



RESmart[®] Auto CPAP System

Service Manual

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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. Other wise, BMC Medical Co. has no responsibility for the result. All information in this manual is protected by law and regulation. All copyrights are belongs to BMC Medical Co.

IMPORTANT, CAUTION AND WARNING in this manual are to emphasize dangers to service people.

WARNING: If do not operate properly, may cause damage to people and environment.

CAUTION: If do not operate properly, may cause damage to instrument.

IMPORTANT: Important information for servicing and repairing.

Safety Notice

Electric Shock

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

Chemical Safety

There may be risk of virus after touching by patient. Please clean device or wear protective glove before servicing and repairing. Please deal with the waste according to regulation. Wash hands by disinfector after operating this device.

1. Introduction

1.1 Intended Use

The RESmart® Auto 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 is to be used only on the instruction of a licensed health care professional. Your home care provider will make the correct pressure settings according to your health care professional's prescription.

This service manual is used to help service people maintenance RESmart® Auto CPAP system of BMC Medical Co. more efficiently. Instructions in this manual may help device work best. Engineer can find needed instruction from this manual quickly.

IMPORTANT!

Read and understand instruction in this manual before operating.

IMPORTANT!

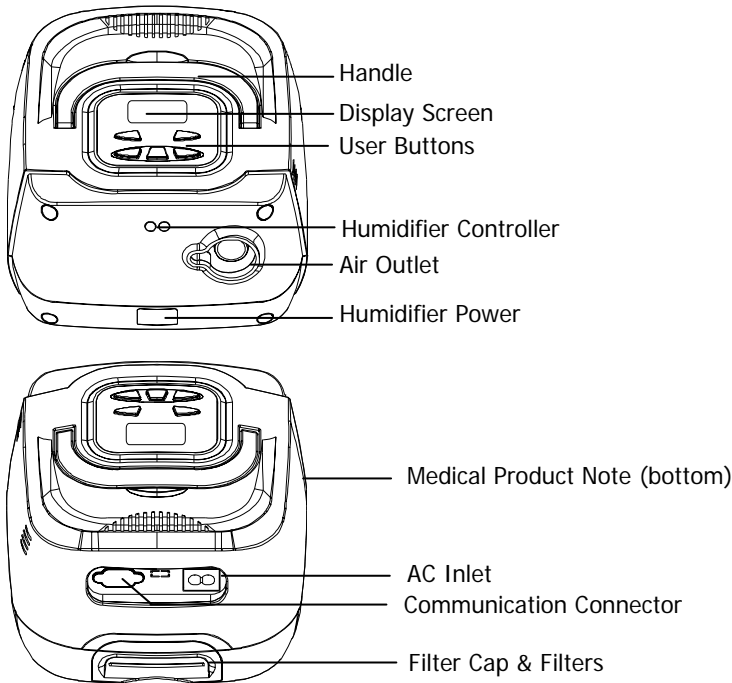
RESmart® Auto CPAP system can not be used for life support.

