Service Manual

Efficia DFM100

Defibrillator/Monitor

866199

PHILIPS

Notice

About This Edition

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WARNING: Radio frequency (RF) interference coming from devices other than the Efficia DFM100 may degrade the performance of the Efficia DFM100. Electromagnetic compatibility with surrounding devices should be assessed prior to using the defibrillator/monitor.

Use of supplies or accessories other than those recommended by Philips may compromise product performance.

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The Efficia DFM100 complies with the requirements of the Medical Device Directive 93/42/EEC and carries the CE 0123 mark accordingly.

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Conventions Used in This Manual

This book contains the following conventions:

WARNING: Warning statements alert you to a potential serious outcome, adverse event or safety hazard. Failure to observe a warning may result in death or serious injury to the user or patient.

CAUTION: Caution statements alert you to where special care is necessary for the safe and effective use of the product. Failure to observe a caution may result in minor or moderate personal injury or damage to the product or other property, loss of data, and possibly in a remote risk of more serious injury and/or cause environmental pollution.

NOTE: Notes contain additional information on usage.

TIP: Tips provide hands-on insight into using or servicing this product.

The "bull's eye" icon indicates a process or a procedure (a set of steps to achieve a certain goal).

The "tools" icon indicates a list of tools or equipment required for a certain task.

Label Text or

Label Text represent keywords.

Online viewing only:

See "Introduction" **on page 1** represents hypertext links, which will display as blue; click on the blue link to go to that destination.

Click for quick access

Abbreviations

Name	Abbreviation
Automated Test Summary	ATS
Customer Service Order	CSO
End-tidal Carbon Dioxide	$EtCO_2$
Electrostatic discharge	ESD
Efficia DFM100 defibrillator/monitor	Efficia DFM100; device
User Interface PCA	UI PCA
Non-invasive Blood Pressure	NBP
Patient Contact Indicator	PCI
Printed Circuit Assembly	PCA
Pulse Oximetry	SpO_2
System-on-Module PCA	SOM PCA

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NOTES

1

Introduction

This Service Manual provides the information needed to successfully service the 866199 Efficia DFM100 defibrillator/monitor. This manual provides you with information on troubleshooting, repair, and performance verification and safety testing of the defibrillator/monitor. There is also information on the theory of operation, maintenance procedures, and ordering parts and supplies.

NOTE: This manual describes all optional features. If your device does not have some of the optional features listed, then disregard the features, controls, and related information described in the manual.

Who Should Use this Manual

The intended users of this manual are technical personnel who have been trained in the safe and proper servicing of the Efficia DFM100.

How to Obtain Training

To assist in training, the Service Training course is available through Philips Online Learning Center at https://www.theonlinelearningcenter.com/Default.aspx.

Overview

In this chapter, you will find general information that you should know before servicing the Efficia DFM100. Detailed information regarding controls, operation, and capabilities of the device can be found in the *Efficia DFM100 Instructions for Use* that was shipped with the product and provides information on setting up the device and regular maintenance procedures, such as performing operational checks. We recommend you review the *Efficia DFM100 Instructions for Use* before servicing this device. This Service Manual assumes you are familiar with the controls and basic operations.

This chapter is organized into the following sections:

Features and Capabilities . . . . . p. 2
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Features and Capabilities

The Efficia DFM100 is a lightweight, portable, defibrillator/monitor. It provides four clinical modes of operation: Monitor, Manual Defibrillation/Synchronized Cardioversion, AED (optional), and Pacing (optional).

Monitor Mode you can monitor up to three ECG waveforms at a time, acquired through a 3- or 5-lead ECG set or multifunction electrode pads. Optional monitoring of pulse oximetry (SpO_2), end-tidal Carbon Dioxide ($EtCO_2$) and non-invasive blood pressure (NBP) are also available. Measurements from these parameters are presented on the display and alarms are available to alert you to changes in the patient's condition. You can also display the Vital Signs Trending Report to view key monitoring parameters and their measurements.

Manual Defibrillation Mode offers simple, 3-step defibrillation. You analyze the patient's ECG and, if appropriate: 1) select an energy setting, 2) charge, and 3) deliver the shock. Defibrillation may be performed using paddles or multifunction electrode pads. Manual Defibrillation Mode also allows you to perform synchronized cardioversion and internal defibrillation.

