

Foreword

First of all, thank you for purchasing the VTF series regenerative braking unit of SHENZHEN V&T TECHNOLOGIES CO., LTD.

This manual is used for the model selection, installation, parameter setting, commissioning and fault diagnosis of the VTF series regenerative braking unit.

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

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

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

Product Introductions

VTF series regenerative braking unit is used to divert energy generated by the motor back onto the power grid for use by other loads. Unlike dynamic braking, which dissipates all braking energy in the form of heat, the VTF RBU(s) avoids wasted energy by delivering it back to the power source for use by other loads. The VTF regenerative braking unit contains the reactor and noise filter. The energy is directed back onto the grid by taking DC voltage from the drive and converting it into a three-phase AC voltage waveform.

Since the VTF transfers power during regeneration (not motoring), it is very economical for regenerative applications. Not only does this save energy and money, it also eliminates the need to safely locate and maintain braking resistors.

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 RBU.



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

- VTF series regenerative braking unit is used to divert energy generated by the motor back onto the power grid for use by other loads.
- VTF series regenerative braking unit cannot be easily applied to applications such as medical device that are directly related to personal safety.
- VTF series regenerative braking unit is manufactured under a strict quality management system. If a fault occurs, it may cause a major accident or loss, safety measures such as redundancy or bypass need to be set, just in case.

■ Arrival Inspection



WARNING

- VTF series regenerative braking unit cannot be installed if the 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 RBU may be damaged.
- The VTF series regenerative braking unit 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 product during installation work. Otherwise the product may be damaged and/or trip on a fault.
- When the product is installed in an electrical control cabinet, the electrical control cabinet shall be equipped with a fan and ventilation port. In addition, air-cooling duct shall be constructed in the cabinet to facilitate heat dissipation.

■ Wiring



DANGER

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



WARNING

- The three-phase power supply should be connected to the terminals A, B, C; otherwise, the RBU will be damaged.
- It is absolutely prohibited to connect a capacitor or phase lead LC/RC noise filter to the the RBU, otherwise the internal components of the RBU will be damaged.
- Please confirm the number of power phases and rated input voltage match the nameplate, otherwise the RBU may be damaged.
- The withstand voltage test cannot be performed to the product; otherwise the RBU may be damaged.
- The main circuit terminal wiring and control circuit terminal wiring of the RBU 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 RBU rated current.
- The terminal connection of the main circuit must be reliable; otherwise, it may cause fire and/or short circuit.

■ Operation



DANGER

- Only after the wiring is completed and covered well, the RBU can be powered up. It is forbidden to remove the cover when the power is on; otherwise, there is a risk of electric shock.
- Before running, confirm that the mechanical installation is reliable; otherwise, it may cause physical injury and/or damage to the equipment.
- Before running, must confirm all personnel are in safe position, otherwise, it may cause physical injury and/or damage to the equipment.
- If automatic fault reset or automatic start after next time powered up function is active, safety isolation measures should be taken for mechanical equipment, otherwise, it may cause physical injury and/or damage to the equipment.
- After the RBU is powered, even if it is in the stop status, the terminals of the RBU are still charged. It is forbidden to touch the terminals, otherwise it may cause electric shock.
- Before reset the RBU, 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 RBU by turning the power supply on or off; otherwise, the RBU 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.
- If used with brake chopper and brake resistor, do not touch heat sink and brake resistor, otherwise there is a danger of burns and/or electric shock.
- When the RBU is used on a lifting machine, such as crane, escalator, elevator, please also configure a mechanical brake.
- Do not change the RBU 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 while the power is on, otherwise there is a danger of electric shock.
- Make sure cut off the power supply before remove the cover.
- Wait at least 10 minutes after cut off the power, or confirm that the charging CHARGE indicator is off before performing maintenance and inspection to prevent the residual voltage of the main circuit capacitor from injuring people.
- Please designate qualified electrical engineers to do the maintenance, inspection and replace parts for the RBU.



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 RBU hardware; otherwise, it will cause personal injury.
- The power of interphone used when close to the RBU 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 RBU or the circuit will be damaged due to factors such as too long or too large screws.

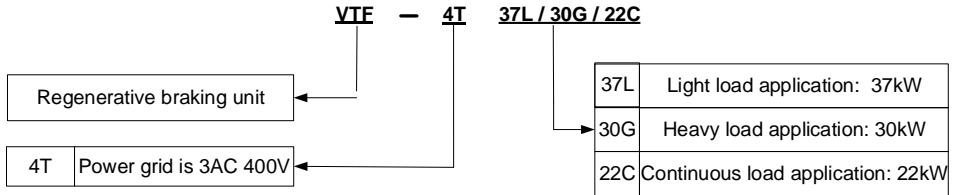
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Chapter 1 Product Information

1.1 Model Description

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



1.2 Technical Specification

	Item	Specification
Power grid	Grid voltage	3 Phase 280V AC~480V AC
	Grid frequency	40Hz~70Hz
Control characteristics	Current control mode	Vector control, current and voltage THD < 5% @ 100% load
	Output control mode	DC bus voltage intelligent predictive control
	Operating voltage	600V DC (380V AC Level) ± 200V DC Adjustable
	Fan Control	Fan runs automatically when the temperature higher than 35°C, Fan stops automatically when the temperature lower than 30°C, can set run mode by parameter.
	Protection	Over-current protection, overload protection, current limiting protection, DC short circuit protection, DC over-voltage protection, DC under-voltage protection, over temperature protection, grid amplitude fault protection, grid frequency fault protection, grid phase fault protection, AC short circuit protection, external EXT terminal input fault protection, etc.
Display	Status indication	Power indicator, monitoring indicator, operation indicator, fault indicator, parameter modification indicator, rectifier feedback/feedback status indicator, keyboard data display, etc.
Ambient	Operating site	Inside the cabinet, no direct sunlight, no conductive dust and corrosive gas. Derating use when the altitude over 1000 meters, the rated output current is reduced by 1% for every 100-meter rising.
	Ambient temperature	-10 to +40°C. Derating use when the temperature between 40 to 50°C, the rated output current is reduced by 1% for every 1 °C increasing.
	Humidity	5 to 95%, no condensing.
	Vibration	3.5 m/s ² , 2~9Hz; 10 m/s ² , 9~200Hz; 15 m/s ² , 200~500Hz.
	Air environment	The product should be installed in the environment without dust, corrosive gas, combustible gas, oil mist, steam, drip and free from direct sunlight.
	Installation	Wall mounted, protection class is IP20.

1.3 Ratings

Model	轻载应用 Light load ratings		重载应用 Heavy load ratings		持续性负载应用 Continuous load ratings		最大电流 Max. current (A)	安装尺寸 Size (Width * Length * Depth)
	Power (kW)	Rated current (A)	Power (kW)	Rated current (A)	Power (kW)	Rated current (A)		
VTF-4T22L/18.5G/11C	22	28	18.5	25	11	17	40	210 * 415 * 249 mm
VTF-4T30L/22G/15C	30	35	22	32	15	25	45	
VTF-4T37L/30G/18.5C	37	36	30	33	18.5	30	45	
VTF-4T45L/37G/22C	45	42	37	40	22	33	70	
VTF-4T55L/45G/30C	55	52	45	50	30	41	81	210 * 540 * 270 mm
VTF-4T75L/55G/37C	75	72	55	67	37	50	90	
VTF-4T90L/75G/45C	90	105	75	95	45	75	135	
VTF-4T110L/90G/55C	110	130	90	120	55	86	160	

1.4 Product Selection Instructions

1. Regenerative duty cycle is based on the time the motor is in regeneration compared to the total cycle time. The VTF has three output current ratings to meet different applications, Light load ratings, Heavy load ratings and Continuous load ratings.
2. Light load ratings, duty cycle is 25%, is suitable for the loads regenerate during deceleration for a long period of time, such as industrial dryer machine, centrifuge, textile machine, printing machine, sugar mill honey dispenser, packaging machine, lathe, knocking machine, pumping unit, paper-making machine, gantry plane, machine tool spindle, etc. If the working conditions cannot be determined, or the deceleration time is relatively short, please select higher power products.
3. Heavy load ratings, duty cycle is 50%, is suitable for loads that go in and out of regeneration, such as winch, cable vehicle, port lifting machine, coal mining machine, hoist, tower crane, down belt machine, windlass, rolling machine, driving, overhead travelling, crane, unwinding and rolling, wire drawing machine, wire-drawing equipment, stacker, unwinding machine, coiler, unloader, ship lock, etc.
4. Continuous load ratings, duty cycle is 100%, is suitable for loads operating in a continuous regenerative state, such as Test Dynamometer, Generator, Decanter Centrifuge (Scroll Motor), Downhill Conveyors, Escalators, Moving Walkways, Unwinder ,etc.
5. The peak current can continue to work for 3 seconds.

