

## **Foreword—About the Products and Manual**

### **[To the Users]**

My honorific users, we are glad that you choose the KSTAR FocusAir Precision Air Conditioner. Before using products, please make sure to read the manual in detail. The Proper operation is necessary to reach longer life and reliability.

### **[Products Guarantee]**

The products can be guaranteed by the guarantee card or contract.

### **[Clause of Irresponsibility]**

1. Beyond the period of free guarantee.
2. Disassembly or maintenance privately without the manufacturer's permission
3. Violation of the products manipulation.
4. Man-made malfunction.
5. The breakdown caused by the irresistible or other adventitious causation in operation.

[Notice: the breakdown caused by any one of the clauses above was not our obligation.]

### **[Customer Service]**

Kstar will provide the overall technical guidance for the customer, you can contact with the nearby Kstar offices or customer service center.

### **[Contacts Us]**

Customer Support Tel: 400-700-9662

[Http://www.kstar.com.cn](http://www.kstar.com.cn)

### **[Remark]**

1. The manual provided together with FocusAir Precision Air Conditioner, please keep it in safety. So that you can read it at any time in need. If the manual is lost or damaged, please contact the manufacturer.
2. This manual is written for the DX air cooled FocusAir Precision Air Conditioner, the content may not be suitable for the other models.
3. The copyright of this manual belongs to Shenzhen Kstar Science & Technology Co., Ltd. All rights are reserved without notice.

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## Products Summary

**Summary**—this chapter mainly introduces the product, model description, working environment, control parameters, composition of system, product specification and module assembly.

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### §1-1 Introduction

#### About the Products

FocusAir precision air conditioners are the new-style high efficiency and energy saving precision environmental control system with the advanced and reliable technology, which are suitable for the telecommunication data centers, IDC centers and data processing rooms, finance security data centers, large IT enterprise data centers and other places. FocusAir can provide an ideal working environment to the precision equipments, such as the servers, exchangers, storage equipments, industrial process and computer equipments.

#### Cooling Capacity

The capacity of the FocusAir precision air conditioners ranges from 20kW to 80kW.

#### Features

FocusAir units have varieties of types, such as the front discharge, left discharge, right discharge, side discharge, air-cooled, water-cooled, glycol cooled and chilled water.

#### Characteristics

1. Various supply air type and various cooling system type;
2. Application for raised floor or non-raised floor.
3. Suitable for new and existing data centers.
4. Can be installed in the middle or at the end of a row.
5. Top or bottom piping/power connections.
6. 100% front and rear service access.
7. Adapts to fit major rack manufactures.
8. Units height can be adjusted.
9. Advanced intelligent microprocessor controller.
10. Multiple remote temperature rack sensors.
11. DC inverter compressor and variable EC fans.
12. Design for high temperature return airflow.

### §1-2 Working Environment

Table1-1 Working Environment

Items		Indoor	Outdoor
Parameters	Temp. t	17°C~40°C	Air-cooled: -15°C~+45°C; Water-cooled: 4°C~40°C
	Humidity %	20%~80%RH	—
Requirements	Altitude	No more than 1000m, or else be used by reducing rating.	
	Power	Voltage 380V±10%, Frequency 50Hz±2Hz	

### §1-3 Model Description

For example: model- FS040FAACENNES

<b>FS</b>	FocusAir Precision Air conditioner	<b>FS</b>	<b>040</b>	<b>F</b>	<b>A</b>	<b>A</b>	<b>C</b>	<b>E</b>	<b>N</b>	<b>N</b>	<b>E</b>	<b>S</b>
<b>020~080</b>	Cooling Capacity-kW											
<b>F</b>	Front discharge											
<b>S</b>	Side discharge											
<b>L</b>	Left discharge											
<b>R</b>	Right discharge											
<b>A</b>	Compressor Air-cooled											
<b>W</b>	Compressor Water-cooled											
<b>G</b>	Compressor Glycol-cooled											
<b>C</b>	Chilled water											
<b>A</b>	R410A											
<b>W</b>	Water											
<b>A</b>	230V/50Hz											
<b>C</b>	400V/50Hz											
<b>B</b>	460V/60Hz											
<b>D</b>	208V/60Hz											
<b>A</b>	AC centrifugal Fan											
<b>E</b>	EC centrifugal Fan											
<b>N</b>	None											
<b>O</b>	One Step Electrical Heater											
<b>T</b>	Tow Step Electrical Heater											
<b>N</b>	None											
<b>B</b>	Electrode Humidifier											
<b>T</b>	Thermostatic Expansion Valve											
<b>E</b>	Electronic Expansion Valve											
<b>N</b>	Not Applicable											
<b>S</b>	Special Configuration											

Figure 1-1 Model Description of FocusAir Products

### §1-4 Components of System

FocusAir precision air conditioner are mainly composed by the refrigeration system, control system, ventilation system, humidification system and heating system. The mainly components as follow:

1. Compressor- DC inverter scroll compressor, high efficiency and energy saving, safety and

high reliability, long life and variable cooling capacity output, etc.

2. Evaporator- Inclined piece type evaporator makes thermal transmission faster and more efficient.
3. Expansion valve- EEV senses the temperature and pressure signal, which accurately regulates the refrigerant flow.
4. Heater- PTC heater brings heat faster and uniformly.
5. Electrode Humidifier- Easy maintenance, energy and water saving, which can work, drain and clean automatically.
6. Filter Drier- protects the refrigeration system from moisture, acids and solid particles.
7. Sight glass- the window of system, which used to observe the condition of the refrigerant in liquid line and the moisture content in refrigerant.
8. Crankcase heater- protects the compressor from damage for the oil diluted and the bearing stressed. The crankcase heater must be electrified and worked at least 12h before the unit switched on.
9. Centrifugal fan- the stepless speed regulation centrifugal EC fans are standard. The fans operate smoothly with low noise, high efficiency and adaptive to variable ESP.
10. Air filter- Standard G4 class filter. Clean out the dust of air, guarantees the cleanliness of the environment.
11. Controller- It is built with a full functions alarm system and 2 levels password protection; it can manage maximum 31 units and connect to the centralized monitoring system in the local network through the optional RS485 serial interface. Also features unit auto startup and cycle rotation of compressor.
12. Graphic display- users can easily know the operating conditions of the components, and set all the parameters through the graphic display.

## §1-5 Products Specifications

### 1. Dimensions and Net Weight

Table 1-2 Dimensions and Net Weight of the Units

Specifications	Models	Dimensions (mm)W1×H×D1	Net Weight (kg)
300mm Front discharge	FS020F	300×2000×1100	≤185
300mm Side discharge	FS020S/L/R	300×2000×1200	≤200
400mm Front discharge	FS025F	400×2000×1100	≤200
400mm Side discharge	FS025S/L/R	400×2000×1200	≤220
600mm Front discharge	FS040F	600×2000×1100	≤360
600mm Side discharge	FS040S/L/R	600×2000×1200	≤385

[Note: W- width; H- height; D- depth]

