ZCH100 Series High Voltage Inverter

Instruction manual

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Statement

The contents of this manual are subject to change without notice. The interface that appears in this manual may differ slightly from the interface of your system because you are using our upgraded product or the version of the product you are using has not yet been upgraded.

Preface to the manual

ZCH100 series high-voltage inverter is a strategically important industrial intelligent high-voltage inverter control system launched by Shanghai Zhongchen Electronic Technology Co. This manual is the instruction manual of ZCH100 series high-voltage frequency converter, and its purpose is to help users and related technical personnel and engineering implementers of the company to understand and master the basic principle, debugging process, operation method, and various precautions in the use and maintenance of ZCH100 series high-voltage frequency converter.

Users must read this manual carefully before use and operate and use it according to the requirements in the manual to avoid unnecessary safety hazards and equipment failure.

Scope of application

This manual is applicable to the use of ZCH100 series high voltage inverter.

The pictures and contents of this manual are explained as an example of debugging system, if you find the interface is different from the interface in this manual in use, please take the actual system used as the standard.

Catalogs

Precautions

The ZCH100 series of high voltage inverters have been designed with personal safety in mind. However, as with any other high voltage device, there are a large number of internal connections where lethal voltages exist. In addition, certain internal components are very hot and therefore should not be touched. For safety reasons, please observe the following when working on or near the ZCH100 series high voltage inverters：

- Before carrying out any maintenance or overhaul work, correct operating procedures must be strictly followed.
- Do not touch any part of the inverter cabinet until you are sure that the inverter is not hot or electrically charged.
- When installing external wiring, follow standard and local safety regulations. There must be a protective isolation section between low voltage (ELV) cables and any other cables specified by CE safety standards.
- Never assume that any dangerous voltages are no longer present in the cabinet after switching off the input disconnect; on the contrary, voltages are still present at the input terminals of the disconnect switch or are present from elsewhere, e.g. when the unit capacitor has not yet been discharged.
- Always operate with one hand, wear safety shoes, protective eyewear and have someone else present at the same time.
- Only use instruments (such as multimeters, oscilloscopes, etc.) that meet the requirements for high-voltage measurements (insulation is provided internally within the instrument, not by grounding the case).
- Never remove the protective cover (labeled with the high voltage symbol) or attempt to measure the circuitry under the cover.
- Be very careful when touching or measuring components in the cabinet, and be extremely careful to prevent the meter rods from touching each other or coming into contact with other terminals.

- Hazardous voltages may still be present in the frequency converter cabinet when the circuit breaker is opened (shutdown) and the power supply is switched off.
- Do not run the inverter with the cabinet door open.
- Only professionals can install, operate, overhaul and maintain inverters, and a professional is defined as “a person who is familiar with the structure and operation of the equipment and has a strong sense of safety”.
- Never disconnect the control power supply when high voltage is supplied, as this will result in severe system overheating or unit damage.
- Do not place flammable materials in, on, or near cabinets, including equipment drawings and manuals.
- Make certain that a flat, flatbed truck base is used to transport the Series High Voltage Inverter. Before unloading the truck, make sure that the concrete base used to store and secure the inverter is level.
- When lifting the inverter system be sure to verify that the crane, ropes and hooks have sufficient tonnage to avoid damaging the inverter if the cabinet falls to the ground or drops too quickly.
- Do not use a forklift to lift electrical cabinets that do not have forklift lift holes. Make sure the forklift tines fit into the forklift lifting holes and that they are of sufficient length.
- When damaged components (e.g., electronic components such as capacitors) are to be disposed of, local regulations and requirements must be followed.
- The nominal weighted sound level at a distance of 1 meter from the inverter can exceed 50 dB during inverter operation.
- Always eliminate electrostatic discharge (ESD) when approaching or touching components in the inverter cabinet. There are many components on the printed wiring board that are sensitive to static electricity, and contacting or maintaining these components should only be done by a professional, and only after reading and understanding proper ESD techniques.

- The following guidance on electrostatic discharges must be followed and can greatly reduce the hazards of static electricity to components on printed wiring boards.
- Make certain that personnel who come into contact with the inverter's printed circuit boards are properly wearing a grounded, antistatic hand halter ring, which must be grounded through a 1M resistor. Grounding gear is available at most electrical stores.
- Static electricity can be eliminated by contact with a grounded conductive body such as a sheet of metal.
- Static sensitive devices must be stored in anti-static bags during transportation.
- When holding the printed wiring board in your hand, always hold the edge portion.
- Do not allow the PCB to slide on any surface (table or worktop). If possible, perform maintenance work on the PCB on a workbench with a conductive surface (grounded through a 1M resistor). If a suitable conductive workbench is not available, a clean steel or aluminum plate can be used instead.
- Avoid non-conducting materials such as plastic and styrene. They can generate large amounts of static electricity and are not easily discharged.
- Use a soldering iron with a grounded end. Also, use a metal vacuum type solder sucker or copper braided wire when removing tin.
- When delivering components to the company for repair, anti-static safety packaging must be used to prevent further damage to the components due to static electricity.

Chapter I Introduction to High Voltage Frequency Converter

1. The Significance of High Voltage Frequency Converter Application

1 Energy saving

（1） Frequency conversion speed control has completely changed the phenomenon of “big horse-drawn cart” due to the design margin of the equipment, and solved the problem of energy loss due to the unadjustable fixed-speed rotation of the motor.

（2） Large throttling losses due to load dampers or valve adjustments no longer exist after frequency conversion.

（3） The load under certain working conditions needs to be adjusted frequently. The linearity of the baffle adjustment is too poor and cannot keep up with the changing speed of the working conditions, so the energy consumption is very high. The variable frequency adjustment response is extremely fast and is basically synchronized with the changes in the working conditions.

（4） The power factor has increased from about 0.85 before frequency conversion to more than 0.95, reducing line losses.

（5） The high-voltage frequency converter itself has very little loss, and the overall efficiency is over 98%.

2. Due to the superior soft start/stop function of the high-voltage inverter (can start at zero speed), it greatly reduces the impact of the start-up shock current on the motor and the power grid, effectively reduces the motor failure, thus prolonging the overhaul cycle and the service life of the motor, and at the same time effectively avoids the adverse impact of the shock load on the power grid.

3. As the input power factor of the high-voltage inverter is above 95%, not only does it not require power compensation, but it also improves the power factor of the grid and reduces reactive power loss.

4. After frequency conversion adjustment, there is no need for manual adjustment, which can prolong the service life of the load as well as the import and export doors, and reduce the cost of overhaul and maintenance.

5. Due to the high-voltage frequency converter unique smooth adjustment of the motor load speed, thus greatly reducing the load as well as the mechanical wear and tear of the motor, and at the same time reduces the temperature of the bearings, shaft tiles, effectively reducing the maintenance costs, and extends the service life of the equipment.

6. The use of frequency conversion adjustment can realize the real-time constant operation of parameters, which improves the safety and stability of system operation.

7. As the frequency conversion speed regulation adopts automatic control, it further improves the automation level of equipment operation control and system operation management, thus truly realizing automatic adjustment and greatly enhancing the safety and reliability of operation.

2.Introduction to ZCH100 Series High Voltage Inverter

The XX series high voltage inverter is a new generation of high voltage inverter developed by Shanghai Zhongchen Electronic Technology Co., Ltd. It adopts direct high and high conversion, multi-level series doubling technology scheme, optimized PWM control algorithm to realize high quality variable variable voltage variable frequency (VVVF) sinusoidal voltage and sinusoidal current output. The product has the following features.

1. Vector control mode

   ZCH100 series high-voltage inverter has two control modes: universal vector and without/with speed sensor. Vector control measures and controls the stator current vector of asynchronous motor, and controls the excitation current and torque current of the asynchronous motor according to the principle of magnetic field orientation, which not only controls the size of the current, but also the phase of the current, which greatly improves the dynamic performance, and has the features of large starting torque, good dynamic response, high speed regulation accuracy, wide speed regulation range, etc.; ZCH100 series high-voltage inverter has the features of general vector and without/with speed sensor, Good dynamic response, high speed control accuracy, wide speed control range and so on.

2. Flying Car Start Function

The frequency converter has the function of flying start, which can realize the forward, reverse and bidirectional flying start of the frequency converter, and it has the function of fast “frequency conversion-industrial frequency -frequency conversion and switching”, which can satisfy the requirement of continuous operation of the load.

3. High-high Approach

Adopts phase shifter transformer input and direct high voltage output by unit series connection.

4. Air-cooled Design

Unique air duct design, the equipment can operate reliably at room temperature 50℃. Adopting top cooling method, easy maintenance. The fan is made of international famous brand products, which is durable.

5. Modular Design

The power unit adopts modular design, can be arbitrarily interchanged, easy to disassemble and install.

6. Friendly Human-computer Interface

The human-machine interface adopts a full Chinese interface touch screen. All operations can be input through buttons or DCS interface to avoid misoperation of the touch screen to the greatest extent. Alarms can be recorded in real time, and alarms can be accurately positioned and historical records stored.

7. Reliable Design

（1）The unit and control part use optical fiber communication

（2）Unit hot standby design

（3）Peripheral control components adopt PLC

（4）The important components of the main circuit are imported high-quality brands. The rated operating parameters of all main circuit components are >2 times the actual operation. The transformer is configured with a capacity of 1.2 to 1.5 times the rated power of the motor, and is equipped with a bottom cooling fan and a top cooling fan.

8. Flexible User Interface

The interface can be hard-wired or in communication mode. In addition to the system settings, the interface status information provides user-defined output interfaces (the user only needs to set the contents of the corresponding I/O outputs in the human-machine interface).

9. High efficiency, high power factor

The efficiency of the whole machine ≥ 98%, power factor ≥ 95%

10. Low Harmonics

When 6 units per phase are connected in series, 36 pulses per phase are used for rectification, and the high-frequency carrier ratio makes the output harmonics <4% at no load and <2% at load.

11. Wide Voltage Input Ranges

Input voltage at 6kV/10kV±10% full load operation, -10%~35% allows long-term derating operation, frequency fluctuations in the range of 50Hz±10%, the equipment can work normally.

12. Small Dv/Dt

Due to the use of unit series output, dv/dt is small, which prolongs the life of the IGBT and reduces the insulation requirements for the entire device.

13. Unit Redundancy Hot Standby Technology

Ensure that the device can output the rated voltage.

14. Unique Unit Bypass Technology

The use of contactor mechanical bypass actuator, with independent bypass control board control and independent power supply power supply, to ensure that the unit can be reliably bypassed in the event of failure, effectively avoiding the bypass can not be normal action due to power loss of the power unit.

15. Automatic Equalization Technology For Line Voltage

When one or several units of a phase fail to be bypassed, in order to ensure the output voltage level and power requirements of the inverter, the series of high-voltage inverter adopts the unique line voltage control mode, which ensures the output line voltage balance of the whole inverter and maximally meets the site operating conditions without arbitrarily resecting the unit in the same position as the failed unit.

16. Instantaneous Power-down Without Interference

When the high voltage instantaneously loses power, the output torque can be pulse-free within 10 cycles. When the high voltage and control power supply lose power at the same time, the inverter system can operate stably until it stops safely.

17. Control Loop Design Dual Power Supply Switching

One channel is supplied by the high-voltage pre-charging cabinet for control power, and the other channel is supplied by the high-voltage input isolation transformer. The double-circuit automatic switching ensures that there is no impact on the equipment after the control power supply is powered off.

18. Unique Over Voltage Protection Technology

In the design, the impact of operating over voltage and lightning over voltage on the equipment is fully considered, and different treatment measures are adopted for different over voltages in the main loop and control loop to improve the reliability of the equipment.

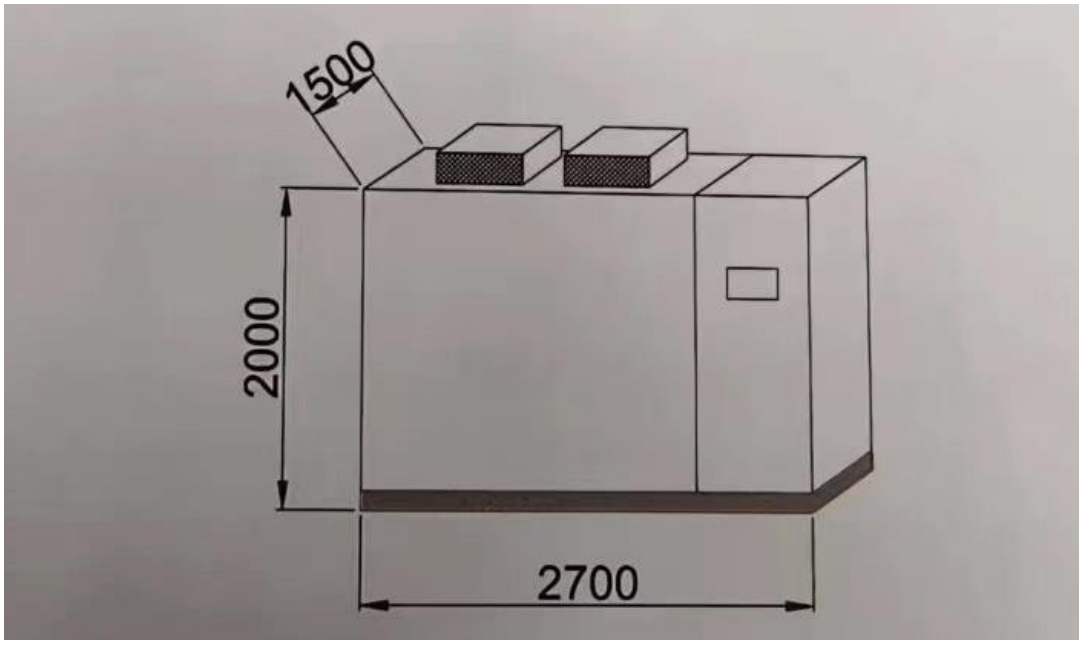
19. Incoming Line Cabinet is Optional

The incoming cabinet can be configured according to the different requirements of users.

3. Structure Introduction

ZCH100 series high voltage frequency converter cabinet consists of three parts: transformer cabinet, power unit cabinet and control cabinet. (Note: ① 280kVA≤P≤1250kVA inverters adopt integrated design; ② The number of fans installed in inverters of the same voltage level varies depending on the power size. The number of fans in the following size diagram is not the standard number of fans).

