



# Positive Pressure Therapy Device Service Manual

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## iBreeze Series

### **IBREEZE SERIERS PRODUCTS**

BPAP/CPAP/AUTO CPAP

Published: October 31, 2017

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■ Version: 1.1

■ Published: October 31, 2017

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### Safety




#### Cautionary Language

In this service manual, Cautionary words include danger, warning, caution and note for safety and other important instructions. The definition of cautionary language: (notice: before reading this manual, please clearly understand what they mean)

- <Danger>: The indication of an urgent risk condition, if not avoided, will lead to death or serious injury.
- <Warning>: Indicates a potential risk condition that, if not avoided, can lead to death or serious injury.
- <Caution>: Indicates a potential risk condition that, if not avoided, can cause minor or moderate damage.
- <Note>: Indicates a potential risk condition that, if not avoided, can cause minor or moderate damage.

## Safety Symbols

During the usage, Please notice the following symbol for safety purposes.

Safety Symbol	Meaning
	Humidifier is been heated, please do not touch the heating parts
	Does not suitable working in the NMR enviornment
	Please follow the instruction manual

## Content

1	Device Overview.....	6
1.1	Device Information.....	6
1.2	Device Composition.....	6
1.3	Device outer structural components.....	7
1.4	Device Disassemble Diagram.....	8
2	Hardware Schematic Description.....	10
2.1	Power Adaptor.....	10
2.2	Main Control PCBA.....	11
2.3	Key Button Set.....	11
2.4	Encoder PCBA.....	11
2.5	SD PCBA.....	11
2.6	Flow PCBA.....	11
2.7	Wireless PCBA.....	12
2.8	Screen.....	12
2.9	Touch Screen and Front Panel.....	12
2.10	Turbine.....	12
3	Gas Flow Diagram.....	12
Chapter 2 Device and Software Operation Instruction.....		13
1.	Starting the device.....	13
2.	Software Structure and Operation Theory.....	13
3.	Software Interface.....	14
4.	Software Update.....	17
5.	Alert.....	17
Chapter 3 Common Troubleshooting Guidelines.....		18
1.	Device Failure.....	19
2.	Function Failure.....	20
3.	Vent/Device Alert.....	21
4.	Other Failure.....	25
Chapter 4 Positive Pressure Therapy Device Service.....		25
1.	Front housing service.....	26
2.	Rear Housing Service.....	29
3.	Calibration.....	33
Chapter 5 System Check after Service.....		38
Chapter 6 Other.....		38
1.	Clean the Device.....	38
2.	Water Tank Cleaning.....	38
3.	Tube Cleaning.....	39
4.	Storage and Discard.....	39
Chapter 7 Service Part List.....		39
Appendix I Wiring Diagram of the Device.....		41
Appendix 2 Product Technical Specifications.....		42
Appendix 3 Sleep Quality Report Terminology interpretation.....		45

## Chapter 1 Overview

### 1 Device Overview

The device provides positive airway pressure support to patients with sleep apnea syndrome (OSA) by establishing pressure differential by turbine mechanism in order to produce the kinetic principle of alveolar ventilation. This can also be used to replace, control or change a person's spontaneous breathing to achieve treatment goals.

#### 1.1 Device Information

- iBreeze Series includes: 4 models of 3.5 inches screen CPAP and 10models of 5inches screen BPAP.
- **CPAP:** iBreeze 20C、iBreeze 20C Pro、iBreeze 20A、iBreeze 20A Pro
- **BPAP:** iBreeze 25S、iBreeze 25A、iBreeze 25A Pro、iBreeze 25ST、iBreeze 25STA、iBreeze 25STA Pro、iBreeze 30ST、iBreeze 30STA、iBreeze 30STA Pro、iBreeze Tech

\*This manual will use CPAP 20A Pro and BPAP Tech as models。



Chart 1-1 iBreeze Tech



Chart 1-2 iBreeze 20A Pro

#### 1.2 Device Composition

The device consists of tube, mask, power, housing and other major parts. The main machine includes:

- Front housing set

- BPAP front housing (touch screen) / CPAP front housing (none touch screen)
- 3.5 inches screen set /5 inches screen set
- Key Board Assembly
- Rotary Encoder (including knob)

- Environmental Light Plate Assembly
- Other: Waterproof strip

**- Rear housing set**

- Rear housing
- Inlet lid and filter
- SD PCBA /SD connection wire /SD Lid/SD Card
- DC Power Cord
- Turbine set
- Water tank set
- Heating plate set
- Main PCBA board
- Wireless PCBA: 2G module or wifi/blue tech module
- Gas link parts (flow sampling tube, water tank intake tube, water tank outtake tube, external outtake tube)
- Water level sensor/water level stopper
- other: rear housing lid、water tank lid and heating plate lid

**1.3 Device outer structural components**

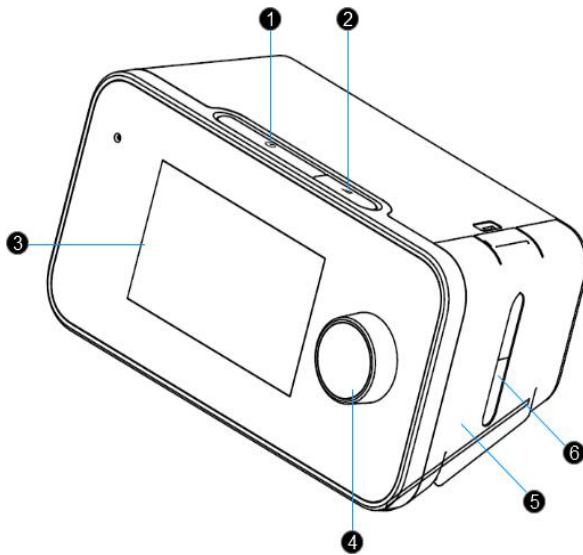


Chart 1-3 iBreeze Tech front view

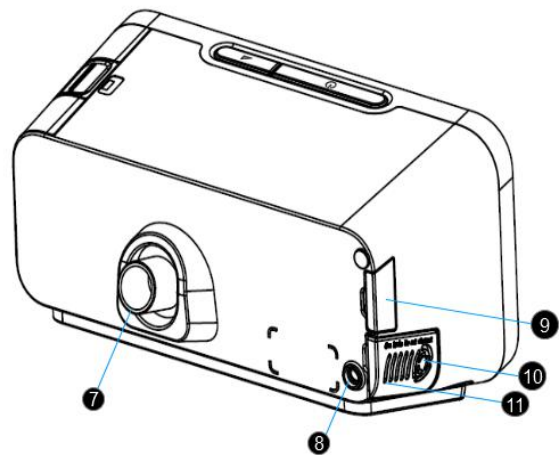


Chart 1-4 iBreeze Tech back view

Item	Function	Description
1	Start/Stop Button	Start/Stop the gas flow
2	Ramp	Start ramp function



Item	Function	Description
3	LCD Screen	Displaying the content on the screen
4	Knob	Turning the knob to change parameters and push in for confirming the change
5	Water tank side plate	Holding and protecting water tank
6	Water tank	Contain the humidifying water
7	Gas outlet	Connecting to a breathing tube
8	Power inlet	Connecting a power cord
9	SD lid	Opening lid to insert a SD card
10	Gas inlet	Inhale gas inlet
11	Filter lid	To open the filter lid to change the filter

#### 1.4 Device Disassemble Diagram

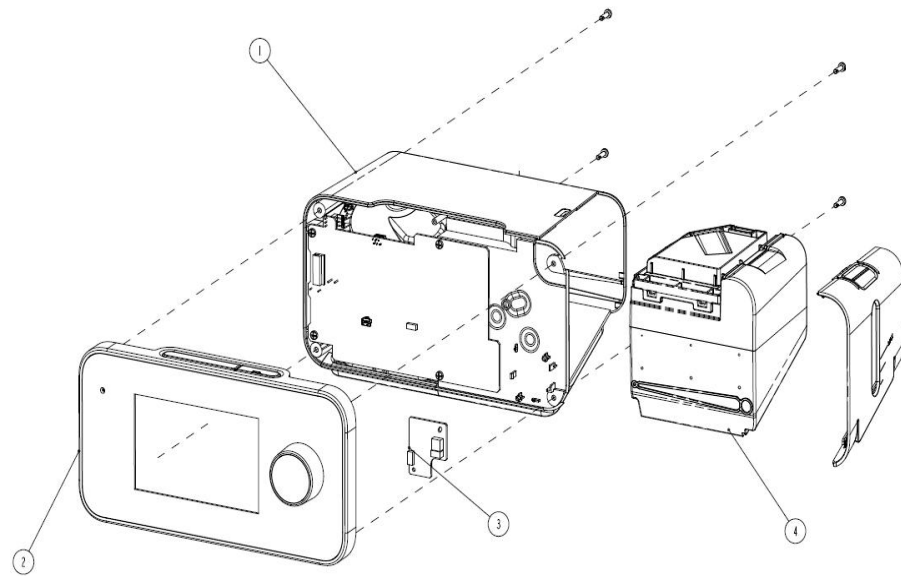


Chart 1-5 iBreeze Tech Disassembling Chart

- ① Rear housing set
- ② Front housing set
- ③ wireless PCBA
- ④ water tank

#### 1.5 Front/Rear housing set wiring diagram

Here displays only the diagram, the detailed wiring map is in Appendix I

### 1.5.1 Front housing wiring diagram

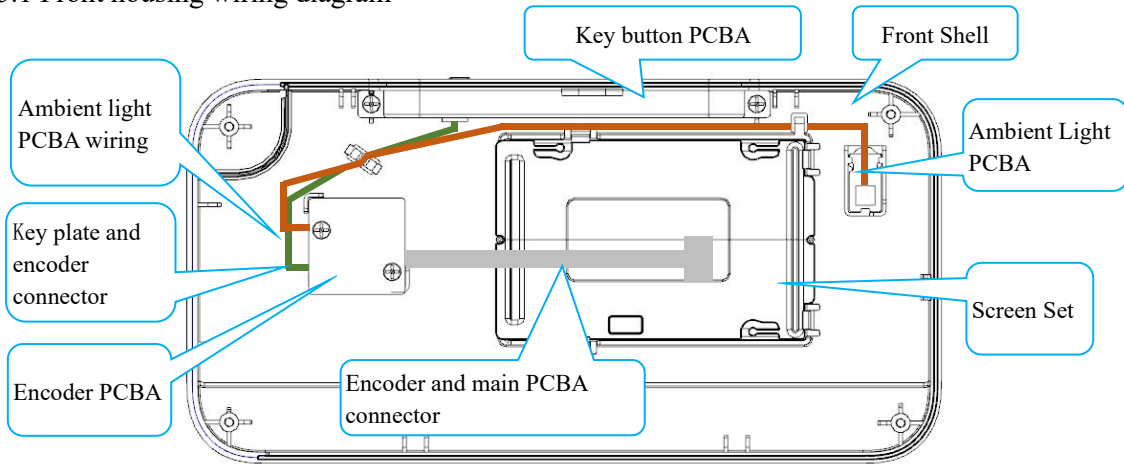


Chart 1-6 iBreeze CPAP (3.5 inches) Front Shell backside view

Attention: iBreeze 20C does not include ambient light set.

