RESmart® Auto CPAP/CPAP System

Service Manual

Table of Contents

IMPORTANT

All data in this manual have been verified correctly. It is sufficient for servicing and repairing this device. If applying this manual on other purpose, the validation should be confirmed by BMC Medical Co., Ltd. Otherwise, BMC Medical Co., Ltd. has no responsibility for the result. All information in this manual is protected by law and regulation. All copyrights belong to BMC Medical Co., Ltd.

IMPORTANT, CAUTIONS and WARNINGS in this manual are to emphasize dangers to service people.

WARNING: If operate improperly, it may cause damage to people and environment.

CAUTION: If operate improperly, it may cause damage to instrument.

IMPORTANT: Important information for servicing and repairing.

Safety Notice

Electric Shock

There is high voltage over 100VAC inside this device, please be sure to repair the device after power off.

Chemical Safety

There may be risk of harmful bacteria and viruses after using by patient, please clean the device or wear protective glove before servicing and repairing.
Please wash your hands with disinfectant after operating the device.
Please deal with the waste according to your local regulation.

1. Introduction

1.1 Intended Use

The RESmart® Auto CPAP/CPAP system is a CPAP (Continuous Positive Airway Pressure) device designed for the treatment of adult Obstructive Sleep Apnea (OSA) only.
The RESmart® Auto CPAP/CPAP system is to be used only on the instruction of a licensed health care professional. Your home care provider will configure suitable pressure settings according to your health care professional's prescription.

This service manual is used to help service engineers to maintain RESmart® Auto CPAP/CPAP system more efficiently. Instructions in this manual may help the device to work in the best condition. Service engineers can find instructions they need from this manual quickly.

IMPORTANT!
Read and understand the instructions in this manual before operating the device.

IMPORTANT!
This device is not intended for life support.

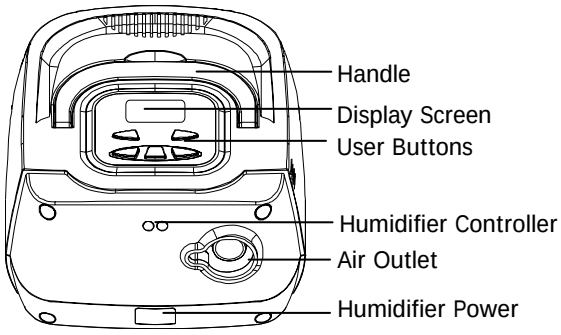
I.2 Implements

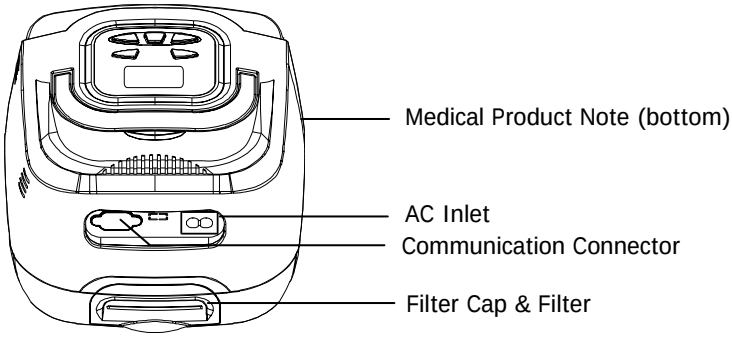
1. Implements for repairing
   Type '+' screwdriver
   Pincers

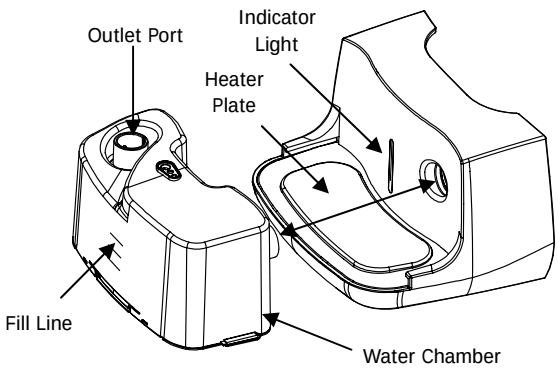
2. Implements for measuring
   Pressure meter