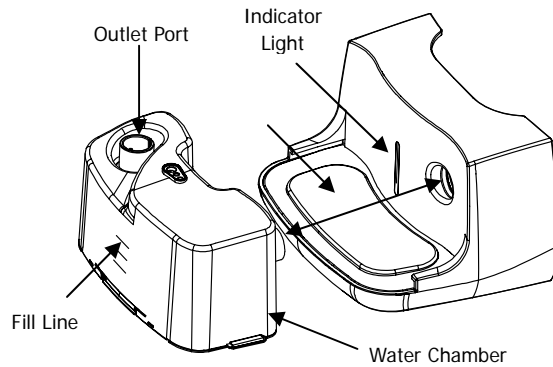
1.2 Implement

1. Implement for repairing
 - Type '+' screw driver
 - Pincers
2. Implement for measuring
 - Pressure meter

2. Structure

2.1 Outer Illumination





2.2 Inner Construction

See appendix A

2.3 Spare Part

See appendix B

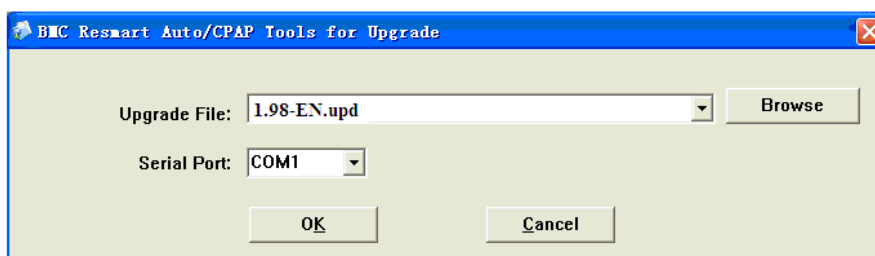
3. Software

3.1 Instruction for Upgrading Device Software

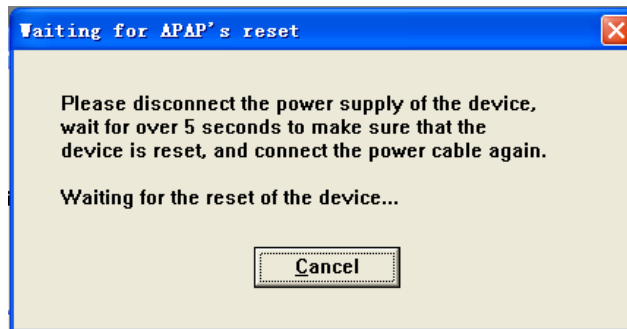
Note: Once the RESmart® Auto CPAP/CPAP device is powered on, the LED display screen will show the software version of the device as the following picture. Please remember the software version in the red frame.



1. Power off the RESmart® Auto CPAP device, then connect PC and the device via data cable.
2. Run the software “BMC RESmart® Tools for Upgrade” from PC and display as below:

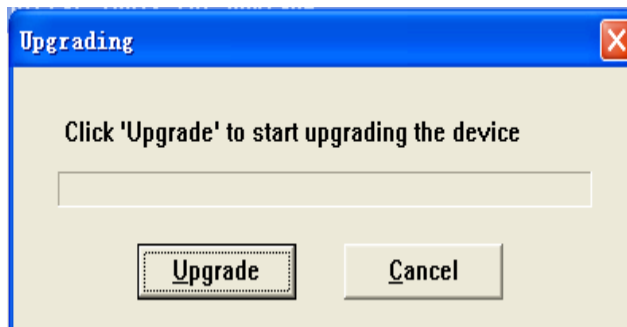


- a) Select the upgrade file which has same suffix letter as the machine version. (For example Version 1.88-EN should choose file name 1.98-EN)
 - b) Select the right serial port, default is COM1.
3. Click “OK”, display as below:



Power on the RESmart® Auto CPAP device. If the device is power on from beginning, please power off the device and turn on again after 5 seconds more.

4. After the device is turned on, the following will display:



Click “Upgrade” to start. If success, the right version number will be displayed on RESmart® Auto CPAP device screen when every power on.

Note: If failed during upgrading, please repeat from above 1-4 steps.

