

Suzhou Invotech Scroll Technologies Co.,Ltd.



# USER MANUAL OF CONTROLLER KIT FOR REFRIGERATION

## Suzhou Invotech Scroll Technologies Co.,Ltd.

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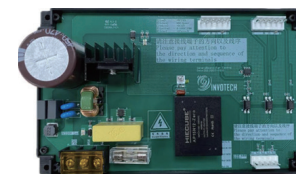
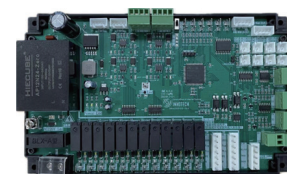
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## 1. Functions and technical parameters

### 1.1. Functions

**Temperature/Pressure control:** 8-way temperature sensors; one way PT100 sensor; right time temperature display; temperature control; alarms for abnormal of sensors.

**Pressure detection:** There are discharge and suction pressure detection functions on controller, it makes controller control the EXV more accurately.

**Fan control:** Controller can drive AC fan, EC fan and DC fan.

**Defrost control:** There are three different defrost mode (none defrost/electrical/Freon) for user to choose.

**Switch signal input:** There are 6 switch inputs.

**Alarms:** there are up to 26 protection functions ensure system safety.

**EXV control:** Controller controls the EXV based on suction super-heat, make the system to operate at its optimal state.

**EVI control:** Controller controls the EVI based on discharge temperature or injection super-heat.

**Spray control:** The spray solenoid valve can be opened or closed to control the discharge temperature.

**RS485:** There are 4 RS485 ports on controller, 2 for driver, 1 for HMI, and 1 for backup.

### 1.2. Parameters

**Measuring temperature range:** -40°C ~150°C (resolution ratio 0.1°C)

**supply voltage:** 100~240VAC 50/60HZ

**Usage environment:** Temperature -25°C ~70°C, relative humidity ≤ 85%, no condensation

**Output capacity:** 250VAC 5A (resistive load)

**temperature sensor:** NTC R25=10KΩ, B(25/50)=3470K

**Pressure sensor:** 4-20mA or 0.5-4.5V

**Interface:** RS485, 9600bps, 8N1

**AC fan (single) rated power:** 500W rated current: 2.5A

**EC fan (single) rated power:** 500W rated current: 2.5A

**DC fan (single) rated power:** 900W rated current: 2.5A, needs to be used with fan power board

## 2. Instruction

### 2.1. Interface Description

#### 2.1.1. Power on/screensaver interface:



- ① HMI version
- ② When there is poor communication during startup, a message prompt will be displayed at this location
- ③ Click to enter the settings interface (displayed when communication is poor)
- ④ Current communication address (default to 1)

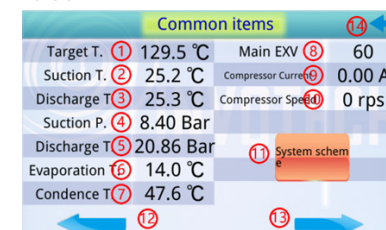
#### 2.1.2. Main interface



- ① Current state (Running/ Shutdown/ Standby/Defrosting/water drop/ Fault)
- ② Compressor Speed
- ③ Setting temperature or pressure
- ④ Discharge temperature
- ⑤ Steps of main EXV
- ⑥ Running mode (temperature/ pressure controlled refrigeration)
- ⑦ Current temperature or pressure label

- ⑧ Current temperature or pressure value
- ⑨ Evaporation temperature corresponding to the suction pressure
- ⑩ System status interface entry
- ⑪ System setting interface entry
- ⑫ Manual defrosting interface entry
- ⑬ On/off interface entry
- ⑭ Alarm query interface entrance
- ⑮ Current alarm information

#### 2.1.3. System status interface



- ① Target Temperature: The target temperature value set by user
- ② Suction Temperature: The temperature of compressor suction inlet.
- ③ Discharge Temperature: The temperature of compressor discharge outlet.
- ④ Suction pressure: The pressure of compressor suction inlet.
- ⑤ Discharge pressure: The pressure of compressor discharge outlet.
- ⑥ Evaporating temperature: Saturation temperature corresponding to suction pressure.
- ⑦ Condensing temperature: Saturation temperature corresponding to discharge pressure.
- ⑧ Main EXV steps: The steps of main EXV.
- ⑨ Output current: The output current value of inverter.
- ⑩ Compressor speed: Right time speed of compressor.

- ⑪ System diagram entry
- ⑫ Other status interface entry
- ⑬ Right time temperature interface entry
- ⑭ Back to main interface

Others			
Main EXV	① 60	Speed of Fan 1	⑦ 0 rpm
Branch EXV	② 0	Speed of fan 2	⑧ 0 rpm
Power-on time	③ 3 H		28 min
Running time	④ 0 H		0 min
Total power-on time	⑤ 3 H		28 min
Total running time	⑥ 0 H		0 min

- ① Main EXV steps: The steps of main EXV.
- ② Branch EXV steps: The steps of branch EXV.
- ③ Power on time: Display the current power on time.
- ④ Running time: Display the current running time of compressor.
- ⑤ Total power on time: Display the total power on time.
- ⑥ Total running time: Display the total running time of compressor.
- ⑦ Speed of fan 1 The speed feedback from variable speed fan 1.
- ⑧ Speed of fan 2: The speed feedback from variable speed fan 2.
- ⑨ Inverter parameter setting interface entry.
- ⑩ Debug interface entry.
- ⑪ Back to main interface.

Inverter status	
Right time speed	① 0 rps
Bus voltage	② 0 V
Output current	③ 0.00 A
Temperature	④ 0 °C
Preset speed	⑤ 0 rps

- ① Right time speed: The compressor speed feedback from interter.
- ② Bus voltage: The value of bus voltage
- ③ Output current: The output current value of inverter.
- ④ Temperature: The highest temperature value of inverter.
- ⑤ Preset speed: The setting speed value by user.
- ⑥ Switch input interface entry.
- ⑦ Other status interface entry
- ⑧ Back to main interface

Switch status	
Low pressure switch	① Trig
Remote switch	② Running
High pressure switch	③ Trig

- ① Low pressure switch: This switch indicate low pressure of system.(0、Normal;1、 Trig)
- ② Remote switch: The status of remote switch.(0、 stop;1、 running)
- ③ High pressure switch: This switch indicate high pressure of system.(0、 Normal;1、 Trig)
- ④ Relay output interface entry.
- ⑤ Inverter parameter setting interface entry.
- ⑥ Back to main interface.

Relay output	
Inverter	① ON OFF
4-way valve	② ON OFF
Defrost bypass	③ ON OFF
Balance bypass	④ ON OFF
Spray valve	⑤ ON OFF
Crankshaft heater	⑥ ON OFF
Inner fan	⑦ ON OFF
Main loop valve	⑧ ON OFF
Outer heater	⑨ ON OFF
Inner heater	⑩ ON OFF
Outer Fan 1	⑪ ON OFF
Outer Fan 2	⑫ ON OFF

- ① Inverter: Output status of relay which controls inverter.
- ② 4-way valve: Similar to the above.
- ③ Defrost bypass: Similar to the above.
- ④ Balance bypass: Similar to the above.
- ⑤ Spray valve: Similar to the above.
- ⑥ Crankshaft heater: Similar to the above.
- ⑦ Inner fan: Similar to the above.
- ⑧ Main loop valve: Similar to the above.
- ⑨ Outer heater: Similar to the above.
- ⑩ Inner heater: Similar to the above.
- ⑪ Outer Fan 1: Similar to the above.
- ⑫ Outer Fan 2: Similar to the above.
- ⑬ Pressure interface entry.
- ⑭ Switch input interface entry.
- ⑮ Back to main interface.

Right time Pressure	
Suction P. (Ampere)	① 8.33 Bar
Discharge P. (Ampere)	② 21.01 Ba
Suction P. (Volt)	③ 10.03 Ba
Discharge P. (Volt)	④ 24.96 Ba

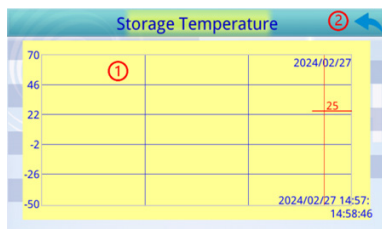
- ① Suction pressure (ampere type): Suction pressure value measured by ampere type pressure sensor.
- ② Suction pressure curve: The curve of suction pressure.
- ③ Discharge pressure (ampere type): Discharge pressure value measured by ampere type pressure sensor.
- ④ Discharge pressure curve: The curve of discharge pressure.
- ⑤ Suction pressure (voltage type): Suction pressure value measured by voltage type pressure sensor.
- ⑥ Discharge pressure (voltage type): Discharge pressure value measured

- by voltage type pressure sensor
- ⑦ Right time temperature interface entry.
- ⑧ Relay output interface entry.
- ⑨ Back to main interface.

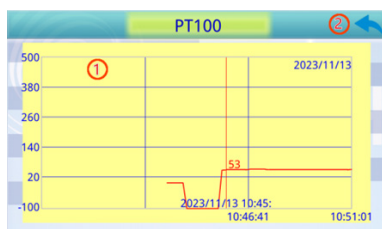
Right time Temperature	
① Storage T.	② 25.0 °C
③ Discharge T.	④ 25.3 °C
⑤ Inner coil T.	⑥ 25.2 °C
⑦ Outer coil T.	⑧ 24.9 °C
⑨ Suction T.	⑩ 25.2 °C
⑪ PT100	⑫ 29.0 °C

- ① Storage temperature: storage temperature curve entry.
- ② Storage temperature: The value of the temperature sensor placed in the storage.
- ③ Discharge temperature: discharge temperature curve entry.
- ④ Discharge temperature: The value of temperature sensor placed at discharge outlet of compressor.
- ⑤ Inner coil temperature: The value of temperature sensor placed at evaporating coil.
- ⑥ Ambient temperature: The value of temperature sensor in the environment.
- ⑦ outer coil temperature: The value of temperature sensor placed at condensing coil.
- ⑧ Suction temperature: The value of temperature sensor placed at suction inlet of compressor.
- ⑨ PT100: PT100 temperature curve entry.
- ⑩ PT100: The value of PT100 sensor.
- ⑪ Debug interface entry.
- ⑫ Pressure interface entry.
- ⑬ Back to main interface.