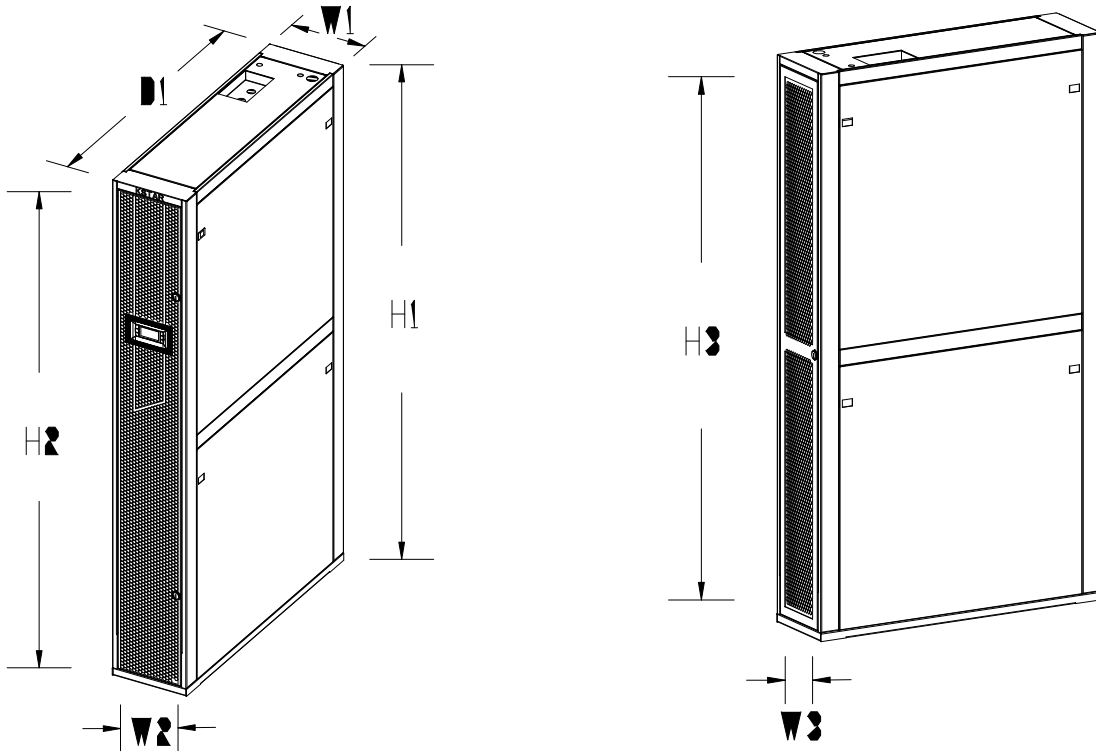


Figure 1-2 300mm Front discharge

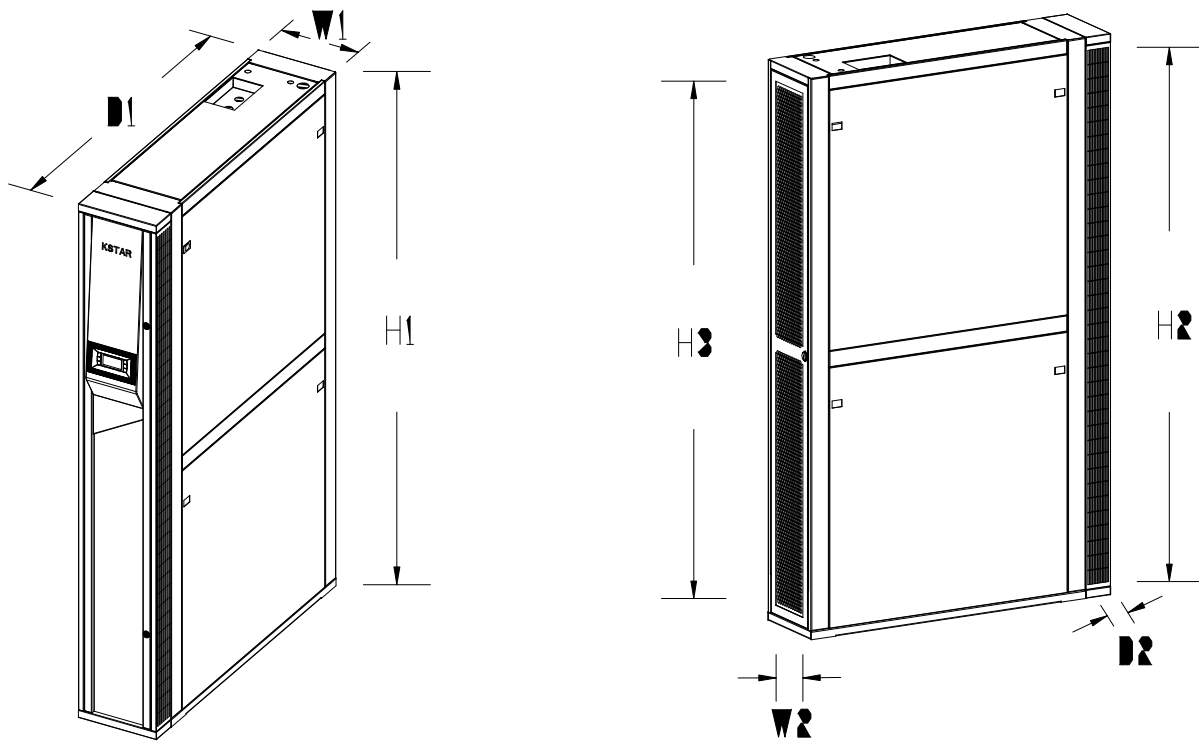


Figure 1-3 300mm Side discharge

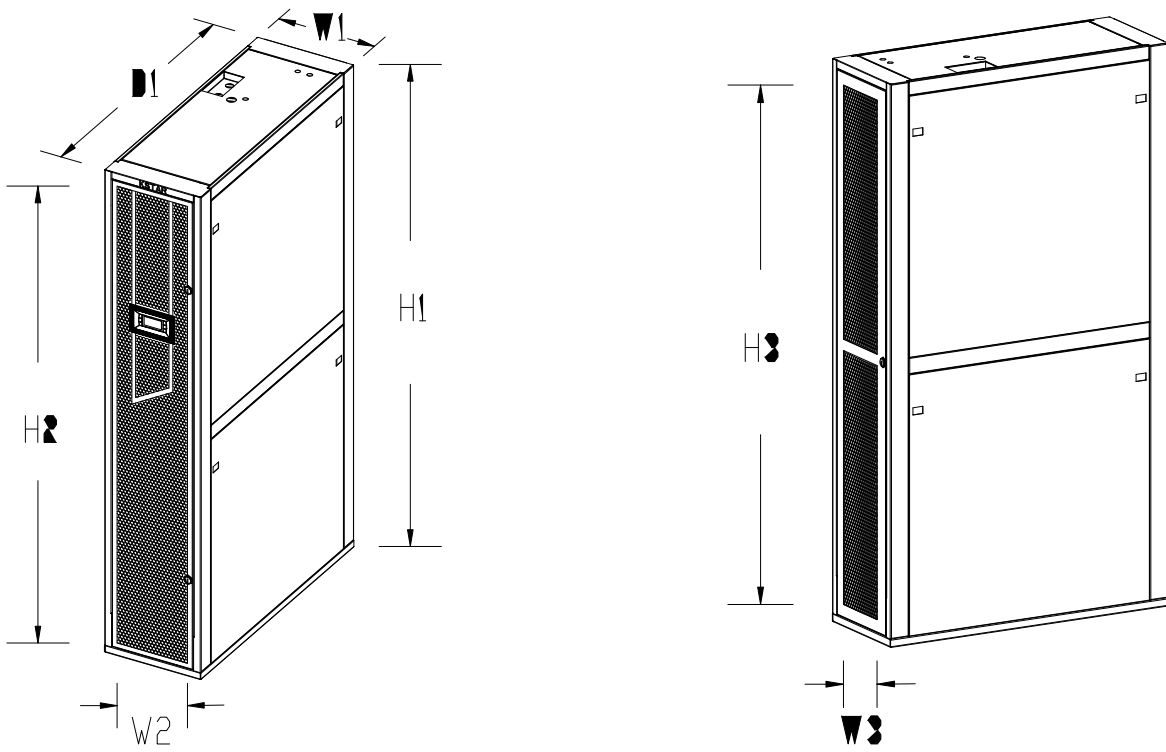


Figure 1-4 400mm Front discharge

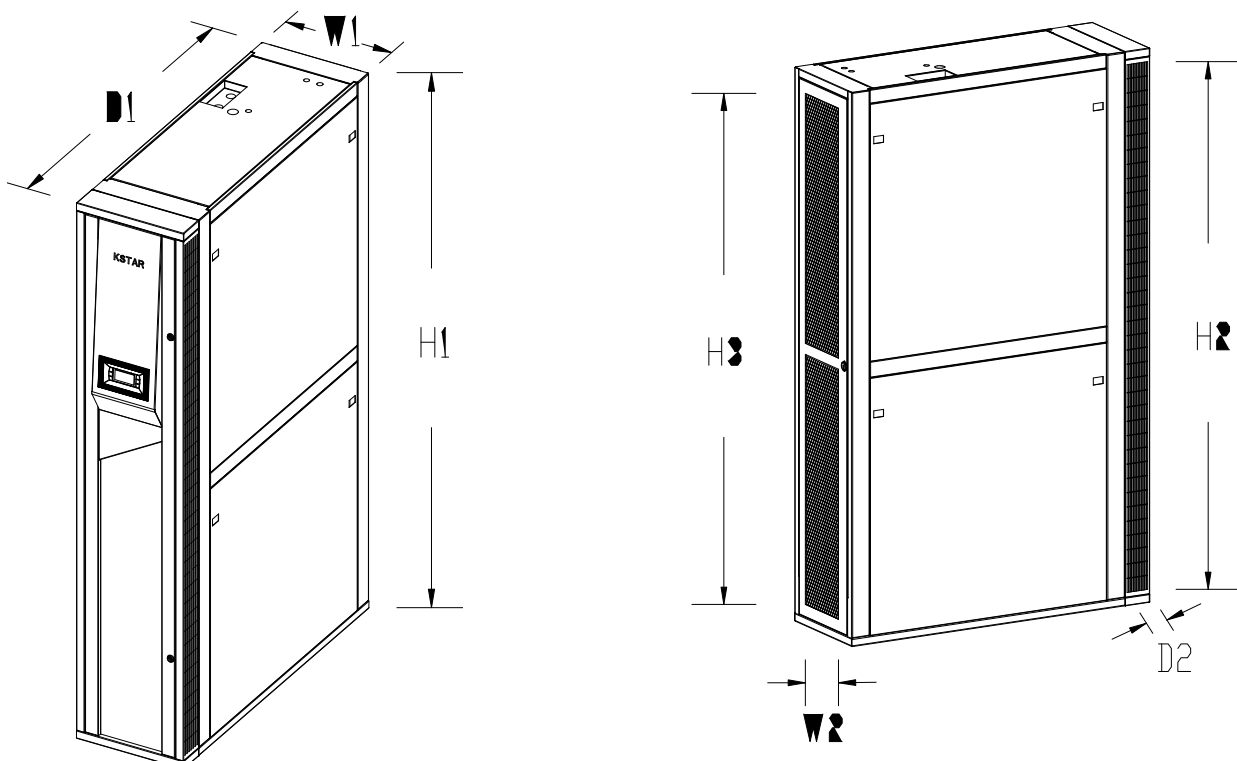


Figure 1-5 400mm Side discharge



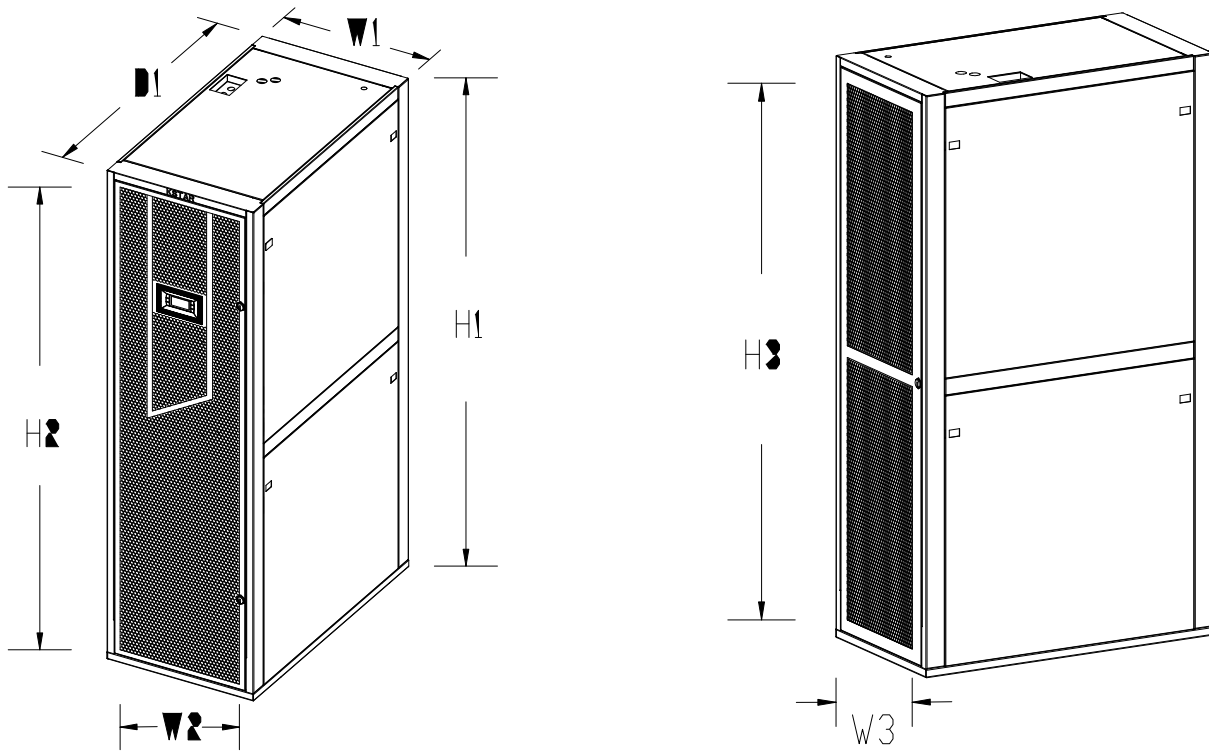


Figure 1-6 600mm Front discharge

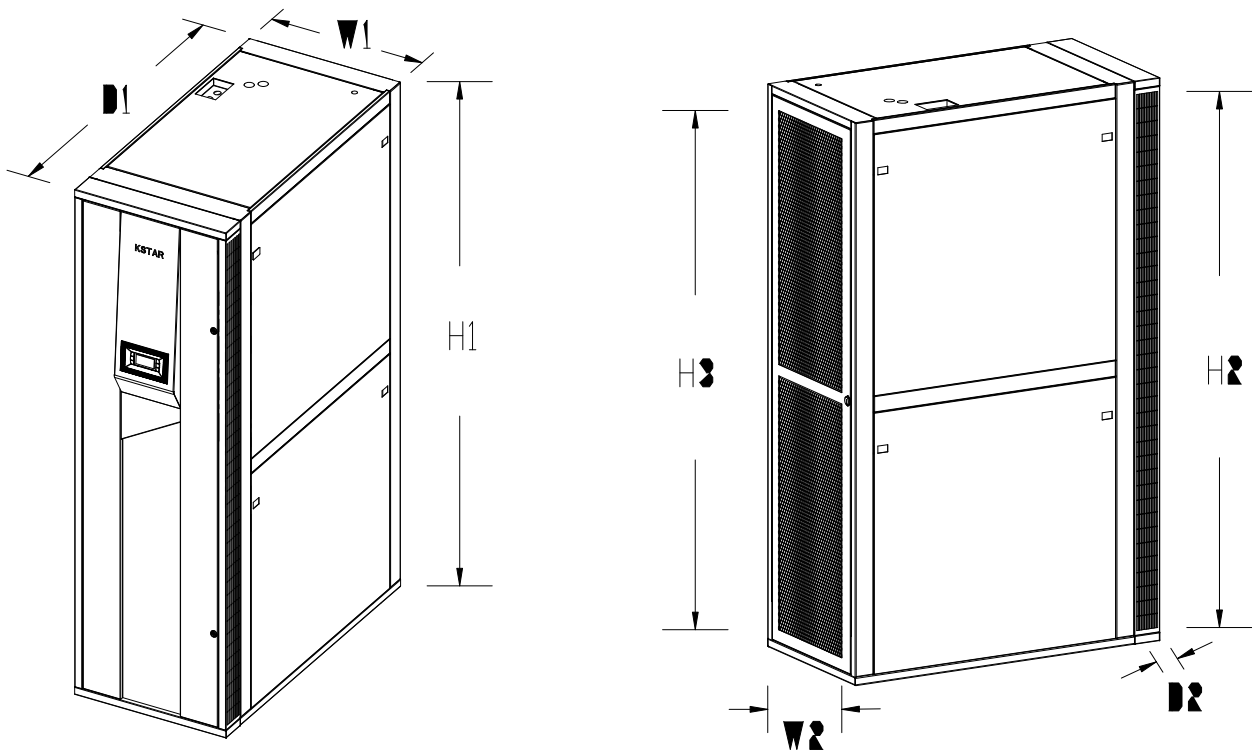


Figure 1-7 600mm Side discharge

Table 1-3 Other Related Dimensions of the Units

Specifications	Models	H2(mm)	W2(mm)	H3(mm)	W3(mm)	D2(mm)
300mm Front discharge	FS020F	1923	234	1868	188	-
300mm Side discharge	FS020S/L/R	1904	188	1868	-	83
400mm Front discharge	FS025F	1893	292	1844	231	-
400mm Side discharge	FS025S/L/R	1904	231	1844	-	83
600mm Front discharge	FS040F	1893	488	1844	431	-
600mm Side discharge	FS040S/L/R	1904	431	1844	-	83

## 2. Side Panel

FocusAir precision air conditioners side panel with snap joint for convenient installation and remove.