2. Structure

2.1 System Features







2.2 Internal Structure

See Appendix A

2.3 Spare Parts

See Appendix B

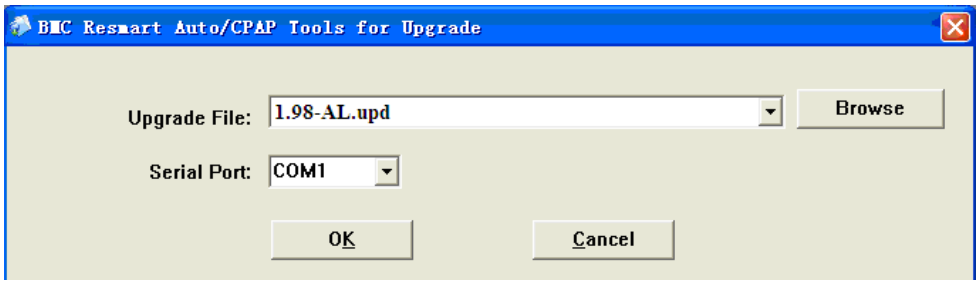
3. Software

3.1 Upgrading Device Firmware

Note: Once the RESmart® Auto CPAP/CPAP device is powered on, the LED display screen will show the software version of the device as the following picture. Please remember the software version in the red frame.

1. Power off the RESmart® Auto CPAP/CPAP device, and then connect the device to PC through the USB data cable.

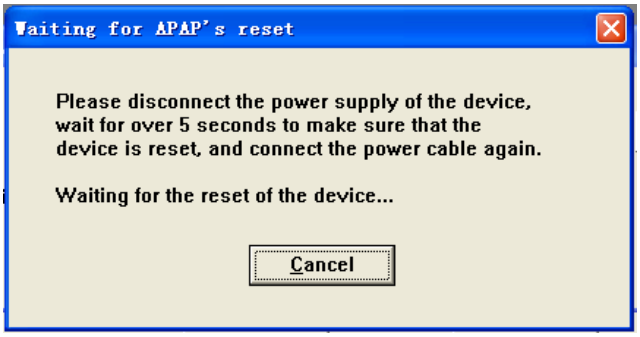
2. Run the software “BMC RESmart Auto CPAP/CPAP Tools for Upgrad” from PC and it will display as below:



a) Select the upgrade file which has same suffix letter as the machine version. (For example V ersion 1.88-AL should choose file name 1.98-AL)

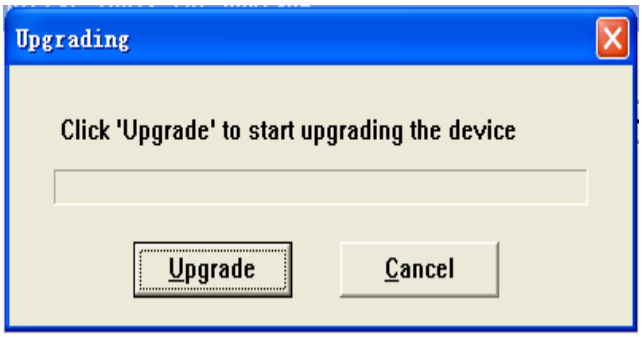
b) Select the right serial port, default is COM1.

3. Click “OK”, it will display as below:



Power on the RESmart® Auto CPAP/CPAP device. If the device is turned on at the beginning, please power off the device and turn on again 5 seconds later.

4. After the device is turned on, it will display as below:



Click “Upgrade” to start. If succeeded, the right version number will be displayed on display screen when powered on.

Note: If the upgrade failed, please repeat above steps 1-4.

If “Error 08” displayed after firmware upgrading, it means unmatched firmware used (for example: applied CPAP firmware to RESmart® Auto CPAP device). In this case, please apply correct firmware and upgrade again.

3.2 Hidden Function

1. **Humidifier matching and dis-matching (This is automatically for the device, if the humidifier is not working properly, perform this operation.)** (Available on version 1.19 and later)

Assemble humidifier on main device, without water chamber. Enter the maintenance menu, and set Ramp=40, then press Heated Humidifier Button when the Init P appears. Thus the humidifier is matched. When ‘OK’ appears on screen, humidifier matching succeeded.

If cut the power supply after pressing ‘Pressure Start/Stop Button’ when the humidifier is matching, the humidifier will be dis-matched.

2. **Reset** (Available on version 1.28 and later)

Press and hold the Ramp Button until the user menu appears (about 3 seconds) when the device is on standby, press +/- User Buttons to access the Date Setting, set ‘YYYY/MM/DD’=’2097/07/01’, then press ‘Pressure Start/Stop Button’ when ‘Hour’ setting appears, thus all device settings and therapy records (doesn’t include Use Days and Use Time) will be reset.

If set ‘Minute’=’16’ during the above procedure, then not only device settings and therapy records, but also patient information will be reset.

If set ‘Minute’=’26’ during the above procedure, then not only device settings, therapy records and patient information, but also Use Days and Use Time will be reset.