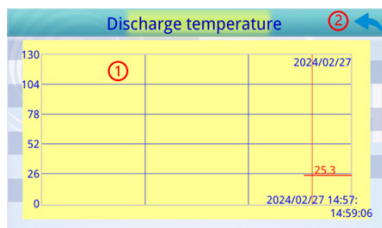




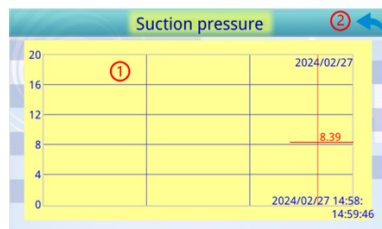
- ① Storage temperature curve: sampling cycle is 10s.
- ② Back to right time temperature interface.



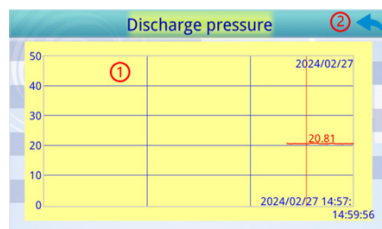
- ① PT100 curve: sampling cycle is 10s
- ② Back to right time temperature interface.



- ① Discharge temperature curve: sampling cycle is 10s.
- ② Back to right time temperature interface.

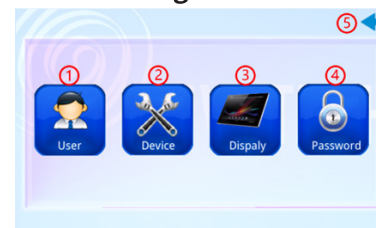


- ① Suction pressure : sampling cycle is 10s.
- ② Back to pressure interface.



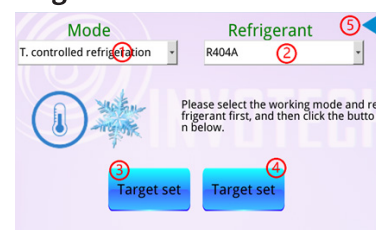
- ① Discharge pressure : sampling cycle is 10s.
- ② Back to pressure interface.

## 2.1.4. Settings



- ① User parameters setting interface entry (no password).  
User parameters: Parameters commonly used by users.
- ② Device parameters setting interface entry (initial password "11111")  
Device parameters: Parameters related to system operation.
- ③ HMI parameters setting interface entry (no password)  
HMI parameters: RTC, language, screen parameters and communication parameters etc.
- ④ Password modification interface entry
- ⑤ Back to main interface

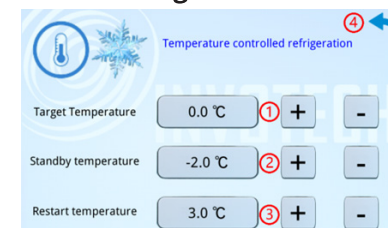
### 2.1.4.1. User parameters setting



- ① Working mode: Mode selection for users to choose from  
The corresponding buttons in ③ and ④ below will appear only after selecting the working mode.

- ② Refrigerant: Refrigerant selection for users to choose from.
- ③ Target set: The entrance to the temperature controlled refrigeration setting interface.
- ④ Target set: The entrance to the pressure controlled refrigeration setting interface.
- ⑤ Back to settings interface.

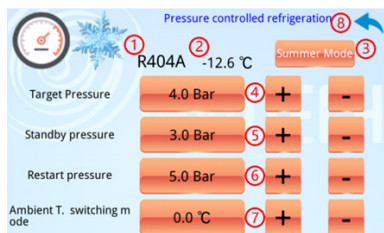
### 2.1.4.1.1. Temperature controlled refrigeration



- ① Target temperature: the controller adjusts the compressor speed, and controls the target at this temperature.  
Click on the numerical value to set the target temperature value, and the "+" / "-" signs on the right can adjust the set value to 0.1 °C each time.
- ② Standby temperature: When the target is below this temperature, the compressor will shut down  
Click on the numerical value to set the standby temperature value, and the "+" / "-" signs on the right can adjust the set value to 0.1 °C each time.
- ③ Restart temperature: When the target is above this temperature, the compressor will restart.  
Click on the numerical value to set the restart temperature value, and the "+" / "-" signs on the right can adjust the set value to 0.1 °C each time.

- ④ Back to user parameter setting interface.

#### 2.1.4.1.2. Pressure controlled refrigeration -summer mode



- ① refrigerant.  
② The saturation temperature corresponding to the target pressure.  
③ The current interface is the summer mode parameter setting interface. Click to switch to the winter mode parameter setting interface.  
④ Target pressure: the controller adjusts the compressor speed, and controls the target at this pressure.

Click on the numerical value to set the target pressure value, and the "+" / "-" signs on the right can adjust the set value to 0.1bar each time.

- ⑤ Standby pressure: When the target is below this pressure, the compressor will shut down

Click on the numerical value to set the standby pressure value, and the "+" / "-" signs on the right can adjust the set value to 0.1bar each time.

- ⑥ Restart pressure: When the target is above this pressure, the compressor will restart.

Click on the numerical value to set the restart pressure value, and the "+" / "-" signs on the right can adjust

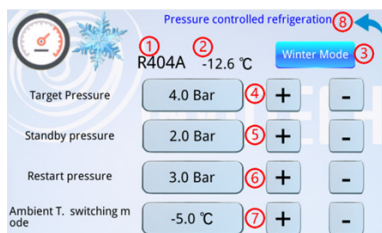
the set value to 0.1bar each time.

- ⑦ Switching mode ambient temperature: The ambient temperature value when the controller switches to summer mode.

Click on the numerical value to set the ambient temperature value, and the "+" / "-" signs on the right can adjust the set value to 0.1 °C each time.

- ⑧ Back to user parameter setting interface.

#### 2.1.4.1.3. Pressure controlled refrigeration -winter mode



- ① refrigerant.  
② The saturation temperature corresponding to the target pressure.  
③ The current interface is the summer mode parameter setting interface. Click to switch to the summer mode parameter setting interface.  
④ Target pressure: the controller adjusts the compressor speed, and controls the target at this pressure.  
Click on the numerical value to set the target pressure value, and the "+" / "-" signs on the right can adjust the set value to 0.1bar each time.

- ⑤ Standby pressure: When the target is below this pressure, the compressor will shut down

Click on the numerical value to set the standby pressure value, and the "+" / "-" signs on the right can adjust the set value to 0.1bar each time.

- ⑥ Restart pressure: When the target is above this pressure, the compressor will restart.

Click on the numerical value to set the restart pressure value, and the "+" / "-" signs on the right can adjust the set value to 0.1bar each time.

- ⑦ Switching mode ambient temperature: The ambient temperature value when the controller switches to winter mode.

Click on the numerical value to set the ambient temperature value, and the "+" / "-" signs on the right can adjust the set value to 0.1 °C each time.

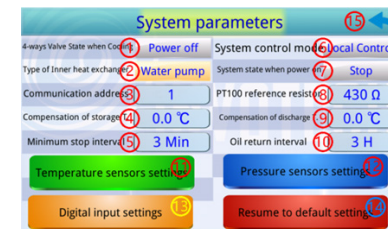
- ⑧ Back to user parameter setting interface.

#### 2.1.4.2. Device parameters setting



- ① System parameters interface entry.  
② Defrosting parameters interface entry.  
③ Fan parameters interface entry.  
④ EXV parameters interface entry.  
⑤ Inverter parameters interface entry.  
⑥ Alarm parameters interface entry.  
⑦ Manual debug interface entry.  
⑧ Back to main interface.

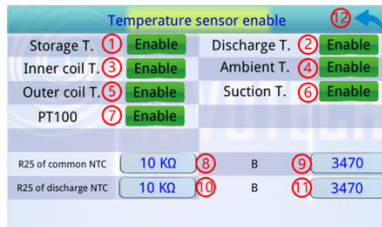
#### 2.1.4.2.1. System parameters setting



- ① Four-way valve status when the mode is refrigeration : The status of the four-way valve when the system is operating in refrigeration mode. (0. Power off, 1. Power on).  
② Type of Inner heat exchangers: fan or water pump.  
③ Communication address of controller: Set the communication address of the controller, setting range: 1-247 (New address takes effect after restart).  
④ Compensation of storage temperature: default value is 0 °C .  
⑤ Minimum stop interval: Set the minimum stopping interval, the default time is 6 minutes.  
⑥ System control mode: 0. Local control; 1. Remote control.  
⑦ System state when power on: 0. Shutdown; 1. Recovery.  
⑧ PT100 reference resistance: Set the PT100 sensor reference resistance, with a default value of 430 Ω. (Please do not modify).  
⑨ Compensation of discharge temperature: default value is 0 °C .  
⑩ Oil return interval: Set the oil return interval time , with a default time of 3 hours.  
⑪ Temperature sensor settings interface entry.  
⑫ Switch input settings interface entry.  
⑬ Pressure sensor settings interface entry.  
⑭ Reset to factory settings entry.

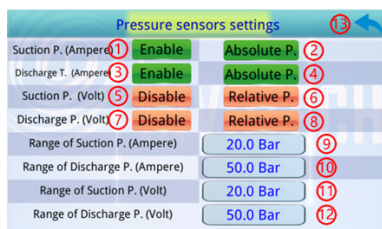
- ⑮ Back to the maintenance settings interface.