Chapter 2 Mechanical Installation

2.1 Installation Environment

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

2.2 Installation Direction and Clearances

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

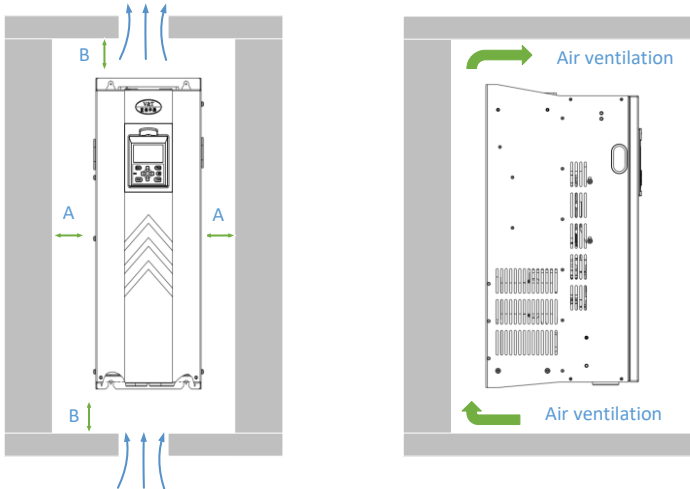
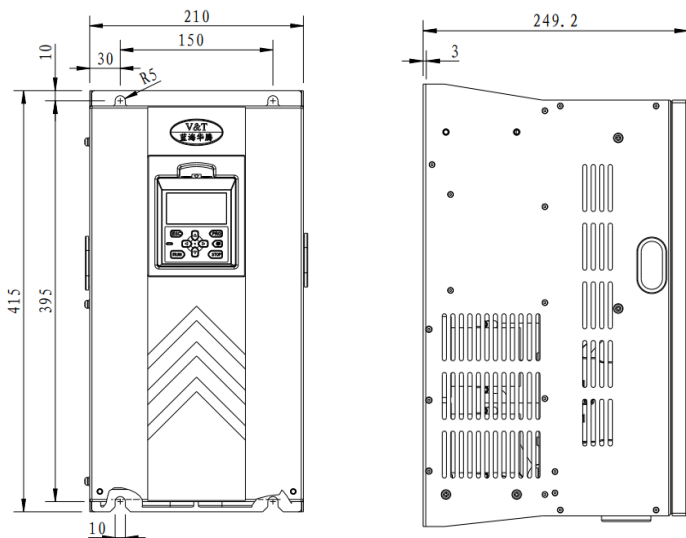


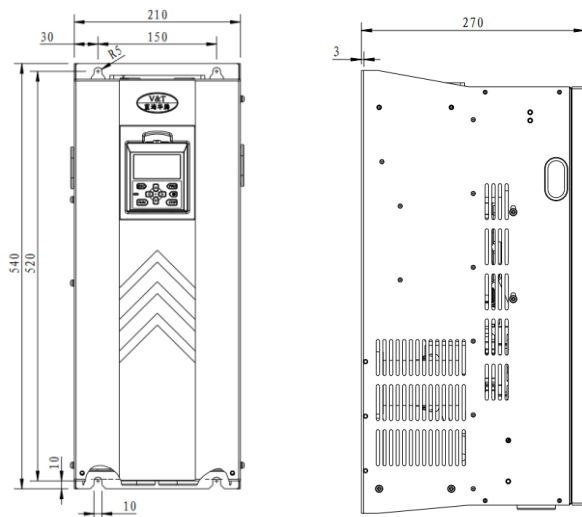
Figure2-1 Installation direction and clearance for RBU

Space A	Space B
$A \geq 100\text{mm}$	$B \geq 200\text{mm}$

2.3 Product Appearance and Dimensions



VTF-4T22L/18.5G/11C ... VTF-4T55L/45G/30C



VTF-4T75L/55G/37C ... VTF-4T110L/90G/55C

Chapter 3 Electrical Installation

3.1 Peripheral Devices Models

RBU model			Cable (mm ²)		
C Type	G Type	L Type	Main circuit	PE	Control circuit
11C	18.5G	22L	≥6	≥6	0.75
15C	22G	30L	≥8	≥8	0.75
18.5C	30G	37L	≥8	≥8	0.75
22C	37G	45L	≥10	≥10	0.75
30C	45G	55L	≥11	≥11	0.75
37C	55G	75L	≥13	≥13	0.75
45C	75G	90L	≥16	≥16	0.75
55C	90G	110L	≥22	≥22	0.75

3.2 Main Circuit Terminal Description

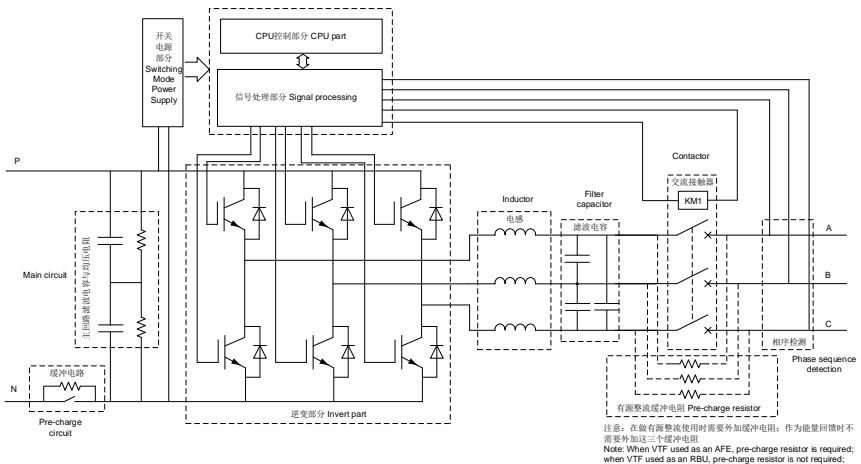
A	B	C	P	N	PE
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Terminal Symbol	Description
A、B、C	Three-phase power grid wiring terminals, no need to distinguish phase sequence
P	DC power input positive end
N	DC power input negative end
PE	Grounding terminal PE

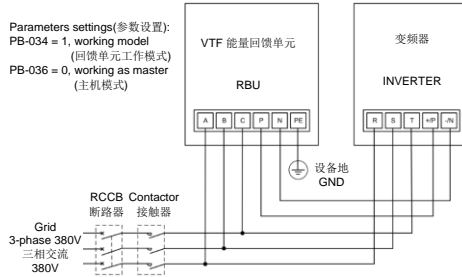
3.3 Attention for Main Circuit Wiring

The main circuit wiring should strictly comply with the following requirements:

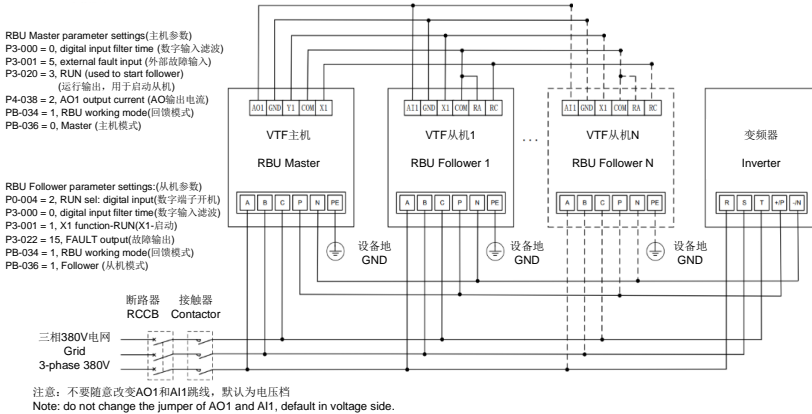
- ◆ Wiring can only be carried out when there is no power at the AC power supply and DC bus terminals.
- ◆ Ensure that the wiring is in good condition, the crimping terminals are not detached, and the cables are not damaged;
- ◆ Choose cables of different colors to distinguish between the positive end and negative end of the DC bus terminals.
- ◆ The P terminal of the RBU is connected to the positive end of the DC bus, and the N terminal of the RBU is connected to the negative end of the DC bus. It cannot be connected in reverse or incorrectly, otherwise there may be a risk of explosion.
- ◆ The PE terminal must be reliably connected to the ground using yellow and green dual color wires.