In **AED Mode (optional)**, the Efficia DFM100 analyzes the patient's ECG and determines whether a shock is advised. Voice prompts guide you through the 2-step defibrillation process, providing easy-to-follow instructions and patient information. Voice prompts are reinforced by messages that appear on the display.

The AED Mode incorporates the Philips' SMART Analysis algorithm for ECG analysis and SMART Biphasic waveform for defibrillation.

Optional **Pacer Mode** offers non-invasive transcutaneous pacing therapy. Pace pulses are delivered through multifunction electrode pads using a monophasic waveform in Demand or Fixed modes.

The Efficia DFM100 is powered by a rechargeable lithium-ion battery. Available battery power is easily determined by viewing the battery power indicators located on the device display and the battery itself. An AC power supply may serve as a secondary power source and for continual battery charging.

The Efficia DFM100 performs Automated Tests on a regular basis. The status of the device's critical functions is reported to the Ready For Use (RFU) indicator. The RFU indicator communicates the status of your device, letting you know if it is operating correctly, needs attention, or is unable to deliver therapy. In addition, the manually performed Operational Check ensures that every part of the Efficia DFM100 functions properly.

The Efficia DFM100 automatically stores critical event and trend data in its internal memory. The Efficia DFM100 also enables you to copy data and event information to a USB flash drive for downloading to a compatible data management solution.

The Efficia DFM100 is highly configurable to better meet the needs of diverse users. Be sure to familiarize yourself with the device's configuration before servicing the Efficia DFM100.

Tour of the Device

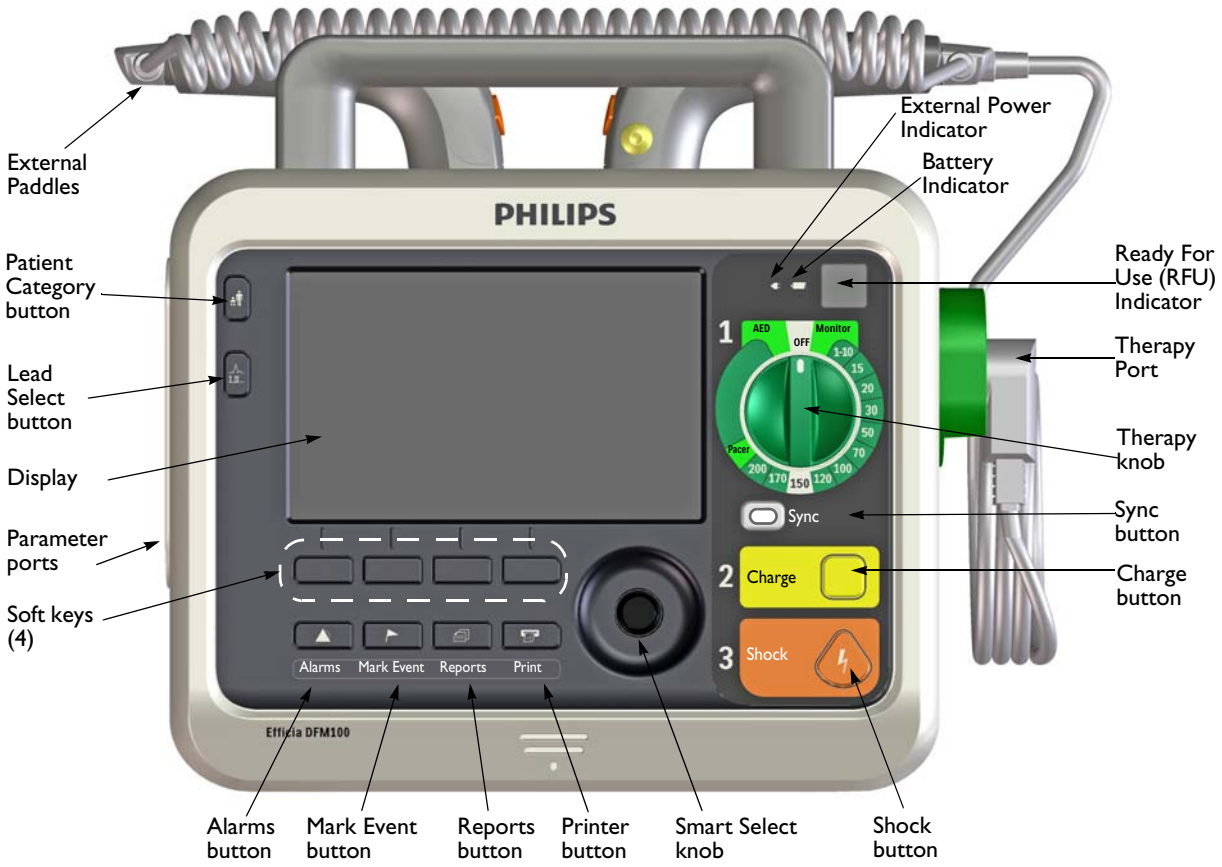
This section gives an overview of the outside of the device.