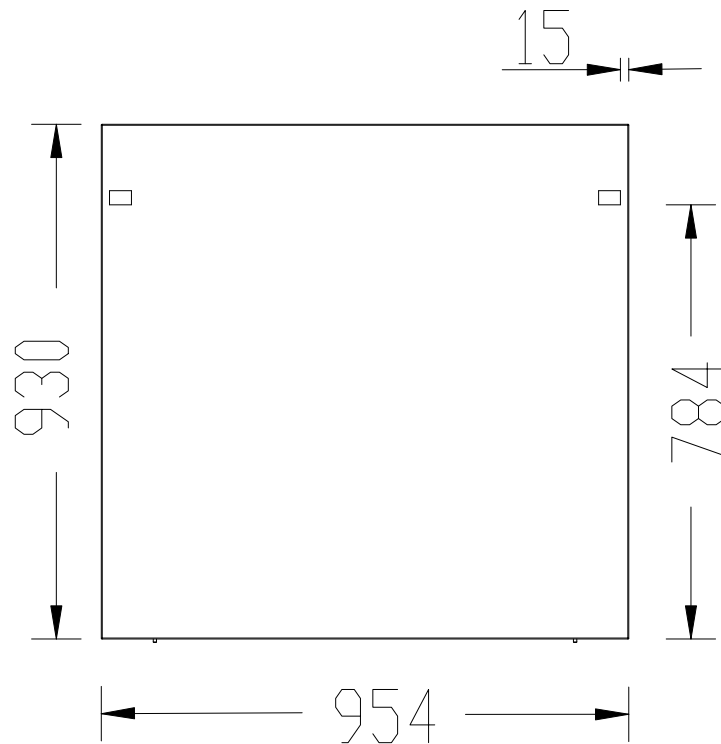


Figure 1-8 Dimensions of the Snap joint in Side Panel

## 3. Floor

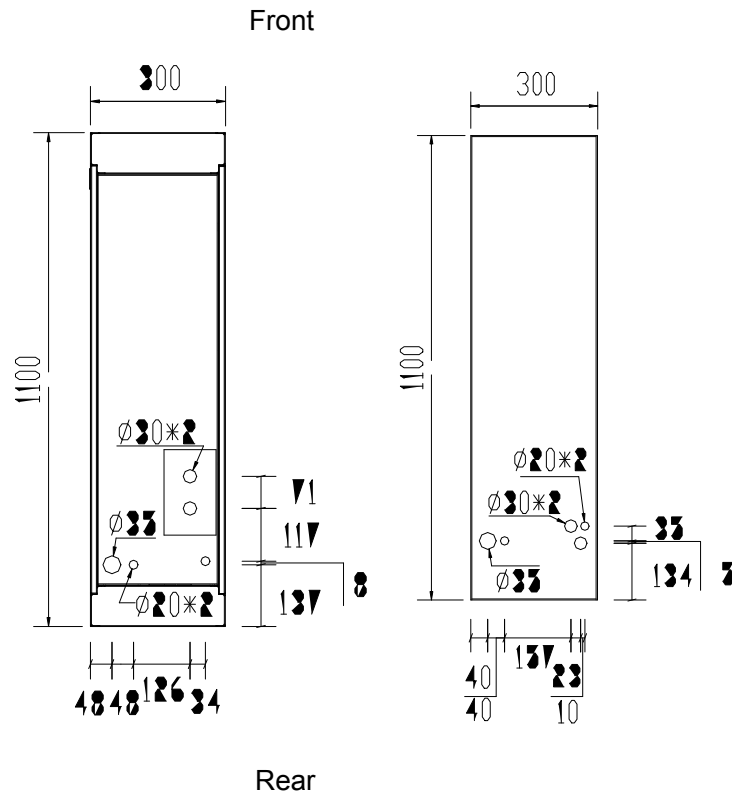


Figure 1-9 Dimensions of the Top Panel and Bottom Panel in 300mm front discharge unit (Left- Top Panel; Right- Bottom Panel)

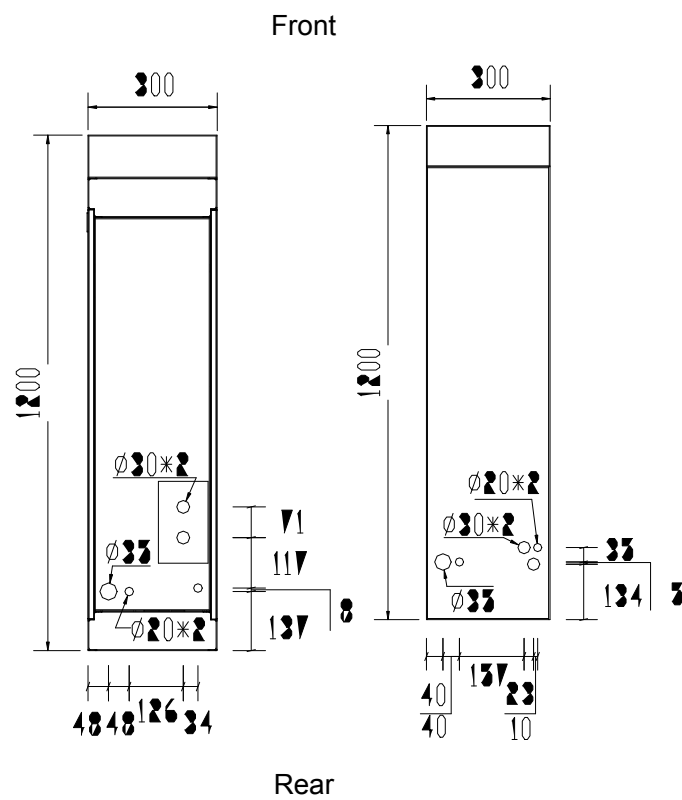


Figure 1-10 Dimensions of the Top Panel and Bottom Panel in 300mm side discharge unit (Left- Top Panel; Right- Bottom Panel)

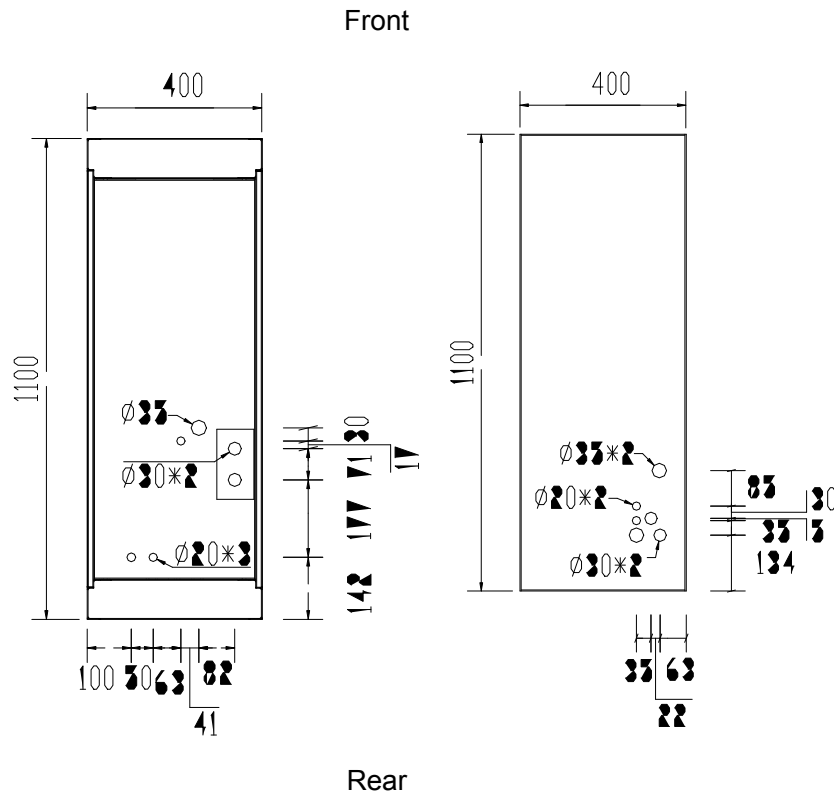


Figure 1-11 Dimensions of the Top Panel and Bottom Panel in 400mm front discharge unit (Left- Top Panel; Right- Bottom Panel)

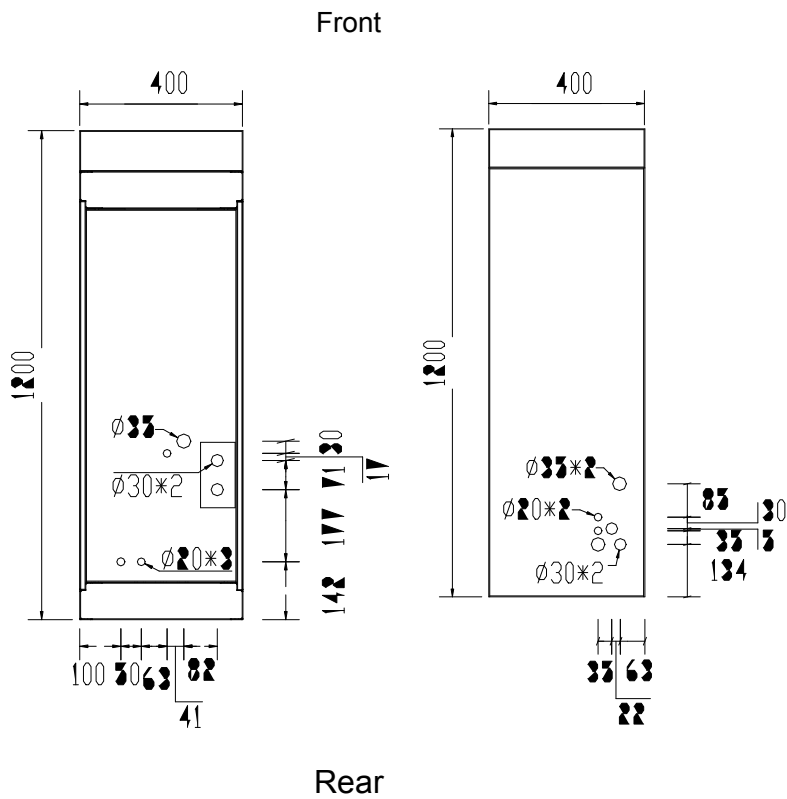


Figure 1-12 Dimensions of the Top Panel and Bottom Panel in 400mm side discharge unit (Left- Top Panel; Right- Bottom Panel)

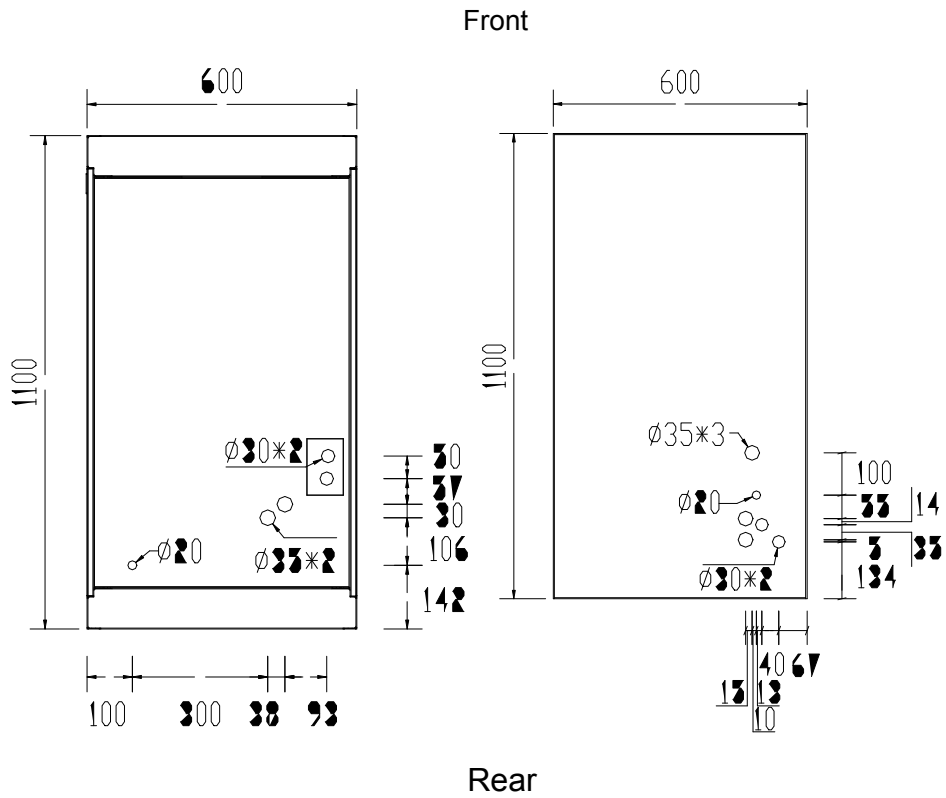


Figure 1-13 Dimensions of the Top Panel and Bottom Panel in 600mm front discharge unit (Left- Top Panel; Right- Bottom Panel)

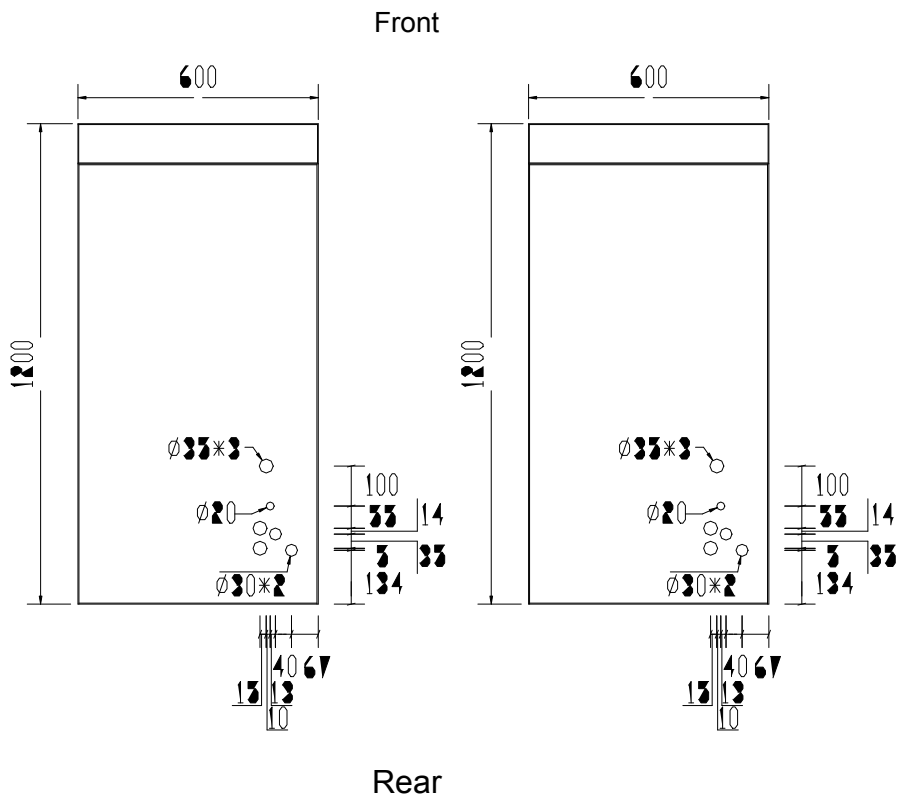


Figure 1-14 Dimensions of the Top Panel and Bottom Panel in 600mm side discharge unit (Left- Top Panel; Right- Bottom Panel)

**Note: The view from top to bottom**

## Reception

**Summary**—this chapter mainly introduces the processes and related issues of the transportation, handling and reception for the units.