### 2.1.4.2.2. System Parameters - Temperature Sensor Enabling



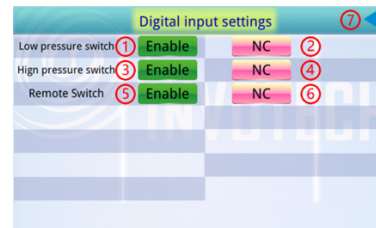
- ① ~ ⑦ Enable or disable the temperature sensors.
- ⑧ R25 of common NTC: Set the resistance value of common NTC at 25 °C, with a default value of 10KΩ.
- ⑨ B value for common NTC: Set the B value for common NTC, with a default value of 3470.
- ⑩ R25 of discharge NTC: Set the resistance value of discharge NTC at 25 °C, default value is 10KΩ.
- ⑪ B value of discharge NTC: Set the B value of discharge NTC, with a default value of 3470.
- ⑫ Back to the system parameter interface.

### 2.1.4.2.3. System Parameters - Pressure Sensor Enabling



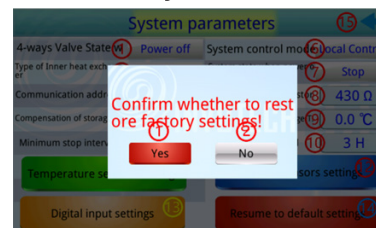
- ① Suction pressure sensor measured by current: Enable or disable this sensor. ( 0, disabled; 1, enabled).
- ② Press to choose absolute pressure display or relative pressure display.
- ③ Discharge pressure sensor measured by current: Enable or disable this sensor. ( 0, disabled; 1, enabled).
- ④ Press to choose absolute pressure display or relative pressure display.
- ⑤ Suction pressure sensor measured by voltage: Enable or disable this sensor. ( 0, disabled; 1, enabled).
- ⑥ Press to choose absolute pressure display or relative pressure display.
- ⑦ Discharge pressure sensor measured by voltage: Enable or disable this sensor. ( 0, disabled; 1, enabled).
- ⑧ Press to choose absolute pressure display or relative pressure display.
- ⑨ Range of suction pressure sensor measured by current: Set the maximum value that can be measured by this sensor.
- ⑩ Range of discharge pressure sensor measured by current: Set the maximum value that can be measured by this sensor.
- ⑪ Range of suction pressure sensor measured by voltage: Set the maximum value that can be measured by this sensor.
- ⑫ Range of discharge pressure sensor measured by voltage: Set the maximum value that can be measured by this sensor.
- ⑬ Back to the system parameter interface.

### 2.1.4.2.4. System Parameters - Digital input settings



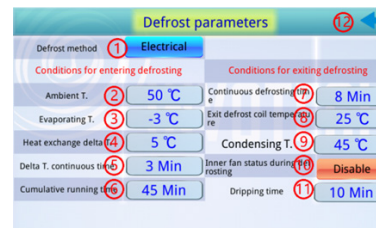
- ①③⑤ Enable or disable the switches, ②④⑥ Set the switches NC or NO.
- ⑦ Back to the system parameter interface.

### 2.1.4.2.5. System parameters - factory reset window



- ① Confirmation: Restore all data to the factory parameters
- ② Cancel

### 2.1.4.2.6. Defrosting parameters



- ① Defrost mode: The defrost mode can be set. ( 0. No defrosting; 1.

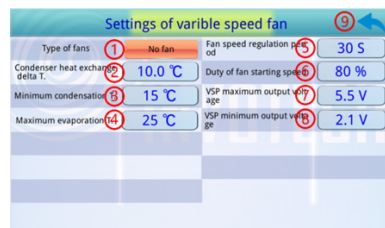
defrosting by electrical heater; 2. Electrical defrosting by Freon);

- ② Entering defrosting environment temperature: The ambient temperature when entering defrosting can be set, with a default temperature of 20 °C.
- ③ Evaporating temperature for entering defrost: The temperature for entering defrost coil (evaporation temperature) can be set, with a default temperature of -3 °C.
- ④ Heat exchanger temperature difference for entering defrost: The temperature for entering defrost heat exchange (evaporation side ambient temperature - evaporating temperature) can be set, with a default temperature of 10 °C.
- ⑤ Heat exchange temperature difference judgment time: The heat exchange temperature difference judgment time can be set, with a default time of 3 minutes.
- ⑥ Entering defrost cumulative running time: The accumulated running time for entering defrost can be set, with a default time of 45 minutes.
- ⑦ Maximum defrosting time: The maximum defrosting time can be set, with a default time of 8 minutes.
- ⑧ Coil temperature to exit defrosting status: The exit defrosting coil temperature can be set, with a default temperature of 25 °C.
- ⑨ Condensation temperature to exit defrosting: The exit defrosting condensation temperature can be set, with a default temperature of 25 °C.
- ⑩ Inner fan status during defrosting: During defrosting, the internal fan status can be set. (0, stop; 1, running).



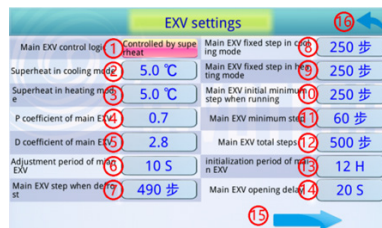
- ⑪ dripping time: Waiting for the drip to end after defrosting, with a default time of 10 minutes.
- ⑫ Back to the maintenance settings interface.

#### 2.1.4.2.7. Fan parameters



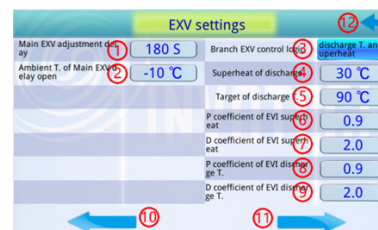
- ① Fan type: 0, AC fan; 1, EC fan; 2, DC fan.
- ② Heat transfer difference: the heat transfer difference between target condensation temperature and ambient temperature can be set, and the default value is 5.0°C.
- ③ Minimum condensation temperature: the lowest condensation temperature to start external fan.
- ④ Maximum evaporating temperature: the highest evaporating temperature to start inner fan.
- ⑤ Fan speed regulation period: If the fan is EC or DC fan, the adjustment cycle can be set, and the default value is 30 seconds.
- ⑥ Fan startup speed percentage: the startup speed percentage of fan can be set, the default value is 80%.
- ⑦ VSP maximum output voltage: the maximum output voltage of the VSP port. The default value is: 10V. (This value must be set according to specification of fan)
- ⑧ Back to the Maintenance Settings interface.

#### 2.1.4.2.8. Electronic expansion valve parameters



- ① Main valve control logic: 0: no EXV 1: controlled by super-heat 2: fixed steps
- ② Refrigeration super-heat: the target super-heat of the main EXV, (super-heat = suction temperature-evaporation temperature).
- ③ Super-heat in heat-pump mode
- ④ P coefficient of main EXV: the proportional coefficient during automatic control of the main EXV.
- ⑤ D coefficient of Main EXV: the differential coefficient during the automatic control of the main EXV.
- ⑥ Adjustment cycle of main EXV
- ⑦ The step of main EXV when defrosting: The fixed steps of main EXV when system is defrosting.
- ⑧ The fixed steps of Main EXV when in refrigeration mode: If “fixed steps” is chosen in parameter ①, the main EXV will keep in this steps at refrigeration mode.
- ⑨ The fixed steps of Main EXV when in heating mode: If “fixed steps” is chosen in parameter ①, the main EXV will keep in this steps at heating mode.
- ⑩ Initial minimum steps of main EXV: the minimum steps of the main EXV during the starting stage of the system.

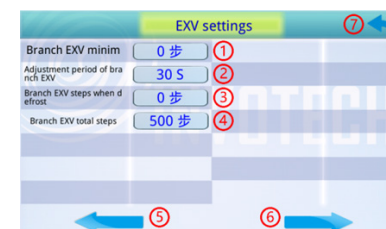
- ⑪ Minimum steps of main EXV: the minimum steps of main EXV during adjustment.
- ⑫ Total steps of main EXV: the maximum steps of main EXV during adjustment.
- ⑬ Initialization cycle of main valve : The main valve needs periodic initialization to ensure the accuracy of its position.
- ⑭ The delay opening time of main EXV: the main EXV is delayed to open in the starting stage.
- ⑮ Go to the next page for settings.
- ⑯ Back to the Maintenance Settings interface.



- ① The delay adjustment time of main EXV: the main EXV is delayed to adjust in the starting stage.
- ② Ambient temperature of Main EXV delayed opening: below this temperature, the delayed opening logic of the main EXV takes effect.
- ③ Branch EXV control logic: 0: no EVI 1: discharge temperature control 2: discharge & super-heat control.
- ④ super-heat of discharge : when discharge temperature is below the value of ⑤, target discharge temperature = condensing temperature + this value.
- ⑤ Target of discharge temperature: when discharge temperature is

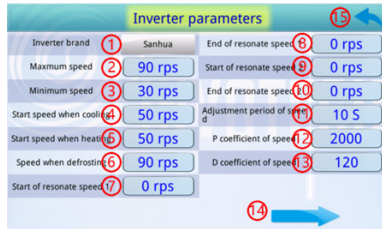
higher than this value, the controller open branch EXV to make it to this value.