3. **Pressure calibration** (Available on version 1.58 and later)

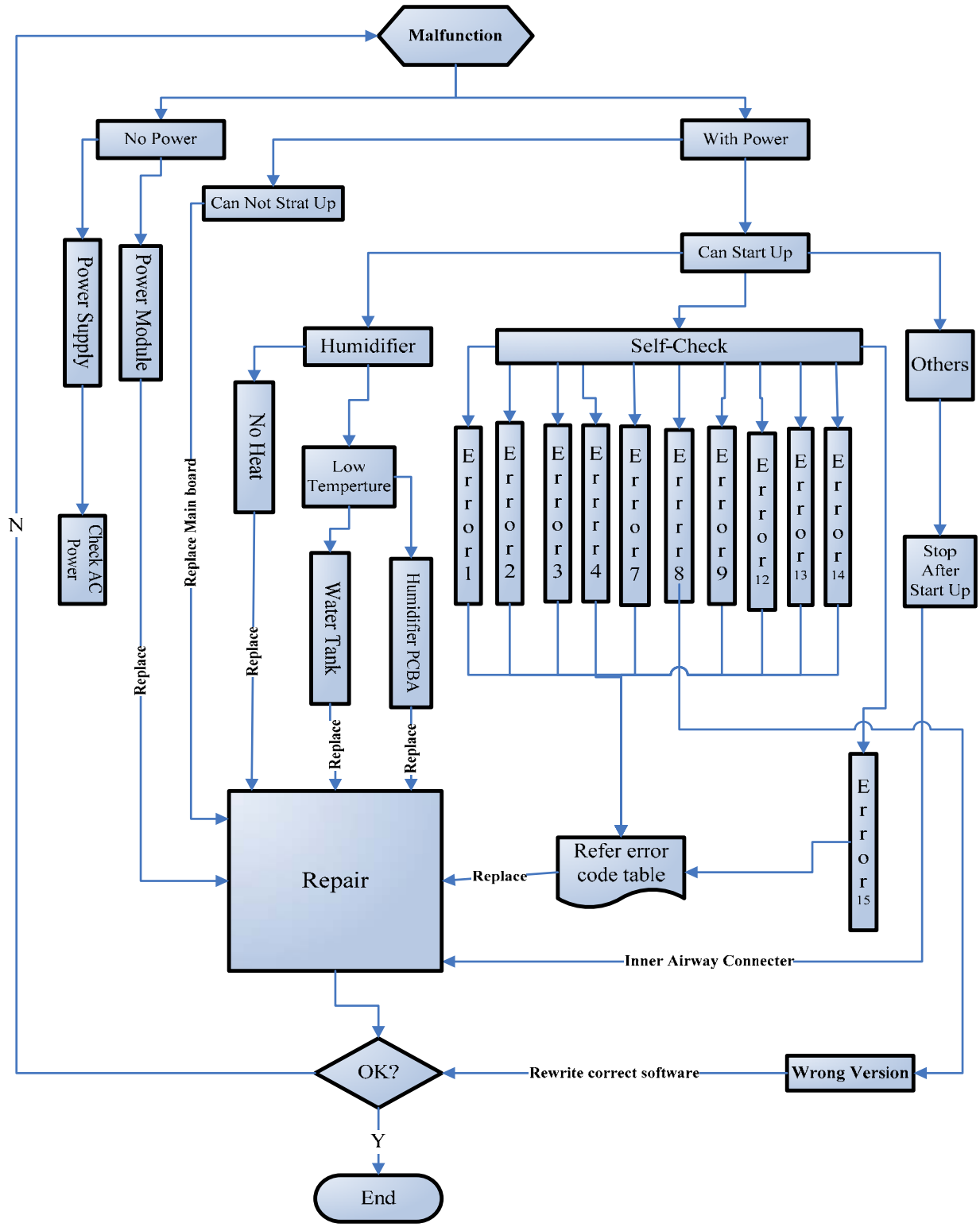
Connect pressure meter to the air outlet of the device, in the Date and Time Setting menu, set 'YYYY/MM/DD'='2098/08/18', press 'Pressure Start/Stop Button' when Hour Setting appears to start the Pressure Calibration. The device output pressure is based on 20 hPa (cmH_2O), and a number will appear on the screen, when the output pressure is stable, if the value on the pressure meter is not 20 hPa (cmH2O), press '+/-' User Buttons to adjust the output pressure , finally press 'Pressure Start/Stop Button' to finish the Pressure Calibration.