Front of the Device

If you have a non-English or non-Japanese version of the device, then no **Alarms**, **Mark Event**, **Reports**, or **Print** text labels or Japanese test labels are present at the functional buttons below the screen. The button functions remain the same regardless of the label presence.

Additional controls and indicators are located on the external paddles.

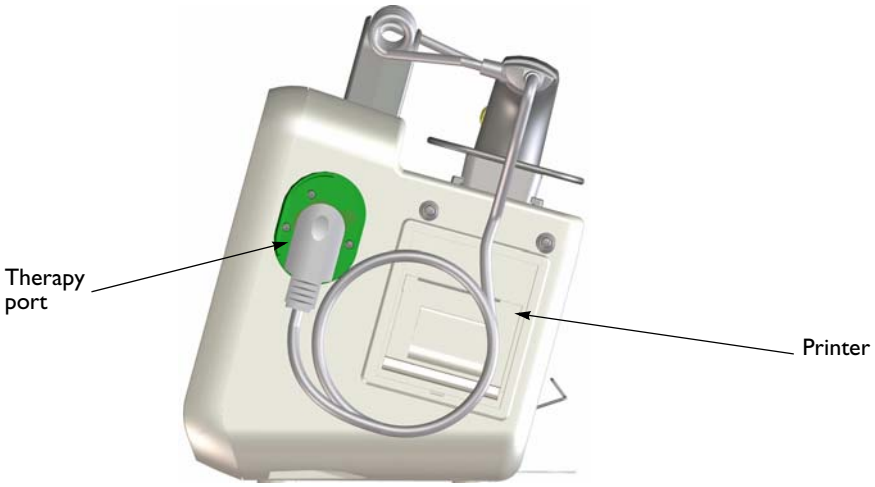
Figure 1 **Efficia DFM100 Front View**



Right (Therapy) Side

The right side of the Efficia DFM100 is dedicated to administering therapy and printing. It contains a therapy port for paddles (external or internal) or a therapy cable with multifunction electrode pads. It also contains the printer.