1、 The following figure shows the dimensions of the 280kVA≤P≤1250kVA inverter (unit: mm):



Instruction：

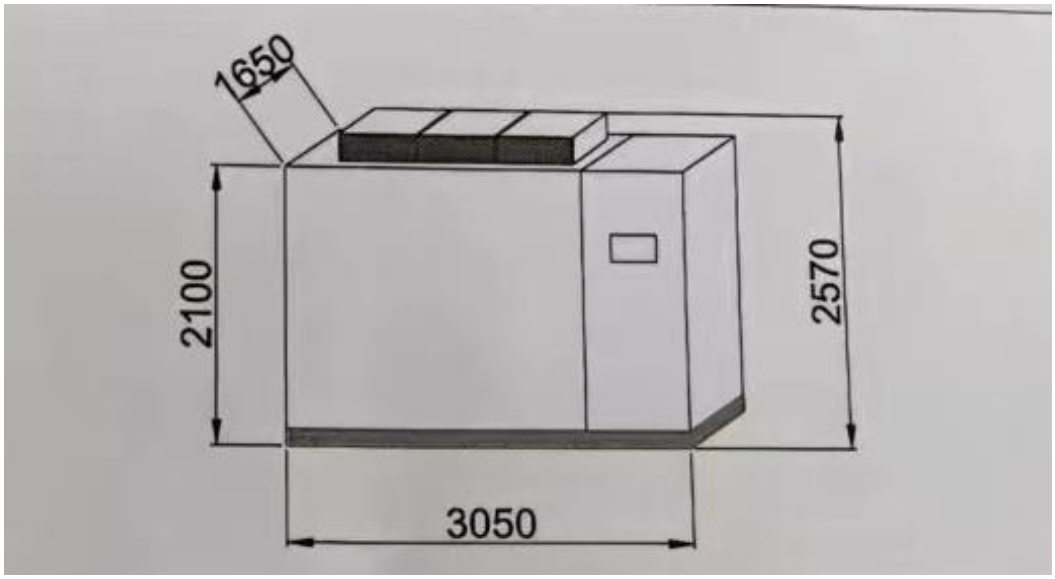
(1) 280kVA~560kVA: with fan height of 2386, 2 fans

(2) 630kVA~800kVA：with fan height of 2386，3 fans

(3) 900kVA~1250kVA: with fan height of 2470，2 fans

(4) The total size of the entire cabinet：Length 2700×Width1500×Height2000。

2、 The following figure shows the dimensions of the 1400kVA≤P≤2500kVA inverter.（unit：mm）：

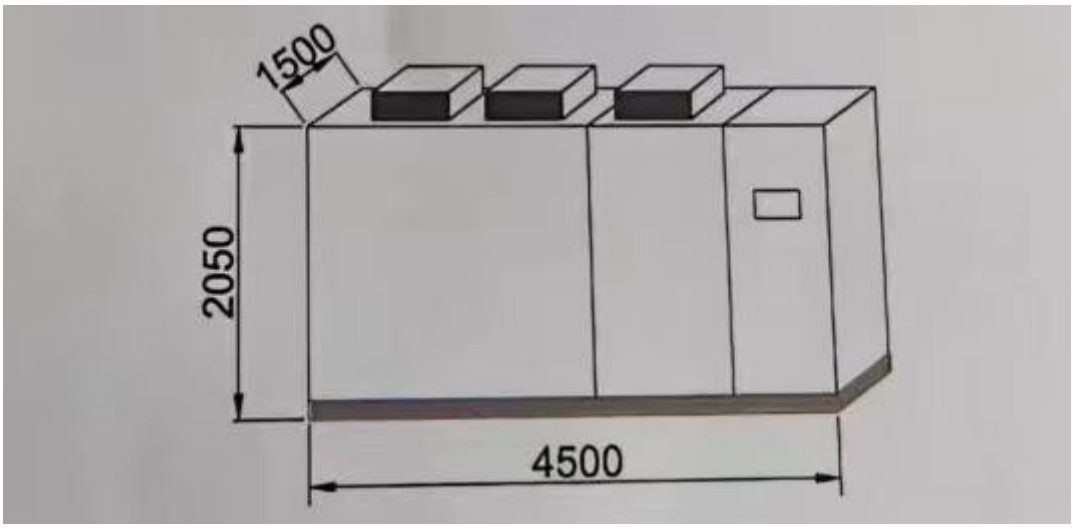


Instruction：

(1) 1400kVA~2500kVA：with fan height of 2570

(2) The total dimensions of the entire cabinet: width 3050 × depth 1650 × height 2100.

3、 The following figure shows the dimensions of the 2800kVA≤P≤4500kVA inverter.（unit：mm）



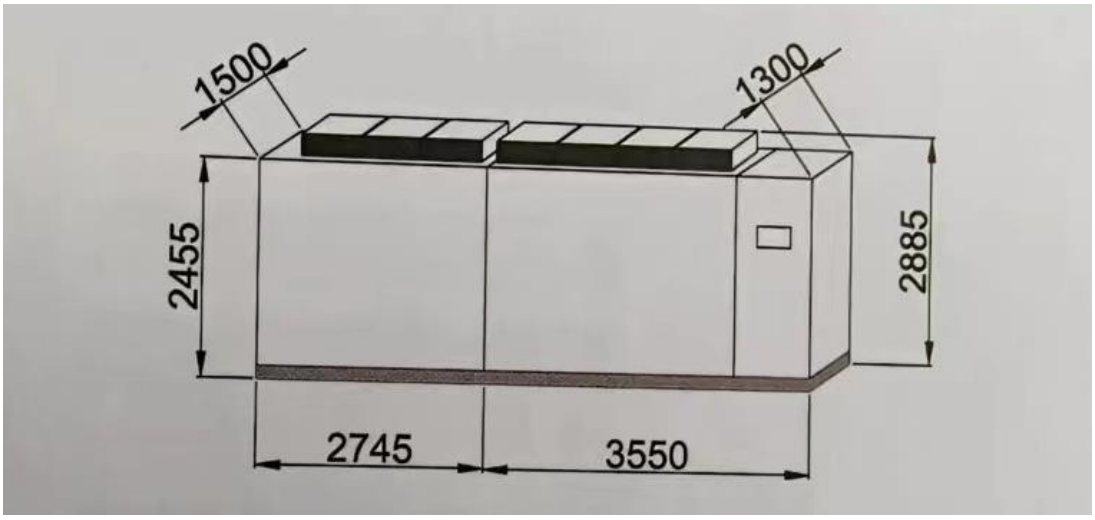
Instruction：

(1) 2800kVA~3150kVA：with fan height of 2525；

(2) 3500kVA~4500kVA：with fan height of 2600；

(3) The total dimensions of the entire cabinet: width 4500 × depth 1500 × height 2050.

4、The following figure shows the dimensions of the 5000kVA≤P≤7000kVA inverter.（unit：mm）：



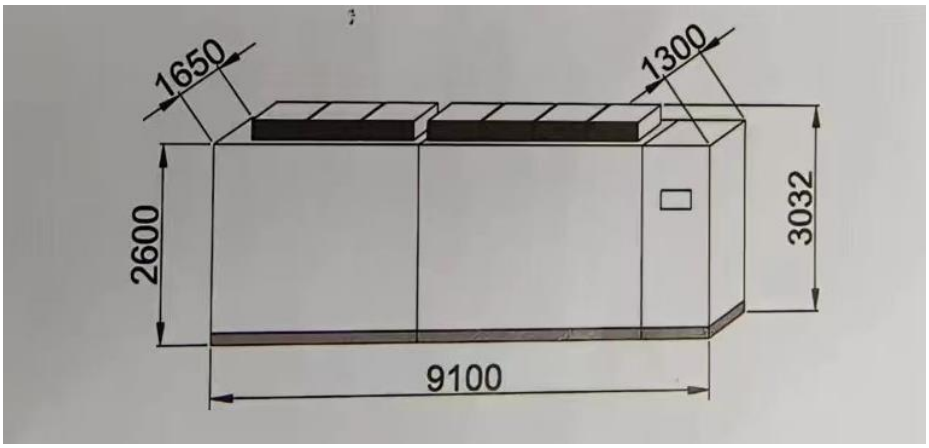
Instruction：

(1) Including fan height 2885；

(2) Control cabinet depth 1300；

(3) The total dimensions of the entire cabinet: width 6925 × depth 1500 × height 2455

5、 The following figure shows the dimensions of the 8000kVA≤P≤9000kVA inverter.（unit：mm）：



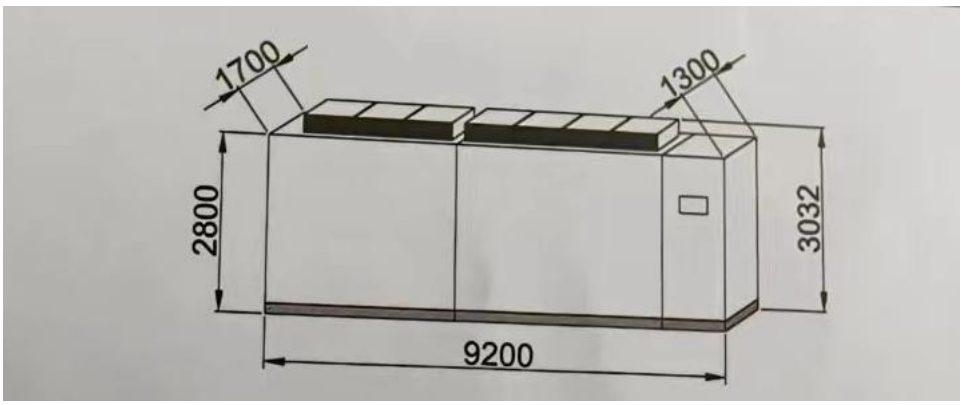
Instruction：

(1) Including fan height 3032；

(2) Control cabinet depth1300；

(3) The total dimensions of the entire cabinet：width 9100×depth 1650×height 2600

6、The following figure shows the dimensions of the 10000kVA≤P≤11250kVA inverter (unit: mm)：



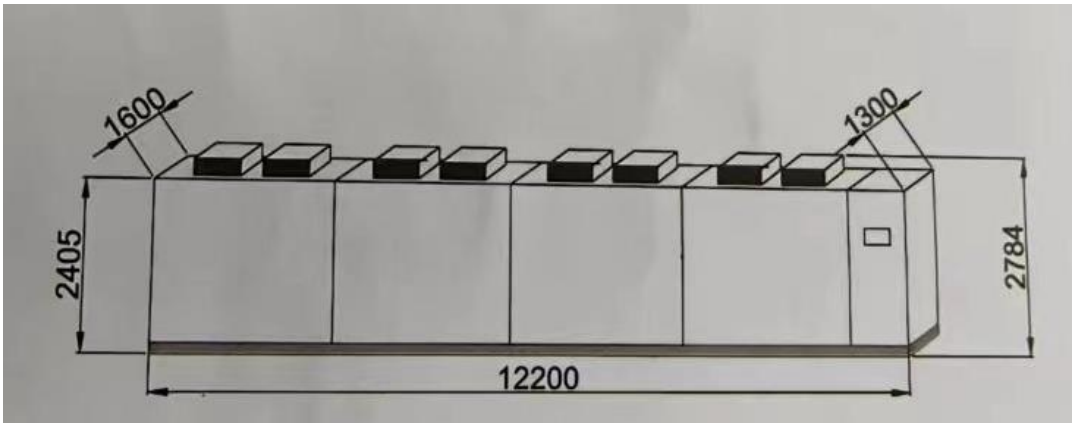
Instruction：

(1) Including fan height 3032；

(2) Control cabinet depth 1300；

(3) The total dimensions of the entire cabinet: width 9200 × depth 1700 × height 2800.

7、The following figure shows the dimensions of the 12500kVA≤P≤13750kVA inverter（unit：mm）



Instruction：

(1) Including fan height 2784

(2) Control cabinet depth 1300

(3) The total dimensions of the entire cabinet：Width 12200×Depth 1600×Height 2405.

For any of the above models of ZCH100 series high-voltage inverters, the transformer cabinet, power unit cabinet, and control cabinet can be disassembled, transported, and assembled during transportation. During installation, the fan cover must be extended to the outdoors to form indoor and outdoor circulation ventilation.

4 Technical Indicators

Number	Project	Parameter	Remark
1	Use standards	"Electricity Industry Standard of the People's Republic of China DL/T994-2006 High Voltage Frequency Converter for Fans and Water Pumps in Thermal Power Plants"	
2	Type and model		Depend on user needs
3	Manufacturer and origin	Manufacture: Shanghai Zhongchen Electronic Technology Co. Origin: Wuhan	
4	Installation Location	Indoor	
5	Technical solutions	Direct high-high mode	
6	Requirements for electric motors	Ordinary three-phase asynchronous motor	
7	Input side of inverter fuse or not	Yes	
8	Rated input voltage/allowable variation range	6kV/10kV ±10%	
9	System input voltage	6kV/10kV	
10	System output voltage	0～6kV, 0～10kV	
11	System output current	Depends on power and on-site working conditions	
12	Maximum output voltage on inverter side	6.3kV/11kV	
13	Rated Capacity	Depend on user needs	
14	Rated input frequency/allowable variation range	50Hz±10%	
15	Sensitivity to grid voltage fluctuations	Not sensitive	
16	Inverter efficiency	≥98%	Different models have slightly different parameters
17	Harmonic	＜2%	
18	Reliability index (mean time between failures)	50000h	
19	Input side power factor	≥95%	Different models have slightly different parameters
20	Control method	Universal vector, without/with speed sensor	

		control method (SVC/FVC)	
21	Control power	380±10%VAC three-phase four-wire	
22	Rectification form and component parameters	3-phase uncontrollable rectification	
23	Inverter unit form	H-bridge inverter	
24	Transmission quadrant	Two quadrants	
25	Whether optical fiber cables are used for electrical isolation parts	Optical fiber communication Model: HFBR—EUS100 Manufacturer: Agilent USA	
26	Noise level	≤60dB	
27	Cooling method	Forced air cooling	
28	Effect of cooling system failure on frequency converter	Within the allowed range, the alarm will not trip.	
29	Overload capacity	120% rated current, 1 minute	
30	Transformer losses		Different models have slightly different parameters
31	Total system loss		
32	Standard control connection	Hardwired	
33	Analog signal (input) specifications and quantity	4-20mA or 0-10V, 4 channels	Expand according to user needs
34	Analog signal (output) specifications and quantity	4-20mA or 0-10V, 5 channels	
35	Switching signal (input) specifications and quantity	10 (relay dry node)	
36	Switching signal (output) specifications and quantity	16 (relay dry node)	
37	Operating keyboard	Touchscreen	
38	Interface language	Chinese	Depends on user requirements
39	Dimensions of frequency conversion device (taking 280kVA≤P≤1250kVA all-in-one machine as an example)	Width 2700mm×Depth 1500mm×Height 2000mm	
40	Weight of frequency conversion device (take all-in-one 280kVA as an example)	About 2620Kg	
41	Pre-opening maintenance or after-opening maintenance	Pre-market maintenance (reliable wall)	

42	Whether an output filter is required	No need	
43	Whether to provide output filter	No offer	
44	After-sales service commitment	Respond within 24 hours	

Chapter II Hardware Part

1 Main Circuit Part

For different voltage levels (6kV/10kV) and power levels of high-voltage inverters, the unit voltage and number will be different, but the basic principles are the same.

Note: The following takes a 3KV three-unit series high-voltage inverter as an example. The main circuit diagram is shown in Figure 2-1 below, which mainly includes the following parts:

1. Phase-shifting Isolation Transformer

The secondary windings of the transformer providing power to the power unit are wound with a certain phase difference from each other, which greatly reduces the input harmonic currents and also allows the power factor to reach over 95% at higher or full loads. Taking 3KV as an example, the phase-shifted isolation transformer in Fig. 2-1 adopts 18 pulse rectification, and the input current harmonics satisfy the regulations and requirements of enterprise standards and IEEE519. In actual manufacturing, the number of pulse rectification can be more, such as 30 or 36 pulse rectification circuit structure, of course, that will increase the difficulty of the transformer winding process.