- ⑥ Kp of EVI at super-heat mode: the proportional coefficient of the branch EXV when working at super-heat mode.(PID parameters).
- ⑦ Kd of EVI at super-heat mode.
- ⑧ Kp of EVI at discharge temperature control mode: the proportional coefficient of the branch EXV when working at discharge temperature control mode.
- ⑨ Ki of EVI at discharge temperature control mode.
- ⑩ Back to the previous page of EXV settings
- ⑪ Go to the next page of EXV Settings
- ⑫ Back to the parameter settings home page



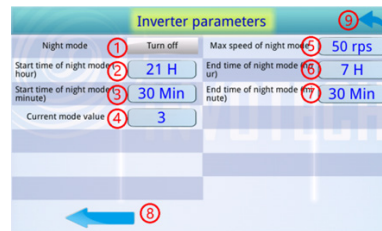
- ① Minimum steps of branch EXV: the minimum steps of branch EXV during the adjustment process.
- ② Adjustment cycle of branch EXV.
- ③ Branch EXV steps when defrosting: the steps of branch EXV when defrosting.
- ④ Total steps of branch EXV: the maximum steps of branch EXV.
- ⑤ Back to the previous page of EXV settings.
- ⑥ Go to the first page of EXV settings.
- ⑦ Back to the parameter settings home page.

#### 2.1.4.2.9. Inverter parameters



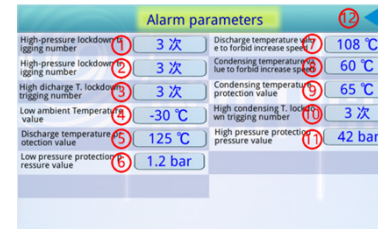
- ① Inverter brand: according to the type of inverter to choose the inverter brand. Restart to take effect.
- ② Maximum speed.
- ③ Minimum speed.
- ④ Start speed in refrigeration mode.
- ⑤ Starting speed in heating mode.
- ⑥ Speed during defrost.
- ⑦ Resonant start speed 1: combined with resonance end speed 1, the speed adjustment process will avoid the speed interval of this section.
- ⑧ Resonant end speed 1: combined with resonance start speed 1, the speed adjustment process will avoid the speed interval of this section.
- ⑨ Resonant start speed 2: combined with resonance end speed 2, the speed adjustment process will avoid the speed interval of this section.
- ⑩ Resonant end speed 2: combined with resonance start speed 2, the speed adjustment process will avoid the speed interval of this section.
- ⑪ Speed adjustment cycle: PID speed adjustment cycle.

- ⑫ Speed adjustment Kp: the proportional coefficient when the speed is automatically controlled according to the target.(PID parameters).
- ⑬ Speed adjustment Kd: the differential coefficient when the speed is automatically controlled according to the target.(PID parameters).
- ⑭ Go to the next page for Settings.
- ⑮ Back to the parameter settings home page.



- ① Night mode: Switch for night mode, select on or off.
- ② Night mode onset (time): the hour time of night mode onset.
- ③ Night mode onset (minutes): minutes of night mode onset.
- ④ Current mode value: display only. 1 & 3 represents entering the night mode; 2 & 4 represents exiting the night mode.
- ⑤ Maximum speed at night mode.
- ⑥ End time of night mode (hour): the hour time at the end of night mode.
- ⑦ End time of night mode (minute): the minute time at the end of night mode.
- ⑧ Back to the previous page of the settings.
- ⑨ Back to the parameter settings home page.

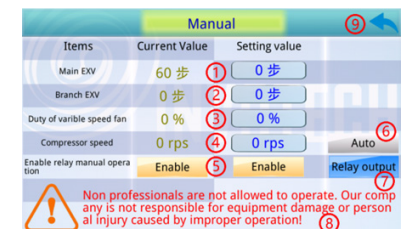
#### 2.1.4.2.10. Alarm parameters



- ① High-pressure protection lockdown times: After triggering the high-pressure protection times of this value within half an hour, the system enters a locked state and needs to be manually reset.
- ② Low-pressure protection lockdown times: After triggering the low-pressure protection times of this value within half an hour, the system enters a locked state and needs to be manually reset.
- ③ High discharge temperature protection lockdown times: After triggering the high discharge temperature protection times of this value within half an hour, the system enters a locked state and needs to be manually reset.
- ④ Low ambient temperature protection value: enter the protection when the ambient temperature on the evaporation side is lower than this value.
- ⑤ Discharge temperature protection value: enter the protection when the discharge temperature is higher than this value.
- ⑥ Low pressure pressure protection value: Pressure value when triggering low pressure protection.
- ⑦ Discharge temperature value to forbid speed increase : when the discharge temperature value is higher than this value, the speed of the

- compressor is limited.
- ⑧ Condensing temperature value to forbid speed increase : when the condensing temperature value is higher than this value, the speed of the compressor is limited.
- ⑨ High condensing temperature protection value: enter the protection when the condensing is higher than this value.
- ⑩ High condensing temperature protection lockdown times: After triggering the high condensing temperature protection times of this value within half an hour, the system enters a locked state and needs to be manually reset
- ⑪ High pressure pressure protection value: Pressure value when triggering high pressure protection.
- ⑫ Return to the parameter settings home page.

#### 2.1.4.2.11. Manual debugging



- ① Main EXV: The current value of the main EXV is displayed, and the manual set value needs to be inconsistent with the last set value to take effect.
- ② Branch EXV: the current value of the branch EXV is displayed, and the manual set value needs to be inconsistent with the last set value to take effect.



- ③ Duty of variable speed fan: the current value of duty of variable speed fan is displayed, and the set value should be inconsistent with the last set value to take effect.
- ④ Compressor speed: the current value of the compressor speed is displayed, the set value should be inconsistent with the last set value to take effect.
- ⑤ Relay output enable: Manual control of single relay output requires enabling status to set.
- ⑥ Compressor speed fixed or automatic control selection button.
- ⑦ Relay output: relay manual operation page.
- ⑧ NOTE
- ⑨ Back to the parameter settings home page.

#### 2.1.4.2.12. Relay manual operation



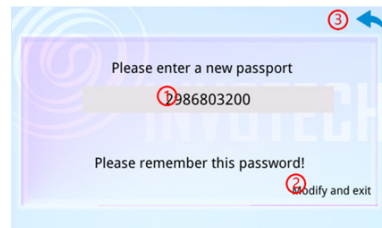
#### 2.1.4.3. HMI Settings



- ① Switch the language, can set up Chinese or English.

- ② Set the screen time, click the corresponding position to set the year, month, day and second. Press "set" button to take effect.
- ③ The time to automatically enter the screen saver after the screen without operation.
- ④ The correspondence address of the slave where this screen attempts to communicate.
- ⑤ Communication Baud rate setting.
- ⑥ Communication verification mode setting.
- ⑦ Communication data bits setting.
- ⑧ Communication stop bit setting.
- ⑨ Confirm setting button after changing the time.
- ⑩ Touch accompaniment.
- ⑪ The current correspondence address is displayed
- ⑫ Communication fault pop-up enable: whether to set an alarm pop-up in the event of a communication fault.
- ⑬ Confirmation button to change the com settings
- ⑭ Obtain the information of HMI version, controller software version, and controller hardware version.

#### 2.1.4.4. Password Settings



Only entering the correct password can enter the Password Settings page

- ① Enter the password that you want to change

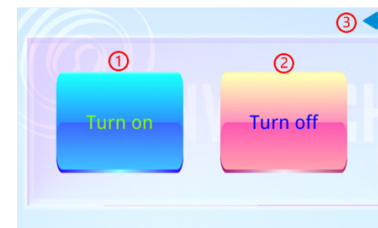
- ② Confirm the modifications and exit
- ③ Abandon modifications and return to the Settings page

#### 2.1.5. manual defrosting



- ① Displays the current running status of system
- ② Manual entry of defrosting
- ③ Manual stop defrosting
- ④ Back to the main page

#### 2.1.6. Startup & Shutdown



- ① System turn on
- ② System shut off
- ③ Back to the main page

#### 2.1.7. Alarm

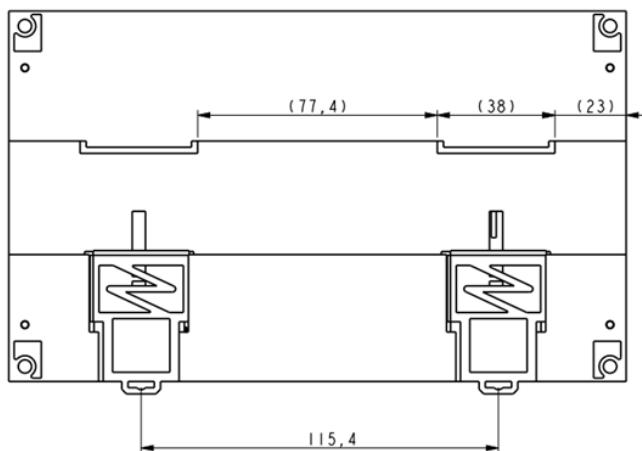
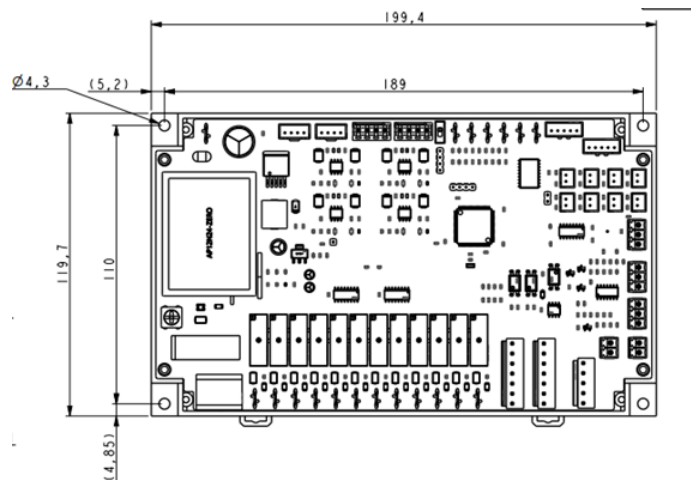
Clr alarm			
序号	触发时间	解除时间	告警信息
1	2024/02/27 15:53:26		Communication error
2	2024/02/27 15:53:26		High pressure switch t