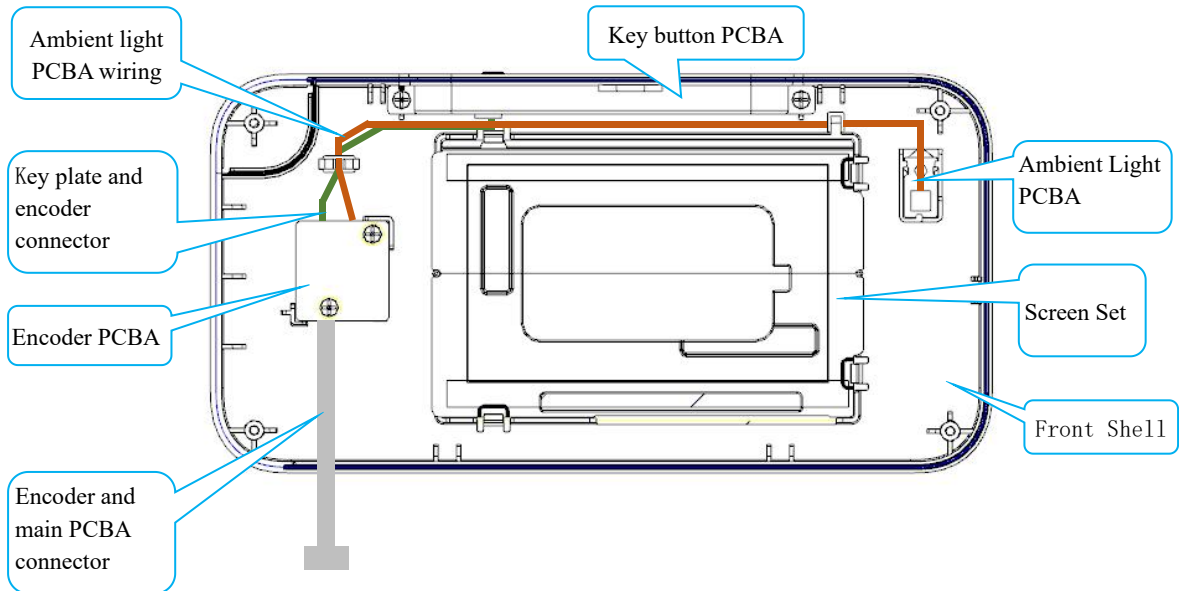


Chart 1-7 iBreeze BPAP (5 inches) front shell backside view

Attention: Above chart is an example diagram, Actual shape is subject to object

### 1.5.2 Rear Side wiring Diagram

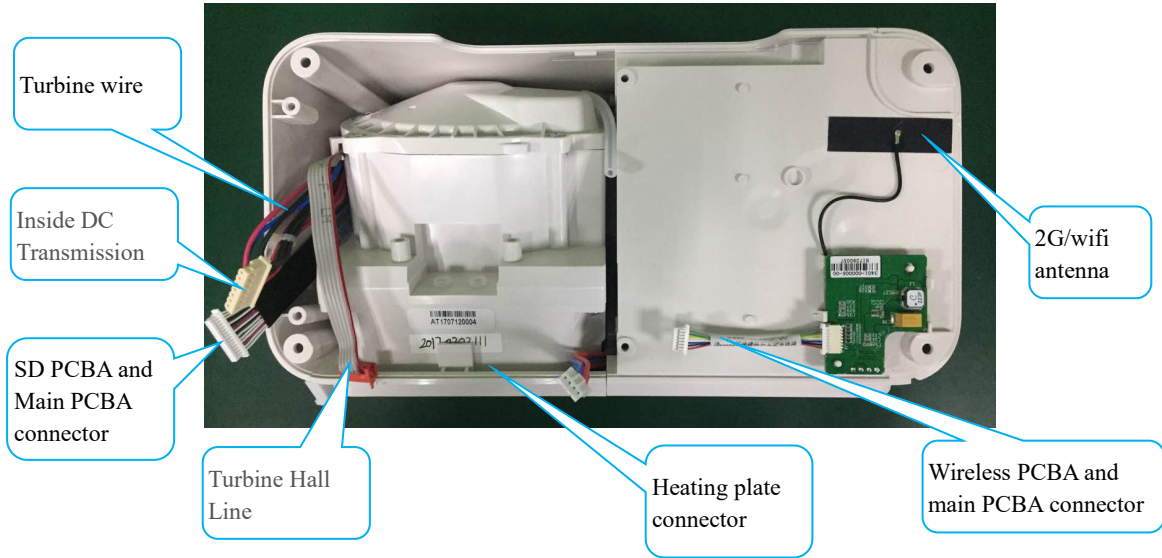


Chart 1-8 iBreeze rear shell view

## 2 Hardware Schematic Description

The hardware is showing as below diagram and includes power adaptor、main control board、key button set、encoder PCBA、SD PCBA、flow PCBA、wireless PCBA、screen、touch screen (BPAP) and turbine.

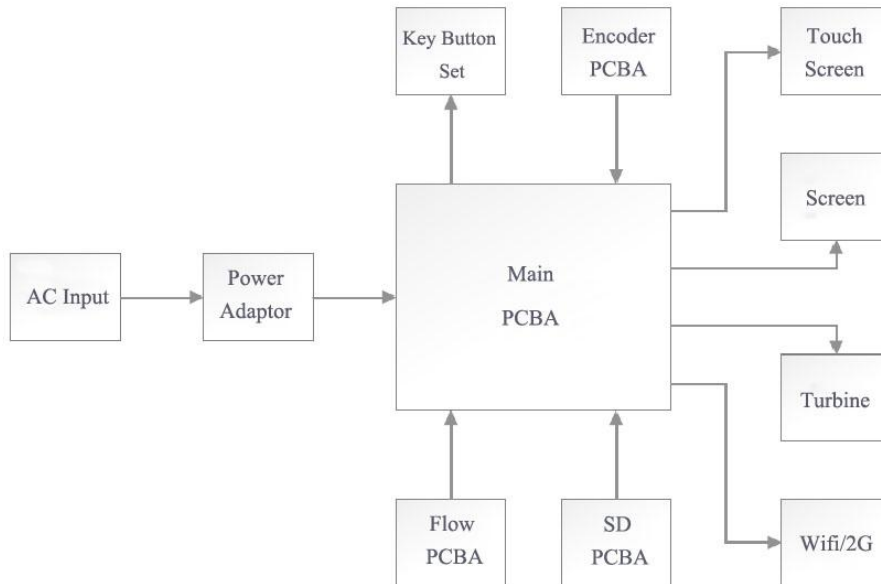


Chart 1-9 Hardware Structural Diagram

### 2.1 Power Adaptor

Power adapter for the overall supply of power, contains of over voltage, over-current, and over-temperature protection function. Its input/output parameters are showing below

Table1 Power adapter input and output parameters

Parameter	Value
Input	100VAC-240VAC 50/60Hz
Output	24VDC-28VDC 2.5A Max

## 2.2 Main Control PCBA

Main control board in charge of computer interaction, turbine control and parameter monitoring. The parameters include the power supply voltage, atmospheric pressure, ambient light intensity, tube pressure, tube flow, ambient temperature and humidity.

The main control board and other boards or components connected by wire connection, including DC input wire, SD card board connection wire, encoder board connection wire, key button Board connector, wireless Board connector.

## 2.3 Key Button Set

The key button PCBA is provided with a vent start/stop button, a ramp button, and a ventilation status indicator. Stop ventilation shows blue and in ventilation shows in green. The key button PCBA is connected with the main control board through the encoder PCBA.

## 2.4 Encoder PCBA

The encoder PCBA is connected with the main control board through the wire, with rotating and switching functions, the user can adjust the display cursor position through the encoder and press the knob for confirmation selection.

## 2.5 SD PCBA

The SD card PCBA is connected directly with the main control board through the wire, and the SD card is used to store the treatment data, upgrade the software, and machine state.

In addition, the SD card PCBA is provided with a micro USB interface for machine calibration.

## 2.6 Flow PCBA

The flow PCBA is assembled on the top of a turbine box for real-time monitoring of tube gas flow. The flow PCBA is also connected with the main control PCBA through the wire.

## 2.7 Wireless PCBA

The wireless PCBA is divided into two optional configurations, wifi board and 2G board, and one machine is configured with only one wireless board, which is used to connect a network platform or an external wireless module (such as a SPO2 module).

## 2.8 Screen

The screen is an important part of human-computer interaction to display the ventilation parameters and configuration options. The display size is divided into two kinds, 3.5 inch and 5 inches, which the size of display is related to the model.

## 2.9 Touch Screen and Front Panel

Touch screen using capacitive screen, is also an important interface for human-computer interaction, and used to match the BPAP model;

The front Panel is primarily cosmetic and decorative, and provides a transparent square area in the display area for a CPAP and APAP models.

## 2.10 Turbine

The turbine is assembled in the turbine box, which is the core part of the machine, with the built-in rotational speed and temperature sensor, corresponding to the gas pressure and flow according to the different output of the ventilation mode.

## 3 Gas Flow Diagram

With the turbine fan as the power source, the ambient atmosphere is boosted, and the pressure or flow pattern is output to the patient through the feedback control algorithm.

The process requires the pressure and flow sensor as feedback input.

By means of heating the water, the humidification of the gas is provided. And the complex ventilation mode, the wetting adjustment, has the algorithm realization.

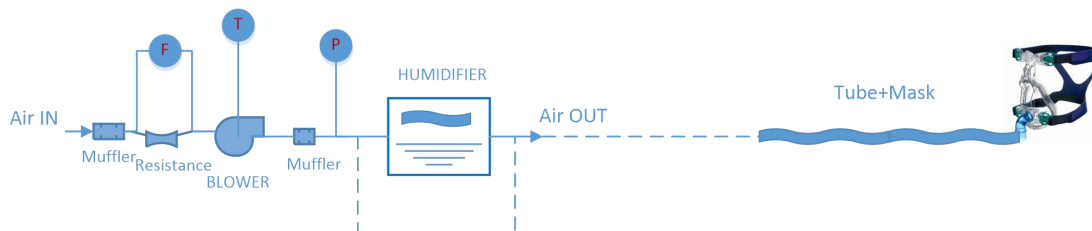


Chart 1-10 Gas Flow Diagram

- F: Flow Sensor

- T: Turbine Temperature Sensor
- P: Pressure Sensor
- Muffler: Noise Reduction
- Resistance: Gas Stopper
- BLOWER: Turbine Housing
- HUMIDIFLER: Humidifier (Consists of Water tank and heating plate)

## **Chapter 2 Device and Software Operation Instruction**

### **1. Starting the device**

Confirm the connection of power supply, boot logo showing in the screen and boot waiting interface in 5 seconds, then the device enters the patient standby interface;

After the factory reset, the language and time setting interface are automatically showing on the screen. Need to complete setup these parameters before entering patient standby interface

#### **Attention:**

- When in the patient standby interface, press ramp key + control knob 5 seconds to enter the doctor standby interface.
- When in the doctor standby interface, press ramp key + control knob 5 seconds to enter the patient standby interface.

### **2. Software Structure and Operation Theory**

The System program of iBreeze series positive pressure ventilation treatment device is composed of bootloader, application, and buzzer control programs.

- iBreeze series BPAP/CPAP application program are system programs used by users;
- Buzzer control program is mainly used to detect the accidental power off and alarm prompts;
- Bootloader Program is mainly used for system storage allocation, restore factory settings, upgrade results feedback, and upgrade process error prompts.

