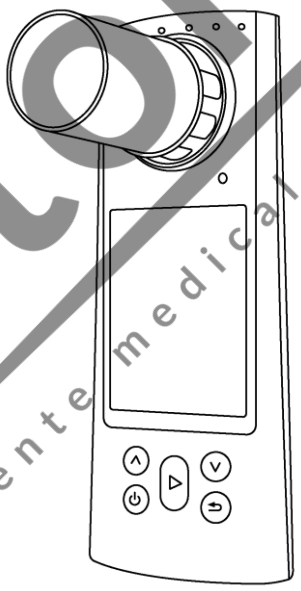
SP80B

Spirometer

Service Manual



Contec Medical Systems Co.,Ltd.

Statement

Our company owns the final explanation right to this manual.

Our company assumes no responsibility for any error that may appear in this document, or for incidental or consequential damage in connection with the furnishing, performance or use of this material.

Please contact us in time for applying this manual.

The content in the manual is subject to change according to actual use or product upgrades and we apologize sincerely for inconvenience caused by version updates.

Service Policy

All of our products have passed strict production guard, quality inspection and got high-normal quality certification. For the problems about payment, consignment and quality in the production and management process, our company will try our best to give proper solution actively with the attitude that "Be serious and responsible to seek long cooperation".

1. Our company will give free repair for product's quality problems during warranty period, which do not contain improper use or human damage, or directly replace by customers.

2. For products beyond warranty period, our company will repair, but charge for accessories and upkeep, taking the circumstances into consideration.

3. For product failure caused by improper use or human damage, we will try our best to repair, but charge for accessories and upkeep, taking the circumstances into consideration.

4. When it is necessary to replace parts during repair and adding part cost, we will give user prior notice and ask for agreement. After the failure disappears, we will return you the parts replaced.

Convention

⚠ **Warning** ⚠ **Points some information you should know to avoid injury to patient and medical staff.**

⚠ **Caution** ⚠ **Points some information you should know to avoid damage to the device.**

⚠ **Note** ⚠ **Points some important information you should pay attention to.**

This manual is used with related ***User Manual***, and the same contents are not repeated. To be familiar with the device is prerequisite to repair, so before servicing, read the device's ***User Manual*** carefully.

General Safety Information

⚠ Warning ⚠

- **Before disassembling, ensure the external power supply and the USB cable have been cut off.**
- **There may be electrical shock when opening the device enclosure. All servicing to the device must be carried out by personnel trained and authorized by our company.**
- **Servicing personnel must wear corresponding apparatus (such as static bangle, etc.).**

⚠ Caution ⚠

- **Before disassembling, please unplug the USB cable, and disassemble all the peripheral equipments, for some circuits and equipments are still working in the instance of power off and direct disassembling will cause damage to some circuitry.**
- **When disassembling the plug wires (electric wires), avoid pulling and drawing directly, first make sure how they are connected and then pull out without strong force.**
- **Use proper tools, such as screwdriver and tweezer, etc., and be careful during operation to avoid any human damage to the device.**
- **After repair, do necessary maintenance to the device.**

⚠ Note ⚠

- **For most components or accessories of this device are tiny, such as screws, it is very important to strictly record the location, size and specification for each component and accessory, and put the components disassembled in sorts, which will help improve service efficiency.**
- **Disassemble the device according to correct steps described in the manual.**
- **Please refer to the user manual for safety information.**
- **Other important safety information is located in this manual where is appropriate.**

Contents

1 Overview

1.1 Brief Introduction

Forced Vital Capacity is the maximum expiration after taking a full breath, it's an important examination content in chest-lung disease and respiratory health, and it is an indispensable testing project in modern Pulmonary inspection. At the same time, it has great significance in respiratory diseases diagnosis, differential diagnosis, treatment evaluation and selection of surgical indications. Thus, with the rapid development of clinical respiratory physiology, clinical applications of lung capacity inspection are also gaining popularity.