### §2-1 Transportation

#### About the Units

FocusAir precision air conditioners comprise the mechanical and electrical equipments. Any mistake in the shipping and handling will cause damage to the units and make them abnormal, please be careful.

#### Notes in Shipping and Handling

1. Please try your best to select the good transporting methods (such as: railway and shipping). When using the trucks, you should choose the better roads, so as to prevent the excessive turbulence.
2. Be sure to comply the related requirements for the environments in transporting and placing.
3. Please use the mechanical carriers to unload and handle the units.
4. The handling angle of the indoor units should be in  $75^{\circ} \sim 105^{\circ}$ .
5. Avoid the collision and rainfall etc.

Table 2-1 Dimensions of the External Packaging and Gross Weight of FocusAir Precision Air Conditioners

Models	Dimension of External Packaging(mm)W×D×H	Gross Weight (kg)
FS020F	430×1260×2212	≤195
FS020S/L/R	430×1360×2212	≤210
FS025F	530×1260×2212	≤210
FS025S/L/R	530×1360×2212	≤230
FS040F	730×1260×2212	≤375
FS040S/L/R	730×1360×2212	≤400

[Note: W- width; H- height; D- depth]

### §2-2 Reception

#### About the units

FocusAir precision air conditioners have been tested strictly and inspected before delivery. Please check the units carefully upon reception of them, and ensure that the units are not damaged in the transportation.

## 1. Suggestion of Reception

The receiving process is shown below.

### Process Flow Chart

Receiving process simulates in figure 2-1, the specific content of each step consults this section.

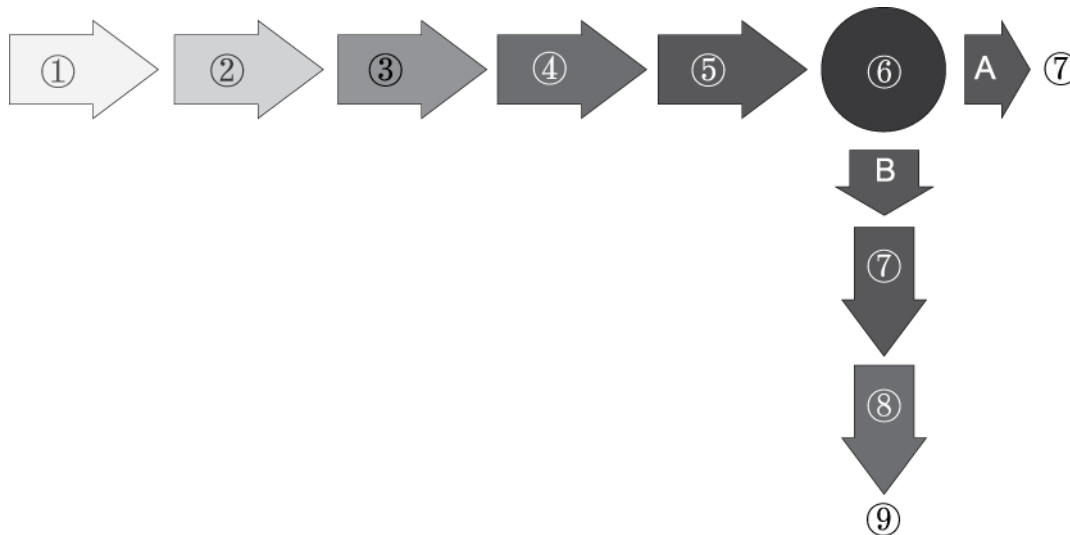


Figure 2-1 Sketch Map of the Receiving Process Simulation

The chart shows the receiving process of condition A and B.

A— installed immediately

B— installed later

Definition in figure 2-1:

①— Arrival;

②— Appearance Inspection;

③— Handling;

④— Unpacking;

⑤— Internal Inspection;

⑥— Acceptance;

A: ⑦— Completion。

B: ⑦— Airproof; ⑧— Storage; ⑨— Completion。

## 2. Appearance Inspection

### Transportation Inspection

After arrival of the unit, check carefully.

Shipping requirements as shown below:

1. Cannot be get wet in the rain.
2. Be lay upright

3. Cannot be stacked.

4. Cannot be collided.

[**Note:** the specific requirements comply to the outer packaging.]

## Appearance Inspection

Appearance inspection includes the product packaging and the appearance inspection.

Contents:

1. Check the outer packaging, ensure that it was not opened;
2. Ensure that there are no apparent damage and collision mark in the outer packaging;
3. Ensure that there is no damage on the exposed parts of the units, such as: fins sag, structural deformation and face paint fall-off.

## Related Notices

1. If you find it unpacking, please check the bill of lading or other aspects if there is any information clew. If not, please contact with the relevant departments.
2. If you find any damage, please indicate the damage on the bill of lading, and submit the damage claim to the shipping company.
3. Any issue above will cause the damage to the units, and make them abnormal, please check out carefully. If you have problems, please contact KSTAR technical service department.

## 3. Unpacking

### Suggestion

1. Before unpacking, we suggest that the units can be handled close to the installation site (or to the storage place).
2. Before unpacking, we suggest users consider the recycling of the packaging.

## Related Notices

1. The units are packed with wood, when you unpacking, please be careful, so as to avoid the damage that make unit abnormal.
2. The guarantee is void if the unit is damaged by improper operation.

## 4. Internal Inspection

### Contents

1. After unpacking, please check out carefully, and ensure all of the components inside are complete and no damage.
2. Check the accessories according to the packing list.

## Related Notices



1. If there is any part missing or damaged, please contact with the carrier and the product suppliers immediately.
2. If you find that the packing list is not complete, please contact with the relevant personnel immediately.

## 5. Storage

After user receives the unit, please store it according to the requirements below.

Table 2-3 Storage Requirements

Contents	Requirements
Environment	Clean ( no dust ), well-ventilated indoor
Temperature	-20°C ~ 54°C
Humidity	5% ~ 80%RH (Non condensing)
Storage Times	Amounted to no more than 6 months, or else the performance shall be calibrated again.

- [Warning:** 1.If the units unpacking already, they must be packed according to the original packaging.  
2. The guarantee is void if the unit is damaged for exposing to the environment for a long time.]

## Preparation for Installation

**Summary**—this chapter mainly introduces the preparation before installation of the units; the contents include the preparation of the installation site and installed location.

---

### §3-1 Installation Site

In order to install and operate in the best condition, make sure that the installation site meets the requirements. The installation site of the unit is very important to control the indoor environment for the high efficiency and balance. It should be selected by the professional engineer.

### Consideration Factors

1. Unit should be installed before server rack installed.
2. The piping and wiring should be convenient in the installation site.
3. Heat preservation and insulation can greatly reduce the heat load of the generator room. Maintaining the positive pressure of the room can prevent the dust and reduce the transfer of thermal load.
4. All the cables and pipelines should be well placed. Some of them under the static floor should be placed carefully when air conditioner is bottom piping type.
5. All the cables and pipelines should be straight and obey local code.
6. The airflow should be unobstructed.

[Explain: the factors above are for reference only, the specific condition should be designed on the basis of the actual situation by the professional engineering company.]

### §3-2 Installed Site

FocusAir precision air conditioners are installed in racks. The installation site of the unit is very important to control the indoor environment for the high efficiency and balance. It should be selected by the professional engineer.

### §3-3 Power

Before installation, please prepare the appropriate power for the unit. The power should match the basic contents of the “requirements”. The specific power supply parameters refer to the technical manual.

## Requirements

1. The power of the units is three phase.
2. The power must comply with the national/ regional standards.
3. The units must be grounded.
4. The power must meet the maximum demand of the units.

### **§3-5 Water Supply and Drainage**

FocusAir precision air conditioners need water supply and drainage. Please set the plumbing in advance before installation. The details refer to the installation of the water supply and drainage in chapter 5.

Humidifier has certain requirements for water supply, including pressure, temperature and quality; It will influence the performance and operation life of the humidifier if the parameters unqualified. Therefore the users should provide the proper water supply system.

#### **Requirements**

1. Water quality: clean water;  
[Note: the electrode humidifier cannot use the deionized water or distilled water.]
2. Conductivity: 350~750 $\mu$ s/cm
3. Temperature: 0~40 $^{\circ}$ C;
4. Pressure: 0.1~0.8Mpa.

## Installation

**Summary**—this chapter mainly introduces the installation forms of system, the mechanical and electrical installation of the indoor unit.

### §4-1 Forms of Installation

The compressors are installed in the indoor unit of the FocusAir precision air conditioner.

Take the compressor for base, the system installation forms are divided into positive fall and negative fall (the negative fall only applies to the air-cooled units).

Positive fall— the vertical installed height of the outdoor unit is higher than the indoor unit.

Negative fall— the vertical installed height of the outdoor unit is lower than the indoor unit.

#### 1、 Value of the Fall Installation

Table 4-1 Value of the Fall Installation

Forms	Value of Vertical Height	Remark
Positive Fall	Maximum: +20m	Indoor unit lower than outdoor unit
Negative Fall	Maximum: -5m	Indoor unit higher than outdoor unit

#### 2、 Requirements

1. When positive fall situation, the inlet pipeline and the drain pipeline of the outdoor units should be set with reserved bend, so as to avoid the liquid flowing back when the unit closed down. It must ensure that the top of bending pipe is higher than the top row of the coil tubes in the outdoor unit.
2. It needs to select the piping extension kit if the positive fall more than 20m or the length of the pipelines more than 30m.
3. We suggest that it should set the oil storage bend on the position every 6m when the vertical height more than 10m.
4. The liquid pipelines should not be exposed to the sunlight directly.
5. The gas pipelines and condensing water drainage pipeline of the indoor units should be set in a certain angle tilt (the horizontal angle of the discharge pipeline should  $\geq 0.3^\circ$ ).
6. The liquid pipelines of the condensers should be set in a certain angle tilt (the horizontal angle of the gas pipeline should  $\geq 0.3^\circ$ ) in the negative fall installation.

#### 3、 Figures of the Positive and Negative Fall Installation

The positive fall installation shows in figure 4-1 and the negative fall installation shows in the

figure 4-2. The marks of the figures refer to the table 4-2.

### §4-2 Dimensions of the Pipelines

The diameter of the pipelines will affect the pressure drop of the system, the flow velocity of the refrigerant and the oil back to the compressors; we suggest that the diameter of the coppers connecting the indoor to the outdoor units refers to the table 4-4.

When the equivalent length of the pipelines more than 30m, it needs to increase the extended components, please consult Kstar Science & Technology Co., Ltd.