#### **2.1 System Application Software Hierarchy Diagram**

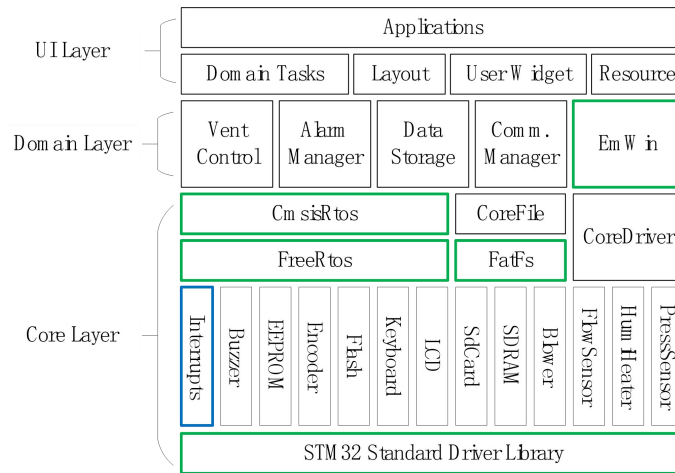


Chart 2-1 System Application Software Hierarchy

- Core Layer
- Domain Layer
- UI Layer

### 3. Software Interface

#### 3.1 Patient Software Interface

The patient menu mainly includes the patient's standby interface shortcut operation, the ventilation interface shortcut operation, the patient setting interface, the comfort adjustment interface, and the patient Information interface.

##### 3.1.1 Patient standby interface:

The patient's standby interface shows SD card, pre-heating status, wireless/ Bluetooth connection status icon, current treatment mode, mask matching degree, humidity adjustment, sleep treatment report, comfort adjustment, and System Setup function. Click function button to enter corresponding function setting interface.

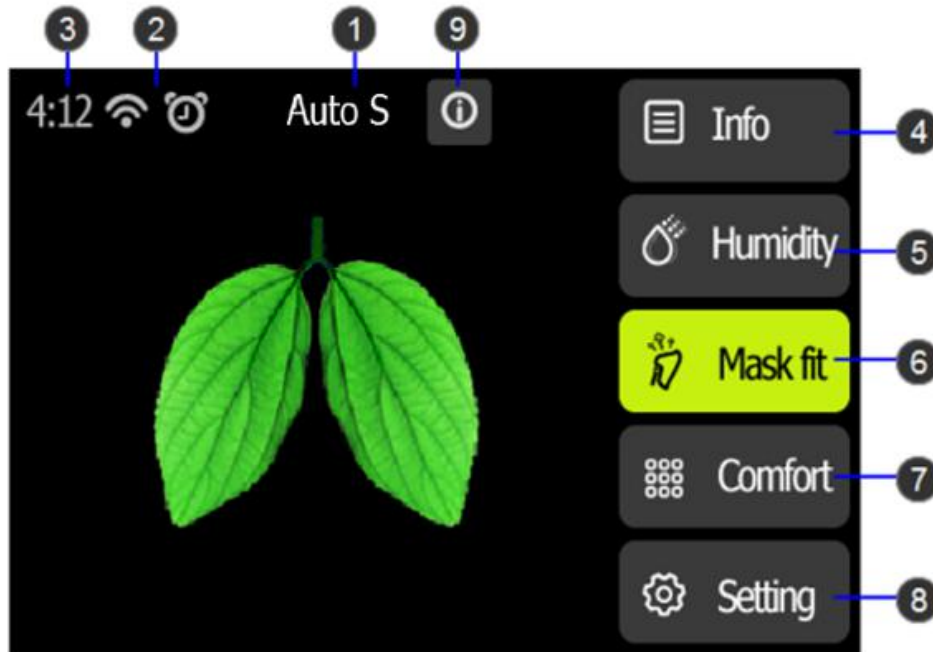


Chart 2-2 Patient Standby Interface

#	Feature	Description
1	Mode	Display the current mode.
2	Enabled Features	Depending on setup, certain enabled therapy features will display here.
3	Time	Display the current time.
4	Patient Sleep Quality Report	Displays the patient sleep quality report and the options for period of the report are: daily (recent 6 days) / 7 days / 14 days / 1 month / 3 months / 6 months / 1 year.
5	Humidity	Set humidifier level to enhance patient comfort of respiration. Option: Auto / 0-8                      Default: 3 Note: The humidity level only can be set when the water in humidifier exceeds the minimum water level for safe operation.
6	Mask Fit	Mask fit feature allows you to check the fit of your mask prior to starting therapy. This is done by measuring the amount of leak.
7	Comfort	Press to enter Comfort setting interface.
8	Setting	Press to enter Patient System Setting interface.
9	Alarm Message	Display the alarm messages.

### 3.2 Doctor Standby Interface

The Doctor interface mainly includes the patient standby interface shortcut operation, the ventilation interface shortcut operation, the patient setting interface, the comfort adjustment



interface, the patient report interface and the alarm setting.

### 3.2.1 Doctor Standby Interface:

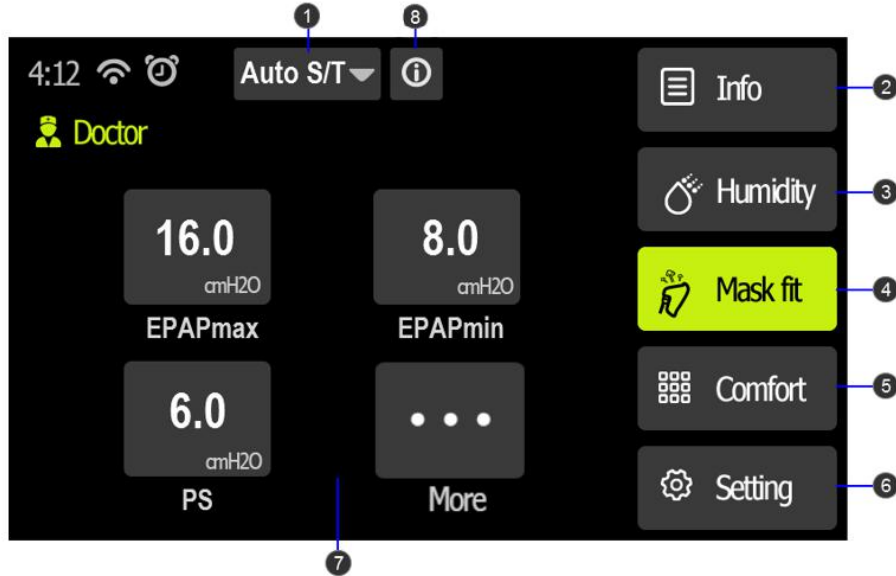


Chart 2-3 Clinical standby interface

The doctor standby interface has more features and parameter settings than the patient standby interface.

#	Feature	Description
1	Therapy Mode	Displays the current mode and you can click here to set the Therapy Mode
2	Patient Sleep Quality Report	Displays the patient sleep quality report and the options for period of the report are: daily (recent 6 days) / 7 days / 14 days / 1 month / 3 months / 6 months / 1 year.
3	Humidity	Humidity level setting, Enhance patient comfort of respiration. Option: Auto / OFF / 1 to 8 Default: 3 When auto humidity is enabled, the control algorithm adjusts the humidifier output to maintain a constant humidity level of 85% relative humidity while protecting against rainout. Note: The humidity only can be set when the water is higher than the limit level in the humidifier.

#	Feature	Description
4	Mask fit	Mask fit test: In the selection of a new mask, need to test the face mask to wear whether the occurrence of leakage In standby or therapy mode, click on the mask fit test icon, display mask fit test in process with the animation interface
5	Comfort	Press Comfort key, enter Clinical comfort setting interface
6	Setting	Press Setting key, enter Clinical System Setting interface
7	Parameters Settings	Sets the parameters of the current therapy mode. Press the More button to view more parameters.
8	Alarm Message	Display the alarm messages.

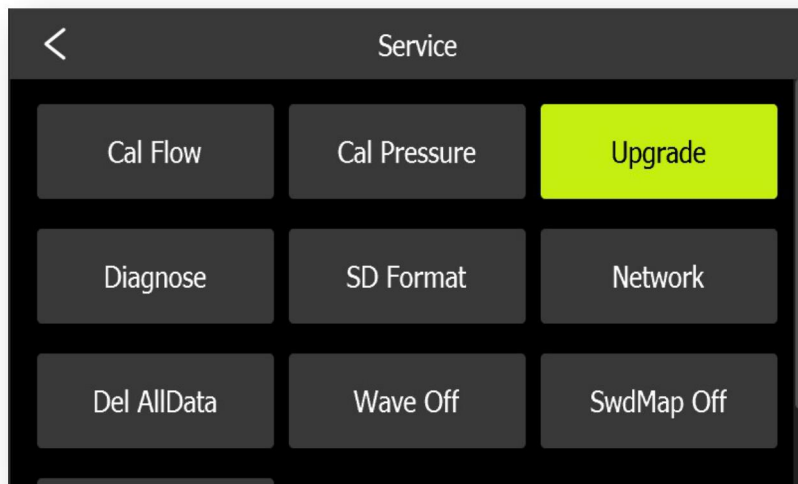
### 3.3 Service

In the doctor standby interface sequentially click Setting → Service →input password into the service interface

Attention: All operations performed at the service interface must be authorized and trained by the manufacture. Unauthorized performance should be held accountable.

## 4. Software Update

In the doctor interface sequentially click Setting →Service →Upgrade



### 4.1 Software Update Methods

4.1.1 SD Card Update: Use the SD card which is load with update software;  
Chart 2-4 Software Update Interface

## 5. Alert

### 5.1 Alert Type

Alert	
Time	Alert
2017/06/22 15:00	System error code:111.Reboot.

Chart 2-5 Alert List Interface

- **Alert 0:** The status bar displays a gray-white tip, which will always be displayed until the alarm condition is no longer satisfied;
- **Alert 1:** The status bar displays yellow and white tips, the start/Stop button has a Blu-ray flashing, and there is an alarm sound, the alarm will always be displayed until the alarm condition is no longer satisfied
- **Alert 2:** Status bar display red background white tip, the Start/Stop button has a Blu-ray flashing, and there is an alarm sound, the alarm for the exclusive alarm, will be displayed until the user open the reminder point to confirm or click on the Start/stop button;
- **Notice:** The status bar displays white and white prompts, and the notification message disappears automatically when the corresponding process is finished

## 5.2 Alert Setup

In the setting interface → Click Alert into alert setting

## Chapter 3 Common Troubleshooting Guidelines

Due to various factors (such as voltage instability, environmental temperature changes, fall and impact, components aging, etc.), iBreeze series positive pressure therapy device may malfunction and affect normal use in the state of transportation, storage, and usage. At this point, there should be an experienced professional engineer of medical equipment to carry out the maintenance task under the instruction following breakdown classification. The so-called part-level overhaul refers to the component analysis, substitution, trial run, and locate the failure to the components of the instrument such as main PCBA, turbine, display module and other parts. Parts maintenance of the component-level must be carried out by the manufacturer.

This chapter provides a description of the replacement subassembly for a common failure. The calibration and component-level maintenance is usually returned to the Resvent factory for execution.