The device is small in volume, low in power consumption, convenient in operation and portable. With high-definition display screen, the device is concise and fashion. To take a measurement, it is required to breathe in fully, and seal the lips around the mouthpiece and then breathe out all air as fast as possible, the screen will directly display the measured parameters, such as Forced Vital Capacity (FVC), Forced Expired Volume in one second (FEV1), Peak Expiratory Flow (PEF). This device has a high accuracy and repeatability.

1.2 Functions and Performance

1.2.1 Performance requirement:

1.2.1.1 Volume range
Measurement range: 0 ~ 10 L
Error: ± 3 % or ± 0.05 L (whichever is greater)
1.2.1.2 Flow range
Measurement range: 0 L/s ~ 16 L/s
Error: ± 15 % or ± 0.2 L/s (whichever is greater)

1.2.2 Main functions

1.2.2.1 Forced Vital Capacity (FVC), Forced Expired Volume in one second (FEV1), the ratio of FEV1 and FVC (FEV1%), Peak expiratory flow (PEF), 25% flow of the FVC (FEF25), 50% flow of the FVC (FEF50), 75% flow of the FVC (FEF75) and average flow between 25% and 75% of the FVC (FEF2575) can be measured. Besides, the testee condition can be shown by the ratio of the measured value and the predicted value.

1.2.2.2 Flow rate-volume chart, volume-time chart display.

1.2.2.3 Data memory, delete, upload and review.

1.2.2.4 Trend chart display.

1.2.2.5 Calibration function.

1.2.2.6 Information prompts when volume or flow goes beyond the limits.

1.2.2.7 Automatic power off when there is no operation in one minute.

1.2.2.8 Rechargeable lithium battery for power supply, with charging indication.

1.2.2.9 Battery power display.

1.3 Appearance

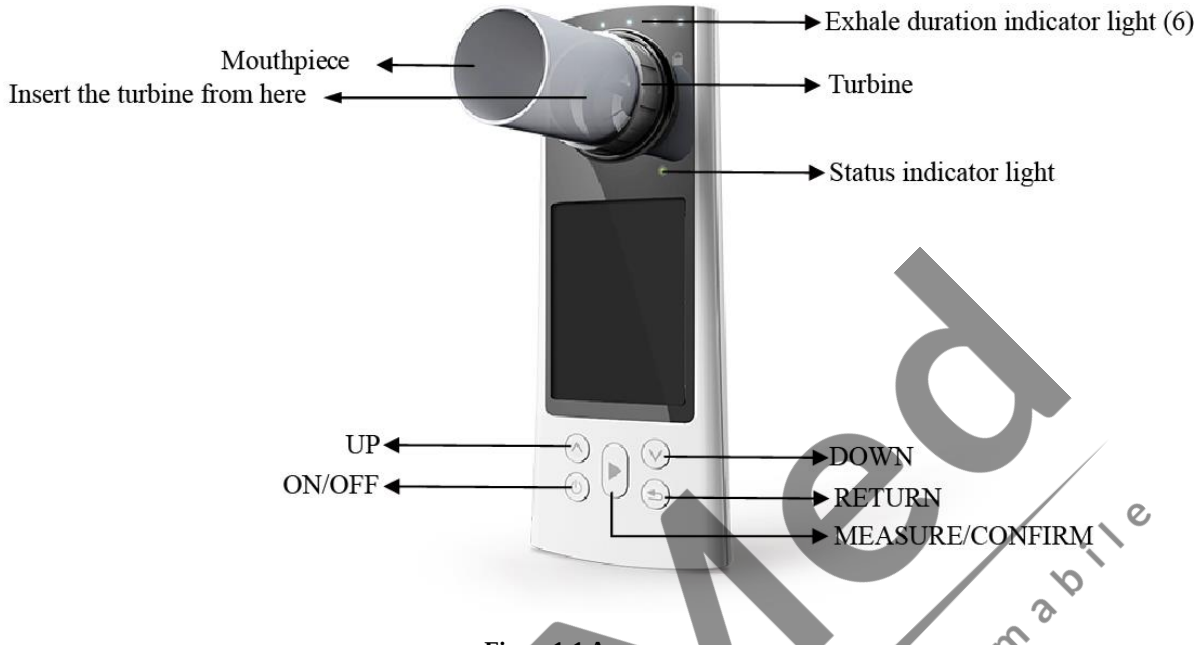


Figure1-1 Appearance

1.4 Environment Requirement

Operation environment:

Temperature

Working: 10℃~40℃

Transport and Storage: -30℃~+55℃

Humidity

Working: ≤80%

Transport and Storage: ≤95%

Atmospheric pressure

Working: 700hPa~1060hPa

Transport and Storage: 500hPa~1060hPa

Power supply

Lithium battery: DC 3.7V

Safety classification: internal power supply equipment, type BF applied part

2 Hardware Principle

Principle block diagram of SP80B Spirometer:

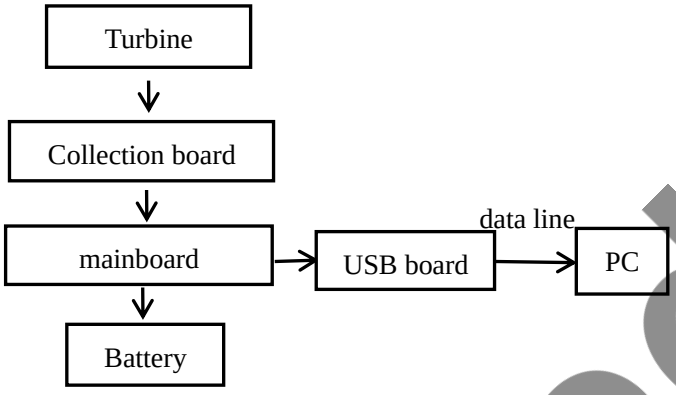


Figure2-1 System block diagram

Block diagram for mainboard:

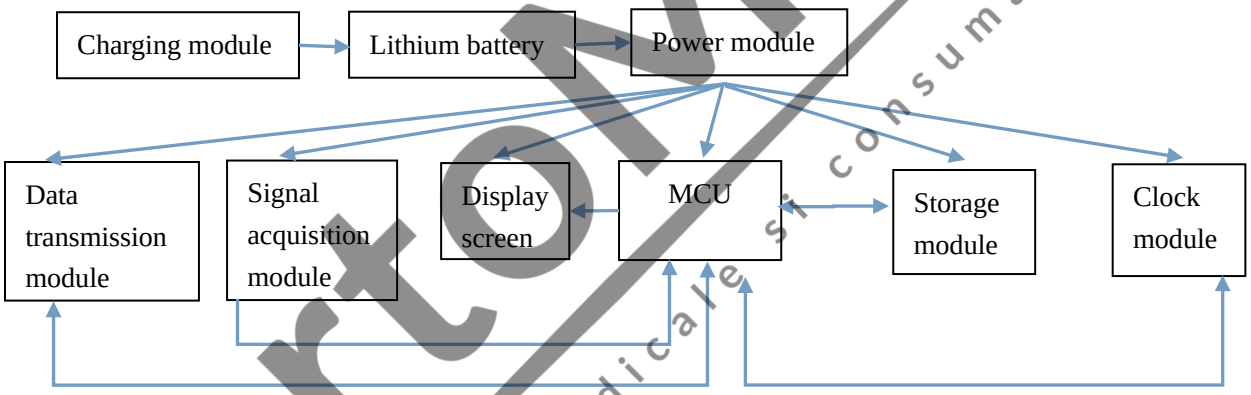


Figure2-2 Block diagram for mainboard

Hardware principle:

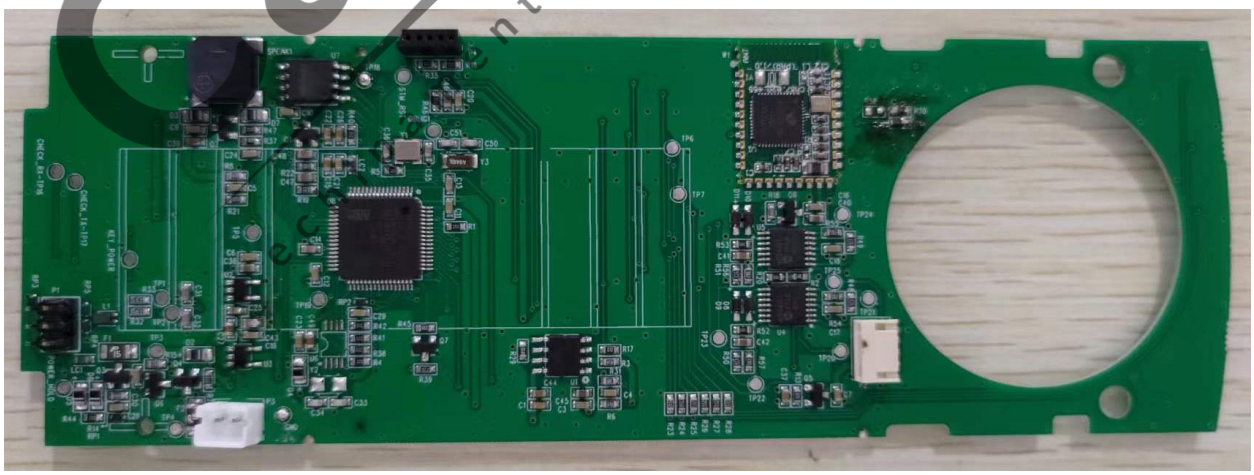


Figure2-3 Mainboard

Interface	Pin definition	Function	Data flow
P1	6P Pin 1-6 DGND, DGND, D+, D-, VUSB, VUSB	Communication interface	Two-way
P2	4P Pin 1-4 VCC, OUT1, OUT2, DGND	Communication interface	Input
P3	2P Pin 1-2 BATT+, GND	Battery interface	——

3 Device Inspection

3.1 System Inspection

Refer to the "User Manual" for specific details of routine test about SP80B Spirometer, this article does not make detailed description, the following contents are used for prompting test key points and the part not specifically stated in user manual.

3.1.1 Appearance and Main Components Inspection

1) Neat and beautiful enclosure, smooth surface, uniform color, no mechanical damage, crack or other defects appear;
2) No peeling or rusting appears on the panel coating layer, the words and labels on the panel are legible and firm;
3) No gas mark, crack, deformation or perfusion overflow phenomenon appears on the plastic components.
4) Panel joint is close and fixed well, and no clearance or sliding appears after fixing.
5) Adjustment parts are flexible and reliable, and no loose for fasteners.
6) Accessories are complete and marks are correct.

3.1.2 Basic function check

1)Press the power button to turn on the device, the LCD screen should display normally. When charging with USB cable, charging indicator light and charging icon are normal.
2)Each button’s operation is flexible and function properly, no situations such as button failure or combo.
3)Enter the measurement interface, take a measurement, the result and waveform are displayed normally.
4)Check the display of device time, the clock should work normally.
5)After the measurement is completed, connect the computer with USB cable, turn on the PC software, data should be uploaded correctly.

3.2 Volume accuracy Inspection

Inspection requirement: in order to ensure the accuracy of the spirometer, the device should be calibrated at least once a year, and calibrate it again after every maintenance.
Inspection tool: scaling barrel
Volume accuracy: ±3% or ±0.05L (whichever is greater)
Test methods: connect the spirometer to the scaling barrel, operate the spirometer into the measurement interface, push the scaling barrel to measure, compare the FVC value displayed on the spirometer with the volume value of the scaling barrel, the error should be in the range of volume accuracy.
Solution: if the error exceeds the required range, calibrate the device again according to the description in the User Manual, then inspect the volume accuracy again.