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

3.2 Hidden Function

1. Humidifier matching and dis-matching (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

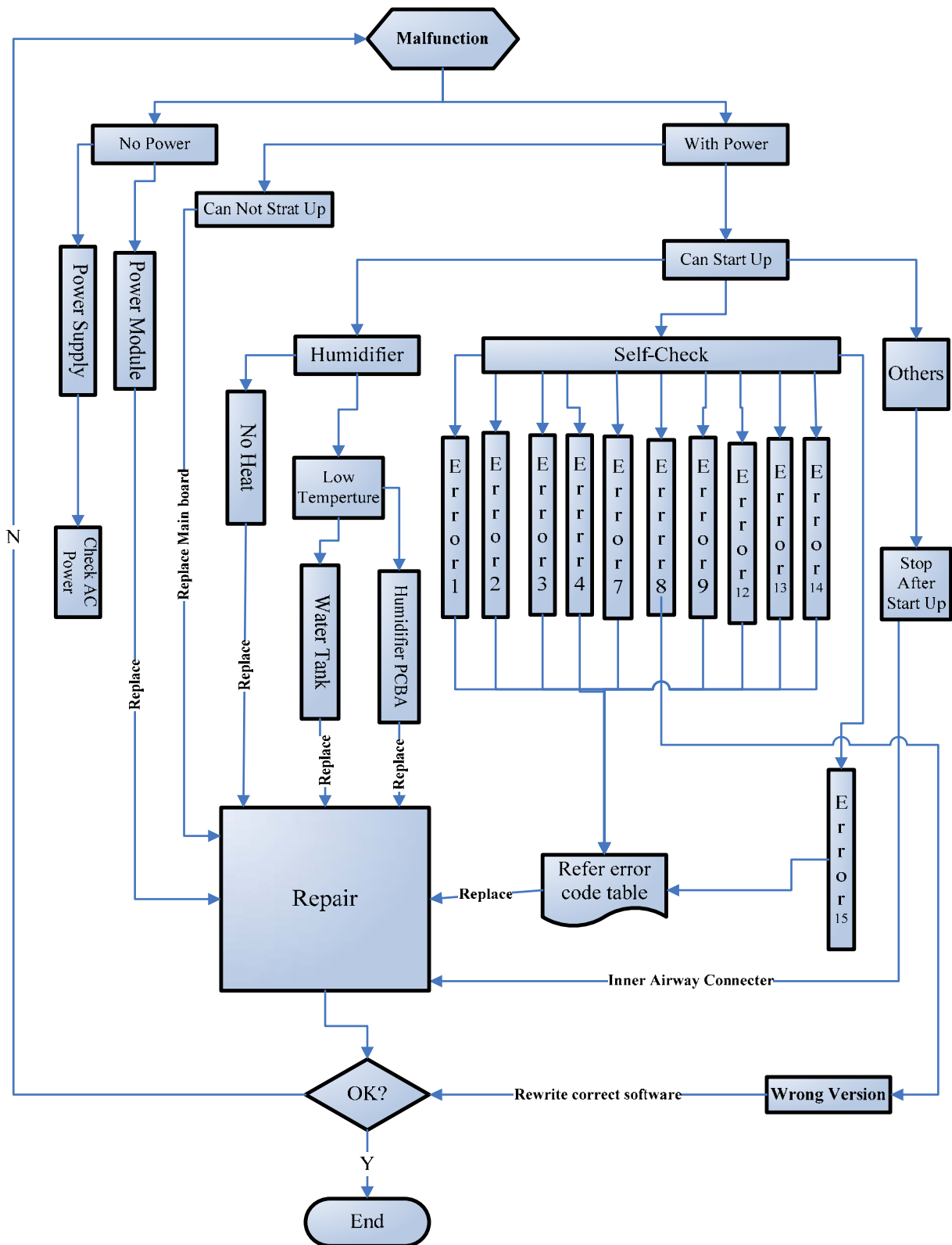
'YYYY/MM/DD'='2098/08/18', press 'Pressure Start/Stop Button' when Hour Setting appears to start the Pressure Calibration. The device output pressure is based on 20 hPa (cmH₂O), and a number will appear on the screen, when the output pressure is stable, if the value on the pressure meter is not 20 hPa (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	Problem	Causing