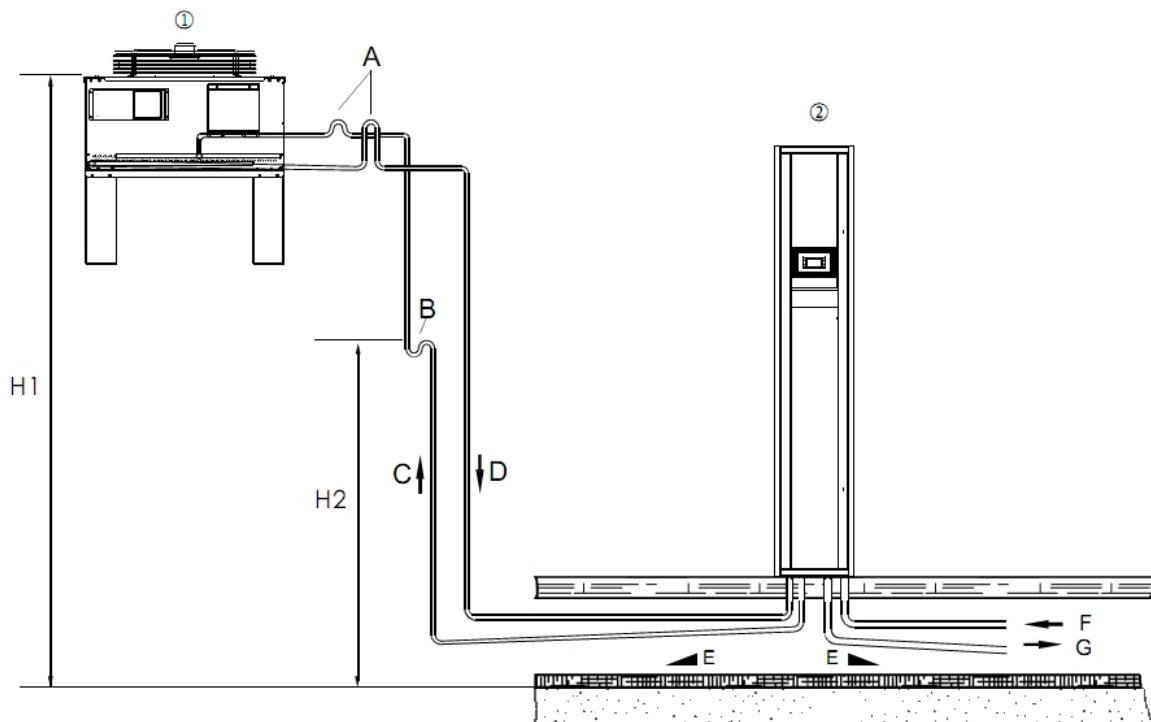


Figure 4-1 Sketch Map of the Positive Fall Installation

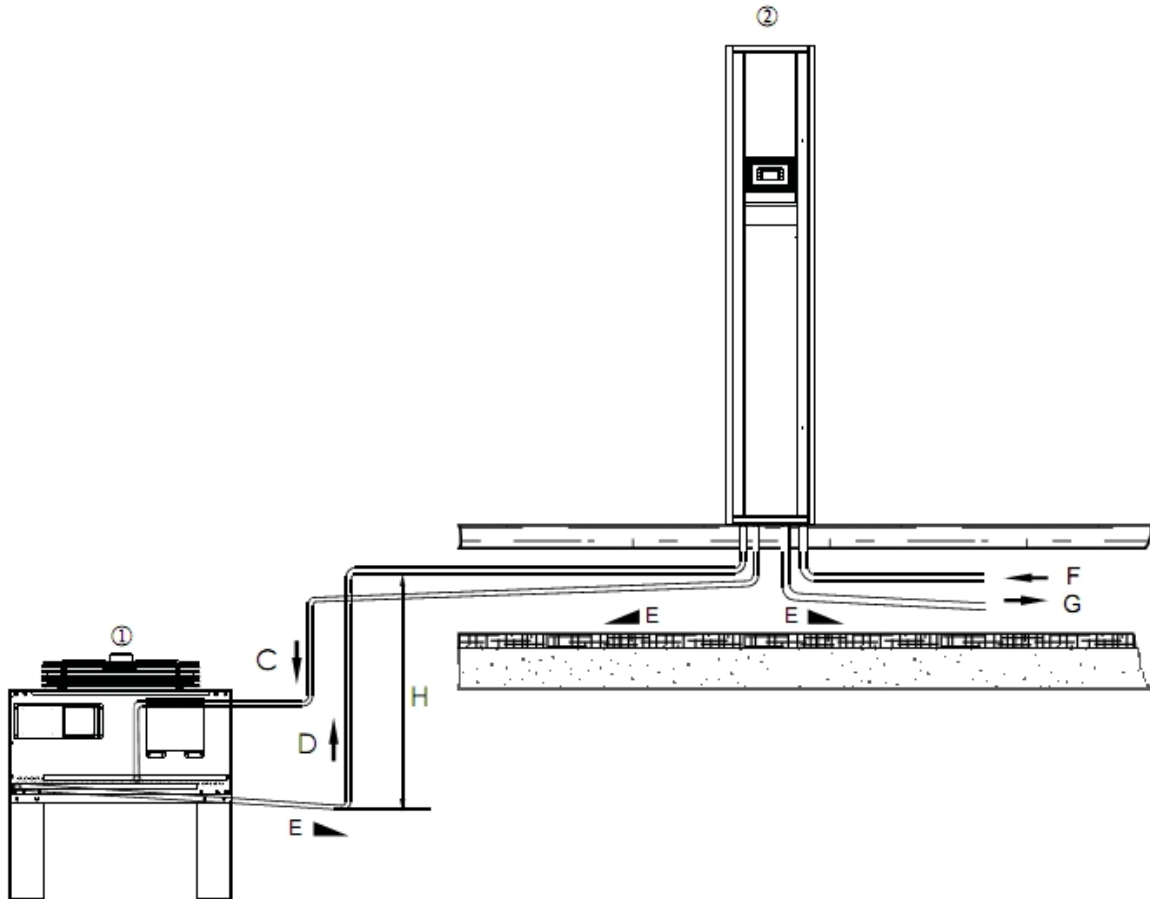


Figure 4-2 Sketch Map of the Negative Fall Installation

Table 4-2 Marks of the Installation Sketch Map

**4-1 Sketch Map of the Positive Fall Installation**

Marks	H1	H2	A	B	C	D	E	F	G
	MAX.20m	5~6m	Reserved Bend	Oil Storage Bend	Gas Flow	Liquid Flow	Outlet Pipe Tilt	Water Supply	Drainage

**4-2 Sketch Map of the Negative Fall Installation**

Marks	H	—	—	—	C	D	E	F	G
	MIN.-5m	—	—	—	Gas Flow	Liquid Flow	Outlet Pipe Tilt	Water Supply	Drainage

Table 4-3 Equivalent Length of the Local Assemblies

Outer Diameter of Liquid Pipeline	Equivalent Length(m)		
	90° Elbow	45° Elbow	T Type Tee
3/8"	0.21	0.10	0.76
1/2"	0.24	0.12	0.76
5/8"	0.27	0.15	0.76
3/4"	0.30	0.18	0.76
7/8"	0.44	0.24	1.1
1-1/8"	0.56	0.30	1.4

Table 4-4 Suggesting Dimensions of the Pipelines

Models	Length of Pipelines (Equivalent Length)					
	10m		20m		30m	
	ØD(mm)	ØL(mm)	ØD(mm)	ØL(mm)	ØD(mm)	ØL(mm)
FS020	22	12	22	12	22	16
FS025	22	12	22	12	22	16
FS040	22	16	25	16	25	19

## §4-3 Mechanical Installation

### 1. Unit Installation

Mechanical installation of the indoor unit

1. Handling the units to the installed place in requirement, as close as possible to the place in principle.
2. Check the spare parts.
3. Remove the related plates.

[**Note:** for the convenience to the installation, the user can carefully remove some of the plates.]

#### 4. Fastness

- 1) Adjust that four foot margin to get desired unit height before installed unit.
- 2) Ensure that four foot margin are at the same level.

#### 5. Requirements of the water supply and drainage

- 1) The users should fit the water supply and drainage pipelines to the units. The supply pipelines should stay next to the unit for easy operation to maintain the humidifier. The users should set a pressure relief valve on the water supply pipeline if the water pressure is higher than 800kPa.

- 2) The users have the responsibility for connecting the water inlet pipeline and drainage pipeline to the indoor unit.
- 3) Strictly ensure the diameter and the slope of the drainage pipelines.
- 4) It should be smooth drainage when doing the drainage test. The drainage pipeline should set the water storage bend.

Table 4-5 Dimensions of the Water Supply and Drainage Pipelines

Models	Inlet of Humidifier Ø	Drainage of Humidifier Ø
FS020~FS040	3/4"	8mm

## Suggestion

The electrode humidifier has an intelligent control system which can automatically adjust the drainage cycle according to the changes of the soluble mineral ions' content (conductivity) in water. It will greatly reduce the deposition rate of the calcium magnesium minerals on the surface of the electrode and tank; prolong the service life of the humidifier. If the conductivity of your local water goes beyond the range showed in section 3-4, please contact the Kstar technical department, and choose the proper humidifier according to your need.

## 2. Connection of the Refrigeration Pipelines

### Principles of Piping Layout

1. All the refrigerant pipelines should be as short as possible and fixed solidly, the layout should be beautiful and orderly, and reduce using elbows.
2. Accord with the requirements of the positive and negative fall installation.
3. Comply with the standard of the diameter selection of the pipelines.
4. The suggested maximum distance between the evaporator and condenser is 30m (equivalent value). If beyond, please contact the manufacturer for help.
5. The copper pipelines passing through the brick structure should be parallel with the casing. The holes in the wall should be sealed after the installation.

### Thermal Insulation

The refrigeration pipelines must be treated with thermal insulation, especially the liquid pipeline of condenser. It will directly influence the cooling performance of the units and the energy saving.

Requirements:

1. Please choose the suitable insulation pipes with the good heat insulating performance, environmental and durable.
2. The insulation pipes must be sealed and closed to the copper pipelines during the pasting.



3. Please do protection to the insulation pipes.

## Connection Operation

1. It should ensure the internal of the pipes and fittings dry and clean before constructing.
2. It should use the high pressure nitrogen gas (0.03MPa) for protection in the welding, using the right tools and solders. The work area should be very clean without flammable objects around, and complete all security works.
3. It should pay attention to control the temperature during the welding. Take some wet cloths to cool down the components which can prevent damaged. (such as: ball valve welding)
4. The connection uses the straight tie-in and 90° elbow. The floor under the support of the indoor unit should be well thermal insulated.
5. Pipelines installed on the exterior wall or the ceiling: all the pipeline supports should be self-contained and meet the strength requirement; the metal supports have no direct contact with the copper pipes; the slope of the level pipelines should comply with design requirement, which make for return oil.

## Test

1. After all the refrigerant pipelines are connected, make the pressurization test with the nitrogen gas. The pressure of nitrogen gas should be  $\geq 2\text{MPa}$ , fills the nitrogen gas from the high and low pressure connection, until balance.
2. If there is no change of the pressure by keeping 24h, the test is eligible. If the temperature difference is changed biggish in 24h, the pressure will have a small change. For example: temperature difference is  $3^{\circ}\text{C}$ , the change of pressure  $\leq 1\%$ , this condition should be eligible. If the pressure changed over the standard value, you should find out the leaking point, then welding and does the pressurization test again.

## §4-4 Wiring for User

### Operation Projects

1. The main power connection.
2. The circuits of outdoor unit connection.
3. Communication link.

### Note

1. All the wiring connection must comply with the state regulation.
2. The full load current of the relevant units refers to the nameplate.
3. The requirements of the main power refer to the nameplate.
4. The electrical installation must be done by the trained professional.

5. Before the wiring connection, you should determine the voltage of the power input, and ensure that the power supply had been shut down.

## Testing

1. The voltage of the power supply is the same as the rated voltage in the nameplate.
2. The electric of system properly connected.
3. All connection tightened.
4. The rating of the circuit breaker or fuse is correct.

## Sketch Maps

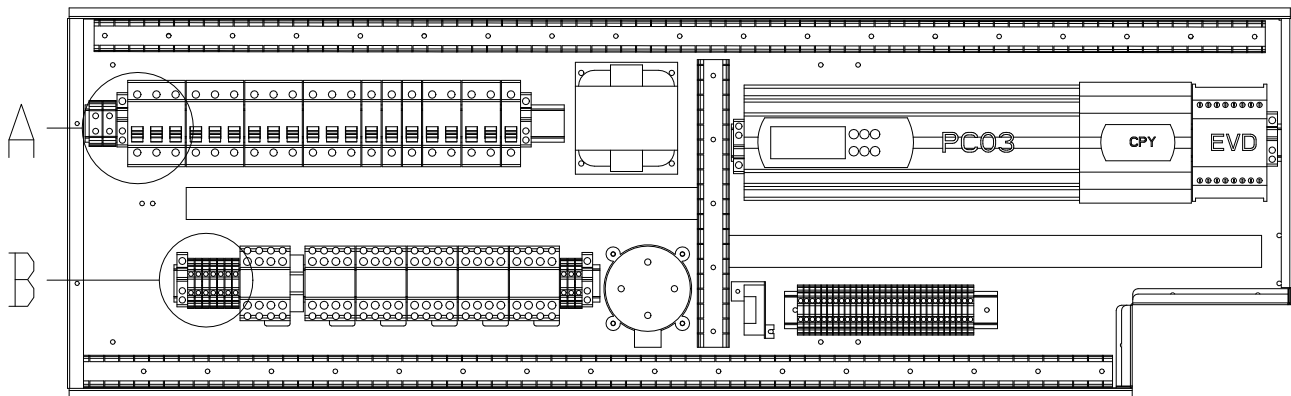


Figure 4-10 Electrical Control Box

Note: A— Power input

B— Output of the air-cooled condenser

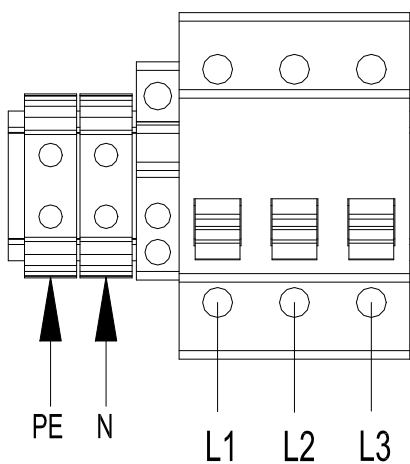


Figure 4-11 Sketch Map of Power Input (A)

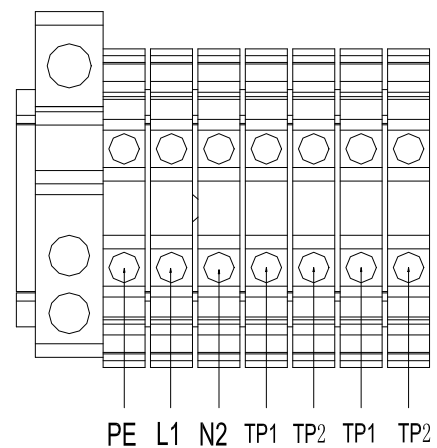


Figure 4-12 Sketch Map of Output to Air-cooled Condenser (B)

## Controller

**Summary**—this chapter mainly introduces the operation and parameter settings of the controller.

---

### §5-1 Summary

FocusAir precision air conditioners configure a world leading technical micro controller, which can accurately control the temperature and humidity, and make the units stable and reliable. The controller stores up the programming control procedures and all the operating parameters, which can be read through the user terminal.

