><td colspan="5">Shows modbus communication speed reference (address 0x8001).</td></tr>
<tr><td>F0-062</td><td>Encoder 1 corresponds to motor rotation speed</td><td>-32767 ... 32767</td><td>rpm</td><td>603E</td></tr>
<tr><td colspan="5">Shows the incremental encoder speed for encoder 1. Measure at any control mode, even VF control, thus check whether the encoder wiring and installation are correct.</td></tr>
<tr><td>F0-063</td><td>Application fault</td><td>0 ... 65535</td><td>/</td><td>603F</td></tr>
<tr><td colspan="5">Shows the fault that will be automatic reset.</td></tr>
<tr><td>F0-064</td><td>Running frequency</td><td>0 ... 655.35</td><td>Hz</td><td>6040</td></tr>
<tr><td>F0-065</td><td>Running speed</td><td>0 ... 65535</td><td>rpm</td><td>6041</td></tr>
<tr><td>F0-066</td><td>Output current</td><td>-3276.8 ... 3276.7</td><td>A</td><td>6042</td></tr>
<tr><td>F0-067</td><td>Output voltage</td><td>0 ... 65535</td><td>V</td><td>6043</td></tr>
<tr><td>F0-068</td><td>Output power</td><td>0.0 ... 6553.5</td><td>kW</td><td>6044</td></tr>
</table>

Parameter	Name	Range	Unit	Modbus address in HEX
F0-064 show the absolute running frequency. F0-065 show the absolute running speed. F0-066 show the measured output current after filtering. F0-067 show the measured output voltage after filtering. F0-068 show the measured output power after filtering.				
F0-069	ECT SPI communication time	0 ... 65535	/	6045
	Displays the ECT SPI communication time.			
F0-070	ECT position reference high order byte	0 ... FFFF	/	6046
F0-071	ECT position reference low order byte	0 ... FFFF	/	6047
F0-070 and F0-071 are used to show the ECT position reference.				
F0-072	ECT Switch position high order byte	0 ... FFFF	/	6048
F0-073	ECT Switch position low order byte	0 ... FFFF	/	6049
F0-072 and F0-073 are used to show the ECT switch position reference.				
F0-074	Encoder 1 Z signal position	0 ... 65535	/	604A
	Shows the encoder 1 Z signal position.			
F0-075	SinCos signal amplitude	0 ... 65535	/	604B
	Shows the SinCos signal amplitude of resolver or SinCos encoder. **Note:** When the resolver installation is not good, may cause the value of F0-075 too low, may cause the drive trips on a fault.			
F0-076	Transmission ratio coefficient	0.000 ... 65.535	/	604C
	This parameter is used to show the transmission ratio coefficient of the 1st encoder and the 2nd encoder.			
F0-077	Encoder 2 Z signal position	0 ... 65535	/	604D
	Shows the encoder 2 phase Z signal position.			
F0-078	CAN control word	0 ... FFFF	/	604E

Parameter F0-078	Name	Description
bit0	Switch on	Ready
bit1	Enable voltage	Main circuit powered up
bit2	Quick stop	Quick stop
bit3	Enable operatiaon	Running
bit6 … bit4	Operation mode specific	Related to drive operation mode
bit7	Fault reset	Fault reset
bit8	halt	Not support yet
bit9	Reserved	
bit10	Positioning command	The drive start internal positioning function, which has the highest priority in non torque loop mode. If you want to ensure the normal

Parameter	Name	Range	Unit	Modbus address in HEX

		operation of other modes, please ensure that this bit value is 0.
bit15 … bit11	Manufacturer specific	Customized by the manufacturer, undefined.

.

F0-079	CAN status word	0 ... FFFF	/	604F

Parameter F0-079	Name	Description
bit0	Ready to switch on	The drive without fault
bit1	Switched on	Waiting enable signal
bit2	Operation enabled	The drive running
bit3	Fault	The drive has a fault
bit4	Voltage enabled	bit4 = 1 after the drive is powered up, it indicates that the main circuit power supply is normal
bit5	Quick stop	Quick stop
bit6	Switch on disabled	Ready
bit7	Warming	bit7= 1 indicates that the has a warming
bit8	Manufacture specific	0 = spindle speed≠0. 1 = spindle speed is 0
bit9	Remote	Remote
bit10	Target reached	The reference has reached, and bit10 has different meanings in different modes. In PP mode, bit10 = 1 indicates that the position has reached the reference position; In CSV mode, bit10 = 1 indicates that the speed has reached the reference speed; In CSP mode, bit10 = 1 indicates that the position has arrived.
bit11	Internal limit active	Reserved
bit13 … bit12	Operation mode specific	Related to each servo mode
bit15 … bit14	Manufacture specific	Customized by the manufacturer, undefined.

F0-080	CAN mode status	0 ... FFFF	/	6050

F0-080 dispay the current mode status.

6061H	Mode
9	Cyclic Synchronous Velocity Mode
10	Cyclic Synchronous Torque Mode

F0-081	CAN error counter	0 ... FFFF	/	6051

This parameter shows the number of CAN communication errors, with the high 8 bits indicating the receive errors and the low 8 bits indicating the send erros.

F0-082	CAN error status	0 ... FFFF	/	6052

Parameter	Name	Range	Unit	Modbus address in HEX
	Display the CAN error status code and error flags. ● **bit 6:4 LEC [2:0]: Last error code** This field is set to 1 by hardware, where the code indicates the previous error condition detected on the CAN bus. If the message is successfully transmitted (received or sent) and no error occurs, this field will be cleared to 0. LEC [2:0]: bits can be set to 0b111 values by software, and these bits are updated by hardware to indicate the current communication status. 000: No error 100: Bit implicit error 001: Filling error 101: Bit explicit error 010: Format error 110: CRC error 011: Confirmation error 111: Set to 1 by software ● **bit 3: reserved**, reset value must be maintained ● **bit 2: BOFF:** Bus off flag Bit2 is set to 1 by hardware when entering sleep mode. When TEC overflows (exceeding 255), it enters the bus shutdown state. ● **bit 1 EPVF,** Error passive flag When the error passive limit is reached (receive errors or send errors >127), bit1 is set to 1 by hardware. ● **bit 0: EWGF, Error Warning sign** When the warning limit is reached, bit 0 is set to 1 by hardware (receive errors or send errors >=96).			
F0-083	**PROFIBUS DP communication status**	0 ... FFFF	/	6053
	The high 8 bits of this parameter display the working status of the PROFIBUS-DP communication, while the low 8 bits display the type of PPO channel.			
F0-084	**PROFIBUS DP communication counter**	0 ... 65535	/	6054
	This parameter shows the number of PROFIBUS-DP communication errors.			
F0-085	**Output current**	0 ... 6553.5	/	6055
	Shows the measured absolute output current after filtering.			
F0-086	**Trip code saved before power cut-off**	0 ... 65535	/	6056
	Shows trip code recorded before power supply is cut-off.			
F0-087	**Total number of parameters**	0 ... 65535	/	6057
	Reserved.			
F0-088	**Speed controller output torque**	0 ... 6553.5	%	6058
	Shows current speed controller output torque, 100.0% = motor rated torque.			
F0-089	**Electrical angle**	0 ... 65535	/	6059
	Mechanical angle: refers to the geometric angle of space occupied by each pole pair of the motor on the inner circle of the stator, i.e. 360 °/p, where p is the number of pole pairs. Electrical angle: In a multi-pole motor, the mechanical angle occupied by each pair of poles is defined as an electrical angle of 360 °, and the relationship between the electrical angle and the mechanical angle is: Electrical angle = mechanical angle × pole pairs			

<table>
<tr><th>Parameter</th><th>Name</th><th>Range</th><th>Unit</th><th>Modbus address in HEX</th></tr>
<tr><td>F0-090</td><td>ECT communication abnormal code</td><td>0 ... 65535</td><td>/</td><td>605A</td></tr>
<tr><td colspan="5">When P0-04=3, if the ECT communication between the drive and the master controller communication failed, this parameter F0-090 will be changed to "2" alarm prompt. In addition, the drive trips on ECT failed.</td></tr>
<tr><td>F0-091</td><td>Current pulse high-order byte</td><td>0 ... 65535</td><td>/</td><td>605B</td></tr>
<tr><td>F0-092</td><td>Current pulse low-order byte</td><td>0 ... 65535</td><td>/</td><td>605C</td></tr>
<tr><td colspan="5">F0-091 and F0-092 are used to show the current pulse reference high order byte.</td></tr>
<tr><td>F0-093</td><td>Permanent magnet motor back EMF</td><td>0.00 ... 655.35</td><td>V</td><td>605D</td></tr>
<tr><td colspan="5">Shows permanent magnet motor back EMF</td></tr>
<tr><td>F0-094</td><td>Frequency reference 1</td><td>0.00 ... 655.35</td><td>Hz</td><td>605E</td></tr>
<tr><td colspan="5">Shows absolute frequency reference.</td></tr>
<tr><td>F0-095</td><td>Open loop main reference</td><td>-327.67 ... 32767</td><td>%</td><td>605F</td></tr>
<tr><td colspan="5">Shows open loop main reference in %. ±100% = ±maximum speed P0-012.</td></tr>
<tr><td>F0-096</td><td>PID output</td><td>-327.67 ... 32767</td><td>%</td><td>6060</td></tr>
<tr><td colspan="5">Shows the PID output, ±100% = ±maximum speed P0-012.</td></tr>
<tr><td>F0-097</td><td>Keypad potentiometer reference value</td><td>0 ... 65535</td><td>/</td><td>6061</td></tr>
<tr><td colspan="5">Shows the VTS-DP04 keypad potentiometer reference value.</td></tr>
<tr><td>F0-098</td><td>Modbus-CMD</td><td>0000 ... FFFF</td><td>/</td><td>6062</td></tr>
<tr><td colspan="5">Shows the Modbus control word (address 0x8000). Refer to Appendix A for more information.
<table>
<tr><th>bit</th><th>Meaning</th><th>bit</th><th>Meaning</th></tr>
<tr><td>0</td><td>0: Stop command
1: Start command</td><td>8bit</td><td>0: Relay1 - OFF
1: Relay1 - ON</td></tr>
<tr><td>1</td><td>0: Run forward
1: Run reverse</td><td>9bit</td><td>0: Relay2 - OFF
1: Relay2 - ON</td></tr>
<tr><td>2</td><td>0: Reset disabled
1: Reset enabled</td><td>10bit</td><td>0: Relay3 - OFF
1: Relay3 - ON</td></tr>
<tr><td>3</td><td>Reserved</td><td>11bit</td><td>0: Disables PID switch speed
1: Enables PID switch speed</td></tr>
<tr><td>4</td><td>Reserved</td><td>12bit</td><td>Reserved</td></tr>
<tr><td>5</td><td>Reserved</td><td>13bit</td><td>Reserved</td></tr>
<tr><td>6</td><td>0: Y1 output OFF
1: Y1 output ON</td><td>14bit</td><td>Reserved</td></tr>
<tr><td>7</td><td>0: Y2 output OFF
1: Y2 output ON</td><td>15bit</td><td>Reserved</td></tr>
</table></td></tr>
<tr><td>F0-099</td><td>AO1 output display</td><td>0.00 ... 100.00</td><td>%</td><td>6063</td></tr>
<tr><td>F0-100</td><td>AO2 output display</td><td>0.00 ... 100.00</td><td>%</td><td>6064</td></tr>
<tr><td colspan="5">F0-099 show the AO1 output, 100.00 = 10V/20mA.
F0-100 show the AO2 output, 100.00 = 10V/20mA.</td></tr>
<tr><td>F0-101</td><td>Orthogonal pulse</td><td>0 ... 6553.5</td><td>Khz</td><td>6065</td></tr>
</table>

<table>
<tr><th>Parameter</th><th>Name</th><th>Range</th><th>Unit</th><th>Modbus address in HEX</th></tr>
<tr><td>F0−102</td><td>Single pulse 1</td><td>0 ... 6553.5</td><td>Khz</td><td>6066</td></tr>
<tr><td>F0−103</td><td>Single pulse 2</td><td>0 ... 6553.5</td><td>Khz</td><td>6067</td></tr>
<tr><td colspan="5">F0−100 show the orthogonal pulse input frequency when B1−000=0.
F0−101 show the single pulse input frequency when B1−000=1.
F0−102 show the single pulse input frequency when B1−000=2.</td></tr>
<tr><td>F0−104</td><td>System status word 2</td><td>0000 ... FFFF</td><td></td><td>6068</td></tr>
<tr><td colspan="4">Shows the drive status word 2.(parameter F0−012 shows the status word 1, please refer to F0−012 for more information)
<table>
<tr><td>Bit 0</td><td>Over voltage regulating</td><td>Bit4 ... Bit15</td><td>Reserved.</td></tr>
<tr><td>Bit 1</td><td>Under voltage regulating</td><td></td><td></td></tr>
<tr><td>Bit 2</td><td>DC braking</td><td></td><td></td></tr>
<tr><td>Bit 3</td><td>Terminal Enable Lock Status</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>F0−105</td><td>Communication torque reference</td><td>−32767 ... 32767</td><td></td><td>6069</td></tr>
<tr><td colspan="4">Shows communication torque reference.</td></tr>
<tr><td>F0−106</td><td>Idref</td><td>−3276.7 ... 3276.7</td><td>/</td><td>606A</td></tr>
<tr><td colspan="4">Shows the reference value of d−axis current.</td></tr>
<tr><td>F0−107</td><td>Udref</td><td>−3276.7 ... 3276.7</td><td>/</td><td>606B</td></tr>
<tr><td colspan="4">Shows the reference value of d−axis voltage.</td></tr>
</table>