4. Malfunction and Countermeasure

4.1 Error Code Table and Information

Error Index	Problems	Probable Cause
Error01	Over temperature inside or temperature sensor fault	Malfunction on main board
Error02	Motor stops working	Malfunction on motor or main board
Error03	Low speed of motor	Malfunction on motor or main board
Error04	Low temperature inside	Malfunction on main board
Error07	Pressure sensor fault	Malfunction on main board
Error08	Wrong firmware version	Firmware
Error09	Host parameter error	Malfunction on main board
Error12	Over temperature inside or flowrate sensor fault	Malfunction on main board
Error13	Temperature below 0°C or flowrate sensor fault	Malfunction on main board
Error14	The motor is over temperature or motor temperature sensor fault	Malfunction on motor or on motor temperature sensor
Error15	Motor temperature sensor fault	Malfunction on motor temperature sensor

4.2 Malfunction Determination



Appendices

Appendix A:

Device Configuration

1. Main device

Fig. A - Main board (backside)

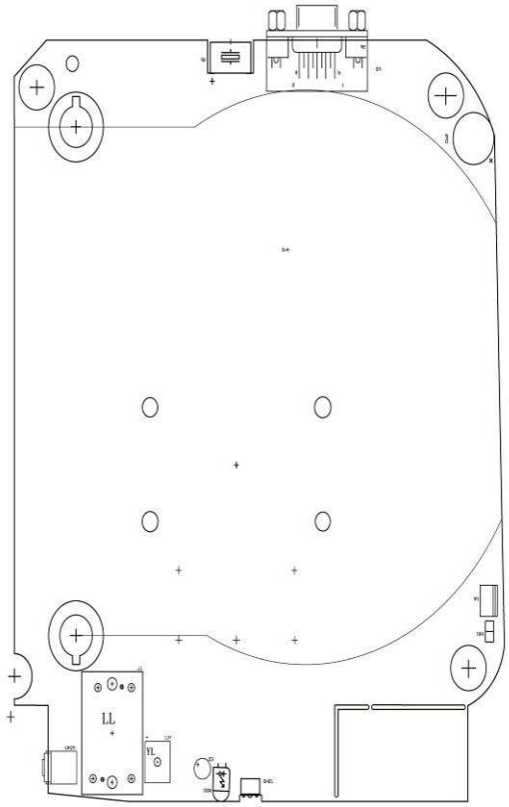
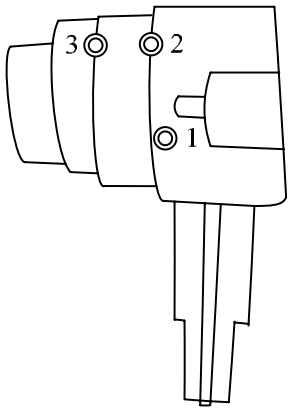


Fig. B – Outlet (left side)



Hole #1, 2 and 3 in Fig. B, connect to sensor YL via silicon rubber canal. Specified in Table 1:

