Service Manual

CPR Simulator

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Chapter 1 Introduction

1.1 Usage

This tool allows users to simulate giving CPR to people who need first aid, with the tool's ability to provide feedback in the form of compression depth, compression speed, as well as ventilation speed and ventilation volume, with this feature it is hoped that users can perform CPR properly and correctly.

Chapter 2: Overview

2.1 Objectives and Scope

The ZEN CPR service manual is intended as a reference for maintenance and repair of the CPR mannequin device and its smartphone application. This manual provides troubleshooting information, repair procedures, calibration, and performance verification to technically qualified service personnel. A technical overview is provided as an introduction to the electronic and mechanical circuitry of the device.

NOTES!Configuration varies for different customers. You may just need to fix some parameters.

2.2 Disassembly Procedure

Use the following guidelines when unpacking the mannequin from its shipping carton.

1. Before opening the mannequin's shipping carton, check for damage.
2. If damage is visible, stop unpacking the carton and contact the shipping company for further instructions. If the carton is still intact, unpack the mannequin.
3. With the mannequin out of the carton, check to see that all items listed on the packing slip (included with delivery) are inside the shipping carton.

4. If an item is missing, double check the carton first, then check with your receiving department.

2.3 Recommended Service Intervals

At the intervals listed below, check the mannequin for normal operation.

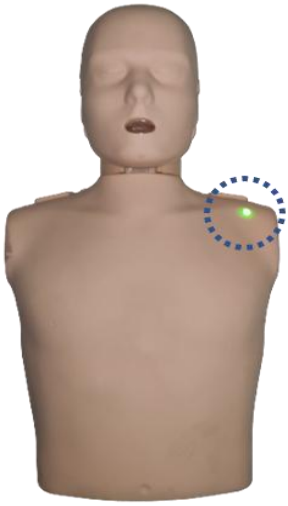
Table1. Service intervals

Interval/Condition	Do	Place in This Manual
Every 6 months to 2 years (according to procedure).	Complete current risk (leak) security checks followed by Functional Verification.	“Functional Verification”
If the battery does not hold a charge.	Check battery capacity.	"Problem solving"
The mannequin has fallen or is suspected of being damaged or handled roughly.	Complete Security Check followed by Functional Verification.	“Functional Verification”
Suspected malfunction with all or part of the monitoring parameters.	Functional Verification of suspected parameters	“Functional Verification”
The mannequin has not passed functional verification	Repairs are followed by safety checks and functional verification	“Functional Verification”

WARNING!If the mannequin is opened for repair or calibration, ensure that the device is turned off to minimize the risk of short circuits.

2.4 Battery Indicator Light

On the ZEN CPR device there is a battery indicator in the form of a light on the left shoulder of the mannequin device as seen in the following image.



Picture1. Battery indicator light

Table2. Meaning of indicator lights

No.	Information	Instruction
1	Flashing red	Battery less than 25%
2	Green	Charging Condition

2.5 Power Button and Charger Connector

Picture2. Power button and charger connector

Table3. Button and charger instructions

No.	Information	Instruction
1	ON/OFF light	If it lights up green then the mannequin device is in the on position, if it doesn't light up then it is in the off position
2	Battery	The mannequin device is equipped with a rechargeable Li-Ion battery.
3	Charger Hole	Connect to a 9v power supply to charge the battery on the mannequin

Chapter 3: Functional Verification

3.1 Introduction

Functional verification procedures ensure correct operation of the mannequin and its options. This procedure should be performed as follows: module level repairs, calibration, or when there are questions about accuracy.

WARNING!If the mannequin is opened for repair or calibration, ensure that the device is turned off to minimize the risk of short circuit.

3.2 Self-Test

Many functions, such as precision of compressions, expansion of the chest when ventilated, and connection of the device to the app, are software operations. During the mannequin startup self-test, the integrity of all programs is checked first. If software testing is successful, hardware testing begins. If all tests are successful, the mannequin is ready for use

3.3 Security testing

The following two safety tests, the current risk safety check (leakage) and the dielectric strength integrity test (hi-pot), must be carried out every time the mannequin is opened for calibration or repair.

3.3.1 Risk (Leakage) Current Test

A current (leakage) risk test should be performed to verify that the patient remains electrically isolated from the mannequin's power circuit.

Check leakage current using a Dynatech Safety Analyzer or Nevada 431F-1D or equivalent. The source current should not exceed 10µA rms. The sink current, measured between the isolated patient connection (ECG) and the mannequin's DC power input connector, should not exceed 20µA rms. Refer to the analyzer operator's manual for proper safety inspection procedures.

3.4 Functional Verification

Function verification should be performed only when the mannequin is fully assembled. If the mannequin has been stored for more than one month without the mannequin being connected to the AC adapter (for recharging), the battery voltage should be checked. The battery must be replaced if it does not hold a charge.