3.4 One RBU Connection



3.5 Multiple RBUs Parallel Connection



3.6 Control Circuit Wiring

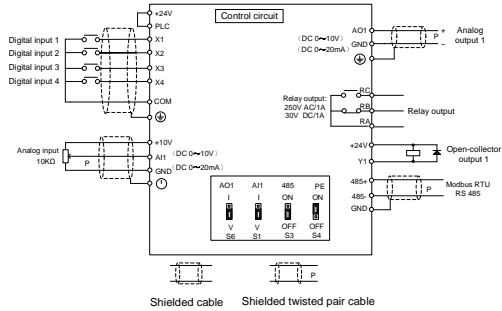


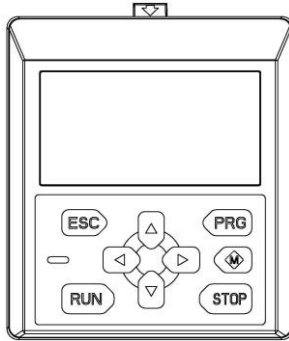
Figure3-6 Control circuit terminal wiring diagram

3.7 Control Circuit Description

Terminal	Symbol	Function description	Technical specifications
Modbus	485+	RS485 positive end	<ul style="list-style-type: none"> ● Baud rate: 4800/9600/19200/38400/57600/115200bps ● Up to 32 units are connected in parallel. ● If more than 32 units are used, repeaters are required.
	485-	RS485 negative end	
	GND	Modbus ground terminal	
Digital inputs	+24V	+24V	24V±10%, internal isolated with GND Maximum output current: 200mA
	PLC	Power supply of DI	Short to +24V by default
	X1 ... X4	Digital inputs 1 ... 7	Input specification: 24VDC ± 20%, 5mA Frequency range: 0 ... 1KHz
	COM	Digital inputs common	The interior isolated from GND
Digital outputs	Y1	Open collector output 1	Voltage range: 24V ± 20% Maximum output current: 50mA
	COM	Y1 common	The interior isolated from GND
Relay outputs	RA/RB/RC	Relay output 1	RA—RB: Normally closed RA—RC: Normally open Contact capacity: 250VAC/1A, 30VDC/1A
	+10V	AI reference voltage	10V ± 3%, internal isolated with COM Maximum output current: 10mA
Analog inputs	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%)
	GND	Analog GND	The interior isolated from COM
	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
Analog outputs	GND	Analog ground terminal	The interior isolated from COM

Chapter 4 Keypad Operation

4.1 Keypad Model










LCD keypad(VTF-DP02)

Figure4-1 Keypad model

The keypad has the following features:

- Set parameters – the parameters can be change by keypad.
- Monitoring function – use the keypad to monitor the parameters value, running state, fault record, etc.
- Start and stop the RBU 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 RBUs 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 RBU 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	<ol style="list-style-type: none"> 1. Enter the sub-menu. 2. Enter the parameter setting menu. 3. Data storage confirmation.
	Escape Key	<ol style="list-style-type: none"> 1. Return to the previous menu. 2. Abandon the modification of the data.
	Increase / Decrease Key	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 1. Press RUN key to start the when run command is keypad.
	Stop / Reset Key	<ol style="list-style-type: none"> 1. Press STOP key to stop when run command selection is keypad. 2. Press STOP key to reset the fault when the RBU has fault. 3. Press M key and STOP key at the same time to stop the RBU by coast to stop immediately.
	Multifunctional Key	<ol style="list-style-type: none"> 1. Press M key and STOP key at the same time to stop the RBU by coast to stop immediately.

4.3 Keypad Indicator

VTF-DP02 indicator description: VTF -DP02 with a status indicator to indicate the RBU in running state, stop state, or fault state.

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

4.4 LCD Keypad Interface

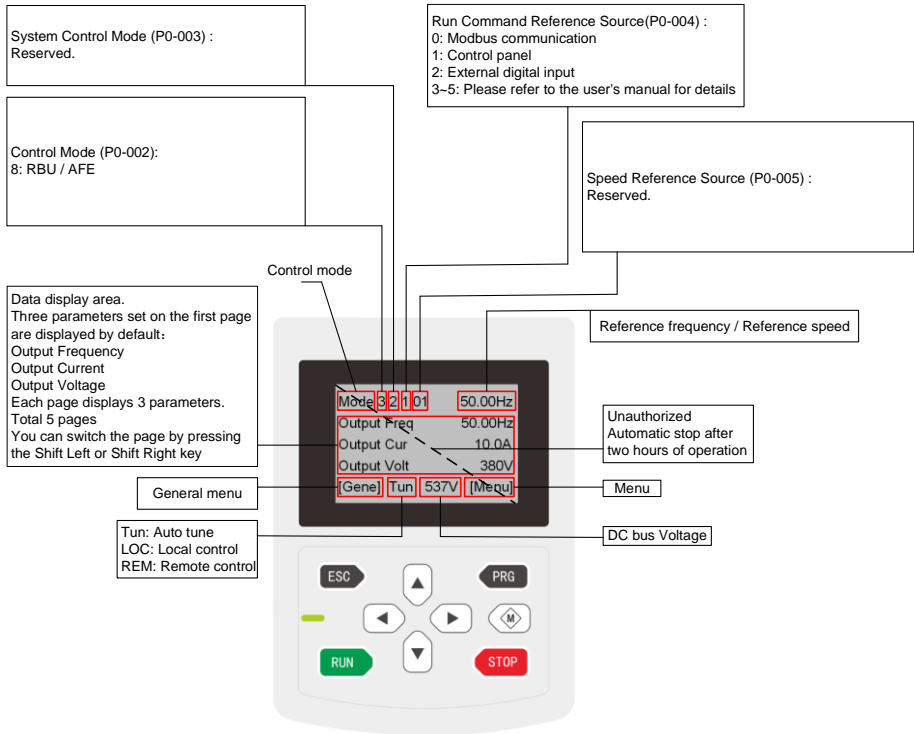
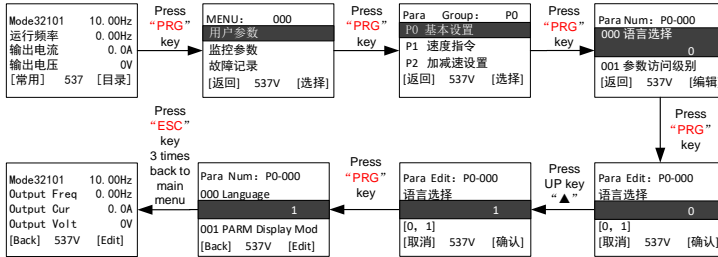


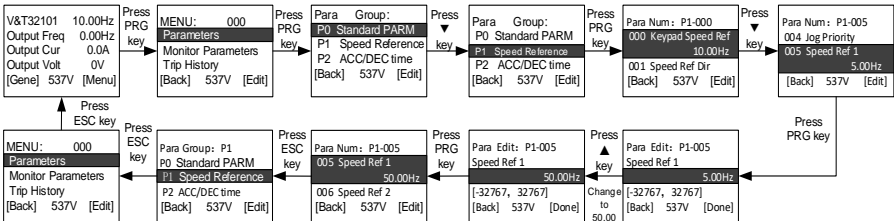
Figure 4-2 Description of LCD keypad display interface

4.5 LCD Keypad Operation

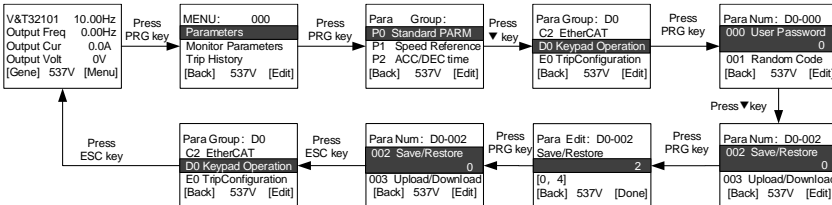
Change display language. (Set P0-000 = 1: display language is English)



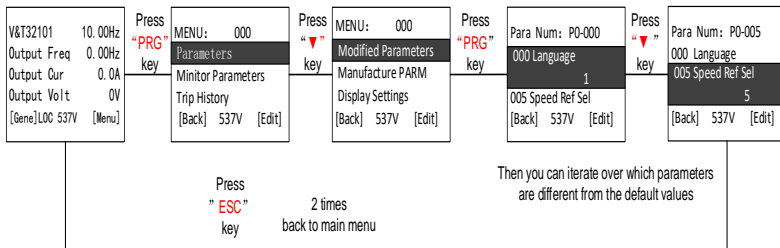
Change a parameter, set P1-005 to 50.00.