Fig. B	Fig. A	Specification of canal
1	Hole #1 on sensor YL	ϕ 2mm, Φ 4mm, L12cm

Table 1

Fig. C – Power PCBA (front side) Sockets figuration

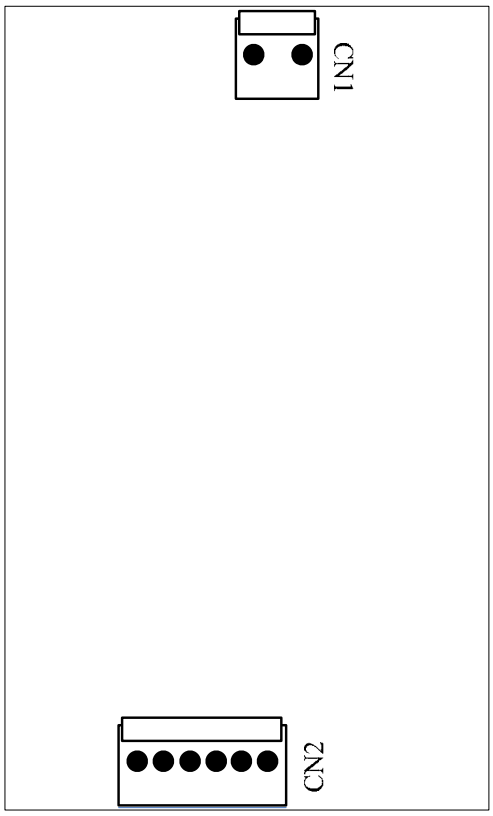


Fig. D – Wire connecting on power PCBA

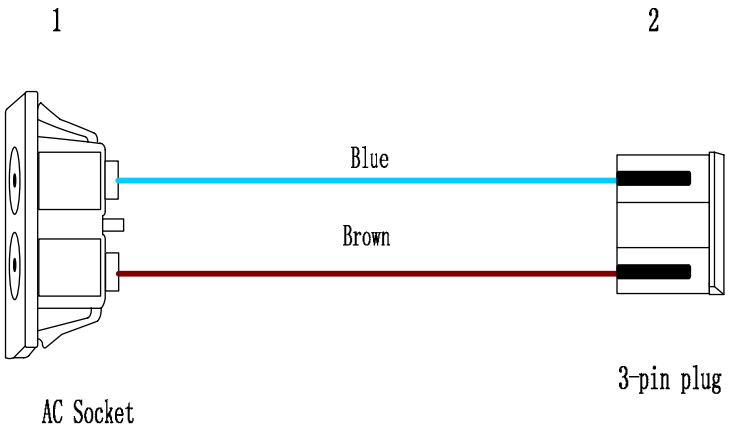


Fig. E – Power supply connecting

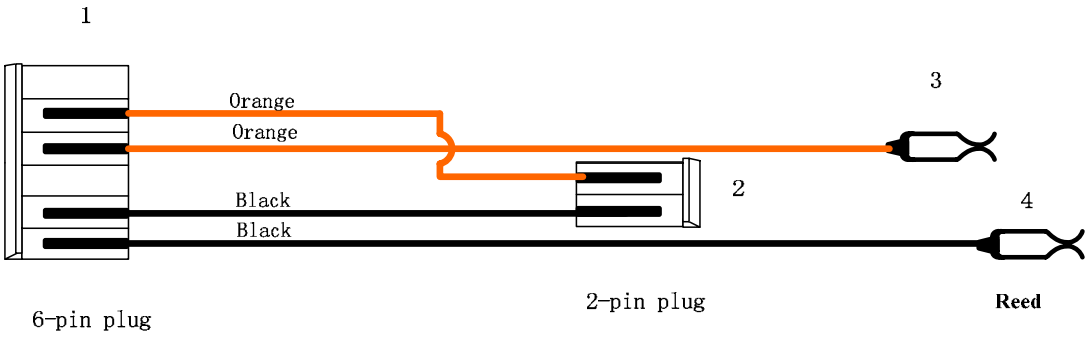
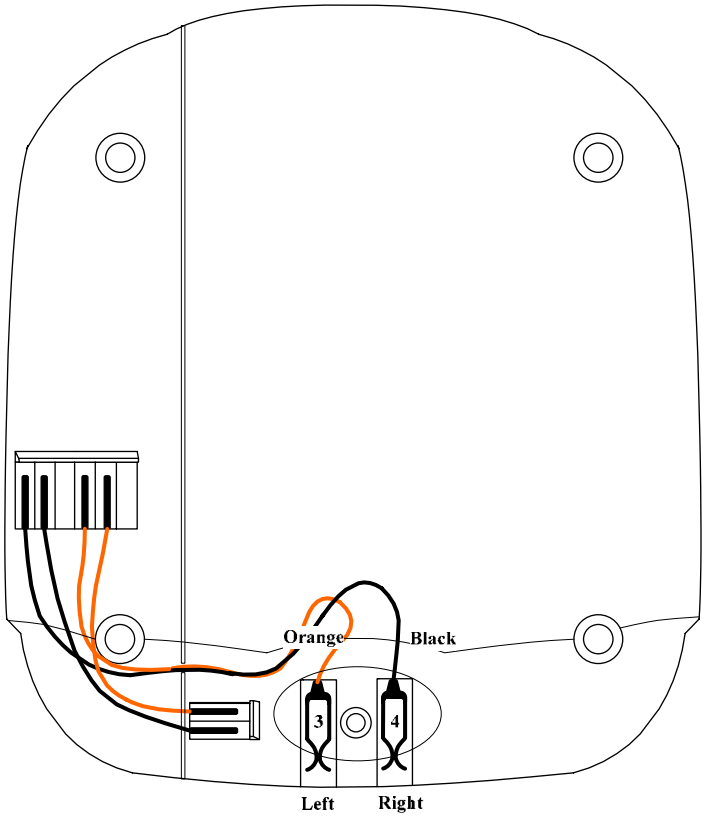


Fig. F – Power supply to humidifier



Connecting relationship:

Part / Fig.	1	2	3	4
D	Back of device	Fig. C: CN1		
E	Fig. C: CN2	Fig. A: P24	Fig. F: Left	Fig. F: Right
Blower 8-pin plug	Fig. A: PM			

Table 2

2. Humidifier

Fig. G – Humidifier PCBA (back side)