NOTES!Before starting the verification procedure, charge the battery for at least 2 hours with the mannequin turned off.

3.4.1 Power system

The following steps check the integrity of the mannequin's power system.

1. Turn off the mannequin by pressing the toggle button
2. Turn the mannequin back on
3. Make sure the battery power indicator is on
4. If it doesn't turn on then there is a possibility there is a problem with the battery.

3.4.2 System Testing

The following procedure checks whether the button operates properly.

1. Turn on the mannequin.
2. Make sure the battery indicator is on and the mannequin is properly lit.
3. Then open the ZEN CPR application, then check whether the mannequin device can be found by the application.
4. If found then try to connect by pressing the start button.
5. Do several compressions on the mannequin, then make sure that the compression animation runs well.
6. Turn off the mannequin

Chapter 4: Repair Procedures

4.1 Introduction

Instructions on how to disassemble the mannequin, disassemble the electronic module, remove the battery, and remove the sensor.

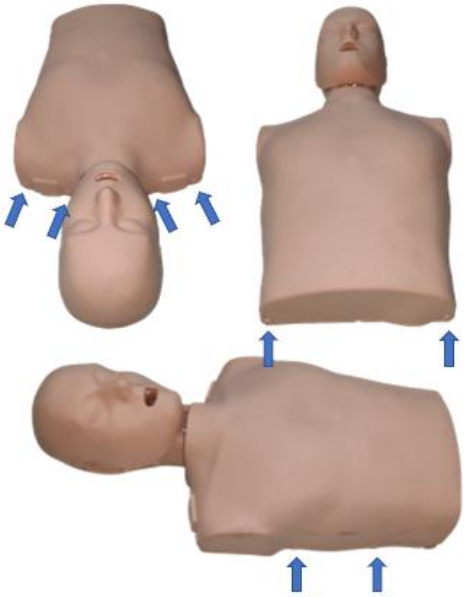
NOTES!In general, reassembly procedures are the opposite of disassembly procedures. If any items require attention during reassembly, they are explained after the disassembly section.

WARNING!If the mannequin is opened for repair or calibration, ensure that the device is turned off to minimize the risk of short circuits.

4.2 Dismantling the Mannequin

Follow these steps to open the mannequin device and gain access to the electrical modules, sensors, and battery.

1. First of all, open the silicone mannequin skin by opening the lock in the part shown in the following image:



Picture3. Mannequin lock

2. After the silicone skin is removed, you will see the inside of the mannequin, which is mostly memory foam.

Picture4. Memory foam mannequin

3. To gain access to the electrical board and sensors, all you need to do is remove the foam from the mannequin body.

Picture5. Removing the mannequin foam

4.3 Replacing the Battery

1. Make sure the simulator is turned off to replace the battery.
2. Open the simulator's skin and foam.
3. Open the battery cover, simply by lifting the battery cover.

Picture6. Open the battery cover

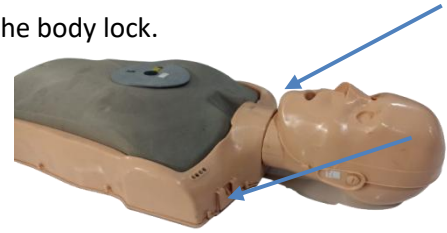
4. Replace the battery in the simulator with another battery, and make sure the battery polarity is correct.