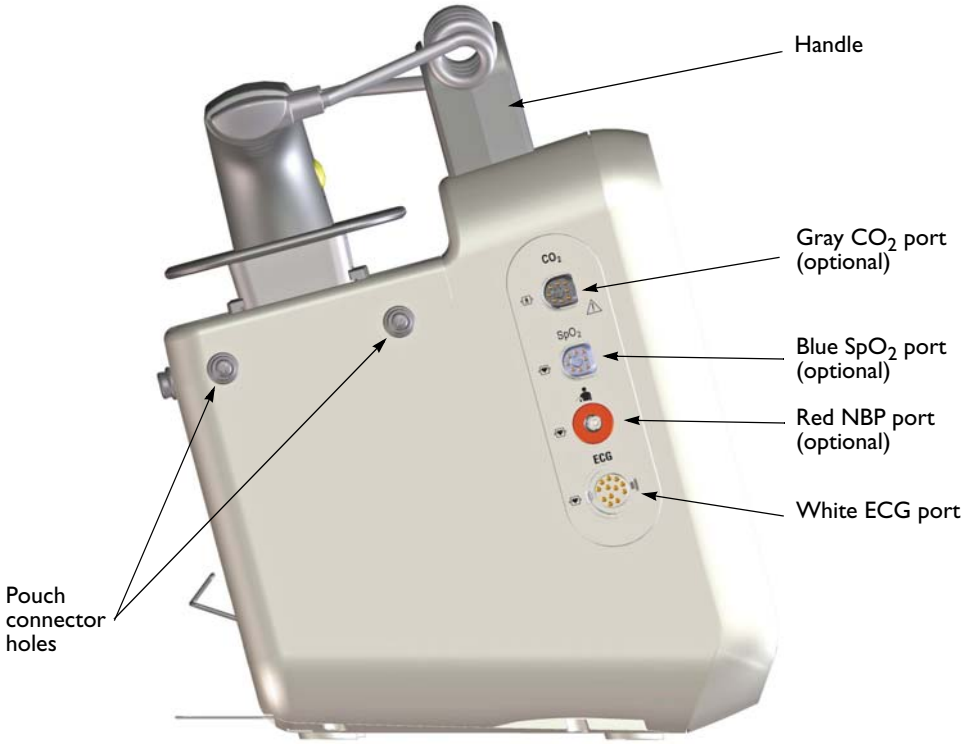
Figure 2 **Right Side View**



Left (Monitoring) Side

The left side of the Efficia DFM100 is dedicated to monitoring key vital signs. It has ECG port and optional $EtCO_2$, SpO_2, NBP ports.

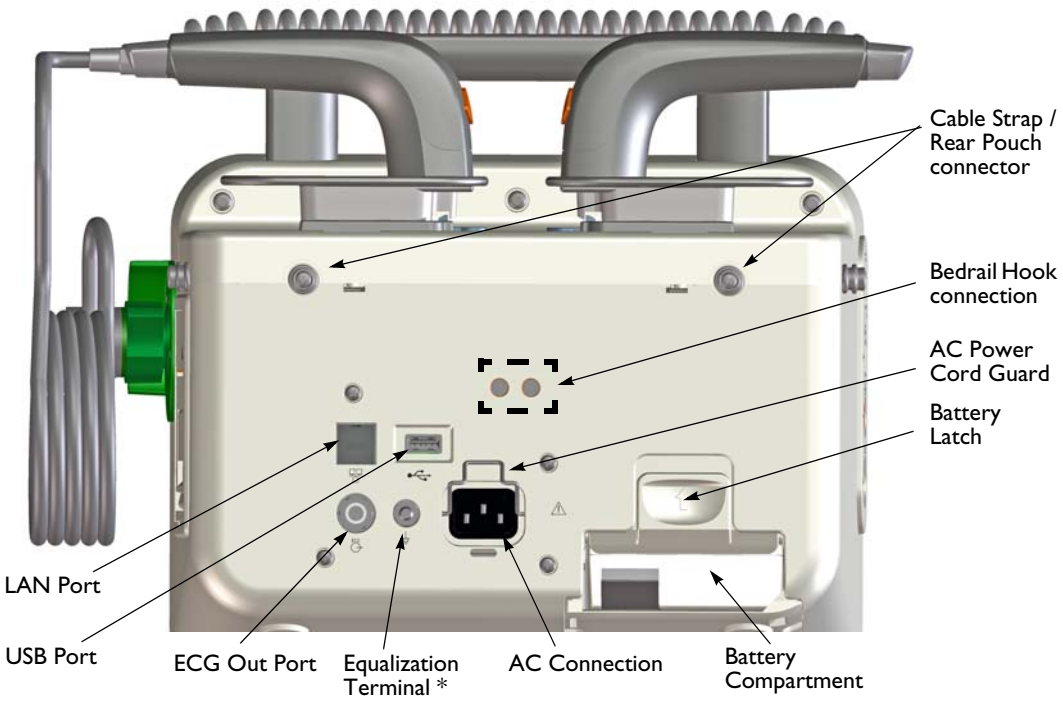
Figure 3 **Left Side View**



Rear Side

The back panel of the Efficia DFM100 has a compartment for the Lithium Ion battery. It also contains the AC power connection, the ECG Out jack to connect to an external monitor, the USB port, the equalization terminal, and the LAN port.

Figure 4 **Rear Side View**



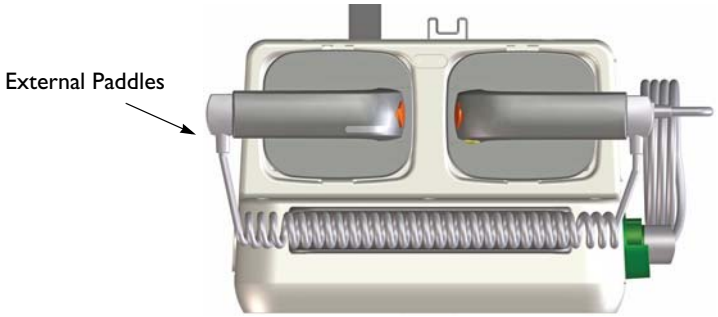
*- When the Efficia DFM100 is used together with the other devices, their equalization terminals can be connected together to eliminate any potential electrical differences between the two.