Reset to Default Value, Set D0-002 to 2.

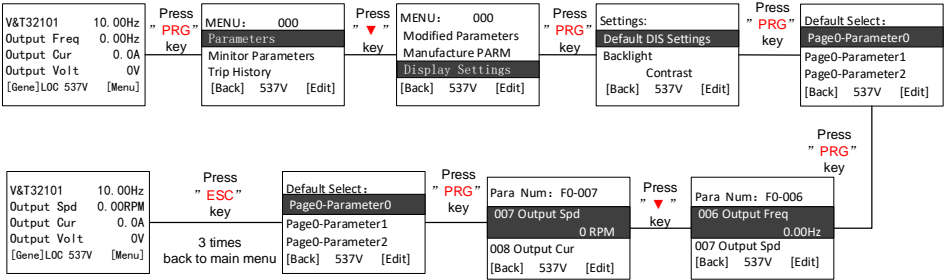


Check which parameters is changed

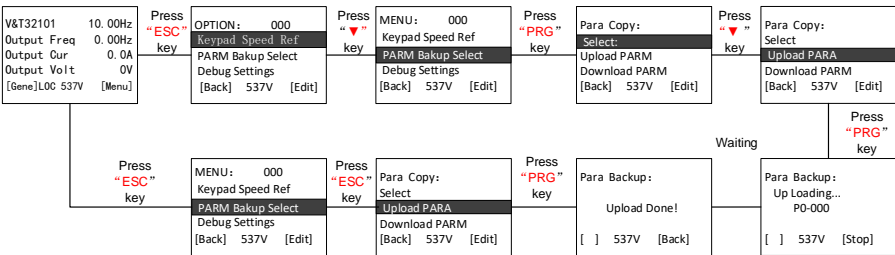


■ *Change the monitoring parameters in default pages?*

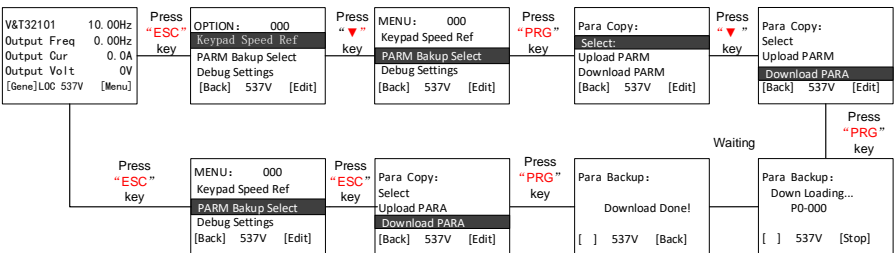
There are 5-page parameters can be display on the main menu mode and three parameters can be selected to display on every page. Each page can be switchover by right key (▶) or left key (◀) on the keypad. For example, if I want to display output speed on the first position of first page:



■ *Back up parameters to LCD keypad*



■ *Download parameters from LCD keypad*



Chapter 5 Parameter List



Parameter groups

Description of each meaning in the parameter list

Group	Group description
P0	Basic parameters
P3	Digital inputs and outputs
P4	Analog inputs and outputs
PB	Advanced control parameters
D0	Keypad parameters
E0	Protection configuration
F0	Status monitoring parameters
F1	Software version
F2	Product bar code
F3	Trip history

Item	Explanation
Parameter	Indicates the number of the parameter, such as P0-000. Notes: <ul style="list-style-type: none"> ➢ 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 RBU is running. x: The parameter only can be changed in stop status. *: The parameter is a read-only parameter and cannot be changed.
Description	Describe the parameters and values.

5.1 Basic Parameters (P0)

Parameter	Name	Default	Range	Unit	Attribute
P0-000	Language	0	0 ... 1	/	x
<p>Selects the language of the parameter interface and other displayed information when viewed on the LCD keypad.</p> <ul style="list-style-type: none"> ● 0: Chinese ● 1: English <div style="display: flex; justify-content: space-around; align-items: center;">   <div style="border: 1px solid black; padding: 5px; margin-left: 20px;"> <p>Notes:</p> <ul style="list-style-type: none"> ➤ The parameter is only effective for LCD keypad. ➤ This parameter only can be changed manually and cannot be restored by parameter D0-002 </div> </div>					
P0-001	Parameters display mode	0	0 ... 5	/	o
<p>Selects parameters display mode by LED keypad.</p> <ul style="list-style-type: none"> ● 0: Display all the parameters. ● 1: Only display the modified parameters. ● 2 ... 5: Reserved. <div style="border: 1px solid black; padding: 5px; margin-left: 20px;"> <p>Note: The parameter is only effective for LED keypad.</p> </div>					
P0-002	Control mode	8	8... 8	/	x
<p>Selects the control mode.</p> <ul style="list-style-type: none"> ● 8: Regenerative braking mode 					
P0-004	Run command selection	1	0 ... 5	/	x
<p>Selects the source of run command.</p> <ul style="list-style-type: none"> ● 0: Modbus communication 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 parameter P3-001 for more information. 					
P0-016	Current limit	100.0	0.0 ... 100.0	%	o
<p>100.0% corresponds to the rated current</p>					

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	/	×

The parameters P3-001 ... P3-004 are used to set the digital input functions.

- **0: No function**

The digital input ON or OFF only displays the terminal status but does not trigger any functions.

- **1: RUN**

Run command input when P0-004 = 2. For example, if digital input X1 is used to start and stop the RBU, 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 = operate in the rotate direction that keep consistent with the speed reference and run command, 1 = operate 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, set P0-004 = 2, P3-001 = 1, P3-002 = 2, and speed reference is a positive value, then:

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

- **5: External fault input**

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

- **6: Fault reset**

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

P3-008	Digital input invert	0000	0000 ... 03FF	/	×						
	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.										
Item	Reserved	-	-	-	-	-	-	X4	X3	X2	X1
Default	0000 00	0	0	0	0	0	0	0	0	0	0
bit	bit15 to bit10	bit9	bit8	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0

- **0: No inversion**
- **1: Inversion active**

Parameter	Name	Default	Range	Unit	Attribute			
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	/	○			
<ul style="list-style-type: none"> ● 0: No function ● 3: RUN The signal is enabled when the RBU is running. ● 13: Authorized When the RBU is in the authorized state, it outputs a signal. ● 15: Fault output When the RBU is in the stop status due to fault output, the signal is enabled. 								
P3-025	Digital output invert	0000	0000 ... 001F	/	×			
		Item	Reserved	RA3	RA3	RA1	Y2	Y1
		Default	0000 0000 000	0	0	0	0	0
		Bit	bit15 ... bit5	bit4	bit3	bit2	bit1	bit0
<ul style="list-style-type: none"> ● 0: No inversion ● 1: Inversion active 								

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	%	○
P4-002	AI1 gain	100.00	0.00 ... 200.00	%	○
P4-038	AO1 analog output function selection	0	0 ... 15	/	○
	<ul style="list-style-type: none"> ● 0: Output 0V. ● 1: Output 10V. ● 3: Current. 				
P4-039	AO1 zero offset	0.00	-100.00 ... 100.00	%	○
P4-040	AO1 gain	100.00	0.00 ... 200.00	%	○

5.12 Advanced Parameter (PB)

Parameter	Name	Default	Range	Unit	Attribute	
PB-000	Carrier frequency	11C	6	1 ... 16	kHz	x
		15C	6	1 ... 12		
		18.5 ... 30C	4	1 ... 12		
		37 ... 45C	4	1 ... 8		
		55C	3	1 ... 6		
<p>Carrier frequency has an important impact on operations of RBU. The higher the carrier frequency, the higher the heat generated. The lower the carrier frequency, the lower leakage current from the RBU, and the lower interference from the RBU affects peripheral devices.</p> <p>Notes:</p> <ul style="list-style-type: none"> ➢ Generally, do not change this value arbitrarily, as it may cause accidental damage. ➢ The default setting for the carrier frequency depends on the RBU capacity (rated current). ➢ The RBU rated current falls when the carrier frequency is increased. 						
PB-024	DC BUS voltage reference	650	550~720	V	o	
<ul style="list-style-type: none"> ● When PB-034 = 0, PB-024 is used as the target value of the bus voltage for AFE. ● When PB-034 = 1, PB-024 is used as the action voltage of the RBU. 						
PB-025	DC BUS voltage controller proportion A/V	0.60	0.01~200.00	A/V	o	
PB-026	DC BUS voltage controller integration time ms	5.0	0.1~2000.0	ms	o	
PB-027	Rectifier main inductance mH	0.500	0.000~10.000	mH	o	
PB-028	Internal resistance of rectifier main inductance	0.002	0.000~10.000	Ω	o	
PB-029	Rectifier power angle compensation	0.0	-60.00~60.0	/	o	
PB-030	Rectifier reactive current	0.0	-60.00~60.0	A	o	
PB-031	DC Bus voltage filtering time ms	0.0	0.0~60.0	ms	o	
PB-032	Minimum return current	6.0	0.1~600.0	A	o	
PB-033	Output cable reactive power compensation angle	0.0	0.0~45.0	/	o	
PB-034	RBU mode selection	1	0 ... 1	/	o	
<ul style="list-style-type: none"> ● 0: AFE mode. When used as an AFE, it can only be selected according to the continuous working type, and the voltage harmonics do not exceed 1.0%~1.5%, and the current harmonics do not exceed 5.0%~8%. ● 1: RBU mode. 						
PB-035	RBU working mode	0	0 ... 2	/	x	
<ul style="list-style-type: none"> ● 0: 100% working type Select when continuous working. ● 1: 50% working type Select when 50% working time. ● 2: 25% working type. Select when 25% working time. 						