- ① Clear real-time alarms
- ② History alarm page entry
- ③ Currently triggered real-time alarm information, including alarm time, release time, and alarm content.
- ④ Back to the main page

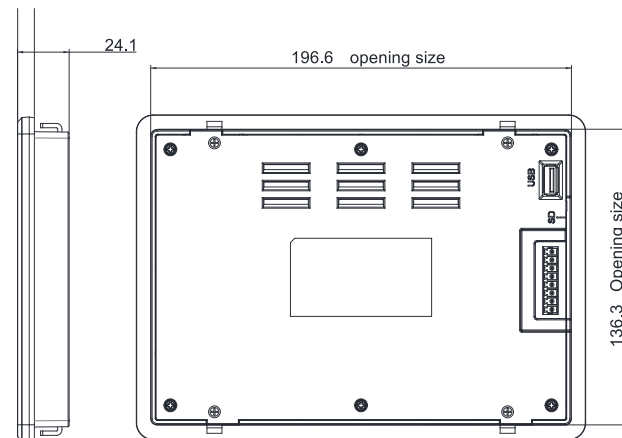
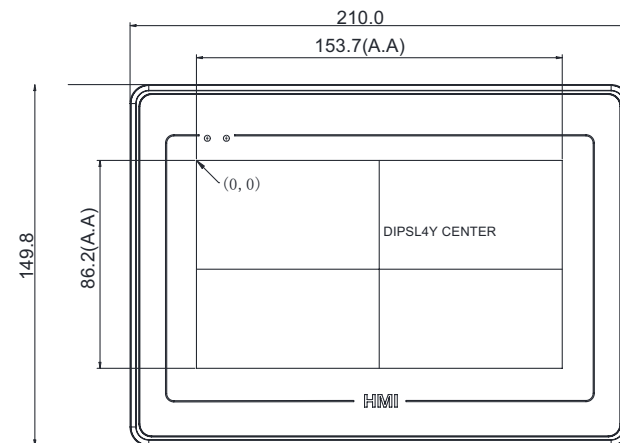
Clr history alarm			
序	触发时间	解除时间	告警信息
1	2024/02/27 15:53:26		Communication error
2	2024/02/27 15:53:26		High pressure switch

- ① Clear the historical alarm information
- ② Real-time alarm page entry
- ③ Displays the historical alarm information, including the alarm time, the release time, and the alarm content
- ④ Historical alarm export needs to be used with USB or SD card
- ⑤ Back to the main page

### 3. Control Board Size



### 4. HMI Size



## 5. Warning logic table

Alarms	instructions	Possible cause / Actions	Restore
Storage Temperature sensor error	The sampled temperature value is not in the normal range.	1. Sensor is not connect. 2. Poor interface contact. 3. Sensor is broken. 4. Wire is not good. 5. The control board is not good.	Automatic recovery
Internal coil temperature sensor error			Automatic recovery
Outer coil temperature sensor error			Automatic recovery
Ambient temperature sensor error			Automatic recovery
Suction temperature probe has sensor error			Automatic recovery
Discharge temperature sensor error			Automatic recovery
The PT100 sensor error			Automatic recovery
Discharge temperature too high protection	Discharge temperature is higher than 125° C (adjustable)	The machine will be locked for three times within half an hour, and click to clear the fault on the HMI after fault-removing.	Lock
Discharge Temp is too high and limited frequency	Discharge temperature is higher than 108° C (adjustable)	The compressor reduces the frequency and automatically recovers when the discharge temperature is lower than 98° C (adjustable)	automatic recovery
The condensation is too high protection	Condensing temperature or outer coil temperature is higher than 65° C (adjustable)	The machine will be locked for three times within half an hour, and click to clear the fault on the HMI after fault-removing.	Lock

Alarms	instructions	Possible cause / Actions	Restore
The condensation is too high and limited	Condensing or outer coil temperature is higher than 60° C (adjustable)	Only alarm, no treatment, when the discharge temperature is lower than 60° C, automatically recover	automatic recovery
High pressure protection	High pressure switch is triggered or discharge pressure is higher than 32bar (adjustable)	The machine will be locked for three times within half an hour, and click to clear the fault on the HMI after fault-removing.	Lock
low voltage protection	Low pressure switch is triggered or suction pressure is lower than 0.2bar (adjustable)	The machine will be locked for three times within half an hour, and click to clear the fault on the HMI after fault-removing.	Lock
Communication failure with inverter	Continuous communication failure with inverter for 10s (0.5s detection once)	1. Poor interface contact. 2. Wire is not good. 3. Wire sequence error. 4. Inverter is broken. 5. The control board is not good.	Automatic recovery
Communication failure with HMI	The popup window on the HMI shows an abnormal communication.	1. Poor interface contact. 2. Wire is not good. 3. Wire sequence error. 4. HMI is broken. 5. The control board is not good.	Automatic recovery
The suction pressure sensor error	The suction pressure was detected as being equal to 0	1. Poor interface contact. 2. Wiring error 3. Wire is not good. 4. Sensor is not good.	Automatic recovery
The discharge pressure sensor error	The discharge pressure is detected as equal to 0	5. The control board is not good. 6. Unfilled refrigerant.	Automatic recovery

## 6. Parameter Setting Explanation Table

Cat- ego- ry	Name	Range	Default	Unit	Location	Re- mark
User settings	Work mode	Tempera- ture control mode/volt- age control mode	Tempera- ture con- trol mode		Setti ngs-User Set- tings	
	Type of refrigerant	R404A/R22/ R410A/ R134A/ R407C/ R407F/R507	R404A		Settings-User Set- tings	
	Target tem- perature	-40~70	0	°C	Settings-User Set- tings-Temperature Control Cooling	
	Standby tem- perature	-40~70	-2	°C	Settings-User Set- tings-Temperature Control Cooling	
	Start tem- perature	-40~70	3	°C	Settings-User Set- tings-Temperature Control Cooling	
	Target Pressure (Summer)	0~50	4.0	Bar	Settings-User Set- tings-Pressure Con- trol Cold	
	Standby Pressure (Summer)	0~50	3.0	Bar	Settings-User Set- tings-Pressure Con- trol Cold	
	Start pres- sure (sum- mer)	0~50	5.0	Bar	Settings-User Set- tings-Pressure Con- trol Cold	
	Switch am- bient tem- perature (summer)	-40~70	5	°C	Settings-User Set- tings-Pressure Con- trol Cold	
	Target Pressure (Winter)	0~50	4.0	Bar	Settings-User Set- tings-Pressure Con- trol Cold	

Cat- ego- ry	Name	Range	Default	Unit	Location	Re- mark
User settings	Standby Pressure (Winter)	0~50	2.0	Bar	Settings-User Set- tings-Pressure Con- trol Cold	
	Start pres- sure (win- ter)	0~50	3.0	Bar	Settings-User Set- tings-Pressure Con- trol Cold	
	Switch am- bient tem- perature (winter)	-40~70	-5	°C	Settings-User Set- tings-Pressure Con- trol Cold	
Maintenance settings/system parameters	Refrigera- tion four- way valve status	Power loss/ power gain	Loss of power		Settings-Maintenance Settings-System Parameters	
	System con- trol mode	Local Con- trol/Remote Control	Local con- trol		Settings-Maintenance Settings-System Parameters	The remote switch needs to be en- abled
	Type of internal unit	Fan/water pump	Fan		Settings-Maintenance Settings-System Parameters	
	System status after power-on	Shutdown/ recovery	Shutdown		Settings-Maintenance Settings-System Parameters	
	Commu- nication address of control board	0-247	1		Settings-Maintenance Settings-System Parameters	
	PT100 reference resistor	0~10000	430	Ω	Settings-Maintenance Settings-System Parameters	

## 6. Parameter Setting Explanation Table

Cat- ego- ry	Name	Range	Default	Unit	Location	Re- mark
Maintenance settings/system parameters	Storage temperature probe correction	-40~70	0	°C	Settings-Maintenance Settings-System Parameters	
	Discharge temperature probe correction	-40~70	0		Settings-Maintenance Settings-System Parameters	
	Minimum Downtime	0~10000	6	Min	Settings-Maintenance Settings-System Parameters	
	Oil return interval	2~10000	3	H	Settings-Maintenance Settings-System Parameters	
	Storage temperature probe	Enable/Disable	Enable		Settings-Maintenance Settings-System Parameters-Temperature Sensor Settings	
	Inner coil temperature probe	Enable/Disable	Enable		Settings-Maintenance Settings-System Parameters-Temperature Sensor Settings	
	Outside coil temperature probe	Enable/Disable	Disable		Settings-Maintenance Settings-System Parameters-Temperature Sensor Settings	
	ambient probe	Enable/Disable	Enable		Settings-Maintenance Settings-System Parameters-Temperature Sensor Settings	
	Suction temperature probe	Enable/Disable	Enable		Settings-Maintenance Settings-System Parameters-Temperature Sensor Settings	
	Discharge temperature probe	Enable/Disable	Enable		Settings-Maintenance Settings-System Parameters-Temperature Sensor Settings	

Cat- ego- ry	Name	Range	Default	Unit	Location	Re- mark
Maintenance settings/system parameters	PT100	Enable/Disable	Disable		Settings-Maintenance Settings-System Parameters-Temperature Sensor Settings	
	R25 for common NTC	0~10000	10	KΩ	Settings-Maintenance Settings-System Parameters-Temperature Sensor Settings	
	B value of common NTC	0~9999	3470		Settings-Maintenance Settings-System Parameters-Temperature Sensor Settings	
	R25 for discharge NTC	0~10000	10	KΩ	Settings-Maintenance Settings-System Parameters-Temperature Sensor Settings	
	B value of discharge NTC	0~9999	3470		Settings-Maintenance Settings-System Parameters-Temperature Sensor Settings	
	Current type suction pressure	Enable/Disable	Disable		Settings-Maintenance Settings-System Parameters-Pressure Sensor Settings	
	Current type discharge voltage	Enable/Disable	Disable		Settings-Maintenance Settings-System Parameters-Pressure Sensor Settings	
	Voltage type suction pressure	Enable/Disable	Enable		Settings-Maintenance Settings-System Parameters-Pressure Sensor Settings	
	Voltage type discharge voltage	Enable/Disable	Enable		Settings-Maintenance Settings-System Parameters-Pressure Sensor Settings	