Error1	Over temperature inside or Temperature sensor fault	Malfunction on main board
Error2	Motor stop	Malfunction on motor or main board
Error3	Motor low speed	Malfunction on motor or main board
Error4	Low temperature inside	Malfunction on main board
Error7	Pressure sensor fault	Malfunction on main board
Error8	Wrong software version	Software
Error9	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 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

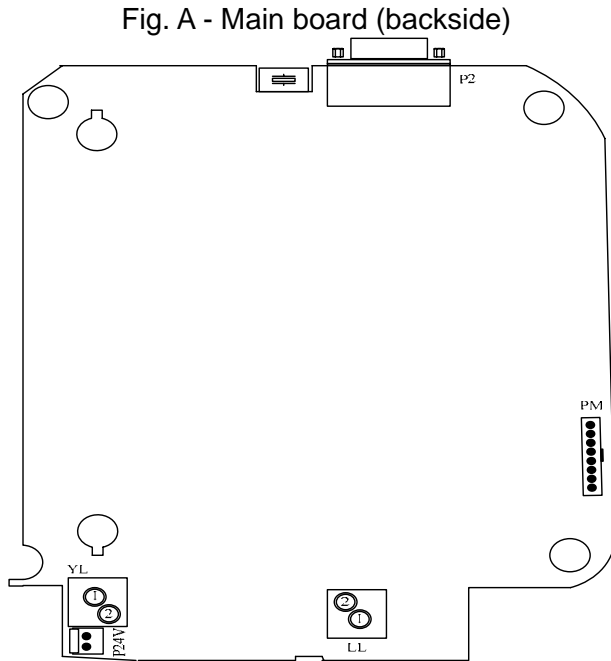
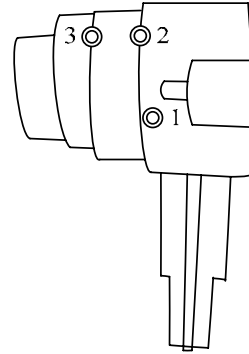