2. Power Unit

The input voltage of the unit depends on the model of the inverter as well as the number of units; there are 3 units in each phase in Figure 2-1, with a total of 9 units in 3 phases, in which each unit is exactly the same and can be used interchangeably, which greatly improves the system maintainability and mass production.

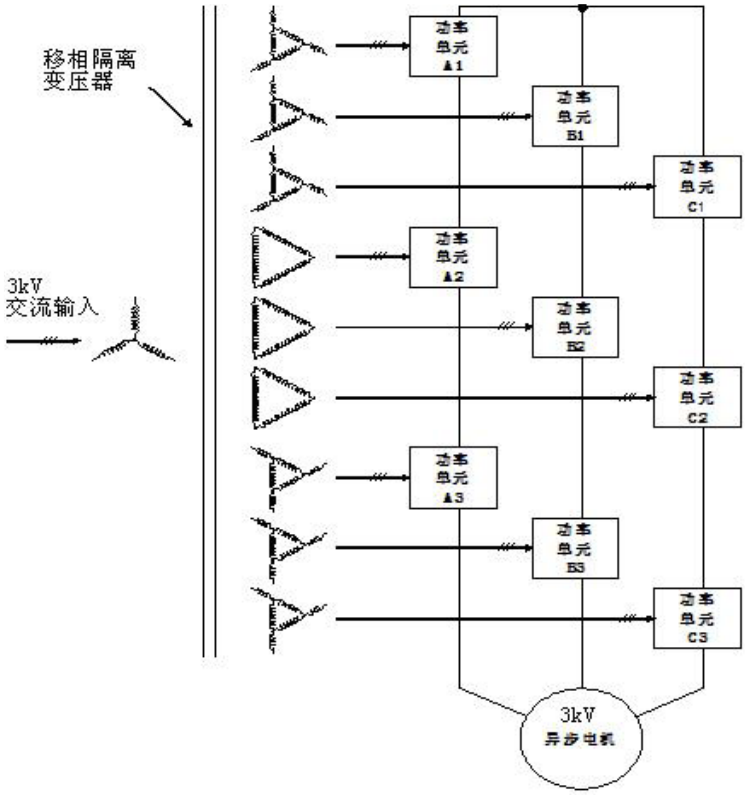


Figure 2-1 Series 3KV High Voltage Inverter Main Circuit Schematic Diagram

Table 2-1 Power Unit Parameters

Line Voltage（KVAC）	Unit Input Voltage（VAC）	Number of power units	Power Range（kVA）
	xxModel	xxModel	
6	690V	3*5	Maximum 7000
10		3*8	Maximum 12500

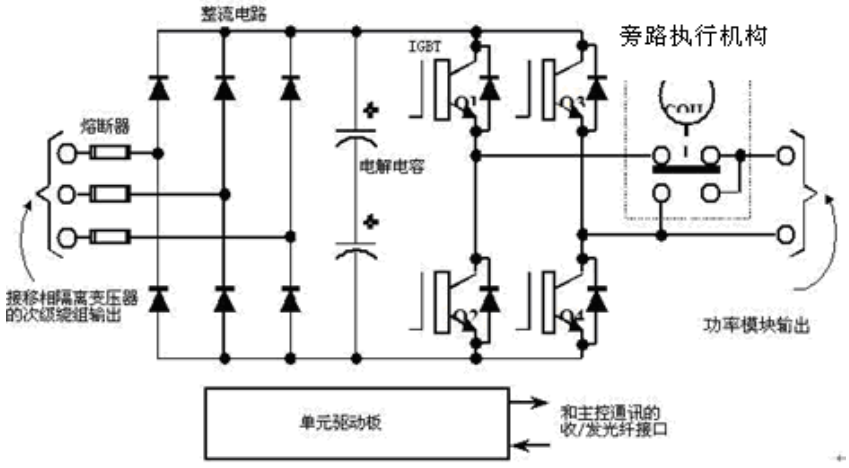


Figure 2-2 Schematic diagram of power unit

As can be seen from Figure 2-2, a complete power unit is mainly composed of several parts such as fuses, rectifier bridges, film capacitors, IGBTs, unit driver boards, bypass actuators, and so on. Among them：

（1）Fuse: Mainly for overcurrent protection

（2）Rectifier bridge: rectifies three-phase AC to DC

（3）Film Capacitor: It acts as an energy storage as well as a filter to smooth out the waveform

（4）IGBT：Power switching devices that control the switching of IGBTs to obtain the desired PWM waveform (DC-AC inversion process)

（5）Bypass actuator：When a unit fails, the bypass actuator can electrically bypass the failed unit so that the entire HV inverter can still continue to work.

（6）Unit Driver Board: Responsible for communicating with the master control, accepting the switching control signals of IGBTs sent by the master control and reporting fault information to the master control (such as over-voltage/under-voltage/damaged IGBTs/abnormal communication and other faults); and controlling/driving the switching of 4 IGBTs at the same time.

2. Master Control Part

1. Hardware Structure

The main control box is powered by an independent power supply. The core part of the control is the main control board. The main control board controls the work of each board in the system. There is a flash memory card on it, which can be removed from the microcomputer board when the main control board is replaced. The flash memory card contains all parameter information and the system program of the inverter, so the main control board can be replaced without reprogramming the main control board.

2.Main Functions In Main Control Part

（1）Communicates bi-directionally with the PLC to receive information such as target frequency/target voltage from the PLC; at the same time feeds back fault information/current frequency/current voltage to the PLC.

（2）According to the target frequency, the switching waveform of each unit conforming to the frequency/voltage/phase is generated and sent to each unit driver board via optical fiber.

（3）Receive a fault signal from the unit driver board and make a unit bypass, etc.

（4）Communicate with the bypass control board to notify the number of the faulty unit that should be bypassed.

3. Working Process of the Main Control Part

The logic function of the main control part is mainly completed by the sampling board, the main control board and the fiber optic interface board. The working process is as follows:

（1）The user tells the PLC the desired operating frequency (or speed) via a touch screen or remote analog signal.

（2）The main control board and PLC communicate through the serial port to get the current operating frequency and voltage.

（3）The main control board generates PWM waveforms for all units in real time based on the desired frequency and voltage.

（4）The main control board communicates with all the unit driver boards at the same time (through the light-receiving module on the fiber-optic interface board), sending the switching status of each unit to each driver board, and at the same time obtaining the status of each unit.

（5）Depending on the unit's fault condition (if any), the appropriate action is taken and the operating mode and fault condition are reported to the PLC.

（6）The main control board sends the bypass command (if there are units that need to be bypassed) and also receives and checks the status of the bypass actuators to verify that they are in the required state.

The main control part of ZCH100 series high voltage inverter is between PLC and power unit, as shown in Figure 2-4 below.

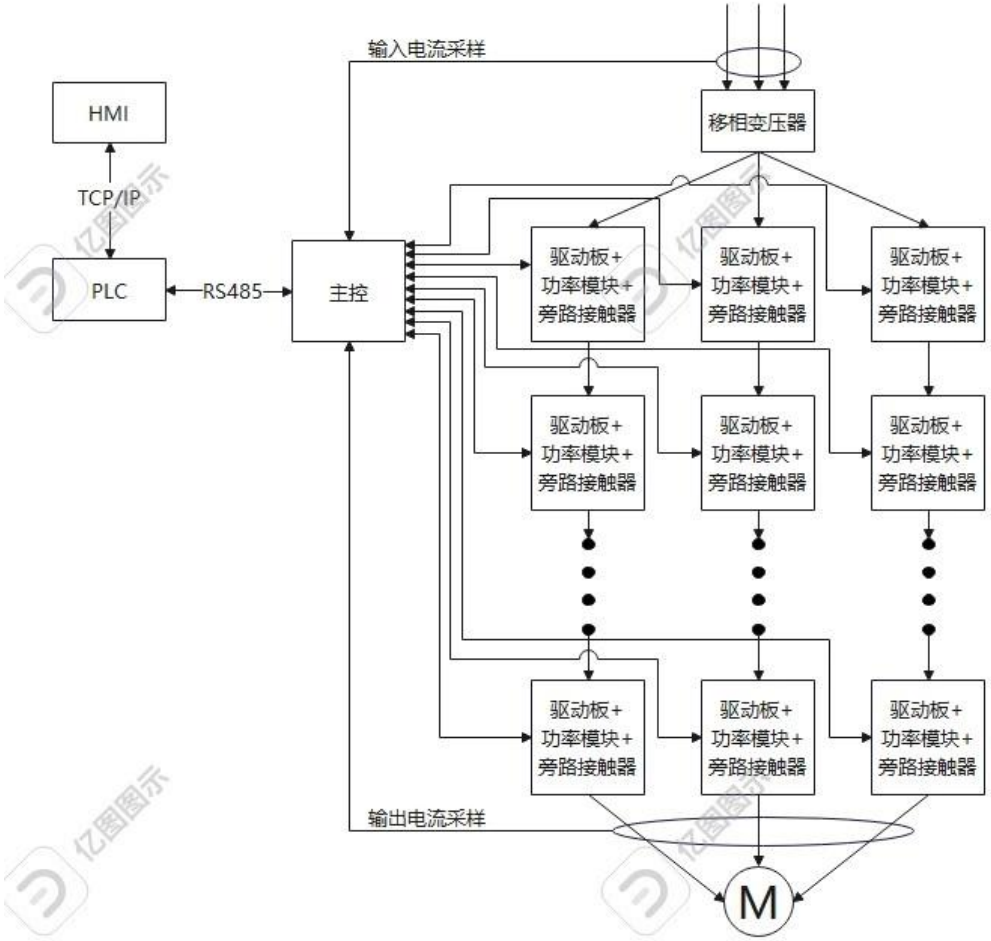


Figure 2-4 Schematic diagram of the structure of the control section of the high-voltage inverter

Chapter III Introduction to the Touch Screen Operator Interface

1. Start Screen

When the touchscreen is powered up, the start screen displays the system overview by default, as follows:

Figure 3-1 Start Screen

Name	Feature	Instructions	Unit
Company name field		Show company logo	
Model number column		Show product detailed model number	
Inverter working process		Show inverter working process status	
Time display column		Show PLC system time	
System overview	Button	Click to enter the system overview screen	
Parameter settings	Button	Click to enter parameter setting screen	
Alarm event	Button	Click to enter the alarm event screen	
Info feedback	Button	Click to enter the feedback screen	
System settings	Button	Click to enter the system settings screen	
User switches	Display	Indicates the switch status of the main circuit of the frequency converter	
running/stop status	Display	Display the "running" or "stop" status of the frequency converter	
local/far away	Display	Display whether the inverter is under local or remote control	
Single step/automatic	Knob	Shows whether the frequency converter is in single-step or automatic mode	
Fault reset	Knob	When an alarm or fault message is triggered, click "Alarm Reset"	
Ready	Indicator Light	Indicates that the inverter is ready	

Run	Indicator Light	Indicates that the inverter is running	
Fault	Indicator Light	Indicates a malfunction of the inverter	
PLC sends commands	Display	Display the content of instructions issued by PLC to the main control	
Master upload command	Display	Display the command content being executed by the main control	
Master control execution command feedback	Display	Display master control execution result feedback	
Set frequency	Input Box	In the running state, the frequency converter sets the operating frequency.	Hz
Motor frequency	Display Box	In running state, the inverter outputs frequency.	Hz
Set speed	Input Box	In the running state, the motor is given a running speed.	r/min
Motor speed	Display Box	In running state, the actual speed of the motor.	r/min
Input voltage A	Display Box	Display system phase A input voltage	V
Input voltage B	Display Box	Display system B phase input voltage	V
Input voltage C	Display Box	Display system phase C input voltage	V
Input current A	Display Box	Display system phase A input current	A
Input current B	Display Box	Display system phase B input current	A
Input current C	Display Box	Display system phase C input current	A
Output voltage A	Display Box	Display the inverter output phase A voltage	V
Output voltage B	Display Box	Display the inverter output B-phase voltage	V
Output voltage C	Display Box	Display the inverter output C phase voltage	V
Output current A	Display Box	Display the inverter output phase A current	A
Output current B	Display Box	Display the inverter output B-phase current	A
Output current C	Display Box	Display the inverter output C phase current	A
Alarm strip	Display	Real-time display of system alarm details	

2. “Parameter setting” Screen

In the start screen, press the "Parameter Settings" button to enter the "Parameter Settings" interface as shown below, which displays the basic parameter settings of the high-voltage inverter. This interface defaults to the motor startup

parameter page, in which "Setting Input" is listed as the parameter setting area. "Master Control Stored" is listed as the actual storage result of the master control. Enter the parameters and click the write button in the upper right corner to save the change results.

Figure 3-2 Parameter setting interface

Number	Instruction	Characterization
1	Reference static starting frequency	Left input, right display
2	Reference static starting voltage	Left input, right display
3	Reference speed start frequency	Left input, right display
4	Reference startup method selection	Left selection, right display
5	No activation below minimum frequency threshold	Left input, right display
6	Restart time interval after inverter failure	Left input, right display
7	Self-restart mode after inverter failure	Left selection, right display
8	Allowed number of times to resume operation after master control failure	Left input, right display
9	Spare	Left input, right display
10	A phase correction coefficient (standby)	Left input, right display
11	B phase correction coefficient (standby)	Left input, right display

12	C phase correction coefficient (standby)	Left input, right display
13	Unit voltage coefficient A	Left input, right display
14	Unit voltage factor B	Left input, right display
15	Standby	Left input, right display
16	Standby	Left input, right display

3. “Basic Parameters of Motor And Equipment” Screen

In the "Parameter Settings" interface, click the "Motor Startup Parameters" drop-down menu, and then click "Motor and Equipment Basic Parameters" to enter the "Motor and Equipment Basic Parameters" interface as shown in Figure 3-3. The user completes the high-voltage Set the basic parameters of the inverter motor and equipment, and then click the write button in the upper right corner to save the changes.

Figure 3-3 Motor and equipment basic parameter interface

Number	Instruction	Characteristic
1	Motor rated frequency	Left input, right display
2	Motor minimum operating frequency	Left input, right display
3	Motor rated voltage	Left input, right display

4	Motor rated speed	Left input, right display
5	Motor rated slip	Left input, right display
6	Motor stator resistance	Left input, right display
7	Number of units	Left input, right display
8	Minimum operating unit	Left input, right display
9	With or without unit bypass function	Left input, right display
10	Equipment incoming line rated voltage	Left input, right display
11	Unit incoming line rated voltage	Left input, right display
12	Motor output wiring phase sequence	Left input, right display
13	Sampling measurement delay	Left input, right display
14	Free descending speed at high motor speed	Left input, right display
15	Unit static rated voltage	Left input, right display
16	Unit 75% load rated voltage	Left input, right display

4. “Motor Increase/Decrease” Screen

In the "Parameter Settings" interface, click the "Motor Startup Parameters" drop-down menu, and then click the "Motor Increase/Deceleration" submenu to enter the "Motor Increase/Deceleration" interface as shown in Figure 3-4. The user completes the high-voltage inverter on this interface. Set the motor acceleration and deceleration parameters, and then click the write button in the upper right corner to save the change results.