## 6. Parameter Setting Explanation Table

Cat-eg-ory	Name	Range	Default	Unit	Location	Re-mark
Maintenance settings/system parameters	Current type suction pressure sensor measuring range	0-99.9	34.5	Bar	Settings-Maintenance Settings-System Parameters-Pressure Sensor Settings	
	Range of current type discharge pressure sensor	0-99.9	34.5	Bar	Settings-Maintenance Settings-System Parameters-Pressure Sensor Settings	
	Volt-age-type suction pressure sensor measuring range	0-99.9	20	Bar	Settings-Maintenance Settings-System Parameters-Pressure Sensor Settings	
	Volt-age-type discharge pressure sensor range	0-99.9	50	Bar	Settings-Maintenance Settings-System Parameters-Pressure Sensor Settings	
	Suction voltage switch	Enable/Disable	Disable		Settings-Maintenance Settings-System Parameters-Switching Value Input Enable	
	Suction voltage switch	NC/NO	NC		Settings-Maintenance Settings-System Parameters-Switching Value Input Enable	
	discharge voltage switch	Enable/Disable	Disable		Settings-Maintenance Settings-System Parameters-Switching Value Input Enable	
	discharge voltage switch	NC/NO	NC		Settings-Maintenance Settings-System Parameters-Switching Value Input Enable	

Cat-eg-ory	Name	Range	Default	Unit	Location	Re-mark
Maintenance settings/system parameters	Remote switch	Enable/Disable	Disable		Settings-Maintenance Settings-System Parameters-Switching Value Input Enable	
	Remote switch	NC/NO	NC		Settings-Maintenance Settings-System Parameters-Switching Value Input Enable	
	Restore factory settings	-	-		Settings-Maintenance Settings-System Parameters	Factory reset after execution
Maintenance Settings/Defrost Parameters	Defrost mode	No defrosting/electric defrosting/hot gas defrosting	Electric defrosting		Set-Maintenance Settings-Defrost Parameters	
	Enter the defrosting ambient temperature	-50~99	20	°C	Set-Maintenance Settings-Defrost Parameters	
	Incoming defrost coil temperature	-50~99	-3	°C	Set-Maintenance Settings-Defrost Parameters	
	Temperature difference of entering defrosting heat exchange	0~99	10	°C	Set-Maintenance Settings-Defrost Parameters	

## 6. Parameter Setting Explanation Table

Cat- ego- ry	Name	Range	Default	Unit	Location	Re- mark
Maintenance Settings/Defrost Parameters	Determina- tion time of heat exchange tempera- ture differ- ence	0~99	3	Min	Set-Maintenance Set- tings-Defrost Param- eters	
	When enter- ing into defrosting accumula- tion opera- tion	0~999	45	Min	Set-Maintenance Set- tings-Defrost Param- eters	
	Maximum defrosting time	0~99	8	Min	Set-Maintenance Set- tings-Defrost Param- eters	
	Exit defrost coil tem- perature	0~99	25	°C	Set-Maintenance Set- tings-Defrost Param- eters	
	Exit defrost condensing tempera- ture	0~99	45	°C	Set-Maintenance Set- tings-Defrost Param- eters	
	Internal unit status during de- frosting	Enable/Dis- able	Disable		Set-Maintenance Set- tings-Defrost Param- eters	
	Dripping time after defrosting	0-999	3	Min	Set-Maintenance Set- tings-Defrost Param- eters	
	Fan type	No frequen- cy conver- sion fan/EC fan/DC fan	There is no variable frequency fan		Settings-Maintenance Settings-Inverter Fan Parameters	
	Frequency conversion fan regula- tion period	0~999	30s		Settings-Maintenance Settings-Inverter Fan Parameters	

Cat- ego- ry	Name	Range	Default	Unit	Location	Re- mark
Maintenance settings/fan parameters	Target condensa- tion ring tempera- ture heat exchange difference	-99.9~99.9	5	°C	Settings-Maintenance Settings-Inverter Fan Parameters	
	Percentage of fan start- ing speed	0-100	80	%	Settings-Maintenance Settings-Inverter Fan Parameters	
	Minimum condensing tempera- ture	-100~100	15	°C	Settings-Maintenance Settings-Inverter Fan Parameters	
	VSP maxi- mum out- put voltage	0-10	10	V	Settings-Maintenance Settings-Inverter Fan Parameters	
Maintenance Settings/ Electronic Expansion Valve Parameters	Main valve control logic	Without electronic expansion valve/ superheat control/ fixed open- ing	Superheat control		Settings-Maintenance Settings-Electronic Expansion Valve	
	Refrigera- tion super- heat	-2~20	5	°C	Settings-Maintenance Settings-Electronic Expansion Valve	
	Heating superheat	0-20	5	°C	Settings-Maintenance Settings-Electronic Expansion Valve	
	The main valve regu- lates Kp	0-10	0.7	°C	Settings-Maintenance Settings-Electronic Expansion Valve	
	Main valve adjustment Kd	0-10	2.8	°C	Settings-Maintenance Settings-Electronic Expansion Valve	

## 6. Parameter Setting Explanation Table

Cat- ego- ry	Name	Range	Default	Unit	Location	Re- mark
Maintenance Settings/Electronic Expansion Valve Parameters	Main valve regulation cycle	0-100	30	S	Settings-Maintenance Settings-Electronic Expansion Valve	
	Main valve defrosting fixed opening	0-9999	490		Settings-Maintenance Settings-Electronic Expansion Valve	
	Main valve refrigeration fixed opening	0-9999	250		Settings-Maintenance Settings-Electronic Expansion Valve	
	Main valve heating fixed opening	0-9999	250		Settings-Maintenance Settings-Electronic Expansion Valve	
	Initial minimum opening of main valve	0-9999	250		Settings-Maintenance Settings-Electronic Expansion Valve	
	Minimum opening of main valve	0-9999	20		Settings-Maintenance Settings-Electronic Expansion Valve	
	Total opening of main valve	0-9999	500		Settings-Maintenance Settings-Electronic Expansion Valve	
	Main valve initialization cycle	0-999	12	H	Settings-Maintenance Settings-Electronic Expansion Valve	
	Delayed opening time of main valve	0-99	3	S	Settings-Maintenance Settings-Electronic Expansion Valve	
	Delay adjustment time of main valve	0-999	180	S	Settings-Maintenance Settings-Electronic Expansion Valve	

Cat- ego- ry	Name	Range	Default	Unit	Location	Re- mark
Maintenance Settings/Electronic Expansion Valve Parameters	Main valve delay opening ambient temperature	-100-100	-10	°C	Settings-Maintenance Settings-Electronic Expansion Valve	
	Auxiliary valve control logic	Discharge temperature + superheat degree/ without auxiliary valve/exhaust temperature control	Discharge temperature + superheat		Settings-Maintenance Settings-Electronic Expansion Valve	
	Economizer superheat	0-10	3	°C	Settings-Maintenance Settings-Electronic Expansion Valve	
	Discharge temperature target	0-999	90	°C	Settings-Maintenance Settings-Electronic Expansion Valve	
	EVI super-heat Kp	0-99.9	0.9		Settings-Maintenance Settings-Electronic Expansion Valve	
	EVI super-heat Kd	0-99.9	2		Settings-Maintenance Settings-Electronic Expansion Valve	
	EVI discharge temperature Kp	0-99.9	0.9		Settings-Maintenance Settings-Electronic Expansion Valve	
	EVI discharge temperature Kd	0-99.9	2		Settings-Maintenance Settings-Electronic Expansion Valve	
	Minimum opening of auxiliary valve	0-9999	0		Settings-Maintenance Settings-Electronic Expansion Valve	

## 6. Parameter Setting Explanation Table

Cat- ego- ry	Name	Range	Default	Unit	Location	Re- mark
Electronic Expansion Valve Parameters	Adjustment cycle of auxiliary valve	0-9999	30	S	Settings-Maintenance Settings-Electronic Expansion Valve	
	Defrosting opening of auxiliary valve	0-9999	0		Settings-Maintenance Settings-Electronic Expansion Valve	
	Total opening of auxiliary valve	0-9999	500		Settings-Maintenance Settings-Electronic Expansion Valve	
	The EVI opens the ambient temperature	-100-100	10	°C	Settings-Maintenance Settings-Electronic Expansion Valve	
Maintenance Settings/Inverter Parameters	Inverter brand	Sanhua/ Sifang/Well- Go	Three flowers		Settings-Maintenance Settings-Inverter Parameters	Power off and restart after setting takes effect
	Maximum speed	0-9999	90	rps	Settings-Maintenance Settings-Inverter Parameters	Power off and restart after setting takes effect
	Minimum speed	0-9999	30	rps	Settings-Maintenance Settings-Inverter Parameters	Power off and restart after setting takes effect