WARNING: Do not connect a LAN cable to the Efficia DFM100 while in a clinical mode. Incorrect ECG diagnosis may result due to excessive electrical background noise.(Refer to IFU)

Top Side

The top of the Efficia DFM100 has a handle for easy transport and, if optional external paddles are present, they reside in the paddle tray on the top of the device.

Figure 5 **Top Side View**



Additional Features

The additional features of the Efficia DFM100 may include:

- Therapy Cable Collar
- Cable Straps
- Cradle
- Carry Bags

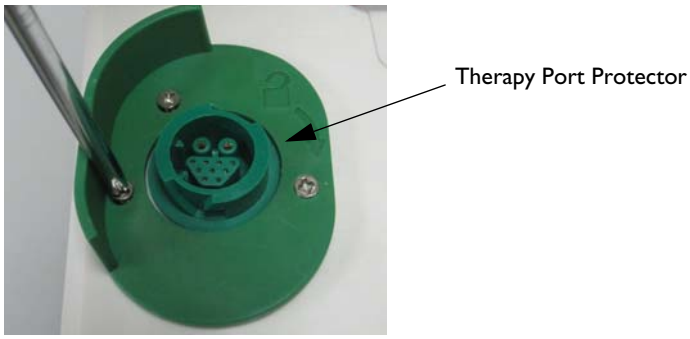
Therapy Cable Collar

When the Efficia DFM100 is used in transport or high-vibration environments, Philips strongly suggests the device be fitted with the Therapy Cable Collar before placing the device into service. The collar adds an extra level of security to prevent excessive wear and vibration with the Therapy port. For Efficia DFM100 EMS devices, the Thearpy Cable Collar base comes installed from the factory.

To Install the Therapy Cable Collar Base

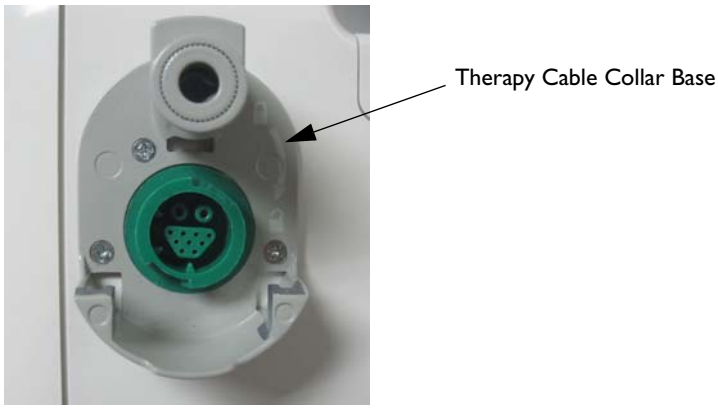
1 Remove the three M3x10 flat-head screws to remove the Therapy Port Protector. See Figure 6.

Figure 6 **Remove Therapy Port Protector**



2 Install the three M3x10 flat-head screws to install the Therapy Cable Collar Base. See Figure 7.

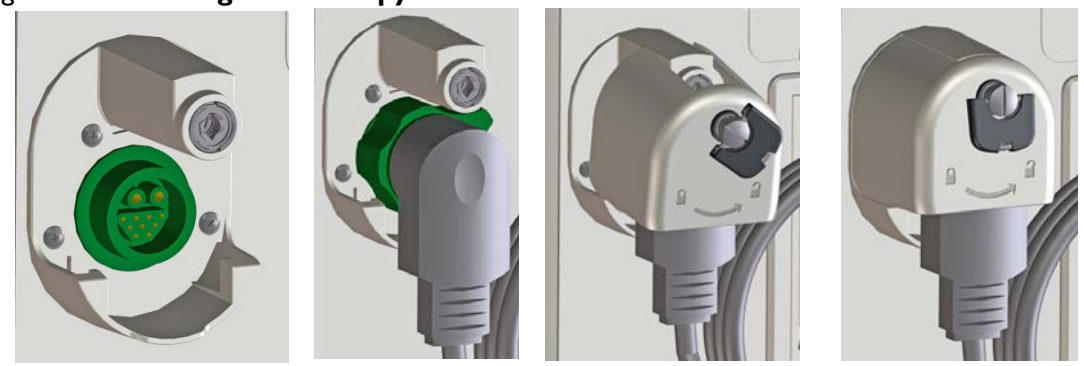
Figure 7 **Install Therapy Cable Collar Base**