4.4 Replacing the Lung Bag

1. Open the skin of the body and head.

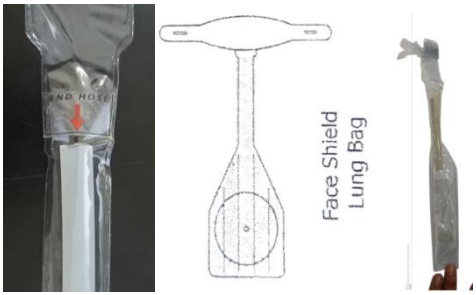
Picture7. Removing the mannequin's skin

2. Opening the body lock.



Picture8. Mannequin body lock

3. Prepare the lung bag (insert the hose to the limit, then fold it according to the instructions in the picture).

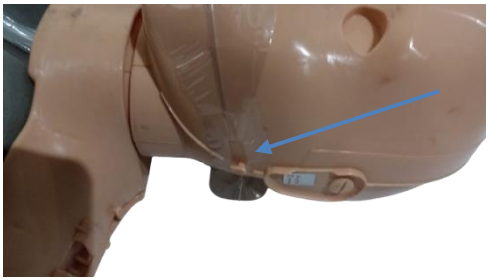


Picture9. Fold the lung bag

4. Insert the lung bag through the simulator's mouth, lift the simulator's chin to facilitate the process.

Picture10. put in the lung bag

5. Glue the double tip lung bag to your mouth, then hook the lung bag to the side of your head.



Picture11. Attach the lung bag

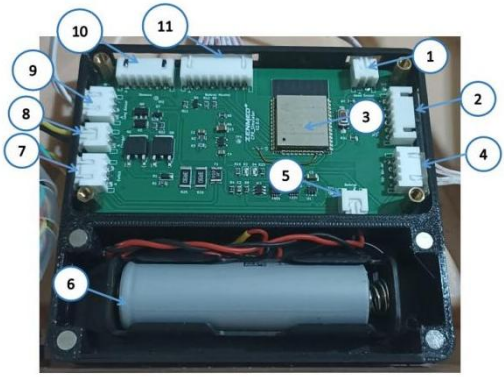
6. Reattach the skin to the head and body.

Picture12. Installing mannequin skin

Chapter 5: Introduction to Circuits

5.1 Main Board

The main board of the ZEN CPR model is equipped with a main processing IC, reset button, regulator module, and sensor connectors.



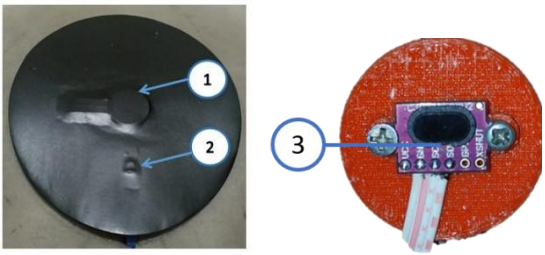
Picture13. Mannequin main board

Table4. Mainboard Instructions

No.	Name	Definition
1	Hand Sensor Connector	Primary Processing
2	Connectorprogrammer	5PIN, Interval: 2.54mm
3	Main processing IC	ESP 32 Wroom
4	Proximity sensor connector	3PIN, Interval: 2.54mm
5	Battery connector	2 PINs, Interval: 2.54mm
6	Battery	Lion 2200 mAH
7	S connectorwitch	3 PINS, Interval: 2.54mm
8	Charging Connector	2 PINs, Interval: 2.54mm
9	Connector Ventilation sensor	3PIN, Interval: 2.54mm
10	Overall sensor connector	6PIN, Interval: 2.54mm

11	Indicator LED connector	8PIN, Interval: 2.54mm

5.2 Sensors



Picture14. Censorship

Table5. Censorship instructions

No.	Name	Definition
1	Pressure Sensor	Hand position detection
2	Magnet Sensor	Measuring ventilation volume
3	Proximity Sensor	Measuring compression depth

Chapter 6: Problem solving

6.1 Introduction

This section provides information that can help troubleshoot mannequin problems.

6.2 Battery Capacity Check

Several variables influence the mannequin battery runtime:

a. Usage time
b. Charge discharge frequency
c. Room temperature
d. Excessive charge duration

6.3 Cleaning the Mannequin Surface

WARNING!Do not use an autoclave, sterilize ethylene oxide, or immerse the mannequin in liquid.

WARNING!Do not allow water or other liquids to spill on the mannequin. Unplug the AC power cord from the mannequin before cleaning or disinfecting.

WARNING!If equipment accidentally gets wet, it should be dried externally and allowed to dry completely before use.

6.4 Long Term Storage

If the mannequin will be stored for a long period of time, package the mannequin and accessories in the original packaging material and shipping carton. Long-term storage facilities must meet the following requirements:

a. In the packaging
b. At room temperature, and not under direct sunlight.
c. Relative humidity of40-60% (non-condensing)
d. No periodic checks are required

6.5 Operator Troubleshooting Chart

Table6. Solution to problem

Problem	Possible causes	Corrective action
The mannequin power LED does not light up.	Battery problem	Check battery condition
	Faulty switch wiring	Check the connections using a multimeter

Problem	Possible causes	Corrective action
Battery operating time is too short on a fully charged battery	Battery damaged	Contact an authorized repair center
The battery indicator does not light up	There is a problem with the battery indicator cable	Check cable connections
	The system has not turned on	Check the switch
The mannequin is not detected in the app	The smartphone's Bluetooth has not been activated	Make sure Bluetooth is active and application permissions are met
The compression depth does not match the display in the application	The compression depth sensor is off-center and facing upwards	Check the position of the sensor and correct its position
	There is a problem with the sensor data cable	Check with a multimeter if there is a problem, replace the cable with a new one
The chest does not expand when ventilated	There is interference with the airways from the mouth to the chest, usually in the neck area	Correct the position of the tube inside the plastic lung
	There is a plastic part of the lung that is torn or has a hole	Contact a technician or distributor for plastic lung replacement

Problem	Possible causes	Corrective action
The ventilation bar display moves erratically	The position of the magnet is not correct	Position the magnet exactly parallel to the magnetic sensor
	There is interference with the sensor data cable	Re-solder the connection