5.23 Software Version (F1, F2)

Parameter	Name	Range	Unit	Modbus address in HEX
F1-000	Software version 1	0000 ... FFFF	/	6100
	The parameters in group F1 are read-only.			
F1-001	Software version 2	0000 ... FFFF	/	6101
F1-002	Software version 3	0000 ... FFFF	/	6102
F1-003	Software version 4	0000 ... 65535	/	6103
F1-004	Keypad ID	0000 ... 65535	/	6104
F1-005	Reserved	0000 ... 65535	/	6105
F1-006	Y	0000 ... 65535	/	6106
F1-007	D	0000 ... 65535	/	6107
F1-008	T	0000 ... 65535	/	6108
F1-009	Drive power	0.0 ... 6553.5	kW	6109
F1-010	Prompt code	0000 ... 65535	/	610A
F1-011	Reserved	0000 ... FFFF	/	610B
F1-012	Keypad copy identification code	0000 ... FFFF	/	610C
F2-000	Barcode information 0	0000 ... FFFF	/	6200
F2-001	Barcode information 1	0000 ... FFFF	/	6201
F2-002	Barcode information 2	0000 ... FFFF	/	6202
F2-003	Barcode information 3	0000 ... FFFF	/	6203

5.24 Trip History (F3)

Parameter	Name	Range	Unit	Modbus address in HEX
F3-000	Trip 0 code	0 ... 65000	/	
	There are 5-group trip history in total. Trip 0 (the latest trip): F3-000 ... F3-009 Trip 1(the 2nd latest trip): F3-010 … F3-019 Trip 2 (the 3rd latest trip): F3-020 … F3-029 Trip 3 (the 4th latest trip): F3-030 … F3-039 Trip 4 (the 5th latest trip): F3-040 … F3-009 **Notes**: ➢ When the trip code is 31, it is an application trip, please check F3-050 for more details. ➢ Refer to "Chapter 6 Diagnostics" for the diagnostics. ➢ When the drive trips on a fault, the current trip code is display in the parameter F0-015. The Modbus address of F0-015 is 0x600F. The host controller can query this address to check whether the drive is in fault state and query the fault code. ➢ The reset signal can be given through keypad, external digital input and communication control word, the reset signal resets the drive after a fault trip if the cause of the fault no longer exists.			
F3-001	Trip 0 running frequency	0.00 ... 650.00	Hz	
F3-002	Trip 0 reference frequency	0.00 ... 650.00	Hz	
F3-003	Trip 0 DC bus voltage	0 ... 60000	V	
F3-004	Trip 0 output current	0.0 ... 6553.5	A	
F3-005	Trip 0 digital inputs status	0000 ... FFFF	/	
F3-006	Trip 0 digital output status	0000 ... FFFF	/	
F3-007	Trip 0 heatsink temperature	0 ... 200	℃	
F3-008	Trip 0 accumulative power-ON Time	0 ... 65000	h	
F3-009	Trip 0 accumulative running Time	0 ... 65000	h	
F3-010	Trip 1 code	0 ... 65000	/	
F3-011	Trip 1 running frequency	0.00 ... 650.00	Hz	
F3-012	Trip 1 reference frequency	0.00 ... 650.00	Hz	
F3-013	Trip 1 DC bus voltage	0 ... 60000	V	
F3-014	Trip 1 output current	0.0 ... 6553.5	A	
F3-015	Trip 1 digital inputs status	0000 ... FFFF	/	
F3-016	Trip 1 digital output status	0000 ... FFFF	/	
F3-017	Trip 1 heatsink temperature	0 ... 200	℃	
F3-018	Trip 1 accumulative power-ON Time	0 ... 65000	h	
F3-019	Trip 1 accumulative running Time	0 ... 65000	h	
F3-020	Trip 2 code	0 ... 65000	/	
F3-021	Trip 2 running frequency	0.00 ... 650.00	Hz	

Parameter	Name	Range	Unit	Modbus address in HEX
F3-022	Trip 2 reference frequency	0.00 ... 650.00	Hz	
F3-023	Trip 2 DC bus voltage	0 ... 60000	V	
F3-024	Trip 2 output current	0.0 ... 6553.5	A	
F3-025	Trip 2 digital inputs status	0000 ... FFFF	/	
F3-026	Trip 2 digital output status	0000 ... FFFF	/	
F3-027	Trip 2 heatsink temperature	0 ... 200	℃	
F3-028	Trip 2 accumulative power-ON Time	0 ... 65000	h	
F3-029	Trip 2 accumulative running Time	0 ... 65000	h	
F3-030	Trip 3 code	0 ... 65000	/	
F3-031	Trip 3 running frequency	0.00 ... 650.00	Hz	
F3-032	Trip 3 reference frequency	0.00 ... 650.00	Hz	
F3-033	Trip 3 DC bus voltage	0 ... 60000	V	
F3-034	Trip 3 output current	0.0 ... 6553.5	A	
F3-035	Trip 3 digital inputs status	0000 ... FFFF	/	
F3-036	Trip 3 digital output status	0000 ... FFFF	/	
F3-037	Trip 3 heatsink temperature	0 ... 200	℃	
F3-038	Trip 3 accumulative power-ON Time	0 ... 65000	h	
F3-039	Trip 3 accumulative running Time	0 ... 65000	h	
F3-040	Trip 4 code	0 ... 65000	/	
F3-041	Trip 4 running frequency	0.00 ... 650.00	Hz	
F3-042	Trip 4 reference frequency	0.00 ... 650.00	Hz	
F3-043	Trip 4 DC bus voltage	0 ... 60000	V	
F3-044	Trip 4 output current	0.0 ... 6553.5	A	
F3-045	Trip 4 digital inputs status	0000 ... FFFF	/	
F3-046	Trip 4 digital output status	0000 ... FFFF	/	
F3-047	Trip 4 heatsink temperature	0 ... 200	℃	
F3-048	Trip 4 accumulative power-ON Time	0 ... 65000	h	
F3-049	Trip 4 accumulative running Time	0 ... 65000	h	
F3-050	Application trip code	0 ... 65535	/	

When the trip code is "31", it is an application trip; the cause of the fault needs to query through parameter F3-050. Refer to "Chapter 6 Diagnostics" for the diagnostics.

F3-050	Cause
1	Over speed
2	Speed error
3	Zero current detection

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.

Even if a fault is the same, they are displayed differently on LCD keypad and LED keypad. These are all explained in the below table.

For details, refer to the following table to identify and correct the cause of the fault.

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

LCD keypad	LED keypad	F0-15 value	Fault Name	Possible causes	Corrective actions
Err-01	E-PEr	1	External fault	Digital input fault is "ON"	Check the corresponding digital input
Err-02	E-oL1	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-03	E-oL2	3	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-04	E-oH1	4	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-05	E-oH2	5	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-06	E-dL1	6	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-07	E-oC-	7	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 controller parameters correctly

LCD keypad	LED keypad	F0–15 value	Fault Name	Possible causes	Corrective actions
Err–08	E–FAL	8	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
				DC bus voltage under voltage (≥75kW)	Check the input power supply
				Built-in brake chopper abnormal (≥75kW)	Seek for technical support
				Rectifier or module overheated (≥75kW)	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–09	E–oU–	9	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–10	E–LU–	10	Under voltage	The input voltage is too low	Check the input power supply
				Abnormal switching power supply	Seek for technical support
Err–11	E–IPF	11	Encoder lost CD phase	CD signal connection is abnormal	Check the encoder and wiring
Err–12	E–oPF	12	Output phase loss	Motor failure	Replace a new motor
				Motor cable is broken	Replace a new motor cable
				Thermal relay failure (if is used)	Check thermal relay
				Output detection circuit failure	Seek for technical support
Err–13	E–EPr	13	EEPROM abnormal	EEPROM read/write abnormal	Seek for technical support
Err–14	E–LIC	14	Unauthorized	Unauthorized	Seek for technical support
Err–15	E–LoS	15	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	E–oUt	16	PID feedback has excessed upper limit	PID feedback exceeds the allowable range	Check whether the actual feedback value exceeds the set allowable range
Err–17	E–ECT	17	ECT communication failed	ET1100 communication failed	Seek for technical support
Err–18	E–CAn	18	CAN Communication failed	CAN communication failed	Seek for technical support

LCD keypad	LED keypad	F0–15 value	Fault Name	Possible causes	Corrective actions
Err–19	E–ETE	19	EtherCAT is disabled	EtherCAT is disabled	Seek for technical support
Err–20	E–DPE	20	PROFIBUS DP communication failed	PROFIBUS DP Communication failed	Check PROFIBUS DP wiring and related parameter settings
				PROFINET Communication failed	Check PROFINET wiring and related parameter settings
Err–21	E–unk	21	Reserved		
Err–22	E–ES–	22	Modbus communication time out	Incorrect baud rate setting	Set the baud rate correctly
				The read and write parameter address is incorrect or the sending and receiving time interval is not suitable	Check the parameter address and check the read and write time interval
				Communication timeout setting is inappropriate	Check the Modbus timeout time
				Modbus communication disconnection	Check the communication wiring
				Poor contact of Keypad	Check the keypad port
Err–23	E–OSE	23	Encoder 1 direction is opposite to encoder 2	Encoder 1 direction is opposite to encoder 2	Check the encoder 1 direction and encoder 2 direction
Err–24	E–AIU	24	Analog input disconnection	The analog disconnection function is turned on, and the analog input value is less than the analog disconnection value	Check the analog input voltage is normal Check the analog disconnection value setting Check the analog gain and other related parameters setting
Err–25	E–AIO	25	Analog input has exceeded upper limit	The analog alarm function is turned on, and the analog input value is greater than the upper value	Check whether the analog input voltage is normal Check whether the analog upper limit is set properly Check whether the analog gain and other related parameters are set properly
Err–26	E–CUr	26	Current detection abnormal	The current detection abnormal	Seek for technical support
Err–27	E–Z1r	27	Encoder 1 phase Z capture failed	Abnormal z-phase pulse capture of the encoder 1	Check the encoder 1 Z phase wiring
Err–28	E–STL	28	Motor stall	Motor stall	Check the motor actual speed and load Check motor parameters setting Check the motor stall parameter setting
Err–29	E–BOT	29	Brake chopper abnormal	Brake chopper working time too long	Check the brake chopper action voltage and load.

LCD keypad	LED keypad	F0–15 value	Fault Name	Possible causes	Corrective actions
Err–30	E–sTA	30	Speed suddenly go out of control	Speed suddenly too high, out of control	Check the motor speed feedback if normal (encoder). Check the motor parameter if setting correctly. Start motor parameters auto tune.
Err–31	E–APF	31	Application fault	When F3–050 = 1, Over speed. The current running speed of the motor exceeds the over-speed detection value.	Check the over-speed detection value setting Check the motor actual speed Check the motor load
				When F3–050 = 2, Speed error. The deviation between the current running speed and the reference speed exceeds the speed error detection value.	Check the speed error detection value setting Check the motor load Check the motor speed whether is stable Check the encoder PPR and wiring
				When F3–050 = 3, Zero current detection. The output current less than the zero current detection value.	Check the zero current detection value setting Check the wiring between the motor and the drive
Err–32	E–PER	32	Input phase loss	Input phase loss.	Check input phase. Check input voltage stability. Check if the input power supply connection is loose

Note: The fault code is also displayed in the F0-013 and F0-014. We can use the two parameters to check if there are multiple faults at the same time. The relationships are shown as follows:

Bit of F0–013	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Value of F0–015	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Bit of F0–014	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Value of F0–015	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17

Appendix A Modbus

1 Support Protocol

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

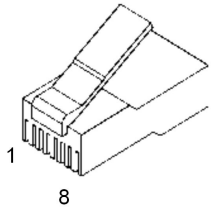
2 Interface Mode

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−1,19200 bps.

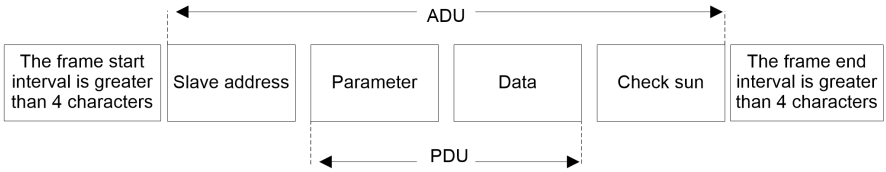
It is recommended to adopt EIA/TIA T568B, the lead of port A is defined as:



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 Description

■ 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

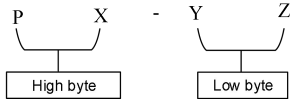
■ Function **0x10 writes multiple parameters** or control word

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

☞ **Note**: Function 0x10 can write up to 16 consecutive address parameters at a time

☞ **Note**: During communication, parameter value is written to RAM instead of ROM. The parameter data will not be saved after power-off.

5 Register Address

<table>
<tr><th>Address Space</th><th>Meaning</th></tr>
<tr><td>Control word register</td><td>0x8000</td></tr>
<tr><td>Speed reference register</td><td>0x8001</td></tr>
<tr><td>Status word</td><td>Parameter F0-000 … F0-108: address 0x6000 … 0x606C
The modbus address of monitoring parameters are listed in the parameters list in chapter 5.</td></tr>
<tr><td>Parameters address</td><td>The calculation method of the register address corresponding to the parameter: the high byte is the parameter group number, and the low byte is the serial number in the group, both expressed in hexadecimal.
 