To Connect the Therapy Cable and install the Therapy Cable Collar Lid:

1. With the base already installed, plug the Therapy Cable into the green connector port.
2. Slide the feet of the Therapy Cable Collar Lid into the grooves on the Therapy Cable Collar base and push the top of the Lid into place. See Figure 8.
3. Grab the Locking Key and push in while turning clockwise until the Key locks into place.
4. To remove the collar lid, lift up on the lid latch and turn counter clockwise. After the Key unlocks, lift the lid out of place. You can also use a flat-head screwdriver to engage and disengage the cover.

Figure 8 **Locking the Therapy Cable Collar Lid into Place**



Base already Installed | Install Therapy Cable | Install Collar Lid | Lock Collar Lid

WARNINGS: If you use the Efficia DFM100 in a transport or high-vibration environment without the Thearpy Cable fully installed, your device is susceptible to premature Therapy port and cable wear and potential failure which may result in a delay in therapy.

Do not leave the Therapy collar base installed without the lid in place. The exposed metal pole could get caught on cables or users' clothing and potentially cause injury.

Cable Straps

To aid with cable management, straps can be snapped on to the side of the Efficia DFM100 in the predefined snap locations or they can be attached to the side carry bags.

Cradle and Side Carry Bags

To install the Efficia DFM100 cradle and side carry bags, all you need is a Phillips-head screwdriver.

To install the cradle and side carry bags:

1. Open the cradle and set the Efficia DFM100 down snugly inside.
2. Taking one cradle edge at a time, lift the edge into place.
3. Use Phillips-head screwdriver, screw two of the snaps provided into the predefined holes on the cradle and into holes on the device. See Figure 9.
4. Use the other four snaps and repeat on the other side and back of the Efficia DFM100.
5. Stretch the long gray cradle strap across the top of the device and thread through the small metal loop. Pull snug and secure in place with the hook and loop fasteners.
6. Take the carry bag with the plastic paper guide inside and align it with the printer on the side of the device. Sanp the bag into place, starting with the bottom first and then the top. Press the hook and loop fasteners together. Tug lightly to confirm a solid connection.

7 Repeat step 6 with the other side bag and the rear bag. See Figure 9.

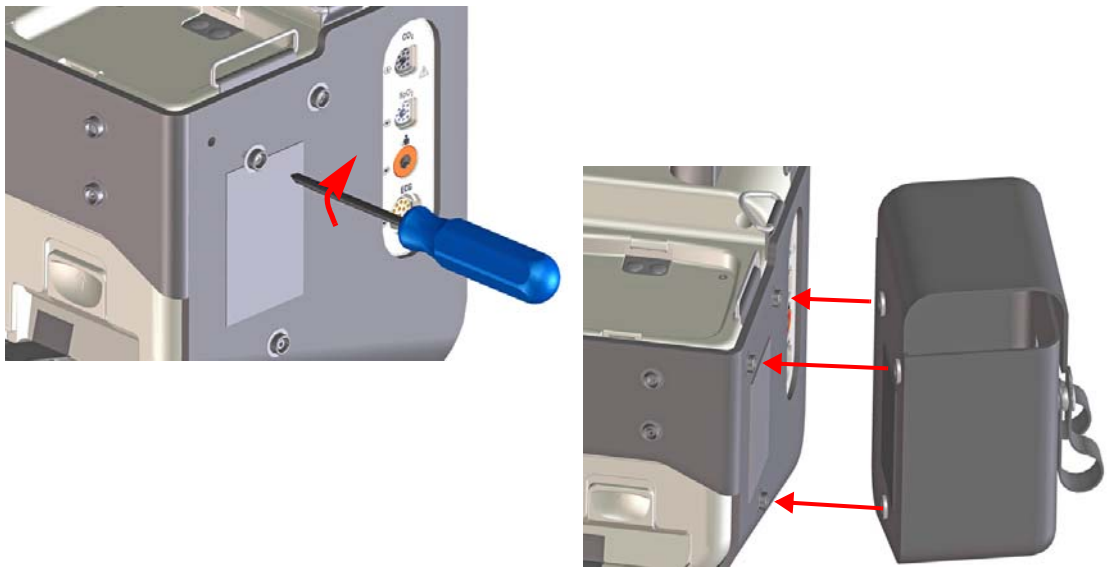
8 **Optional tray cover pouch**: If you want to install the tray cover pouch, use the hook and loop strip to fasten one dege of the bag through the metal loop on one side of the device. Stretch the pouch across the paddle tray and fasten the other side. Tug lightly to confirm a solid connection.