Parameter	Name	Default	Range	Unit	Attribute
PB-036	Master follower mode	1	0 ... 1	/	x
	<ul style="list-style-type: none"> ● 0: Master mode. The RBU operates in master mode. When multiple RBUs are connected in parallel, this RBU is used as master and other RBU(s) are used as follower. When the DC bus only has on RBU, it must set to master mode. ● 1: Follower mode. The RBU operates in follower mode. When multiple RBUs are connected in parallel, this RBU is used as follower mode. 				

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. <ul style="list-style-type: none"> ● 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. <p>One position: Data bits</p> <ul style="list-style-type: none"> ● 0: 8 data bits ● 1: 7 data bits <p>Tens position: Parity</p> <ul style="list-style-type: none"> ● 0: No parity ● 1: Odd parity ● 2: Even parity <p>Hundreds position: Stop bit (s)</p> <ul style="list-style-type: none"> ● 0: 1 stops bit ● 1: 2 stops 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 RBU trips on a fault even communication is normal.					
C0-004	Communication break detect time	0	0 ... 65535	/	○
The RBU 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	/	○
<ul style="list-style-type: none"> ● 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. <p>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.</p>					
C0-006	Communication break power on delay time	0	0 ... 65535	/	○
After the RBU 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).					

5.20 Keypad Parameters (D0)

Parameter	Name	Default	Range	Unit	Attribute
D0-000	User password	0	0 ... 65535	/	○
<p>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.</p> <ul style="list-style-type: none"> 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. <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Make password take effect:</p> <ul style="list-style-type: none"> ➤ Press the ESC + PRG + ▲(UP) key at the same time. ➤ No key operation for 5 minutes. ➤ Repower on. </div>					
D0-001	Random code	0	0 ... 10000	/	×
Used by the manufacturer to check parameters under special circumstances.					
D0-002	Parameter restore	0	0 ... 4	/	×
<ul style="list-style-type: none"> ● 0: Disabled ● 1: Save all the parameters to memory. The function is used to store values changed by communication. ● 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. <p>Note: After the operation is completed, the value will automatically revert to 0.</p>					
D0-003	Parameters upload and download enable	0	0 ... 11	/	×
<p>Ones position: Upload parameter values to keypad</p> <ul style="list-style-type: none"> ● 0: Enabled ● 1: Disabled <p>Tens position: Download parameter values to RBU</p> <ul style="list-style-type: none"> ● 0: Enabled ● 1: Disabled <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Note:</p> <ul style="list-style-type: none"> ➤ Only effective for LED keypad. ➤ The parameters upload and download function (D0-004) can be disabled by parameter D0-003. </div>					
D0-004	Parameters upload and download	0	0 ... 20	/	×

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Parameter	Name	Default	Range	Unit	Attribute																
	<ul style="list-style-type: none"> ● 00: No action ● 01: Save parameter values to keypad. ● 11: Download parameter values to RBU. 																				
	<p>Notes:</p> <ul style="list-style-type: none"> ➢ Only effective for LED keypad ➢ After the operation is completed, the value will automatically revert to 0. 																				
D0-005	<p>M Key function selection</p> <ul style="list-style-type: none"> ● 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 RBU output. 	0000	0000 ... FFFF	/	×																
	<p>Note: M + STOP key can immediately cut off the RBU output is very useful when commissioning.</p>																				
D0-006	<p>Reserved</p> <p>Reserved</p>	0	0 ... 65535	/	×																
D0-007	<p>Keypad lock Key function selection</p> <ul style="list-style-type: none"> ● 0: Unlock ● 1: Lock all keys ● 2: Lock all keys except RUN key and STOP key 	0	0 ... 2	/	○																
D0-008	<p>Password protection range</p> <p>Defines the protect method when the user password (d0-000) is effective. After modification, the parameter is effective after repower on.</p> <ul style="list-style-type: none"> ● 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. 	0	0 ... 2	/	×																
D0-009	<p>Hidden parameter group selection</p> <p>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.</p> <table style="width: 100%; border: none;"> <tr> <td style="text-align: center;">bit0: P0</td> <td style="text-align: center;">bit1: P1</td> <td style="text-align: center;">bit2: P2</td> <td style="text-align: center;">bit3: P3</td> </tr> <tr> <td style="text-align: center;">bit4: P4</td> <td style="text-align: center;">bit5: P5</td> <td style="text-align: center;">bit6: P6</td> <td style="text-align: center;">bit7: P7</td> </tr> <tr> <td style="text-align: center;">bit8: P8</td> <td style="text-align: center;">bit9: P9</td> <td style="text-align: center;">bit10: PA</td> <td style="text-align: center;">bit11: PB</td> </tr> <tr> <td style="text-align: center;">bit12: PC</td> <td style="text-align: center;">bit13: A0</td> <td style="text-align: center;">bit14: B0</td> <td style="text-align: center;">bit15: B1</td> </tr> </table>	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	0000	0000 ... FFFF	/	×
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	<p>Hidden parameter group selection</p> <p>Selects the parameter groups hidden for C0, C1, C2, D0, E0, F0, F1, F2, and F3. 0 = visible, 1 = invisible.</p> <table style="width: 100%; border: none;"> <tr> <td style="text-align: center;">bit0: C0</td> <td style="text-align: center;">bit1: C1</td> <td style="text-align: center;">bit2: C2</td> <td style="text-align: center;">bit3: D0</td> </tr> <tr> <td style="text-align: center;">bit4: E0</td> <td style="text-align: center;">bit5: F0</td> <td style="text-align: center;">bit6: F1</td> <td style="text-align: center;">bit7: F2</td> </tr> <tr> <td style="text-align: center;">bit8: F7</td> <td colspan="3" style="text-align: center;">bit9...bit15: reserved</td> </tr> </table>	bit0: C0	bit1: C1	bit2: C2	bit3: D0	bit4: E0	bit5: F0	bit6: F1	bit7: F2	bit8: F7	bit9...bit15: reserved			0000	0000 ... FFFF	/	×				
bit0: C0	bit1: C1	bit2: C2	bit3: D0																		
bit4: E0	bit5: F0	bit6: F1	bit7: F2																		
bit8: F7	bit9...bit15: reserved																				
D0-011	<p>LCD backlight setting</p> <p>Selects the backlight display mode.</p>	0	0 ... 2	/	×																

Parameter	Name	Default	Range	Unit	Attribute										
	<ul style="list-style-type: none"> ● 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	/	○										
	<p>All the status monitoring parameters in Group F0 has a unique keypad display address. The keypad address is the low byte 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".</p> <div style="text-align: center;"> <p>D0-013 = 08 06</p> <p>The Modbus address of output current is 6008, the low byte is 08</p> <p>The Modbus address of running speed is 6006, the low byte is 06</p> </div> <ul style="list-style-type: none"> ● 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. <p>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.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td rowspan="2" style="text-align: center; vertical-align: middle;">LED</td> <td>Tens position and Ones position</td> <td>The 1st monitored parameter</td> </tr> <tr> <td>Thousands position and Hundreds position</td> <td>The 2nd monitored parameter</td> </tr> <tr> <td rowspan="2" style="text-align: center; vertical-align: middle;">LCD</td> <td>Tens position and Ones position</td> <td>The 1st page the 1st monitored parameter</td> </tr> <tr> <td>Thousands position and Hundreds position</td> <td>The 1st page the 2nd monitored parameter</td> </tr> </table>					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
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	/	○										

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Parameter	Name	Default	Range	Unit	Attribute
	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		
D0-019	Keypad default display setting 6	1211	0000 ... FFFF	/	○
	LCD	Tens position and Ones position	The 5th page the 1st monitored parameter		
		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		
		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 RBU 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 RBU.					