<table>
<tr><td colspan="2">High byte</td></tr>
<tr><td>Parameters group</td><td>High byte value of address</td></tr>
<tr><td>P0 … PF</td><td>0x00 … 0x0F</td></tr>
<tr><td>A0</td><td>0x10</td></tr>
<tr><td>b0 … b1</td><td>0x20 … 0x21</td></tr>
<tr><td>C0 … C2</td><td>0x30 …0x32</td></tr>
<tr><td>d0</td><td>0x40</td></tr>
<tr><td>E0</td><td>0x50</td></tr>
<tr><td>F0 … F3</td><td>0x60 … 0x63</td></tr>
<tr><td colspan="2">Low byte</td></tr>
<tr><td>000 … 255</td><td>0x00 … 0xFF</td></tr>
</table>
Example: The Modbus operation address of parameter Pb-023:
(0x0b<<8) + 23 = 0x0b17</td></tr>
</table>

■ Control Word Register (Address: 0x8000)

bit	Meaning	bit	Meaning
0	0: Stop command 1: Run command	8	0: No action 1: Relay1 - ON
1	Reserved	9	0: No action 1: Relay2 - ON
2	0: No action 1: Reset enabled	10	0: No action 1: Relay3 - ON
3	Reserved	11	0: No action 1: Enables PID switch speed
4	Reserved	12	Reserved
5	Reserved	13	Reserved
6	0: No action 1: Y1 - ON	14	Reserved
7	0: No action 1: Y2 - ON	15	Reserved