We divided failure into 4 groups

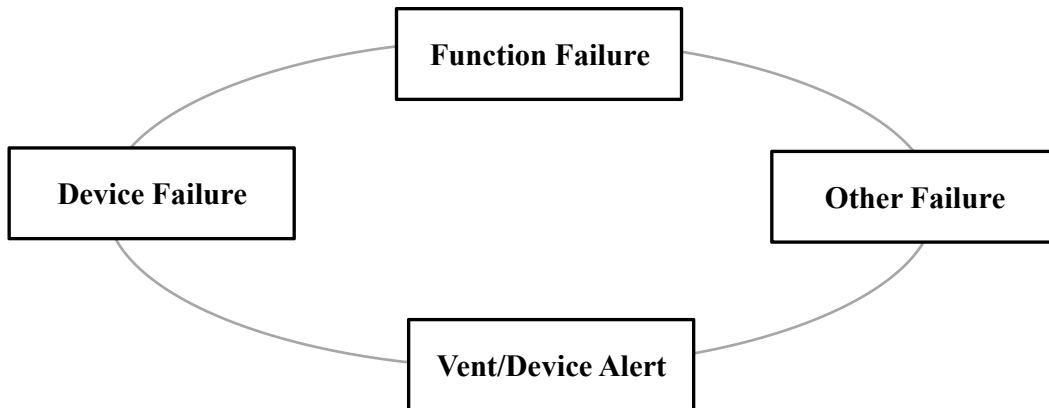


Chart 3-1 Failure Category

## 1. Device Failure

No.	Description	Possible Reason	Resolving
1	After the power on, no display in the screen, no light in the power indicator and no sound from buzzer	1) Loose connect with power adaptor or power adapter failure. 2) Internal DC connection failure 3) Main PCBA failure	1st. Check and replace power adaptor 2nd. Replace DC connection wire 3rd. Replace main PCBA
2	No display in the screen but the power indicator shines light	1) Screen wire loose 2) Screen malfunction 3) Main PCBA failure	1st. Reconnect Screen wire 2nd. Replace Screen 3rd. Replace main PCBA
3	Device Crash	Software BUG or main PCBA malfunction	1st. Restart the machine 2nd. Update software 3rd. Replace main PCBA
4	Repeatedly appears power off/self-restart	Power connection malfunction	1st. Check the power adapter and the main PCBA connection 2nd. Check and repair the inside DC connection

5	Repeatedly appears blurred /black screen	Screen wire failure	1st. Check and repaired screen connection 2nd. Replace the screen
6	Front Panel or touch screen cocked	Front Shell under great stress so that the front panel or touch screen cocked	Replace front shell set
7	System software cannot start	Software BUG, loose or main PCBA failure	1st. Restart 2nd. Software update 3rd. Replace the main PCBA
8	Poor device appearance	1) Assemble loose during the transportation 2) Part appearance damage;	1st. Re-assemble; 2nd. Replace the damage parts

## 2. Function Failure

N0.	Description	Possible Reason	Resolving
1	Touchscreen failure	1) Touchscreen wire loose 2) Touchscreen broken	1st. Reconnect touch screen wire 2nd. Replace the front sell set
2	Key button board or knob encoder failure	1) Key button board or knob encoder connection failure 2) Key button board or knob encoder failure	1st. Replace or repaired the connection wire 2nd. Replace the key button board or encoder
3	Buzzer failure	Buzzer PCBA failure	Replace the buzzer PCBA
4	Cannot connect to the internet	1) Not Configured network connections; 2) Connection fault between wireless module and main PCBA 3) Wireless module failure; 4) Main PCBA failure	1st. Configure the network correctly according to the user manual; 2nd. Replace or repair the connection wire 3rd. Replace the wireless module 4th. Replace the main PCBA
5	Other function failure	Main PCBA failure	Replace the main PCBA
6	Un-usual Wave form or parameter	Main PCBA failure	Replace the main PCBA
7	Incorrect time	1) Lack of electricity in button battery	1st. Replace the button battery in main PCBA

		2) Main PCBA failure	2nd. Replace main PCBA
8	Poor Humidification	1) Leak in the system 2) Incrustant in water tank 3) Water tank aged or failure 4) Heating plate aged or failure 5) Main PCBA failure	1st. Check water tank set and connection to tube. 2nd. Wash the humidifier 3rd. Replace the humidifier 4th. Replace the heating plate or Insulated mat 5th. Replace main PCBA

### 3. Vent/Device Alert

iBreeze series devices have a better self-test function and system provides fault alert during self-test, calibration, and testing, Resolution is showing in below table

Alert Description	Type	Possible Reason	Resolving
Water level to low Please add water to proper level	Alert 0	During the humidification, water level below the limited level	Take the water tank out and add the water to proper level
SD Card in Synchronization , please do not pull the SD card or turn off power	Notice	1. Insert the SD card and synchronization starts; 2. Import SD card content	No operation
SD is full and please replace the SD card	Notice	In the standby interface, SD storage left about 200M	Replace an new SD card or empty SD card after output its contents
SD Card cannot be written please pull out the card, unlock and re-insert the card to device	Notice	SD can only be read, not written	Pull out the SD card, unlock and re-insert into the device
SD card failure pull out and re-insert	Notice	SD card failure, possibly: 1.SD card cannot be either read or written; 2.SD card read or written error.	Pull out the SD card and re-insert, or replace with a new one
Equipment	Notice		No operation

Alert Description	Type	Possible Reason	Resolving
Intelligent Drying			
Tube has expired, please replace it	Notice	In the standby interface , tube usage time exceed the setup usage time	Click “confirm” and replace the tube
Water tank has expired, please replace it	Notice	In the standby interface , water tank usage time exceed the setup usage time	Click “confirm” and replace the water tank
Filter has expired, please replace it	Notice	In the standby interface , filter usage time exceed the setup usage time	Click “confirm” and replace the filter
Face mask has expired, please replace it	Notice	In the standby interface , face mask usage time exceed the setup usage time	Click “confirm” and replace the face mask
Time to maintain the equipment, please contact your supplier	Notice	In the standby interface, maintenance time exceed the setup period	Click “confirm” and contact the supplier for service
Please turn on the Bluetooth and use a smart phone to set up Wifi password	Notice	Device is not set up with correct Wifi password	Set up correct Wifi password under instruction of user manual
Configuration information error, please confirm to restore the configuration	Alert1	Wrong Configuration	Restore Configuration

The list of system errors is as follows:

State : System error code is three digits, 0 Beginning for calibrated error codes; 1 beginning for the error code of the self-test; 2 beginning for performance test error

No.	Error Code	Possible Reason	Resolving
1	012	Therapy device is unable to establish communicate with calibration	Check the connection between therapy device and coalition device

2	013	System Leakage: Does not block calibration device gas outlet during the calibration of pressure	Block the calibration gas outlet
3	014	Low pressure zero AD value 1. Pressure sampling tube is being bent or pressed 2. Main PCBA or Pressure sensor broken	1st. Check pressure sample tube; 2nd. Replace the main PCBA
4	015	High pressure zero AD value 1. Pressure sampling tube is being bent or pressed 2. Main PCBA or Pressure sensor broken	3rd. Check pressure sample tube; 4th. Replace the main PCBA
5	016	Low maximum pressure value: 1. Pressure sampling tube is being bent or pressed; 2. Leakage in the system; 3. Pressure sensor or main PCBA malfunction;	1st. Check the pressure sampling tube; 2nd. Check connection joints for leakage; 3rd. Replace the main PCBA; 4th. Check the turbine
7	018	Linearity difference of pressure calibration curve: 1. Pressure sampling tube is being bent or pressed; 2. Leakage in the system; 3. Pressure sensor or main PCBA malfunction	1st. Check the pressure sampling tube; 2nd. Check connection joints for leakage; 3rd. Replace the main PCBA
8	020	Abnormal reading of standard equipment during flow calibration : The machine is unable to establish communication with the calibration device.	Check the connection between the device and calibration equipment
9	021	Low 0 Flow Ad value	This error does not occur in iBreeze 20C: 1st. Check external flow interference while current calibration; 2nd. Device pressure sampling abnormal or not performing



10	022	High 0 flow AD value	<p>This error does not occur in iBreeze 20C:</p> <p>1st. Check external flow interference while current calibration;</p> <p>2nd. Device pressure sampling</p>
11	023	<p>Low maximum flow value:</p> <p>1. The calibration equipment outlet is blocked;</p> <p>2. Leakage of machine or connecting tube;</p> <p>3. Turbine malfunction</p>	<p>1st. Check whether the calibration equipment outlet is blocked;</p> <p>2nd. Check the leak at joint of device and calibration equipment ;</p> <p>3rd. Check Turbine</p>
12	024	<p>Non-monotone flow rate calibration curve</p> <p>1. blocked tube;</p> <p>2. external flow interference while current calibration</p> <p>3. No grid gas resistance or gas resistance installation in the turbine box;</p> <p>4. Flow sensor malfunction;</p> <p>5. Pressure sensor malfunction ; 6. Turbine malfunction</p>	<p>This error does not occur in iBreeze 20C:</p> <p>1st. Check if the connecting tube is blocked or bent;</p> <p>2nd. Ensure the current calibration environment is not disturbed by external flow;</p> <p>3rd. Ensure that the grid air resistance in the turbine box is installed properly;</p> <p>4th. Replace flow sensor board;</p> <p>5th. Perform the pressure calibration, if the pressure calibration passed, it indicates that the pressure sensor is working properly</p> <p>6th. Check the turbine</p>
13	025	Standard equipment needs to be zero	Zeroing the standard equipment
14	100	<p>Abnormal input voltage</p> <p>1. Wrong power adapter;</p> <p>2. Broken Power Adapter;</p> <p>3. Broken Main PCBA</p>	<p>1st. Use Resvent provided power adapter;</p> <p>2nd. Replace power adapter;</p> <p>3rd. Replace main PCBA</p>
15	101	Flow Sensor malfunction	<p>1st. Make sure the right connection;</p> <p>2nd. Observe the reading to make sure the flow sensor works proper ;</p>

16	102	Pressure sensor malfunction	1st. Check the pressure sampling tube 2nd. Replace the main PCBA
17	103	Water level sensor malfunction	1st. Check the water level sensor connection 2nd. Replace water level sensor
18	104	Atmosphere Pressure sensor malfunction	Replace the main PCBA
19	105	Ambient light sensor malfunction	1st. Check the connection 2nd. Replace the ambient light sensor PCBA
20	106	Temp/humidity sensor error	Replace the main PCBA
21	111	EEPROM Read-only data exception	Replace main PCBA
22	112	Flash error	Replace main PCBA
23	113	RTC clock error	1st. Check if the sensor signal connector is plugged in reversely; 2nd. Turbine is over heated; 3rd. Replace main PCBA
24	200	Turbine malfunction	1st. Check if the sensor signal connector is plugged in reversely; 2nd. Turbine is over heated; 3rd. Replace main PCBA。
25	201	Heating Plate malfunction	1st. Check the connection; 2nd. Heating plated is over heated; 3rd. Replace the main PCBA

#### 4. Other Failure

If the distributor or service people cannot handle the malfunction, they can report the incident back to Resvent service center and ask for parts replacement.

## Chapter 4 Positive Pressure Therapy Device Service

## 1. Front housing service

Front housing include front shell, ( front panel or touch screen ),encoder(including knob), key button, screen set ( screen and bracket ).

