ACH100 Series High-Voltage Variable Frequency Speed Regulation (VFSR) System

User Operation Manual (V5.1)

SUZHOU VEICHI ELECTRIC Co., Ltd.

2019

Declaration

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SUZHOU VEICHI ELECTRIC Co., Ltd.

Introduction

Thank you for investing in VEICHI High-voltage Variable Frequency Speed Regulation (VFSR) system of SUZHOU VEICHI ELECTRIC Co., Ltd.

This manual belongs to the user's files.

As applied to understand, this manual provides enough information. If you would use ACH100 series High-voltage VFSR safely and reliably, which can fully enjoy the advanced design idea, strongly recommend that you read this manual, especially the safety rules and the part of the warning.

You can also get perfect effective information from the following sources.

The local offices

Please contact the local office in your area, to consult relevant services, prices and to debug matters.

Technical Support Center

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CONTENTS

I. Instructions for safe use

Description of signs

 : "Caution" sign. If you do not operate the equipment according to the requirements, you may be moderately or slightly injured, or material loss may occur.

 : "Danger" sign. If you do not operate the equipment according to the requirements, the equipment may be badly damaged or you may be seriously injured.

Safety guidelines

Before the installation and operation of ACH100 series High-voltage VFSR, please carefully read this manual. It contains the necessary information for the equipment to play sound performances and to avoid error operating.

- The safety instructions are applicable to all operation of ACH100 series High-voltage VFSR. Ignoring them can cause bodily injury and even death.

- Only certified specialty personnel familiar with electrical related rules and regulations are allowed to install and maintain equipment.

- The High-voltage VFSR is high voltage equipment. Please do not make maintenance in charged. Also please do not open the Cabinet Door at least an hour after the high voltage power supply is off, therefore power modules can fully release their capacitors' voltage to keep safe work.

- It is very important that strictly according to the manual wiring instructions. Error connection may damage VFSR or other equipment connected with it.

- The content of this user manual describes the characteristics of the product, but usually not product guarantee. If there is any doubt, please timely put forward to my company.

- Please, process packaging waste in accordance with the relevant laws and regulations clause, and pay attention to recycle the packaging material.

1.1. Installation

 Danger
1. Keep combustible materials away from the equipment to prevent the risk of fire. 2. To prevent the risk of explosion, do not install the product in an environment with explosive gas.


Caution

1. It is very important. To keep high-voltage VFSR operating normally and safely, ensure transporting, storing, placing and installing by correct way, as well as careful operating and maintaining.
2. During transporting and storing, must ensure the high voltage inverter does not suffer from physical impact and vibration, it is also necessary to ensure that are not affected by rain and is not stored in the high temperature environment.

1.2. Wiring


Danger

1. To prevent the risk of electric shock, wiring must be performed by workers with certified qualification.
2. To prevent the risk of electric shock, wiring can be started only after the input power is confirmed to be fully disconnected.
3. To prevent the risk of electric shock, the grounding terminal of the VFSR system must be properly grounded.


Caution

3. To prevent the risk of property damage, main loop terminal must be securely connected with conducting lug.
4. To prevent the risk of property damage, it is strictly prohibited to connect the terminal on the control board to AC 220V or 380V power.
5. The exposed portions of the lug connecting the main loop and cable must be well bound with insulation tape to prevent the risk of short-circuit explosion and property damage.

1.3. Operation


Danger

1. VFSR system is high-voltage hazardous equipment, so any operator concerned must operate it in strict accordance with the operating regulations.
2. Parameters have been set up logically along with the installation of the equipment, so the user is not allowed to revise and set up the parameters of the system at random without the manufacturer's permission.

3. When the system needs to be powered up, firstly the control system shall power up; close the breaker only when the high-voltage closing signal sends out high voltage “Closing permit”.
4. To avoid danger, when the inverter runs，do not open the cabinet door and perform wiring operation.
5. The workers on duty without certified training are not allowed to perform operation on touch screen.


Caution

1. The persons not related to operation shall keep a safe distance away from the operating site.
2. The equipment is provided with touch screen, so please remember not to knock or scratch it with hard objects.

1.4. Maintenance


Danger

1. Overhaul and maintenance can be performed more than 10 minutes after main power circuit powers off, in order to prevent injury caused by the voltage left in circuit or scolding by the radiator.
2. If the storage time of the device is more than 2 years, check the insulation resistance with a megohmmeter before power up, or gradually increase voltage with a voltage regulator to prevent the risk of electric shock or explosion.
3. Maintenance, replacement of parts, or replacement of power unit must be implemented by specialized technical personnel; they shall also check whether there are tools, elements, conducting wires or others left in the machine.
4. The boxes for packing this equipment can be repeated use of packaging. Please keep them for future use or return to the manufacturer

Ⅱ. Product overview

2.1. Features of ACH100 series VFSR system

The ACH100 series High-voltage VFSR System is independently researched and developed and produced by SUZHOU VEICHI ELECTRIC Co., Ltd., for driving and speed regulating AC motors drive. The following detail shows its features:

● Independent development of sinusoidal PWM control technology with fast response, high precision. The frequency conversion efficiency is over 98%

● Using the power unit series folding wave technology, mature technology, reliable performance

● Power unit modular structure, easy to maintain

● High-voltage VFSR system output voltage with AVR (automatic voltage regulation) voltage stabilizing function, prevent damage of the insulation of the high voltage to the motor and reduce the loss of motor racing

● Speed start-up (also called speed tracking) function, the realization of motor restart in the rotation, continuous production to meet customer demand

● Torque increase function reduce in the low frequency voltage, improve the motor output torque

● Instantaneous power lost restart function, meet the grid double the power switch and electrical breakdown again

● Power Unit bypass function, a few units failure automatic removal of fault, does not affect the overall frequency converter operation

● Power Unit bypass and automatic reset function, fault element is back to normal after automatic again put into operation, improve the reliability of the inverter

● Color TFT touch screen, provides the English versions of the language, friendly interface, convenient input parameters and to check the system status

Other Features:

● Power unit with the main control board using optical fiber communication, fully electric isolation, anti-jamming ability

● Master power supply dual power supply, the design of the additional UPS, greatly improved the security of the control system

● Perfect protection function design, to ensure the safety of the motor and VFSR

● Isolated RS485 interface and the standard Modbus communication protocol, offers a variety of communication methods

● Fault record and failure parameters function, realized the accurate location of the fault, easy to find and troubleshooting

● ACH100 High-voltage VFSR output and the impact on the network side meet the national standards, without having to install filter, reactive power compensation device, reduce the harmonic governance and the cost of network capacity expansion.

2.2. Principles of ACH100 series VFSR system

ACH100 series VFSR system comprises transformer cabinets, power cabinets, control cabinets and bypass cabinets (optional), as shown in Figure 2.1.

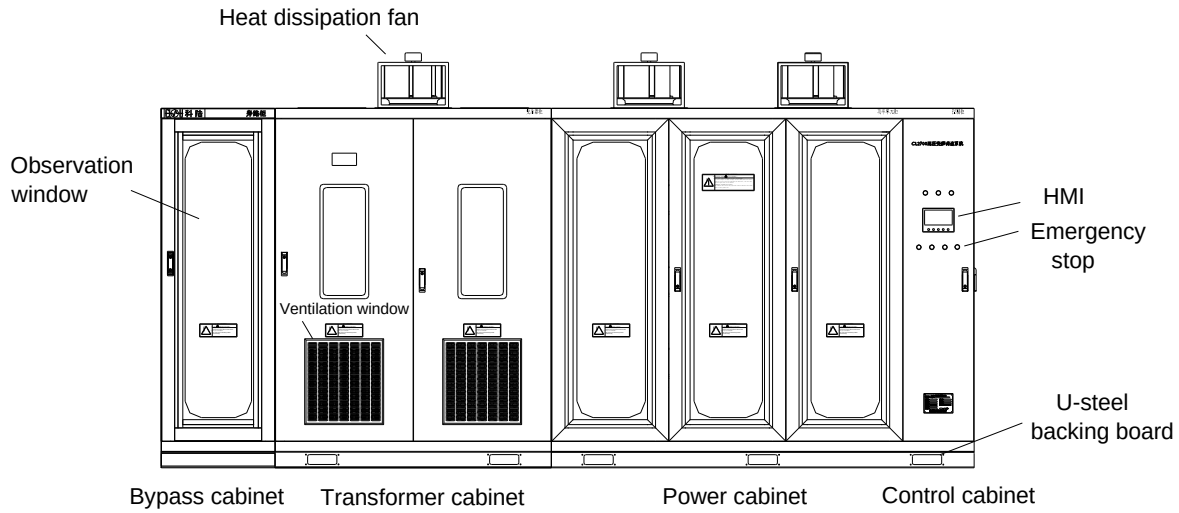


Figure 2.1 Typical composition of ACH100 series-connection H-bridge high-voltage VFSR system

Figure 2.1 shows the composition of main schematic system. The real-life installation modes may vary with the specific products of various series. Moreover, in response to series products below 10kv/1400kW and 6kv/900kw, optimized design scheme has been adopted, thus not only ensuring the reliability, but also enabling the structure to be more compact, lowering the user's requirements for installation space. (The quantity of power cabinets vary with the specific capacity of devices.)

Figure 2.2 is the principle scheme for the power circuit of series-connection H-bridge high-voltage VFSR system (5 series/phases). In standard inverter, for 6kV, each phase includes 5 power units. For 10kV, each phase includes 8 power units (But for non-standard inverter, such as 6.6kv, each phase includes 6 power units).

Figure 2.3 is the principle scheme for power unit of Series-connection H-bridge high-Volt VFSR.

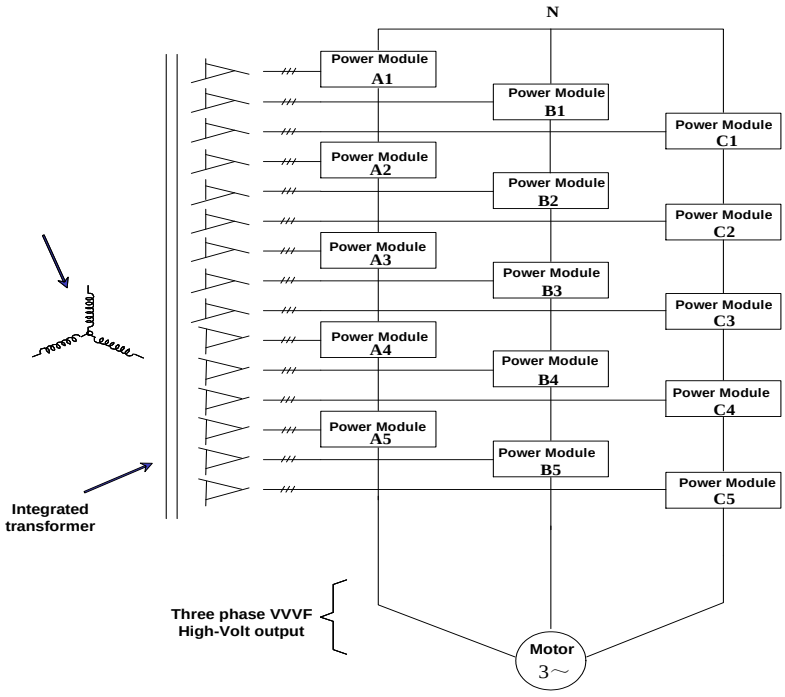


Figure 2.2 Principle scheme for the power circuit of series-connection H-bridge high-voltage VFSR system (6 series/phases)

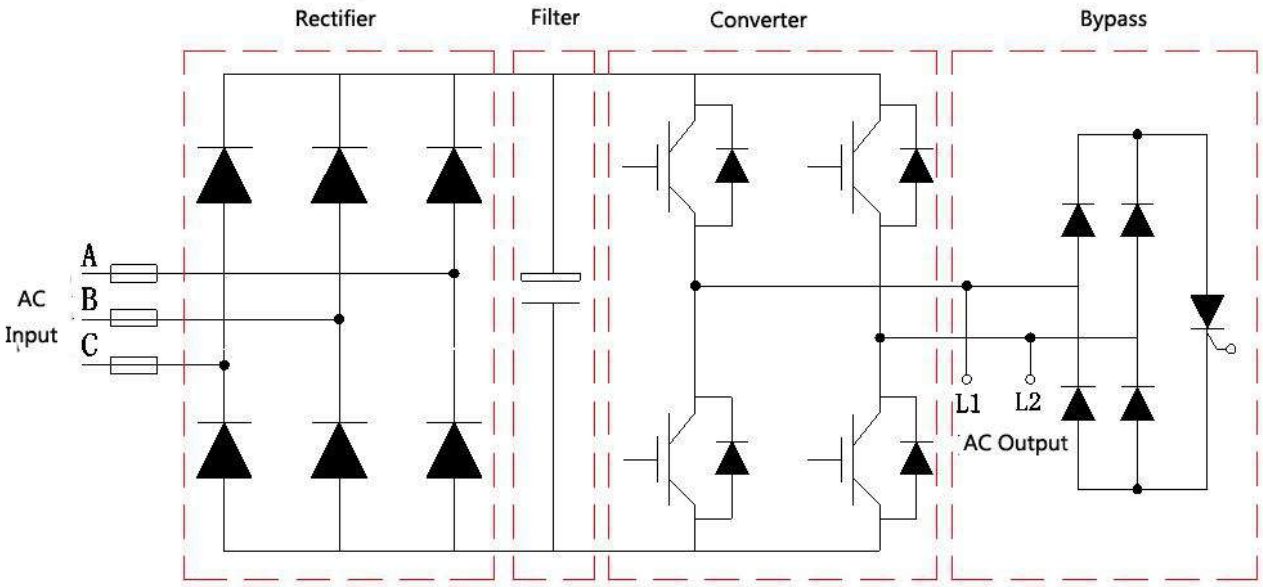


Figure 2.3 Internal circuit principle scheme of single power unit for H-bridge

2.2.1 Composition of bypass cabinet

Bypass cabinet is optional. The user may not use bypass cabinet. The high-voltage input and output cables are connected through the wiring terminals in transformer cabinet and power cabinet. If using bypass cabinet, select “one-driving-one” or “one-driving-two” control mode; or select manual bypass or auto bypass control mode; the composition of the bypass cabinet varies correspondingly.

The bypass cabinet in manual bypass mode is mainly composed of vacuum contactor and isolation switch, as shown in Figure 2.4. The manual shifting between variable frequency and power frequency operation can be realized during application. When overhauling high-voltage variable frequency device, the closing of bypass isolation switch can supply high voltage power for high-voltage motor from grid directly without affecting the user’s utilization; while the disconnection of variable frequency isolation switch, featuring conspicuous physical breakpoint, can guarantee the personal safety of overhaul staff. Mechanical interlocking function between bypass isolation switch and variable frequency isolation switch can prevent the power frequency loop and variable frequency loop from simultaneous conduction. Vacuum contact is used for precharge loop.