Figure 3-4 Motor acceleration and deceleration interface

Number	Instruction	Characterization
1	<1/32 segment increasing frequency speed	Left input, right display
2	<1/32 band frequency reduction speed	Left input, right display
3	<1/8 segment increasing frequency speed	Left input, right display
4	<1/8 segment frequency reduction speed	Left input, right display
5	<2/8 segment increasing frequency speed	Left input, right display 示
6	<2/8 segment frequency reduction speed	Left input, right display
7	<3/8 segment increasing frequency speed	Left input, right display
8	<3/8 segment frequency reduction speed	Left input, right display
9	<4/8 segment increasing frequency speed	Left input, right display
10	<4/8 segment frequency reduction speed	Left input, right display
11	<5/8 segment increasing frequency speed	Left input, right display
12	<5/8 segment frequency reduction speed	Left input, right display
13	<6/8 segment increasing frequency speed	Left input, right display
14	<6/8 segment frequency reduction speed	Left input, right display
15	>6/8 segment increasing frequency speed	Left input, right display

16	>6/8 segment frequency reduction speed	Left input, right display

5. "Motor Resonance Point" Screen

In the "Parameter Settings" interface, click the "Motor Starting Parameters" drop-down menu, and then click the "Motor Resonance Point" submenu to enter the "Motor Resonance Point" interface as shown in Figure 3-5. The user completes the high-voltage inverter on this interface. Set the motor resonance point parameters, and then click the write button in the upper right corner to save the changes.

Figure 3-5 Motor resonance point setting interface

Number	Instruction	Characterization
1	Width of resonance point	Left input, right display
2	0th resonance point	Left input, right display
3	First resonance point	Left input, right display
4	2nd resonance point	Left input, right display
5	3rd resonance point	Left input, right display
6	Spare	Left input, right display

7	Spare	Left input, right display
8	Spare	Left input, right display
9	Spare	Left input, right display
10	Spare	Left input, right display
11	Spare	Left input, right display
12	Spare	Left input, right display
13	Spare	Left input, right display
14	Spare	Left input, right display
15	Spare	Left input, right display
16	Spare	Left input, right display

6. "Motor Operation Curve" Screen

In the "Parameter Settings" interface, click the "Motor Starting Parameters" drop-down menu, and then click the "Motor Operating Curve" submenu to enter the "Motor Operating Curve" interface as shown in Figure 3-6. The user completes the high-voltage inverter on this interface. Set the motor operating curve parameters, and then click the write button in the upper right corner to save the changes.

Figure 3-6 Motor operating curve interface

Number	Instruction	Characterization
1	Fv at the lowest frequency	Left input, right display
2	Fv at 1/32 frequency	Left input, right display
3	Fv at 1/16 frequency	Left input, right display
4	Fv at 1/8 frequency	Left input, right display
5	Fv for 2/8 frequency	Left input, right display
6	Fv at 3/8 frequency	Left input, right display
7	Fv at 4/8 frequency	Left input, right display
8	Fv at 5/8 frequency	Left input, right display
9	Fv at 6/8 frequency	Left input, right display
10	Fv at 7/8 frequency	Left input, right display
11	Fv at 8/8 frequency	Left input, right display
12	Spare	Left input, right display
13	Spare	Left input, right display
14	Spare	Left input, right display
15	Spare	Left input, right display
16	Spare	Left input, right display

7. “Protection Parameters” Screen

In the interface of “Parameter Setting”, click the drop-down menu of “Motor Starting Parameters”, and then click the sub-menu of “Protection Parameters” to enter the interface of “Protection Parameters” as shown in Figure 3-7 below. Parameters” interface is shown in Figure 3-7 below, the user completes the setting of HV inverter protection parameters on this interface, and then clicks the upper-right corner of the write button to save the results of the changes.

Figure 3-7 Protection Parameters Screen

Number	Instruction	Characterization
1	Motor rated current	Left input, right display
2	Protection current effective value	Left input, right display
3	Instantaneous maximum value of quick-break current	Left input, right display
4	Light overload current	Left input, right display
5	Heavy overload current	Left input, right display
6	Allowable time for light overload	Left input, right display
7	Allowable time for heavy overload	Left input, right display
8	Output voltage quick-break instantaneous maximum value	Left input, right display
9	Input voltage quick-break instantaneous maximum value	Left input, right display
10	Induced voltage modulus minimum value	Left input, right display
11	Maximum output current unbalance	Left input, right display
12	Output voltage maximum unbalance	Left input, right display
13	Input voltage maximum unbalance	Left input, right display
14	Spare	Left input, right display

15	Spare	Left input, right display
16	Spare	Left input, right display

8. “Protection Enable” Screen

In the “Parameter Setting” interface, click the “Motor Starting Parameters” drop-down menu, and then click the “Protection Enable” submenu to enter the “Protection Enable” interface as shown in Figure 3-7 below. Enable” interface is shown in Figure 3-7 below, users can complete the setting of HV inverter protection enable on this interface, and then click on the upper right corner of the write button to save the result of changes.

Figure 3-7 Protection Enable Screen

Number	Instruction	Characterization
1	General Protection Enable 1	Left input, right display
2	General Protection Enable 2	Left input, right display
3	Auto-tuning carrier enable	Left input, right display
4	Saddle wave enable	Left input, right display
5	DC resistance compensation	Left input, right display
6	Whether the automatic test bypass	Left input, right

	operation is normal before startup	display
7	Whether the unit can be switched on or off during operation	Left input, right display
8	Spare	Left input, right display
9	Spare	Left input, right display
10	Spare	Left input, right display
11	Spare	Left input, right display
12	Spare	Left input, right display
13	Spare	Left input, right display
14	Spare	Left input, right display
15	Spare	Left input, right display
16	Spare	Left input, right display

9. “Sampling Zero Setting” Screen

In the “Parameter Setting” interface, click on the “Motor Startup Parameters” drop-down menu, and then click on the “Sampling Zero Setting” sub-menu to enter the “Sampling Zero Setting” interface as shown in Figure 3-7 below, where users can complete the setting of sampling zero setting of HV inverter. Sampling Zero Setting” interface is shown in Figure 3-7 below, the user completes the setting of HV inverter sampling zero setting on this interface, and then clicks the upper-right corner of the write button to save the results of the changes.

Figure 3-8 Sampling Zero Setting Interface

Number	Instruction	Characterization
1	Sampling channel 0 zero value	Left input, right display
2	Sampling channel 1 zero value	Left input, right display
3	Sampling channel 2 zero value	Left input, right display
4	Sampling channel 3 zero value	Left input, right display
5	Sampling channel 4 zero value	Left input, right display
6	Sampling channel 5 zero value	Left input, right display
7	Sampling channel 6 zero value	Left input, right display
8	Sampling channel 7 zero value	Left input, right display
9	Sampling channel 8 zero value	Left input, right display
10	Sampling channel 9 zero value	Left input, right display
11	Sampling channel 10 zero value	Left input, right display
12	Sampling channel 11 zero value	Left input, right display
13	Sampling channel 12 zero value	Left input, right display
14	Sampling channel 13 zero value	Left input, right display

15	Sampling channel 14 zero value	Left input, right display
16	Sampling channel 15 zero value	Left input, right display

10. "Motor Parameters" Screen

In the "Parameter Setting" interface, click on the "Motor Starting Parameters" drop-down menu, and then click on the "Sampling Coefficient" submenu to enter the "Sampling Coefficient" interface as shown in Figure 3-8 below. Coefficients" interface is shown in Figure 3-8 below, users can complete the setting of sampling coefficients of HV inverter on this interface, and then click the upper-right corner of the Write button to save the results of the changes.

Figure 3-8 Sampling Factor Screen

Number	Instruction	Characterization
1	Sampling channel 0 factor K	Left input, right display
2	Sampling channel 1 factor K	Left input, right display
3	Sampling channel 2 factor K	Left input, right display
4	Sampling channel 3 factor K	Left input, right display
5	Sampling channel 4 factor K	Left input, right display
6	Sampling channel 5 factor K	Left input, right display
7	Sampling channel 6 factor K	Left input, right display
8	Sampling channel 7 factor K	Left input, right display

9	Sampling channel 8 factor K	Left input, right display
10	Sampling channel 9 factor K	Left input, right display
11	Sampling channel 10 factor K	Left input, right display
12	Sampling channel 11 factor K	Left input, right display
13	Sampling channel 12 factor K	Left input, right display
14	Sampling channel 13 factor K	Left input, right display
15	Sampling channel 14 factor K	Left input, right display
16	Sampling channel 15 factor K	Left input, right display

11. “PLC Reserved Parameter Setting” Screen

In the interface of “Parameter Setting”, click the drop-down menu of “Motor Starting Parameters”, and then click the sub-menu of “PLC Retained Parameter Setting” to enter the interface of “PLC Retained Parameter Setting” as shown in Figure 3-9 below. “PLC reserved parameter settings” interface is shown in Figure 3-9 below, users in this interface to complete the high-voltage inverter PLC reserved parameter settings, and then click on the upper-right corner of the write button to save the results of the changes.

Figure 3-9 PLC Reserved Parameter Setting Interface

Number	Instruction	Characterization
1	Output switch yes or no	Right 1 selection, right 2 display
2	Target frequency sources	Right 1 selection, right 2 display
3	Pre-charge time	Right Input
4	Manual restart interval after shutdown	Right Input
5	Number of automatic restarts allowed after the fault is cleared	Right Input
6	Waiting interval for restart after shutdown in automatic mode	Right Input
7	Pre-charged knife switch with or without	Right 1 selection, right 2 display
8	Free or reduced frequency shutdown	Right 1 selection, right 2 display
9	Shutdown to static stop wait interval	Right Input
10	High-voltage input voltage signal source	Right 1 selection, right 2 display
11	Type of fault clearance	Right 1 selection, right 2 display
12	Spare	Right Input
13	Spare	Right Input
14	Spare	Right Input
15	Spare	Right Input
16	Number of communication timeouts between PLC and main control	Right Display

12. “Unit Hardware Failure Settings” Parameter Screen

In the “Parameter Setting” interface, click on the “Motor Startup Parameters” drop-down menu, then click on the “Unit Hardware Failure Setting” submenu, enter the “Parameter Setting” interface as shown in Figure 3-10 and Figure 3-11. “The interface is shown in Figure 3-10 and Figure 3-11 below. Users can complete the setting of HV inverter unit hardware failure on this interface, and then click the write button in the upper right corner to save the change result, so as to simulate the unit failure and test the purpose of the protection action of the main controller.

Figure 3-10 Unit Hardware Fault Setting Interface

Number	Instruction	Characterization
1	Hardware failure in unit A0	Right 1 input, right 2 display
2	Hardware failure in unit A1	Right 1 input, right 2 display
3	Hardware failure in unit A2	Right 1 input, right 2 display
4	Hardware failure in unit A3	Right 1 input, right 2 display
5	Hardware failure in unit A4	Right 1 input, right 2 display
6	Hardware failure in unit A5	Right 1 input, right 2 display
7	Hardware failure in unit A6	Right 1 input, right 2 display
8	Hardware failure in unit A7	Right 1 input, right 2 display
9	Hardware failure in unit A8	Right 1 input, right 2 display
10	Hardware failure in unit A9	Right 1 input, right 2 display 示
11	Hardware failure in unit A10	Right 1 input, right 2 display
12	Hardware failure in unit A11	Right 1 input, right 2 display
13	Hardware failure in unit A12	Right 1 input, right 2 display
14	Hardware failure in unit A13	Right 1 input, right 2 display

15	Hardware failure in unit A13	Right 1 input, right 2 display
16	Hardware failure in unit A15	Right 1 input, right 2 display

Clicking on the 1 Setting input to the right of A0 Unit Hardware Failure sets the unit hardware failure type as shown in Figure 3-11 below, with Normal indicating that the failure has not been committed, and Failure indicating that the failure has been committed, as is the case for A-phase, B-phase, and C-phase units.

Figure 3-11 Phase A Power Unit Fault Type Setting

13. "Alarm Events" Screen

Click on the alarm event button in the start screen of the touch screen, the screen jumps to the real-time record and history screen, click on the real-time record drop-down menu, you can switch back and forth between the real-time record and history screen, the screen content is as follows Figure 3-12 and Figure 3-13.

Figure 3-12 Real-Time Recording

Figure 3-13 History

14. Information Feedback Screen

Click the information feedback button in the start screen of the touch screen, the screen jumps to the information feedback screen, the screen defaults to display the unit fault status interface, click the unit locking fault observation page and unit

fault status, you can switch back and forth between the unit fault status and the unit locking fault observation page to display the interface, the content of the screen is as follows Figure 3-14 and Figure 3-15.

Figure 3-14 Unit Failure Status

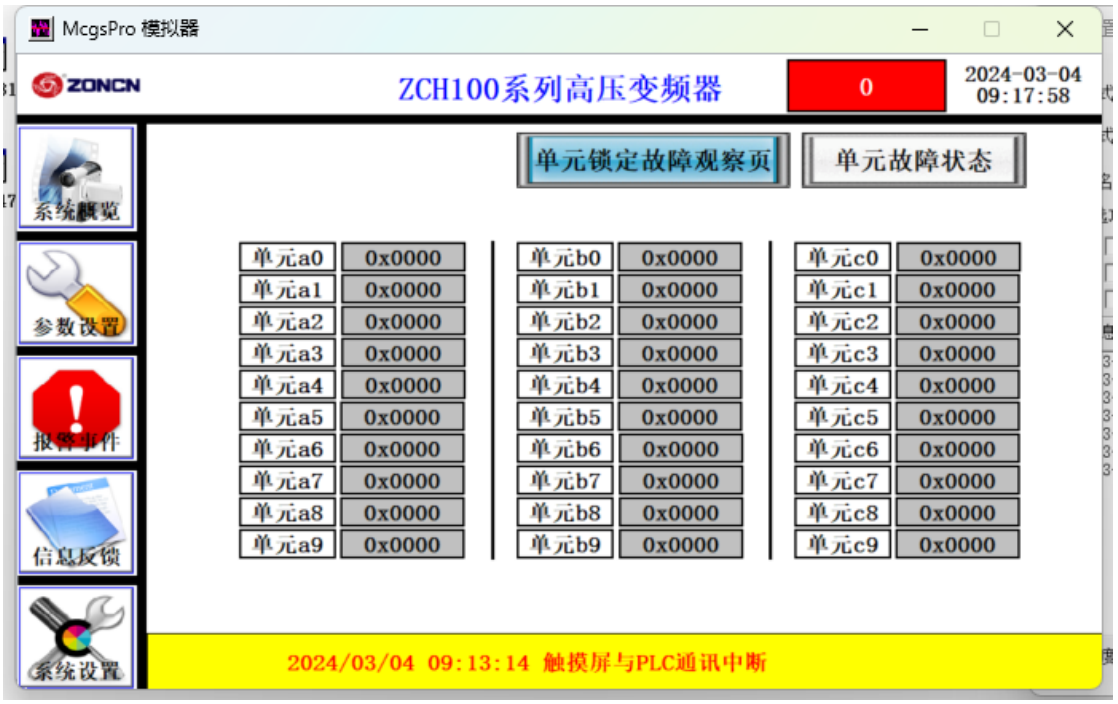


Figure 3-15 Unit Lock Fault Watch Page

15. Unit DC Voltage

Click the Unit Fault Status drop-down menu in the Information Feedback screen, click Unit DC Voltage, and the screen jumps to the Unit DC Voltage screen, which is shown in Figure 3-16 below.