Cat- ego- ry	Name	Range	Default	Unit	Location	Re- mark
Maintenance Settings/Inverter Parameters	Starting speed during cooling	0-9999	50	rps	Settings-Maintenance Settings-Inverter Parameters	
	Starting speed during heating	0-9999	50	rps	Settings-Maintenance Settings-Inverter Parameters	
	Speed during defrosting	0-9999	90	rps	Settings-Maintenance Settings-Inverter Parameters	
	Resonance Start Speed 1	0-9999	0	rps	Settings-Maintenance Settings-Inverter Parameters	
	Resonance End Speed 1	0-9999	0	rps	Settings-Maintenance Settings-Inverter Parameters	
	Resonance Start Speed 2	0-9999	0	rps	Settings-Maintenance Settings-Inverter Parameters	
	Resonance End Speed 2	0-9999	0	rps	Settings-Maintenance Settings-Inverter Parameters	
	Speed regulation cycle	0-999	30	S	Settings-Maintenance Settings-Inverter Parameters	
	Speed adjustment Kp	0-9999	2000		Settings-Maintenance Settings-Inverter Parameters	
	Speed adjustment Kd	0-9999	120		Settings-Maintenance Settings-Inverter Parameters	
	Night mode	On/off	Close		Settings-Maintenance Settings-Inverter Parameters	

## 6. Parameter Setting Explanation Table

Cat- ego- ry	Name	Range	Default	Unit	Location	Re- mark
Maintenance Settings/Inverter Parameters	Night mode start (hours)	0-23	21	Min	Settings-Maintenance Settings-Inverter Parameters	
	Night mode start (min)	0-59	30	H	Settings-Maintenance Settings-Inverter Parameters	
	End of night mode (hours)	0-23	7	Min	Settings-Maintenance Settings-Inverter Parameters	
	End of night mode (minutes)	0-59	30	H	Settings-Maintenance Settings-Inverter Parameters	
	Night mode maximum frequency	0-9999	50	rps	Settings-Maintenance Settings-Inverter Parameters	
Maintenance settings/alarm parameter	Locking times of high voltage protection	0-99	3		Settings-Maintenance Settings-Alarm Parameters	
	Locking times of low-voltage protection	0-99	3		Settings-Maintenance Settings-Alarm Parameters	
	Number of times of locking due to too high discharge temperature	0-99	3		Settings-Maintenance Settings-Alarm Parameters	
	Over-low ambient temperature protection value	-50-99	-30	°C	Settings-Maintenance Settings-Alarm Parameters	

Cat- ego- ry	Name	Range	Default	Unit	Location	Re- mark
Maintenance settings/alarm parameter	Protection value of inlet and outlet water temperature difference	-50-99	10	°C	Settings-Maintenance Settings-Alarm Parameters	
	Discharge temperature protection value	-50-999	125	°C	Settings-Maintenance Settings-Alarm Parameters	
	Frequency-limited discharge temperature	-50-999	108	°C	Settings-Maintenance Settings-Alarm Parameters	
	Frequency limiting condensation temperature	-50-99	60	°C	Settings-Maintenance Settings-Alarm Parameters	
	Condensation temperature protection value	-50-99	65	°C	Settings-Maintenance Settings-Alarm Parameters	
	Locking times of condensation protection	0-99	3		Settings-Maintenance Settings-Alarm Parameters	
	High pressure protection pressure value	0-500	31	Bar	Settings-Maintenance Settings-Alarm Parameters	
	Low pressure protection pressure value	0-500	0.6	Bar	Settings-Maintenance Settings-Alarm Parameters	



## 7. Control logic

### 7.1. work mode

There are two cooling modes here, temperature controlled refrigeration and pressure controlled refrigeration;  
If temperature controlled refrigeration mode is chosen, an analog input (storage temperature) should be added to be the control target.

### 7.2. temperature control

The temperature control point is determined by "target temperature", "standby temperature" and "restart temperature". In this mode, system start to work when the temperature detected on the storage temperature sensor is higher than the "restart temperature", and stop when the temperature is lower than the "standby temperature". The speed adjustment function of the controller takes "target temperature" as the control target.

### 7.3. pressure control

The pressure control point is determined by "target pressure", "standby pressure" and "restart pressure". In this mode, system start to work when the suction pressure is higher than the "start pressure", and stop when the suction pressure is below the "standby pressure". The speed adjustment function of the controller takes "target pressure" as the control target.

### 7.4. startup condition

When the system is in shutdown or standby mode and the following conditions are met simultaneously, the system will enter operating mode:

- ① Receive "Turn on" command from the HMI in local control mode or receive operation command from the remote switch in remote control mode.
- ② There was no error in the system causing the compressor to shut down.
- ③ The compressor has been shut down for more than 6 minutes (this parameter is adjustable).
- ④ The suction pressure is higher than the set "restart pressure" or the target temperature is higher than the set "restart temperature".

### 7.5. stop condition

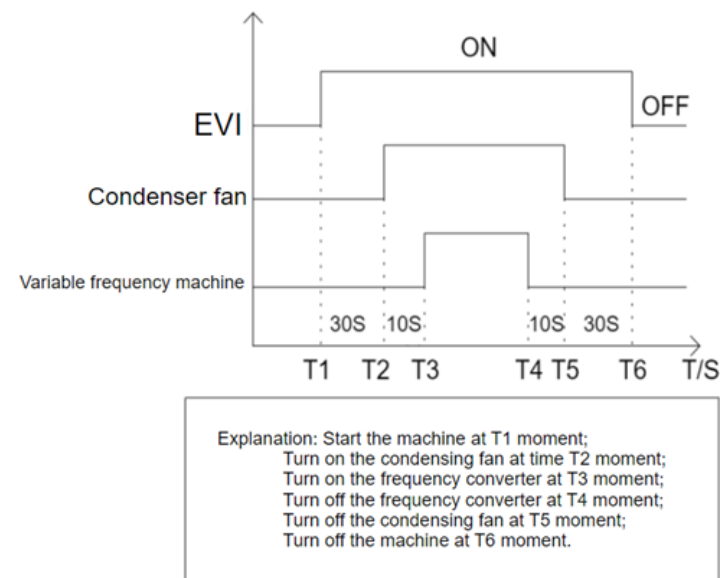
In the local control mode, the controller receives the "Turn off" command from the HMI, the system stops; in the remote control mode, the shutdown command comes from the remote switch.

### 7.6. standby condition

When the system is running, the system enters the standby state when one of the following conditions is met:

- ① The suction pressure or storage temperature is below the "standby pressure" or "standby temperature", and the converter set speed is lower than or equal to the minimum speed.
- ② An error occurs that causes the compressor stop.

## 7.7. system timing



## 7.8. Speed adjustment

The compressor starts at a speed of 50Hz and starts speed adjustment after running for 2 minutes. The speed adjustment cycle is 30s.

In pressure control mode, the controller compares suction pressure with the target pressure, performs PID calculations, and adjusts compressor speed between the highest and lowest speeds. If the current suction pressure is lower than the standby pressure and at the lowest speed, the compressor will stop.

In temperature control mode, the controller compares storage temperature with the target temperature, performs PID calculation, and adjusts compressor speed between the highest and lowest speeds. If the current storage temperature is lower than the standby temperature and at the lowest speed, the compressor will stop.

When the discharge temperature is higher than the set frequency limit temperature (108°C), the variable frequency compressor will reduce the speed by 1 rps every 30 seconds until the temperature below 98°C.

## 7.9. Defrost logic

### 7.9.1. defrosting entry conditions

Necessary conditions: the system is in running state.  
any of the following three conditions is met:

- ① Evaporation temperature < "into the defrost coil temperature" time to reach "into the defrost cumulative operation" into the defrost;
- ② Manual defrost interface press "defrost" to enter the defrost.
- ③ Meet the following conditions, and enter the defrost:

The time when the storage temperature is less than "entering the defrosting ambient temperature" and the evaporation temperature is less than "entering the defrosting coil temperature" reaches 1 minute simultaneously;  
Running time is over 20min;

The heat exchange temperature difference between the evaporator coil and the environment meets the requirement of "entering defrosting heat exchange temperature difference" and the time reaches the "heat exchange temperature difference judgment time".

### 7.9.2. defrosting exit conditions

Necessary condition: The unit is in defrosting state.  
any of the following three conditions is met:

- Continuous defrosting time > "Maximum defrost time";
- Condensing temperature > 45°C (adjustable);
- Inner coil Temperature > "Exit defrost coil temperature" (adjustable).

### 7.9.3. Defrosting method

There are two defrosting method available: electrical heater defrosting and Freon defrosting. Electrical heater defrosting needs to use the internal heating output port DO9 for the opening and closing of electric heater;  
In Freon defrosting method, the four-way valve will change its direction to exchange the evaporator and condenser.

### 7.9.4. Dripping water

A defrosting and dripping time can be set, and after defrosting, the system will not immediately return to its original cooling or heating state. Wait for the set defrosting and dripping time before resuming operation. If the time is set too short, it may cause the water in the water accumulation tray to enter the cooling state before it is fully drained. This residual water will turn into ice, making it impossible for the defrosting water to flow away in the future. The ice will accumulate thicker and damage the evaporator.

## 7.10. Main EXV adjustment

Main EXV adjustment logic:

Power on initialization: The main EXV opens to the "total steps of main EXV" and then drops to the "minimum steps of main EXV";  
Fault detected: If suction temperature sensor is error, the steps of the EXV is set to "fixed steps of main EXV in refrigeration mode"

Start stage (the first 3 minutes after the compressor starts running): Calculate the initial steps of main EXV based on the ambient temperatures of evaporator and condenser. If the calculated value is lower than the "initial minimum steps of main EXV", use the "initial minimum steps of main valve" as the initial step;  
Adjustment stage (3 minutes after the compressor starts running): After an interval of 30 seconds, calculate the target steps of main EXV based on the PID algorithm.

Compressor shutdown stage: Close the main EXV to the "minimum steps of the main valve".

## 7.11. Branch EXV adjustment

Adjustment logic of Branch EXV:

Power initialization: The branch EXV opens to the "total steps of main EXV" and then drops to the "minimum steps of main EXV";

If "No EVI Control" mode is chosen, close the branch EXV to the minimum step;

If "Discharge temperature control" mode is chosen, the target discharge temperature in the adjustment period is 90°C (adjustable);

If "Discharge temperature super-heat control" mode is chosen, the target discharge temperature in the adjustment period is condensing temperature + super-heat; (30°C adjustable).