5.21 Protection Configuration (E0)

Parameter	Name	Default	Range	Unit	Attribute																																
E0-000	Fault configuration 1	0000	0000 ... FFFF	/	x																																
E0-001	Fault configuration 2	0000	0000 ... FFFF	/	x																																
<p>Parameters from E0-000 to E0-007 are key parameters for faults. In special cases, permission and guidance from the manufacturer must be obtained.</p> <p>bit0 ... bit 15, fault type corresponding to each binary bit:</p> <p>Parameter E0-000:</p> <table style="width:100%; border:none;"> <tr> <td style="width:25%;">bit0: External fault</td> <td style="width:25%;">bit1: IGBT overload</td> <td style="width:25%;">bit2: Reserved</td> <td style="width:25%;">bit3: IGBT over temperature</td> </tr> <tr> <td>bit4: Reserved</td> <td>bit5: Reserved</td> <td>bit6: Over current</td> <td>bit7: Module protection</td> </tr> <tr> <td>bit8: Over voltage</td> <td>bit9: Under voltage</td> <td>bit10: Reserved</td> <td>bit11: Output phase loss</td> </tr> <tr> <td>bit12: EEPROM fault</td> <td>bit13: Unauthorized</td> <td>bit14: Reserved</td> <td>bit15: Reserved</td> </tr> </table> <p>Parameter E0-001:</p> <table style="width:100%; border:none;"> <tr> <td style="width:25%;">bit0: Reserved</td> <td style="width:25%;">bit1: Reserved</td> <td style="width:25%;">bit2: Reserved</td> <td style="width:25%;">bit3: Reserved</td> </tr> <tr> <td>bit4: Pre-charge fault</td> <td>bit5: Modbus timeout</td> <td>bit6: Reserved</td> <td>bit7: Analog input break</td> </tr> <tr> <td>bit8: Analog input too high</td> <td>bit9: Current detect fault</td> <td>bit10: Reserved</td> <td>bit11: Reserved</td> </tr> <tr> <td>bit12: Reserved</td> <td>bit13: Reserved</td> <td>bit14: Reserved</td> <td>bit15: Reserved</td> </tr> </table> <ul style="list-style-type: none"> ● 0: Fault is not shielded ● 1: Fault is shielded 						bit0: External fault	bit1: IGBT overload	bit2: Reserved	bit3: IGBT over temperature	bit4: Reserved	bit5: Reserved	bit6: Over current	bit7: Module protection	bit8: Over voltage	bit9: Under voltage	bit10: Reserved	bit11: Output phase loss	bit12: EEPROM fault	bit13: Unauthorized	bit14: Reserved	bit15: Reserved	bit0: Reserved	bit1: Reserved	bit2: Reserved	bit3: Reserved	bit4: Pre-charge fault	bit5: Modbus timeout	bit6: Reserved	bit7: Analog input break	bit8: Analog input too high	bit9: Current detect fault	bit10: Reserved	bit11: Reserved	bit12: Reserved	bit13: Reserved	bit14: Reserved	bit15: Reserved
bit0: External fault	bit1: IGBT overload	bit2: Reserved	bit3: IGBT over temperature																																		
bit4: Reserved	bit5: Reserved	bit6: Over current	bit7: Module protection																																		
bit8: Over voltage	bit9: Under voltage	bit10: Reserved	bit11: Output phase loss																																		
bit12: EEPROM fault	bit13: Unauthorized	bit14: Reserved	bit15: Reserved																																		
bit0: Reserved	bit1: Reserved	bit2: Reserved	bit3: Reserved																																		
bit4: Pre-charge fault	bit5: Modbus timeout	bit6: Reserved	bit7: Analog input break																																		
bit8: Analog input too high	bit9: Current detect fault	bit10: Reserved	bit11: Reserved																																		
bit12: Reserved	bit13: Reserved	bit14: Reserved	bit15: Reserved																																		
E0-002	Fault display configuration 1	0000	0000 ... FFFF	/	x																																
E0-003	Fault display configuration 2	0000	0000 ... FFFF	/	x																																
<p>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:</p> <ul style="list-style-type: none"> ● 0: Fault displayed on the keypad. ● 1: Fault displayed on the keypad is shielded. 																																					
E0-004	Fault lock configuration 1	FDFE	0000 ... FFFF	/	x																																
E0-005	Fault lock configuration 2	FFFF	0000 ... FFFF	/	x																																
<p>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:</p> <ul style="list-style-type: none"> ● 0: Fault Lock is disabled ● 1: Fault Lock is enabled 																																					
E0-021	Fan running mode	0	0 ... 2	/	o																																
<ul style="list-style-type: none"> ● 0: Fan is running when the RBU in running state. ● 1: Fan is running after the RBU is powered up. ● 2: Fan is running according the IGBT temperature. <p style="padding-left: 20px;">The cooling fan is running when the temperature is higher than 40℃ and stop when the temperature is lower than 35℃.</p> <p>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℃.</p>																																					

5.22 Status Monitoring Parameters (F0)

Parameter	Name	Range	Unit	Modbus address in HEX																																
F0-002	Reference torque	-6553.5 ... 6553.5	%	6002																																
F0-005	DC bus voltage	0 ... 65535	V	6005																																
F0-006	Running frequency	-327.67 ... 327.67	Hz	6006																																
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																																
F0-012	System status	0000 ... FFFF	/	600C																																
Shows the RBU status word 1.(parameter F0-104 shows the status word 2, please refer to F0-104 for more information)																																				
<table border="1"> <thead> <tr> <th>Bit 0</th> <th>Ready</th> <th>Bit 8</th> <th>Reserved</th> </tr> </thead> <tbody> <tr> <td>Bit 1</td> <td>Pre-charge OK</td> <td>Bit 9</td> <td>Reserved</td> </tr> <tr> <td>Bit 2</td> <td>Running</td> <td>Bit 10</td> <td>Reserved</td> </tr> <tr> <td>Bit 3</td> <td>Reserved</td> <td>Bit 11</td> <td>Reserved</td> </tr> <tr> <td>Bit 4</td> <td>Reserved</td> <td>Bit 12</td> <td>authorized</td> </tr> <tr> <td>Bit 5</td> <td>Reserved</td> <td>Bit 13</td> <td>Reserved</td> </tr> <tr> <td>Bit 6</td> <td>Reserved</td> <td>Bit 14</td> <td>Super user</td> </tr> <tr> <td>Bit 7</td> <td>Reserved</td> <td>Bit 15</td> <td>Reserved</td> </tr> </tbody> </table>					Bit 0	Ready	Bit 8	Reserved	Bit 1	Pre-charge OK	Bit 9	Reserved	Bit 2	Running	Bit 10	Reserved	Bit 3	Reserved	Bit 11	Reserved	Bit 4	Reserved	Bit 12	authorized	Bit 5	Reserved	Bit 13	Reserved	Bit 6	Reserved	Bit 14	Super user	Bit 7	Reserved	Bit 15	Reserved
Bit 0	Ready	Bit 8	Reserved																																	
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Bit 4	Reserved	Bit 12	authorized																																	
Bit 5	Reserved	Bit 13	Reserved																																	
Bit 6	Reserved	Bit 14	Super user																																	
Bit 7	Reserved	Bit 15	Reserved																																	
F0-013	RBU fault display 1	0000 ... FFFF	/	600D																																
F0-014	RBU fault display 2	0000 ... FFFF	/	600E																																
<p>F0-013 when the corresponding bit=1, it indicates the RBU has a fault in the corresponding bit.</p> <p>bit0: External fault bit1: IGBT overload bit2: Reserved bit3: IGBT over temperature bit4: Reserved bit5: Reserved bit6: Over current bit7: Module protection bit8: Over voltage bit9: Under voltage bit10: Reserved bit11: Output phase loss bit12: EEPROM fault bit13: Unauthorized bit14: Reserved bit15: Reserved</p> <p>F0-014, when the corresponding bit=1, it indicates the RBU has a fault in the corresponding bit.</p> <p>bit0: Reserved bit1: Reserved bit2: Reserved bit3: Reserved bit4: Pre-charge fault bit5: Modbus timeout bit6: Reserved bit7: Analog input break bit8: Analog input too high bit9: Current detect fault bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved</p>																																				