Figure 3-16 Unit DC Voltage

16. Unit 5V Power Supply

Click the Unit Fault Status drop-down menu in the Information Feedback screen, click Unit 5V Power Supply, and the screen jumps to the Unit 5V Power Supply screen, which is shown in Figure 3-17 below.

Figure 3-17 Unit 5V Power Supply

17. Unit Temperature

Click the Unit Failure Status drop-down menu in the Information Feedback screen, click Unit Temperature, and the screen jumps to the Unit Temperature screen, which is shown in Figure 3-18 below.

Figure 3-18 Unit Temperature

18. Sampling RMS

In the information feedback interface, click the unit fault status drop-down menu, click the Sampling RMS submenu, the screen jumps to the Sampling RMS screen, and the screen content is shown in Figure 3-19 below.

Figure 3-19 Sampling RMS

19. Sampled Instantaneous Values

In the information feedback interface, click the unit fault status drop-down menu, click the Sampling Instantaneous Value submenu, the screen jumps to the Sampling Instantaneous Value screen, and the screen content is shown in Figure 3-20 below.

Figure 3-20 Sampling Instantaneous Values

20. Sampling Zero Value

In the information feedback interface, click the unit fault status drop-down menu, click the sampling zero value submenu, the screen jumps to the sampling zero value screen, the screen content is as follows Figure 3-21.

Figure 3-21 Sampling Zero Value

21. Sampling Waveform Period

Click the Unit Fault Status drop-down menu in the Information Feedback interface, click the Sampling Waveform Cycle submenu, and the screen jumps to the Sampling Waveform Cycle screen, which is shown in Figure 3-22 below.

Figure 3-22 Sampling Waveform Period

22. Commissioning Data

In the information feedback interface, click the unit fault status drop-down menu, click the debugging data submenu, the screen jumps to the debugging data screen, the screen content is as follows Figure 3-23. enter the debugging page number to switch the debugging data page.

Figure 3-23 Debugging Data

23. Status of Units

Click the Unit Failure Status drop-down menu in the Information Feedback interface, click the Unit Working Status submenu, and the screen jumps to the Unit Working Status screen, which is shown in Figure 3-24 below.

Figure 3-24 Unit Operating Status

Chapter IV User Installation And Commissioning Steps And Procedures

In order to better guide customers on the series of high-voltage inverter installation and commissioning, this chapter mainly introduces the steps and procedures for installation and commissioning, as well as the safety issues that need to be paid attention to in the operation process.

1. Basic Information On the End Customer

User Name	
Address Details	
Zip Code	
Contact person	
Contact Number	Office Phone: Fax: Cell phone:

2. Frequency Converter And Motor Parameters

Frequency Converter		Motor	
Model		Model	
Manufacturer		Manufacturer	
Adaptation Power		Motor Power	
Input Voltage		Rated Voltage	
Device ID		Power Factor	
Whether the center point is grounded		Whether the center point is grounded	
Date of Manufacture		Date of Manufacture	

3. Main Parameters of the Load

（One tow two need to fill in the load two）

Load 1		Load 2	
Load Name		Load Name	
Load Function		Load Function	
Model		Model	
Manufacturer		Manufacturer	
Adapted Power		Adapted Power	
Usage		Usage	
User Number		User Number	
Date of manufacture		Date of manufacture	

4. Installation Environment

Temperature	
Nearby corrosive gases	
There are liquid/gas lines nearby.	
Humidity Level	
Nearby conductive dust	
Whether the air inlet/outlet is protected from rain/snow	

5. Pre-power-up Checks And Confirmations

Number	Content		Result
1	Civil construction inspection	The house is well enclosed and does not leak.	
		The house space meets the requirements for installation and commissioning.	
		The house has well installed windows and doors.	
		The house cable trench or bridge is up to code and free of standing water.	
		Duct installation complete, no air leakage.	
		House has ample air intake (intake is screened).	
		The duct outlet does not leak and is protected against rodents, birds, etc.	
2	Cabinet Inspection	Cabinet fan installed correctly and securely.	
		Tightened between cabinets with no gaps.	
		The cabinet is reliably connected to the base.	
		Cabinet door opens and closes freely, filter removes freely.	
		Cabinet aligned horizontally with floor	
		Each power unit has good contact with the top of it and the screws are fixed correctly.	
3	Equipment grounding inspection	Cabinet grounding	
		Knife gate and vacuum contactor grounding	
		Control cabinet grounding	
		Transformer grounding	
		Transformer secondary side third winding (auxiliary winding) grounded at XYZ.	
		Lightning arrester, grounding of live indicator	
		The user's high voltage cable shield ensures that it is grounded at the incoming cabinet end.	
		The user interface incoming cable shield is grounded at the control cabinet end (single-ended grounding required).	
4	High-voltage cable check (disconnect the user's	High-voltage cable from user's high-voltage cabinet to inverter feeder cabinet (confirm with multimeter)	
		High-voltage cable from inverter feeder cabinet to inverter transformer (confirm with multimeter)	

	grounding knife gate, the high-voltage cable ABC to the motor is connected, the input cable ABC is not available)	Inverter output to incoming cabinet high voltage cable (confirm with multimeter)	
		Inlet cabinet to motor high voltage cable (confirm with multimeter)	
		The distance between the outer jacket, shielding layer and armoring layer of high-voltage cables and the high-voltage charged body is more than 125mm.	
5	Is there any abnormality in the right item	Bypass control interface board (loose fiber optic, power wiring)	
		Main control system (whether the cover is tight, fiber optic wiring, etc. is completed)	
		Terminal adapter plate (wired securely)	
		Sampling resistance (whether resistance value is 1MΩ or 2MΩ)	
		Voltage Hall Sensors (TVS Tubes)	
		Current Hall sensor (wiring complete or not)	
		Vacuum contactor (clean or not)	
		Knife gate (good contact or not)	
6	Reliability of fiber optic connections	Transmitting and receiving optical fibers for each unit	
		Fiber optics in the main control system	
		Bypass control panel fiber optics	
7	The voltage detection circuit wiring is correct	Correct wiring from A/B/C phase HV outputs to A/B/C phase sampling resistors.	
		Correct wiring from A/B/C phase sampling resistor output line to A/B/C phase Hall sensor detection terminal	
		Correct wiring from A/B/C phase Hall sensor signal outputs to the inputs (AD1-1/ AD1-2/ AD1-3) of the terminal adapter.	
8	Check the resistance value of the cabinet ground and record it in detail.	Control power supply A to the cabinet earth (take each 3P open the incoming and outgoing side) > 1M	
		Control power supply B to the cabinet earth (take the inlet and outlet side of each 3P switch) > 1M	
		Control power supply C to the earth of the cabinet (take the inlet and outlet side of each 3P switch) > 1M	
		The control power supply L is connected to the earth of the cabinet (take the incoming and outgoing sides of the 2P switch).	
		The control power supply N is connected to the earth of the cabinet (take the incoming and outgoing sides of the 2P switch).	
		24V + to cabinet earth (measured on switching power supply) not available	
		24V - not available to cabinet earth (measured on switching power supply)	

		±15V to cabinet earth (measured at switching power supply) does not make sense	
9	Cooling fan check (Record resistance value)	Clean fan blades, flexible rotation, no abnormal noise	
		A to B resistance (3-15Ω)	
		B to C resistance (3-15Ω)	
		C to A resistance (3-15Ω)	
		Fan three-phase resistance should be balanced (deviation less than 10%)	
		A, B, C to cabinet earth resistance >1MΩ	
10	Power unit check	Completion of the first two elements of the power unit inspection record is required.	See Power Unit Inspection Record Form
11	Other inspections	Phase shifter transformer input side ±5% tap shorting tabs are connected correctly	
		Tighten the wiring screws on the primary and secondary sides of the phase-shifting transformer. Pay special attention to the direct connection between the high-voltage cable nose from the secondary side to the power unit and the copper plate of the phase-shifting transformer (there must be no nuts in the middle)	
		The backup UPS (if installed) input and output plugs are firm and the voltage specifications meet the requirements.	
		Make sure all cabinets are clean and free of foreign matter	
		The control and detection signal wiring from the control cabinet to the high-voltage switch cabinet and transformer cabinet is completed, and the wiring is consistent with the drawings.	
		The user-side interface signal wiring is completed and the wiring is consistent with the drawing.	
		The user-side high-voltage switch signal wiring is completed, and the wiring is consistent with the drawing.	
		The 220V and 380V power cable wiring is completed, the wiring is consistent with the drawing, and the 380VAC power supply phase sequence is correct.	
		The communication cable connections between PLC and touch screen and PLC and main control are firm and reliable.	
		The communication cable connection between the terminal adapter board and the sampling interface board is firm and reliable.	

6. Control Power Supply Power-on Debugging

Number	Content	Result

1	Preparation before debugging	User side switch disconnected, switchgear trolley rolled out	
2	Control power supply	Close each circuit air switch in turn, the backup UPS power supply	
3	User-controlled power detection	380V $_{AC}$±10%	
		220V_{AC}±10%	
	Main switching power supply detection	220V_{AC}±10%	
		+24V_{DC}±5%	
		＋15V_{DC}±5%	
		－15V_{DC}±5%	
	Bypass switching power supply detection	+24V_{DC}±5%	
4	User-side switch opening and closing test	The user-side high-voltage switch is in the commissioning position (do the opening and closing action experiment, check the touch screen user-side switch feedback, and whether the PLC can correctly divide the user-side switch.)	
		Analog fault trip signal (start inverter in inverter state, HV detects fault trip) can the user side HV switch be tripped open	
5	Check the right side of the power supply, work properly	Bypass control interface board (indicator flashes 1Hz)	
		Main control system (indicator light flashes 1Hz)	
		PLC (RUN indicator on)	
		Voltage Hall sensor (±15VDC supply normal)	
		Current Hall sensor (±15VDC supply normal)	
		Touch screen (no alarm)	
6	User Interface Testing	In the commissioning state, the in-place frequency converter starts and stops the inverter with normal logic	
		Remote start and stop the inverter in the commissioning state with normal logic	
		In the debugging state, the frequency is increased or decreased by remote speed, and during the frequency increase, the remote frequency lock is normal, and the remote frequency feedback is normal.	

		In the case of a knife gate cabinet, check to see if the user-side switch is tripped when stopped, if it is set to automatically trip the switch.	
		Hardware triggered to jump the user-side switch signal, fault signal, alarm signal, inverter ready signal, the relevant display action is normal.	
		Other user interfaces test fine	
7	Industrial Frequency Inspection	Power frequency and frequency conversion interlocking are correct.	
		Power frequency closing is normal.	
		Other user interlocks are correct	
8	Bypass Inspection	Need to complete power unit inspection record related content	See power unit inspection record form
9	Fan Steering Determination	Start the fan on the touch screen. Check whether the fan is normal. If not, change the phase of the input power supply.	

***Focused experimental sections are in bold**

7. Current Limiting Resistor Back-feeding Commissioning

Number		Operation	Content (observed phenomena)	Results (values)
1	Confirm status before debugging	In debugging state		
		Disconnect from the user's motor (via knife gate or vacuum switch)		
		If the user's incoming line wiring is completed, there will be high voltage in the user-side high-voltage switch cabinet during the test, which requires user confirmation.		
		Communicate with users about experimental projects, confirm emergency measures, and explain safety precautions.		

		The input power supply of the current limiting resistor is connected to 380VAC, and the output is connected to the third winding ABC of the phase-shifting transformer through a 10A circuit breaker (at the secondary side 220VAC auxiliary winding)		
		It is necessary to check whether XYZ at the 220VAC auxiliary winding on the secondary side is reliably grounded.		
		Verify that the raw side of the phase-shifted transformer is grounded (not allowed to be grounded) after it passes through the inverter feeder cabinet and enters the user-side switchgear, i.e., the user's high-voltage switchgear grounding knife gate is not allowed to be grounded.		
		Remove the main circuit power detection contactor coil wiring (wrap to prevent shorting or grounding).		
2	Experimental procedure	Close the circuit breaker, and the user's AC380 power supply charges the unit through the current limiting resistor to the auxiliary winding of the phase-shifting transformer.		
		Optical fiber self-test: In debugging state, when the frequency is <1Hz, set the start of fiber self-test on the touch screen	From A1, A2, A3 to A9 unit blocking IGBT indicator lights up sequentially for 3 sec.	
		Start in debug state, set target frequency 0.5Hz	Communication normal indicator (3, green) flashes for all units at 0.1 Hz (unit self-test)	
		Set target frequency 0.9Hz	Observe whether there is a unit failure situation, there must be first troubleshooting	

			Analog unit failure, to restore the unit failure need to stop the inverter, current limiting resistor re-power, pay attention to restore the fiber.	
		Set target frequency 50Hz	Observe whether the three-phase voltage is consistent and linear, and whether all unit indicators are consistent	
3	Completion of the test	Stop (press the emergency stop button or lower the frequency first and then press the stop button)	Blocking IGBT indicator (5, red) on, feedback frequency 0 Hz	
		Remove current limiting resistor input and output wires		
		Restore main circuit power detection contactor coil wiring.		

Note: ① The current limiting resistor has the same function as the voltage regulator; if a voltage regulator is used, the test method is the same.

② If the inverter is equipped with a pre-charging function, install a current-limiting resistor, and use the current-limiting resistor to reverse power supply, please refer to the relevant regulations for the operating steps.

③ If the inverter is equipped with a precharge function, since the high voltage part and the low voltage are connected through a current limiting resistor, if the relevant signal is accidentally triggered, the inverter can reversely supply power to the high voltage by controlling the power supply. Therefore, when working in a power cabinet or switch cabinet, be sure to disconnect the incoming line circuit breaker of the current-limiting resistor. Otherwise, serious consequences may occur, including personal injury or equipment damage.

8. High-voltage Power-on Debugging Test

Number	Operation	Content (observed phenomenon)	Result (value)	Remark
1	Confirm before powering on	Verify that the current limiting resistor input and output wires are removed.		
		Communicate with users about experimental items, confirm emergency measures, and explain safety precautions.		