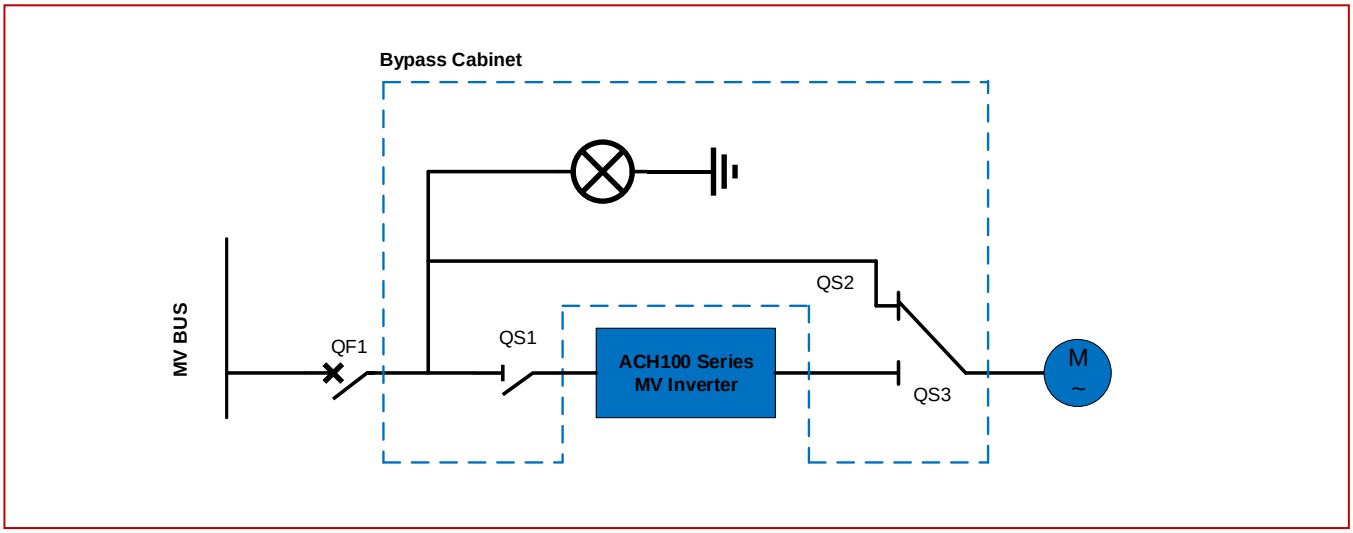


Figure 2.4 Bypass cabinet in manual mode

The bypass cabinet in manual mode is mainly composed of vacuum contactor, isolation switch and other devices, as shown in Figure 2.5. Manual operation is not needed. Automatic control is realized through the IO panel of the control cabinet. When the system has a fault, automatically cut off the three-phase outputs from the inverter output to motor and switch to power supply directly from grid, resulting in no shutdown of the system. The bypass cabinet in automatic bypass mode is equipped with Isolation switch QS1 and QS2 inside. The isolation switch is closed in normal conditions, and disconnected when overhauling the inverter, with conspicuous physical breakpoint, thus guaranteeing the personal safety of overhaul staff.

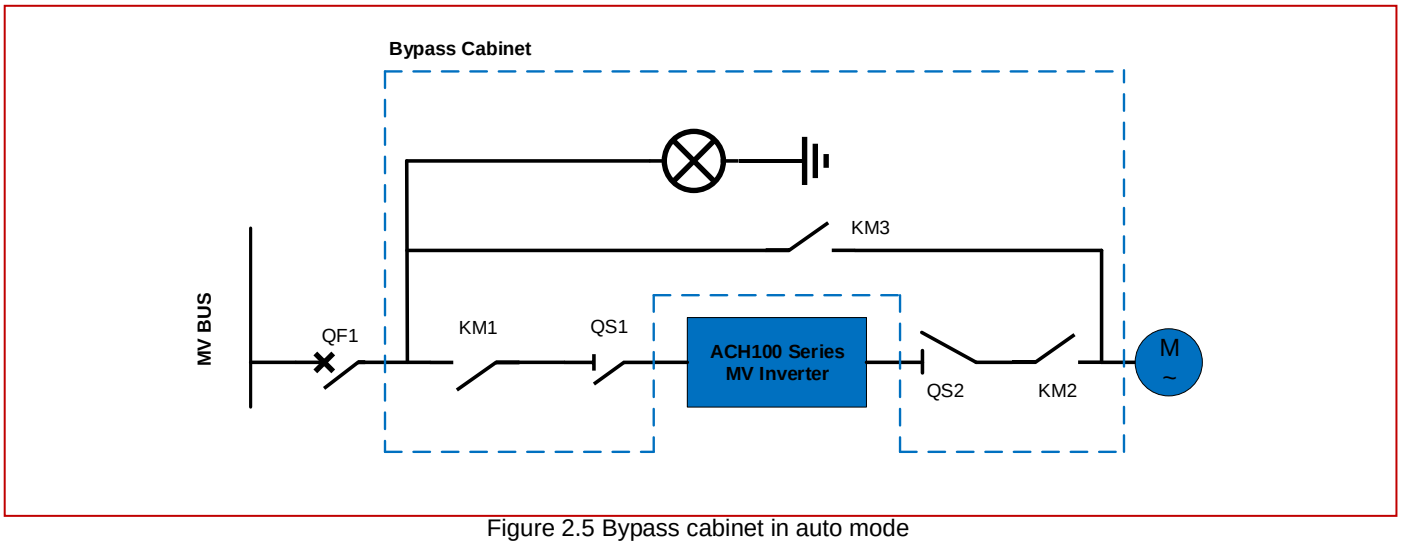


Figure 2.5 Bypass cabinet in auto mode

2.2.2 Composition of transformer cabinet

The transformer cabinet is mainly equipped with high-voltage isolation phase-shifting transformer inside. Take the 6kV high-voltage VFSR system as an example. When adopting 1700V-level IGBT, each phase in the power cabinet is composed of 5 or 6 power units. The power for these units is all supplied by the secondary side of the isolation phase-shifting transformer. The difference between the neighbouring phases on the secondary side is one phase. Multiple series-connection rectification can be realized. In the primary side of the phase-shifting transformer, the currents converted on the secondary side are superimposed, and then it is found that the current waveform is very similar to sine wave. Therefore, the harmonic interference of grid is slim, totally satisfying the requirements of various international and national standards including IEEE 519-1992 and GB/T14549-93. Meanwhile, the power factor of the system is improved. The transformer cabinet also includes temperature monitor controller and temperature measuring point inside (the temperature controller is installed inside the transformer cabinet). It monitors the temperature of each-phase winding circularly in real time. When the temperature is higher than the preset value, the 6 cross flow fans at the bottom of the transformer cabinet start up to eliminate heat. The transformer temperature monitor cans feedback the information of transformer fault to the control cabinet to ensure the reliable operation of the transformer.

2.2.3 Composition of power cabinet

Power cabinet is the core component of main circuit of inverter power. It is composed of many of the same power units. The output voltages of various power units series-connected after superposition form the three-phase voltages from output to motor.

Take the 6kv / 5 unit high-voltage VFSR system as an example. Each phase includes 5 power units, while the output voltage for each power unit is AC 692V, then the phase voltage is 5×692, namely 3464V, and the phase-to-phase voltage is 6kV correspondingly.

If the device designed is 10kV VFSR system, each phase includes 8 power units.

The adoption of the optimized PWM (Pulse Width Modulation) control technology with proprietary intellectual property rights enables the voltage waveform of motor very similar to sine wave with small harmonic wave content and low dv/dt, without additional wave filter required, which can directly output to normal asynchronous motor and have no requirements for the length of the cable from inverter to motor. High-speed fiber can be used for communication between power units and control cabinet, thus effectively avoiding electromagnetic interference and improving the reliability of the system.

2.2.4 Composition of control cabinet

Control cabinet is the core of the whole high-voltage VFSR system. It performs logic processing and calculation according to local or remote operation and setting, through collecting the voltage and current analogue quantity in system as well as various switching value, and then determines and controls the actions of various power units, further driving the motor and meeting output requirements.

Control cabinet contains UPS (Uninterruptible Power Supply), breaker, DSP control panel, IO panel, fibre optic panel, LCD operation human-machine interface and control buttons, switches and others inside, wherein the calculations are all executed in DSP control panel. The control core is a professionally designed double-DSP (Digital Signal Processor), supplemented by FPGA (field programmable gate array) and CPLD (Complex Programmable Logic Devices). The adoption of them in the inverter not only enables performance of high speed operation and realizes complex control function, but also greatly simplifies the design of control circuit and improves the reliability of control system.

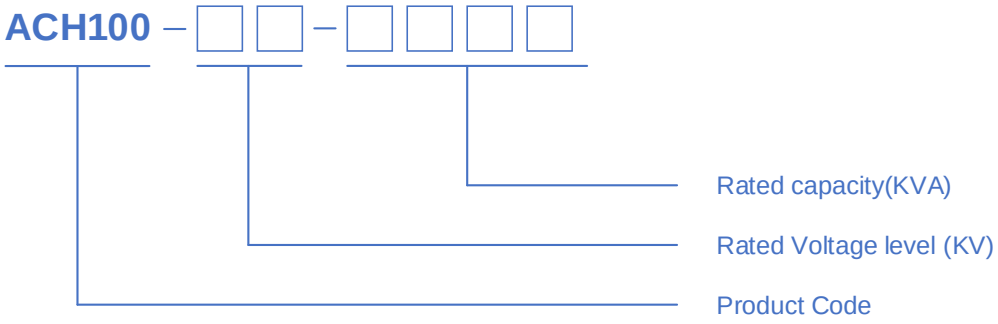
2.3. Performance indexes of ACH100 series VFSR system

Input	Voltage/frequency of main loop	3~10kV, 45～55Hz
	Control loop	Single-phase 220V or three phase 380V, 50Hz/60Hz
	Allowable variation	Voltage: ＋10% (input phase-shifting transformer has ±5% tapping); voltage unbalance factor: <3%, frequency: ±10%
	Input power factor	> 0.95 (>20% rated load)
Output	Applicable motor (kW)	160~3550(3kV), 200~8000(6kV), 250~10000(10kV).
	Rated capacity (kVA)	200~4500（3kV）300~10000（6kV）350~125000（10kV）
	Rated voltage (3-phase)	3~10kV
	Overload capacity of current	1 minute for 120% of rated load; 3 seconds for 150%; immediate protection for 180%
	Output frequency	0.5~120Hz
Operational control characteristics	Inverter efficiency	> 0.97 (under rated load)
	Control mode	VVVF control (High performance automatic slip compensation), simple vector control
	Maximum frequency	50~120Hz
	Basic frequency	20~60Hz
	Starting frequency	0.01~10Hz
	Frequency resolution	Analogue setting: 0.1%; digital setting: 0.01Hz
	Frequency accuracy	Analogue setting: ±0.5% of maximum frequency; digital setting: ±0.1% of maximum frequency
	Acceleration/deceleration time	The low frequency band and the high frequency band are 10~120s and 10~400s respectively.
	Characteristics of voltage/frequency	Constant V/F when under basic frequency, constant power when over basic frequency
	Frequency setting	Digital panel operation or analogue setting (4~20mA), host computer communication setting
Structure	Protection class	IP41, other classes can be tailor-made
	Overall structure	Multi-cabinet type
	Cooling mode	Forced-air cooling by the fan at the top
Output signal	Relay output	250VAC 12A/50VDC 1A
	Open-circuit collector output	24VDC, max. 100mA, output impedance 30~35Ω
	Calibration of analogue meter	50.0～200.0% (minimum unit: 0.1%)
	Output of analogue meter	4~20mA or 0~10V
Protection		Inverter input overvoltage, undervoltage protection, inverter overcurrent protection, inverter overload protection, transformer overheat protection, power unit DC overvoltage, undervoltage protection, power unit communication fault protection, main control power failure protection, etc. Troubleshooting and exception handling.
Application environment		Operating temperature: 0℃～+45℃ Storage temperature: -40℃～+70℃ Relative humidity: 5%～90% (non-condensing) Elevation: <1000m, derating for over 1000m
Safety specifications		High-voltage inverter properly grounded, the resistance of the metal part possibly contacted and enclosure grounding location is no more than 0.1Ω, capable of withstanding the short-circuit impact calculated as per corresponding switch (over 40kA), the grounding point has conspicuous grounding mark. The high-voltage inverter is equipped with electric shock prevention facilities like shielding case inside.

2.4 Series model description of VEICHI VFSR system

2.4.1 Model and meanings of high-voltage VFSR device

The method for formulating the model of high-voltage VFSR device is as below:



2.5. Applicable scope of ACH100 series VFSR system

ACH100 series VFSR system can be widely applied in the following places:

1 Power industry: boiler water feeding pump, supply blower, induced draft fan, etc.

2 Mining industry: Water drainage pump and exhaust fan for shaft, etc.

3 Metallurgy industry: blast furnace blower, steelmaking oxygen generator, dust removal machine, etc.

4 Petrochemical industry: large-scale oil conveyance pump, compressor for chemical production use, etc.

5 Urban construction: tap water supply pump, central air conditioning compressor, etc.

To sum up, in the large-power blowers, water pumps and other machines adopted in power, mine, metallurgy, chemical, transportation and other fields, if ACH100 series VFSR system is used to control speed instead of the traditional mechanical control mode, a significant energy saving effect can be obtained.

Ⅲ. Transportation, storage, installation and wiring

3.1. Description of transportation and storage

3.1.1 Transportation conditions:

The product can be transported by automobile, train, airplane, ship and other tools. The product shall be carefully handled during transportation to prevent exposure to rain, direct sunshine, and also shall be free from violent vibration, impact and upside-down placement. Transportation temperature shall be within -40℃～+70℃.

The maximum height of the inverter device shall be 2950mm and shall be 3250mm after packaging. The transportation shall take the height limit and other factors of the route into account.

3.1.2 Storage conditions

1) Room is well ventilated.

2) Efforts shall be made to avoid high temperature and humid conditions - humidity shall be less than 90%RH; it shall be free from exposure to rain.

3) Free from combustibles, corrosive gas and liquids.

4) Ambient temperature: -40℃～＋70℃

3.2. Mechanical installation

3.2.1 Environmental requirements

To enable the inverter to stably and reliably run for a long period of time, the installation environment shall meet the following requirements:

The minimum ambient temperature is 0°, the maximum is no more than 45° and the variation of the temperature in operating environment for each hour shall be less than 5°. When the environment conditions cannot meet the requirements, an air conditioning device shall be installed in the location; otherwise the system shall be derated for application.

The relative humidity of the field environment shall be less than 90% (at 20°) and free from condensation. The variation of the humidity on site for each hour shall be no more than 5%.

The elevation of the installation site shall be below 1000m; otherwise the system shall be derated for application.

Keep the inverter away from places with high dust content, corrosive or explosive gas, or gas which may destroy insulation, or conductive dust in the air.

The severity level of vibration frequency allowed by the device installation location shall be no more than 150Hz.

3.2.2 Description of cabinet installation

3.2.2.1 Dimensional requirements

See Appendix 3 for the dimensions of ACH100 high-voltage VFSR system.

The clearance between the back of the whole set of the device over 800kW and the wall shall be more than 1000mm. The inverter below 800kW is a small scale device, so considering the fact that power units are provided both in front of and behind the power cabinet, the clearance between the back of the cabinet and wall shall be more than 1500mm. The clearance between the top of the whole series device and the roof shall be more than 1000mm, and that between the obverse side of the device and wall shall be more than 1500mm.