6 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
}
```

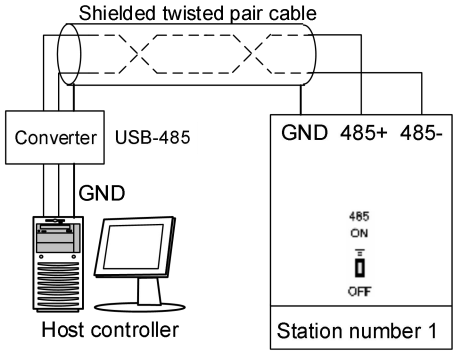
7 Communication Example

Run:							
	Address	Function code	Register address	Register contents			Checksum
Request	0x01	0x06	0x8000	0x0001			0x61CA
Response	0x01	0x06	0x8000	0x0001			0x61CA
Stop:							
	Address	Function code	Register address	Register contents			Checksum
Request	0x01	0x06	0x8000	0x0000			0xA00A
Response	0x01	0x06	0x8000	0x0000			0xA00A
Run and set speed reference to 50.00Hz							
	Address	Function code	Register address	Number	Bytes	Register contents	Check sum
Request	0x01	0x10	0x8000	0x0002	0x04	0x0001,0x1388	0xCEFF
Response	0x01	0x10	0x8000	0x0004	None	None	0xE80A

☞ **Note**: The parameters modified by communication will not be saved after the power off. If you need to save them, perform a save operation (d0-002=1) before power off.

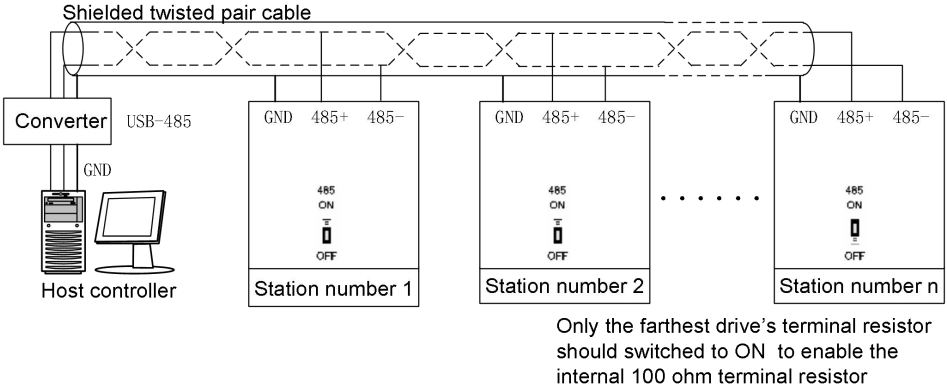
8 Network Construction

■ The connection of one drive and one host controller



Appendix Figure 3 The connection of one drive and one host controller

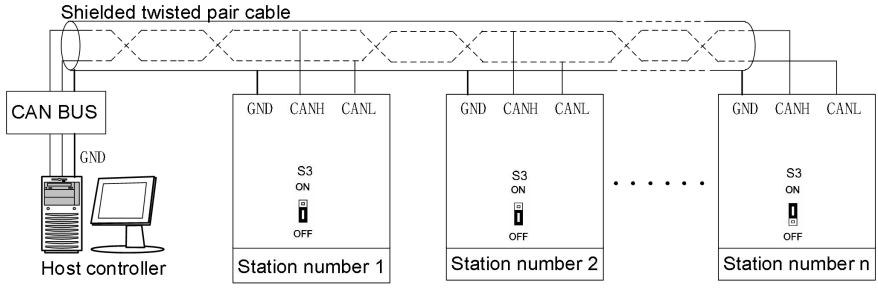
■ The connection of multiple drives and one host controller



Appendix Figure 4 The connection of multiple drives and one host controller

Appendix B CANopen

1 CANopen Topology



Only the farthest drive's terminal resistor should switched to ON to enable the internal 120 ohm terminal resistor

The connection of multiple drives and one host controller

2 Data Format

◆ **System-related parameter settings**

Parameter	Name	Default	Range	Unit	Attribute	Description
P0-004	Run command selection	1	0 ... 5	/	×	4: CAN
P0-005	Speed reference selection	1	0 ... 14	/	×	3: CAN
PA-000	Torque reference and direction	0000	0000 ... 0047	/	×	2: CAN
C1-000	CAN / PROFIBUS-DP /	2	0 ... 127	/	○	0~127
C1-001	CAN baud rate	0	0 ... 4	/	○	0: CAN is disabled 1: 125kbps 2: 250kbps 3: 500kbps 4: 1000kbps
C1-008	CANopen selection	0	0 ... 2	/	×	0: CANopen 1: CAN bus 2: CAN bus, receive the PROFINET command and convert to CAN

◆ **CAN Bus message data format**

Following the CAN 2.0B communication protocol, standard frame or extended frame can be used to realize data exchange between drive and drive, and host controller and drive. The protocol stipulates that the data message should use Intel data format, that is, low bytes first, high bytes later, and others refer to ISO 11898 standard.

① **Basic format of the frame data**

Message ID	Parameter 1 (word0)		Parameter 2 (word1)		Parameter 3 (word2)		Parameter 4 (word3)	
	High byte	Low byte	High byte	Low byte	High byte	Low byte	High byte	Low byte

② **Send message format**

● Send message 1			
Parameter 1 (C1-040) When C1-040 = 0x0000: Low Bytes: Drive status High byte: Alarm ID	Parameter 2: (C1-041) When C1-041 = 0x0000: Running frequency	Parameter 3 (C1-024)	Parameter 4 (C1-025)

Parameter 1 low-byte description:			
Bit0	0 = Stop 1 = Run	Bit4	0 = Unchanged 1 = Emergency stop (reserved)
Bit1	0 = unchanged 1 = Reverse	Bit5	0 = Unchanged 1 = Ramp stop
Bit2	0 = unchanged 1 = Reset	Bit6	Reserved
Bit3	0 = unchanged 1 = Jogging	Bit7	Reserved

Parameter 1 high-byte description:			
Bit0	0 =Speed loop. 1 = Torque loop	Bit1 … bit7	Reserved

● Send message 2			
Parameter 1 (C1-026)	Parameter 2 (C1-027)	Parameter 3 (C1-028)	Parameter 4 (C1-029)
● Send message 3			
Parameter 1 (C1-030)	Parameter 2 (C1-031)	Parameter 3 (C1-032)	Parameter 4 (C1-033)

③ **Received message format**

● Received message 1			
Parameter 1 (C1-042) When C1-042 = 0x0000: Low bytes: Control command High Bytes: Control mode	Parameter 2 (C1-043) When C1-043 = 0x0000: Set Frequency (0 … 100.00%)	Parameter 3 (C1-034)	Parameter 4 (C1-035)

Parameter 1 low-byte description:			
Bit0	0 = Stop 1 = Run	Bit4	0 = Unchanged 1 = Emergency stop (reserved)
Bit1	0 = unchanged 1 = Reverse	Bit5	0 = Unchanged 1 = Ramp stop
Bit2	0 = unchanged 1 = Reset	Bit6	Reserved
Bit3	0 = unchanged 1 = Jogging	Bit7	Reserved

Parameter 1 high-byte description:			
Bit0	0: Speed loop 1: Torque loop	Bit1 … bit7	Reserved

● Receive message 2			
Parameter 1 (C1-036)	Parameter 2 (C1-037)	Parameter 3 (C1-038)	Parameter 4 (C1-039)

3 CANopen Protocol

◆ **Object dictionary**

The core concept of CANopen is the device object dictionary, which is an orderly group of objects and describes the relationship between application objects and CANopen packets. CANopen Communication can access all the parameters of the drive through the Object Dictionary (OD).

Index range 索引范围	Description 描述
0000_h	Reserved 保留
0001_h to $025F_h$	Data types 数据类型
0260_h to $0FFF_h$	Reserved 保留
1000_h to $1FFF_h$	Communication profile area 通讯对象子协议区
2000_h to $5FFF_h$	Manufacturer-specific profile area 制造商特定子协议区
6000_h to $9FFF_h$	Standardized profile area 标准化设备子协议区
$A000_h$ to $AFFF_h$	Network variables 网络变量（符合 IEC61131-3）
$B000_h$ to $BFFF_h$	System variables 用于路由网关的系统变量
$C000_h$ to $FFFF_h$	Reserved 保留

As shown in Table above, defines the object dictionary index area, where:

1000 h … 1FFFh: store the common communication parameters

2000 h … 5FFFh: correspond to the drive parameter one by one, the mapping relationship between drive parameter and object dictionary is as follows:

Object dictionary index =0x2000 + parameter group number

Object dictionary subindex = parameter number in group + 1

Parameter Group	Object Dictionary Index
P0 … PD	0x2000 … 0x200d
A0	0x2010
B0 … B1	0x2020 … 0x2021
C0 … C2	0x2030 … 0x2032
D0	0x2040
E0	0x2050
F0 … F3	0x2060 … 0x2063

Example: The parameter P2-006 corresponds to the object dictionary of 0x2002 - 0x07

6000 H … 9FFF H: Commonly used area, store the DSP402 protocol parameters.

◆ **Commonly used communication objects**

The CANopen communication defines the following messages (communication objects)

Abbreviation	Name	Description
NMT	Network Management	For the CANopen network management
SDO	Service Data Object	For non-time-critical data, such as parameters
PDO	Process Data Object	For transmit real-time data (control word, reference value, status) Include 3 sending and 3 receiving PDO channels
SYNC	Synchronization Message	Used to synchronize the CAN nodes
EMCY	Emergency Message	Used to transmit alarm events of the drive
Heartbeat	Error Control Protocol	Used to monitor the lifetime status of all the nodes

◆ **Communication object identifier**

The communication object identifier (COB−ID) specifies the priority and identification of the object during the communication process. The COB−ID corresponds to the 11bits frame ID of CAN 2.0A. The 11 bits COB−ID consists of two parts, 4 bits object function code and 7 bits node address, as follows:

10	9	8	7	6	5	4	3	2	1	0
Function code				Node ID						

Each communication object of CANopen has a default COB−ID, which can be read through the SDO. The list of the object COB−ID is shown below.

Communication object	Function code	Node ID	COB−ID	Object index
NMT	0000b	0	000H	−
SYNC	0001b	0	080H	1005H,1006H
EMCY	0001b	1 … 127	080H + Node ID	1014H
TSDO (send)	1011b	1 … 127	580H + Node ID	1200H
RSDO (received)	1100b	1 … 127	600H + Node ID	1200H
TPDO 1 (send)	0011b	1 … 127	180H + Node ID	1800H
RPDO 1 (received)	0100b	1 … 127	200H + Node ID	1400H
TPDO 2 (send)	0101b	1 … 127	280H + Node ID	1801H
RPDO 2 (received)	0110b	1 … 127	300H + Node ID	1401H
TPDO 3 (send)	0111b	1 … 127	380H + Node ID	1802H
RPDO 3 (received)	1000b	1 … 127	400H + Node ID	1402H
Heartbeat	1110b	1 … 127	700H + Node ID	1016H,1017H

For example: The COB−ID of TPD02 of node 2 is 280H + 2=282H.

◆**The NMT network management system**

Network Management (NMT) is responsible for initialize, start, and stop networks and devices in the network. In network management, only one master node, one or more slave nodes are allowed in the same network, and follow the master-slave mode. Only NMT−Master node can send NMT messages. The message format is as follows:

COB−ID	RTR	Data0	Data1
000h	0	Control word	Node ID

The COB−ID of the NMT message is fixed to "000h". The data area consists of two bytes: the first byte is the command word, and the second byte is the CANopen node address, 0 = is broadcast then has effective for all slave devices.

The NMT message command:

Control word	Description
0x01	Start the remote node
0x02	Stop the remote node
0x80	Enter the pre-operation state
0x81	Reset node
0x82	Reset communication

NMT management involves 6 states of a CANopen node after power on, including:

(1) Initializing: Initialize the functional components including CAN controller after the node is powered up.

(2) Application Reset: Reset the application program of the node (start), such as the initial value of digital outputs and analog outputs.

(3) Communication reset: Reset the CANopen communication of the node (start), after the reset, the CANopen communication of this node is enabled.

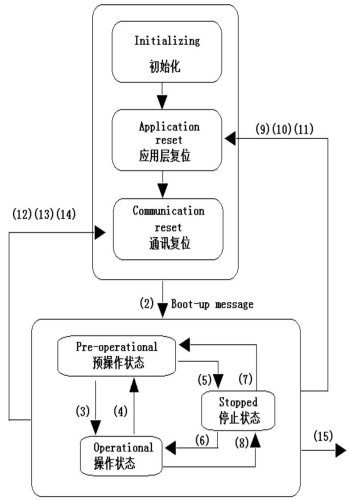
(4) Pre-operational: The CANopen communication of the node is in the operational state, then this node cannot perform PDO communication, but can perform SDO for parameter configuration and NMT network management operation.

(5) Operational: After the node receives a start command from the NMT host, then the CANopen communication is activated. After the PDO communication is started, the data is transmitted according to the rules stipulated in the object dictionary. Similarly, SDO can also transmit data and modify the node parameters.

(6) Stopped: After the node receives a stop command from the NMT host, the PDO communication of the node stops, but the SDO and NMT network management can operate on the node.

The NMT host can allow any CANopen node in the network to switch over the other 5 states through the NMT command except Initializing state. As shown in the figure below.

(1) Power on
(2) Automatic switch to Pre-operational
(3) and (6) NMT Switch to Operational
(4) and (7) NMT Switch to Pre-operational
(5) and (8) NMT Switch to Stopped.
(9), (10) and (11) NMT Switch to Application reset
(12), (13) and (14) NMT Switch to Communication reset
(15) Power off or hardware reset



The device automatically initializes after powered-on, after the initialization completion, sends a Boot up signal to enter the pre-operation state automatically, which is the main configuration state of the node. After completing the configuration, the node needs the NMT host to send an NMT message to enter the operational state. The operating state is the state when CANopen is working normally, and all modules works normally.

When the NMT host sends a stop node message, the device enters to the stop state, and only the NMT module works normally.

The CANopen services supported in the various NMT states are shown in the following table:

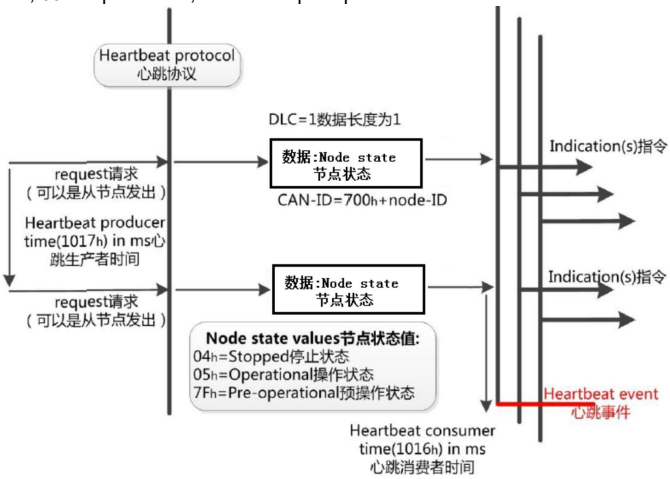
Service	Pre-operation	Operation	Stop
Network Management (NMT)	Yes	Yes	Yes
Synchronous object (SYNC)	Yes	Yes	No
Emergency Message (EMCY)	Yes	Yes	No
Service data object (SDO)	Yes	Yes	No
Process data object (PDO)	No	Yes	No
Error control	Yes	Yes	Yes

◆ **The NMT node status and the heartbeat message**

To monitor the CANopen node if online and the node status. The CANopen application usually requires the slave station to send status messages (heartbeat messages) regularly online, so that the master station can check whether the slave station is faulty or out of the network.

As shown in the figure below, it is the format of heartbeat message. CANID is the same as 700h + Node-ID, and the data is 1 byte, representing the current state of the node.

04h = stopped, 05h= operational, and 7Fh = pre-operational..



◆ **Service data object (SDO)**

SDO is mainly used for parameter configuration of CANopen master station to slave nodes. The SDO transmission follows the client-server mode, where each message requires a reply message to ensure the accuracy of data transmission.

In a CANopen system, usually the CANopen slave node acts as the SDO server, and the CANopen master node acts as the client. The SDO client accesses the object dictionary on the SDO server through index and sub index. This way, the CANopen master node can access the parameters of any object dictionary entry from the slave node, and the SDO can also transmit data of any length (when the data length exceeds 4 bytes, it is split into multiple packets to transfer).

The transmission of SDO is divided into fast SDO protocol and ordinary SDO protocol (segment transmission).

- **The Fast SDO protocol**

Fast SDO transmission is mainly used for reads and writes of no more than 4 bytes. Read and write messages are as follows:

Write message format of fast SDO transmission										
		COB-ID	0	1	2	3	4	5	6	7
Client →		600h+Node ID	CS command	Index (2 is high byte)		subindex	Data (High Byte After)			
Server ←	Normal	580h+Node ID	60h	Index (2 is high byte)		subindex	Data not used (supplement 0)			
	Abnormal		80h	Index (2 is high byte)		subindex	Stop code			

Read message format of fast SDO transmission										
		COB-ID	0	1	2	3	4	5	6	7
Client→		600h+Node ID	40h	Index (2 is high byte)		subindex	Data not used (supplement 0)			
Server ←	Normal	580h+Node ID	CS command	Index (2 is high byte)		subindex	Data (High Byte After)			
	Abnormal		80h	Index (2 is high byte)		subindex	Stop code			

CS Command:
2Fh = write one byte
2Bh = write two bytes
27h= write three bytes
23h= write four bytes
60h= write successful response
80h= abnormal response
40h= read
4Fh = read one byte
4Bh = read two bytes
47h= read the three bytes
43h= read the four bytes

For example, write the parameter P1-000 = 1000 of slave station is 2, the master sends message:

COB-ID	0	1	2	3	4	5	6	7
602	23	01	20	01	E8	03	00	00

If the writing is successful, the slave station return message is as follows:

COB-ID	0	1	2	3	4	5	6	7
582	23	01	20	01	00	00	00	00

If the write data type is incorrect, the fault code 0x06070010 is returned as follows:

COB-ID	0	1	2	3	4	5	6	7
582	80	01	20	01	10	00	07	06

Read the running speed parameter F0-007, the master station sent message:

COB -ID	0	1	2	3	4	5	6	7
602	40	60	20	08	00	00	00	00

Return the current actual speed 1000 from slave station, send message:

COB -ID	0	1	2	3	4	5	6	7
582	4b	60	20	08	E 8	03	00	00

- **The segmented SDO protocol**