4 Device Disassembling/Assembling

4.1 Disassembling

Note: unplug the USB cable and turn off the device before disassembling it.

4.1.1 Disassembly of Protection Screen and Front Shell

According to following steps and Figure4-1, disassemble the enclosure with a screwdriver.

1. Turn the turbine anticlockwise and pull it out gently.

Figure4-1

2. Remove the front shell after removing the protection screen.

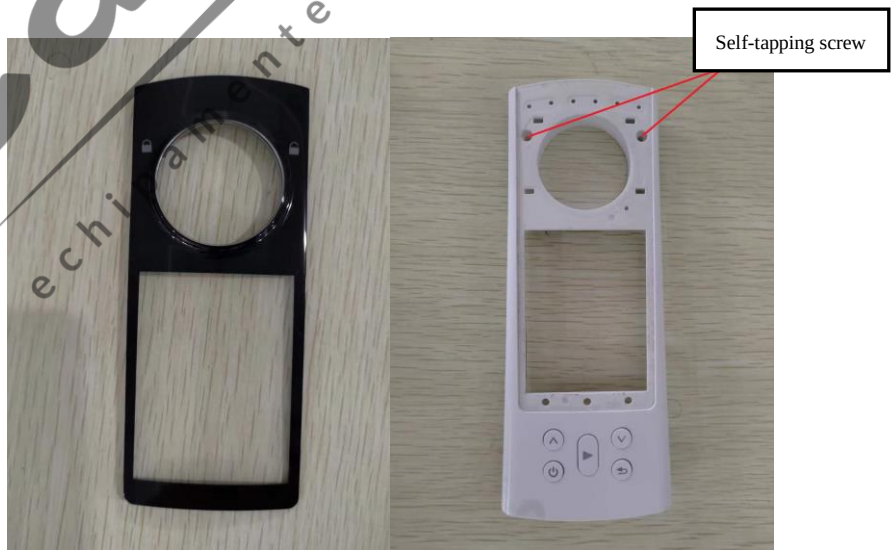


Figure4-2

3. After opening the enclosure, the internal structure is shown as Figure4-3**.**

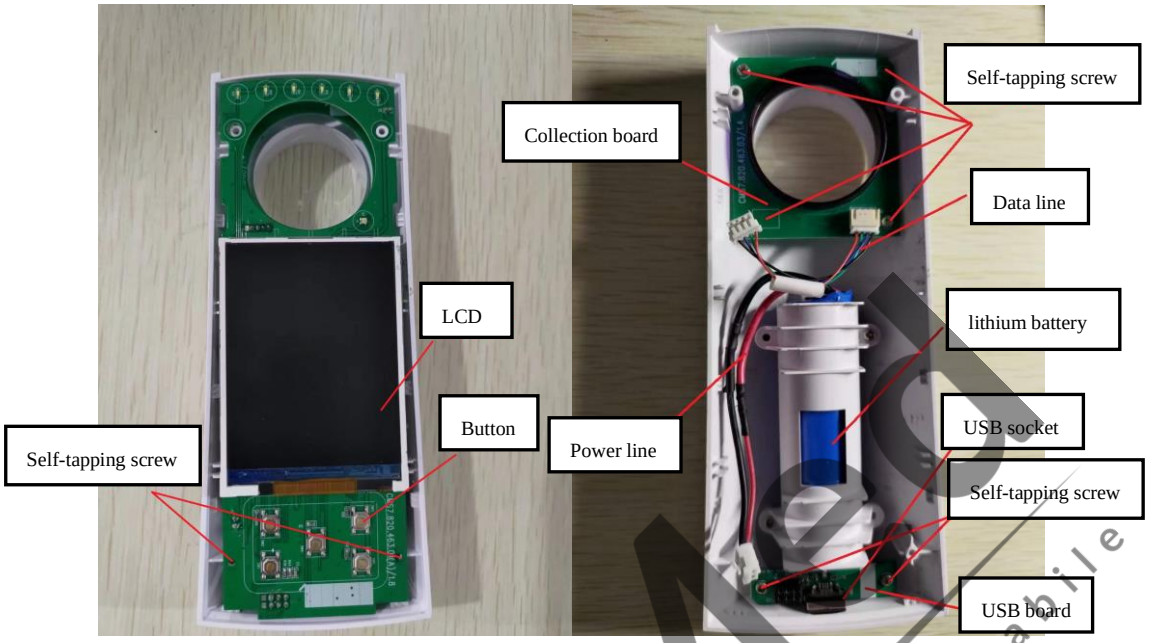


Figure4-3

4.1.2 Disassembly of Modules

According to following steps and Figure4-3, disassemble modules with a screwdriver.

1.Pull out the data line.
2.Dismantle two self-tapping screws of mainboard to take out the mainboard. The display screen should be protected from scratches and dirt after dismantling the mainboard.
3.Dismantle four self-tapping screws of collection board to take out the collection board.
4.Dismantle two self-tapping screws of USB board to take out the USB board.

4.2 Assembling

Assembling according to the reversed order of disassembling.

5 Troubleshooting

5.1 Device Fault

No.	Trouble	Analysis	Solution
1	The device can not be powered on.	1.Low voltage or no voltage. 2.Battery is out of service; 3.The circuit fault of power module on circuit board; 4.The fault of button; 5The fault of crystal oscillator.	1.Please charge the device. 2.Replace the battery; 3.Check the circuit of power module, replace the broken components; 4.Replace the button; 5.Replace the crystal oscillator.
2	Button is disabled	The fault of button.	Replace the button;
3	The use time is too short after charging.	1.The device is not fully charged. 2.Device battery damaged.	1.Please charge the device. 2.Replace the battery.
4	The device can not be fully charged after charging more than 10 hours.	1.The fault of charging chip. 2.Device battery damaged.	1.Replace the charging chip. 2.Please charge the device.