3.2.2.2 Ventilation requirements

Inverter device shall be installed in the place with effective ventilation and heat dissipation. Cooling fan shall be equipped on the top of the inverter. Currently, all models of inverters are air cooled type.

3.2.2.3 Securing requirements

The cabinets of the inverter shall all be firmly installed on the base and reliably grounded in the workshop. Attention shall be paid to ensuring that various cabinets shall be integrated. During installation, the inverter shall be prevented from impact and vibration. The cabinets are not allowed to be placed upside down and the inclination angle shall be within 30°.

3.3. Electric installation

The electric installation of the inverter mainly consists of the input & output high-voltage cables from cabinet to site, connecting lines between cabinets, power lines and signal lines between cabinets and site control system, etc.

3.3.1 Precautions for electric installation


Danger

1. The input and output high-voltage cables must be strictly tested for voltage withstanding.
2. The input and output cables must be separately arranged to prevent danger caused by insulation damage.
3. The signal line from site to inverter device and the electric wire shall be separately arranged, wherein the signal line must adopt twisting method, shielded wire preferably, and one terminal of the shielded wire shall be properly grounded.
4. Keep the cabinet for the inverter device reliably grounded in the workshop to ensure personal safety.
5. When performing electric installation for the device, special grounding electrode shall be buried for the control system with the grounding resistance no more than 2 ohm.
6. Before measuring the insulation resistance of the transformer and performing power frequency voltage-withstanding test, the connecting line between the transformer and power units must be disconnected.

3.3.2 Wiring of main loop

3.3.2.1 Connection of high voltage cable

The main high voltage cables connected with the inverter comprise input 6kV or 10kV power lines and the cables with corresponding level of 6kV or 10kV voltage insulation shall be used. A, B and C are connected with corresponding U0, V0 and W0 terminals of the inverter (L1, L2 and L3 for the input terminals of some series). The three phases from the output of the inverter to motor are 6kV or 10kV high voltage cables as well with the terminals known as U, V and W connecting the terminal of motor directly.

The connection of high voltage cables shall also pay attention to:

- Phase sequence requirements for both input and output;
- Input voltage and inverter voltage requirements match;
- The cable diameter and voltage withstanding for input and output shall meet the requirements;
- The high voltage switch on power side shall be provided with effective lightning-protection measures.

3.3.2.2 Connection between cabinets

The connecting line between cabinets shall be removed for the first on-site installation or major overhauling. Re-connection shall take the following aspects into consideration:

Before removing the connecting line between cabinets, check whether there is damage or loss on the connecting trough and connecting line mark; in case of damage or unidentifiable condition, the person performing the removal shall make conspicuous mark.

Any operation involving the connecting line between cabinets, including the power cables between transformer cabinet and power cabinet, as well as other control signal lines, shall be performed by the specialized servicing workers from the manufacturer. To prevent a serious safety accident, the user shall not implement re-connection or removal without permission.

3.3.3 Wiring of control circuit

3.3.3.1 Connection of control power

Description of power route	Line No.
External 220V power supply L	U30
External 220V power supply N	N30
Transformer power supply U	U31
Transformer power supply V	V31
Transformer power supply W	W31
Transformer power supply N	N31

3.3.3.2 Digital multi-functional terminals

Multi-function input:

DESCRIPTION OF SIGNAL	LINE NO.	DEFAULT FUNCTION
DI MULTI-FUNCTIONAL TERMINAL 1	X1	RUNNING PERMIT
DI MULTI-FUNCTIONAL TERMINAL 2	X2	EXTERNAL PULSE START
DI MULTI-FUNCTIONAL TERMINAL 3	X3	EXTERNAL PULSE STOP
DI MULTI-FUNCTIONAL TERMINAL 4	X4	EXTERNAL FAULT
DI MULTI-FUNCTIONAL TERMINAL 5	X5	EXTERNAL RESET
DI MULTI-FUNCTIONAL TERMINAL 6	X6	NO
DI MULTI-FUNCTIONAL TERMINAL 7	X7	NO
DI MULTI-FUNCTIONAL TERMINAL 8	X8	NO
COMMON POINT		COMMON POINT

Multi-function output:

DESCRIPTION OF SIGNAL	LINE NO.	DEFAULT FUNCTION
DO MULTI-FUNCTIONAL TERMINAL 1	Y1（Y1A、Y1B）	REMOTE CONTROL
DO MULTI-FUNCTIONAL TERMINAL 2	Y2（Y2A、Y2B）	SYSTEM READY
DO MULTI-FUNCTIONAL TERMINAL 3	Y3（Y3A、Y3B）	RUN
DO MULTI-FUNCTIONAL TERMINAL 4	Y4（Y4A、Y4B）	WARNING
DO MULTI-FUNCTIONAL TERMINAL 5	Y5（Y5A、Y5B）	FAULT
DO MULTI-FUNCTIONAL TERMINAL 6	Y6（Y6A、Y6B）	NO
DO MULTI-FUNCTIONAL TERMINAL 7	Y7（Y7A、Y7B）	NO
DO MULTI-FUNCTIONAL TERMINAL 8	Y8（Y8A、Y8B）	RUN (FIXED)

3.3.3.3 Multi-functional terminal of analogue quantity

The system reserves 2 channels of input for analogue quantity and one channel special for frequency analogue signal demand to the user with the configuration of DC4～20mA current type. The terminals and corresponding line numbers are as below:

Description of signal	Line No.	Default function
Analog input 1+	IR+	Reserve
Analog input 1+	IT+	Reserve
Analog input 1+	FEST+	Frequency given
AGND	EG	
Analog output 1	A0	Setting frequency
Analog output 1 GND	CG	
Analog output 2	A1	Actual Speed
Analog output 2 GND	CG	
Analog output 3	A2	Output current
Analog output 3 GND	CG	
Analog output 4	A3	Output Voltage
Analog output 4 GND	CG	

Ⅳ. Description of standard operation of the VFSR system

4.1. Buttons on door and switch description

The indicators and operation buttons on the panel of the control cabinet are divided into two types: automatic bypass cabinet and manual bypass cabinet. Automatic bypass cabinet has additional “variable frequency/power frequency operation mode” and “high voltage closing-opening” operation buttons compared with the manual bypass cabinet mode. Take the control cabinet in manual mode as an example, as shown in Figure 4.1:

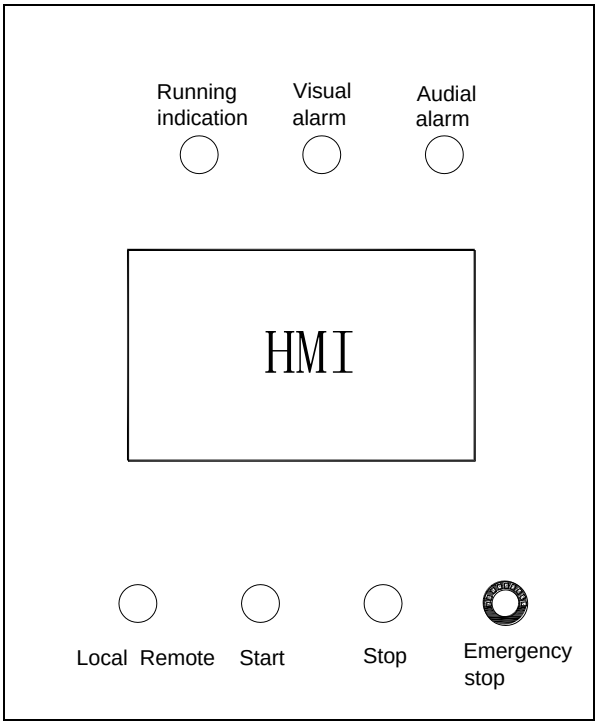


Figure 4.1 Arrangement of door panel of control cabinet in manual bypass mode

Centering on touch screen, audible and visual alarm indicator in the upper part; “running indication”, “start/stop control” and “local/remote” switch in the lower part from left to right, “emergency stop” button on the rightmost side.

4.2 Control interface

The operating interface of the ACH100 series product is mainly classified into 5 parts as shown in Figure 4.2, wherein, the status bar and 8 buttons at the bottom are constantly displayed (each page has such contents and displays the same contents), other contents vary along with the contents on the current interface, all buttons are operated through touching screen.

4.2.1 Title bar

Title succinctly representing the company name or the contents of the current interface

4.2.2 Main display part:

The middle part of the screen is main display interface. Main status information and setting input are displayed

and completed in this area. The display contents will be detailed according to the pages by parts.

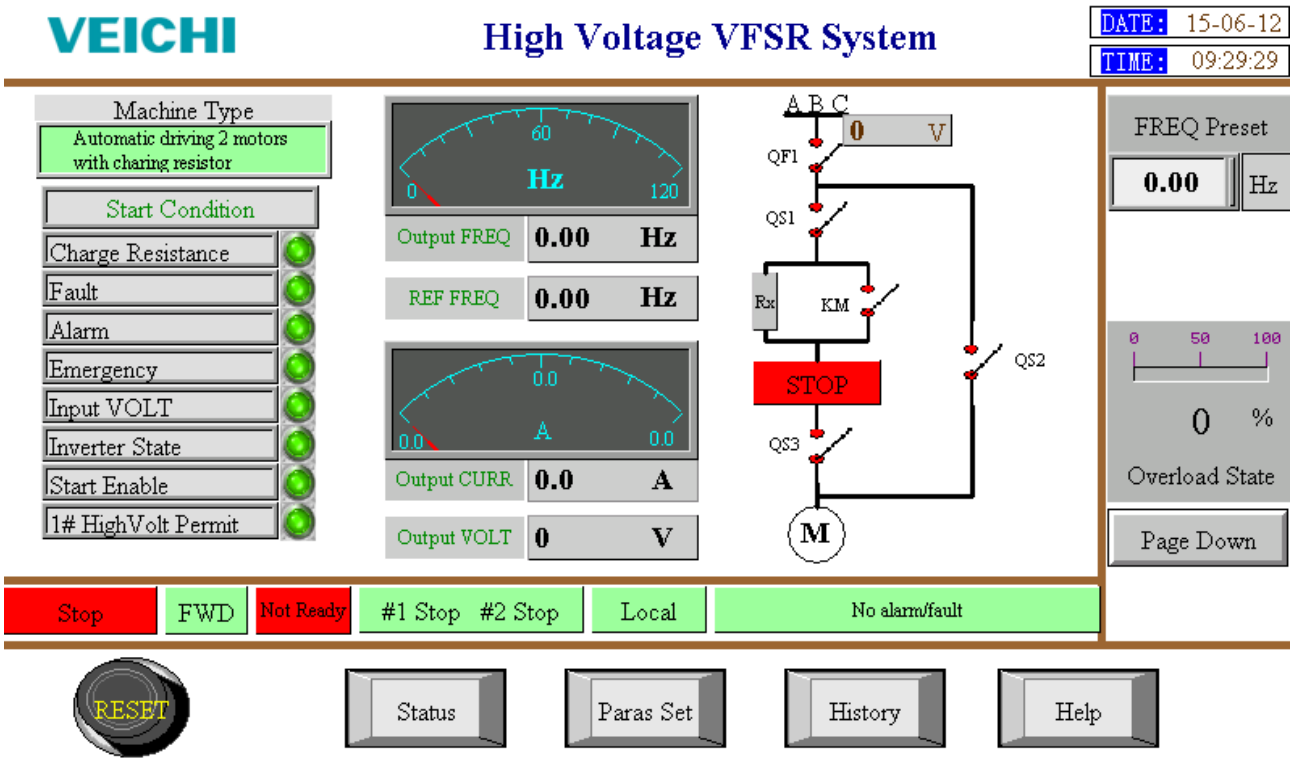


Figure 4.2 Main operating interface of LCD touch screen of ACH100 high-voltage VFSR system

4.2.3 Status bar:

This part includes fixed display contents on each page so that the operator performs real-time monitor system. Status bar is divided into six groups:

4.2.4 The first group to the fourth group:

The first group: “running” and “system shutdown”.

The second group: “Forward” and “Reverse”.

The third group: “Ready” and “Not Ready”.

The forth group: Breaker combination, according to a detailed display and the state (contact) are shown in table 4.1

Type of VFSR	Knife combination of state	KM1/QS1	KM2/QS2	KM3/QS3	KM4/QS4	KM5/QS5	KM6/QS6
1 by 1	VF	Closed	Closed	Break			
	Bypass	Break	Break	Closed			
	STOP	Break	Break	Break			
1 by 2	#1 STOP / #2 STOP	Break	Break	Break	Break	Break	Break
	#1 VF / #2 STOP	Closed	Closed	Break	Break	Break	Break
	#1 Bypass/#2 STOP	Break	Break	Closed	Break	Break	Break
	#1 STOP/#2 Bypass	Break	Break	Break	Break	Break	Closed
	#1 STOP / #2 VF	Break	Break	Break	Closed	Closed	Break
	#1Bypass/#2Bypass	Break	Break	Closed	Break	Break	Closed
	#1 VF / #2 Bypass	Closed	Closed	Break	Break	Break	Closed
	#1 Bypass / #2 VF	Break	Break	Closed	Closed	Closed	Break
Failure state	#1 FAULT / #2 STOP	Machine #1 FAULT					
	#1 FAULT/#2 Bypass						
	#1 STOP / #2 FAULT	Machine #2 FAULT					
	#1 Bypass/#2 FAULT						
Abnormal state	Abnormal Knob Position	Frequency knobs do not meet the operation specification					
	Abnormal Breaker Position	Contactor or breaker Abnormal					

Description: KM and QS label described in Appendix 1

TABLE 4.1 Breaker Combination

The fifth group: “Local control” and “Remote control”.

The Six group is about fault and alarm records. Wherein, fault is displayed on red background and alarm is displayed on yellow background. When the system only has one piece of alarm information (without fault information), the prompt box of text information keeps displaying this alarm information until the alarm and fault information of the system changes; when the system has 2 or more pieces of alarm information (without fault information), the system will display the alarm information circularly until the alarm and fault information of the system changes; when the system only has one piece of fault information (without alarm), the prompt box of text information keeps displaying this fault information until the alarm and fault information of the system changes; when the system has 2 or more pieces of fault information, the prompt box of text information keeps displaying the earliest fault until the alarm and fault information of the system changes; when the system has both alarm and fault information, the system will latch-display the fault information detected for the first time.

4.2.5 Lower functional keys (5 pieces)

4.2.5.1 The left one: "Reset".

When an alarm event occurs, press the reset button, the following effect.

- Alarm signal is generated when the lift drive running or stopped
- When an alarm occurs in operation, after pressing this button, the alarm buzzer will be closed
- If the alarm has been lifted, all alarm indicator will turn off, fault and alarm display box in the status bar will no longer display is cleared of alert source
- If the alarm persists, the control counter board alarm indicator and remote alarm indicator continues to alarm,

fault and alarm display box in the status bar will continue to display the alarm source

- The operation will be recorded in the operating part of the bar history is recorded (if no records, you may not have a successful response button), on the "operational records" column will be described in detail in the history section

When a fault event occurs, press the reset button, the following effect

- Fault signal is generated when the lift drive running or stopped
- When downtime, press this button alarm buzzer will be closed
- If the fault has been lifted, all alarm indicator will turn off, fault and alarm display box in the status bar will no longer display the fault source is cleared
- If the problem persists, then you need to carefully check the source of the problem, after troubleshooting to press the "fault reset" to reset the drive
- The operation will be recorded in the operating part of the bar history is recorded (if no records, you may not have a successful response button), on the "operational records" column will be described in detail in the history section

4.2.5.2 “Status display”, “parameter setting”, “history” and “help”

These 4 keys are used to access different display interfaces. "Status display" button corresponding to the start time display interface; and "Parameter Settings" button to set the corresponding interface; "History" is used to display the history of faults; "Help" button will jump to the help screen.