2	Set startup status	Set in-place control, commissioning status, frequency control; check for consistency on the touch screen.		
3	Setting motor parameters	According to the nameplate of the motor, input the motor parameters in the interface of "**Motor Parameters**" of the touch screen, and press the parameter confirmation button, and it will be valid after displaying the sign of "**Successful Parameter Setting**". Disconnect the switch between inverter and motor, measure the resistance value between two phases at the motor end with a multimeter in the outlet cabinet, and input it into the motor parameters.		Motor rated voltage; motor rated current; motor rated power; motor rated speed; motor power factor; motor direct resistance; motor rated frequency, etc.
4	Dual power supply switching experiment	After high-voltage power-up, start the fan manually and do the double power switching test to confirm that the switching is normal and the fan turns correctly during the switching process.		
5	Start	If it is an automatic cabinet, the vacuum contactor K1 closes normally; the unit indicator light displays normally; the high-voltage live indicator light is on; the electromagnetic lock of the switch cabinet cannot operate.		
6	Set target frequency to 25Hz	When the frequency rises above 1Hz, the indicator lights of the unit display the same situation. Observe the voltage value of the touch screen at 25Hz, 3KV (6KV inverter) or 5KV (10KV inverter).		Record voltage value
	Set target frequency to 50Hz			
8	Set target frequency to 0Hz	Observe whether the frequency drops to 0Hz.		

9. High Voltage Power on Load Test

Number	Operation	Content (observed phenomenon)	Result (value)
1	Power frequency starting motor	Motor turns normally	
		Motor current is normal	
		Motor vibration is normal	

2	Preparation before frequency conversion start-up	Set motor protection parameters and operating status	
		Check whether the internal wiring of the frequency converter is correct	
3	Start the inverter, set the target frequency to 20Hz, and start the motor.	Confirm that the motor is turning, running normally, without pulsation, and the sound is normal.	
4	Set target frequency to 50Hz	Observing the motor operation conditions (vibration, sound, temperature) allows the user's motor maintenance personnel to make judgments. And record the maximum output current (50Hz).	
5	The voltage detection signal is correct and the current detection signal is correct. Correct the voltage and current parameters if necessary.	If the displayed value of the voltage differs by more than 10% from the corresponding value of the theoretical voltage at the frequency point or if the deviation between phases is large (10%), find out the relevant reasons and record the process parameters.	
		If the deviation of the displayed value of the current between phases is greater than 10%, find out the cause and record the process parameters. If it is less than 10%, correct the three-phase current parameters until they are balanced.	
6	Stop the inverter	Motor stops freely, speed decreases	
7	Setting the inverter **fly start allow function,** starting the inverter, observing the motor running status.	Motor runs normally during search, no pulsation, normal sound.	
		Touch screen displays the flyer startup success symbol.	
		Frequency converter to 40Hz	
		Frequency converter frequency increase to 50Hz, motor frequency increase process running normally, no pulsation, sound normal.	
8	User interface analog speed feed test	The touch screen is set to **speed control**, the user is given a 4-20mA signal remotely and corrected to 0-100% in the analog setting interface of the touch screen, and the motor speed changes with the input signal.	
		After the frequency is stabilized, disconnect the 4-20mA signal source, the touch screen displays the 4-20mA signal loss alarm message and locks the current frequency output. Restore the 4-20mA signal, the frequency follows the change.	

9	Inverter running at 50Hz, user interface analog frequency feedback test	At a frequency of 50 Hz, TB5:41-TB5:42 (motor speed output) outputs 20 mA and records the signal current value with a deviation of 10% from the recommended value.	
10	4 hours of continuous operation	Observe the inverter for any abnormalities.	

Annex I Power Unit Inspection Records

Unit number	Control power supply pre-power-up check		Check after powering up the control power supply					Current limiting resistor powered up
	Transformer to power unit wiring check	Fastening and fastening screws check	Bypass action check					Unit communication fiber inspection
			Normal (recorded resistance)		Bypass (suction action)	Bypass (record resistance)		
			Normally open	Normally closed		Normally open	Normally closed	
A1								
A2								
A3								
A4								
A5								
A6								
A7								
A8								
A9								
B1								
B2								
B3								
B4								
B5								
B6								
B7								
B8								
B9								
C1								
C2								
C3								
C4								
C5								
C6								
C7								
C8								
C9								

Transformer to power unit wiring inspection: Use a multimeter to check the high-voltage cables connecting the phase-shifting transformer and the power unit one by one.
Check the fast fuse and fastening screws: Use a multimeter to check whether the fast fuse is blown, and use a wrench to check whether the power unit screws are tight.
Check the contact between the power unit and the guide groove: Use a multimeter to check whether the contact between the power unit and the guide groove is good.
Check the bypass operation: first manually bypass on the bypass board to see if the bypass operates.

In the normal state, when the **left neutral point is interconnected** (the inverter output line is led from A6/B6/C6), there is no communication between A(n-1)-1 and An-1 and **the resistance is greater than** 0.1 MΩ, A(n-1)-1 and An-5 are connected and **the resistance value is less than 1 ohm**; **when the neutral point on the right side is interconnected** (the inverter output line is led from A1/B1/C1), An-1, A(n+ 1) There is no connection between -1 and **the resistance is greater than 0.1** MΩ, there is connection between An-5 and A(n+1)-1 and **the resistance is less than 1 ohm**;
In the bypass state, the resistance is exactly the opposite. Other units can be deduced in the same way.

Note: **When the neutral points on the left are interconnected**, when measuring unit A1, under normal conditions, there is no communication between A1-1 and B1-5 and **the resistance is greater than 0.1 MΩ**, but there is communication between A1-5 and B1-5 and the resistance is greater than 0.1 MΩ. **Less than 1 ohm**; B1, C1 units and so on. **In the bypass state, the resistance is exactly the opposite.**
When the neutral points on the right are interconnected, when measuring unit A9, under normal conditions, there is no communication between A9-1 and B9-5 and the **resistance is greater than 0.1 MΩ**, and there is communication between A9-5 and B9-5 and **the resistance is less than 1 Ohm**; B1, C1 units and so on. **In the bypass state, the resistance is exactly the opposite.**

Annex II Record of parameters during commissioning

Number	Parameter Name	Factory Default	Field Modified Values	Remark
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

……				

Annex III Record of Residual Issues on Site

Number	Phenomenon	Responsible party	Processing methods and processing time limits
1			
2			
3			

Special Attention ：

(1) In the motor and the inverter high-voltage into the insulation test, the cable and the inverter connected to the cable to be disconnected, can not be shaken on the inverter equipment itself high-voltage test.

(2) High-voltage inverter in the input high-voltage or counter-feeding inverter within the life-threatening high voltage, do not open the cabinet door or touch the possible charged parts;

(3) High-voltage inverter high-voltage input and output cables should not be connected to the wrong, otherwise equipment damage and personal injury will occur;

(4) High-voltage inverter in operation must ensure that the normal operation of the cooling fan and cooling air ducts are unobstructed;

Signature confirmation from the customer's site engineer:

Signature of commissioning engineer confirms:

Date:

Chapter V. Principles

1 Introduction

High voltage inverters are designed for standard three-phase AC high-voltage induction motor applications. Asynchronous motors are widely used due to their durability, simple structure, adaptability, and low price. On the other hand, synchronous motors are used in applications where higher efficiency is required. However, when powered by the utility grid (60 or 50Hz), the motor speed is fixed.ZCH100 series high voltage inverter can regulate the speed without affecting the motor performance. It changes the motor speed by converting the fixed-frequency, fixed-voltage utility power supply to a variable-frequency, variable-voltage power supply, and this conversion is electronic without any moving parts. Unlike the old style inverter, the series of high voltage inverter will not produce the user's unwanted side effects during the conversion process. Features:

- Does not cause significant harmonic distortion in plant distribution systems; does not require power filters; does not interfere with sensitive equipment; does not cause resonance problems with power factor compensation capacitors.
- Power factor is high, typically 95% or higher over the entire speed range, eliminating the need for power factor compensation.
- There is no need to reduce any ratings of the motor due to output harmonics. No additional heat generated in the motor compared to direct use of grid voltage.
- No torque pulsations causing mechanical resonance.
- No significant increase in motor noise compared to using grid power directly.
- No significant impact on motor insulation compared to direct use of the grid power supply.
- The rated motor torque can be unrestricted over the entire motor speed range and is only affected by the motor's own overheating limits.
- Fan noise is typically less than 75 dB, so normal conversation is possible even next to a fully loaded inverter.

- Fully modular construction allows damaged modules to be replaced in minutes. Advanced microprocessor-based diagnostic programs pinpoint the location of any fault.

2. Main Circuit

The ZCH100 series of high-voltage inverters obtain medium and high voltages by stacking the outputs of several low-voltage power units. The low-voltage power units are simply modified versions of the standard low-voltage PWM (Pulse Width Modulation) motor inverters that have been widely used for many years. Figure 5-1 shows a typical circuit topology of a 3000V series inverter with a 630V unit. Each phase of the motor is driven by three power units in series, which are connected in a star connection with the neutral line floating. Each unit is powered by an isolated secondary winding of an isolation transformer. Each of the nine secondary windings has a rated voltage of 630 VAC and a power of one-ninth of the total power. The power unit and its corresponding transformer secondary winding are insulated to ground to 5kV. for different output voltage levels, simply expand the number of units in series per phase, the basic principle is the same. For 4000V inverter, Figure 5-1 should be expanded to 4 power units in series per phase, the isolation transformer has 12 secondary windings. 5400V inverter 5 power units in series per phase, the isolation transformer has 15 secondary windings.

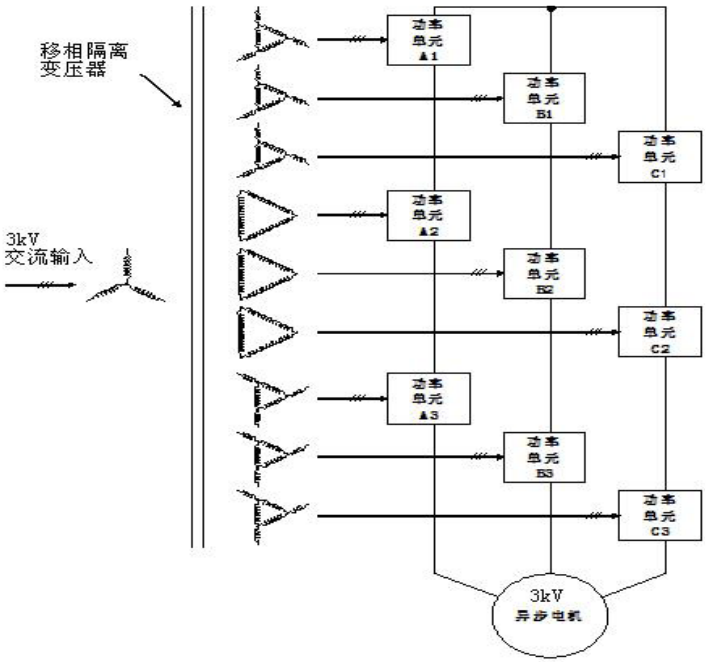


Figure 5-1 Schematic diagram of high-voltage inverter topology (three units per phase, 3000 VAC output)

Three 630VAC power units per phase in series produce a phase voltage of 1890V AC, five 630V AC power units in series produce a phase voltage of 3150V AC and a line voltage of up to 5400V AC. Other unit voltage levels are available, the number of units will be different for different output voltages, however, the basic principle is the same. All power units receive commands from the same central controller. These commands are transmitted via fiber optic cables to ensure an insulation level of 5kV.

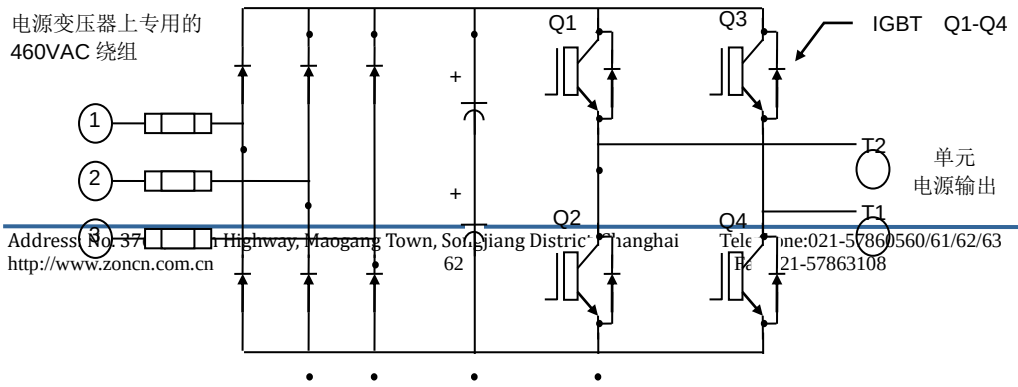
The secondary windings of the transformer supplying the power units are wound with a phase difference between them, thus eliminating most of the harmonic currents caused by the individual power units, so that the primary current is approximately sinusoidal, and thus the power factor can be kept high, typically above 95% at full load.

3. Modes of Unit Control

A schematic diagram of a typical power unit is shown in Figure 5-2. In this example, a three-phase diode rectifier powered by a 630 VAC secondary charges a DC capacitor bank to approximately 900 VDC, which is supplied to a single-phase H-bridge inverter circuit consisting of IGBTs.

At any given moment, there are only three possible output voltages for each cell; if Q1 and Q4 are on, the output from T1 to T2 will be +900V, if Q2 and Q3 are on, the output will be -900V, and if Q1 and Q3 or Q2 and Q4 are on, the output will be 0V.

With 3 power units per phase, the circuit shown in Figure 5-1 provides seven different phase voltages (±2700V, ±1800V, ±900V or 0V). Five power units per phase can provide 11 different voltage levels. The ability to provide many different voltage levels allows the inverter to produce an output waveform that is very close to a sine wave.



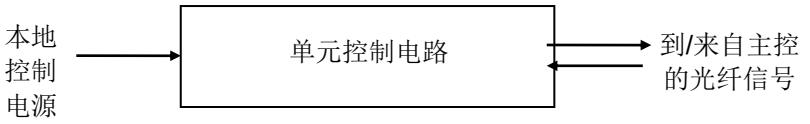


Figure 5-2 Typical Power Unit Schematic

The following illustrates how these waveforms are generated for the 3-cell per phase case. First, a reference signal is established for each phase which are digital models of the ideal waveform to be approximated. In FIG. 5-3, RA is the reference signal for phase A. This reference signal is compared to three triangular carriers. The three carriers are identical except for a certain phase difference in sequence.

As long as the reference signal is greater than the inverse of the first carrier (no phase shift), signal L1 is high and vice versa L1 is low. l1 is used to control transistor pairs Q1 and Q2 in cell A1 (see transistor pairs on the left in Figure 5-2). As long as the reference signal is greater than the inverse phase of the first carrier, the signal R1 is high and vice versa.R1 is used to control transistor pairs Q3 and Q4 in cell A1 (see the transistor pairs on the right in Figure 5-2).The difference between L1 and R1 gives the output waveform of cell A1, as shown in Figure 5-3, Phase A Waveforms, for A1.

In the same manner, the reference signal is compared with the second carrier waveform (which has a 60-degree phase shift from the carrier waveform of A1) and its inverse to generate the control signals L2 and R2 for the transistor pairs in unit A2. the output waveform of unit A2 is shown in A2.

Finally, the reference signal is compared with the third carrier waveform (which has a 120-degree phase shift from the carrier waveform A1) and its inverse phase to generate the control signals L3 and R3 for the transistors in the unit A3.The output waveform of the unit A3 is shown in A3.