9 **Optional shoulder strap**: Hook the strap into place, using the front metal loops on each side of the cradle.

NOTES: When snapping the therapy/printer side bag in place, confirm that the printer paper path is clear so the strip can come out of the printer freely.

For in-hospital use, the side carry bags can be installed without the cradle.

Figure 9 **Attaching the Cradle and Side Carry Bags**



Docking Station Installation

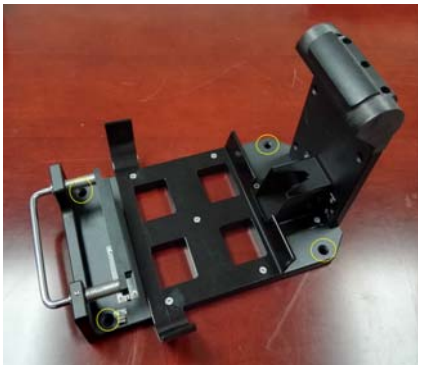
This Installation Guide provides the information needed to successfully install the 866199 Efficia DFM100 defibrillator/monitor Docking Station with the device on the ambulance shelf as **Shelf Mount**. The docking station is designed for installing the DFM100 Defibrillator/Monitor with pouch system.

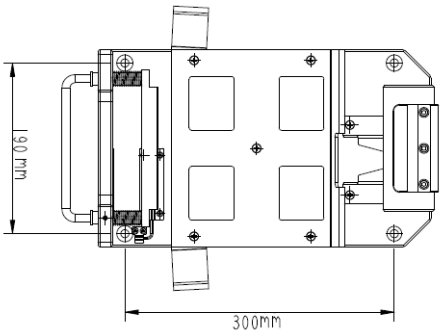
NOTE: Be sure that the proper ambulance shelf is available before installing the docking station.

To Install the Docking Station

1 Place the Docking Station on the ambulance shelf, securely fix the docking station on the shelf by installing the four M8 x30 screws into the four screw holes located on the base of the docking station. The installation size of the four mounting holes on the bottom plate is as below picture shows.

Figure 10 **Docking Station Installation-1**

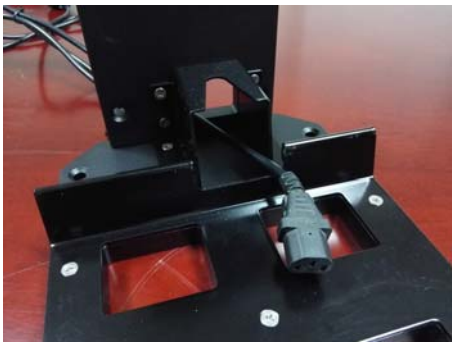


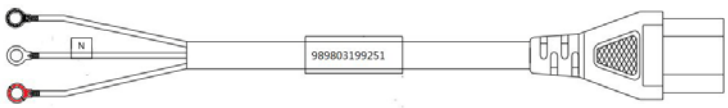


2 Connect the three wires end of the power cable to the high output terminals on the AC inverter located in the ambulance.

3 Let the socket end of the power cable pass through the docking station.

Figure 11 **Docking Station Installation-2**





Power Cable for Docking Station

To Install the DFM100 Device

1 Secure the bedrail mount to the back of the device.
   - **a** Secure the top two M 4x25 screws with washers first (A position).
   - **b** Secure the bottom two M 4x12 screws with washers (B position).
   - **c** Do not cross-thread or overtighten the screws.

Figure 12 **DFM100 Device Installation-1**

M 4x12 M 4x25

2 Install the cradle and side carry bags. Accessories can be installed before or after DFM100 with pouch system placed onto the docking system.