4.2.5.3 Functional keys on the right

This part of keys mainly includes “previous page”, “next page” and “save the setting”, but the contents may vary according to different pages.

The main interface real-time displays the related operating parameters of VFSR system. They are detailed respectively below:

4.2.6 Set frequency

Display the given frequency of the high-voltage VFSR system. When the frequency given source is set to be digital giving, click “revise given frequency button” on the main interface to revise the frequency, then click “given frequency saving” on the main interface to save the revision. If the input frequency is over the parameter limit scope, this operation will be invalid. If the frequency given source is set to be analogue giving, the giving is made by DCS system analogue quantity (DC4-20mA) through analogue input terminal; when the frequency given source is set to be terminal giving, read the given value from the multi-functional digital input terminal (multi-stage x rotating speed fluctuation); if the frequency given source is set to be communication giving, the upper hose computer may give the value through main board communication system (232/485 communication port).

4.2.7 Output frequency:

Display the output frequency of the high-voltage VFSR system. During open-loop operation, when the VFSR system accelerates or decelerates, the operating frequency and given frequency may be temporarily different; after up to steady state, the output frequency and set frequency will be equal. If in external closed-loop mode, the output frequency will be automatically adjusted by site feedback quantity.

4.2.8 Output current:

The effective value of the current of actual output wire for the high-voltage VFSR system; unit: Ampere (A).

4.2.9 Output voltage:

The effective value of the voltage of actual output wire for the high-voltage VFSR system; unit: kilovolt (kV).

4.2.10 Overload rate of device:

Reflect the inverse time limit treatment when the VFSR system is in over current operation in the form of progress bar.

Click “next page” to enter into the second page of status display, as shown in Figure 4.3.

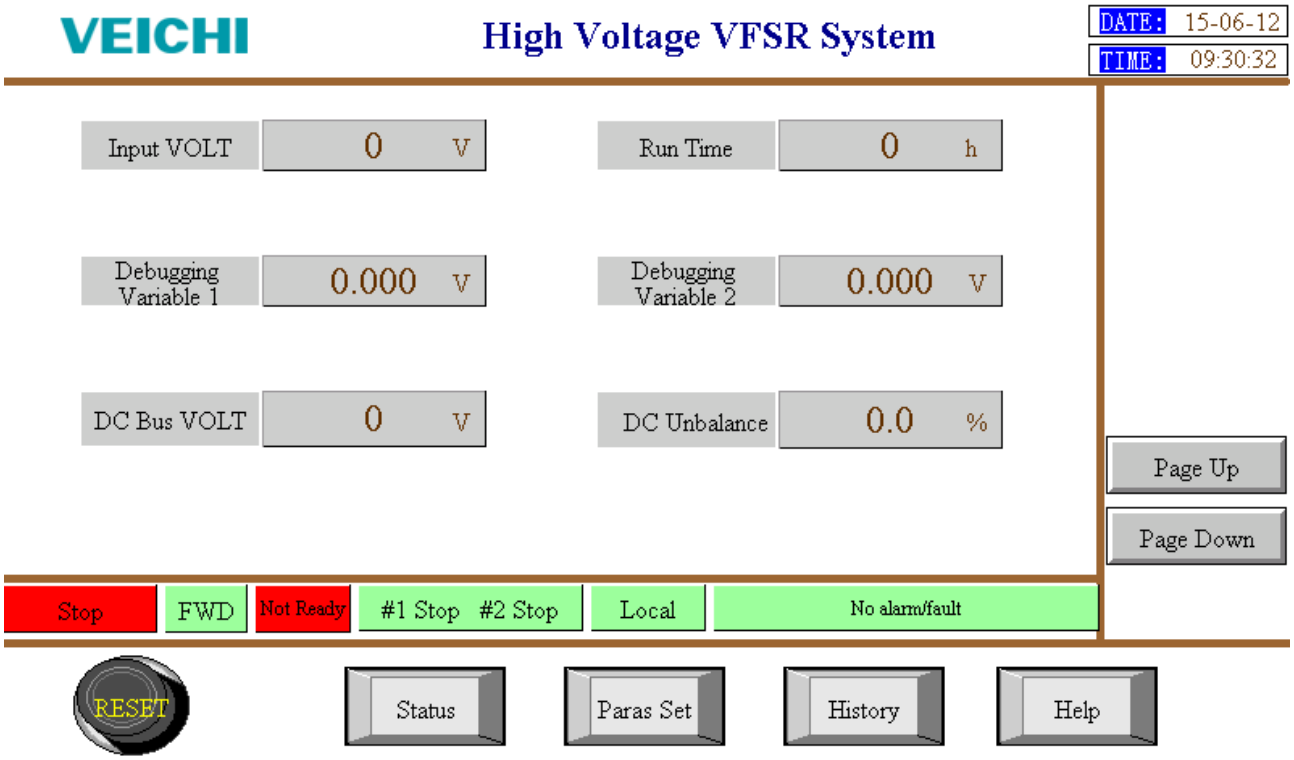


Figure 4.3 The second page of status display of the LCD touch screen of ACH100 high-voltage VFSR system

The variables displayed in this page are detailed as below:

4.2.11 Input voltage:

The voltage effective value of actual input wire of the high-voltage VFSR system; unit: volt (V).

4.2.13 Operating time:

Actual operating time of the high-voltage VFSR system; unit: hour.

4.2.14 DC voltage:

The DC voltage value in the power units of the high-voltage VFSR system; unit: volt (V).

4.2.15 DC voltage unbalance degree:

The mean value of three samples taken from DC voltage value in multiple power units respectively in the three phases of the high-voltage VFSR system

4.2.16 Debugging variable 1 and debugging variable 2:

For testing use by the debugging personnel from the manufacturer

Click “next page” to enter into the third page of status display, as shown in Figure 4.4.

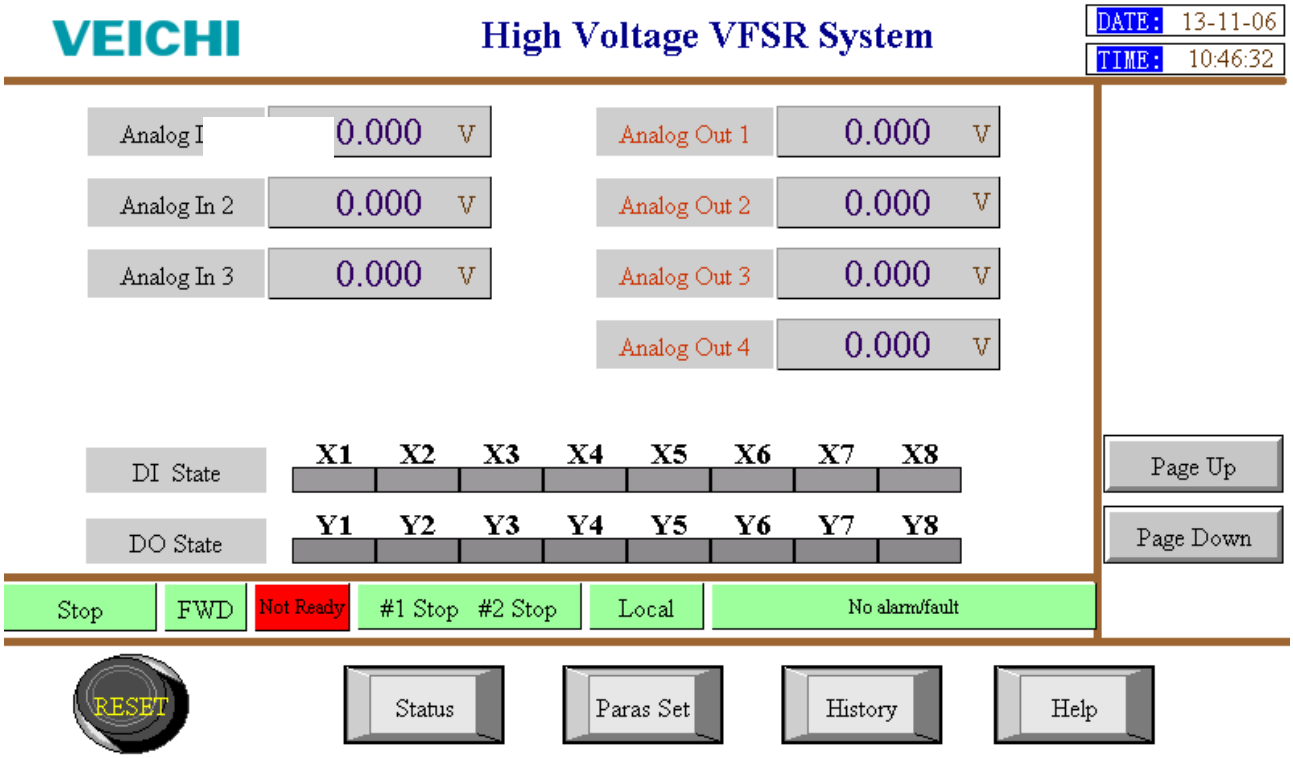


Figure 4.4 The third page of status display of the LCD touch screen of ACH100 high-voltage VFSR system

The variables displayed in this page are detailed as below:

4.2.17 Analogue input 1, 2, 3;

For testing use by the debugging personnel from the manufacturer

4.2.18 Analogue output 1, 2, 3, 4;

For testing use by the debugging personnel from the manufacturer. When the user sets analogue multi-functional terminal output, these values can be used for debugging, indicating actual analogue output voltage value ranging from 0 to 10V.

4.2.19 Digital input or output of functional terminal:

The switch on and off of the indicator represent the input level of digital input (output) 0~7 ports.

Click “next page” to enter into the third page of status display, as shown in Figure 4.5.

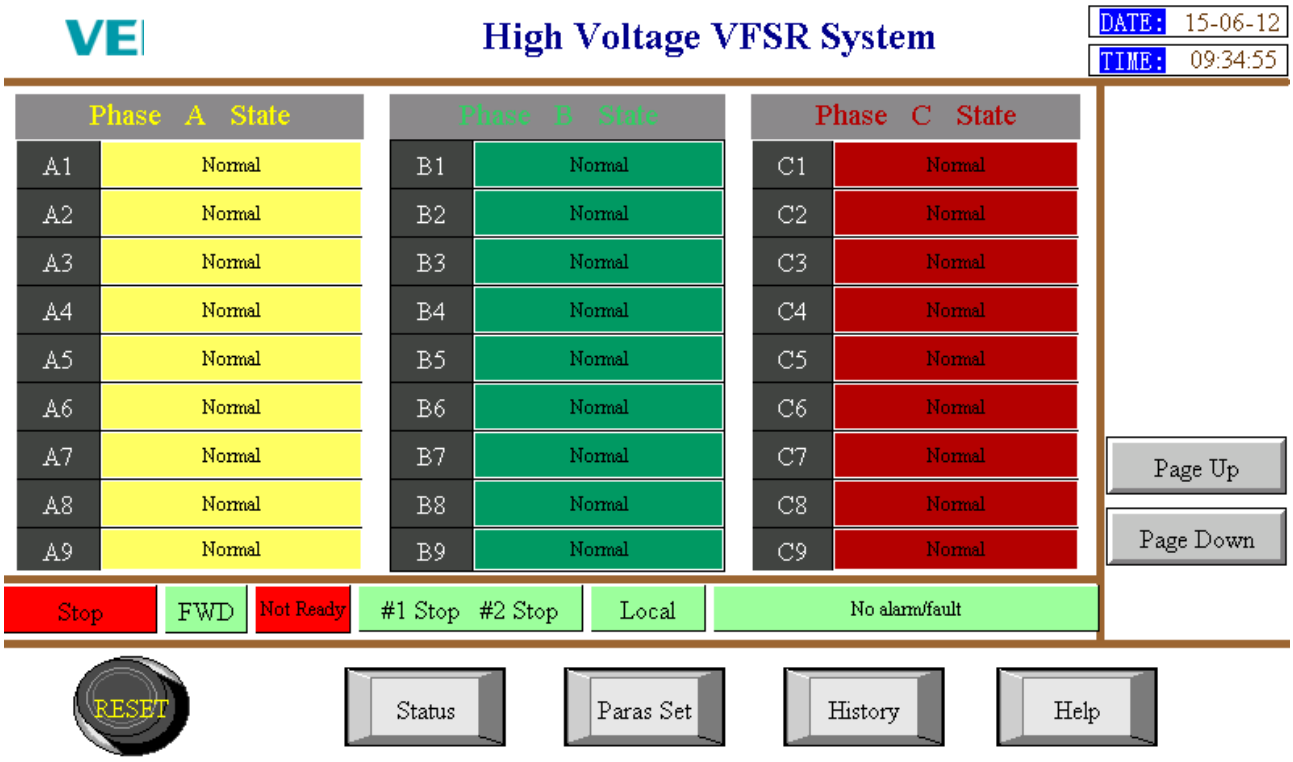


Figure 4.5 The fourth page of status display of the LCD touch screen of ACH100 high-voltage VFSR system

This page displays the status information of various power units in three phases.

Click “next page” to enter into the third page of status display, as shown in Figure 4.6.

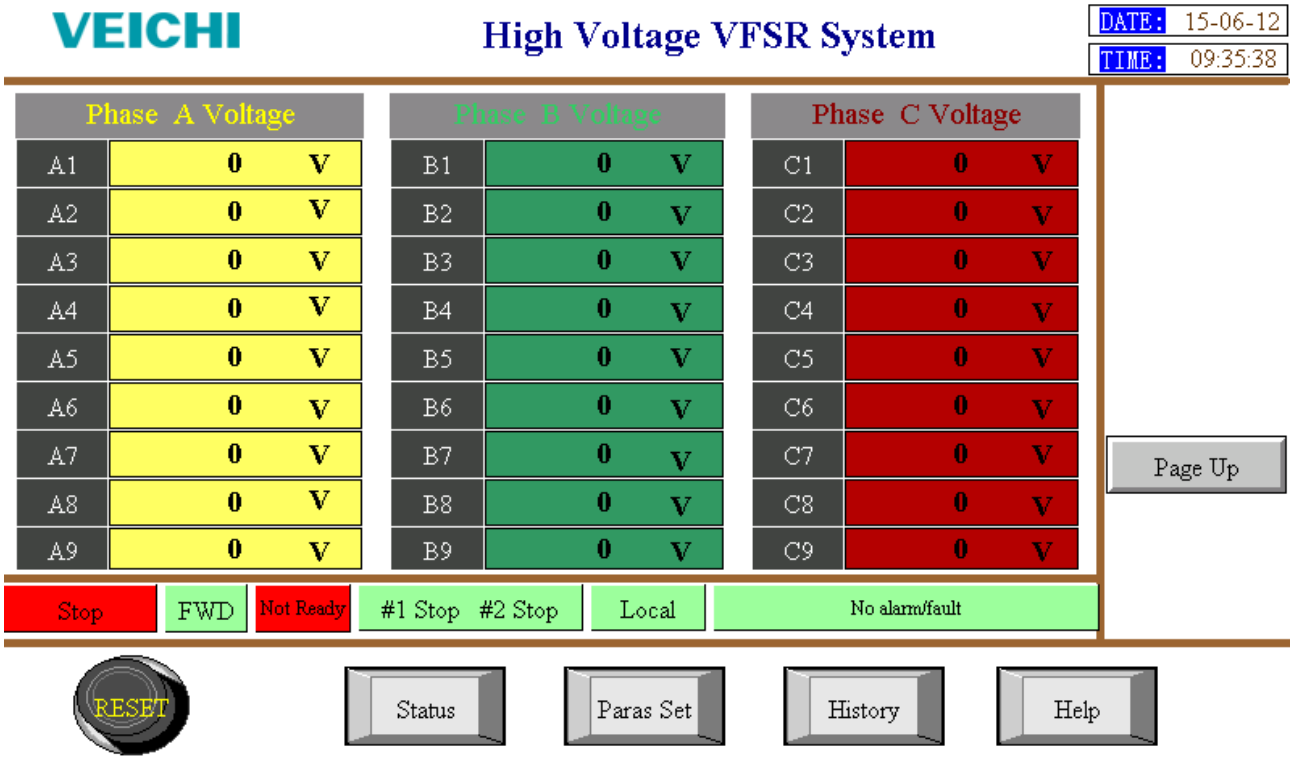


Figure 4.6 The fifth page of status display of the LCD touch screen of ACH100 high-voltage VFSR system

This page displays the DC voltage value of various power units in three phases.