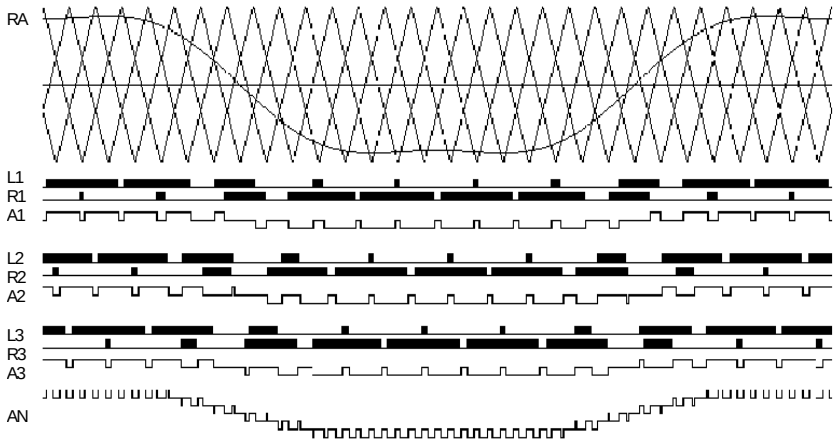


Figure 5-3 Phase A Waveform

The sum of the output voltages of units A1, A2, and A3 produces the inverter's phase A output phase voltage, as shown in Figure 5-3, AN. There are seven different voltage levels, as described earlier, and note that this voltage is defined as the voltage from terminal A to the floating neutral in the inverter, not the motor neutral.

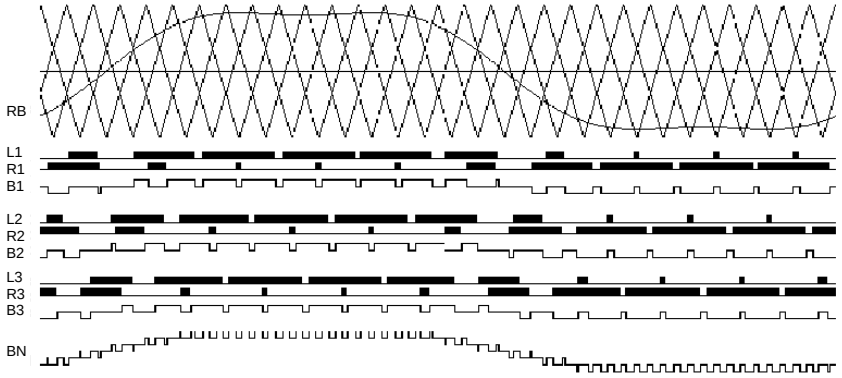


Figure 5-4 Phase B Waveform

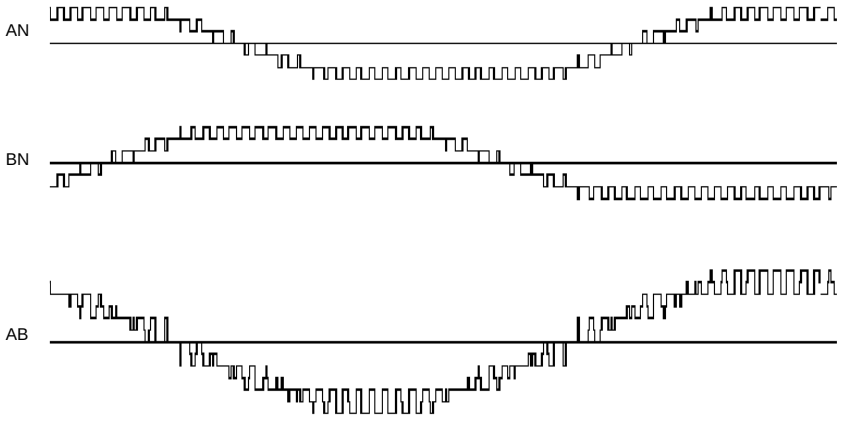


Figure 5-5 Line Voltage Waveforms

Figure 5-4 shows the same signals for phase B. The three carrier signals are the same as in Figure 5-3, but there is an angular phase shift between the carrier signals corresponding to A. The reference signal RB is also the same as in Figure 5-3, but with a phase lag of 120 degrees (at the reference frequency). The sum of the output voltages of units B1, B2, and B3 produces the inverter's B-phase phase voltage, such as BN in Fig. 5-4. Fig. 5-5 repeats the waveforms of phase voltages AN and BN, and the difference between AN and BN forms the line voltage added to the motor, such as AB in Fig. 5-5.

Chapter VI Alarms, Malfunctions And Handling Measures

All alarms, faults, and messages will be displayed on the touch panel with the symbol “Arriving” when the alarm is activated and “Leaving” when it is cleared.

If a fault or alarm occurs, it will be displayed on the panel. The master software and hardware detects faults and alarms and saves them in the fault recorder. Faults can be directly detected hardware faults or they can be generated by the software.

Unit faults are detected by the unit control system logic on the unit control board within each power unit. Each power unit has its own detection circuitry. The master control system interprets, displays, and records unit faults based on the unit in which the fault occurred and the content of the fault.

Typically, all faults will cause the inverter to immediately stop supplying power to the motor and disable inverter operation. Some user-defined faults can be programmed through the system to control the response of the inverter. Alarms will be displayed and logged, but will not normally prohibit the inverter from running.

Number	Form	Alert message	Treatment measures	Remark
1	Message	The frequency converter is in running state and not allowed to start.	Start again after pressing stop button.	
2		The user side switch is not closed for startup.	Re-start after closing the user side switch.	
3		Inverter/Industrial frequency/commissioning switch in the wrong position, start-up not allowed	Adjust the knob position and start again	
4		Incorrect switch position in the feeder cabinet does not allow startup.	Adjust K1, K2, K3 position and start again.	
5		Emergency stop button is not reset and is not allowed to be activated.	Start again after resetting the emergency stop button.	
6		Fan fault feedback, no startup allowed.	Check the fan and start it again.	
7		Motor stop time protection, no start allowed.	Adjust the protection value or wait 10 minutes and start again.	
8		The bypass system is not powered up and will not be allowed to start up.	Check bypass power and start again	
9		Remote/local knob is not in the right position to allow startup.	Adjust the knob position and start again	
10		Pre-charge failure	Checking the pre-charging circuit	
11		Fan closing failure	Check the fan or closing circuit	
12		Fan tripping failure	Fan can’t open the gate normally, check the circuit and press the stop	

			button to open the gate again.	
13		Blocking IGBT failure	Check the main control and communication lines	
14		Switchgear vacuum contactor closing failure	Check vacuum contactors and control circuits	
15		Switchgear vacuum contactor tripping failure	Check vacuum contactors and control circuits	
16		Successful setting of master control parameters	Successful setting of master control parameters	
17		Master parameter setting failure	Reset master parameters	
18		Variable frequency local start	Frequency conversion local start recording	
19		Frequency conversion remote start	Frequency conversion remote start record	
20		Frequency conversion stops operation	Frequency conversion stops recording	
21		K3 bypass action, power frequency starts	K3 bypass action, power frequency starts	
22		Power frequency remote start	Power frequency remote start record	
23		Power frequency stops	Power frequency stop recording	
24		Frequency conversion emergency stop operation	Frequency conversion emergency stop record	
25	Alarms	A1 unit communication failure	The frequency converter will run in bypass and will be inspected during the next shutdown.	
26		A1 unit voltage is high	Unit voltage is too high alarm	
27		A1 unit voltage is low	Unit voltage is too low alarm	
28		A1 unit overcurrent	The frequency converter will be bypassed for operation and serviced during the next shutdown.	
29		A1 unit IGBT failure	The frequency converter will be bypassed for operation and serviced during the next shutdown.	
30		A1 unit over temperature	Unit over-temperature alarm, service on next shutdown	
31		Wind turbine failure alarm during operation	The inverter continues to run and will not start until after the next shutdown to service the fan	
32		The wind turbine stops and alarms during operation.	Abnormal feedback from the fan during operation, the fan can only be started after the next shutdown for maintenance.	
33		Main circuit power failure alarm during operation	Check the main circuit power of the inverter	
34		Control circuit power failure alarm during operation	Check the inverter control power supply and circuit	
35		Bypass system power failure alarm during operation	Checking the power supply circuit of the inverter bypass system	
36		Current imbalance alarm	Detection of power unit main circuit and detection circuit	
37		Overload Alarm	Check the overload protection parameter settings, frequency increase/decrease time settings and	

			load characteristics of the inverter.	
38		Overcurrent Alarm	Check the overcurrent protection parameter settings of the inverter and check the main circuit and load characteristics.	
39		Voltage imbalance alarm	Checking the power unit and detection circuit, etc.	
40		PLC communication timeout alarm during operation	Check the communication connection between the master control and the PLC.	
41		Transformer over-temperature alarm	Inspection of transformer heat sink fan and temperature controller.	
42		Alarm for loss of 4-20mA remote feed signal during operation	Check the corresponding analog input control cable.	
43		Single-phase grounding alarm during operation.	Check system interface boards	
44		Main circuit power-down restart failure alarm during operation.	Check the main circuit of the inverter system.	
45		Flying car startup failure alarm	Check the main control system and current detection circuit.	
46		Voltage tracking fault alarm during operation	Check the main control system and voltage detection circuit.	
47		Main control communication calibration error alarm during operation	Check master communication connection	
48		Bypass communication failure alarm during operation	Check the connection between the master and the bypass system	
49		Main control hardware failure alarm during operation	Check the main control system circuit	
50		Unit overcurrent and fault alarms during operation	Checking the main circuit and load characteristics of the power unit	
51	Faults	Emergency stop for fan failure during operation	Check the fan before starting	
52		Emergency stop for fan failure during operation	Check the fan before starting	
53		Emergency stop for main circuit power-down during operation	Checking the main circuit power supply of the inverter checking	
54		Emergency stop for control loop power-down during operation	Check the inverter control power and circuit	
55		Emergency stop for bypass system power-down during operation	Checking the power supply circuit of the inverter bypass system	
56		Emergency stop for current imbalance	Detection of power unit main circuit and detection circuit	
57		Overload emergency stop	Check the overload protection parameter settings, frequency increase/decrease time settings and load characteristics of the inverter.	
58		Overcurrent emergency stop	Check the overcurrent protection parameter settings of the inverter and check the main circuit and load	

			characteristics.	
59		Voltage unbalance emergency stop	Checking the power unit and detection circuit, etc.	
60		PLC communication timeout emergency stop during operation	Check the communication connection between the master control and the PLC	
61		Transformer over temperature trip emergency stop	Inspection of transformer heat sink fan and temperature controller	
62		Main circuit power down during operation restart failure emergency stop	Checking the inverter system main circuit	
63		Flying car start failure emergency stop	Check the main control system and current detection circuit	
64		Emergency stop for voltage tracking faults during operation	Check the main control system and voltage detection circuit	
65		Emergency stop for main control communication calibration error during operation	Check master communication connection	
66		Emergency stop for bypass communication failure during operation	Check the connection between the master and the bypass system	
67		Main control abnormal blocking emergency stop during operation	Check the main control system circuit	
68		Emergency stop for main control hardware failure during operation	Check the main control system circuit	
69		Unit overcurrent and fault emergency stop during operation	Checking the main circuit and load characteristics of the power unit	

Chapter VII Frequency Converter Start, Stop, Raise And Lower Frequency Operation

1. Operation Control Mode

For motorized loads, the device has three control methods

a：Closed-loop control with pressure and flow rate as control objects: automatic control based on the input 4-20mA analog value.

b: Open-loop control with rotational speed as the control object: in this way, the user can set the rotational speed according to the working conditions in the remote operation (DCS or remote operation box), and the frequency converter will take the rotational speed as the control value, and the frequency change in this way will be based on the analog quantity inputted by the user, and the 4mA corresponds to the 0 rotational speed, and the 20mA corresponds to the rated rotational speed.

c: Open-loop control with frequency as the control object: This method is operated in the local operation (operated on the equipment body) by setting the output frequency directly from the touch panel, and the frequency converter takes the frequency as the control target value.

The above three control methods can be set by the user through the human-machine interface (touch screen) to meet the requirements of different working conditions.

2. Starting, Stopping, And Frequency Rise And Fall Operation Steps of Frequency Converter

Steps	Items	Steps	Note
1	Control power up	Close the control cabinet air switch	
2	Inspection before closing the user side switch	Is the position of the incoming knife gate correct?	
3		Is the transformer cabinet door locked?	
4		Is the entrance cabinet door locked?	
5		Is the power unit cabinet door locked?	
6		Is the filter clean?	
7		Confirm whether the switch closing permission signal on the user side of the inverter is valid	
8		Does the inverter have alarm or fault feedback?	
9	High voltage power on	Close user side switch	

10	Local control of frequency converter	Make sure the remote/local knob is in the local position	
11		Confirm that the frequency conversion/power frequency/debugging knob is in the frequency conversion position	
12		Confirm that the frequency/speed control is in the frequency control position	
13		Press the frequency conversion start button of the control cabinet	
14		If it cannot be started, follow the messages on the touch screen.	
15		Control the inverter by setting the frequency	
16		Stopping the inverter with the inverter stop and emergency stop buttons	
17	Remote control frequency converter	Make sure the remote/local knob is in the remote position	
18		Confirm that the frequency conversion/power frequency/debugging knob is in the frequency conversion position	
19		Confirm that the frequency/speed control is in the speed control position	
20		Confirm whether the inverter ready signal is valid	
21		Provide remote start signal to the inverter	
22		If it cannot be started, follow the messages on the touch screen.	
23		The frequency converter is controlled by the speed given. If there is no speed given, the frequency converter runs at the lower limit frequency.	
24		During frequency modulation, if the frequency fluctuates, lock the frequency through the frequency lock signal.	
25		Stopping the inverter with the inverter stop and emergency stop buttons.	
26	Inverter frequency bypass operation	Frequency conversion stops the inverter	
27		Disconnect the user side switch	
28		Disconnect K1 and K2, close K3	
29		Close the user side switch to start the motor	
30	Daily inspection of inverter operation	Check if the filter is clean	
31		Check the inverter for alarms, fault messages	
32		Check for abnormal motor sounds	
33		Check whether the output voltage and output current of the touch screen inverter are balanced.	
34		Check whether the inverter cooling fan is running normally	

Chapter VIII Equipment Packaging, Transportation, Storage and Installation

1. Package

Equipment packaging must comply with the requirements of the relevant packaging and transportation specifications to ensure that the product is not subject to mechanical damage during transportation and storage, and have the ability to prevent rain, snow and dust, equipment accompanied by documents：

☐ Packing list (with spare parts) 1 copy ☐Factory information list 1 copy

☐ Certificate of Conformity 1pc ☐Factory report of the whole machine 1pc

☐ Dry-type transformer random file 1 set ☐ Disconnect switch manual 1pc

☐ High-voltage inverter instruction manual 3pcs ☐User electrical drawings 3pcs

2. Shipment

（1）The equipment can be transported by car, train, ship and other means of transportation. The equipment must be carefully and gently placed during transportation, rain, sun exposure is strictly prohibited, there should be no violent vibration, impact and inverted. The transportation temperature should be within the range of -20～+65℃.