If the transmission data is greater than 4 bytes, segmented SDO needs to be used for frame transmission. It is less often used in the application and is not explained here.

◆ **Process data object (PDO)**

The process data object PDO is used to transmit real-time data, and the transmission does not need to answer. It belongs to one-way transmission and is the main data transmission mode of CANopen. The drive has 3 TPDO and 3 RPDO to realize the data transfer of the PDO, and the list of related objects are as follows:

Name		COB−ID	Communication object	Mapping object
TPDO	1	180h + Node ID	1800h	1A00h
	2	280h + Node ID	1801h	1A01h
	3	380h + Node ID	1802h	1A02h
RPDO	1	200h + Node ID	1400h	1600h
	2	300h + Node ID	1401h	1601h
	3	400h + Node ID	1402h	1602h

TPDO 1 and RPDO 1 only support the transmission of three parameters, and the other PDO supports the transmission of four parameters.

For example, TPPDO 1 mapping is as follows:

Index	Sub subindex	Object content
1A00h Mapping parameters	01h	60410010h maps to the subindex 00h of the index 6041h, and the object is 16 bits
	02h	606C0020h maps to the subindex 00h of the index 606Ch, and the object is 32 bits
	03h	20600910h map to the subindex 09h of the index 2060h, the object is 16 bits

◆ **Emergency Object Services (EMCY)**

When the drive has a fault, the drive sends a frame emergency message informing the current drive type and the error code. The error code type is shown below:

603F value	Fault code	F0−015 value	Fault description	Possible causes	Corrective actions
0x7500	Err 1	1	External fault	Digital input fault is "ON"	Check the corresponding digital input
0x3230	Err 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
0x3230	Err 3	3	Motor overload protection	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
0x4210	Err 4	4	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
0x3330	Err 5	5	Motor over	Motor temperature too high	Improve ventilation and heat

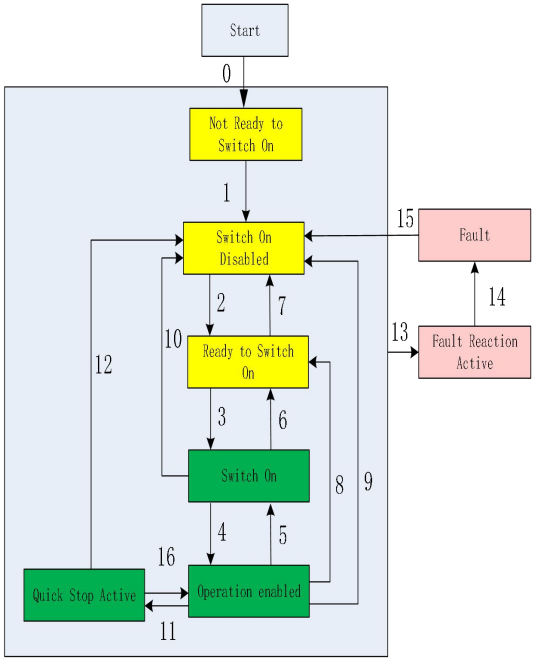
603F value	Fault code	F0-015 value	Fault description	Possible causes	Corrective actions
			temperature		dissipation
				Thermistor resistance is abnormal	Check the thermistor
				Setting motor sensor protection threshold is improper	Check the parameter setting
0x7305	Err 6	6	Encoder fault	Encoder connection 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
0x2311	Err 7	7	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 controller parameters correctly
0x2312	Err 8	8	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
				DC bus voltage under voltage	Check the input power supply
				Built-in brake chopper abnormal	Seek for technical support
				Rectifier or module overheated	Seek for technical support
				The pre-charged contactor closes abnormally	Check the input power supply
				Poor contact of the internal connectors	Ask professional technicians for maintenance
0x3210	Err 9	9	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
				Motor short circuit to ground	Check the motor and motor wiring
0x3220	Err 10	10	Under voltage	The input voltage is too low	Check the input power supply
				Abnormal switching power supply	Seek for technical support
0xff00	Err 11	11	Encoder lost CD phase	CD signal connection is abnormal	Check the encoder and wiring
	Err 12	12	Output phase loss	Motor failure	Replace a new motor
				Motor cable is broken	Replace a new motor cable
				Thermal relay failure (if is used)	Check thermal relay
				Output detection circuit failure	Seek for technical support

603F value	Fault code	F0-015 value	Fault description	Possible causes	Corrective actions
0x5530	Err 13	**13**	EEPROM abnormal	EEPROM read/write abnormal	Seek for technical support
0xff00	Err 14	**14**	Unauthorized	Unauthorized	Seek for technical support
0xff00	Err 15	**15**	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
0xff00	Err 16	**16**	PID feedback has excessed upper limit	PID feedback exceeds the allowable range	Check whether the actual feedback value exceeds the set allowable range
0xff00	Err 17	**17**	ECT communication failed	ET1100 communication failed	Seek for technical support
0xff00	Err 18	**18**	CAN Communication failed	CAN communication failed	Seek for technical support
0xff00	Err 19	**19**	EtherCAT is disabled	EtherCAT is disabled	Seek for technical support

4 Drive Operation Mode

- **CiA402 state machine**

  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 responde 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)

◆ **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 operatiaon	The drive is enabled
4~6	Operation mode specific	Related to the 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.						

◆ **Status word 6041H**

Index	Object Name	Status Word					Object type	VAR	Data type	Uint16
6041h	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 reached the reference position. In CSV mode, bit10 = 1: the speed reached 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

◆ **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	0~10	Preset value	0

Currently, the drive provides the following 2 operation modes:

Value of 6060H	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).

◆ **Cyclic Synchronous Velocity Mode**

Cyclic Synchronous Velocity Mode (Periodic synchronous speed mode), the speed command curve planning is completed by the main station, and the driver performs the set speed of the main station in real time.

① **Method of operation**

- Set the drive parameter [P004: enable selection] set to 4 (can bus enable);
- Set the drive parameter [P005: speed instruction selection] is set to 3 (given by canbus communication).
- Set the drive parameter [P006: speed instruction unit] is set to 1 (0: Hz, 1: rpm)
- The setting of [6060H: Mode of operation] is 9 (Cyclic Synchronous Velocity Mode);
- Set the drive acceleration and deceleration time [P201: acceleration time], [P202: deceleration time] (unit: 0.01 seconds, time from 0 RPM to maximum speed P012);
- Set [6040H: Control Word] enabling drive (enabling when set to 0x0F); if there is an error, please set 0x80 clear fault first;
- Set [60 FFH: Target velocity] as the target rotation speed (unit: RPM);

- Query [606 CH: Velocity Actual Value] query the actual speed feedback;
- Query [6041H: Status Word] to obtain the drive status feedback

② Other objects

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

③ 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 more information of each object.

④ Application examples

- Set the drive parameter [P0−004: run command selection] to 4.
- Set the drive parameter [P0−005: speed reference selection] to 3.
- Set the drive parameter [P0−006: speed unit] is set to 1.
- Set [6060H: Mode of operation] to 9 (Cyclic Synchronous Velocity Mode).
- Set [6040H: Control Word] to 0x0F to enable the drive.
- Set [60FFH: Target velocity] as the target rotation speed (unit: RPM).

◆ **Cyclic Synchronous Torque Mode**

Cyclic Synchronous Torque Mode, the torque command curve planning is completed by the master, and the drive run in torque loop and torque reference sent from master in real time.

Note: The parking mode of this mode is free parking.

① Method of operation

- Set the drive parameter [P0−004: run command selection] to 4.
- Set the drive parameter ones position of [PA−000: torque instruction selection] to 2.
- Set [6060H: Mode of operation] to 10 (Cyclic Synchronous Torque Mode).
- Set the maximum speed of the drive [P0−012: maximum speed].
- Set the [6040H: Control Word] to 0x0F to enable the drive.
- Set [6071H: Target Torque] as the target torque (unit: 0.1% rated torque), and the set value can be viewed from the drive monitoring parameter C0−061.
- Query [606CH: Velocity Actual Value] query the actual speed feedback.
- Query [6041H: Status Word] to obtain the drive status feedback.

② Other objects

- Query [6078H: Current actual value] to obtain the actual current (unit: 0.1A).
- Query [6074H: Torque demand value] to obtain the internal actual torque instruction (unit: 0.1% rated torque).
- Query [6077H: Torque actual value] to obtain the actual torque feedback (unit: 0.1% rated torque).

③ 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 more information of each object.

④ Application examples

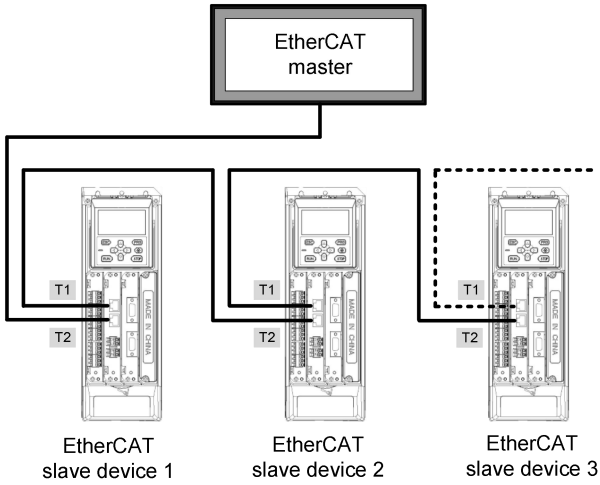
- Set the drive parameter [P0−004: Run command selection] to 4.
- Set the drive parameter ones position of [PA−000: torque instruction selection] to 2.
- Set [6060H: Mode of operation] to 10 (Cyclic Synchronous Torque Mode).
- Set [6040H: Control Word] to 0x0F to enable drive.
- Set [6071H: Target Torque] as the target torque (unit: 0.1% rated torque).

5 Commonly Used Objects

Index	Name	Type	Attr
603FH	Error Code	U INTEGER16	RO
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	INTEGER32	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
607AH	Target Position	INTEGER32	RW
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
60F4H	Following error actual value	INTEGER32	RO
60FFH	Target velocity	INTEGER32	RW

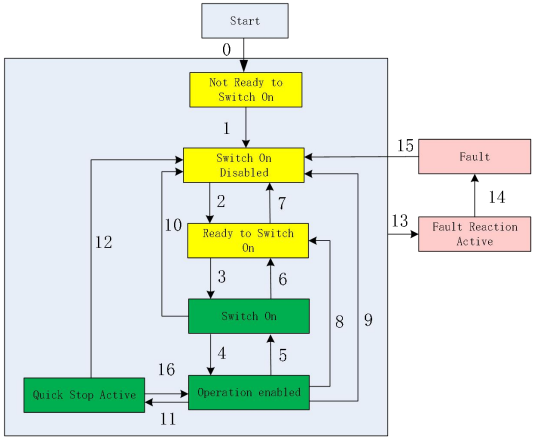
Appendix C EtherCAT

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 operatiaon	The drive is enabled
4~6	Operation mode specific	Related to the 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	Object Name	Status Word					Object type	VAR	Data type	Uint16
6041H	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 $\neq$ 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**

Paramete	Name	Range	Description
P0−004	Run command selection	0 … 5	3: EtherCAT
P0−005	Speed reference selection	0 … 14	4: EtherCAT
C2−000	EtherCAT speed reference unit	0: RPM 1: PULSE/S	Set according to the requirements
C2−001	EtherCAT position reference smoothing cycle	1~65535 us	
C2−002	The EtherCAT clock synchronize with the drive	0: Synchronization not allowed 1: Synchronization allowed	
C2−003	EtherCAT pulse input gear ratio numerator	1~65535	
C2−004	EtherCAT pulse input gear ratio denominator	1~65535	
C2−005	EtherCAT communication enable	0: Disabled 1: Enabled	1: Enabled
C2−006	EtherCAT position loop reference mode	0: Relative position 1: Absolute position.	
C2−018	Probe mode	0: Encoder Z triggering 1: Encoder Z or digital input triggering	
B0−001	Position loop reference selection	0: Pulse input 1: EtherCAT	1: EtherCAT
PA−000	Torque reference and direction selection	0000 … 0047	Ones position = 3:

◆ **Profile Position Mode**

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.

① **Setting steps**

- Set the drive parameter: P0−004 = 3 (EtherCAT).
- Set the drive parameter: B0−001 = 1 (EtherCAT).
- Set the drive parameter: C2−006 = 0.
- Set [6060H: Mode of Operation] = 1 [Profile Position Mode].
- Set [6081H: Profile Velocity] = Current step position command constant running speed (unit: RPM); the value should not higher than the parameter B0−003 (Position loop max. speed); (internal limit the value ≥ 1rpm).
- Set [6083H: Profile acceleration] = position loop acceleration time (unit: 0.01S, the time from 0 rpm to B0−003), corresponds to the drive internal parameter B0−004, range 0.00 … 655.35.
  Set [6084H: Profile deceleration] = position loop deceleration time (unit: 0.01S, the time from the B0−003 to 0 rpm), corresponds to the drive internal parameter B0−005, range 0.00~655.35.
- Set position loop gear ratio [B0−006: numerator] and [B0−007: denominator].
  Note: The gear ratio is effective when update position is relative position and ineffective when update position is absolute position.

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

- Query the actual position feedback through 6064H (Position Actual Value).
- Obtain the drive status feedback through 6041H (Status Word).

② Other objects

- Obtain the position target value (unit: pulse) through [6062H: Position demand value].
- Obtain the deviation between the target position and actual position (unit: pulse) through [60F4H: Following error actual value].

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
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.

- Control Word (0x6040) of Profile Position Mode

Object	Control Word					Object type	VAR	Data type	Uint16
Access	RW	Mappin	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.

- Status word (0x6041) of Profile Position Mode

Object	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

④ Application examples

- Set the drive parameter P0−004 = 3 (Run command: EtherCAT).
- Set the drive parameter B0−001 = 1 (Speed reference: EtherCAT).
- Set the drive parameter C2−006 = 0.
- Set 6060H = 1, select Profile Position Mode.
- Set 607AH = 10000 (e.g., 10000 pulse), set the position value.
- Set 6081H = 200 (such as 200 RPM), set the position command constant running speed (unit: RPM).
- 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).
- After the above parameters are set, then enable the drive: 6040H=0x0F.
- 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).
- 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.
- Query bit10 of 6041H to see if the target position is reached after 10ms delay.

◆ **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

- Set the drive parameter P0-004 = 3 (Run command: EtherCAT).
- Set the drive parameter B0-001 = 1 (Position loop reference selection).
- Set the drive parameter C2-006 = 0 (Target position is a relative value).
- Set [6060H: Mode of operation] = 8 (Cyclic Synchronous Position Mode).
- Set the drive parameters [C2-001: EtherCAT position reference smoothing cycle] should set the same position interpolation period of the master.
- Set the drive position loop gear ratio parameters [B0-006: gear ratio numerator] and [B0-007: gear ratio denominator].
- Set [6040H: Control Word] = 0x0F to enable drive and trigger the target position to take effect.
- Set [607AH: Target Position] as the target position (unit: pulse).
- Query [6064H: Position Actual Value] query the actual position feedback.
- Query [6041H: Status Word] to obtain the drive status feedback.

② Other objects

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

- Set the drive parameter P0-004 = 3 (EtherCAT).
- Set the drive parameter B0-001= 1 (EtherCAT).
- Set the drive parameter C2-006 = 0.
- Set [6060H: Mode of operation] = 8 (Cyclic Synchronous Position Mode).