4.3. Parameters setting

The parameters of the high-voltage VFSR system all support on-line revision. Regardless of which running mode the VFSR system is in, click “parameters setting” on the main interface to enter into parameter group for selecting interface, as shown in Figure 4.7. Click corresponding button to enter into corresponding parameter group for settings.

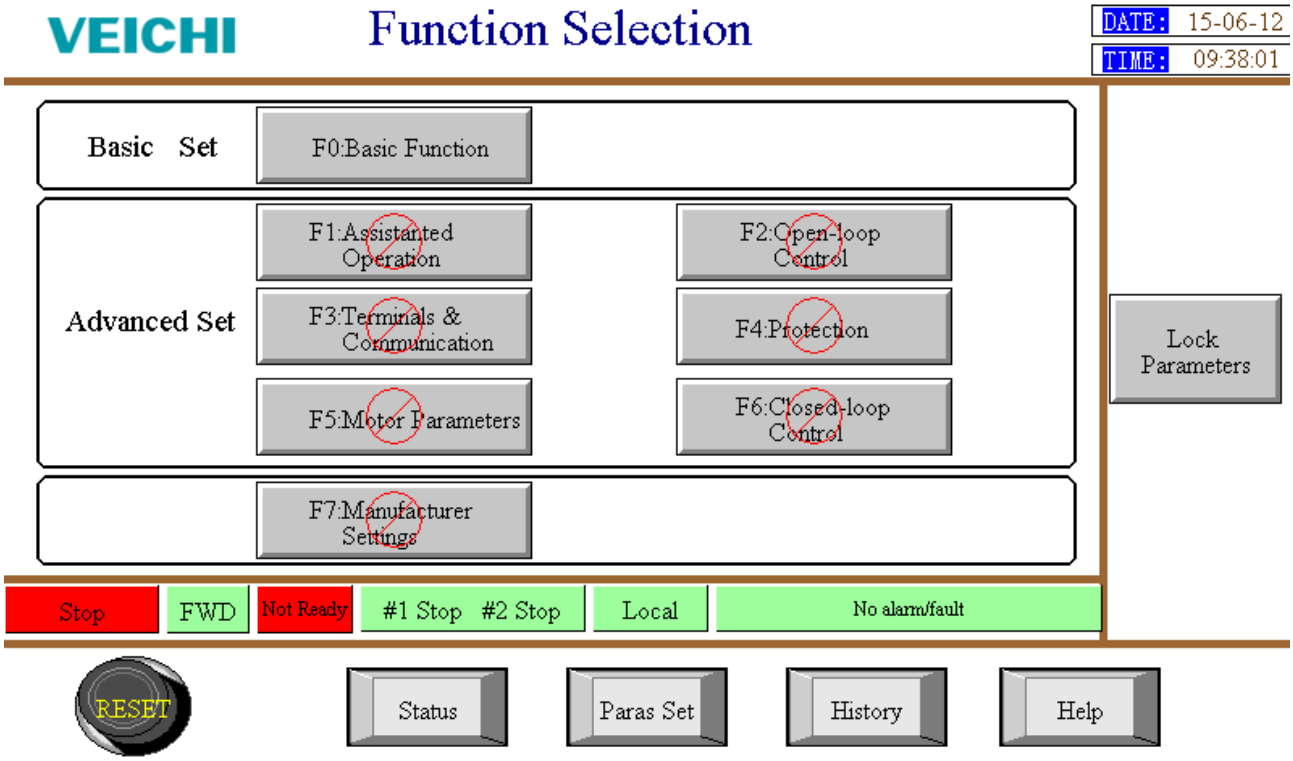


Figure 4.7 Parameter selection interface of LCD touch screen of ACH100 high-voltage VFSR system

4.3.1 Setting of basic parameters

Click “F0 basic functional parameters” button on the interface shown in Figure 4.7 to enter into basic parameters setting:

Code	Definition	Default	Edition permission
F0.0 Control mode	0: VVVF open-loop control	0	×
F0.2 Frequency set source	0: Digital setting 1: Analogue setting 2: Terminal setting 3: Communication setting	0	×
F0.3 Output frequency digital setting	F0.8～F0.7 (minimum unit: 0.01Hz)	50.00Hz	○
F0.4 Rotating direction of motor	0: Forward/reverse allowed 1: Forward only 2: Reverse only	0	×
F0.6 Rated operating frequency	10.00.0 ～ 120.00Hz (minimum unit: 0.01Hz)	50.00Hz	×
F0.7	F0.8～120.00Hz (minimum unit: 0.01Hz)	50.00Hz	○

Upper limit of output frequency			
F0.8 Lower limit of output frequency	0.00～F0.7 (minimum unit: 0.01Hz)	5.00Hz	○
F0.9 Rated output voltage	0～1×rated output voltage of inverter F7.9 (0.09kV ～ 10kV, factory default parameter) (minimum unit: 0.01kV)	Rated voltage of inverter	×
F0.10Acceleration time	1～3600s (minimum unit: 1s)	60s	○
F0.11 Deceleration time	1～3600s (minimum unit: 1s)	60s	○

4.3.2 Setting of advanced parameters

The setting of advanced parameters comprises 6 groups, mainly including some special parameters. The setting of these parameters requires a better understanding of the inverter itself. Therefore, the setting is protected by password and can be performed by personnel at a certain level.

F1: Assistant operation

Code	Definition	Default	Edition permission
F1.0 Setting of user operation password	4-digit password: **** (scope: 0000～9999)	1234	×
F1.1 Power-up parameters initializing	0: Retrieve the parameters saved previously (excluding rotation speed giving) 1: Retrieve the parameters saved previously (including rotation speed giving) 2: Retrieve the factory default values	0	×
F1.2 Selection of starting mode	0: started by starting frequency 1: standby	0	×
F1.3 Starting frequency	0.00Hz ～ 10.00Hz (minimum unit: 0.01Hz)	1.00Hz	○
F1.4 Holding time of starting frequency	0.0～50.0s (minimum unit: 1s)	0.0s	○
F1.5 Acceleration & deceleration mode	0: Linear 1: standby	0	×
F1.8 Stop mode	0: Free stop 1: Deceleration stop	0	×
F1.11 Transition time of forward/reverse	0.0～6000.0s (minimum unit: 1s)	1s	○
F1.12 Setting of carrier frequency	500Hz～5000Hz	500Hz	○
F1.14 Working mode of lower frequency limit	0: Run as per lower frequency limit 1: Stop	0	×
F1.16 AVR Function	0: Prohibited 1: All enabled except deceleration mode 2: Enabled all the time	0	×
F1.20 Frequency up to detection width	0.00.0～10.00Hz (minimum unit: 0.01Hz)	2.50Hz	○
F1.21 FDT level	0.00.0 ～ 120.00Hz (minimum unit: 0.01Hz)	50.00Hz	○
F1.22 FDT signal lag	0.00.0～10.00Hz (minimum unit: 0.01Hz)	1.00Hz	○

F1.24 IGBT driving dead time	3.0～15.0us (minimum unit: 0.1us)	5.0us	×

F2: open-loop control

Code	Definition	Default	Edition permission
F2.0 V/F curve control mode	0: Linear voltage/frequency (constant torque load) 1: Descending torque curve 1 (second power). 2: User customized curve (defined by F2.1-F2.6).	0	×
F2.1 Intermediate voltage 1 of any V/F curve	0.01～F0.9 (minimum unit: 0.0) (=0, not work)	0	×
F2.2 Intermediate frequency 1 of any V/F curve	0.0～<F0.6 (minimum unit: 0.01Hz) (=0, not work)<F0.6	0	×
F2.3 Intermediate voltage 2 of any V/F curve	F2.1～F0.9 (minimum unit: 0.0) (=0, not work)	0	×
F2.4 Intermediate frequency 2 of any V/F curve	F2.2～<F0.6 (minimum unit: 0.01Hz) (=0, not work)	0	×
F2.5 Intermediate voltage 3 of any V/F curve	F2.3～F0.9 (minimum unit: 0.0) (=0, not work)	0	×
F2.6 Intermediate frequency 3 of any V/F curve	F2.4～<F0.6 (minimum unit: 0.01Hz) (=0, not work)	0	×
F2.7 Hopping frequency 1	0.00～120.00Hz (minimum unit: 0.01Hz) (<=F0.7, F2.7～F2.16 with this limit)	0.00Hz	×
F2.8 Width of hopping frequency 1	0.00.0～10.00Hz (minimum unit: 0.01Hz)	0.00Hz	×
F2.9 Hopping frequency 2	0.00.0～120.00Hz (minimum unit: 0.01Hz)	0.00Hz	×
F2.10 Width of hopping frequency 2	0.00.0～10.00Hz (minimum unit: 0.01Hz)	0.00Hz	×
F2.11 Hopping frequency 3	0.00.0～120.00Hz (minimum unit: 0.01Hz)	0.00Hz	×
F2.12 Width of hopping frequency 3	0.00.0～10.00Hz (minimum unit: 0.01Hz)	0.00Hz	×
F2.13 Hopping frequency 4	0.00.0～120.00Hz (minimum unit: 0.01Hz)	0.00Hz	×
F2.14 Width of hopping frequency 4	0.00.0～10.00Hz (minimum unit: 0.01Hz)	0.00Hz	×
F2.15 Hopping frequency 5	0.00.0～120.00Hz (minimum unit: 0.01Hz)	0.00Hz	×
F2.16 Width of hopping frequency 5	0.00.0～10.00Hz (minimum unit: 0.01Hz)	0.00Hz	×
F2.17 Torque boosting mode	0: Manual 1: Automatic	0	○
F2.18 Manual torque boosting voltage value	Rated voltage F0.9×(0.0 ～ 30.0%) (minimum unit: 0.1%)	1.0%	○
F2.19	Rated voltage F0.6×(0.0 ～ 50.0 %)	10.0%	○

Manual torque boosting frequency to cut-off point	(minimum unit: 0.1%)		
F2.20 Slip compensation mode	0: Manual 1: Automatic	0	○
F2.21 Manual slip compensation setting	Rated voltage F0.6×(0.0 ～ 200.0%) (minimum unit: 0.1%)	0.0%	○
F2.22 Upper limit of automatic slip compensation	0.00～5.00	0.00Hz	○
F2.23 Multi-speed frequency 1	0.00~120.00	5.00Hz	
F2.24 Multi-speed frequency 2	0.00~120.00	10.00Hz	
F2.25 Multi-speed frequency 3	0.00~120.00	15.00Hz	
F2.26 Multi-speed frequency 4	0.00~120.00	20.00Hz	
F2.27 Multi-speed frequency 5	0.00~120.00	30.00Hz	
F2.28 Multi-speed frequency 6	0.00~120.00	40.00Hz	
F2.29 Multi-speed frequency 7	0.00~120.00	50.00Hz	
F2.30 Multi-speed mode enable	0: Close 1: Open		

F3: Terminal and communication

Code	Definition	Default	Edition permission
F3.0 Functional selection of input terminal X1	0: No function 1: External start/stop 2: External pulse start 3: External pulse stop 4: Rotation speed up 5: Rotation speed down 6: Operating allowed 7: Selection of operating direction 8: External reset 9: External fault 10: Multi-stage speed 1 11: Multi-stage speed 2 12: Multi-stage speed 3 13: High-volt switch state	6	×
F3.1 Functional selection of input terminal X2		2	×
F3.2 Functional selection of input terminal X3		3	×
F3.3 Functional selection of input terminal X4		9	×
F3.4 Functional selection of input terminal X5		8	×
F3.5 Functional selection of input terminal X6		0	×
F3.6 Functional selection of input terminal X7		0	×
F3.7 Functional selection of input terminal X8		0	×
F3.8 Polarity setting of input terminal	0: normally open 1: normally closed	0	×
F3.9	0: No function	11	×

Functional selection of output terminal Y1	1: system ready 2: Inverter fault 3: Inverter alarm 4: #1 System bypass 5: #2 System bypass 6: Rotation speed up to 7: Frequency detection level 8: #1 High voltage on permit 9: #2 High voltage on permit 10: Charged indication 11: Remote indication 12: Running 13: #1 Inverter mode 14: #2 Inverter mode		
F3.10 Functional selection of output terminal Y2		1	×
F3.11 Functional selection of output terminal Y3		12	×
F3.12 Functional selection of output terminal Y4		3	×
F3.13 Functional selection of output terminal Y5		2	×
F3.14 Functional selection of output terminal Y6		0	×
F3.15 Functional selection of output terminal Y7		0	×
F3.16 Functional selection of output terminal Y8		0	×
F3.17 Polarity setting of output terminal	0: normally open 1: normally closed	0	×
F3.18 AO1 (XOA channel) function	0: No function 1: Setting frequency 2: Output frequency 3: Rotor speed 4: Output voltage 5: Output current 6: Output power 7: A phase voltage 8: B phase voltage 9: C phase voltage	1	×
F3.19 AO2 (XOB channel) function		3	×
F3.20 AO3 (XOC channel) function		5	×
F3.21 AO4 (XOD channel) function		4	×
F3.22 AO1 (XOA channel) proportionality coefficient	20.0～500.0% (minimum unit: 0.1%) When this value is set to be x%, the corresponding output voltage is 0～10V, indicating (－2)×x% times of rated value ~ 2×x% times of rated value	129.5%	○
F3.23 AO2 (XOB channel) proportionality coefficient		129.5%	○
F3.24 AO3 (XOC channel) proportionality coefficient		129.5%	○
F3.25 AO4 (XOD channel) proportionality coefficient		129.5%	○
F3.30 Analogue input AI1 functional selection (IR channel)	0: No function 1: Frequency giving 2: Close loop giving 1 3: Close loop giving 2 4: Close loop giving 3 5: Feedback channel 1 6: Feedback channel 2 7: Feedback channel 3		×
F3.31 Analogue input AI2 functional selection (IT channel)			×
F3.32	0~1.000 (4mA correspond 0Hz)		