### Composition

- Main controller
- User terminal

### Functions

1. All functions alarm system
2. Record all alarm events
3. Unit startup automatically if power restored
4. Remote control the units on/ off
5. Set the temperature, humidity and other parameters
6. Count the running times of the main components, and make them cycle and rotation
7. Display the operating condition and real-time parameters
8. Can timing switch unit on/ off
9. Programmable LAN management can manage 8 units at the most. Support maximum 8 units to work together as a group
10. Allow manual control to the main components
11. Allow for setting up the operating condition of the electronic expansion valves
12. 2 levels password protection (user password and factory password)
13. Through the optional RS485 serial interface connected to the centralized monitoring system.

### §5-2 User Terminal

The user terminal has a big LCD with beautiful outlook, and it can be easy operated. Users can easily know the operating conditions of each component, and set all the parameters through the graphic display.

The user terminal is composed by the LCD and 6 function buttons.

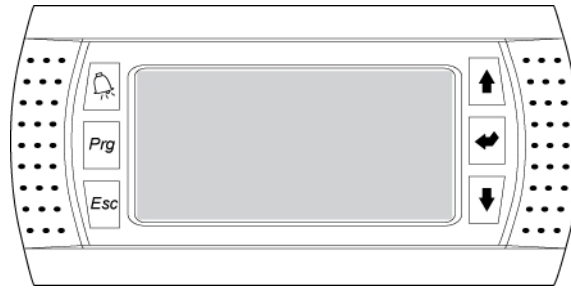








Figure 5-1 User Terminal

## Functions of the Buttons

Table 5-1 Functions of the Buttons in User Terminal

Ico	Buttons	Functions
	<b>ALARM</b>	Examine the alarms and reset, the red light flashing when alarm
	<b>PRG</b>	Access to the menu choices
	<b>ESC</b>	Exit button
	<b>UP</b>	Move up the cursor; choose the submenu you need; Increase the parameters value.
	<b>ENTER</b>	Confirm the menu; confirm to change the parameter value
	<b>DOWN</b>	Move down the cursor; choose the submenu you need; decrease the parameters value.

## Display Information

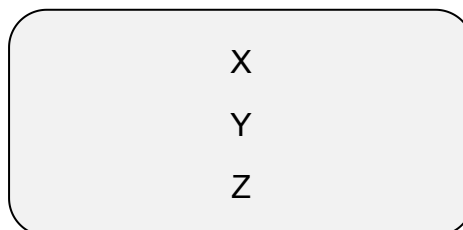


Figure 5-2 Screenshots of the User Terminal

Information:

X- Show the time and date;

Y- Show the temperature and humidity of indoor;

Z- Show the information about the operation of the unit.

### §5-3 Switching on / off Operation

The unit can be controlled in two ways: key-press (switch on/off) and intelligence (switch on/off).

## Key-press Control

First of all, press the PRG button of the user terminal, then press the downward button and access the switch menu of the unit, finally press the “ENTER” button, the display will show the unit switching on. When switch off the unit, press the PRG button and downward button, then press the “ENTER” button to access the menu, press the “ENTER” button again the unit will switch off.

## Intelligence Control

By the following ways:

- a) Remote control switching the unit on/off
- b) Centralized monitoring system
- c) Timing system
- d) Automatic conversion system

## §5-4 Check the Operating Condition of the Unit

You can check the working modes of the unit by pressing the “UP” button, as shown in figure 6-2.

## Working Modes

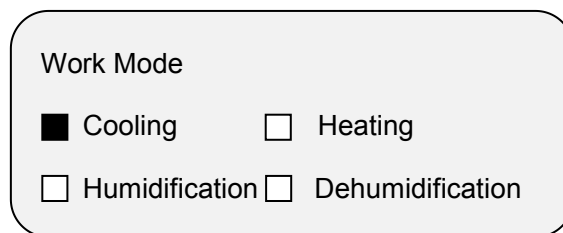


Figure 5-3 Page of the Work Mode

## §5-5 Unit settings

If you want to check or preset the parameters of the units, access the menu by pressing the “PRG” button:

1. Maintenance
2. Printer
3. Input /output
4. Clock
5. Set Point
6. User
7. Manufacturer
8. Board Switch
9. On-Off Unit

## 1、Maintenance

In this menu, you can check the code and system information of the software, the runtimes and the maximum runtimes of the hardware, the alarm history records, the probe calibration, and the inspection and modifying the maintenance password by manual operation of the unit.

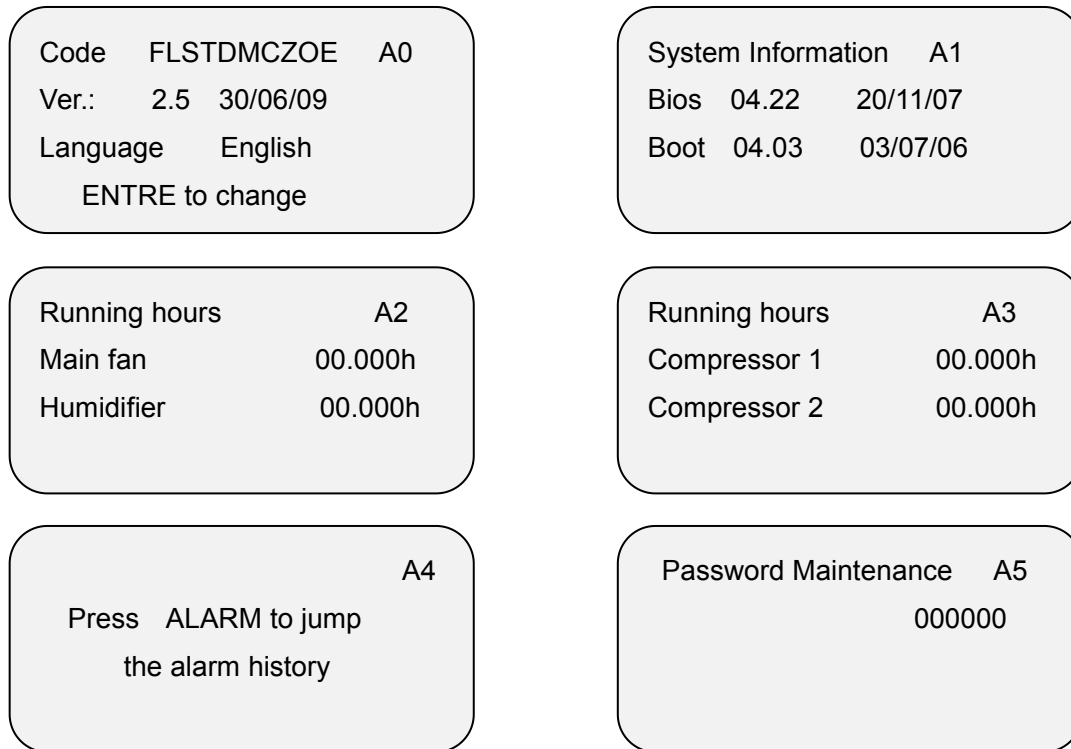


Figure 5-4 Page of Maintenance

## 2、Printer

In this menu, when the printer had been installed, you can carry through the print management and print the related records.

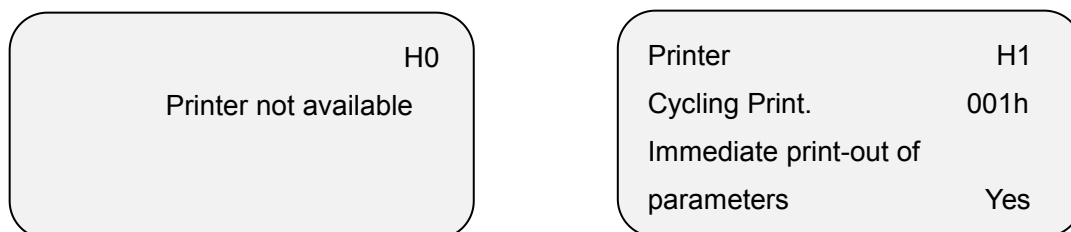


Figure 5-5 Page of Printer

## 3、Input / Output

You can check the corresponding meaning of each input and output port in controller, and each parameter for the actual operation of the units.

Note:

- a) The input and output parameters cannot be modified but only for check.
- b) The relevant ports of the digital input are all closed if the unit operating normally. When the unit is abnormal, the output relay of the port will disconnect and the unit will alarm.
- c) The condition corresponding to each port of unit is shown in the menu of the digital output and analogue output, such as: operations of the fan, compressor, electrical heater and humidifier.
- d) The unit will switch off if there is a serious alarm.

Analog Inputs	I0
Amb. humidity	50.0%
Pr 1	—bar —°C
Pr 2	—bar —°C

Analog Inputs	I1
Room Temp.	23°C
Supply Air	—°C
External Temp.	—°C

Dig. Inputs 1-3	I3
Overl. or HP C1	-C-
Overl. or HP C2	-C-
Overl. Heat 1	-O-

Dig. Inputs 4-6	I4
Overl. Heat 2	-O-
Air Filter	-C-
Overl. Fan	-O-

Dig. Inputs 7-8	I5
Air Flow	-O-
Remote On-off	-C-

Dig. Inputs 9-11	I6
Low Press. C1	-C-
Low Press. C2	-C-
Not used ID11	-O-

Dig. Inputs 12-14	I7
Fire/smoke	-C-
Overl.cond.fan 1	-C-
Overl.cond.fan 2	-C-

Analog Outputs	Ia
Humidifier	05.0V
Main Fan	05.0V
Recovery	05.0V

Dig. Outputs 1-3	Ib
Main Fan	Off
Compressor 1	Off
Compressor 2	Off

Dig. Outputs 4-6	Ic
Heater 1	Off
Heater 2	Off
Dehumidif.	Off

Dig. Outputs 7-8	Id
Recovery	Off
Light Alarm	Off

Dig. Outputs 9-11	Ie
Not Used DO09	Off
Not Used DO10	Off
Humidifier	On

Dig. Outputs 12-14	If
Not Used DO12	Off
Not Used DO13	Off
Not Used DO14	Off

Current total	Ig
Steam flow	8.0kg/h
Conductivity	200uS/cm



Nominal Values	lh	Cylinder 1	li
Nom.prod.	8.0kg/h	Status	Soft start
Nom.current	8.7A	Activity	Fill
Voltage	400V3-ph	Amps	8.7A
Cyl.1 Cont.	lj	Driver 1	lk
Cyl.1 Fill	Off	EEV Mode	MAN.
Cyl.1 Drain	Off	EEV Position	0040
Water Level	High	Power Request	20%
Driver 1 R407C	ll	Driver 1 R407C	lm
Superheat	11.0°C	Evap.press.	6.8bar
Sat.temp.	20.0°C	Evap.temp.	10.0°C
Suct.temp.	20.0°C	Cond.temp.	45.0°C
Driver 2	ln	Driver 2 R407C	lo
EEV Mode	MAN.	Superheat	11.0°C
EEV Position	0040	Sat.temp.	20.0°C
Power Request	20%	Suct.temp.	20.0°C
Driver 2 R407C	lp	Firmware	lq
Evap.press	6.8bar	Driver 1 ver.	100 001
Evap.temp.	10.0°C	Driver 2 ver.	100 002
Cond.temp.	45.0°C		

Figure 5-6 Pages of Input and Output

#### 4、Clock

You can modify the system time of the controller in this menu.

#### 5、Set Point

In this menu, you can check or change the temperature and humidity of the initial setting, so as to change the working model of the unit. When the indoor temperature was higher than the set point, the unit will work in cooling mode; and if the indoor temperature was lower than the set

point, the unit will work in heating mode. But in a certain precision area, it will come forth a dead zone and the unit neither cooling nor heating because of the setting precision of the temperature.

Set Point	S1
Temperature	24.0°C
Humidity	50.0%

Figure 5-7 Page of Set Point

## 6、User

You can set all parameters of the units according to the operating environment in the user menu. First set the limited temperature and humidity, then set the temperature difference and humidity control. Finally you can set the offset value of the temperature and humidity according to the unit operating environment currently.

You can set the user password as your need. The default initial password of the units is "9990".