5	The sound of buzzer is not normal	The fault of buzzer.	Replace the buzzer.

5.2 Display Fault

No.	Trouble	Analysis	Solution
1	The display disappears suddenly.	1.The device is set to automatic power off when there is no operation in 2 minutes. 2.The fault of display screen; 3.The fault of power supply.	1.Normal 2.Replace the display screen; 3.Replace the broken components of power circuit.
2	The figure is wrong and unorderly	1.Storage error arising from abnormal power down; 2.Storage error arising from misoperation; 3.The fault of memory chip.	1.Delete the current case and remeasure; 2.Delete the current case and remeasure; 3.Replace the memory chip.

5.3 Measurement Fault

No.	Trouble	Analysis	Solution
1	The device can't finish measurement for a long time, and the data can't be displayed.	1.The start speed is too low, the device does not measure. 2.Device malfunction. 3.The circuit fault of signal acquisition part. 4.The fault of turbine.	1.Remeasure according to the User Manual. 2.Remeasure or restart the device. 3.Check the circuit of signal acquisition part, replace the broken components. 4.Replace the turbine and calibrate the device again.
2	The measurement result is not accurate.	1.The fault of turbine. 2.The device is uncalibrated.	1.Replace the turbine. 2.Calibrate the device again.

5.4 Upload Fault

No.	Trouble	Analysis	Solution
1	Data can not be uploaded to PC.	1.The fault of data conversion chip; 2.The fault of USB chip; 3.The fault of USB block; 4.The USB cable is damaged.	1.Replace the data conversion chip; 2.Replace the USB chip; 3.Replace the USB block; 4.Replace the USB cable.

Annex Ⅰ

Product Failure Feedback Table					
Client Name		Linkman		Telephone	
Product Name		Product Model		Purchase Time	
Product Number					

No.	Failure Description (attached figure)	Frequency	Date
1			
2			
3			
4			
5			
6			
7			
8			

⚠ Note ⚠ This table is used for failure information feedback to help our company deal with new failures in time and give good solution. Please fill in carefully.

CONTEC

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