FREQ input zero offset			
F3.33 FREQ Ratio	0~500		
F3.34 AI1 input zero offset	0.0～80.0% (minimum unit: 0.1%)		
F3.35 AI1 input proportionality coefficient	0.00～100.00 (minimum unit: 0.01)		
F3.36 AI2 input zero offset	0.0～80.0% (minimum unit: 0.1%)	0.0%	×
F3.37 AI2 input proportionality coefficient	0.00～100.00 (minimum unit: 0.01)	0.00	×
F3.38 AI3 input zero offset (UIN)	0.0～80.0% (minimum unit: 0.1%) “Debugging running” can be changed	0.0%	×
F3.39 AI3 input proportionality coefficient (UIN)	0.00～100.00 (minimum unit: 0.01) “Debugging running” can be changed	0.00	×
F3.40 AI4 (IA) input zero offset	0.0～80.0% (minimum unit: 0.1%) “Debugging running” can be changed	0.0%	×
F3.41 AI4 (IA) input proportionality coefficient	0.00 ～ 100.00 (minimum unit: 0.01) “Debugging running” can be changed	0.00	×
F3.42 AI5 (IC) input zero offset	0.0～80.0% (minimum unit: 0.1%) “Debugging running” can be changed	0.0%	×
F3.43 AI5 (IC) input proportionality coefficient	0.00 ～ 100.00 (minimum unit: 0.01) “Debugging running” can be changed	0.00	×
F3.44 AI6 (U1) input zero offset	0.0 ～ 80.0% (minimum unit: 0.1%) “Debugging running” can be changed	0.0%	×
F3.45 AI6 (U1) input proportionality coefficient	0.00 ～ 100.00 (minimum unit: 0.01) “Debugging running” can be changed	0.00	×
F3.46 AI7 (U2) input zero offset	0.0 ～ 80.0 % (minimum unit: 0.1%) “Debugging running” can be changed	0.0%	×
F3.47 AI7 (U2) input proportionality coefficient	0.00 ～ 100.00 (minimum unit: 0.01) “Debugging running” can be changed	0.00	×
F3.48 AI8 (U3) input zero offset	0.0～80.0% (minimum unit: 0.1%) “Debugging running” can be changed	0.0%	×
F3.49 AI8 (U3) input proportionality coefficient	0.00～100.00 (minimum unit: 0.01) “Debugging running” can be changed	0.00	×
F3.50 User analogue input fluctuation inhibition	0.0～10.0% (minimum unit: 0.1)	0.2%	○
F3.51 A1～A3 analogue input quantity type	0 : Voltage 1: Current 2: Pressure 3: Flow	0	○

F4: Protection function

Code	Definition	Default	Edition permission
F4.0 Overload protection mode of motor	0: No action (alarm) 1: Inverter blocking output (alarm).	1	×
F4.1 Maximum long-term operating current of motor	50%～150% of the rated current of motor (minimum unit: 1 %) (<=F4.2)	110%	×
F4.2 Over current protection threshold of motor	120%～180% of rated current of motor (minimum unit: 1%) (<=F7.11)	180%	╳
F4.3 Overload rate alarm threshold of motor	10%～100% (minimum unit: 1%)	75%	×
F4.4 Phase-lacking detection function	0: no input phase-lacking detection, no output phase-lacking detection 1: no input phase-lacking detection, with output phase-lacking detection 2: with input phase-lacking detection, no output phase-lacking detection 3: with input phase-lacking detection, with output phase-lacking detection	0	×
F4.5 Overvoltage stalling device	0: Prohibited 1: Enabled	1	×
F4.6 Overvoltage stalling voltage threshold	100～130% of rated DC voltage of unit (minimum unit: 1%)	110%	×
F4.7 Automatic current limiting device	0: Prohibited 1: Valid during acceleration and deceleration, invalid at constant speed 2: Constantly valid	1	×
F4.8 Automatic current limiting threshold	50%～180% of rated current of motor (minimum unit: 1%) (≤F4.2)	120%	×
F4.09 Power failure restart function	0: Prohibited 1: Enabled	0	╳
F4.10 Power failure restart delay time	3~50s	3	╳
F4.11 System auto-bypass setting	0: Prohibited 1: Enable	0	╳
F4.12 AC input undervoltage protection threshold	10～90% of rated input voltage (minimum unit: 1%)	80%	×
F4.13 AC input overvoltage protection threshold	100～130% of rated input voltage (minimum unit: 1%)	115%	×
F4.14 DC undervoltage alarm threshold	10～90% of rated DC voltage of unit (975v currently) (minimum unit: 1%)	80%	○
F4.15 DC overvoltage alarm threshold	100～130% of rated DC voltage of unit (minimum unit: 1%)	120%	○
F4.16 DC undervoltage protection threshold	10～90% of rated DC voltage of unit (minimum unit: 1%)	75%	╳
F4.17 DC overvoltage protection	100～130% of rated DC voltage of unit (minimum unit: 1%)	130%	╳

threshold			
F4.18 Cabinet door opened during running	0: alarm 1: protection	0	○
F4.19 Quantity of unit allowed for bypass for each phase	0～Number of units per phase (for H bridge only)	0	×
F4.20 Total quantity of unit allowed for bypass	0～3×Number of units per phase (for H bridge only)	0	×
F4.21 System auto-bypass delay time	4~200s	4	×

F5: Parameters of motor

Code	Definition	Default	Edition permission
F5.0 Rated power of motor	0～9000kW (minimum unit: 1kW)	Rated by inverter	×
F5.1 Rated voltage of motor	0～11.00kV (minimum unit: 0.01kV)	Set per model	×
F5.2 Rated current of motor	0～1200A (minimum unit: 1A)	Rated by inverter	×
F5.3 Rated speed of motor	0～5000rpm	0	×
F5.4 Rated frequency of motor	0～120Hz (minimum unit: 0.01Hz)	50	×
F5.5 Number of pole pairs of motor	0～7 (minimum unit: 1)	0	×
F5.6 Rated torque of motor	0～9,000Nm (minimum unit: 1)	0	×
F5.7 Rated efficiency of motor	0～0.99 (minimum unit: 0.01)	0.9	×
F5.8 Rated power factor of motor	0～0.99 (minimum unit: 0.01)	0.85	×
F5.9 no-load current of motor	0～50% (rated current of motor) (minimum unit: 1%)	30%	×
F5.10 Parameters setting mode of motor	0: Manual input 1: Static type self-tuning (tuning after setting, then return to 0) 2: Rotating type self-tuning (tuning after setting, then return to 0)	0	×
F5.11 Stator resistance	0.0～50.0% (minimum unit: 0.1)	Confirmed per model	×
F5.12 Rotor resistance	0.0～50.0% (minimum unit: 0.1)	Confirmed per model	×
F5.13 Mutual inductance	0.0～2,000.0% (minimum unit: 0.1)	Confirmed per model	×
F5.14 Stator leakage inductance	0.0～50.0% (minimum unit: 0.1)	Confirmed per model	×
F5.15 Rotor leakage inductance	0.0～50.0% (minimum unit: 0.1)	Confirmed per model	×

F6: Closed-loop control

Code	Definition	Default	Edition permission
F6.0 Closed-loop control	0: No pressure/flow close loop 1: With pressure/flow close loop	0	×
F6.1 Selection of pressure given quantity	0: Manual setting 1: Analogue setting	0	×

F6.2 PI adjust polarity	0-100%	0	×
F6.3 Pressure PI regulator P	1～1024	1	×
F6.4 Pressure PI regulator I	1～1024	1	×
F6.5 Maximum deviation allowed by setting and feedback	Set value × (0～20%)	2%	×

4.4 Switching of VFSR system control mode

4.4.1 Local control

When the “Remote/Local” is switched to local option, the start/stop operation of the inverter is controlled by the change-over switch on the control cabinet door without affecting the frequency giving mode or the functions of input terminal excluding start/stop. For instance: as for emergency stop, external fault input and other functions, regardless of local control or remote control, once the emergency stop is required, send out a signal to the inverter, then the inverter can stop output immediately.

Switching to remote control can be realized only when the VFSR system is in stop state.

4.4.2 Remote DCS control

When “remote/local” switch selects remote control, local operation frequency setting and start/stop control will become invalid. Other buttons on the local operation panel still work. In remote control mode, parameters can also be revised through local main interface.

Switching to remote control can be realized only when the VFSR system is in stop state.

4.5. Running mode of VFSR system

4.5.1 Open loop running

After the system is ready, when remote option is selected in "remote/local", the high-voltage VFSR system will start from the stop state according to the acceleration time and then run at the frequency set by the user if with a remote start command. In stop state, when local option is selected in "remote/local", remote start command will become invalid, the starting of the high-voltage VFSR system will be realized through the “start/stop” switch on local operation cabinet panel.

4.5.2 Close loop running

If closed-loop running mode is selected in the parameter setting, the high-voltage VFSR system will run according to closed-loop running mode after starting. In closed-loop mode, the user may set the desired value of the controlled variables (such as pressure), the high-voltage VFSR system will automatically regulate the speed of the motor according to the actual value of the controlled variables as per the PID parameters set by the system so as to enable the actual value of the controlled variables to automatically follow the desired value.

4.5.3 Normal stop

When remote option is selected in "remote/local", if with remote stop command, the high-voltage VFSY system may stop according to the mode of parameter set stop. When local option is selected in "remote/local", remote stop command will become invalid, the starting of the high-voltage VFSR system will be realized through the “start/stop” switch on local operation cabinet panel.

4.5.4 Emergency stop

In all cases, the “emergency stop” button on local panel is effective. When receiving an emergency stop command or having a fault, the system will block pulse immediately, and freely stop (some customers require cut off high voltage simultaneously). Re-starting is allowed only after emergency stop constant keeping button is reset and fault is reset.

In case of a fault, the system will perform emergency stop, but will not cut off high voltage.

4.6. Alarm cancel and fault reset

4.6.1 Alarm cancel

When the system has an alarm, audible and visual alarm is provided. After troubleshooting and restoration, the user may press “alarm cancel” button to cancel alarm and flashing. When the alarm takes place in stop state, the system cannot get ready for starting and the inverter and the system cannot be started until the alarm is cancelled. If an alarm occurs and the high-voltage VFSR system is in running state, the system will keep running. After pressing “alarm cancel” without eliminating the alarm, the system will re-activate flashing alarm indication.

4.6.2 Fault reset

When the high-voltage VFSR system runs, the “fault reset” button on local main interface does not work. Therefore, the system must stop firstly to perform fault reset operation in case of a fault (“start/stop control” switch is required to be switched to stop state in local or remote operation mode).

In remote operation mode, remote reset signal does not work when the system is in running state.

4.7 Normal operation procedures of VFSR system

Before utilization of ACH100 high-voltage VFSR system, please carefully read the user manual to ensure that all operations will not affect the safety of the operators and equipment. When the system is in stop state and requires start-running, especially for the first start-up, the following procedures shall be followed:

4.7.1 Local control with automatic bypass cabinet

1. Check switching status and connecting line. Check bypass cabinet to confirm the vacuum contactor KM1, KM2, KM3, KM4 and isolation switch QS1, QS2 are in disconnection mode; check control cabinet to confirm that the connecting line of DSP control panel, including the interface of fibre part, is reliably connected. Check all miniature circuit breakers in control cabinet are in disconnection mode (repeat start-up after running may not disconnect the circuit breakers in control cabinet).
2. Connecting line of frequency giving mode. Open-loop control frequency digital setting mode is adopted mostly for local mode (or as per other giving mode), so connecting line is not required.
3. Control circuit power-up. Confirm that system control power is in normal condition.
4. Modulation parameter. Digital setting. Confirm “frequency set source” in F0 basic functional parameters is digital setting. After setting, LCD touch screen returns to main operating interface.
5. Check and confirm the location of various buttons on local panel is correct. Select local control for “local/remote”; select variable frequency control for “variable frequency/bypass”; “high voltage closing” is in disconnection state.
6. Close switch to supply high voltage. Manually close the input isolation switch QS1 and output isolation switch QS2 of inverter; after the high voltage and bypass cabinet have high voltage indication, set the

"high voltage closing/opening" in closing state; after KM1 and KM2, KM4 (for high power only, KM4 has skip indication after steady recharging) closes successively and gives indication (KM3 has no indication), switch cabinet switches on normally.

7. High voltage power-up is in normal condition and system interface shows no alarm or fault; otherwise, disconnect high-voltage and bypass cabinet switch and return to the first step for troubleshooting.
8. After forward/reverse parameters of motor are regulated, give a frequency signal through interface, turn the "start/stop control" switch on control cabinet door to start location, the "running" indicator will be on and the motor will start and speed up to the designated frequency and then become stable according to the command. The variation of input voltage, output current and output frequency can be observed through HMI screen.
9. When the motor requires speed changing during normal running, click "revise frequency" button on main interface to edit new frequency (or as per other giving mode); after pressing "set frequency", the target frequency is revised and the system begins to adjust frequency.
10. When requiring short-term stop, directly turn the "start/stop control" switch on the local control cabinet panel to stop location, then the motor will stop freely or decelerate to stop in the designated mode. Or click "emergency stop" button to urgently stop the system (capable of cutting off the high voltage of bypass cabinet simultaneously).

4.7.2 Remote control with automatic bypass cabinet

1、 Check switching status and connecting line. Check bypass cabinet. Automatic bypass cabinet mode: confirm the vacuum contactor KM1, KM2, KM3, KM4 (special for high power) and isolation switch QS1, QS2 are in disconnection mode; manual bypass cabinet mode: isolation switch QS1, QS2, QS3, KM1 (special for high power). Check control cabinet and confirm that the connecting line of DSP control panel, including the interface of fiber part, is reliably connected. Check all miniature circuit breakers in control cabinet are in disconnection mode (during repeat start-up after running, the circuit breakers in control cabinet may not be disconnected).

2、 Connecting line of frequency giving mode. For digital setting, set through local operating interface only; as to analogue setting, confirm that analogue signal (DC4-20mA) has been connected to Freq channel of IO panel; for multi-power terminal giving, confirm multi-functional switch has been connected to input terminal strip X5; as to communication setting, confirm whether the host computer is normally connected with main board communication port. If requiring closed-loop control, connect frequency given line and confirm that feedback signal (DC4-20mA) has been connected to IR and IT channel of IO panel.

3、 Control circuit power-up. Confirm that system control power is in normal condition and no alarm or fault takes place.

4、 Modulation parameter. If the frequency giving is digital setting, confirm that "frequency set source" in F0 basic functional parameter is digital setting; in case that the frequency giving is analogue giving, confirm that "frequency set source" in F0 basic functional parameter is analogue setting; in case that the frequency giving is multi-functional terminal giving, confirm that "frequency set source" in F0 is terminal giving and confirm that the wiring channel corresponding to F3 "terminal and communication" has set parameters; if the frequency setting is host computer communication giving, confirm that "frequency set

source" in F0 basic functional parameter is communication setting. If the customer requires closed-loop control, set frequency and confirm that the "closed-loop control function" in the list of parameters F6 is in opening state and configure the parameters according to the motor conditions.