（2）The maximum height of the equipment is 2750mm, and the total height after packing is 2650mm (packing after unloading the fan). When choosing the means of transportation, it is necessary to consider at the same time whether or not there is a limit to the existence of high factors in the transportation process.

3. Storage

The equipment should be able to be stored under the environmental conditions specified in GB4798.1, which requires：

☐ Ambient temperature grade 1K4: -15～+55℃

☐ Relative humidity level 1K3: 5% ~ 95%

☐ The equipment must not be exposed to the sun, rain or snow, and should be stored in a ventilated, dry and dust-free warehouse

☐ Equipment should be stored to prevent rodent intrusion and mold attack

☐ Equipment should be protected from corrosion by salt spray, dangerous gases, corrosive liquids, etc.

4. Civil Engineering Installation

1. Environmental requirements

In order for the inverter to operate stably and reliably for a long time, the following requirements are made for the installation environment of the inverter:

（1）The minimum temperature is -10℃, the maximum ambient temperature is 50℃, and the change in working environment temperature should not be greater than 5℃/h. If the ambient temperature exceeds the allowable value, appropriate air conditioning equipment should be considered.

（2）The installation height should be less than 1000 meters above sea level. If the installation height exceeds 1000 meters, the equipment needs to be derated for use.

（3）Under the ambient temperature of 20°C, the humidity requirement is less than 90%, and the relative humidity change rate does not exceed 5% per hour to avoid condensation.

（4）Do not install the inverter in an environment with air pollution such as large dust, corrosive or explosive gas, conductive dust, etc.

（5）The frequency converter should be installed on a solid and vibration-free site.

（6）A reliable grounding point should be provided (the grounding point should have an obvious grounding mark).

2. Equipment installation and civil engineering layout drawing (Note: The following takes 6KV/710KW＜P≤1250KW one-to-one inverter as an example)

□ The load-bearing pressure of the ground foundation is P>4000Pa

□ Base for 10 # national standard channel steel welded closed frame to become a whole, welded and polished smooth, requires a flat surface.

□ Base support channel steel framing requires two coats of rust-resistant paint primer.

□ After the inverter is in place, the base of the inverter is spot welded to the channel steel of the foundation base, and the plant net is grounded.

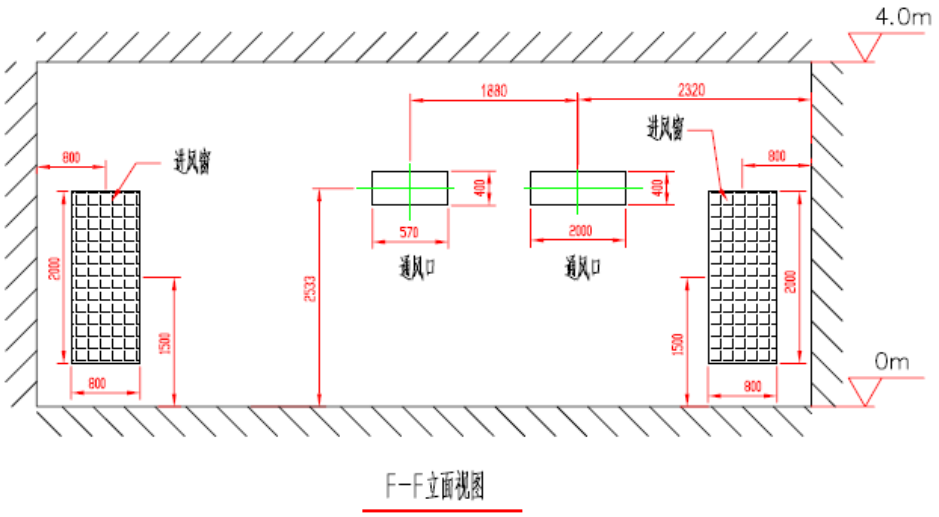


Figure 8-1 Civil Engineering Layout (Elevation View)

During the civil construction of the plant, one wall was reserved as an opening, and the wall was built after the inverter equipment was transferred into position.

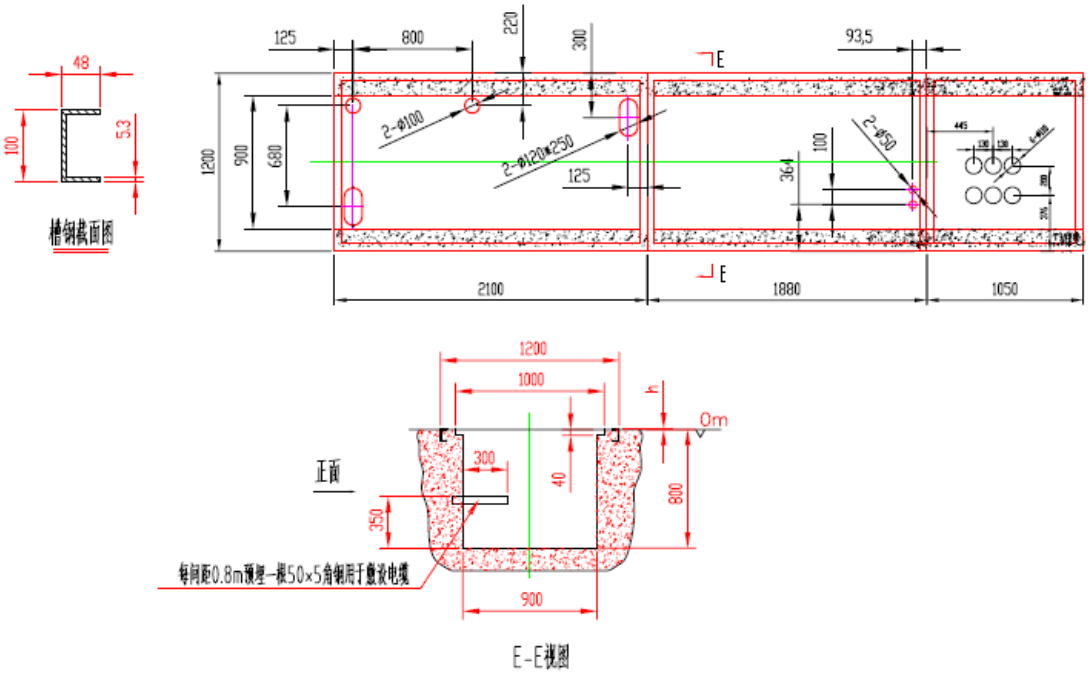


Figure 8-2 Diagram of cable trench and channel foundation

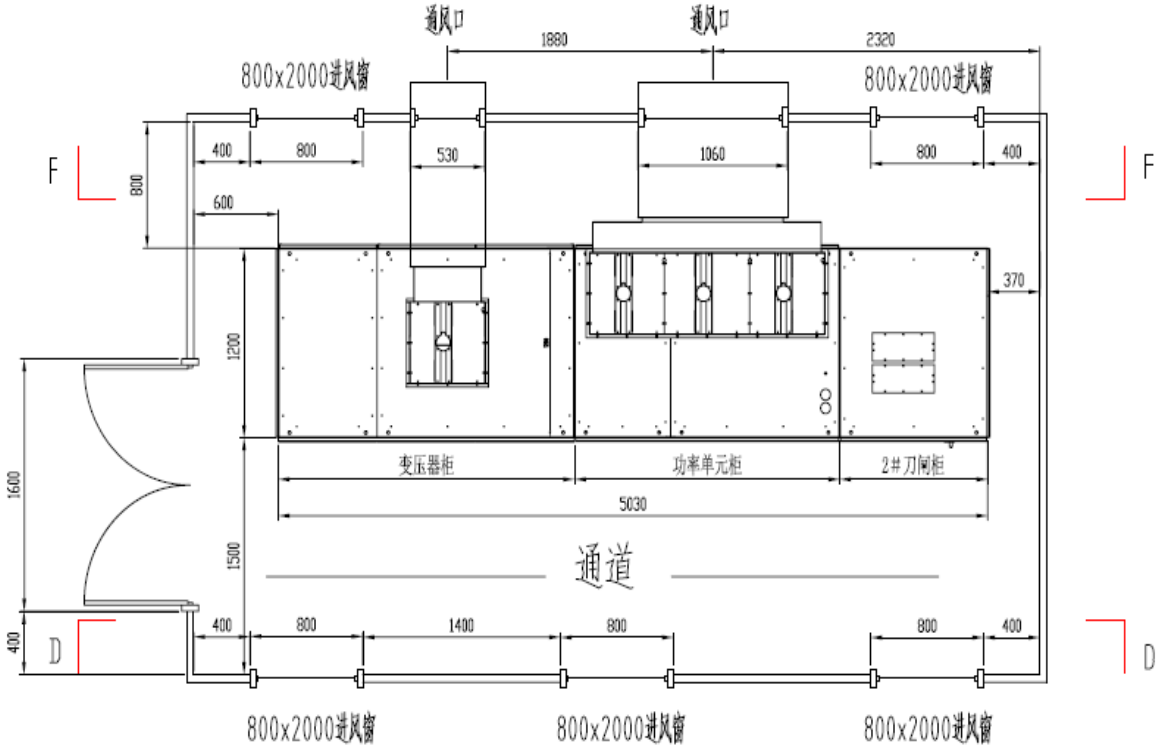


Figure 8-3 Civil Engineering Layout (Plan)

☐ The reference value for the height of “h” from the ground is 2mm, which can be adjusted slightly by the technical requirements of the site

☐ Users according to the actual situation of the site dug cable trench and the cable trench through. Air inlet window for high-voltage inverter air inlet

☐ In order to prevent larger dust particles from entering the high-voltage inverter, a flat-type primary filter (G4) must be installed to filter the air

☐ Double door lower closure, upper stainless steel strainer

☐ The inverter is evenly spaced from the surrounding walls at spatial intervals

☐ Ground foundation bearing pressure P>4000Pa

☐ The walls are painted white and the concrete floor is covered with 4mm thick insulating rubber mats

☐ Three lights are installed at the top of the passageway.

3. Cabinet installation

When the inverter equipment is installed, considering the needs of ventilation and heat dissipation and operation space, the distance between the back of the

whole set of devices and the wall is recommended to be not less than 500mm, the distance between the top of the devices and the roof space is recommended to be not less than 1000mm, and the distance between the front of the devices and the wall is recommended to be not less than 1500mm. all cabinets should be firmly installed on the base and be reliably connected to the earth of the plant. The cabinets should be connected to each other as a whole. During installation, the inverter should be prevented from impact and vibration, all cabinets should not be inverted, and the tilt angle should not exceed 30 degrees.

5. Electrical Installation

The electrical installation mainly includes the input and output high-voltage cables from the cabinet to the site, the connecting wires between the cabinets, and the wiring of the control and signal lines between the cabinet and the site.

1 Input/output high voltage cable, control cable

(1) Schedule: Recommended selection of high-voltage cables and control cables

Control cable 1: KVVP22-3×1.0 (analog), 3 cables are required according to the standard user interface

Control cable 2: KVVP22-10×1.0 (switch value), 2 cables are required according to the standard user interface

Control cable 3: KVVP22-5×1.5 (to the user switch cabinet), 1 cable is required according to the standard user interface

Control power cable model: KVVP22-4×2.5, 1 cable is required according to the standard user interface

Table 8-2 High-voltage cable selection table (taking 6kV as an example)

Inverter model	Adapted motor (kW)	Input cable
-Y6KV/500	300－500	YJV-6KV-3*50
-Y6KV/800	700－800	YJV-6KV-3*70
-Y6KV/1000	900－1000	YJV-6KV-3*95
-Y6KV/1350	1100－1250	YJV-6KV-3*120
-Y6KV/1600	1400－1600	YJV-6KV-3*150
-Y6KV/2000	1800－2000	YJV-6KV-3*185

The high-voltage cables of 3KV and 10KV inverters are converted according to the rated current of the motor. Please refer to the above table for selection. If the length of the input high-voltage cable from the high-voltage switch cabinet to the inverter and the length of the output high-voltage cable from the inverter to the

motor exceeds 1000 meters, the recommended cable diameter should be a cable with a larger specification.

（2）High voltage cable and control cable wiring diagram 8-5

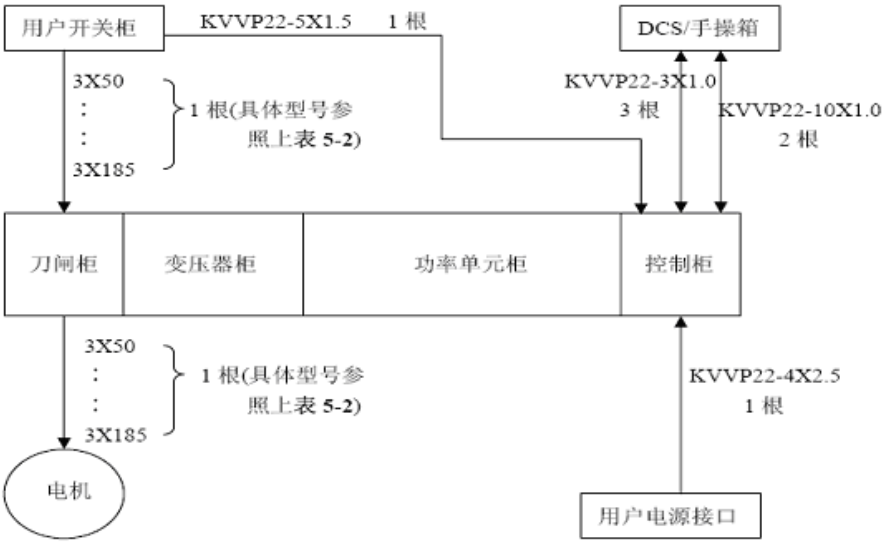


Figure 8-5 Schematic diagram of high-voltage cable and control cable wiring

2. Connecting lines between cabinets

3. Connection of power lines and control signal lines

Table 8-3 User interface table

Number	Signal description	Line number
1	Remote frequency conversion start signal	Standard_Start+
		Standard_Start-
2	Remote frequency conversion stop signal	Standard_Stop+
		Standard_Stop-
3	Remote reset signal	Standard_Reset+
		Standard_Reset-
4	frequency lock signal	Fre_locked+
		Fre_locked-
5	Emergency stop signal	E_Stope+
		E_Stope-
6	Remote power frequency start	Bypass_Start+
		Bypass_Start-
The following 4 public terminals		COM1
7	Frequency converter operation instructions	HVF_Running
8	Drive ready indication	HVF_Ready
9	Frequency converter fault indication	HVF_Tripped
10	Frequency converter alarm indication	HVF_Alarm
11	Distant given frequency	Freq_Input+
		Freq_Input-

12	AI backup	Spare_AI1+
		Spare_AI1-
13	Motor current output AO	Moter_Amps+
		Moter_Amps-
14	Motor speed output AO	Moter_Freq+
		Moter_Freq-
15	User switch 1 closing allowed	Sw_Permitting1+
		Sw_Permitting1-
16	Jump user high voltage switch 1	HVF_OffInputCom1
		HVF_OffInputNo1
		HVF_OffInputNc1
17	User switch 2 closing allowed	Sw_Permitting2+
		Sw_Permitting2-
18	Jump user high voltage switch 2	HVF_OffInputCom2
		HVF_OffInputNo2
		HVF_OffInputNc2