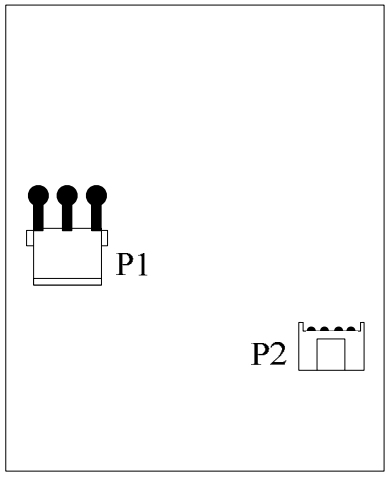


Fig. H – Power supply to humidifier

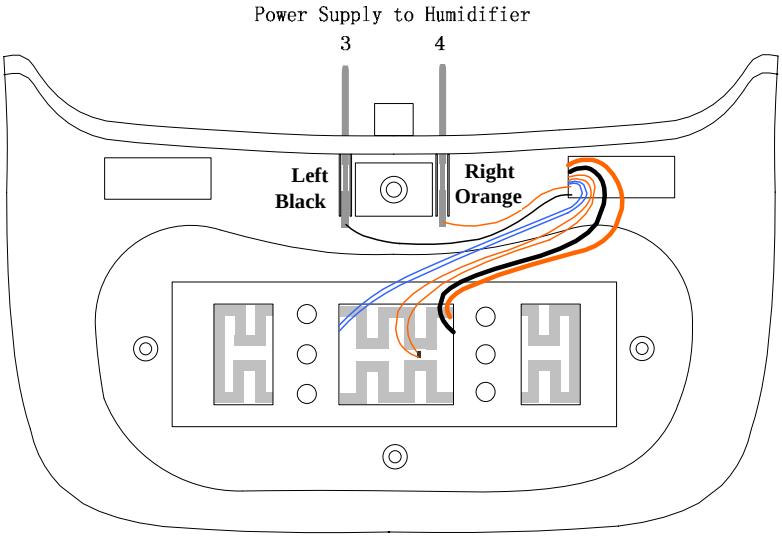
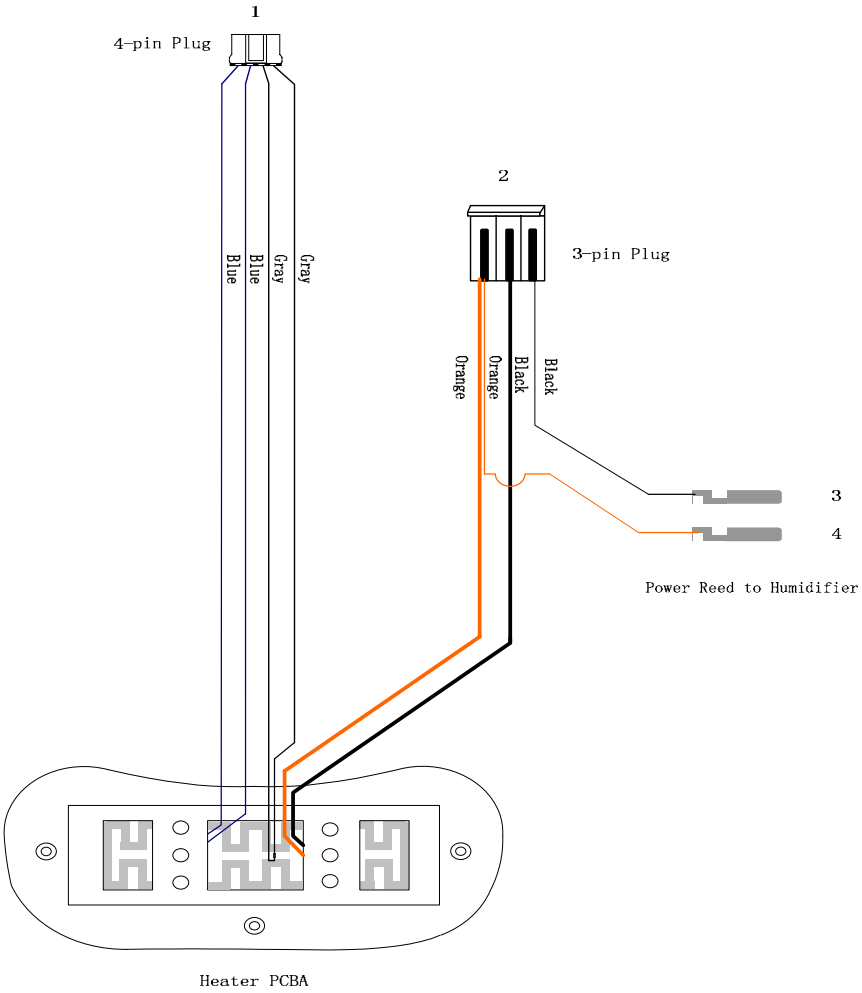