### 1.1 Front housing Service

1.1.1 showing in chart4-1 and 4-2, Set the device as showing in chart and take the screw off,



Chart 4-1



Cross head Screw  
driver M3\*8

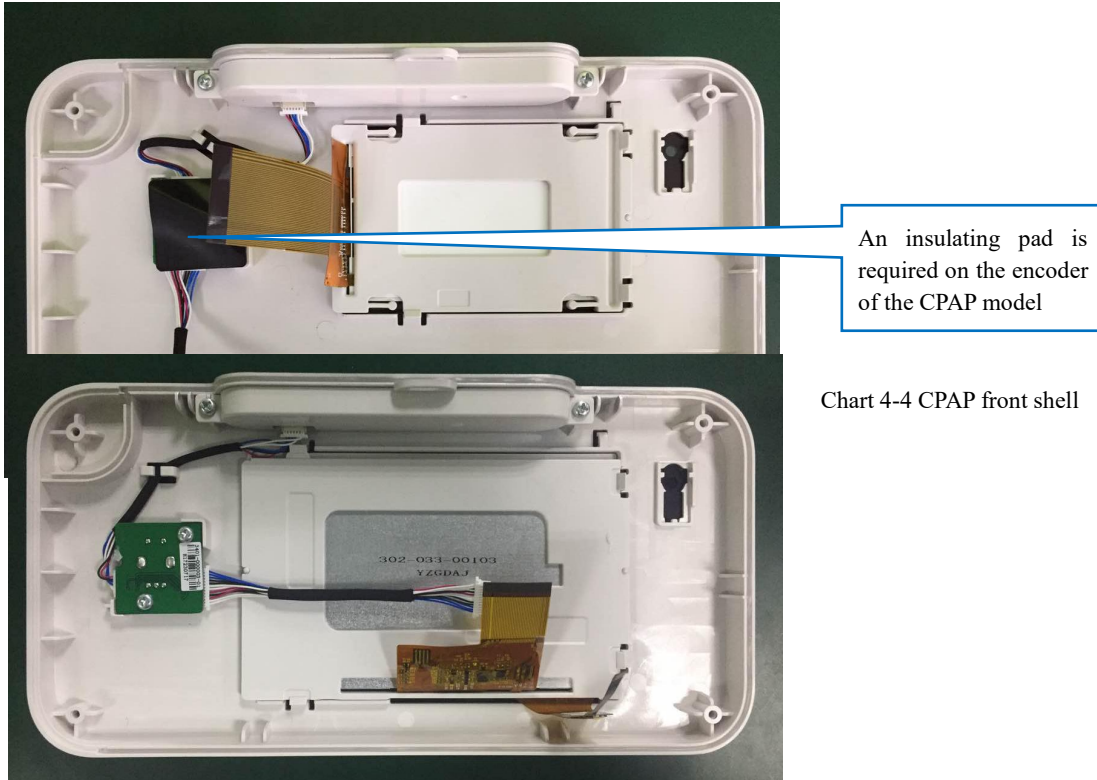
Chart 4-2

1.1.1 As showing in chart below, push down the fastener, then take the front shell from rear housing set, be careful not to push too hard to protect the connecting wire.



Chart 4-3

1.1.2 As showing in the chart 4-1 and 4-2, install the replace front shell and fix the position with M3\*8 screw showing in chart 4-1 and 4-2.



An insulating pad is required on the encoder of the CPAP model

Chart 4-4 CPAP front shell

Chart 4-5 BPAP front shell

**1.2 Encoder and Key Button Service**

1.2.1 As showing in the chart 4-4 and 4-5, take off the screws;

1.2.2 Connect wire and then replace the new encoder onto the front shell, use 2 M3\*8 screws to fix the encoder (add the water resistance pad and smooth side up)

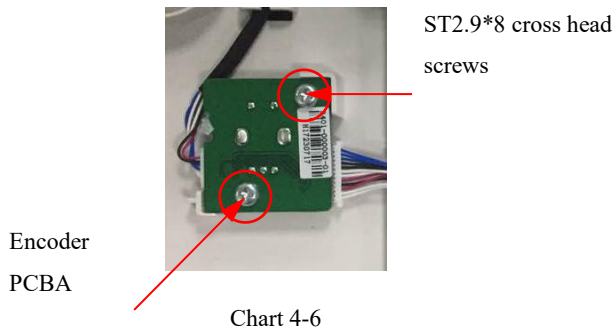


Chart 4-6

1.2.3 As in chart 4-6 and 4-7, take the screw driver off;

1.2.4 Replace the new or fixed key button set onto front shell, fastened with 3 M3\*8 cross head screw

attention: key button has “Concave notch”.



Chart 1-7

1.2.5 As showing in chart 4-6 and 4-7, take off the screw, following the steps showing below to change key button PCBA and START/RAMP button

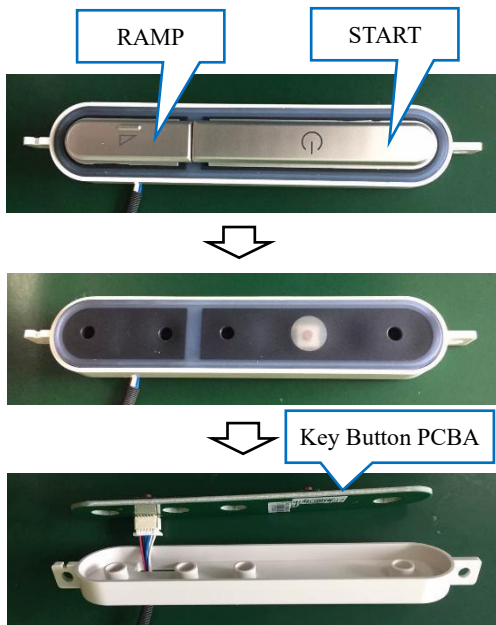


Chart4-8

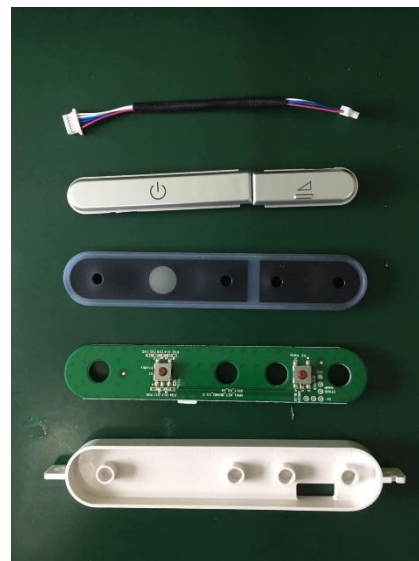


Chart 4-9

### 1.3 Screen set service and assembly

BPAP and CPAP screens and their fixtures are disassembled in the same way (we use BPAP as an example)

1.3.1 As in chart 4-10, Pull the clip A to the right in the diagram;

1.3.2 As in the chart 4-11, Use your hand to slowly lift the screen holder and remove it. (as in chart 4-12), attention: do not touch the screen

13.2 After changing the screen, as in chart 4-9, Mount the screen to the display fixture (No visible dust, dirt and damage shall on the screen);

1.3.3 mount the screen set onto the front shell, do not pressed the screen or touch screen wire



Chart 4-10



Chart 4-11



Chart 4-12

## 1.4 Front Shell Seal Up

1.4.1 follow the step 1.1.1、 1.1.2 to re-install the front shell onto front housing (do not forget to install the screen, touch screen connection wire, encoder knob and board, and main PCBA connecting wire.

## 2. Rear Housing Service

Rear housing includes main PCBA, water tank, water tank inlet and outlet tube, device gas outlet tube, turbine set, heating set, SD card, DC socket, and water level sensor.

### 2.1 Gas outlet and water tank inlet and outlet service

2.1.1 As in chart 4-13, turn the gas outlet counter clockwise to take off ;

2.1.2 As in chart 4-14, take off 4 ST2.9\*8 cross head screws to disassemble the outlet holder

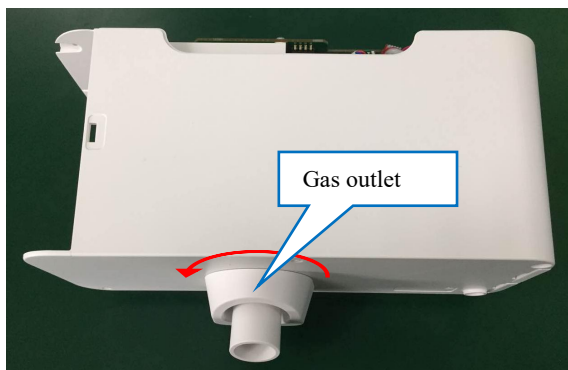


Chart 4-13

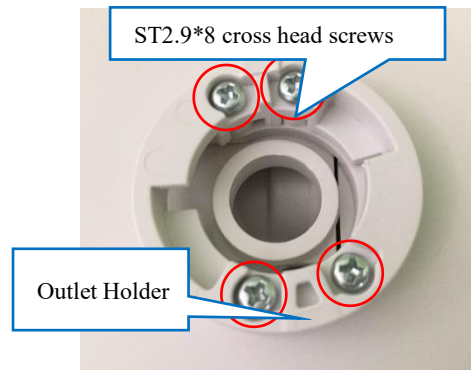


Chart 4-14

2.1.3 As in chart 4-15 and 4-16, the water tank outlet can be taken off after take off the gas outlet holder as above;



Chart 4-15



Chart 4-16

2.1.4 As in chart 4-16, take off water tank inlet after taking off 2 ST2.9\*8 cross head screw;

2.1.5 Replace the relevant parts according to the requirement and then put back into the water tank inlet, water tank outlet, gas outlet holder and gas outlet in order.



Chart 4-17



Chart 4-18

## 2.2 Main PCBA Service

2.2.1 As in chart 4-17, first take off and connection wire, pressure sampling tube and 4 ST2.9\*8 screws from main PCBA, ;

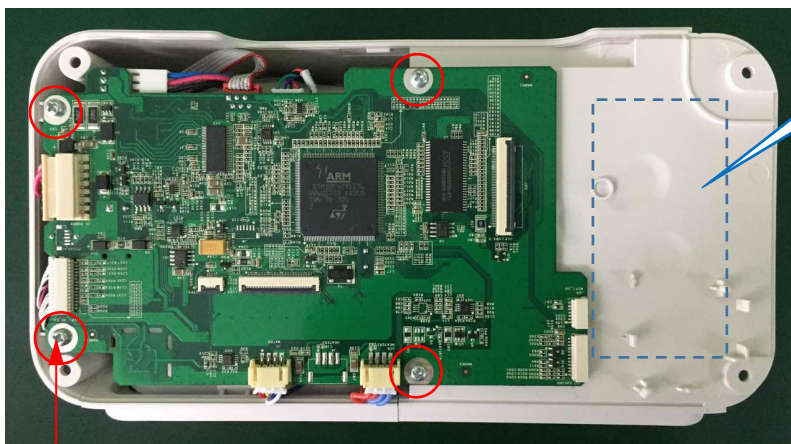
ST2.9\*8 cross head  
screw

Chart 4-17



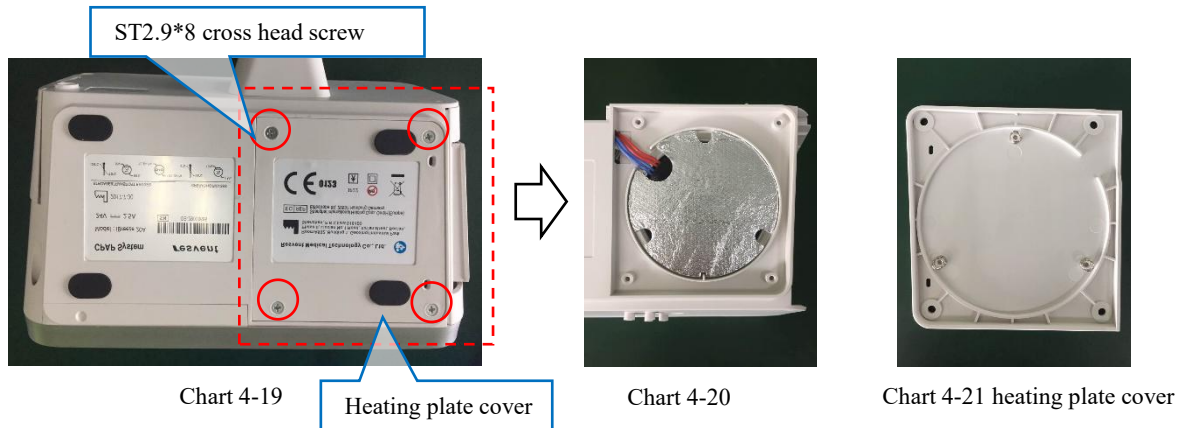
Chart 4-18

2.2.2 After the replacement of the main PCBA in accordance with the Appendix I, use 4 ST2.9\*8 cross head screw to fix onto rear housing.