<table border="1"> <tr> <td>User Password</td> <td>P0</td> </tr> <tr> <td></td> <td>9999</td> </tr> </table>	User Password	P0		9999	<table border="1"> <tr> <td>Limits Set Point</td> <td>P1</td> </tr> <tr> <td>Temperature</td> <td></td> </tr> <tr> <td>Min.</td> <td>10.0°C</td> </tr> <tr> <td>Max.</td> <td>50.0°C</td> </tr> </table>	Limits Set Point	P1	Temperature		Min.	10.0°C	Max.	50.0°C				
User Password	P0																
	9999																
Limits Set Point	P1																
Temperature																	
Min.	10.0°C																
Max.	50.0°C																
<table border="1"> <tr> <td>Limits Set Point</td> <td>P2</td> </tr> <tr> <td>Humidity</td> <td></td> </tr> <tr> <td>Min.</td> <td>30.0%</td> </tr> <tr> <td>Max.</td> <td>70.0%</td> </tr> </table>	Limits Set Point	P2	Humidity		Min.	30.0%	Max.	70.0%	<table border="1"> <tr> <td>Temperature</td> <td>P3</td> </tr> <tr> <td>Cool Differ.</td> <td>2.0°C</td> </tr> <tr> <td>Heat Differ.</td> <td>2.0°C</td> </tr> <tr> <td>Neutral Zone</td> <td></td> </tr> </table>	Temperature	P3	Cool Differ.	2.0°C	Heat Differ.	2.0°C	Neutral Zone	
Limits Set Point	P2																
Humidity																	
Min.	30.0%																
Max.	70.0%																
Temperature	P3																
Cool Differ.	2.0°C																
Heat Differ.	2.0°C																
Neutral Zone																	
<table border="1"> <tr> <td>Humidity</td> <td>P4</td> </tr> <tr> <td>Dehumid.band</td> <td>10.0%</td> </tr> <tr> <td>Humidity Band</td> <td>10.0%</td> </tr> <tr> <td>Max.product.</td> <td>100.0%</td> </tr> </table>	Humidity	P4	Dehumid.band	10.0%	Humidity Band	10.0%	Max.product.	100.0%	<table border="1"> <tr> <td>Show Language</td> <td>P5</td> </tr> <tr> <td>Mask at Start-up</td> <td>NO</td> </tr> <tr> <td>Off unit by key</td> <td>NO</td> </tr> <tr> <td>En. Remote On/Off</td> <td>NO</td> </tr> </table>	Show Language	P5	Mask at Start-up	NO	Off unit by key	NO	En. Remote On/Off	NO
Humidity	P4																
Dehumid.band	10.0%																
Humidity Band	10.0%																
Max.product.	100.0%																
Show Language	P5																
Mask at Start-up	NO																
Off unit by key	NO																
En. Remote On/Off	NO																
<table border="1"> <tr> <td>Temperature Alarm</td> <td>P8</td> </tr> <tr> <td>Low Offset</td> <td>10.0°C</td> </tr> <tr> <td>High Offset</td> <td>50.0°C</td> </tr> </table>	Temperature Alarm	P8	Low Offset	10.0°C	High Offset	50.0°C	<table border="1"> <tr> <td>Humidity Alarm</td> <td>P9</td> </tr> <tr> <td>Low Offset</td> <td>30.0%</td> </tr> <tr> <td>High Offset</td> <td>70.0%</td> </tr> </table>	Humidity Alarm	P9	Low Offset	30.0%	High Offset	70.0%				
Temperature Alarm	P8																
Low Offset	10.0°C																
High Offset	50.0°C																
Humidity Alarm	P9																
Low Offset	30.0%																
High Offset	70.0%																
<table border="1"> <tr> <td>Sel. Type Alarm</td> <td>Pb</td> </tr> <tr> <td>S=serious</td> <td>N=not ser.</td> </tr> <tr> <td>A01: NNNNN</td> <td>A06: NNNNN</td> </tr> <tr> <td>A11: NNNNN</td> <td>A16: NNNNN</td> </tr> </table>	Sel. Type Alarm	Pb	S=serious	N=not ser.	A01: NNNNN	A06: NNNNN	A11: NNNNN	A16: NNNNN	<table border="1"> <tr> <td>Sel. Type Alarm</td> <td>Pc</td> </tr> <tr> <td>S=serious</td> <td>N=not ser.</td> </tr> <tr> <td>A21: NNNNN</td> <td>A26: NNNNN</td> </tr> <tr> <td>A31: NNNNN</td> <td>A36: NNNNN</td> </tr> </table>	Sel. Type Alarm	Pc	S=serious	N=not ser.	A21: NNNNN	A26: NNNNN	A31: NNNNN	A36: NNNNN
Sel. Type Alarm	Pb																
S=serious	N=not ser.																
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A31: NNNNN	A36: NNNNN																
<table border="1"> <tr> <td>Sel. Type Alarm</td> <td>Pd</td> </tr> <tr> <td>S=serious</td> <td>N=not ser.</td> </tr> <tr> <td>A41: NNNNN</td> <td>A46: NNNNN</td> </tr> <tr> <td>A51: NNNNN</td> <td>A56: NNNNN</td> </tr> </table>	Sel. Type Alarm	Pd	S=serious	N=not ser.	A41: NNNNN	A46: NNNNN	A51: NNNNN	A56: NNNNN	<table border="1"> <tr> <td>Sel. Type Alarm</td> <td>Pe</td> </tr> <tr> <td>S=serious</td> <td>N=not ser.</td> </tr> <tr> <td>A61: NNNNN</td> <td>A66: NNNNN</td> </tr> <tr> <td>A71: NNNNN</td> <td>A76: NNNNN</td> </tr> </table>	Sel. Type Alarm	Pe	S=serious	N=not ser.	A61: NNNNN	A66: NNNNN	A71: NNNNN	A76: NNNNN
Sel. Type Alarm	Pd																
S=serious	N=not ser.																
A41: NNNNN	A46: NNNNN																
A51: NNNNN	A56: NNNNN																
Sel. Type Alarm	Pe																
S=serious	N=not ser.																
A61: NNNNN	A66: NNNNN																
A71: NNNNN	A76: NNNNN																

Figure 5-8 Page of User Setting

## 7、Manufacturer

These parameters are the system configuring parameters of the units, which have been set up

when out of factory, and do not need to be made any change.

## 8、Board Switch

This function is used for the operation of several units displayed in one user terminal. When you want to check the working status of other units in the user terminal, you just need to modify the address in the menu.

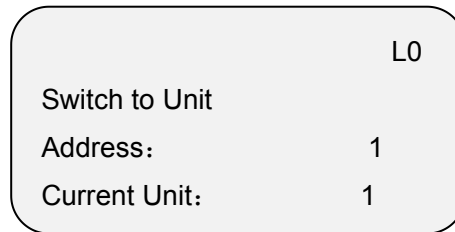


Figure 5-9 Page of Board Switch

## 9、On- Off Unit

You can switch on and off the units in this menu. Before this operation, please confirm that Page 5 “Allow switch the unit off” in the user menu should be chosen as “Yes”.



Figure 5-10 Page of On-Off Unit

## §5-6 Logic and Set Point of Temperature

The cooling and heating operation of the units are managed mainly based on the difference value between the return air temperature of the room and setting temperature, and it can adjust the heating or cooling range in proportion. The dead zone is defined a zone that working around a small area of the set point and the unit will not be activated. Setting the dead zone in the temperature set point can mainly prevent the unit starting up and closing down frequently. The logic is shown in figure 5-13.

### Other temperature functions:

The high and low temperature alarm will cause an alarm signal and have modifiable delay

times. The dehumidification will stop when the return air temperature is lower than the lowest set point. And when the temperature returns above and higher than the lowest set point, the dehumidification will start again. The set point and the difference value can be modified.

Temperature Alarm	P8	Low Temp. Limit	G9
Low Offset	10.0°C	(Stop Dehumidify)	
High Offset	10.0°C	Differential	5.0°C
		Offset	5.0°C

Figure 5-11 Page of Temperature Control

### §5-7 Logic and set of humidity

The humidification and dehumidification are managed based on the humidity value measured by the humidity probe. It can adjust humidification and dehumidification quantity in proportion by comparing the difference value between the set point and the measured value of the humidity probe. There is also a fixed dead zone around the set point. Humidification is completed by a fixed humidifier.

Set point	S1	Humidity Control	P4
Temperature	24.0°C	Dehumid. Band	10.0%
Humidity	50.0%	Humidification Band	10.0%
		Max. Product.	100.0%

Figure 5-12 Page of Humidity Control

**Other Humidity Control Functions:**

The high and low humidity alarm will cause an alarm signal on the screen and have a modifiable delay. The setting page and logic are shown in figure 5-13.

Humidity Alarm	P9
Low Offset	10.0%
High Offset	10.0%

Figure 5-13 Page of Other Humidity Control Functions

## Inspection and Debugging

**Summary**—this chapter mainly introduces the inspection, functions test and operation debugging after the units installed.

---

### §6-1 Inspection

#### Initial Inspection

The initial inspection can check the installation quality of the units again. The suggested contents of the initial inspection are shown in table 6-1.

Table 6-1 Suggested Contents of Initial Inspection

Inspection Items	Contents
<b>Structure</b>	Ensure that the units had been firmly and horizontally installed on the platform
<b>Connection</b>	Ensure that all the fittings of the units had been connected properly
<b>Ventilation</b>	Ensure that the air distribution systems had been installed correctly
<b>Others</b>	Ensure that the related transportation fasteners and temporary connections of the units had been demolished normally

#### Electrical Inspection

Electrical inspection must ensure that all electrical connections should be correctly and reliably connected, and the units had been earthed properly. All the electrical wirings must comply with the nation/ region standard. The suggested contents of the electrical inspection are shown in table 6-2.

Table 6-2 Suggested Contents of Electrical Inspection

Inspection Items	Contents
<b>Power</b>	Ensure that the power meets the requirements (380V/50Hz/3PH), and the voltage difference is $\pm 10\%$
<b>Grounding</b>	Ensure that the grounding is under the rules (cannot use the water pipe for grounding)
<b>Connection</b>	Ensure that all the electrical wirings are correct.
<b>Indoor and Outdoor Communication</b>	Ensure that the communication of the indoor unit and outdoor unit is normal
<b>Monitoring Communication</b>	Connected or not
<b>Group Communication</b>	Connected or not

## Pipeline Inspection

This inspection can ensure that the refrigerant pipelines had been installed correctly, and promoted the lubricating oil return to the compressor. If there was no proper installation of the pipelines and oil storage bend, it may lead the unit abnormally working and the oil returning is not smooth. The suggested contents of the refrigerant pipeline inspection are shown in table 6-3.

Table 6-3 Suggested Contents of the Refrigerant Pipeline Inspection

Inspection Items	Contents
<b>Pipeline Layout</b>	Ensure that the pipeline layout had been performed based on the requirements
<b>Oil Return</b>	Ensure that the pipelines had been installed the oil storage bends and the outlet pipelines had been arranged aslant
<b>Thermal Insulation</b>	Ensure that the thermal insulation had been arranged perfectly and the pipelines had no exposed parts
<b>Protection</b>	Ensure that the pipelines had been protected based on the related requirements

## §6-2 Vacuum Pumping and Refrigerant Charging

### Suggestion

We suggest that the vacuum pumping and refrigerant charging of the system should be done after the users had correctly checked the equipment, so as to avoid the repeated operation.

### Lubricating Oil Adding

When the length and height of the pipelines exceed a certain value, it should add a certain amount of the lubricating oil to the system so as to ensure the normal lubricating of the compressors. The adding volume refers to the §6-3 Lubricating Oil Adding Quantity.

### Vacuum Pumping

After the leak detection, release the nitrogen gas of the system, start the vacuum pumping, keep no less than 90 minutes, with the crankshaft heater opened at the same time, until the absolute vacuum of the system infinitely close to 100Pa.

[**Note:** it is suggested that the vacuum pumping should be done before the function inspection.]

## Refrigerant Charging

The refrigerant charging volume is confirmed based on the total effective length of connected pipelines.

### Operation Steps:



The first step: after the vacuum pumping, charge the liquid refrigerant from the receiver valve, the charging volume is shown in table 6-4.

The second step: start up the unit and calibrate the refrigerant charging volume, make the subcooling and superheat fill the requirements when the unit has operated smoothly.

[**Note:** the requirements of the subcooling and superheat of the unit refer to the technical manual.]

[**Limit:** the second step must be operated after the function inspection and all the tests were eligible.]

[**Note:** the proper volume of the refrigerant charging will directly affect the performance of the units. Therefore the refrigerant charging must be operated by the professional engineers.]

Table 6-4 Refrigerant Charging Volume

Models of FocusAir	Condenser Models(Standard)	Charging Volume(kg)
FS020	KCS36	10
FS025	KCS36	10.5
FS040	KCS54	22.7

### Refrigerant Adding

If the length of the connecting pipeline between the indoor unit and outdoor unit exceeds 10m, it needs to add some refrigerant again to keep the system normal.

The adding volume refers to the calculation method below:

Refrigerant Adding Volume (kg) = Refrigerant Adding Volume per meter of Liquid Pipeline (kg/m) × Total length of Extended Pipeline (m)

The refrigerant adding volumes per meter of the liquid pipeline with different diameters is shown in table 6-5.

Table 6-5 Adding Volumes per Meter of the Liquid Pipeline with Different Diameters

Outer Diameters of Liquid Pipeline(mm)	Refrigerant Adding Volumes per Meter(kg/m)
9.52	0.060
12.7	0.112
16	0.181
19	0.261
22	0.362
28.6	0.618

[**Note:** the charging volume above can be used as the primary budget before installation and the guidance of refrigerant charging after installation. The actual charging volumes of the project should base on the final debugging results.]

### §6-3 Adding Lubricating Oil

When the connecting pipelines long enough, the lubricating oil will adhere to the pipe wall

along with the discharge of the compressor, it will affect the oil return cycle. At this time, we should replenish some lubricating oil to the refrigeration system, so as to ensure the compressor running normally.

In general, it cannot add lubricating oil if the length of connecting pipeline within 30m. The adding volume of lubricating oil refers to the calculation formula below:

$$\text{Calculation Formula: } L=22.94R-0.1O$$

Notes: L—Adding Volume of Lubricating Oil (ml)

R—Refrigerant Charging Volume (kg)

O—Initial Charging Volume of Lubricating Oil in Compressor (ml)

Table 6-6 Initial Charging Volume of Lubricating Oil in Compressor

Unit Models	Compressor model and quantity	Initial Charging Volume (ml)
FS020	E405DHD-36D2G×1	500
FS025	C-SDP205H02B×1	1700
FS040	E655DHD-65D2G×1	1900

HFC refrigerant (R134a, R407C, R410A) system must use the polyester lubricating oil. FS020、FS040 use FVC68D lubricating oil, FS025 use FV68S lubricating oil.

You can check the original charging volume in the compressor nameplate. The charging volume of the lubricating oil again in the scene should be less 118ml than the original charging.

