Service Manual

CPR Simulator

P1

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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 P1 CPR simulator service manual is intended as a reference for maintenance and repair of the CPR simulator 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 simulator from its shipping carton.

1. Before opening the simulator 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 simulator.
3. With the simulator 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 simulator for normal operation.

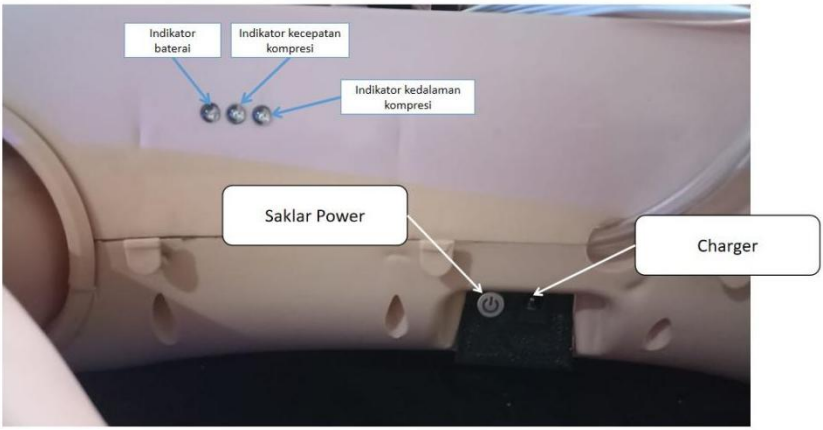
Table1. Service Interval

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 simulator has been dropped 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 simulator has not passed functional verification	Repairs are followed by safety checks and functional verification	“Functional Verification”

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

2.4 Battery Indicator Light

On the CPR Simulator P1 device there is a battery indicator in the form of a light on the right body of the simulator as seen in the following image.



Picture1. Interface on the simulator

Table2. Description Battery indicator

No.	Information	Instruction
1	Flashing red	Battery less than 25%
2	Green	Charging Condition
3	Constant red	Safe battery percentage

2.5 Power Button and Charger Connector

Table3. Power description on the simulator

No.	Information	Instruction
1	Indicator light	The indicator light will light blue when the switch is turned on, and if the battery is not discharged.
2	Battery	The simulator device is equipped with a rechargeable Li-Ion battery.
3	Charger Hole	Connect to a 5v power supply to charge the battery on the simulator

Chapter 3: Functional Verification

3.1 Introduction

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

WARNING!If the simulator 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 simulator 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 simulator is ready for use

3.3 Security testing

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

3.3.1 Risk (Leakage) Current Test

Current (leakage) risk tests should be performed to verify that the patient remains electrically isolated from the simulator 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 simulator 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 simulator is fully assembled. If the simulator has been stored for more than one month without the simulator 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 simulator turned off.

3.4.1 Power system

The following steps check the integrity of the simulator power system.

1. Turn off the simulator by pressing the toggle button
2. Restart the simulator
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 simulator.
2. Make sure the battery indicator is on and the simulator is powered on properly.
3. Then open the CPR Simulator application, then check whether the simulator device can be found by the application.
4. If found then try to connect by pressing the start button.
5. Perform several compressions on the simulator, then ensure that the compression animation runs well.
6. Turn off the simulator

Chapter 4: Repair Procedures

4.1 Introduction

Instructions on how to disassemble the simulator, disassemble electronic modules, remove batteries and remove sensors.

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

4.2 Dismantling the simulator

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

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

Picture2. Simulator lock

2. After the silicone skin is removed, the simulator cover will be visible.

Picture3. Simulator bust cover

3. To gain access to the electrical board and sensors, all you need to do is remove the simulator's chest cover.

Picture4. The interior of the P1 simulator

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.

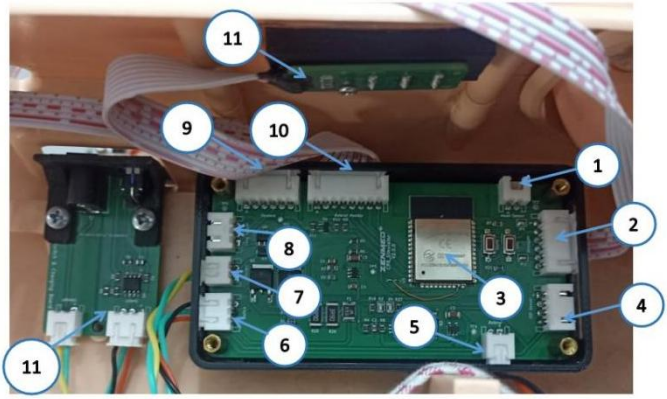
Picture5. Open the battery cover

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

Chapter 5: Introduction to Circuits

5.1 Main Board

The main board of the P1 simulator is equipped with a main processing IC, reset button, regulator module, and sensor connectors.



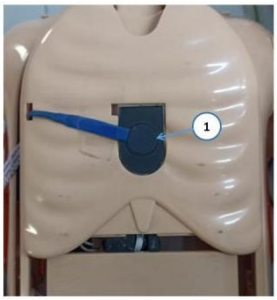
Picture6. Simulator main board

Table4. Description of simulator board components

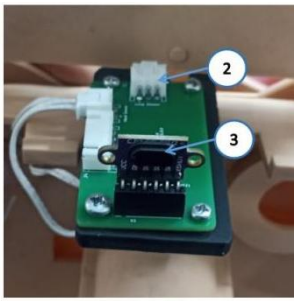
No.	Name	Definition

1	Hand sensor connection	2PIN, Interval: 2.54mm
2	Programmer Connector	6 PINS, Interval: 2.54mm
3	Main processor	ESP32 room
4	Connectorproximity sensor	4PIN, Interval: 2.54mm
5	Battery connector	2PIN, Interval: 2.54mm
6	Connectorswitches	3PIN, Interval: 2.54mm
7	Connectorchargers	2PIN, Interval: 2.54mm
8	Connectorventilation sensor	3PIN, Interval: 2.54mm
9	Connector*LED indicators*	6PIN, Interval: 2.54mm
10	ConnectorOverall sensor	8PIN, Interval: 2.54mm
11	PCB LED indicators	Contains 3 RGB LEDs
12	PCB Switch and charging	Contains DC Jack and momentary button

5.2 Sensors



Picture7. FSR sensors



Picture8. Distance and hall sensors

Table5. Description of sensors on the simulator

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

Chapter 6: Problem solving

6.1 Introduction

This section provides information that can help troubleshoot simulator problems.

6.2 Battery Capacity Check

Several variables influence the simulator's battery runtime:

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

6.3 Cleaning the simulator surface

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

WARNING!Do not allow water or other liquids to spill onto the simulator. Unplug the AC power cord from the simulator 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 simulator will be stored for a long period of time, package the simulator and accessories in the original packaging material and shipping carton. Long-term storage facilities must meet the following requirements:

a. In the
b. From -40 to 75 °C (-40 to 167 °F)
c. Relative humidity from 10-95% (non-condensing)
d. No periodic checks are required

6.5 Operator Troubleshooting Chart

Table6. Solution to problem

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