Adjustment stage (3 minutes after the compressor starts running): After an interval of 30 seconds, calculate the target steps of branch EXV based on the PID algorithm.

Compressor shutdown stage: Close the branch EXV to the "minimum steps of the branch valve".

## 7.12. Internal fan / water pump control logic

According to the "internal machine type" judgment,  
"internal fan":

When the compressor is powered on, the internal unit is also powered on. If the compressor is powered off, the internal fan will be powered off after a delay of 30 seconds.

When shutting down, both the compressor and internal fan are powered off simultaneously.

"water pump":

The unit runs continuously while in operation, unaffected by compressor shutdown operation.

Power off when the unit shut down.

### 7.13. External fan control

The start and operation of the external fan needs to meet the following two conditions

The compressor is running.

Condensing temperature > "lowest condensation temperature".

The EC fan and DC fan ports have the function of variable frequency regulation. The DC fan requires an external DC power board, and the EC fan can be used directly.

Start stage (30s before the start of the compressor): If the condensation temperature meets the "lowest condensation temperature", the fan shall use "Initial fan speed duty cycle (0-100%, default 80%)" As the initial rotational speed;

Adjustment stage (30s after the operation state of the press): Calculate fan speed based on PID algorithm.

### 7.14. Spray valve control logic

Open the spray valve when the discharge temperature > "target discharge temperature of branch EXV"; close the spray valve when the discharge temperature < "target discharge temperature of branch EXV" -20°C .

### 7.15. Crankshaft heating control logic

If the compressor is in shutdown state and the ambient temperature is lower than 25°C , turn on the crankshaft heater;

If the compressor is running, or the ambient temperature is higher than 30 °C , turn off the crankshaft heater.

### 7.16. Oil return

When the compressor runs continuously for 3 hours (adjustable) and the speed is below 3600RPM, the compressor speed increases to 3600RPM to enter the return oil state. The oil return continues until the next speed adjustment cycle.

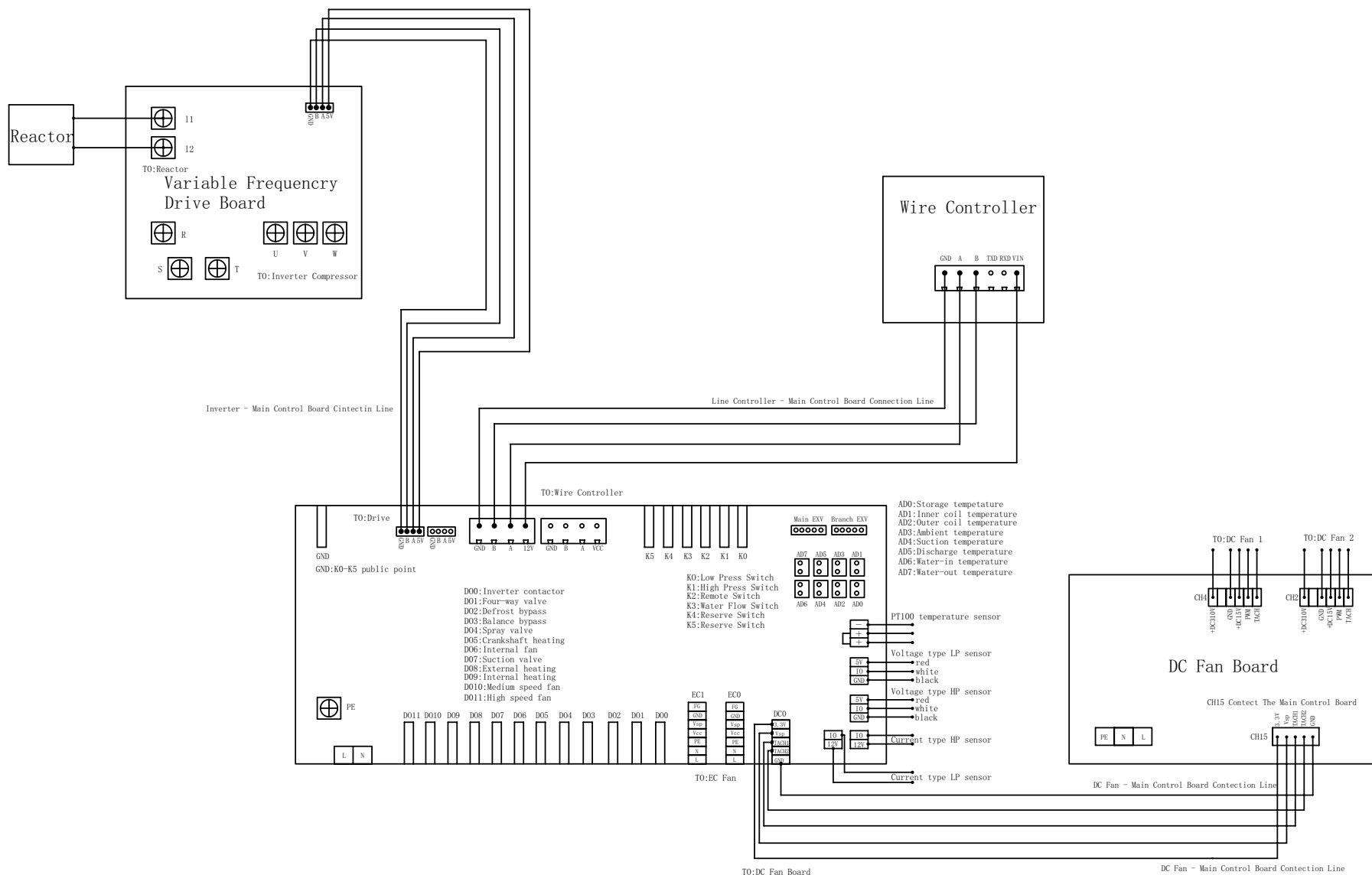
## 8. HMI



## 8.1. Product Parameter

Model Description	HMI80480KM070_1011_4C,6P38 vertical (RS485, Capacitive screen)
Product series	Medical grade HMI human-machine interface
Core processor	400M SOC processor
operating system	No operating system, can run on power
Protocol	Support MODBUS RTU、FX2N、FX3U、DELTA(DVP)、XINJIE(XC)、XINJIE(XD)、FATEK (FB)、HAIWELL (N/S)、SAMKOOKN. EMERSON、DCBUS、XGUS etc.
Script	Version 5.3 LUA script, which can run user written logic, protocols, and algorithm functions inside the screen
size	7.0 inches
resolution ratio	800*480
installation direction	Supports 0, 90, 180, and 270 degree rotation installation display
Storage	128 Mbit
Word bank	Built in vector font, edge anti aliasing processing, support for any disk size ASCII, GBK, GB2312, UNIC() DE (global language) font library, and can also customize any computer font display
Image storage	Supports JPEG and PNG (semi transparent/full transparent) compression, and supports image storage of any size. Accumulation can store approximately 185 full screen images (calculated based on a size of 80KB per image, BMP format is not recommended). The compression ratio of the image varies, and this value will fluctuate up and down
colour	65K color, 16 bit RGB
voltage	5-36V
consumption	backlight off: 0.6W Backlight is the brightest: 2.4W
Communication methods	RS485 or RS232
Baud rate	RS485: 1200 ~ 115200bps、Typical Baud Rate: 19200bps RS232: 1200 ~ 921600bps,Typical Baud Rate: 115200bps
Communication connector specifications	2EDG3.81-6P vertical
Local download of images	SD card, serial port, USB drive
Firmware Wooden Ground/Remote Upgrade	Insert SD card/USB drive for local upgrade/support remote serial port upgrade of user motherboard for screen firmware
Remote image upgrade	Support users to remotely use their motherboard serial port to upgrade screen related image projects, font libraries, configuration files, etc
Screen effective display area (AA)	length* width=153.7mm*86.2mm
Product dimensions (length * width * height)	210.0mm* 149.8mm*24.1mm (MAX)
Product window size (length * width)	196.6mm* 136.3 mm
Supporting upper computer software	VisualHMI®
video player	MP4 video format, sharing storage space with images. If one resolution is 800 * 600, the video bit rate 3000Kbps, audio bit rate 166Kbps, frame rate 25Hz video files, occupying 21.9MB/min of storage

## 9. System wiring diagram



## 10. List of main control components

Applicable Platform	Part Number/ Model	Part Name	Quantity	Remarks
YIM/YIF	170-2014-00	Freezing & Refrigeration Main Control Assembly	Assembly	
	100-2005-00	NTC Temperature Probe	5	
	100-2006-01	Voltage-type Pressure Sensor (20bar)	1	
	100-2006-02	Voltage-type Pressure Sensor (50bar)	1	
	100-2008-01	Cable for HMI and control board	1	
	100-2008-04	DC Fan Power Board Adapter Cable	1	
	100-2016-00	7-inch HMI (Freezing/Refrigeration)	1	
	100-2021-00	Variable Frequency Main Control Board V2.0 (Freezing & Refrigeration Assembly)	1	
	100-2022-00	Dual-Channel DC Fan Power Board Assembly	1	

Applicable Platform	Part Number/ Model	Part Name	Quantity	Remarks
YIM/YIF	170-2014-02	Freezing & Refrigeration Main Control Assembly	Assembly	
	100-2005-00	NTC Temperature Probe	5	
	100-2006-01	Voltage-type Pressure Sensor (20bar)	1	
	100-2006-02	Voltage-type Pressure Sensor (50bar)	1	
	100-2008-01	Cable for HMI and control board	1	
	100-2016-00	7-inch HMI (Freezing & Refrigeration)	1	
	100-2021-00	Variable Frequency Main Control Board V2.0 (Freezing & Refrigeration Assembly)	1	