- Set [6040H: Control Word] = 0x0F to enable the drive.
- 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

- Set the drive parameter P0-004 = 3 (Run command: EtherCAT).
- Set the drive parameter P0-005 = 4 (Speed reference: EtherCAT).
- Set the drive parameter C2-000= 0 (0: RPM, 1: pulse / s); Set the EtherCAT pulse input gear ratio [C2-003: gear ratio numerator] and [C2-004: gear ratio denominator].
- Set [6060H: Mode of operation] = 9 (Cyclic Synchronous Velocity Mode).
- Set the drive acceleration time P2-001 and deceleration time P2-002 (unit: in 0.01 seconds).
- Set the [6040H: Control Word] to enable the drive (enable when set to 0x0F).
- Set [60FFH: Target Velocity] as the target rotation speed (unit: RPM).
- Query [606CH: Velocity Actual Value] query the actual speed feedback.
- Query [6041H: Status Word] to obtain the drive status feedback.

② Other objects

- 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

- Set the drive parameter P0-004 = 3 (Run command: EtherCAT).
- Set the drive parameter P0-005 = 4 (Speed reference: EtherCAT).
- Set the drive parameter C2-000= 0.
- Set 6060H = 9 (Mode of operation = Cyclic Synchronous Velocity Mode).
- Set 6040H = 0x0F (Control Word, 0x0F = enable the drive).
- Set 60FFH = Target velocity (unit: RPM).

◆ **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**

- Set the drive parameter P0-004 = 3 (Run command: EtherCAT).
- Set the ones position of parameter PA-000 = ***3, torque reference selection is EtherCAT.
- Set 6060H = 10 (Mode of operation = Cyclic Synchronous Torque Mode).
- Set C2-001 (EtherCAT position reference smoothing cycle) is the same as the position insertion cycle of the master.
- Set the maximum speed P0-012 of the drive.
- Set the 6040H = 0x0F to enable the drive (Control Word, 0x0F = enable the drive).
- Set 6071H = Target Torque (unit: 0.1% rated torque), and the actual torque reference can be viewed on monitored parameter of the drive.
- Query [606CH: Velocity Actual Value] query the actual speed feedback.
- Query [6041H: Status Word] to obtain the drive status feedback.

② **Other objects**

- Query [6078H: Current actual value] to obtain the actual current (unit: 0.1A).
- Query [6074H: Torque demand value] to obtain the torque reference (unit: 0.1% of rated torque).
- 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**

- Set the drive parameter P0-004 = 3 (Run command: EtherCAT).
- Set the ones position of parameter PA-000 = ***3, torque reference selection is EtherCAT.
- Set 6060H = 10 (Mode of operation = Cyclic Synchronous Torque Mode).
- Set the 6040H = 0x0F to enable the drive (Control Word, 0x0F = enable the drive).
- Set 6071H = Target Torque (unit: 0.1% rated torque).

◆ **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 or digital input of the drive.

When C2-018 = 0 only supports the encoder Z signal as the trigger signal or event, C2-018 = 1 supports the encoder Z signal or external digital input as the trigger signal (digital input function is set to "63") or event, and the capture result is stored at 0x60BA.

① **List of related objects**

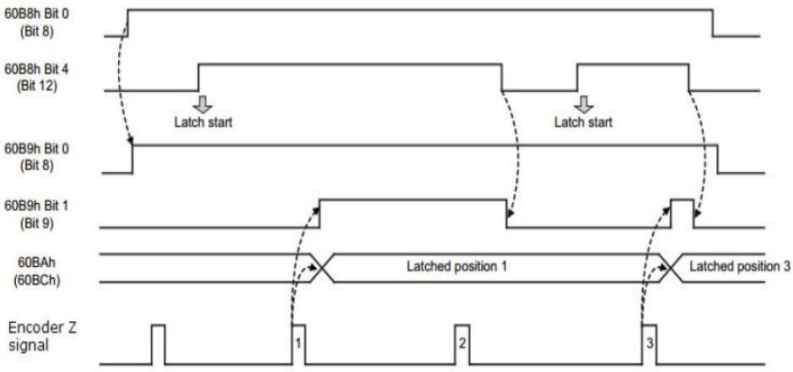
Index	Name	Type	Attr
60B8H	Touch probe function	U INTEGER16	RW
60B9H	Touch Probe Status word	U INTEGER16	R O
60BAH	Probe 1 positive edge value (Encoder zero signal)	INTEGER 32	RO

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		

Note: The bit 2 of 60B8h is invalid when C2-018 = 0, valid when C2-018 = 1.

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:

- Set the drive parameters C2-018 = 0 (probe mode: Only Z signal of the encoder).
- Set 6060h = 9 (Mode of operation = Cyclic Synchronous Velocity Mode).
- Set 60FFh = 200 (Target velocity is 200 RPM).
- Set 6040h = 0x0F (Control Word = 0x0F to enable the drive).
- Set 60B8h = 0x01 (Touch probe function = 0x01 to enable Touch probe function).
- Set 60B8h = 0x11 (Touch probe function = 0x11, latch start Touch probe function).
- Query 60B9h (Touch Probe Status word), bit1 = 1, indicating the completion of the capture.
- Query 60BAh (Probe1 positive edge value) to obtain the actual value of Z position.
- Set 60B8h = 0x00: (Touch probe function = 0x00, touch probe function capture is completed).

◆ **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 control function. Refer to parameter group B0 for more details.

The B0-016 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

- Set the drive parameter P0-004 = 3 (Run command: EtherCAT).
- Set 6060H (Mode of operation] to non-torque mode: 8 or 9.
- Set the value of B0-016 (Orientation position references 1), relative to the Z position (unit: pulse).
- Set B0-017 (Orientation start speed), B0-018（Orientation deceleration time) and B0-019 (Orientation gain].
- 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.
- Query 606Ch (Velocity Actual Value) query the actual speed feedback.
- 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

- Query [6078H: Current actual value] to obtain the actual current (unit: 0.1A).
- Query [6064H: Position Actual Value] query the actual position of the motor feedback.
- Query [6062H: Position demand value] to obtain the target position (unit: pulse).
- 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

- Set the drive parameter P0-004 = 3 (Run command: EtherCAT).
- Set 6060h = 9 (Mode of operation = Cyclic Synchronous Velocity Mode).
- 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. For more details, please check Chapter 6 fault diagnosis for other faults.

0x603F value	Fault code	F0-015 value	Fault description	Possible cause	the way to deal with a situation
0x7500	Err 1	1	External fault	Digital input fault is "ON"	Check the corresponding digital input
0x3230	Err 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
				Overloading for a long time	Reduce overload time and
				Drive power selection is too small	Replace with a suitable drive
0x3230	Err 3	3	Motor overload	Power supply voltage too low	Check the power supply voltage
				Motor stall or load suddenly	Check motor load and drive
				V/F curve setting are not correct	Adjust V/F curve and torque
0x4210	Err 4	4	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

0x603F value	Fault code	F0-015 value	Fault description	Possible cause	the way to deal with a situation
				Temperature detect circuit failure	Seek for technical support
0x3330	Err 5	5	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
0x7305	Err 6	6	Encoder fault 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
				Encoder connection is incorrect	Change encoder wiring
0x2311	Err7	7	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 controller parameters correctly
0x2312	Err 8	8	Module protection	Module failure	Seek out the technical support.
				U, V, W short-circuited to ground	Check whether the output wiring is short-circuited to ground
				Bus undervoltage	Check whether the input power supply is abnormal and whether the load mutation causes the bus voltage to be lowered.
				Abnormal built-in brake chopper	Seek out the technical services.
				Rectifier or module overheating	Seek out the technical services.
				The pre-charged contactor closes abnormally	Check the input power supply or seek the technical service.
				Poor contact of the internal connectors	Ask professional technicians for maintenance
0x3210	Err 9	9	Over voltage	Motor short circuit to ground	Check the motor and motor
				Start when the motor is spinning	Start after the motor at standstill
				Load inertia is too large	Use appropriate brake chopper
				Deceleration time is too short	Extend the deceleration time
				The input voltage is too high	Check the input power supply
0x3220	Err 10	10	Under voltage	The input voltage is too low	Check the input power supply
				Abnormal switching power supply	Seek for technical support

0x603F value	Fault code	F0−015 value	Fault description	Possible cause	the way to deal with a situation
0xff00	Err 11	11	Encoder lost CD phase	CD signal connection is abnormal	Check the encoder and wiring
	Err 12	12	Output phase loss	Motor failure	Replace a new motor
				Motor cable is broken	Replace a new motor cable
				Thermal relay failure (if is used)	Check thermal relay
				Output detection circuit failure	Seek for technical support
0x5530	Err 13	13	EEPROM abnormal	EEPROM read/write abnormal	Seek for technical support
0xff00	Err 14	14	Unauthorized	Unauthorized	Seek for technical support
0xff00	Err 15	15	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
0xff00	Err 16	16	PID feedback out of range	PID feedback exceeds the acceptable range	Check whether the actual feedback value exceeds the set acceptable range
0xff00	Err 17	17	EtherCAT failed	ET1100 communication failed	Seek for technical support
0xff00	Err 18	18	CAN failed	CAN communication failed	Seek for technical support
0xff00	Err 19	19	EtherCAT is disabled	EtherCAT is disabled	Seek for technical support

7 Position Reference Mode

C2−006 = 0 (Target position shall be a relative value)								
0x6060 (Mode of Operation)	9	8	8	8	8	8	8	8
0x6061 (Mode of Operation Display)	9	9	9	8	8	8	8	8
0x6062 (Position Demand Value)	⋯	⋯	1022	1022	1022+(d −c)	1022+(e−c)	1022+(f−c)	⋯
0x6064(Position Actual Value)	⋯	1021	1022	1022	1022+(d −c)	1022+(e−c)	1022+(f−c)	⋯
0x607A (Target Position)		a	b	c	d	e	f	⋯
C2-006 = 1 (Target position shall be an absolute value)								
0x6060 (Mode of Operation)	9	8	8	8	8	8	8	8
0x6061 (Mode of Operation Display)	9	9	9	8	8	8	8	8
0x6062 (Position Demand Value)	⋯	⋯	1022	1022	d	e	f	⋯
0x6064(Position Actual Value)	⋯	1021	1022	1022	d	e	f	⋯
0x607A (Target Position)		a	b	c	d	e	f	⋯
Other Parameters								
F0−070 and F−071: System reference value (0x607A).								
F0−072 and F0−073: Initial system reference value (607 AH) when switching.								
F0−003 and F0−004: Reference position value (0x6062).								
F0−016 and F0−017: Actual position value (0x6064).								

8 Commonly Used Objects

Index	Name	Type	Attr
603FH	Error Code	U INTEGER16	RO
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	INTEGER32	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
607AH	Target Position	INTEGER32	RW
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
60F4H	Following error actual value	INTEGER32	RO
60FFH	Target velocity	INTEGER32	RW
2108H	Motor Temperature	INTEGER 16	RO
2109H	IGBT Temperature	INTEGER 16	RO
210AH	Drive Error Code	INTEGER 16	RO
210BH	Custom parameter1	INTEGER 16	RO
210CH	Custom parameter2	INTEGER 16	RO
210DH	Custom parameter3	INTEGER 16	RO
210EH	Custom parameter4	INTEGER 16	RO
210FH	Custom parameter5	INTEGER 16	RO

Note: The parameter index = group index + parameter number in group + 1. The group index starts from 0x2000 and accumulates in order according to the parameters list, as shown in the following table.

Group	Index	Group	Index	Group	Index	Group	Index
P0	0x2000	P1	0x2001	P2	0x2002	P3	0x2003
P4	0x2004	P5	0x2005	P6	0x2006	P7	0x2007
P8	0x2008	P9	0x2009	PA	0x200A	Pb	0x200B
PC	0x200C	A0	0x200D	1	0x200E	B2	0x200F
C0	0x2010	C1	0x2011	C2	0x2012	D0	0x2013
E0	0x2014						

E.g., the index of parameter P1−000 is 0x2001: 1, the index of parameter C0−002 is 0x2010: 3.

9 Customized Objects

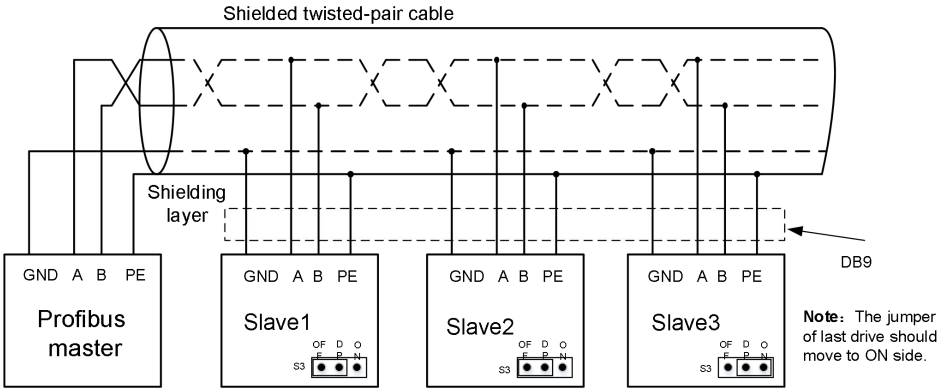
The objects 0x210B … 0x210F are customized objects:

Parameters	Name	Range	Related Settings
C2−008	Transfer parameter address 1	0 … F0 group parameter number maximum value	Used to select the content of the object 0x210B
C2−009	Transfer parameter address 2	0 … F0 group parameter number maximum value	Used to select the content of the object 0x210C
C2−010	Transfer parameter address 3	0 … F0 group parameter number maximum value	Used to select the content of the object 0x210D
C2−011	Transfer parameter address 4	0 … F0 group parameter number maximum value	Used to select the content of the object 0x210E
C2−012	Transfer parameter address 5	0 … F0 group parameter number maximum value	Used to select the content of the object 0x210F

E.g., if the value of F0−020 (digital input state) is read by index 0x210B, then set C2−008 = 20. If the value of F0−021 (digital output state) is read by 0x210C index, then set C2−009 = 21.

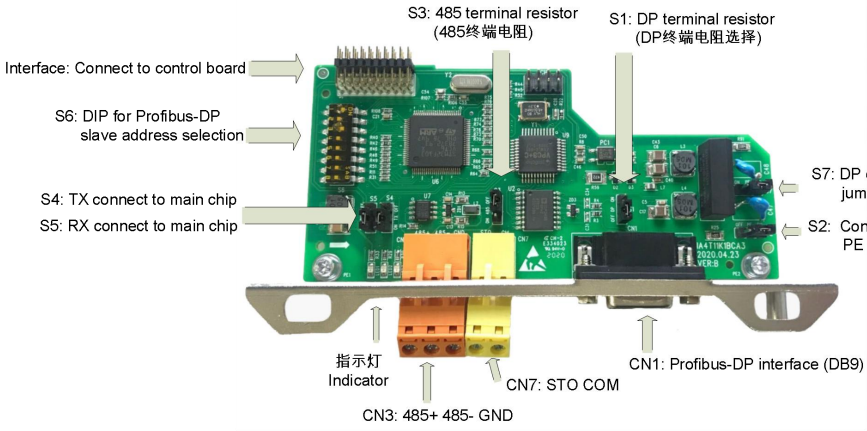
Appendix D PROFIBUS-DP

1 Network Topology



2 PROFIBUS-DP Card Description

◆ **Appearance and layout**

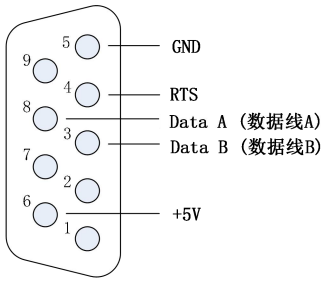


◆ **Description of terminals**

Item	Symbol	Name	Description
CN1: PROFIBUS−DP Interface (DB9)	pin 1, pin 2, pin 7 and pin 9	NC	Reserved
	Pin 3	Data signal B	Data signal positive +
	pin4	RTS	Request to send a signal
	pin 5	GND	5V power supply GND
	pin 6	+5V	5V power supply
	pin 8	Data signal A	Data signal negative -
CN3: RS485	485+	RS485+	RS485 communication positive +
	485−	RS485−	RS485 communication negative -
	GND	GND	RS485 GND
CN7: STO	STO	Safe torque off signal input	The STO function works within 5ms after STO input is enabled, and cut off the output torque of the motor.
	COM	COM	
Indicator	LED1 (Green)	Power supply indicator	**ON**: The power supply is normal **OFF**: Drive is not connected to power supply or PROFIBUS-DP card is not installed correctly.
	LED2 (Red)	Connection indicator between the drive and the PROFIBUS-DP card	**ON**: PROFIBUS-DP card and drive communication is normal. **OFF**: PROFIBUS-DP card initialization is not successful, has problem connection with the drive. ① Check if the PROFIBUS-DP card inserted correctly. ② Check if the PROFIBUS-DP card is damaged. **Flash**: The communication between the PROFIBUS-DP card and the drive communication failed or exits interference. ① check if C2−005 = 2. ② Check if the slave device address setting is correct.
	LED3 (Green)	Communication indicator between the master and the PROFIBUS-DP card	**ON**: PROFIBUS-DP card and PROFIBUS-DP master communication is normal. **OFF**: PROFIBUS-DP card and PROFIBUS-DP master communication failed. ① Check if the slave device address setting is correct. ② Check the PROFIBUS cable.

Note: Refer to Chapter 3 for more jumper description.

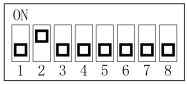
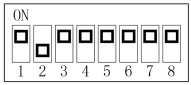
◆ **PROFIBUS DP DB9 interface description**



DB9 connector pin definition

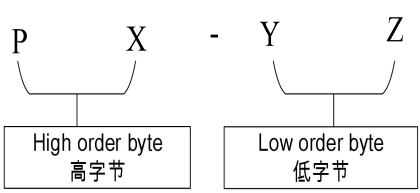
◆ **Dial switch description**