## 2.3 Heating plate service

2.3.1 Take off the turbine set and main PCBA

2.3.2 As in chart 4-9, take off 4 ST2.9\*8 cross head screen before take off the heating plate cover;



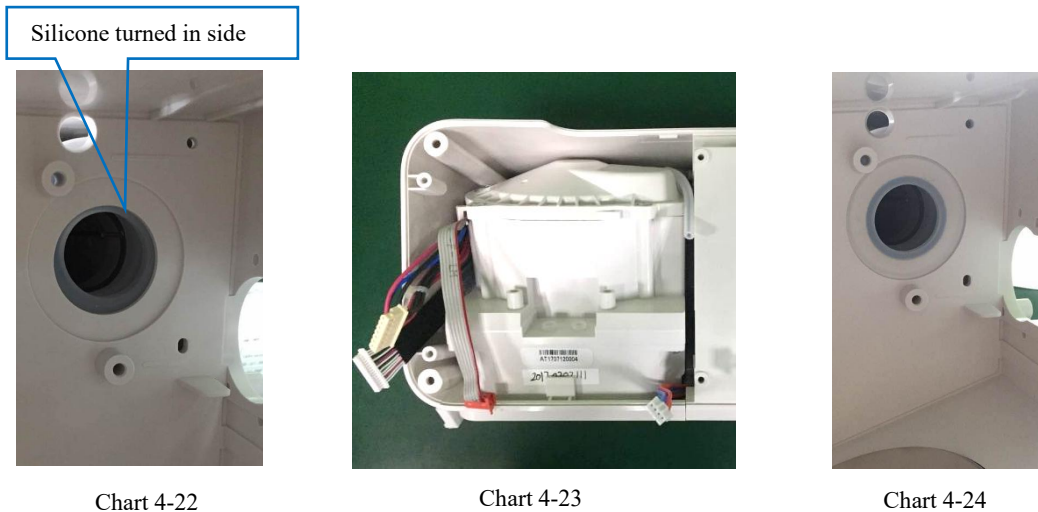
2.3.3 As in chart 4-20, take off the heating plate after taking off the connection wire;

2.3.4 Replace the new heating plate onto rear housing bottom, add the heating plate cover and fix the parts with 4 ST 2.9\*8 screws;

## 2.4 Turbine Set Service

2.4.1 Before unpacking the turbine housing, first you need to disassemble the main PCBA, gas tube, water tank inlet/outlet, then turn the silicone of the turbine to one side as in chart 4-22.;

2.4.2 As in chart 4-23, take out the turbine set from rear housing.



2.4.3 Re-install the new turbine back to the rear housing; as showing in chart 4-24, pull the silicone to the heating plate side, then re-install the main PCBA、water tank inlet/outlet, gas outlet and close the back cover.

## 2.5 Wireless Module Service

2.5.1 As in chart 4-25, First remove the wireless module and main PCBA connecting wire and antennas, then take the wireless module off;



2.5.2 To replace a new wireless module with install antenna and wire connect to main PCBA onto the back shell support board, pay attention to the installation direction;

2.5.3 connect wireless module wire to the main PCBA, then stick the antenna onto the back shell as showing in chart 4-24

**attention:** the antennas are different between WIFI/Bluetooth and 2/3G module

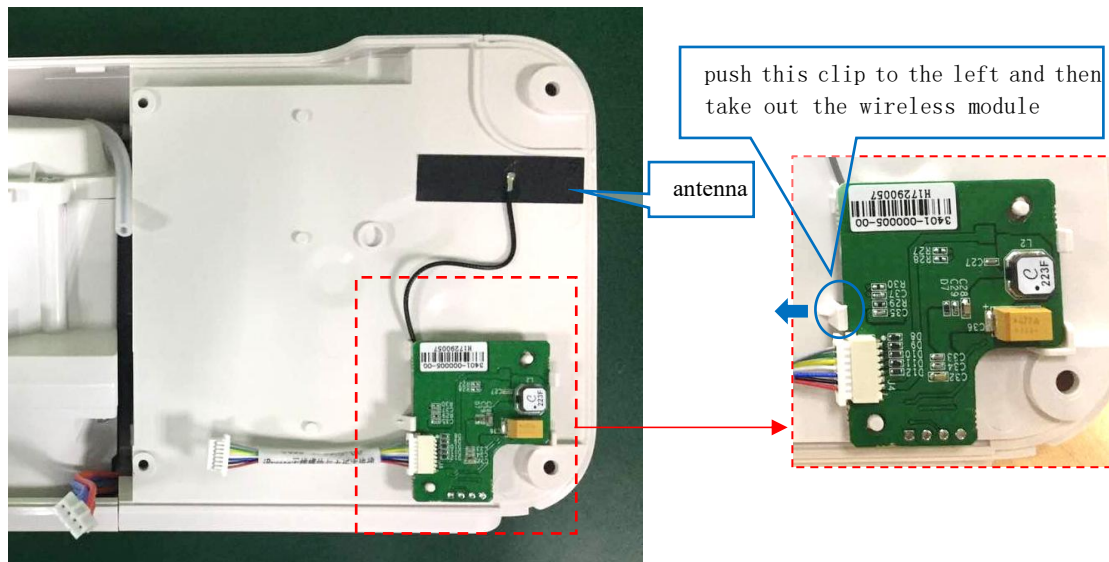


Chart 4-25

## 2.6 DC Socket, SD Card PCBA and Water Level Sensor Service

2.6.1 Follow the step 2.2 and 2.4, take out main PCBA and turbine set;

2.6.2 As in chart 4-26 enlarge diagram ① and ②, take off the DC socket and SD card PCBA after taking off the screws from rear shell;

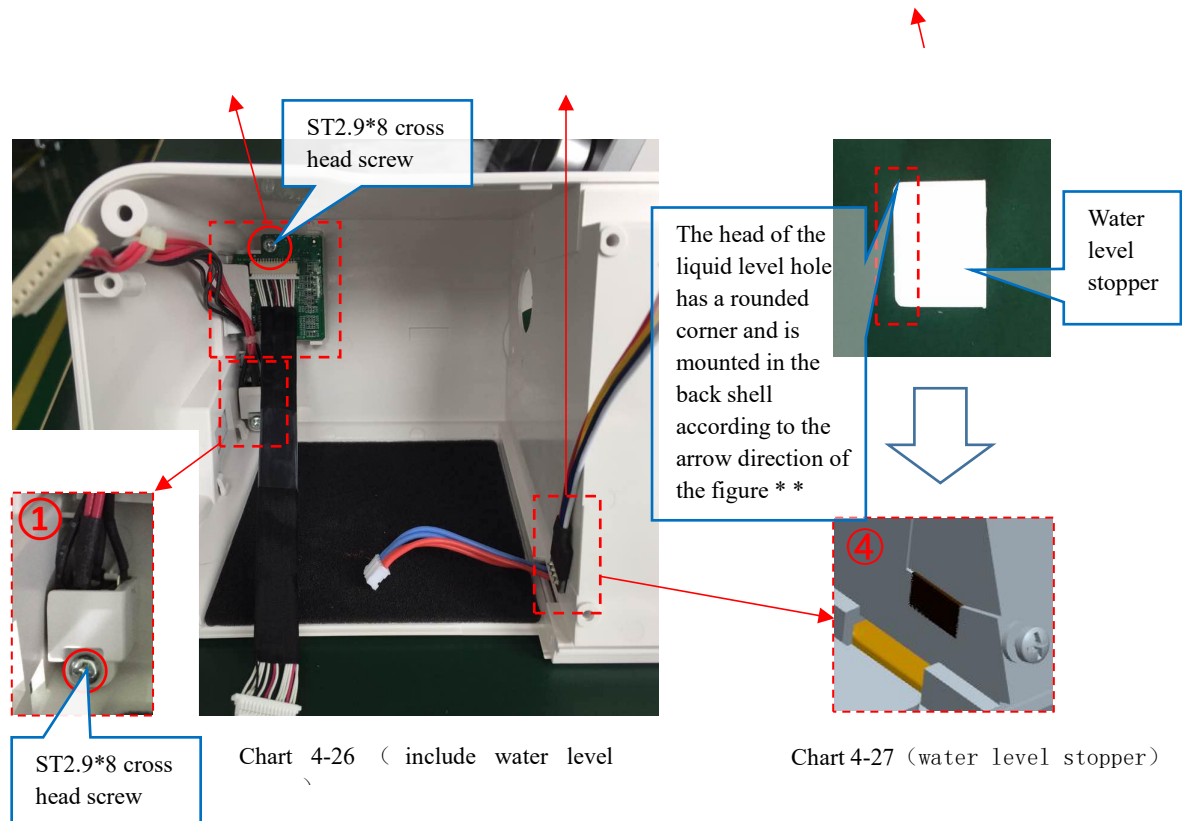
2.6.3 As in chart 4-26 enlarge ③, use an unshapen tool to push the water level sensor out rear shell from the side of heating plate ( or water level stopper as showing in chart 4-27);

2.6.4 Put the replaced SD card PCBA or DC socket onto back shell and fix it with M3\*6 cross head screw;

2.7.3 Tear off the back paper from water level sensor and gum the sensor at the rear shell;

2.7.3 Then install the turbine set, main PCBA, water inlet/outlet and gas tube. After installation, close the cover.





### 3. Calibration

The device needs to be calibrated when replacing turbine set and main PCBA

#### 3.1 Test equipment: Vt Plus

##### 3.1.1 Pressure Calibration:

3.1.1.1 As shown in chart 4-28, Connect the device with VT Plus;

Attention: Needs to block “HIGH FLOW EXHAUST” on the left side of Vt Plus and use a small tube to link the “+Gas on FLUID” ports with the tube.

3.1.1.2 Turn on the Vt Plus for 5 minutes;

3.1.1.3 As shown in 4-29, please select “BTPS”, “cmH2O” in Vt Plus;

3.1.1.4 Turn on the therapy device, push the ramp button for 5 seconds then enter doctor mode;

3.1.1.5 Click Setting→ Service→ input password→ Cal Pressure→ Vt Plus;

3.1.1.6 As shown in chart 4-31, wait for the calibration to complete;

3.1.1.7 As shown in chart 4-32, record the test result. Also record the error code, if the pressure or flow calibration fails.