Fig. B – Outlet (leftside)



Hole #1, 2 and 3 in Fig. B, connect to sensor YL and LL 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
2	Hole #2 on sensor LL	φ 2mm, Φ 4mm, L12cm
3	Hole #1 on sensor LL	φ 2mm, Φ 4mm, L8cm

Table 1

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

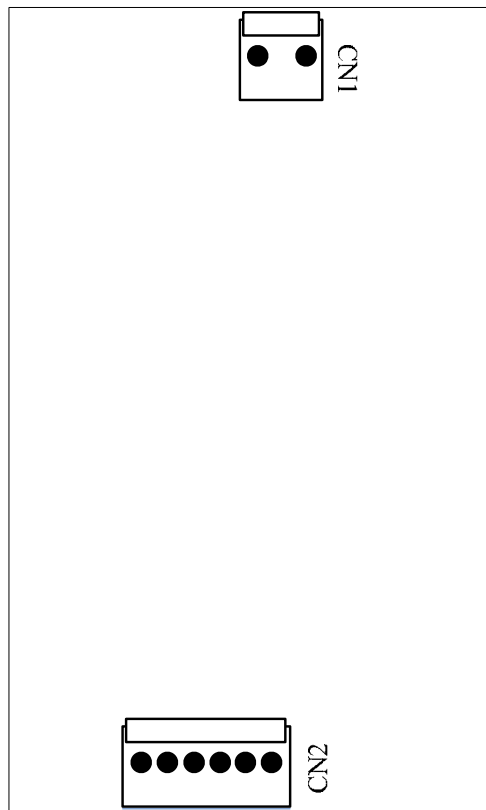


Fig. D – Wire connecting on power PCBA

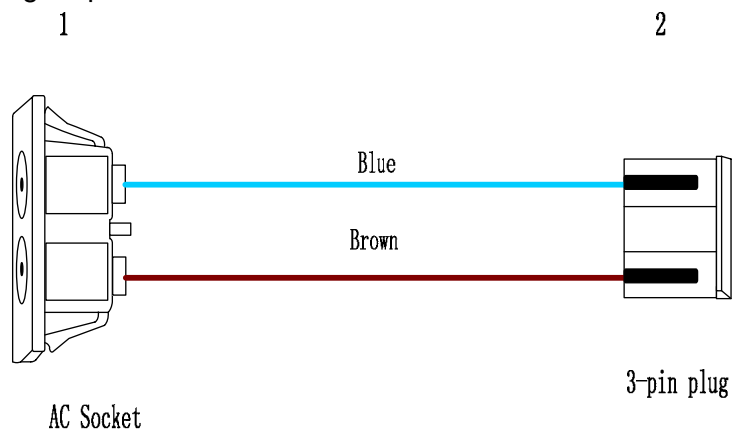


Fig. E – Power supply connecting

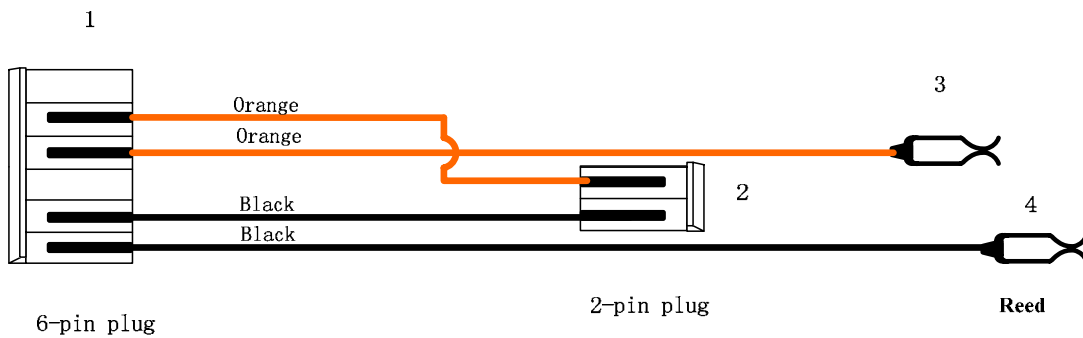
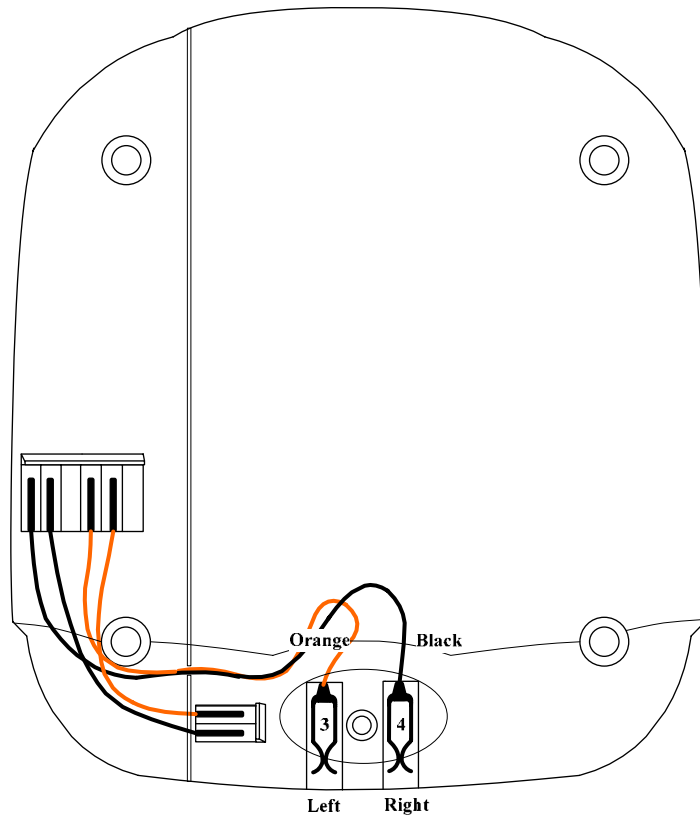


Fig. F – Power supply to humidifier



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)