The DIP switch (S6) 1 … 7 corresponds to bit binary bit 0 … bit 6 (where ON represents the corresponding bit = 1 and OFF represents the corresponding bit = 0), and the effective range is 1 to 125. As shown in the below:

DIP S6 switch	DIP value (7 MSB ~ 1 LSB)	Address (ID)
	0000001	1
	0000010	2
	0000011	3
…	…	…
	1111101	125

3 PROFIBUS-DP Communication Setting

- **Slave address and terminal resistor setting**
  ① Set the slave device address by DIP S6 in the PROFIBUS-DP network.
  ② Set the terminal resistor jumper (S1). The terminator resistor of the last device (address) should move to ON side. The terminator resistor of the rest device (address) should move to OFF side.
  ③ Install the PROFIBUS−DP card to the drive.
- **Drive communication parameter setting**
  Set the parameter C1−007 = 1 to enable to communication between the PROFIBUS−DP card and the drive after the PROFIBUS−DP card is properly installed to the drive.
- **PROFIBUS-DP reference parameters**
  Run reference selection: P0−004 = 5.
  Speed reference selection: P0−005 = 13.
  Torque reference selection: ones position of PA−000 is set to 7.
- **Setting and reading of the periodicity of the functional parameters**
  When using PROFIBUS-DP card, parameters are periodically set and read, and corresponding communication data types are set according to actual requirements (there are five communication types: PPO1 … PPO5). See the following section for specific communication protocol.
  The periodic write and read parameters require the register address of relevant parameters in communication. The following is the register address calculation method of the drive parameters: the high byte is the parameter group number, and the low byte is the serial number in the group, which is expressed in hexadecimal.



High Order Bytes: P0 … PF: 0x00 … 0x0F
A0: 0x10
b0 … b1: 0x20 … 0x21
C0 … C2: 0x30 … 0x32
d0: 0x40
E0: 0x50
F0 … F3: 0x60 … 0x63
Low Order Bytes: 00 … 99: 0x00 … 0x63

Example: The Modbus operation address of the parameter Pb−023 is (0x0b <<8) + 23=0x0b17

- **PLC configuration**
  We must first import the GSD file to the PROFIBUS-DP configuration software for the configuration, so that the corresponding slave device is added to the master system, and the GSD file can be obtained from agents or manufacturers. After completing the configuration, the PLC can communicate with the PROFIBUS-DP card normally, and the next step is to write program in the PLC.

4 PROFIBUS-DP Data Format

◆ **Data transfer format**

The PPO type is used as the data transfer format in the PROFIDRIVE protocol, and the PPO types are divided into five types: PPO1, PPO2, PPO3, PPO 4 and PPO5. The functional description is as follows:

Data type	Support functions
PPO1	Single parameter operation
	Drive command, frequency setting and torque setting
	Drive status, operating frequency and torque output
PPO2	Single parameter operation
	Drive command, frequency setting and torque setting
	Drive status, operating frequency and torque output
	Set 4 parameters in cycle
	Read 4 parameters in cycle
PPO3	Drive command, frequency setting and torque setting
	Drive status, operating frequency and torque output
PPO4	Drive command, frequency setting and torque setting
	Drive status, operating frequency and torque output
	Set 4 parameters in cycle
	Read 4 parameters in cycle
PPO5	Single-function parameter operation
	Drive command, frequency setting and torque setting
	Drive status, operating frequency and torque output
	Set 9 parameters in cycle
	Read 9 parameters in cycle

The data blocks contained in the PPO type data format are divided into two areas, PKW area (parameter values) and PZD area (process data). The PPO type data format is as follows:

PP type	PKW (8 Bytes)	PZD1 (2 Bytes)	PZD2 (2 Bytes)	PZD 3 (2 Bytes)	PZD4 … PZD7 (8 Bytes)	PZD8 … PZD12 (10 Bytes)
PPO1	YES	YES	YES	YES	×	×
PPO2	YES	YES	YES	YES	YES	×
PPO3	×	YES	YES	YES	×	×
PPO4	×	YES	YES	YES	YES	×
PPO5	YES	YES	YES	YES	YES	YES

◆ **Description of PKW area**

PKW is a separate area designed for the reading and writing of single parameters on the drive. The communication address of the parameter is directly given by the communication data.

PKW data consists of three data areas, PKE, IND and PWE. PKE data byte length is 2 bytes, IND data byte length is 2 bytes and PWE data byte length is 4 bytes. The data format is shown in the following table:

PKW data sent by master							
Operating command	Parameter address		Reserved			Write operation: the parameter value Read operation: no value	
PKE	PKE	IND	IND	PWE	PWE	PWE	PWE
PKW data responded by the drive							
Operating command	Parameter address		Reserved			Success: return value Failure: error code	
PKE	PKE	IND	IND	PWE	PWE	PWE	PWE

Data description

PKW description of master sending data		PKW description for the drive response data
PKE	High 4 bits: Command code 0: No request 1: Read the parameter data 2: Change the parameter data 3: Change parameter data (RAM) (The above command code is decimal data) Low 4 bits: Reserved Low 8 bits: Parameter address high order byte	High 4 bits: Response code 0: No request 1: Parameters operation correct 7: Unable to perform Low 4 bits: reserved Low 8 bits: Parameter address high order byte
IND	High 8 bits: parameter address low order byte Low 8 bits: Reserved	High 8 bits: Parameter address low order byte Lower 8 bits: Reserved
PWE	High 16 bits: Reserved Low 16 bits: No function when read request; parameter value when write request.	Request successful: Parameter value Request failed: Error code (same as MODBUS): 1: Illegal command 2: Illegal address 3: Illegal data 4: Other error

Examples 1: The master reads the drive parameter F0−000:

PKW data sent by master: 10 60 00 00 00 00 00 00

PKW data responded by the drive if operation is successful: 10 60 00 00 00 00 13 88

PKW data responded by the drive if operation is unsuccessful: 70 60 00 00 00 00 error-code

Examples 2: The master sets the drive parameter P1−000=2000

PKW data sent by master: 20 01 00 00 00 00 07 d0

PKW data responded by the drive if operation is successful: 10 01 00 00 00 00 07 d0

PKW data responded by the drive if operation is unsuccessful: 70 01 00 00 00 00 error-code

Note: PKW will interact with the drive in cyclic, when use write command (PKE = 0x20xx) to continuously operate the EEPROM will greatly reduce the life of the EEPROM. It is recommended to use non-circular write operation (SFB53) or use operation command "3" in PKW (write only to RAM) to change the parameters.

◆ **Description of PZD area**

PZD is an area of the PROFIBUS/PROFINET telegram used to exchange data between the drive and the controller cyclically: control word, status word, speed setpoint, speed status, torque, etc.

PZD area sent by the master			
Drive command	Drive speed command%	Drive target torque	Chane drive parameters in real-time
PZD1	PZD2	PZD3	PZD 4 … PZD12
PZD area responded by the drive			
Drive Status	Drive operating frequency	Drive actual torque	Read drive parameters in real time
PZD1	PZD2	PZD3	PZD 4 … PZD12
PZD area sent by the master			
PZD1	Drive command word (command source to be set to communication) Low 8 bits: Command word Bit 0: 0 = Stop. 1 = Start. Bit 1: 0 = Forward direction, 1 = Reverse direction. Bit 2: 0 = No reset input, 1 = Reset. Bit 3: 0 = No jogging input, 1 = Jogging input. Bit 4: 0 = No coast to stop, 1 = Coast to stop. Bit 5: 0 = No ramp stop. 1 = Ramp stop. High 8 bits: mode control Bit 0 … bit 1: 0 = Speed control, 1 = Torque control.		
PZD2	Drive target speed, -100.00% … 100.00%, 100.00% = Maximum speed.		
PZD3	Drive target torque, -300.0% … + 300%, 100.00% = 100% Motor rated torque.		
PZD 4 … PZD12	Change the functional parameter values in real-time, Not write to EEPROM		
PZD area responded by the drive description			
PZD1	Low 8 bits: Drive running status word Bit 0: 0 = Drive has stopped. 1 = Drive is running. Bit 1: 0 = Forward running. 1= Reverse operation. Bit 2: 0 = No fault. 1 = Drive has a fault. Bit 3: 0 = Operating frequency has not reached. 1 = Operating frequency has reached. Bit 4: 0 = Not in acceleration process. 1 = In acceleration process. Bit 5: 0 = Not in deceleration process. 1 = In deceleration process. Bit 6: 0 = Not in zero speed. 1 = In zero speed. Bit 7: 0 = Position control not yet completed. 1 = Position control completed. High 8: Reserved.		
PZD2	Drive actual operating frequency (signed value)		
PZD3	Actual torque of the drive		
PZD 4 … PZD12	Read parameter values in real time.		

The default value for all PZDs is F0−000 (24576 in decimal), Unused PZDs can be left unchanged and their default values can be retained. Each slave device should set the PZD mapping relationship separately according to the requirements (if the slave device mapping relationship is the same, you can select a slave device that has already been set up, press CTRL + C, then select the PROFIBUS-DP bus in the configuration to directly modify the address after pressing CTRL + V). All the above operations complete the operation of PROFIBUS slave device, and then program in PLC software to control the drive.

Appendix E PROFINET

1 PROFINET Communication Setting

- **Parameter settings**

  After the PROFINET card is correctly installed to the drive, set C1-007=2 (standard PROFINET communication) or C1-007 = 3 (extended PROFINET communication), then the PROFINET card can establish communication with the drive.

  ① If the parameter C1-007=2 is the standard PROFINET communication, without the CAN network bridge transfer function.

  ② If the parameter C1.07=3 is extended PROFINET communication, with CAN bridge transfer function.

  Note: The "xml" file is different for C1-007=2 and C1-007=3. Please ask the local agent or manufacture for the correct "xml" file.

- **Set the relevant parameter of communication control**

  ① Run command selection: P0-004 = 5.

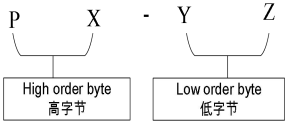
  ② Speed reference selection: P0-005 = 13.

  ③ Torque reference selection: ones position of PA.00 = ***7.

- **Set periodic reading and writing of functional parameters**

  When the PROFINET is used as the standard PROFINET communication, two sub-slots are set for the periodic setting and reading of the parameters. When the PROFINET is used as the extended PROFINET communication, 30 sub-slots are set to support the use of 30 nodes, so as to realize the periodic setting and reading of the parameters of each node.

  Write or read parameters require the register address of relevant parameters in communication. The following is the register address calculation method: the high byte is the parameter group number, and the low byte is the serial number in the group, which is expressed in hexadecimal.



High Order Bytes: P0 … PF: 0x00 … 0x0F
A0: 0x10
b0 … b1: 0x20 … 0x21
C0 … C2: 0x30 … 0x32
d0: 0x40
E0: 0x50
F0 … F3: 0x60 … 0x63

Low Order Bytes: 00 … 99: 0x00 … 0x63

Example: The Modbus operation address of the parameter Pb−023 is (0x0b <<8) + 23=0x0b17

- **The PLC configuration**

  ① Ask the agent or manufacturer for the "xml" file.

  ② Import the correct "xml" file to the master station system.

  ③ After completing the configuration, programming in PLC.

2 PROFINET Data Format

◆ **Data transfer format**

Use different lengths of communication data types PZD as data transfer formats in the PROFINET protocol. Select the appropriate communication data type PZD based on actual requirements.

Table 1: Standard PROFINET communication data type format

Data type	Data length	Support function
IDT_SM_NAME_TEL1	PZD-5/5	Drive command, frequency setting (PZD 1-2)
		Drive status, operating frequency (PZD 1-2)
		Write 3 parameters in cycle (PZD 3-5)
		Read 3 parameters in cycle (PZD 3-5)
IDT_SM_NAME_TEL2	PZD-7/7	Drive command, frequency setting (PZD 1-2)
		Drive status, operating frequency (PZD 1-2)
		Write 5 parameters in cycle (PZD 3-7)
		Read 5 parameters in cycle (PZD 3-7)
IDT_SM_NAME_TEL3	PZD-9/9	Drive command, frequency setting (PZD 1-2)
		Drive status, operating frequency (PZD 1-2)
		Write 7 parameters in cycle (PZD 3-9)
		Read 7 parameters in cycle (PZD 3-9)
IDT_SM_NAME_TEL4	PZD-11/11	Drive command, frequency setting (PZD 1-2)
		Drive status, operating frequency (PZD 1-2)
		Write 9 parameters in cycle (PZD 3-11)
		Read 9 parameters in cycle (PZD 3-11)
IDT_SM_NAME_TEL5	PZD-13/13	Drive command, frequency setting (PZD 1-2)
		Drive status, operating frequency (PZD 1-2)
		Write 11 parameters in cycle (PZD 3-13)
		Read 11 parameters in cycle (PZD 3-13)
IDT_SM_NAME_SUP_TEL1	PWK+PZD-5/5	Operate one parameter (PKW)
		Drive command, frequency setting (PZD 1-2)
		Drive status, operating frequency (PZD 1-2)
		Write 3 parameters in cycle (PZD 3-5)
		Read 3 parameters in cycle (PZD 3-5)
IDT_SM_NAME_SUP_TEL2	PWK+PZD-9/9	Operate one parameter (PKW)
		Drive command, frequency setting (PZD 1-2)
		Drive status, operating frequency (PZD 1-2)
		Write 7 parameters in cycle (PZD 3-9)
		Read 7 parameters in cycle (PZD 3-9)
IDT_SM_NAME_SUP_TEL3	PWK+PZD-13/13	Operate one parameter (PKW)
		Drive command, frequency setting (PZD 1-2)
		Drive status, operating frequency (PZD 1-2)
		Write 11 parameters in cycle (PZD 3-13)
		Read 11 parameters in cycle (PZD 3-13)
IDT_SM_NAME_ADD2	inPZD-in2	Read 2 parameters in cycle (PZD 1-2)
IDT_SM_NAME_ADD4	inPZD-in4	Read 4 parameters in cycle (PZD 1-4)
IDT_SM_NAME_ADD6	inPZD-in6	Read 6 parameters in cycle (PZD 1-6)
IDT_SM_NAME_ADD8	inPZD-in8	Read 8 parameters in cycle (PZD 1-8)

Table 2: Extended PROFINET communication data type format

Data type	Data length	Support function
IDT_SM_NAME_TEL1	PZD - in4 / out4	Drive command, frequency setting (PZD 1-2)
		Drive status, operating frequency (PZD 1-2)
		Write 2 parameters in cycle (PZD 3-4)
		Read 2 parameters in cycle (PZD 3-4)
IDT_SM_NAME_TEL2	PZD - in8 / out4	Drive command, frequency setting (PZD 1-2)
		Drive status, operating frequency (PZD 1-2)
		Write 2 parameters in cycle (PZD 3-4)
		Read 6 parameters in cycle (PZD 3-8)
IDT_SM_NAME_TEL3	PZD - in10 / out4	Drive command, frequency setting (PZD 1-2)
		Drive status, operating frequency (PZD 1-2)
		Write 2 parameters in cycle (PZD 3-4)
		Read 8 parameters in cycle (PZD 3-10)