Fig. I – Heater PCBA



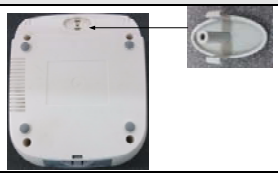
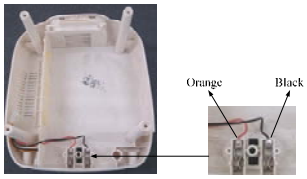
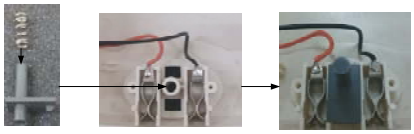
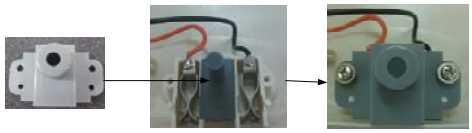
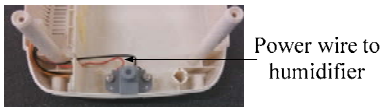
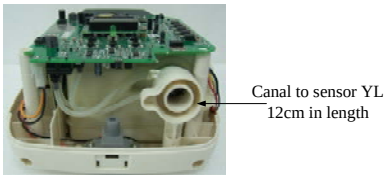
Connecting relationship:

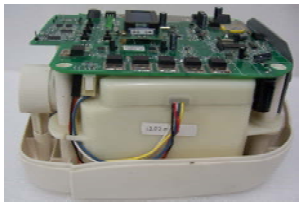
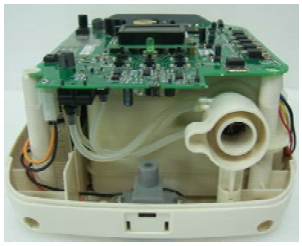
Part / Fig.	1	2	3	4
I	Fig. G: P2	Fig. G: P1	Fig. H: Left	Fig. H: Right

Table 3

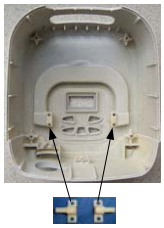
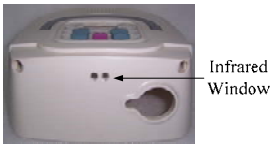
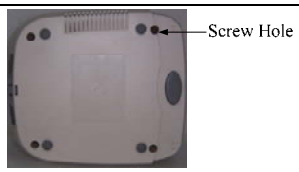
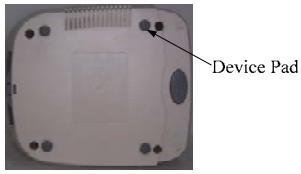
Components Illumination

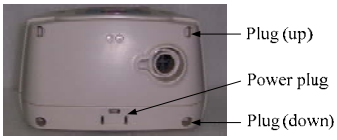
1. Device Inside

S/N	Assembly	Figure
1	Insert humidifier locker on the shield bottom.	
2	Insert humidifier power supply reed on the shield bottom as per Fig. E and F.	
3	Assemble the humidifier locker and button spring.	
4	Put fixing on the spring and fix by screw (2× 3mm*8mm).	
5	Put power wire.	
6	Assemble the shield back on the bottom, fix by screw (2×3mm*8mm).	
7	Assemble the foam pad (non-woven side up),	
8	Insert the blower unit	
9	Connect the air hole of the pressure sensor YL on the main board with the bottom hole (hole#1) in the front of the blower outlet with a canal of 12 cm in length and 2 mm in inner-diameter.	

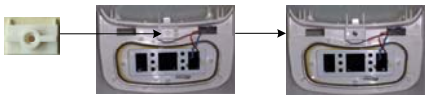
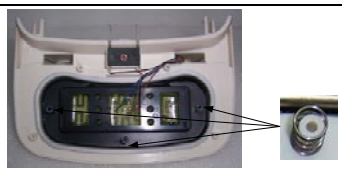
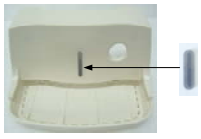
10	Clean up the blower wires and wind them with a tube. Insert the plugs into sockets PM. Put the lead of thermistor into socket PRT on main board. Connect the main board to 24V power supply.	
11	Draw the shield back backwards and put the 3-pin plug into the corresponding socket on its back. Lay the main board onto the 4 supporting poles on the shield bottom and set it into the power board via the fixing pole on PCB and get the main board fixed. Put blower wires on the side into the gap between blower unit and shield bottom.	

2. Device Outside

S/N	Assembly	Figure
1	Put the handle in the socket of the shield cover.	
2	Assemble handle fixing to handle and fix by screw (4*3*8 mm).	
3	Assemble the infrared window.	
4	Assemble and fix the panel.	
5	Put on the key buttons.	
6	Assemble shield cover on the bottom, adjust the position of outlet and make sure it is clamped in the right socket.	
7	Fix the shield by 4 pieces screws (M3*10 mm).	
8	Stick the 4 pieces of device pads.	
9	Put in the filter and assemble the cover.	