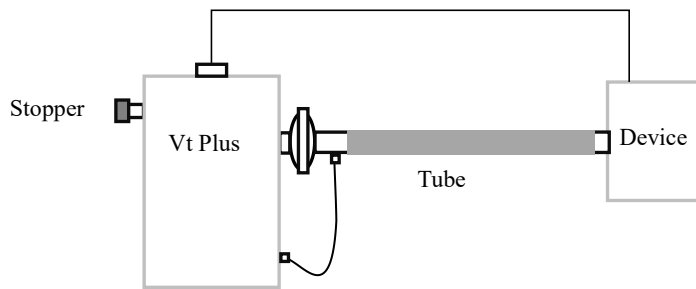


Chart 4-28

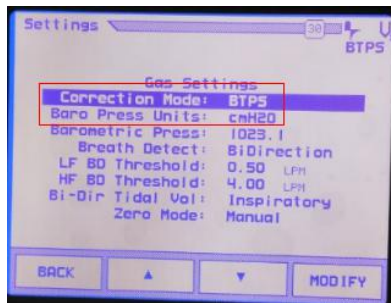


Chart 4-29

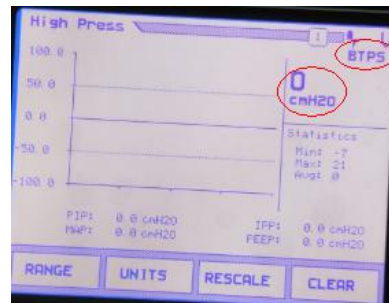


Chart 4-30

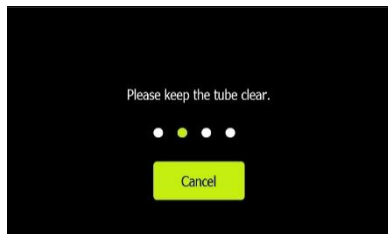


Chart 4-31

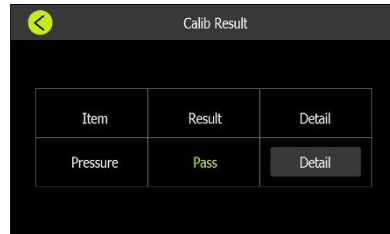


Chart 4-32

### 3.1.2 Flow Calibration:

3.1.2.1 As shown in chart 4-33, set up connection of the device with VT plus by using tube and wire

attention: Cap the small connection on the side of connecting head with Vt Plus own cap;

3.1.1.2 Turn on the VT for 5 minutes;

3.1.2.3 As shown in chart 4-34, choose the “High Flow” on the Vt Plus;

3.1.2.4 Turn on the therapy device , push the ramp button for 5 seconds enter the doctor interface;

3.1.2.5 Under the doctor interface click Setting→ Service; →input password→ Cal

Flow→ Vt Plus; ;

3.1.2.6 As shown in chart 4-35, wait for calibration to finish;

3.1.2.7 As shown in chart 4-36, record the test result. Also record the error code, if the pressure or flow calibration fails

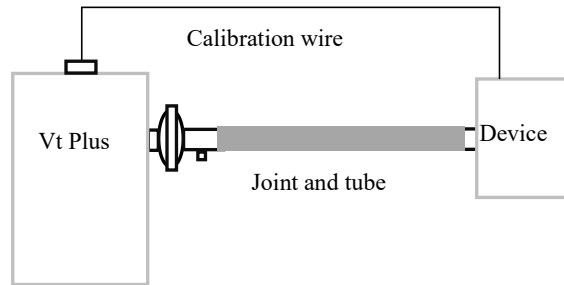


Chart 4-33

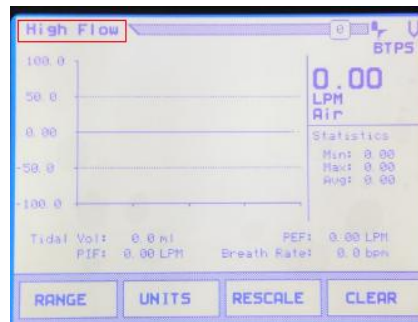


Chart 4-34

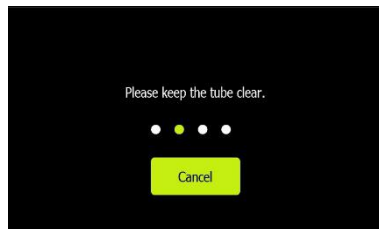


Chart 4-35

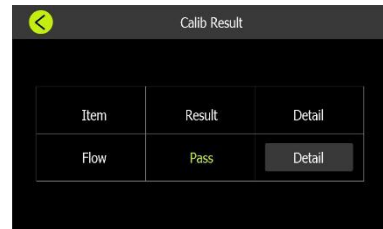


Chart 4-36

### 3.2 Test equipment: PF300

#### 3.2.1 Pressure Calibration:

3.2.1.1 As shown in chart 4-37, set up connection between the therapy device and testing equipment with tube and wire

- 1) The device outlet→ tubePF300→ Front side “Hight (range) flow testing channel”;
- 2) Connect the device from its mini USB port to the RJ 45 port of PF 300 with special cable
- 3) Block the “high (range) flow test channel” on the back side of PF 300 and use a

small tube to link the high pressure port of pressure differential of PF 300 with the tube

3.2.1.2 Turn on the therapy device and PF 300;

3.2.1.3 As shown in chart A, observe the PF screen reading of “Flow H”. if the reading is not zero, then click “Menu”->“Zero!”;

3.2.1.4 Push the ramp button for 5 seconds enter the doctor interface;

3.2.1.5 Under the doctor interface click Setting→ Service; →input password→ Cal Flow→ PF300;

3.2.1.9 As shown in chart 4-39, wait for the calibration to finish;

3.2.1.10 As shown in chart 4-40, record the test result. Also record the error code, if the pressure or flow calibration fails

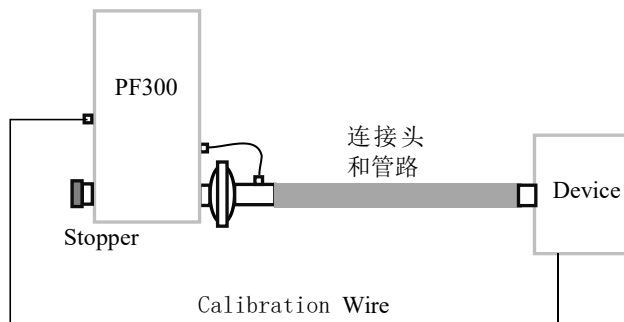


Chart 4-36



Chart A



Chart 4-37

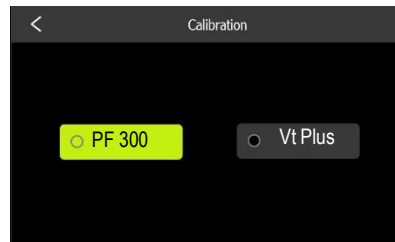


Chart 4-38

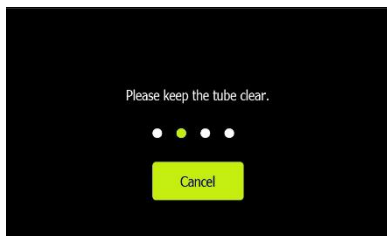


Chart 4-39

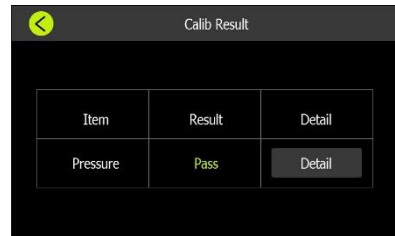


Chart 4-40

3.2.2 Flow Calibration:

3.2.2.1 As shown in chart 4-41, set up connection between the therapy device and testing equipment with tube and wire

- 1) Device gas outlet→ tube→ Front “High (rang) flow testing channel of PF300;
  - 2) Connect the device from its mini USB port to the RJ 45 port of PF 300 with special cable
  - 3) Join is block with its own cap
- 3.2.2.2 Turn on the therapy device and PF 300;
  - 3.2.2.3 As shown in chart A, observe the PF screen reading of “Flow H”. if the reading is not zero, then click “Menu”->“Zero!”;
  - 3.2.2.4 Push the ramp button for 5 seconds enter the doctor interface;
  - 3.2.2.5 Under the doctor interface click Setting→ Service; →input password→ Cal Flow→ PF300;
  - 3.2.2.9 As shown in chart 4-44, wait for the calibration to finish;
  - 3.2.2.10 As shown in chart 4-45, record the test result. Also record the error code, if the pressure or flow calibration fails

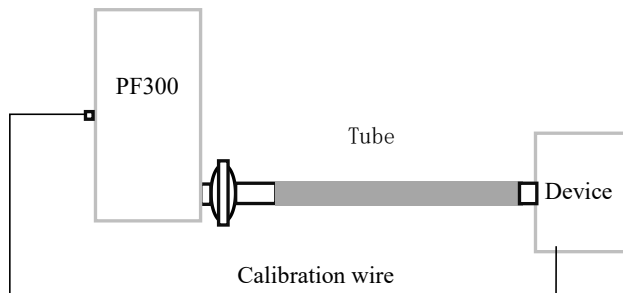


Chart 4-41

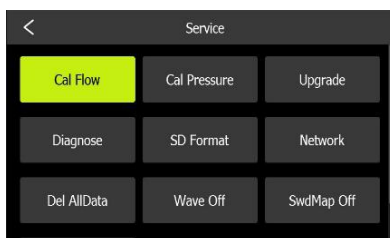


Chart 4-42



Chart 4-43

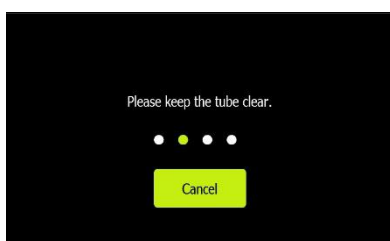


Chart 4-44

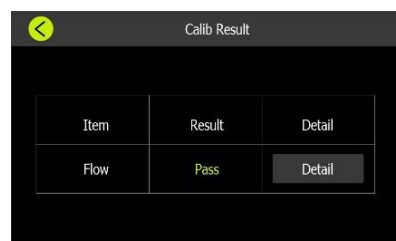


Chart 4-45

## Chapter 5 System Check after Service

After service, there are some inspection to do to ensure the reliability of the repairs.

### 1. Assembly Condition Inspection

- Assembly Fastening, shaking machine without internal residue;
- Button operation smoothly;
- Product Configuration Complete, Socket mounting fastening

### 2. Device Configuration

After service, confirm the device configuration comply with before.

### 4. Turn the device on

The device and screen can run normally after boot. There is no error message appearing on the screen and the time and clock setting are normal.

### 5. Normal Operation

- Keypad buttons and encoder knobs should function normally as described in the user manual;
- All the indication lights, key tone and alert tone function normally;
- Touch screen (if included) function well;
- Run about half an hour to observe whether there is a black screen and software crash;

## Chapter 6 Other

To avoid exposure to dust and moisture which can cause the performance and reliability of the device impaired, the user must clean the device regularly.

Machines do not require regular maintenance. If you notice that the device is not working properly, the abnormal sound is emitted, the device or power supply has dropped from the desktop, or has been incorrectly operated, the liquid enters the inside of the device, the casing ruptures, please disconnect the power supply and contact your supplier.

### 1. Clean the Device

Please unplug the device before cleaning. Do not let any liquid enter inside of device. Clean the outside of the device with a cloth which slightly dipped in a mild detergent and dry thoroughly the device before reconnecting to the power supply. Please check the device and all joint parts after cleaning.

### 2. Water Tank Cleaning

Water tank ought to be cleaned before first use. Follow the chart 6-1 to take out the water

tank and open the lid. In addition, water tank needs to be cleaned regularly

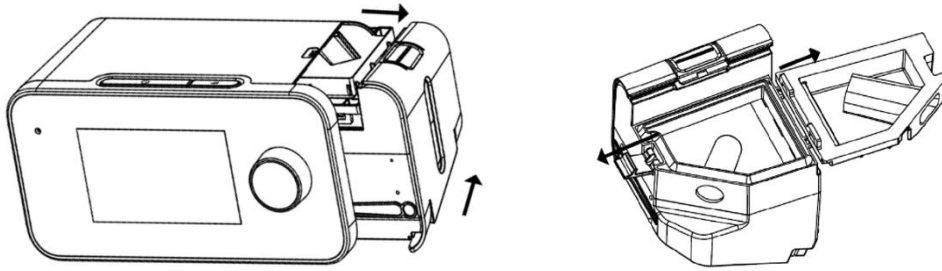


Chart 6-1

### 3. Tube Cleaning

Tube ought to be cleaned before first use and daily. Take off the tube from a device and use neutral washing liquid to clean the tube. Then rinse the tube with water and dry.