## §6-4 Function Inspection

### Note

Before the units start up, please make sure that the unit had been strictly checked, the filters were clean and properly installed, and there were no sundries inside the unit.

### Inspection Contents

- Supply power to the unit, and do the testing without load.
- Inspect the voltage of the power supply connecting point, the voltage no exceeding  $\pm 10\%$  of the rating in nameplate.
- The rotation direction of the compressor and fan is correct.
- Inspection of control functions.

## §6-5 Debugging

### 1、Adjusting of Refrigerant Charging Volume

On the basis of the unit designed parameters (subcooling, superheat and pressure etc.), you can adjust the refrigerant charging volume during the unit started up and operated, and make the charging volume fill the requirements.

## **2、 Debugging Contents**

- a) Measure and record the operation parameters of the unit.
- b) Compressor operation debugging.
- c) Fan operation debugging.
- d) Electrode humidifier operation debugging.
- e) Electrical heater operation debugging.

[**Note:** the commissioning debugging should be conducted by the professional engineers.]

## Daily Operation

**Summary**—this chapter mainly introduces the related fundamentals of refrigeration and control, the daily operation, system failure phenomena and disposal methods of the precision air conditioner.

### §7-1 Related Principles

#### 1、 Main Components and Functions of the Refrigeration Systems

Table 7-1 Main Components and Functions of the Refrigeration Systems

Components	Functions
<b>Compressor</b>	Increases the pressure of the refrigerant, ensure the pressure needed to condense the gaseous refrigerant into the liquid under the normal temperature, and increases the power for refrigeration cycle simultaneity.
<b>Condenser</b>	Heat exchange with the heat transfer medium (air, water), condense the high temperature gaseous refrigerant into liquid.
<b>Expansion Valve</b>	Reduces the pressure of the refrigerant, make the pressure corresponding to the evaporating temperature, control the refrigerant flow and maintain the condensing pressure simultaneity.
<b>Evaporator</b>	Refrigerant evaporating in the evaporator and absorbing the heat of the medium (air, water), and achieve refrigeration.

#### 2、 Refrigeration Fundamentals

The compressor absorbs the low temperature and low pressure superheated refrigerant vapor from the evaporator, and discharges the high temperature and high pressure superheated refrigerant vapor after the compression, then the vapor passes through the condenser and exchanges with heat transfer medium (air, water), and gradually condenses into high pressure subcooling liquid refrigerant. After leaving the condenser, the refrigerant passes through the expansion valve with the throttling and a drop in pressure, then it changes into the low temperature and low pressure two-phase state refrigerant with the most liquid state, vaporizes in the evaporator with proper flow by absorbing heat from the cooled space, and achieves refrigeration; after the heat exchange in evaporator, the refrigerant changes into the superheating vapor, and sucked by the compressor again, repeat the cycle constantly.

##### 1) p-h Diagram

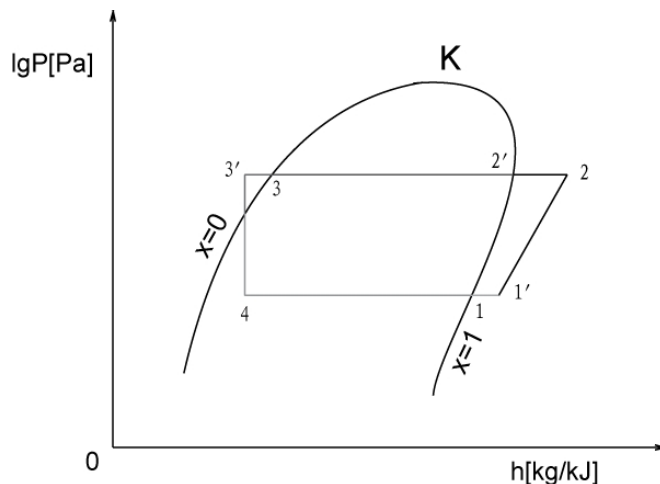


Figure 7-1 p-h Diagram

## 2) Principle Diagram of Refrigeration Cycle

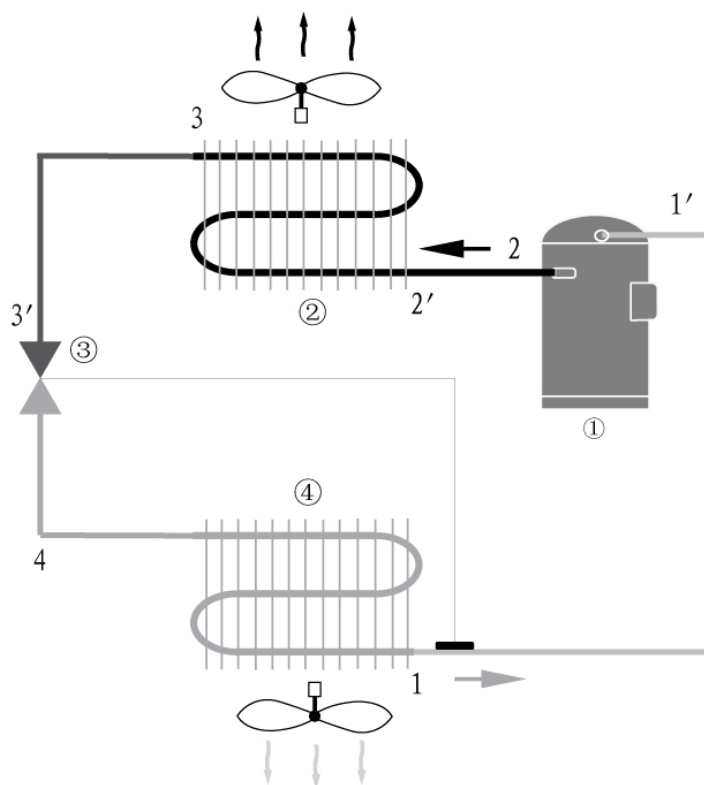


Figure 7-2 Principle Diagram of Refrigeration Cycle

- Note:
- ① — Compressor
  - ② — Condenser
  - ③ — Expansion Valve
  - ④ — Evaporator

## 3) State Points

The numerical values of figure 7-1 and 7-2 denote each thermodynamic state points of the

refrigerant in the cycle process of the refrigeration system. The thermodynamic state of each state point refers to the annotation below:

- 1 — Low temperature and low pressure saturated vapor;
- 1' — Low temperature superheating vapor;
- 2 — High temperature superheating vapor;
- 2' — High temperature and high pressure saturated vapor;
- 3 — High pressure saturated liquid;
- 3' — Subcooling liquid;
- 4 — Low temperature and low pressure two-phase state.

### **3、 Control Principle**

The control logic of the unit refers to introduction of the chapter 5.

### **4、 Humidification and Dehumidification**

The unit humidifies or dehumidifies based on the controller contrasted the actual humidity detected by the humidity probe and the user setting point. The humidification is conducted by the electrode humidifier, and the dehumidification is conducted by the refrigeration cycle.

### **5、 Heating**

The heating of the unit is configured the electrical heaters.

### **§7-2 Daily Operation**

In the daily management, the management and maintenance for the precision air conditioner mainly includes the refrigeration system, fans, air filters, humidifier, heater and the drainage. The proper operation of the daily management will have a great effect on the stable operation, service life and the energy saving of the units. Please carry out the daily management for the precision air conditioner strictly.

Table 7-2 Items of the Daily Operation

Items	Contents
<b>Patrol</b>	Inspect the air conditioner system and ensure it under the normal operation
	Each function and parameter is normal, if there were alarm conditions, you should inspect the alarm records and analyze the causes
<b>Ventilation System</b>	Inspect the air filter
	Inspect the fan without abnormal noise
	Inspect the current of the motor without abnormality
	Inspect the air lost alarm device without abnormality
<b>Refrigeration System</b>	The suction pressure and discharge pressure are normal
	Ensure that the refrigerant charging volume is proper
	Without the refrigerant leak
	Check the color of the sight glass
	The drainage of the water receiver is smooth
	The expansion valve without frost
	The compressor without frost
	The evaporator without frost
	The pipeline without damage
	The insulation of the pipeline is normal
<b>Humidifier</b>	The fouling condition
	The water supply and drainage are smooth
	The steam pipe is smooth
<b>Other</b>	Inspect the wiring terminal without loose
	Ensure the screws without desquamating
	Inspect the voltage of the power supply, keep it under the normal range
	The situation of the floor below is normal
	Ensure the fixing of the indoor unit without loose

### §7-3 Phenomenon of the Common Fault Alarm and Solutions

The faults of the precision air conditioner mainly have the faults of the refrigeration system, control system, ventilation system and the communication. The common faults and suggested treatments refer to the table 7-3.

[**Note:** when the unit had faults, and you cannot simply remove, please contact the KSTAR for technical support.]

[**Warning:** Part of the circuits in the system is 400V/50Hz, it is only allowed for the professional and technical personnel to maintain and operate, and operation in charged must be extra careful.]

Table 7-3 Phenomenon of the Common Fault Alarm and Countermeasure

<b>Faults</b>	<b>Possible Causes</b>	<b>Solutions</b>
<b>Unit not start-up</b>	The unit had not been connected to the power	Inspect the power input of the unit, ensure that the connection is good.
	The phase-sequence of the power is wrong connected	Inspect the phase-sequence and wiring of the power
<b>Air channel fault and alarm</b>	Difference pressure switch set improperly	Adjust the difference pressure switch over again
	The filter clogging and the air flow short circuit	Replace the air filter, eliminate the obstacles
	Fan reversal and phase lack	Inspect the phase-sequence and wiring of the power supply
	Fan fault	Measure the 3-phase static resistance of the fan motor, if the coil burning, the value should be more than 5 MΩ .
	The detecting tube of the difference pressure switch had been blocked.	Remove the obstacles of the detecting tube
<b>Compressor overload</b>	The thermal load overloaded	Inspect the insulation and the airproofing of the air conditioning room, add the unit if necessary
	The refrigerant in system is too much	Discharge the excess refrigerant
	Compressor faults	Compressor locked, it must replace a new compressor if the insulation of the motor coil had problem
	The voltage of power supply exceeded	Remove the instable factors of the power
	The compressor wiring loosed	Retighten the wiring
<b>High pressure protection alarm</b>	High pressure protection switch fault	Replace a new switch
	Adjustment of the expansion valve too loose	Properly adjust the opening degree of the expansion valve
	Expansion valve fault or the installed location of the temperature bulb error	Replace the expansion valve, and correctly install the temperature bulb
	The refrigerant charging to much in summer	Remove the excess refrigerant, control the high pressure under 2.3~2.8MPa
	The condenser fouling	Clean the dust and dirt on the surface of the condenser
	The axial fan does not work	Inspect the static and grounding resistance of the axial fan, replace the fan if the coil burned
	The system had the non	Discharge portion of the gas from the



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	condensable gas	high point of the system, conduct the vacuum pumping and refrigerant charging again if necessary
<b>Fan overload</b>	The airflow too much	Inspect the installation of the filter, and the proper airflow
	Voltage too low	Inspect the power input
	Motor winding of fan fault	Ensure that the motor winding is normal
<b>Low pressure protection alarm</b>	Low pressure protection switch fault	Replace a new switch
	The opening degree of the expansion valve is too small	Properly adjust the opening degree of the expansion valve
	Expansion valve fault or the installed location of the temperature bulb error	Replace the expansion valve, and correctly install the temperature bulb
	Lack of refrigerant in the system	Add refrigerant again, control the low pressure under 0.9~1MPa
	Filter Drier jammed	Replace a new filter drier
	Evaporator frost	Defrosting for the evaporator
	Fouling of the evaporator surface	Clean the evaporator surface
	The airflow too small	Ensure that the air filter and air return pipes had not been jammed
The setting of the low pressure protection delay is incorrect	Reset the delay time	
<b>High temperature alarm</b>	The setting of the temperature upper limit is unreasonable	Reset the value
	The load of the unit is too small	Inspect the airproofing of the room, add the unit if necessary
	The refrigeration system is not open	Inspection the operation condition of the refrigeration system
<b>Low temperature alarm</b>	The setting of the temperature lower limit is unreasonable	Reset the value
	The site is abnormal	Inspect the airproofing of the room in winter, ensure there is normal
	The current of the electrical heater is unreasonable	Inspect the operation condition of the electrical heater
<b>Electrical heater superheat alarm</b>	Air filter jammed	Replace a new air filter
	The airflow is too small	Ensure that the airflow is smooth, and clear the obstruction
<b>Humidification fault alarm</b>	The humidifier without current	Inspect the wiring of the power supply, ensure the phase-sequence is correct
	Humidification current is too large	Inspect the hardness of the water, ensure that the hardness is proper, and the humidifying tank is clean, replace a

		new one if dirty
	Humidification current is too small	Inspect the conductivity of the water supply, add some salt properly and increase the ionic concentration if the conductivity too small
	The humidifier water shortage	Ensure that the water tap is open, the wiring of water inlet solenoid valve is not loose, and the valve had not been damaged
	Humidifier without drainage	Ensure that the wiring of the drainage solenoid valve is not loose, and the valve had not been damaged
<b>Low humidity alarm</b>	The setting of the humidity lower limit is unreasonable	Reset the value
	The unit does not configured the humidifier	Configure humidifier if necessary
	Humidifier abnormal	Inspect the operation condition of the humidifier
<b>High humidity alarm</b>	The setting of the humidity upper limit is unreasonable	Reset the value
	The room had not done the moisture-proof measure	Do the moisture-proof for the room