10	Put on all plugs if necessary (without humidifier).	

3. Humidifier

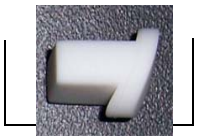
S/N	Assembly	Figure
1	As per Fig. H, assemble the heater plane and wire. Fix them by screw (3*8 mm).	 
2	Put springs on each of the three poles on heater plane.	
3	Assemble the scaleboard on the heater plane and fix by screws (3*8 mm).	
4	As per Table 3, assemble heater PCBA and wires.	
5	Put the humidifier inner connector on the shield.	
6	Put on light window.	
7	Assemble the inner and outer shield.	
8	Fix on the screws (M3*10mm).	

Appendix B:

Spare Parts Configuration

S/N	Name	Quantity	Figure

1	Shield Cover	1	
2	Handle	1	
3	Handle Fixin	2	
4	Shield Bottom	1	
5	Humidifier Clip	1	
6	Humidifier Locker	1	
7	Humidifier Fixing	1	
8	Filter Cover	1	
9	Shield Back	1	
10	Outlet	1	

11	PCBA Fixing	2	
12	Infrared Window	2	
13	Panel	1	
14	Humidifier Outer Shield	1	
15	Humidifier Inner Shield	1	
16	Light Window	1	
17	Pole Platelet	1	
18	Humidifier Power Plug	1	
19	Humidifier Plug (left-up)	1	
20	Humidifier Plug (left-down)	1	
21	Humidifier Plug (right-up)	1	

22	Humidifier Plug (right-down)	1	
23	Device Pad	6	
24	Blower Connector	1	
25	Humidifier Inner Connector	1	
26	Key Button	1	
27	Humidifier Scaleboard	1	
28	Heater Plane Spring	3	
29	Button Spring	1	

Spare Parts List

Part Name	S/N	Qty	Unit	Classify	Use
Main Board PCBA	1220EP0A-2000	1	PC	PCBA	Main Device
Heater PCBA	1220HW01-1000	1	PC	PCBA	Humidifier
Power Supply PCBA	123B0048	1	PC	PCBA	Main Device
Blower Unit (TKD)	1220CP0A11130	1	PC	Assembly	Main Device
Heater Plane	1220HW0112100	1	Set	Assembly	Humidifier
Power Supply PCBA Wire	120002	1	Set	Wire	Main Device
Main Board PCBA Wire	120003	1	Set	Wire	Main Device
Silicon Rubber Canal	290001	1	PC	Assembly	Main Device
Handle	210030	1	PC	Plastic	Main Device

Handle Fixing	210011	2	PC	Plastic	Main Device
Shield Bottom	210031	1	PC	Plastic	Main Device
Humidifier Clip	210004	1	PC	Plastic	Main Device
Humidifier Locker	210012	1	PC	Plastic	Main Device
Humidifier Fixing	210013	1	PC	Plastic	Main Device
Filter Cover	210005	1	PC	Plastic	Main Device
Shield Back	210006	1	PC	Plastic	Main Device
Outlet	210007	1	Set	Plastic	Main Device
PCBA Fixing	210014	2	PC	Plastic	Main Device
Infrared Window	210010	2	PC	Plastic	Main Device
Panel	210036	1	PC	Plastic	Main Device
Power Supply PCBA Fixing	210015	1	PC	Plastic	Main Device
Humidifier Outer Shield	210038	1	PC	Plastic	Humidifier
Humidifier Inner Shield	210039	1	PC	Plastic	Humidifier
Pole Platelet	210025	1	PC	Plastic	Humidifier
Light Window	210023	1	PC	Plastic	Humidifier
Button Spring	230001	1	PC	Metal	Main Device
Humidifier Scale Board	230004	1	PC	Metal	Humidifier
Heater Plane Spring	230005	3	PC	Metal	Humidifier
Humidifier Power Plug	220004	1	PC	Rubber	Main Device
Humidifier Plug (left-up)	220005	1	PC	Rubber	Main Device
Humidifier Plug (left-down)	220006	1	PC	Rubber	Main Device
Humidifier Plug (right-up)	220007	1	PC	Rubber	Main Device
Humidifier Plug (right-down)	220008	1	PC	Rubber	Main Device
Device Pad	220001	6	PC	Rubber	All
Key Button	220002	1	PC	Rubber	Main Device
Blower Connector	220003	1	PC	Rubber	Main Device
Humidifier Inner Connector	220009	1	PC	Rubber	Humidifier
Screw-1		8	PC	Screw	All
Screw-2		9	PC	Screw	All
Sunk Screw		4	PC	Screw	Main Device