5、 Check and confirm the location of various buttons on panel is correct. Select remote control for "local/remote", enable the "variable frequency/power frequency, ME local control" in variable state, remote "high voltage closing/opening" is in opening state and "power-up allowed" is in prohibit position.

6、 Close switch and supply high voltage. Manually close the input isolation switch QS1 and output isolation switch QS2 of inverter; turn the "power-up allowed" to allow position; after power up and the high voltage and bypass cabinet have high voltage indication, set the "high voltage closing/opening" in closing state; after KM1 and KM2, KM4 (for high power only, have skip indication after steady recharging of power cabinet) closes successively and gives closing indication (KM3 has no indication), namely, bypass cabinet switches on normally.

7、 After confirming that high voltage power-up is normal and the system has no alarm or fault, the audible and visual indicator is in extinguishing state. In case of alarm or fault, disconnect power and restore to the previous step for troubleshooting.

8、 After adjusting the forward/reverse parameters of motor, give a frequency signal, turn the "start/stop control" operation knob of remote system to start position, then the motor will start as commanded and begin to rotate. "Running" indicator on control cabinet door shall be on; HMI screen displays the variation of input voltage, output current and output frequency.

9、 When the motor requires speed changing during normal running, click "revise frequency" button on main interface to edit new frequency (or as per other giving mode); after pressing "set frequency", the target frequency is revised and the system begins to adjust frequency.

10、 Turn the "start/stop control" operation knob of remote control to stop location when requiring a stop, the motor then stops in the designated mode. Or click "emergency stop" button to urgently stop the system and cut off the high voltage of bypass cabinet.

4.7.3 Local control with manual bypass cabinet

1、 Check switching status and connecting line. Check whether bypass cabinet, isolation switch QS1, QS2, QS3 and KM1 (for high power only) are in disconnection mode. Check control cabinet and confirm that the connecting line of DSP control panel, including the interface of fiber part, is reliably connected. Check all miniature circuit breakers in control cabinet are in disconnection mode (during repeat start-up after running, the circuit breakers in control cabinet may not be disconnected).

2、 Connecting line of frequency giving mode. Generally adopt open-loop control frequency digital setting mode (not recommended for others) for local control, so connecting line is not used.

3、 Control circuit power-up. Confirm that system control power is in normal condition.

4、 Modulation parameter. Digital setting. Confirm "frequency set source" in F0 basic functional parameters is digital setting. After setting, LCD touch screen returns to main operating interface.

5、 Check and confirm the location of various buttons on local panel is correct. Select local control for "local/remote".

6、 Close switch to supply high voltage. Close QS1 and QS3, confirm QS2 (bypass) and KM1 (high power) are in disconnection mode, then supply high voltage on power distribution side (high voltage is normal

at high power, KM1 has skip indication).

7、 High voltage power-up is in normal condition and the system is free from alarm or fault. Otherwise, switch off the high voltage and bypass cabinet, return to the first step for troubleshooting.

8、 After forward/reverse parameters of motor are regulated, give a frequency signal through interface, turn the “start/stop control” switch to start location, the “running” indicator on control cabinet door will be on and the motor will start and speed up to the designated frequency and then become stable according to the command. The variation of input voltage, output current and output frequency can be observed through HMI screen.

9、 When the motor requires speed changing during normal running, click “revise frequency” button on main interface to edit new frequency (or as per other giving mode); after pressing “set frequency”, the target frequency is revised and the system begins to adjust frequency.

10、 Turn “start/stop control” switch on control cabinet panel to stop position directly when requiring a stop, then the motor stops in the designated mode. Or click “emergency stop” button to urgently stop the system and cut off the high voltage on power distribution side (high voltage may not be disconnected for short-term stop).

4.7.4 Remote control with manual bypass cabinet

1、 Check switching status and connecting line. Check bypass cabinet, isolation switch QS1, QS2, QS3 and KM1 (for high power only). Check control cabinet and confirm that the connecting line of DSP control panel, including the interface of fiber part, is reliably connected. Check all miniature circuit breakers in control cabinet are in disconnection mode (during repeat start-up after running, the circuit breakers in control cabinet may not be disconnected).

2、 Connecting line of frequency giving mode. For digital setting, set through local operating interface only; as to analogue setting, confirm that analogue signal (DC4-20mA) has been connected to Freq channel of IO panel; for multi-power terminal giving, confirm multi-functional switch has been connected to input terminal strip X5; as to communication setting, confirm whether the host computer is normally connected with main board communication port. If requiring closed-loop control, connect frequency given line and confirm that feedback signal (DC4-20mA) has been connected to IR and IT channel of IO panel.

3、 Control circuit power-up. Confirm that system control power is in normal condition and no alarm or fault takes place.

4、 Modulation parameter. If the frequency giving is digital setting, confirm that “frequency set source” in F0 basic functional parameter is digital setting; in case that the frequency giving is analogue giving, confirm that “frequency set source” in F0 basic functional parameter is analogue setting; in case that the frequency giving is multi-functional terminal giving, confirm that “frequency set source” in F0 is terminal giving; if the frequency setting is host computer communication giving, confirm that “frequency set source” in F0 basic functional parameter is communication setting. If the customer requires closed-loop control, set frequency and confirm that the “closed-loop control function” in the list of parameters F6 is in opening state and configure the parameters according to the motor conditions.

5、 Check and confirm the location of various buttons on local panel is correct. Select remote control for “local/remote”, select stop position for “start/stop” control and prohibit “power-up allowed”.

6、 Close switch and supply high voltage. Close QS1 and QS3 locally, confirm QS2 (bypass) and KM1 are in disconnection mode, remote-turn “power-up allowed” to allow supply high voltage on power distribution side.

7、 After confirming that high voltage power-up is normal and the system has no alarm or fault, the audible and visual device goes out normally.

8、 After forward/reverse parameters of motor are regulated, give a frequency signal by referring to the set frequency, remote-turn the “start/stop control” switch to start location. At this time, the motor starts as commanded and begins to rotate, the “running” indicator is on; the entire start-up process is monitored through “set frequency”, “output current” and “output frequency” meters on DCS system.

9、 When the motor is required to change speed during normal running: for digital setting, click “revise frequency” button on the interface to edit the frequency, and then save the revision; for analogue setting, revise the target frequency through adjusting analogue set current signal; for terminal setting, revise the target frequency through the “multi-stage speed” change-over switch and rotation speed rising/descending in multi-functional digital input signal; for communication setting, revise the target frequency through regulating the hose computer communication so as to meet production requirements.

10、 Turn the “start/stop control” operation knob on remote cabinet door to stop location when requiring a stop, the motor then stops in the designated mode. Or click “emergency stop” button to urgently stop the system and cut off the high voltage of bypass cabinet.

4.8 Precautions for operation

 Danger
1. VFSR system is high-voltage hazardous equipment, so any operator concerned must operate it in strict accordance with the operating regulations. 2. Parameters have been set up logically along with the installation of the equipment, so the user is not allowed to revise and set up the parameters of the system at random without the manufacturer’s permission. 3. When the system needs to be powered up, firstly the control system shall power up, close the breaker only when the high-voltage closing signal sends out high voltage “Closing permit”. 4. To avoid danger, when the inverter runs，do not open the cabinet door and perform wiring operation. 5. The workers on duty without certified training are not allowed to perform operation on touch screen.

Ⅴ. Countermeasures against faults and treatment of abnormity

The abnormity in the VFSR system is generally displayed in two types: alarm information and fault information. In case of an alarm, the system can still work, but light alarm indicator to activate audible and visual alarm. In case of a fault, the system will automatically stop and disconnect high voltage, light fault indicator and activate audible and visual alarm. Fault self-locking can be cancelled and re-start-up is possible only after the fault is completely removed and “fault reset” button is pressed. All alarm and fault information will be recorded by the system. The

history of alarm and fault records can be referred to through clicking “fault records”.

5.1 Possible abnormities and their treatment

Code	Information name	Level	Related description
1	Overload alarm	Alarm	When the accumulated overload quantity is over the alarm limit set by the user (F4.3), an alarm begins. This alarm may take place when the system runs at over current, the reasons for over current may consist of: 1. Over high load; 2. Over short acceleration time; 3. Over small protection coefficient set; 4. Torque lifted too high or improper V/F curve.
2	DC under voltage alarm	Alarm	When the DC voltage collected is lower than the alarm limit (F4.25), an alarm takes places; the possible reasons for this are: 1. Abnormity of power voltage; 2. High load starting in grid; 3. Alarm limit (F4.25) parameter set is over high.
3	DC over voltage alarm	Alarm	When the DC voltage collected is more than the alarm limit (F4.26), an alarm takes places; the possible reasons for this are: 1. Over short deceleration time; 2. Abnormity of input voltage; 3. With energy feedback load; 4. Alarm limit (F4.26) parameter set is over low.
6	Alarm for cabinet door opened	Alarm	When a high voltage cabinet door is opened and parameter F4.29 is “alarm”, an alarm takes place; the possible reasons for this are: 1. The door for any bypass cabinet, transformer cabinet, power cabinet and control cabinet may be opened; 2. The connection line among various travel switches on cabinet door may break.
7	Fan power disconnected	Alarm	The disconnection mode of fan power switch or power wire disconnection may generate this alarm.
8	Over temperature of transformer	Alarm	Due to the temperature controller inside the transformer cabinet, or abnormal connecting line between the temperature controller output signal and IO panel.
9	Transformer alarm	Alarm	Due to the temperature controller inside the transformer cabinet, or abnormal connecting line between the temperature controller output signal and IO panel.
11-19	Unit A1~A9 bypass alarm	Alarm	Units of phase A with bypass.
21-29	Unit B1~B9 bypass alarm	Alarm	Units of phase B with bypass.
31-39	Unit C1~C9 bypass alarm	Alarm	Units of phase C with bypass.
40	Improper disconnection of contactor	Alarm	After IO panel sends out opening command, if contactor status does not change within 3s upon detection, alarm occurs.
41	Improper closing of contactor	Alarm	After IO panel sends out closing command, if the contactor status does not change within 3s upon

			detection, alarm occurs.
42	Unit alarm	Alarm	When a certain power unit has a fault (quantity is determined by user setting related functional parameters), corresponding unit automatically pass by, the system does not stop running and keep running as derated (the corresponding units of the other two phases begin automatic bypass or use mid-offset algorithm). In such case, the system provides “unit bypass alarm”, and the user cannot use long-term full-loaded running of the inverter.
48	Panel button is not in proper position	Alarm	When the local operating panel button is not in proper position, alarm occurs. Possible reasons for this are: 1. Before high voltage closing, start/stop switch is in start-up status; 2. When the system is in variable frequency running status, high voltage switch is in disconnection location.

Code	Information name	Level	Related description
0101	Unit fault	Fault	When the fault quantity of power units exceeds the set value, the whole system immediately blocks pulse, freely stops and disconnects high voltage switch and provides “unit bypass fault” indication.
0131	Inverter input phase lacking	Fault	Possible reasons for this fault are: 1. Abnormal AC input power; 2. Abnormal connecting line of AC input, CJ1 and CJ2; 3. PT does not work properly.
0132	Inverter input under voltage	Fault	When the effective value of AC input voltage collected is lower than the alarm limit (F4.20), an alarm takes places; the possible reasons for this are: 1. Abnormity of power voltage; 2. High load starting in grid; 3. Alarm limit (F4.20) parameter set is over high.
0133	Inverter input over voltage	Fault	When the effective value of AC input voltage collected is more than the alarm limit (F4.21), an alarm takes places; the possible reasons for this are: 1. Abnormity of power voltage; 2. Alarm limit (F4.21) parameter set is over low.
0134	Inverter DC under voltage	Fault	When the DC voltage collected is lower than the alarm limit (F4.27), an alarm takes places; the possible reasons for this are: 1. Abnormity of power voltage; 2. High load starting in grid; 3. Alarm limit (F4.27) parameter set is over high.
0135	Inverter DC over voltage	Fault	When the DC voltage collected is more than the alarm limit (F4.28), an alarm takes places; the possible reasons for this are: 1. Over short deceleration time; 2. Abnormity of input voltage; 3. With energy feedback load; 4. Alarm limit (F4.28) parameter set is over low.
0136	DC voltage unbalance of inverter	Fault	Get the DC voltages of three units of three phases through voltage sensor respectively, take the two voltages having the highest difference among the three voltages,

			compare it with the mean value of the thee voltages. Over 25% indicates a fault. Possible reasons for this are: 1. Output imbalance of three phases; 2. Load imbalance of three phases; 3. One or two among the three sensors work improperly; 4. Certain sensor signal transmission line breaks.
0138	Output short-circuit of inverter	Fault	Judge the effective value of output current. Over the protection threshold set by the user (F7.11) continuously for 2ms indicates a fault. Possible reasons for this are: 1. Three-phase output has grounding symptom; 2. Overlong connecting line between inverter and motor and over high carrier frequency.
0140	Overheating protection	Fault	Over high unit radiator temperature may lead to a fault; possible reasons are: 1. Long period of over current running; 2. Poor ventilation and air duct blockage; 3. Over high environmental temperature.
0141	Motor overload	Fault	When the accumulated overload quantity reaches 100%, the system performs protections. This alarm may take place when the system runs at over current, the reasons for over current may consist of: 1. Over high load; 2. Over short acceleration time; 3. Torque lifted too high or improper V/F curve; 4. Over low grid voltage; 5. Over current activation parameter F4.2 set is too low.
0144	Double-port RAM fault	Fault	Contact the manufacturer.
0149	AD collection fault	Fault	Possible reasons for this are: 1. Analogue signal collection passage is abnormal; 2. Voltage sensor works improperly; 3. Current sensor works improperly; 4. There is something wrong with IO panel transmittal circuit. Contact the manufacturer.
0150	EEPROM read/write fault	Fault	Contact the manufacturer.
0151	External fault	Fault	Remote control mode ＋ remote fault signal
0152	Fault for cabinet door opened	Fault	When a high voltage cabinet door is opened and parameter F4.29 is “fault”, an fault takes place; the possible reasons for this are: 1. The door for any bypass cabinet, transformer cabinet, power cabinet and control cabinet may be opened; 2. The connection line among various travel switches on cabinet door may be broken.
0153	Main control power failure	Fault	Possible reasons for this are: 1. Main 220V power failure; 2. Power double-cut fails; 3. The connecting line between auxiliary contact of the contactor and IO panel is disconnected.
0154	220V power failure	Fault	220V control power switch is off or the connecting line between auxiliary contact of relay and IO panel is disconnected.
0155	Standby	Fault	Standby
0158	Transformer fault	Fault	Due to the temperature controller inside the transformer cabinet, or abnormal connecting line between the

			temperature controller output signal and IO panel.
0159	Transformer trip	Fault	Due to the temperature controller inside the transformer cabinet, or abnormal connecting line between the temperature controller output signal and IO panel.

5.2 Fault reset

 Caution
1. To prevent permanent damage of the inverter, thoroughly check the causes of faults and eliminate them before resetting. 2. In case of having a fault after reset or incapable of being reset, the causes shall be located; continuous resetting may damage the inverter. 3. A delay of 5 minutes is required for resetting during overload and overheating protection action.