Parameter	Name	Range	Unit	Modbus address in HEX																																																																				
F0-015	RBU fault Code	0 ... 65535	/	600F																																																																				
Shows the fault code when the RBU trips on a fault. When F0-015 = 0, means no fault.																																																																								
<table border="1"> <thead> <tr> <th>F0-015</th> <th>Fault name</th> <th>F0-015</th> <th>Fault name</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>External fault</td> <td>17</td> <td>Reserved</td> </tr> <tr> <td>2</td> <td>IGBT overload</td> <td>18</td> <td>Reserved</td> </tr> <tr> <td>3</td> <td>Reserved</td> <td>19</td> <td>Reserved</td> </tr> <tr> <td>4</td> <td>IGBT over temperatur</td> <td>20</td> <td>Reserved</td> </tr> <tr> <td>5</td> <td>Reserved</td> <td>21</td> <td>Pre-charge fault</td> </tr> <tr> <td>6</td> <td>Reserved</td> <td>22</td> <td>Modbus timeout</td> </tr> <tr> <td>7</td> <td>Over current</td> <td>23</td> <td>Reserved</td> </tr> <tr> <td>8</td> <td>Module protection</td> <td>24</td> <td>Analog input break</td> </tr> <tr> <td>9</td> <td>Over voltage</td> <td>25</td> <td>Analog input too high</td> </tr> <tr> <td>10</td> <td>Under voltage</td> <td>26</td> <td>Current detect fault</td> </tr> <tr> <td>11</td> <td>Reserved</td> <td>27</td> <td>Reserved</td> </tr> <tr> <td>12</td> <td>Output phase loss</td> <td>28</td> <td>Reserved</td> </tr> <tr> <td>13</td> <td>EEPROM fault</td> <td>29</td> <td>Reserved</td> </tr> <tr> <td>14</td> <td>Unauthorized</td> <td>30</td> <td>Reserved</td> </tr> <tr> <td>15</td> <td>Reserved</td> <td>31</td> <td>Reserved</td> </tr> <tr> <td>16</td> <td>Reserved</td> <td>32</td> <td>Reserved</td> </tr> </tbody> </table>					F0-015	Fault name	F0-015	Fault name	1	External fault	17	Reserved	2	IGBT overload	18	Reserved	3	Reserved	19	Reserved	4	IGBT over temperatur	20	Reserved	5	Reserved	21	Pre-charge fault	6	Reserved	22	Modbus timeout	7	Over current	23	Reserved	8	Module protection	24	Analog input break	9	Over voltage	25	Analog input too high	10	Under voltage	26	Current detect fault	11	Reserved	27	Reserved	12	Output phase loss	28	Reserved	13	EEPROM fault	29	Reserved	14	Unauthorized	30	Reserved	15	Reserved	31	Reserved	16	Reserved	32	Reserved
F0-015	Fault name	F0-015	Fault name																																																																					
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15	Reserved	31	Reserved																																																																					
16	Reserved	32	Reserved																																																																					
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:																																																																								
<table> <tbody> <tr> <td>bit0: X1</td> <td>bit1: X2</td> <td>bit2: X3</td> <td>bit3: X4</td> </tr> <tr> <td>bit4: X5</td> <td>bit5: X6</td> <td>bit6: X7</td> <td>bit7: A11</td> </tr> <tr> <td>bit8: A12</td> <td>bit9: A13</td> <td>bit10: virtual X1</td> <td>bit11: virtual X2</td> </tr> <tr> <td>bit12: virtual X3</td> <td>bit13: virtual X4</td> <td>bit14: virtual X5</td> <td>bit15: reserved</td> </tr> </tbody> </table>					bit0: X1	bit1: X2	bit2: X3	bit3: X4	bit4: X5	bit5: X6	bit6: X7	bit7: A11	bit8: A12	bit9: A13	bit10: virtual X1	bit11: virtual X2	bit12: virtual X3	bit13: virtual X4	bit14: virtual X5	bit15: reserved																																																				
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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:																																																																								
<table> <tbody> <tr> <td>bit0: Y1</td> <td>bit1: Y2</td> <td>bit2: Relay1</td> <td>bit3: Relay2</td> </tr> <tr> <td>bit4: Relay3</td> <td>bit5 ... bit15: reserved</td> <td></td> <td></td> </tr> </tbody> </table>					bit0: Y1	bit1: Y2	bit2: Relay1	bit3: Relay2	bit4: Relay3	bit5 ... bit15: reserved																																																														
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bit4: Relay3	bit5 ... bit15: reserved																																																																							
F0-022	IGBT temperature	-1000 ... 10000	°C	6016																																																																				
Shows the measured IGBT temperature.																																																																								
F0-023	AI1 input value	-32.767 ... 32.767	V	6017																																																																				
F0-034	Accumulative power-on time (hours)	0 ... 65535	h	6022																																																																				

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Parameter	Name	Range	Unit	Modbus address in HEX																
F0-035	Accumulative power –on time (minutes)	0 ... 65535	min	6023																
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																
Show accumulative running time. Total running time = F0-036 + F0-037/60.																				
F0-038	CPU utilization	0.0 ... 6553.5	%	6026																
Shows CPU utilization.																				
F0-048	AI1 sampling value	-32.767 ... 32.767	V	6030																
F0-060	System status 1	0 ... 65535	/	603C																
Shows system status word 1.																				
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%;">bit0</td> <td style="width: 20%;">Running</td> <td style="width: 10%;">bit4</td> <td style="width: 60%;">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</td> <td></td> <td></td> </tr> </table>					bit0	Running	bit4	Keypad is locked	bit1	reserved	bit6 ... bit5	Running command reference 00: keypad 01: digital input 10: RS485 11: other	bit2	reserved	bit15 ... bit7	reserved	bit3	reverse		
bit0	Running	bit4	Keypad is locked																	
bit1	reserved	bit6 ... bit5	Running command reference 00: keypad 01: digital input 10: RS485 11: other																	
bit2	reserved	bit15 ... bit7	reserved																	
bit3	reverse																			
F0-061	Communication reference	-32767 ... 32767	/	603D																
Shows communication speed reference (address 0x8001).																				
F0-064	Running frequency	0 ... 655.35	Hz	6040																
F0-066	Output current	-3276.8 ... 3276.7	A	6042																
F0-067	Output voltage	0 ... 65535	V	6043																
F0-068	Output power	0.0 ... 6553.5	kW	6044																
F0-064 show the absolute running frequency.																				
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.																				
F0-078	Switching frequency	0 ... 65535	/	604E																
Reserved.																				

5.23 Software Version (F1, F2)

Parameter	Name	Range	Unit	Modbus address in HEX
F1-000	Software version 1	0000 ... FFFF	/	
	The parameters in group F1 are read-only.			
F1-001	Software version 2	0000 ... FFFF	/	
F1-002	Software version 3	0000 ... FFFF	/	
F1-003	Software version 4	0000 ... 65535	/	
F1-004	Keypad ID	0000 ... 65535	/	
F1-005	Reserved	0000 ... 65535	/	
F1-006	Y	0000 ... 65535	/	
F1-007	D	0000 ... 65535	/	
F1-008	T	0000 ... 65535	/	
F1-009	RBU power	0.0 ... 6553.5	kW	
F1-010	Prompt code	0000 ... 65535	/	
F2-000	Barcode information 0	0000 ... FFFF	/	
F2-001	Barcode information 1	0000 ... FFFF	/	
F2-002	Barcode information 2	0000 ... FFFF	/	
F2-003	Barcode information 3	0000 ... FFFF	/	