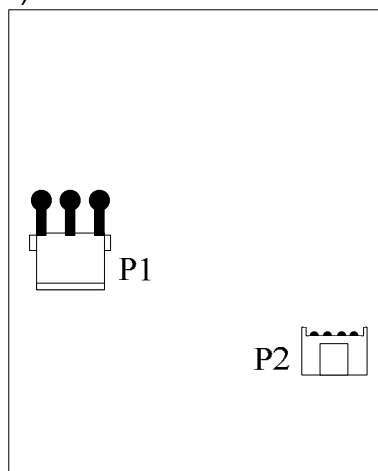


Fig. H – Power supply to humidifier

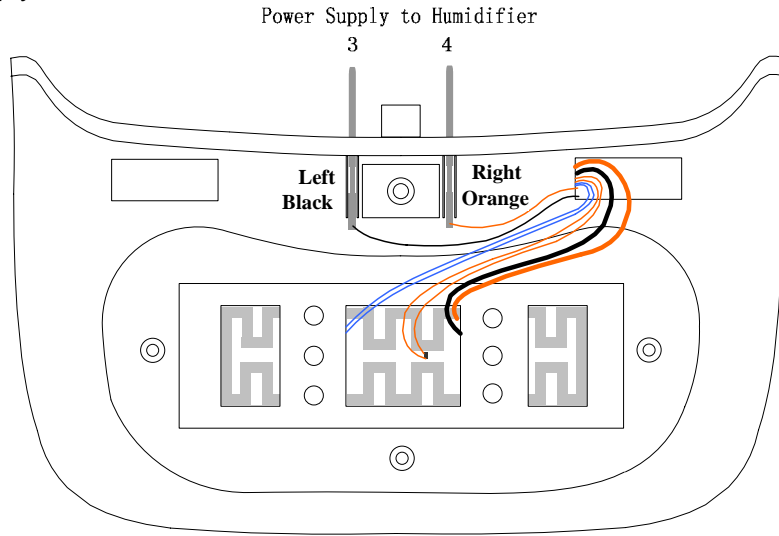
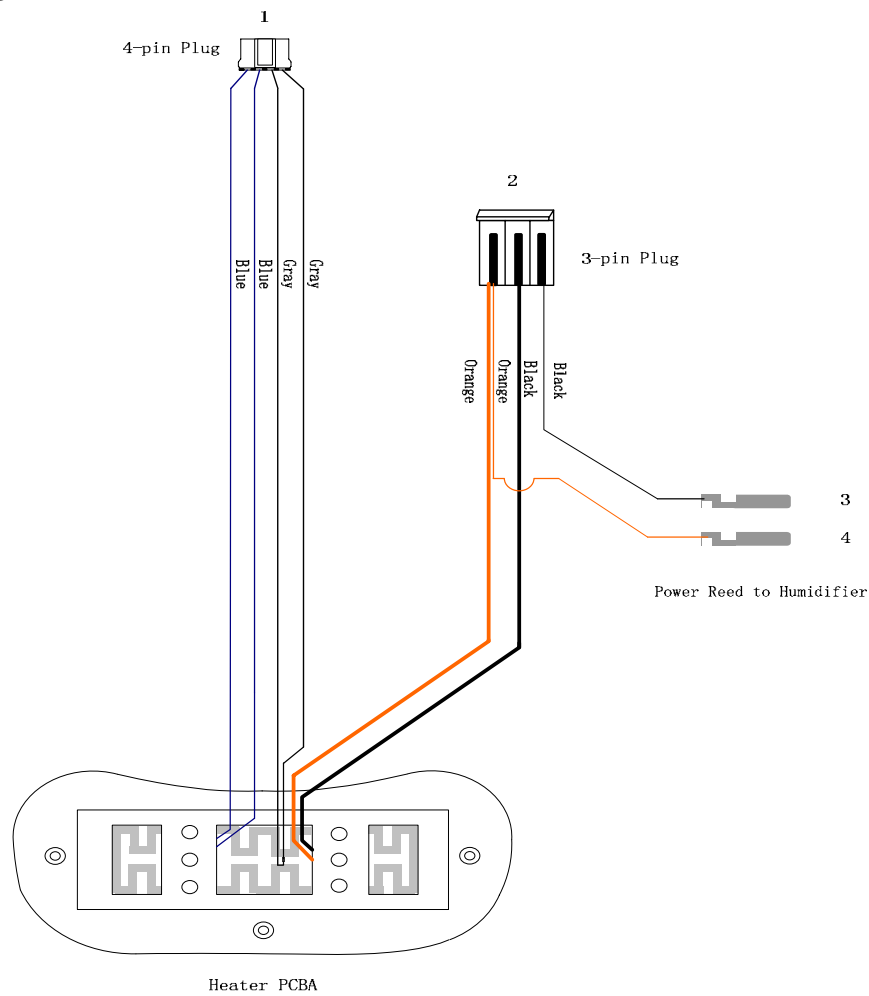


Fig. I – Heater PCBA




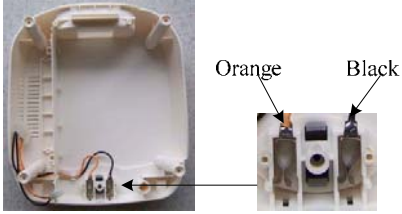
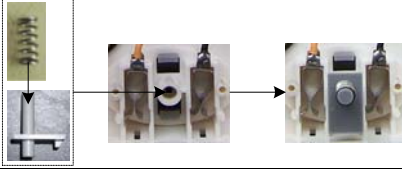



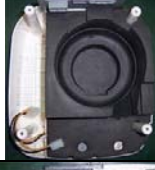




Connecting relationship:









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

Table 3


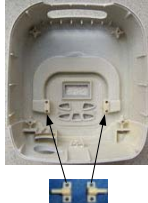



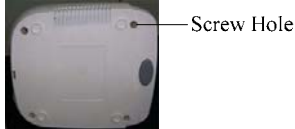
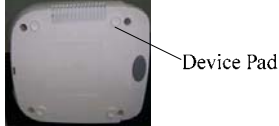