Ⅵ. Predictive and preventive maintenance

6.1 Routine inspection and maintenance

 Caution
Inspection must be performed by specialized technical personnel; the inverter power shall be cut off if necessary.

ACH100 high-voltage frequency VFSR system features high reliability, electric system free of maintenance, etc. However, in real-life application, affected by ambient temperature, humidity, dust, vibration and aging of internal elements of the inverter, the inverter may have some potential problems during running. To enable the inverter to run stably for a long period of time, the inverter must be checked once every 3~6 months. The contents for inspection are as shown below:

Frequency		Items	Contents	Judgment standard
Routine	Regularly			
√		Running environment	1. Temperature, humidity 2. Dust, air	1. When temperature > 40℃, open the cover of the inverter. Humidity < 90%, free from frost deposit 2. Free from bad odour, flammable & explosive gas
	√	Cooling system	1. Installation environment 2. Inverter self-provided fan	1. Installation environment is well ventilated, no air duct blockage 2. Self-provided fan runs normally, free from abnormal noise
√		Inverter body	1. Vibration, temperature rising 2. Noise 3. Conducting wire, terminal	1. Steady vibration, normal temperature of air outlet 2. Free from abnormal noise and bad odour（Noise level is no more than 85db in normal working conditions） 3. No loosened screws that require tightening
√		Motor	1. Vibration, temperature rising 2. Noise	1. Steady running, normal temperature 2. No abnormity or changing noise
√		Input, output parameters	1. Input voltage 2. Output current	1. Input voltage is within specified scope 2. Output current is below rated value.
√		Transformer cabinet	1. Winding temperature of transformer	1. The transformer temperature is below the limit 80℃.
	√	Insulation & voltage withstanding	1. Insulation resistance between energized circuit and ground (crust) 2. Insulation strength between various energized circuit and ground (crust) as well as between circuits without electric connection	1. When ambient temperature is 20℃ and relative humidity is 90%, no less than 100MΩ. 2. Testing voltage is 1.25 times of maximum instantaneous voltage in loop (excluding overvoltage), continuous time is 1min.

6.2 Inspection and replacement of worn parts

Some elements in the inverter may show signs of wear and tear or the degradation of performance during application. To guarantee reliable running, perform preventive maintenance, and replace the affected parts if necessary.

◆ Filtering capacitance

The pulsating current of main loop may affect the performance of aluminium electrolytic filtering capacitance. The affecting degree is related to the ambient temperature and application conditions. The electrolytic capacitance for the inverter used in normal condition shall be replaced once every 4 ~ 5 years.

In case of electrolyte leakage of electrolytic capacitor, emergence of safety valve or expansion of capacitance body, stop the inverter immediately for replacement.

◆ Cooling fans

The cooling fans inside the inverter all have a service life of about 15000 hours (about 2 years for continuous running of the inverter). In case that the fans have abnormal noise or vibration, immediately replace them.

6.3 Warranty

The warranty period is 12 months. During the warranty period, if the malfunction or damage occurs under normal use, the company provides free repair or replacement.

Note: The warranty scope refers only to the inverter unit.

During the warranty period, certain failures shall be charged for the following reasons:

1. Failure caused by failure to follow the operating manual or exceed the standard specifications.
2. Failure caused by self-repair and modification without permission.
3. Failure due to poor storage.
4. Faults caused when the frequency converter is used for abnormal functions.
5. Damage to the machine due to fire, salt, gas corrosion, earthquakes, storms, floods, lightning, voltage abnormalities or other force majeure.

Appendix 1. Description of electric elements in cabinet

Name	Functions	Cabinet
Vacuum contactor KM1	Incoming switch of inverter (one drag two 1# inverter)	Automatic bypass cabinet
Vacuum contactor KM2	Outgoing switch of inverter (one drag two 1# inverter)	
Vacuum contactor KM3	Power supply switch of system	
Vacuum contactor KM4	Incoming switch of inverter (one drag two 2# inverter)	
Vacuum contactor KM5	Outgoing switch of inverter (one drag two 2# inverter)	
Vacuum contactor KM6	Power supply switch of inverter (one drag two 2# inverter)	
Isolation switch QS1	Incoming isolation switch of inverter	
Isolation switch QS2	Outgoing isolation switch of inverter	
Isolation switch QS3	2# Incoming isolation switch of inverter	
Isolation switch QS4	2# Outgoing isolation switch of inverter	
Isolation switch QS1	Incoming isolation switch of inverter 1# (one drag two)	Manual bypass cabinet
Isolation switch QS2	Double throw isolation switch on power supply side of inverter 1#	
Isolation switch QS3	Double throw isolation switch on outgoing side of inverter 1#	
Isolation switch QS4	Incoming isolation switch of inverter 2# (one drag two)	
Isolation switch QS5	Double throw isolation switch on power supply side of inverter 2#	
Isolation switch QS6	Double throw isolation switch on outgoing side of inverter 2#	
Vacuum contactor KM	Charging resistance switch of power cabinet (high power)	
Circuit breaker DL41	Switch of fans for power cabinet	Control cabinet
Circuit breaker DL51	Switch of fans for transformer cabinet	
Circuit breaker DL21	Master switch of 220V control power	
Circuit breaker DL22	Switch of 220V operation power	
Circuit breaker DL23	Switch of temperature controller power of transformer	

Appendix 2. Specifications and Parameters of ACH100 series VFSR system

Table 1 ACH100-06 series product (6KV)—Integrate machine

Volt	Inverter capacitor (KVA)	Adapted motor power (KW)	Model	Dimension(mm) (Not include bypass cabinet)	Weight(T)	gross heating value (kw)	Air volume of transformer cabinet (m^3/h)	Air volume of power cabinet (m^3/h)	Total air volume(m^3/h)
6kV	315	250	ACH100-06-0250-AM	2650*1500*2580	2.9	10.0	7500	7500	15000
6kV	355	280	ACH100-06-0280-AM		2.9	11.2			
6kV	400	315	ACH100-06-0315-AM		3.0	12.6			
6kV	450	355	ACH100-06-0355-AM		3.0	14.2			
6kV	500	400	ACH100-06-0400-AM		3.0	16.0			
6kV	560	450	ACH100-06-0450-AM		3.2	18.0			
6kV	630	500	ACH100-06-0500-AM		3.3	20.0			
6kV	710	560	ACH100-06-0560-AM		3.4	22.4			
6kV	800	630	ACH100-06-0630-AM		3.6	25.2			
6kV	900	710	ACH100-06-0710-AM		3.8	28.4			
6kV	1000	800	ACH100-06-0800-AM		3.9	32.0			
6kV	1120	900	ACH100-06-0900-AM		4.3	36.0			
Note: Integrate machine refers to the MV VFSR system model that integrates control cabinet, power cabinet and transformer cabinet.									

Among them, the size and weight of bypass cabinet are as follows:

Bypass type	Inverter capacitor (KVA)	Adapted motor power (KW)	Model	Dimension(mm)	Weight(T)
Manual	/	/	/	700*1300*2200	0.8T
Automatic	/	/	/	1100*1300*2200	1.1T

Table 2 ACH100-10 series product (10KV)—Integrate machine

Volt	Inverter capacitor (KVA)	Adapted motor power (KW)	Model	Dimension(mm) (Not include bypass cabinet)	Weight(T)	gross heating value (kw)	Air volume of transformer cabinet (m^3/h)	Air volume of power cabinet (m^3/h)	Total air volume(m^3/h)
10kV	315	250	ACH100-10-0250-AM	2650*1500*2580	3.3	10.0	7500	7500	15000
10kV	355	280	ACH100-10-0280-AM		3.3	11.2			
10kV	400	315	ACH100-10-0315-AM		3.4	12.6			
10kV	450	355	ACH100-10-0355-AM		3.5	14.2			
10kV	500	400	ACH100-10-0400-AM		3.6	16.0			
10kV	560	450	ACH100-10-0450-AM		3.6	18.0			
10kV	630	500	ACH100-10-0500-AM		3.7	20.0			
10kV	710	560	ACH100-10-0560-AM		4.0	22.4			
10kV	800	630	ACH100-10-0630-AM		4.0	25.2			
10kV	900	710	ACH100-10-0710-AM		4.4	28.4			
10kV	1000	800	ACH100-10-0800-AM		4.5	32.0			
10kV	1120	900	ACH100-10-0900-AM		4.7	35.0			
10kV	1250	1000	ACH100-10-1000-AM		5.0	40.0			
10kV	1400	1120	ACH100-10-1120-AM		5.3	40.0			
10kV	1600	1250	ACH100-10-1250-AM		5.4	44.8			
10kV	1700	1320	ACH100-10-1320-AM		5.6	50.0	12000	12000	24000
10kV	1800	1400	ACH100-10-1400-AM		5.9	56.0			
Note: Integrate machine refers to the MV VFSR system model that integrates control cabinet, power cabinet and transformer cabinet.									

Among them, the size and weight of bypass cabinet are as follows:

Bypass type	Inverter capacitor (KVA)	Adapted motor power (KW)	Model	Dimension(mm)	Weight(T)
Manual	/	/	/	700*1300*2200	0.8T
Automatic	/	/	/	1100*1300*2200	1.1T

Table 3 ACH100-06 series product (6KV)—separated machine

Volt	Inverter capacitor (KVA)	Adapted motor power (KW)	Model	Dimension(mm) (Not include bypass cabinet)	Weight(T)	gross heating value (kw)	Air volume of transformer cabinet (m^3/h)	Air volume of power cabinet (m^3/h)	Total air volume(m^3/h)
6kV	315	250	ACH100-06-0250	3200*1500*2580	3.1	10.0	7500	7500	15000
6kV	355	280	ACH100-06-0280		3.1	11.2			
6kV	400	315	ACH100-06-0315		3.2	12.6			
6kV	450	355	ACH100-06-0355		3.2	14.2			
6kV	500	400	ACH100-06-0400		3.2	16.0			
6kV	560	450	ACH100-06-0450		3.4	18.0			
6kV	630	500	ACH100-06-0500		3.5	20.0			
6kV	700	560	ACH100-06-0560		3.6	22.4			
6kV	800	630	ACH100-06-0630		3.8	25.2			
6kV	900	710	ACH100-06-0710		4.0	28.4			
6kV	1000	800	ACH100-06-0800		4.1	32.0			
6kV	1120	900	ACH100-06-0900		4.5	36.0			
Note: Separate machine refers to a set of MV VFSR system divided into control cabinet, power cabinet, transformer cabinet, bypass cabinet (optional)									

Among them, the size and weight of bypass cabinet are as follows:

Bypass cabinet	Bypass type	Inverter capacitor	Model	Dimension (mm)	Weight (T)	Remark
BA27	Manual	/	BA27K4	700*1300*2200	0.8T	Separate machine <= 1400KW, standard configuration BA27 bypass cabinet
	Auto		BA27K1	1100*1300*2200	1.1T	
CV27	Manual	/	CV27K2	700*1300*2300	0.9T	Separate machine 1600KW-2240KW, standard configuration CV27 bypass cabinet
	Auto		CV27K1	1100*1300*2300	1.2T	
BA53	Manual	/	BA53K2	700*1300*2400	1.0T	Separate machine 2500KW-4240KW, standard configuration BA53 bypass cabinet
	Auto		BA53K1	1100*1300*2400	1.3T	
BA72	Manual	/	/	/	/	Separate machine 4500KW-5600KW, standard configuration BA72 bypass cabinet
	Auto	/	BA72K2	1100*1500*2600	1.4T	

Table 4 ACH100-10 series product (10KV)—separated machine

Volt	Inverter capacitor (KVA)	Adapted motor power (KW)	Model	Dimension(mm) (Not include bypass cabinet)	Weight(T)	gross heating value (kw)	Air volume of transformer cabinet (m^3/h)	Air volume of power cabinet (m^3/h)	Total air volume(m^3/h)
10kV	315	250	ACH100-10-0250	3200*1500*2580	3.5	10.0	7500	7500	15000
10kV	355	280	ACH100-10-0280		3.5	11.2			
10kV	400	315	ACH100-10-0315		3.6	12.6			
10kV	450	355	ACH100-10-0355		3.7	14.2			
10kV	500	400	ACH100-10-0400		3.8	16.0			
10kV	560	450	ACH100-10-0450		3.8	18.0			
10kV	630	500	ACH100-10-0500		3.9	20.0			
10kV	700	560	ACH100-10-0560		4.2	22.4			
10kV	800	630	ACH100-10-0630		4.2	25.2			
10kV	900	710	ACH100-10-0710		4.6	28.4			
10kV	1000	800	ACH100-10-0800		4.7	32.0			
10kV	1120	900	ACH100-10-0900		4.9	35.0			
10kV	1250	1000	ACH100-10-1000		5.2	40.0			
10kV	1400	1120	ACH100-10-1120		5.5	40.0			
10kV	1600	1250	ACH100-10-1250		5.6	44.8			
10kV	1700	1320	ACH100-10-1320		5.8	50.0	12000	12000	24000
10kV	1800	1400	ACH100-10-1400		6.1	56.0			
10kV	2000	1600	ACH100-10-1600	4200*1300*2680	6.5	64.0	15000	15000	30000
10kV	2120	1700	ACH100-10-1700		6.6	68.0			
10kV	2250	1800	ACH100-10-1800		6.8	72.0			
10kV	2500	2000	ACH100-10-2000		7.1	80.0			
10kV	2800	2240	ACH100-10-2240		7.2	89.6			
10KV	3150	2500	ACH100-10-2500	4700*1300*2780	8.1	100.0	15000	15000	30000
10KV	3500	2800	ACH100-10-2800		8.2	112.0			
10KV	4000	3150	ACH100-10-3150		8.3	126.0			

10KV	4500	3550	ACH100-10-3550		8.5	142.0			
10KV	5000	4000	ACH100-10-4000	6100*1300*2750	11.1	160.0	10500	37500	21000
10KV	5300	4240	ACH100-10-4240		12.4	169.6			
10KV	5600	4500	ACH100-10-4500	6830*1500*2980	14.6	180.0	22500	37500	60000
10KV	6300	5000	ACH100-10-5000		15.2	200.0			
10KV	7000	5600	ACH100-10-5600		15.7	224.0			
Note: Separate machine refers to a set of MV VFSR system divided into control cabinet, power cabinet, transformer cabinet, bypass cabinet (optional)									

Among them, the size and weight of bypass cabinet are as follows:

Bypass cabinet	Bypass type	Inverter capacitor	Model	Dimension (mm)	Weight (T)	Remark
BA27	Manual	/	BA27K4	700*1300*2200	0.8T	Separate machine <= 1400KW, standard configuration BA27 bypass cabinet
	Auto		BA27K1	1100*1300*2200	1.1T	
CV27	Manual	/	CV27K2	700*1300*2300	0.9T	Separate machine 1600KW-2240KW, standard configuration CV27 bypass cabinet
	Auto		CV27K1	1100*1300*2300	1.2T	
BA53	Manual	/	BA53K2	700*1300*2400	1.0T	Separate machine 2500KW-4240KW, standard configuration BA53 bypass cabinet
	Auto		BA53K1	1100*1300*2400	1.3T	
BA72	Manual	/	/	/	/	Separate machine 4500KW-5600KW, standard configuration BA72 bypass cabinet
	Auto	/	BA72K2	1100*1500*2600	1.4T	