IDT_SM_NAME_TEL4	PZD - in12 / out4	Drive command, frequency setting (PZD 1-2)
		Drive status, operating frequency (PZD 1-2)
		Write 2 parameters in cycle (PZD 3-4)
		Read 10 parameters in cycle (PZD 3-12)
IDT_SM_NAME_TEL5	PZD - in6 / out6	Drive command, frequency setting (PZD 1-2)
		Drive status, operating frequency (PZD 1-2)
		Write 4 parameters in cycle (PZD 3-6)
		Read 4 parameters in cycle (PZD 3-6)
IDT_SM_NAME_TEL6	PZD - in8 / out6	Drive command, frequency setting (PZD 1-2)
		Drive status, operating frequency (PZD 1-2)
		Write 4 parameters in cycle (PZD 3-6)
		Read 6 parameters in cycle (PZD 3-8)
IDT_SM_NAME_TEL7	PZD - in10 / out6	Drive command, frequency setting (PZD 1-2)
		Drive status, operating frequency (PZD 1-2)
		Write 4 parameters in cycle (PZD 3-6)
		Read 8 parameters in cycle (PZD 3-10)
IDT_SM_NAME_TEL8	PZD - in12 / out6	Drive command, frequency setting (PZD 1-2)
		Drive status, operating frequency (PZD 1-2)
		Write 4 parameters in cycle (PZD 3-6)
		Read 10 parameters in cycle (PZD 3-12)
IDT_SM_NAME_TEL9	PZD - in8 / out8	Drive command, frequency setting (PZD 1-2)
		Drive status, operating frequency (PZD 1-2)
		Write 6 parameters in cycle (PZD 3-8)
		Read 6 parameters in cycle (PZD 3-8)
IDT_SM_NAME_TEL10	PZD - in10 / out8	Drive command, frequency setting (PZD 1-2)
		Drive status, operating frequency (PZD 1-2)
		Write 6 parameters in cycle (PZD 3-8)
		Read 8 parameters in cycle (PZD 3-10)
IDT_SM_NAME_TEL11	PZD - in12 / out8	Drive command, frequency setting (PZD 1-2)
		Drive status, operating frequency (PZD 1-2)
		Write 6 parameters in cycle (PZD 3-8)
		Read 10 parameters in cycle (PZD 3-12)

◆ **Description of PKW area data**

PKW data mainly realizes the read and write one parameter of the drive by master station, and the parameter communication address of the drive is directly given by the communication data. PKW data format consists of three data areas, PKE, IND and PWE. PKE data length is 2 bytes, IND data length is 2 bytes, and PWE data length is 4 bytes. The data format is shown in the following table:

Master sending data PKW							
Operating command	Parameter address		Reserved			Write operation: the parameter value Read operation: no	
PKE	PKE	IND	IND	PWE	PWE	PWE	PWE
Drive response data PKW							
Operating command	Parameter address		Reserved			Success: return value Failure: error code	
PKE	PKE	IND	IND	PWE	PWE	PWE	PWE

Data description

PKW description (master sending data)		PKW description (drive response data)
PKE	High 4 bits: Command code 0: No request 1: Read the parameter value 2: Change the parameter value 3: Change parameter value (RAM) (The above command code data in decimal) Low 4 bits: Reserved Low 8 bits: Parameter address high order byte	High 4 bits: Response code 0: No request 1: Parameters operation correct 7: Cannot execute Low 4 bits: Reserved Low 8 bits: Parameter address high order byte
IND	High 8 bits: Parameter address low order byte Low 8 bits: Reserved	High 8 bits: Parameter address low order byte Lower 8 bits: Reserved
PWE	High 16 bits: Reserved Low 16 bits: No function when read request and parameter value when write request.	Request successful: Parameter value Request failed: Error code (same as MODBUS): 1: Illegal command 2: Illegal address 3: Illegal data 4: Other error

E.g., 1, the master reads the drive parameter F0−000:

PKW data sent by master: 10 60 00 00 00 00 00 00

PKW data responded by the drive if operation is successful: 10 60 00 00 00 00 13 88

PKW data responded by the drive if operation is unsuccessful: 70 60 00 00 00 00 error-code

E.g., 2, the master sets the drive parameter P1−000=2000

PKW data sent by master: 20 01 00 00 00 00 07 d0

PKW data responded by the drive if operation is successful: 10 01 00 00 00 00 07 d0

PKW data responded by the drive if operation is unsuccessful: 70 01 00 00 00 00 error-code

Note: PKW will interact with the drive in cycle. Use write command (PKE = 0x20xx) to continuously operate the EEPROM will greatly reduce the life of the EEPROM. It is recommended to use non-circular write operation (SFB53) or use operation command "3" in PKW (write only to RAM) to change the parameters.

◆ **Description of PZD area data**

PZD is an area of the PROFIBUS/PROFINET telegram used to exchange data between the drive and the controller cyclically: control word, status word, speed setpoint, speed status, torque, etc.

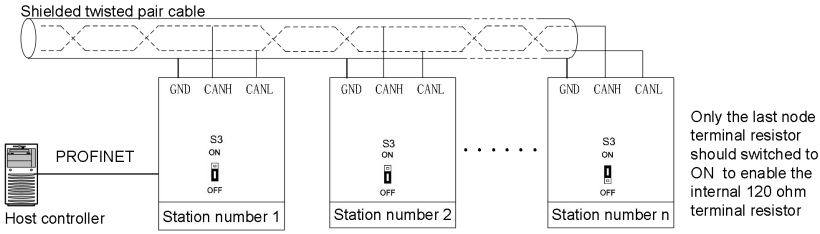
PZD area sent by the master		
Drive command	Drive speed command%	Change drive parameters in real-time
PZD1	PZD2	PZD 3 … PZD13
PZD area responded by the drive		
Drive Status	Drive operating frequency	Read drive parameters in real time
PZD1	PZD2	PZD 3 … PZD13

PZD area sent by the master	
PZD1	Drive command word (set command source to communication) Low 8 bits: Command word Bit 0: 0 = Stop. 1 = Start. Bit 1: 0 = Forward direction, 1 = Reverse direction. Bit 2: 0 = No reset input, 1 = Reset input. Bit 3: 0 = No jogging input, 1 = Jogging input. Bit 4: 0 = No coast to stop, 1 = Coast to stop. Bit 5: 0 = No ramp stop. 1 = Ramp stop. High 8 bits: Mode control Bit 0 … bit 1: 0 = Speed control, 1 = Torque control.
PZD2	Drive target speed, -100.00% … 100.00%, 100.00% = Maximum speed.
PZD 3 … PZD13	Change parameter values in real-time. Not write to EEPROM
PZD area responded by the drive description	
PZD1	Low 8 bits: Drive running status word Bit 0: 0 = Drive has stopped. 1 = Drive is running. Bit 1: 0 = Forward running. 1= Reverse running. Bit 2: 0 = No fault. 1 = Drive has a fault. Bit 3: 0 = Operating frequency has not reached. 1 = Operating frequency has reached. Bit 4: 0 = Not in acceleration process. 1 = In acceleration process. Bit 5: 0 = Not in deceleration process. 1 = In deceleration process. Bit 6: 0 = Not in zero speed. 1 = In zero speed. Bit 7: 0 = Position control not yet completed. 1 = Position control completed. High 8: Fault code.
PZD2	Drive actual operating frequency (signed value)
PZD 4 … PZD12	Read parameter values in real time.

3 Expand PROFINET

◆ **System network structure**

A drive receives data from PROFINET master station and then sends the data to CAN bus. And the drive can receive other drive data from CAN bus and send the master station (such as PLC) through PROFINET communication, so as to realize the data interactive transmission from PLC to each drive. The system structure is shown in the following figure.



◆ **Drive parameter settings**

The whole system can realize the data transmission of no more than 30 nodes. Each node communication data type can be configured through the PLC master station (IDT_SM_NAME_TEL1 to IDT_SM_NAME_TEL 11). The PLC master station uniformly configures the communication addresses and data of each node, no need to set the communication addresses and types of each node separately. Each node only needs to set several parameters to enable the PROFINET to CAN function, as described below:

① Set C1-007 = 3 to enable extended PROFINET communication, only the CAN master require set this parameter, the slave does not require set.

② Set C1-000 = CAN communication address, 1 = CAN master station, other values are the slave station address, the slave station address must be set successively from 2 (no interval).

③ Set C1-001 = CAN Baud rate parameter.

④ Set C1-006 = total number of slave station parameter. Must be set to total number of slave station (excluding the main station) for the master station. And don't need to be set for slave station.

⑤ Set C1-008 = CAN type selection: 2 = that CAN is configured as CAN bridge transfer function.

⑥ Set C1-021 = CAN Message 1 sending period

◆ **The PLC software configuration**

① In PLC software configuration, first import the "xml" file, establish the PROFINET communication.

② Set up relevant network properties and connections, and assign device names.

③ Configure communication data types for each node in sub slots. The first sub slot is set to the drive equipped with a PROFINET card as the host. From the second sub slot as the slave station, and the settings must be set in sequence. Unused sub slots do not need to be set.

④ Each node's communication data can be transmitted by selecting one of the data types (IDT_SM_NAME_TEL 1 … IDT_SM_NAME_TEL 11).

⑤ The host drive receives data through PROFINET communication, then through CAN bus communication transfer the data to parameters C1-024 … C1-039 of the slave station.

◆ **CAN Bus message data format**

Follow the CAN 2.0B communication protocol, standard frame or extended frame can be used to realize data exchange between drive and drive, and host controller and drive. The protocol stipulates the data message should use Intel data format, that is, low bytes first, high bytes later, and others refer to ISO 11898 standard.

① Basic format of the frame data

Message ID	Parameter 1 (word0)		Parameter 2 (word1)		Parameter 3 (word2)		Parameter 4 (word3)	
	High byte	Low byte	High byte	Low byte	High byte	Low byte	High byte	Low byte

② Send message 1 format

Parameter 1 ((C1-040) Low bytes: Drive status High bytes: Alarm ID	Parameter 2: (C1-041) Running frequency	Parameter 3 (C1-024)	Parameter 4 (C1-025)

③ Send message 2 format

Parameter 1 (C1-026)	Parameter 2 (C1-027)	Parameter 3 (C1-028)	Parameter 4 (C1-029)

④ Send message 3 format

Parameter 1 (C1-030)	Parameter 2 (C1-031)	Parameter 3 (C1-032)	Parameter 4 (C1-033)

⑤ Received message 1 format

Parameter 1 (C1-042) Low bytes: Control command High bytes: Control mode	Parameter 2 (C1-043) Set frequency (range: 0 … 100.00%)	Parameter 3 (C1-034)	Parameter 4 (C1-035)

⑥ Receive message 2 format

Parameter 1 (C1-036)	Parameter 2 (C1-037)	Parameter 3 (C1-038)	Parameter 4 (C1-039)

Note: If the torque reference selection is parameter setting, the parameter is PA-002.

4 Related Parameters

Parameter	Name	Default	Range	Unit	Attribute
C1-000	CAN / PROFIBUS-DP / PROFINET address	2	0 ... 127	/	○
C1-001	CAN baud rate	0	0 ... 4	/	○
	0: CAN is disabled. 1: 125kbps. 2: 250kbps. 3: 500kbps. 4: 1000kbps				
C1-002	CAN communication fault detection time	2.0	0.0 ... 6553.5	s	×
C1-003	CAN command smoothing cycle	5000	1 ... 65535	us	×
C1-004	Reserved	0	0 ... 65535	/	×
C1-005	Reserved	0	0 ... 65535	/	×
C1-006	Slave number	0	0 ... 30	/	×
	Valid when C1-000=1 and C1-008 = 2. The total of CAN slave number except the host.				
C1-007	PROFIBUS DP and PROFINET selection	0	0 ... 3	/	×
	0: Disable. 1: PROFIBUS DP. 2: PROFINET. 3: PROFINET convert to CAN.				
C1-008	CANopen selection	0	0 ... 2	/	×
	0: CANopen. 1: CAN bus. 2: CAN bus, and receive the PROFINET data convert to CAN				
C1-009	CAN message frame format	0	0 ... 1	/	×
	0: Standard frame. 1: Extended frame				

C1-010	Send message ID1 low order byte	100	0000 ... FFFF	/	×
C1-011	Send message ID1 high order byte	0	0000 ... 1FFF	/	×
C1-012	Send message ID2 low order byte	200	0000 ... FFFF	/	×
C1-013	Send message ID2 high order byte	0	0000 ... 1FFF	/	×
C1-014	Send message ID3 low order byte	300	0000 ... FFFF	/	×
C1-015	Send message ID3 high order byte	0	0000 ... 1FFF	/	×
C1-016	Receive message ID1 low order byte	180	0000 ... FFFF	/	×
C1-017	Receive message ID1 high order byte	0	0000 ... 1FFF	/	×
C1-018	Receive message ID2 low order byte	280	0000 ... FFFF	/	×
C1-019	Receive message ID2 high order byte	0	0000 ... 1FFF	/	×
C1-020	Receive message enable	1	0 ... 11	/	×
	Ones position: 0: Disables receive message 1. 1: Enables receive message 1 **Tens position:** 0: Disables receive message 2. 1: Enables receive message 2				
C1-021	Message 1 sending period	50	0 ... 65535	/	×
	Defines the sending period of message 1. 0 = disable message 1 sending function.				
C1-022	Message 2 sending period	100	0 ... 65535	/	×
	Defines the sending period of message 2. 0 = disable message 2 sending function.				
C1-023	Message 3 sending period	0	0 ... 65535	/	×
	Defines the sending period of message 3. 0 = disable message 3sending function.				
C1-024	Parameter 3 address of send message 1	6008	0000 ... FFFF	/	×
C1-025	Parameter 4 address of send message 1	6005	0000 ... FFFF	/	×
C1-026	Parameter 1 address of send message 2	6007	0000 ... FFFF	/	×
C1-027	Parameter 2 address of send message 2	600A	0000 ... FFFF	/	×
C1-028	Parameter 3 address of send message 2	6009	0000 ... FFFF	/	×
C1-029	Parameter 4 address of send message 2	6016	0000 ... FFFF	/	×
C1-030	Parameter 1 address of send message 3	0	0000 ... FFFF	/	×
C1-031	Parameter 2 address of send message 3	0	0000 ... FFFF	/	×
C1-032	Parameter 3 address of send message 3	0	0000 ... FFFF	/	×
C1-033	Parameter 4 address of send message 3	0	0000 ... FFFF	/	×
C1-034	Parameter 3 address of received message 1	0A02	0000 ... FFFF	/	×
C1-035	Parameter 4 address of received message 1	0	0000 ... FFFF	/	×
C1-036	Parameter 1 address of received message 2	0	0000 ... FFFF	/	×
C1-037	Parameter 2 address of received message 2	0	0000 ... FFFF	/	×
C1-038	Parameter 3 address of received message 2	0	0000 ... FFFF	/	×
C1-039	Parameter 4 address of received message 2	0	0000 ... FFFF	/	×
C1-040	Send message 1 parameter 1 address	0	0000 ... FFFF	/	×
C1-041	Send message 1 parameter 2 address	0	0000 ... FFFF	/	×
C1-042	Parameter 1 address of received message 1	0	0000 ... FFFF	/	×
C1-043	Parameter 2 address of received message 1	0	0000 ... FFFF	/	×

5 Error and Monitor

■ Error message

Error display	Description
E-DPE or "DP / PN communication fault"	PROFINET communication failure. Without PROFINET communication data from the PLC master station. PROFINET communication type does not match the "xml" file.
E-CAn or "CAN, communication fault "	CAN communication failure. Without CAN data received or error on CAN bus

■ Status words

Parameter	Description
F0-083	Display the current PROFINET connection status in PROFINET communication.
F0-084	Display slave station connection status when extended PROFINET communication is enabled.
F0-078	Display CAN / PROFIBUS-DP / PROFINET communication control word.
F0-079	Display CAN / PROFIBUS-DP / PROFINET status. Display slave station error state when extended PROFINET communication is enabled.
F0-080	Display CAN / PROFIBUS-DP / PROFINET communication mode status.
F0-081	Display CAN communication error number.
F0-082	Display CAN communication error status.