5.24 Trip History (F3)

Parameter	Name	Range	Unit	Modbus address in HEX
F3-000	Trip 0 code	0 ... 65000	/	
	<p>There are 5-group trip history in total.</p> <p>Trip 0 (the latest trip): F3-000 ... F3-009</p> <p>Trip 1(the 2nd latest trip): F3-010 ... F3-019</p> <p>Trip 2 (the 3rd latest trip): F3-020 ... F3-029</p> <p>Trip 3 (the 4th latest trip): F3-030 ... F3-039</p> <p>Trip 4 (the 5th latest trip): F3-040 ... F3-009</p> <p>Notes:</p> <ul style="list-style-type: none"> ➤ 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 RBU 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 RBU 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 RBU 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	°C	
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	°C	
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	°C									
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	°C									
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	°C									
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	/									
<p>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.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>F3-050</th> <th>Cause</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Over speed</td> </tr> <tr> <td>2</td> <td>Speed error</td> </tr> <tr> <td>3</td> <td>Zero current detection</td> </tr> </tbody> </table>					F3-050	Cause	1	Over speed	2	Speed error	3	Zero current detection
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 RBU faults, the RBU output is disabled so that the RBU stops switching off the output 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	F0-015 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	RBU overload	Power supply voltage too low	Check the power supply voltage
				Overloading for a long time	Reduce overload time and reduce load
				RBU power selection is too small	Replace with a suitable RBU
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 RBU power
				Temperature detect circuit failure	Seek for technical support
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
				Parameters are not correctly	Set Parameters correctly
				Ramp-up time was set too short	Extended acceleration time
				The RBU power mismatch	Replace with a suitable RBU
				Current controller not correctly set	Set current controller parameters correctly
Err-08	E-FAL	8	Module protection	Module failure	Seek for technical support
				Output short-circuited to ground	Check the output cable
				Module overheated ($\geq 75\text{kW}$)	Seek for technical support
				The pre-charged contactor closes abnormally ($\geq 185\text{kW}$)	Check the input power supply
				Poor contact of the internal connectors	Ask professional technicians for maintenance
Err-09	E-oU-	9	Over voltage	Output terminals short to ground	Check the cable
				The input voltage is too high	Check the input power supply

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LCD keypad	LED keypad	F0-015 value	Fault Name	Possible causes	Corrective actions
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-12	E-oPF	12	Output phase loss	Cable is broken	Replace a new cable
				Thermal relay failure (if is used)	Check thermal relay
				Output detection circuit failure	Seek for technical support
Err-13	E-EP	13	EEPROM abnormal	EEPROM read/write abnormal	Seek for technical support
Err-14	E-LIC	14	Unauthorized	Unauthorized	Seek for technical support
Err-22	E-ES-	22	Modbus communication time out	Incorrect baud rate setting	Set the baud rate correctly
				incorrect address setting	Check the parameter address and check the read and write time interval
				Communication timeout	Check the Modbus timeout time
				Modbus communication disconnection	Check the communication wiring
				Poor contact of keypad	Check the keypad port
Err-26	E-CUr	26	Current detection abnormal	The current detection abnormal	Seek for technical support

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 Communication

1 Support Protocol

Support Modbus protocol, RTU format, Broadcast address is 0, slave address is “1–247”, and “248–255” for reservation.

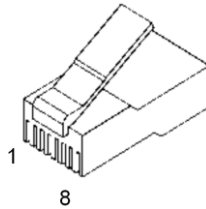
2 Interface Mode

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

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

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

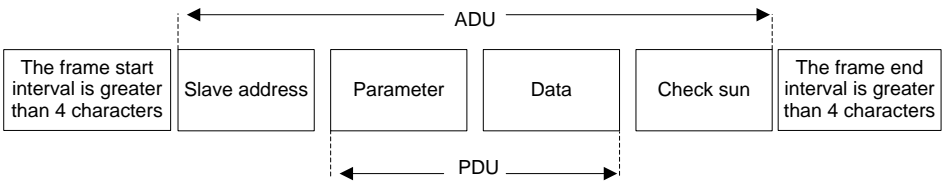
It is recommended to adopt EIA/TIA T568B, the lead of port A is defined as:



Attached Figure 1 RJ45 interface

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

3 Protocol Format



Attached Figure 2 Protocol format

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

4 Function Interpretation

■ Function **0x03** reads parameters.

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

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

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

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

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

Notes:

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

5 Register Address

Address Space	Meaning
Control word register	0x8000, refer to " 5.1 Control word register (Address: 0x8000)" for more information.
Speed reference register	0x8001
Torque reference register	0x800E
AO output register 1	0x8006
AO output register 2	0x8007
Status word	Parameters F0–000 to F0–200 corresponding to address 0x6000 to 0x60C8. The Modbus address of status monitoring parameters (Group F0) are listed in Chapter 5.
Parameters address	<p>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 number in the group, both expressed in hexadecimal.</p> <div style="text-align: center;"> <p style="margin-left: 40px;"> $\begin{matrix} P & X & - & A & B & C \\ \hline \text{High byte} & & & \text{Low byte} \end{matrix}$ </p> </div> <p>High byte: P0 ... PF corresponds to 0x00 ... 0x0F A0 corresponds to 0x10 B0 ... B1 corresponds to 0x20 ... 0x21 C0 ... C2 corresponds to 0x30 ... 0x32 D0 corresponds to 0x40 E0 corresponds to 0x50 F0 ... F3 corresponds to 0x60 ... 0x63</p> <p>Low byte: 00 ... 255 corresponds to 0x00 ... 0xFF</p> <p>Example: The Modbus operation address of parameter PB–023 is 0x0b17, the calculation process is as follows, this calculation method is suitable for calculating the addresses of all parameters:</p> <div style="text-align: center;"> <p style="margin-left: 40px;"> $\begin{matrix} P & X & - & A & B & C \\ \hline \text{High byte: parameter group number} & & & \text{Low byte: the number in the group} \end{matrix}$ </p> <p style="margin-left: 40px;"> $\begin{matrix} P & B & - & 0 & 2 & 3 \\ \hline 0x0B & & & 0x17 \end{matrix}$ </p> <p style="margin-left: 40px;"> $(0x0b \ll 8) + 0x17$ </p> <p style="margin-left: 40px;">0x0B17</p> </div>

5.1 Control word register (Address: 0x8000)

bit	Meaning	位	Meaning
0	0: Stop command 1: Start command	8bit	0: Relay1 – OFF 1: Relay1 – ON
1	0: Run forward 1: Run reverse	9bit	Reserved
2	0: Reset disabled 1: Reset enabled	10bit	Reserved
3	Reserved	11bit	Reserved
4	Reserved	12bit	Reserved
5	Reserved	13bit	Reserved
6	0: Y1 output OFF 1: Y1 output ON	14bit	Reserved
7	Reserved	15bit	Reserved

6 Modbus Communication Example

Run (The following is Hexadecimal data):							
	Address	Function code	Register address	Register contents	Checksum		
Request	01	06	8000	0001	61CA		
Response	01	06	8000	0001	61CA		
Stop (The following is Hexadecimal data):							
	Address	Function code	Register address	Register contents	Checksum		
Request	01	06	8000	0000	A00A		
Response	01	06	8000	0000	A00A		
Run and set speed reference to 50.00Hz (The following is Hexadecimal data):							
	Address	Function code	Register address	Number	Bytes	Register contents	Check sum
Request	01	10	8000	0002	04	0001 1388	CEFF
Response	01	10	8000	0004	-	-	E80A

Note: The parameters modified by communication will not be saved after power off. If you need to save them, perform a save operation (D0-002=1) before power off.

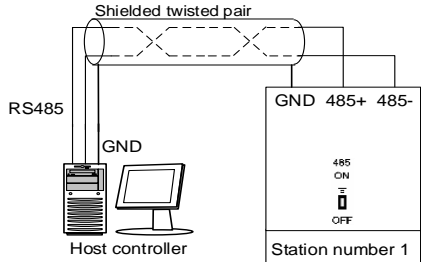
7 CRC16 Function

```
unsigned int crc16 (unsigned char *data, unsigned char length)
```

```
{
    unsigned int i, crc_result=0xffff;
    while (length-->0)
    {
        crc_result ^= *data++;
        for (i=0; i<8; i++)
        {
            if (crc_result & 0x0001)
                crc_result = (crc_result >> 1) ^ 0xa001;
            else
                crc_result = crc_result >> 1;
        }
    }
    return (crc_result = ((crc_result & 0xffff) << 8) | (crc_result >> 8)); //交换 CRC16 校验和高低字节
}
```

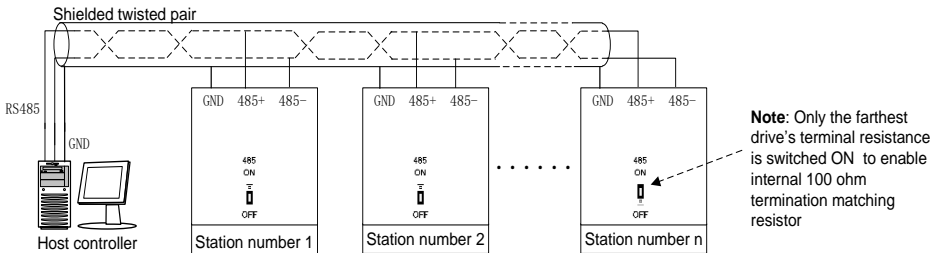
8 Network Construction

■ The Modbus connection for one RBU



Appendix Figure 3 The connection of one RBU

■ The Modbus connection for RBUs



Appendix Figure 4 The connection for multiple RBUs