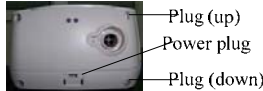
Components Illumination

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	Assembly the humidifier locker and button spring.	
4	Put fixing on the spring and fix by screw (2×3mm*8mm).	
5	Put power wire.	
6	Assembly the shield back on the bottom, fix by screw (2×3mm*8mm).	
7	Assembly foam (bottom) into shield bottom.	
8	Assembly AC power socket on the shield back (character face up).	
9	Clean up the wire.	
10	Assembly power PCBA in the socket and connect all plugs. Clean up the wire.	
11	Connect outlet to blower connector, fix by clip.	


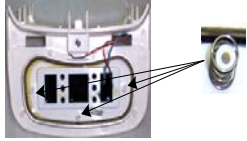
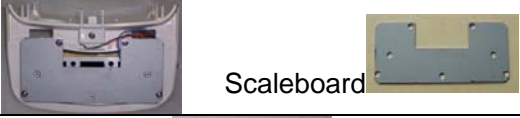

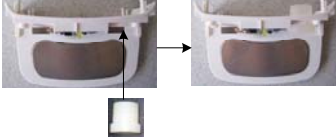


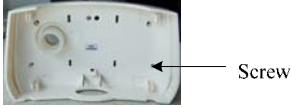
12	Connect blower to connector and fix by clip. Put the integrated one in the right place.	
13	Covered by foam cover and clean up wires.	
14	Assembly fixing clip on the main board PCBA.	 <p>PCBA Fixing Clip</p> <p>Pressure Sensor</p>
15	Plug the 8-pin plug of blower in the socket PM plug #2 as in Fig. E in the socket P24 on the main board PCBA.	
16	Assembly the main board PCBA on fixing pole and make sure the clip clamps power PCBA.	  <p>PCBA Fixing Pole</p>
17	<p>1. As per Table 1, connect sensor YL to outlet by silicon rubber canal.</p> <p>2. Connect sensor LL to outlet by silicon rubber canal.</p>	 <p>12cm canal for YL sensor</p>  <p>8cm canal for LL sensor</p> <p>12cm canal for LL sensor</p>

2. Device Outside

S/N	Assembly	Figure
18	Put handle in the socket on shield cover.	
19	Assembly handle fixing to handle and fix by screw (4×3mm*8mm).	
20	Assembly the infrared window.	
21	Assembly and fix the panel.	
23	Put on the key button.	
24	Assembly shield cover on the bottom, adjust the position of outlet and make sure it is clamped in the right socket.	
25	Fix the shield by screws (4×M3*10mm).	
26	Stick four device pads.	
27	Put in filter and assembly the cover.	
28	Put on all plugs if necessary (without humidifier).	





3. Humidifier

S/N	Assembly	Figure
1	As per Fig. H, assembly the heater plane and wire. Fix them by screw (3mm*8mm).	

		
2	Put spring on each of three poles on heater plane.	
3	Assembly the scaleboard on the heater plane and fix by screw (3mm*8mm).	 Scaleboard
4	As per Table 3, assembly heater PCBA and wires.	
5	Put the humidifier inner connector on the shield.	
6	Put on light window.	
7	Assembly the inner and outer shield.	
8	Fix on screw (M3*10mm).	 Screw

Appendix B:

Spare Part Configuration

S/N	Name	Qty	Figure
1	Shield Cover	1	
2	Handle	1	
3	Handle Fixing	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 Part List

Part Name	S/N	Qty	Unit	Classify	Use
Main Board PCBA	140008	1	PC	PCBA	Main Device
Heater PCBA	140009	1	PC	PCBA	Humidifier
Power Supply PCBA	270003	1	PC	PCBA	Main Device
Blower	1220CP0A11130	1	PC	Assembly	Main Device

Heater Plane	230006	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
Foam (bottom)	240001	1	PC	Foam	Main Device
Foam (cover)	240002	1	PC	Foam	Main Device
Shield Cover	210029	1	PC	Plastic	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
Power Cord	110009	1	PC	Accessory	All