### 4. Storage and Discard

#### 3.1 Storage Equipment

- Turn off therapy mode
- Disconnect the power supply
- Clean the device and parts
- Place the device and parts in a dry place

#### 3.2 Electronic Waste Disposal



- a. Never throw the product into regular garbage. Consulting authorized certified electronic waste recycling companies for how to dispose of these wastes properly. You can get the companies addresses from environmental officials or local governments.
- b. Device packaging (cartons and fillers) can be discarded as waste paper.

#### Risks and hazards of reusing disposable articles

Disposal material can be used only once. Repentantly use disposal material can cause infection or damage device that can be harmful to users.

## Chapter 7 Service Part List

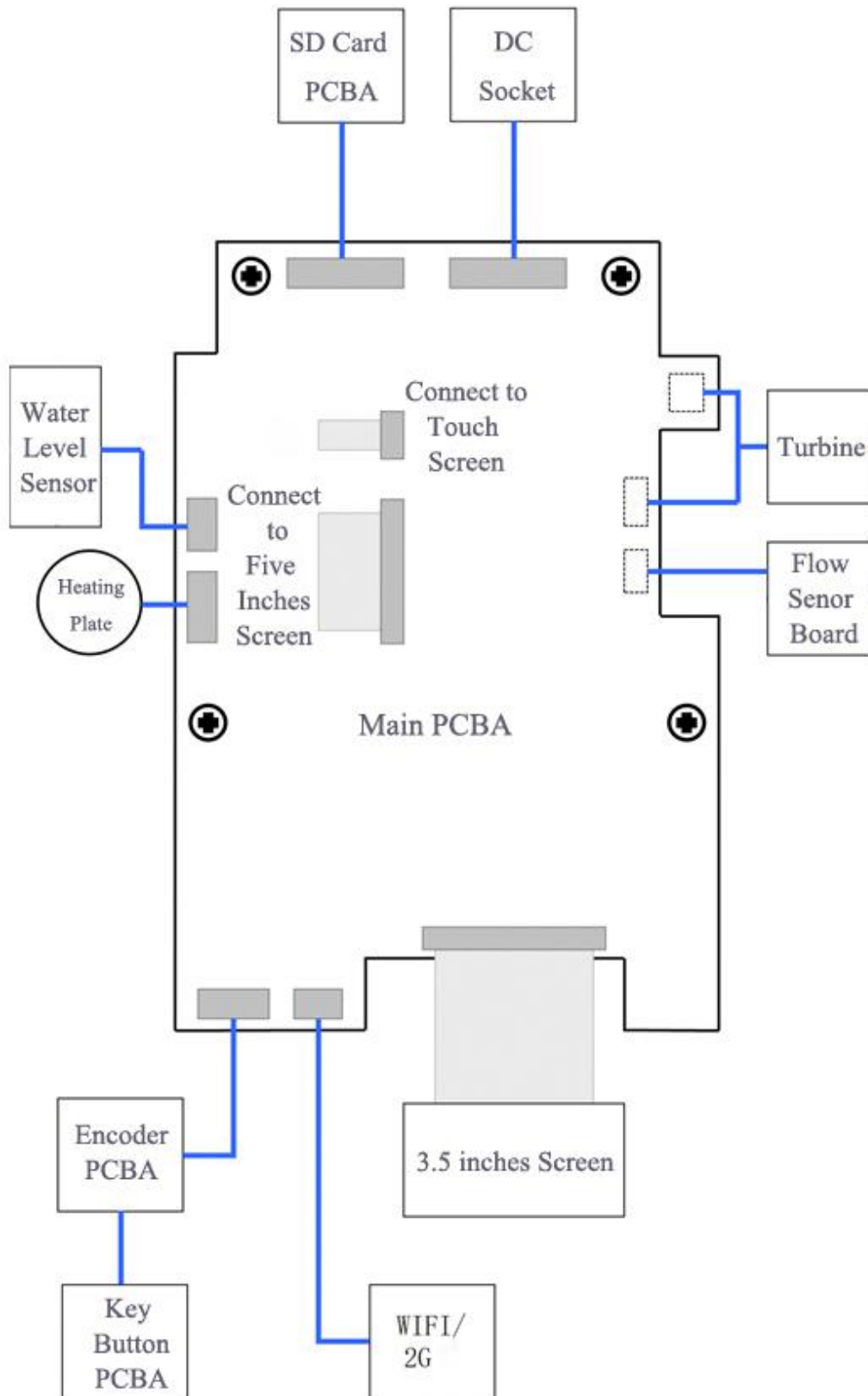
Name	Part Number	Quantity	Unit
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Heating Tube	R-5000-000018-00	1	Set
Filter	R-5001-000001-00	5	Piece
BPAP Front Housing	R-3407-000005-00	1	Set
CPAP Front Housing	R-3407-000006-00	1	Set
CPAP 20A Pro Front Housing	R-3600-000029-00	1	Set
Back Housing	R-3600-000001-00	1	Piece
Turbine Set	R-3600-000002-00	1	Set
Water Tank Inlet	R-1001-000036-00	1	Piece
Water Tank outlet (with silicone pipe)	R-1001-000027-00	1	Piece
Button Battery CR1220	R-0502-000001-00	1	Piece
Heating Plate Set	R-3500-000001-00	1	Piece
WIFI/Bluetooth Module	R-3407-000004-00	1	Piece
Water Tank Set	R-3600-000003-00	1	Piece
SPO2 Oximeter	R-3500-000009-00	1	Set
2G Module	R-3407-000003-00	1	Set
Screws	R-1009-000001-00	1	Set
SD Card	R-0501-000025-00	1	Piece
Power Adapter	R-3400-000001-00	1	Set
Tube 19mm	R-5000-000010-00	1	Piece
Tube 15mm	R-5000-000011-00	1	Piece
Full Face Mask	R-5000-000003-00	1	Piece
Nasal Mask	R-5000-000006-00	1	Piece
Pillow Mask	R-5000-000012-00	1	Piece

Remark : Please contact Resvent for other parts inquiry

## Appendix I Wiring Diagram of the Device



## Appendix 2 Product Technical Specifications

The technical specifications of the device are as follows:

Item		Specifications
Physical properties	Size ( Length x width x height ) mm	238x178x128mm
	Weight	≈1.7kg
Working Environment	Temperature	5°C ~ 35 °C
	Humidity	10% ~ 95% None Condensation
	Atmosphere	70kPa ~ 106kPa
Storage Environment	Temperature	-25°C ~ 70°C
	Humidity	5% ~ 95% None Condensation
	Atmosphere	70kPa ~ 106kPa
Noise	A Weighted sound level	≤28dBA
	A weighted sound power level	≤36dBA
执行标准	IEC 60601-1	General safety standard for medical electronic equipment
	ISO 80601-2-70	Particular requirements for basic safety and essential performance of sleep apnea breathing therapy equipment
	EN 60601-1-2	Medical Electrical Equipment – Part 1-2: General Requirements for Basic Safety and Essential Performance – Collateral Standard: Electromagnetic Disturbances – Requirements and Tests
	ISO 8185	Respiratory tract humidifiers for medical use – Particular requirements for respiratory humidification systems
	ISO 23328-1	Breathing system filters for anesthetic and respiratory use -- Part 1: Salt test method to assess filtration performance

Item		Specifications
	ISO 17510-2	Sleep apnea breathing therapy -- Part 2: Masks and application accessories
Electromagnetic compatibility	RF emission level	1 group, B level
Electrical specifications	AC Power	SHANGHAI BIAOJUN ELECTRONICS TECHNOLIGY CO., LTD. Model: BJE01-40-006HM AC Input: 100 -240 V ~ 50/60Hz 2.0A Max
	DC Power	24V, $\leq 2.5A$
Security features	shock protection	Class II Equipment
	Shock Protection Grade	BF
	Working Mode	Continuously
	Liquide Protect Grade	IP22
	Degree of safety of flammable narcotic gas	Cannot be used in the case of flammable anesthetic gases mixed with air or mixed with oxygen and nitrous oxide
	Installing and Using Categories	Portable Devices
	Power Connection mode	detachable power cord adapter
Air Filter	Air filter	Filtration efficiency: >75% for ~7-micron dust
	Anti-allergy Filter	Filtration efficiency: >98% for ~7-8 micron dust; >80% for ~0.5 micron dust
压力	Set Range	4.0-30cmH2O ( BPAP increment 0.2cmH2O ) 4. 0-20cmH2O (CPAP)
	Maximum Pressure	40 cmH2O
	Static pressure Control precision	$\pm 0.5$ cmH2O (worst)

Item		Specifications
	Dynamic Pressure Control precision	$\pm 1$ cmH <sub>2</sub> O (worst)
	Monitoring pressure accuracy	$\pm(2\%*\text{full scale} + 4\%*\text{actual reading})$
Flow	Flow	>120L/min
Humidifier	Water capacity	>270mL
	Maximum controlled pressure	40 cmH <sub>2</sub> O
	Wetting ability	>10mg/L (within setting range)
	Temperature at patient end	<41°C

### Appendix 3 Sleep Quality Report Terminology interpretation

Terminology relating to sleep quality reports for this device:

No.	Name	Description
1	AHI	Apnea Hypopnea Index: Apnea refers to the total cessation of breathing airflow over 10 seconds during the sleep process; low ventilation means that the intensity (amplitude) of respiratory flow in the sleep process is lower than the basal level of more than 50%, accompanied by a lower level of blood oxygen saturation =4% or minor-awakening; The Sleep Apnea Hypopnea index refers to the number of apnea and low ventilation during sleep hours per hour.
2	OAI	Obstructive airway Apnea Index is a series of systemic complications, such as low oxygen and hypercapnia during sleep, disordered sleep, formation of heart, brain, lung, kidney, endocrine disorders, etc.
3	CAI	Central Apnea Index
4	AI	Apnea index: Apnea refers to the total cessation of breathing airflow over 10 seconds during sleep. The apnea index is the number of apnea per hour of sleep.
5	HI	Low ventilation index: Low ventilation means that the respiratory flow intensity (amplitude) of the sleep process decreases by more than 50%, and is accompanied by a lower level of =4% or minor-awakening; respiratory Low ventilation index refers to the number of breaths per hour during sleep time.
6	P95	P95 inhale pressure refers to 95% pressure value of the total inhale pressure
7	EPAP95	P95 Expiratory pressure refers to 95% pressure value of the total expiratory pressure.
8	RR	Breathing frequency
9	Ti	Inhale time
10	I:E	Ratio of inhale and exhale time
11	Spont%	Self-breathing ratio: autonomous breathing time/total use time

No.	Name	Description
12	PB%	Periodic breath ratio: periodic expiratory time/Total use time is always used periodically for respiratory enhancement to accelerate and attenuate the slow alternating appearance. The most common are Chen-shi breath and Biot (Biot) breathing
13	RERA	Respiratory effort correlation awakening refers to the failure to reach the standard of apnea or low ventilation, but with $\geq 10$ s abnormal breathing effort and associated micro-awakening
14	SNI	Snoring index: That is, the breathing coarse sound after falling asleep
15	VT	Tidal Volume
16	MV	Minute Tidal Volume
17	AVG.LEAK	Average Leakage

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