Figure 13 **DFM100 Device Installation-2**

3 Insert the socket end of the power cable into the AC connection on the back of the device. Lower the locking lever to secure the connection.

Figure 14 **DFM100 Device Installation-3**

4 Use one hand to put the bedrail mount onto the docking station and use another hand to prop up the bottom of the device.

Figure 15 **DFM100 Device Installation-4**

The bedrail mount is locked along the edge of the bedrail mount stage.

5 After placing the bedrail mount onto the docking station, pull out the latch on the docking station and put the device onto the docking station. Loosen the latch and the DFM100 device is installed in the docking station.

Figure 16 **DFM100 Device Installation-5**

The latch is locked on the edge of the front case.

6 Use the Hex L wrench to lock the screw.

Figure 17 **DFM100 Device Installation-6**

7 The installation is completed.

General Service Information

Keep the following points in mind when servicing this product.

Installation

The Efficia DFM100 does not require installation. The *Efficia DFM100 Instructions for Use* (IFU) describe the setup required before placing the device into service, as well as configuration options (see "Passwords" below for the configuration password). All setup activities are designed to be performed by personnel trained in the proper operation of the product.

To obtain a copy of the *Efficia DFM100 Instructions for Use* and other Efficia DFM100 documentation in your local language visit: http://www.philips.com/ProductDocs and follow links to Browse our document library —> Resuscitation/Defibrillators Products—> Efficia DFM100 (Marketing)—> Instructions for Use.

Display Menus

To display a menu, press the Smart Select knob to bring up the Main Menu. Then turn the Smart Select knob to scroll up or down through the available choices until the desired selection is highlighted. To activate the selection, press the Smart Select knob. Select **Exit** to close the menu without making a selection.

The menus have a wrap-around scrolling feature - once you reach the bottom of a menu, it automatically wraps around to the top of the menu and continues scrolling.

Passwords

A password is required in order to access some modes within the defibrillator/monitor. The passwords are:

- Service Mode: 73275
- Configuration Mode: 752749

Upgrades

Upgrades are available to add specific functionality to the device after purchase. Table 1 shows the available upgrades:

Table 1 **Efficia DFM100 Upgrades**

Upgrade #	Upgrade Function
866260	SpO_2
866261	NBP
866262	$EtCO_2$
866263	AED Mode
866264	External Pacing

Consult your sales representative, dealer, or distributor for the latest details. See also "Ordering Supplies and Accessories" on page 177.

Preventive Maintenance

Preventive maintenance and periodic operational checks are intended to be performed by the user. These topics are respectively covered in the "Maintenance" and "Operational and Shift Checks" chapters of the *Instructions for Use*.

The Maintenance chapter of this manual provides $EtCO_2$ testing procedures. Experienced and trained Efficia DFM100 users (e.g. nurses or biomedical and clinical engineers) may perform the EtCO2 test.

Repair Philosophy

Defibrillator/Monitor

The repair philosophy of the Efficia DFM100 is subassembly replacement. Examples of subassemblies are the printer, the Processor Printed Circuit Assembly (PCA), Therapy PCA, and selected connectors and other items. Repairs that involve replacing components on a PCA are not supported.

CAUTION: Individual component replacement should not be attempted. Component level repair is inadvisable due to the extensive use of surface mount technology and the high parts-density on the circuit boards. Unauthorized component replacement can impair performance of the Efficia DFM100 and void warranty.

WARNING: Remove all power sources (AC and battery) before opening the device. Failure to do so may allow the device to charge without warning and could result in serious injury or death.

Battery

The 989803190371 lithium-ion battery is rechargeable. At the end of the battery's useful life, it should be recycled or discarded according to local regulations and replaced. Refer to the *Efficia DFM100 Instructions for Use* for additional information.

For information on ordering replacements, see "Ordering Supplies and Accessories" on page 177.

WARNING: Never crush, penetrate, or attempt to open lithium-ion batteries. Never incinerate lithium-ion batteries. High case temperatures resulting from abuse of the battery could cause physical injury. The electrolyte is highly flammable. Rupture of the battery pack may cause venting and ignition of the flammable cell gases.

CAUTION: Due to their high energy density, lithium-ion batteries can deliver significant power. Use care when working with or testing lithium-ion batteries. Do not short-circuit the terminals.

Accessing Service Mode

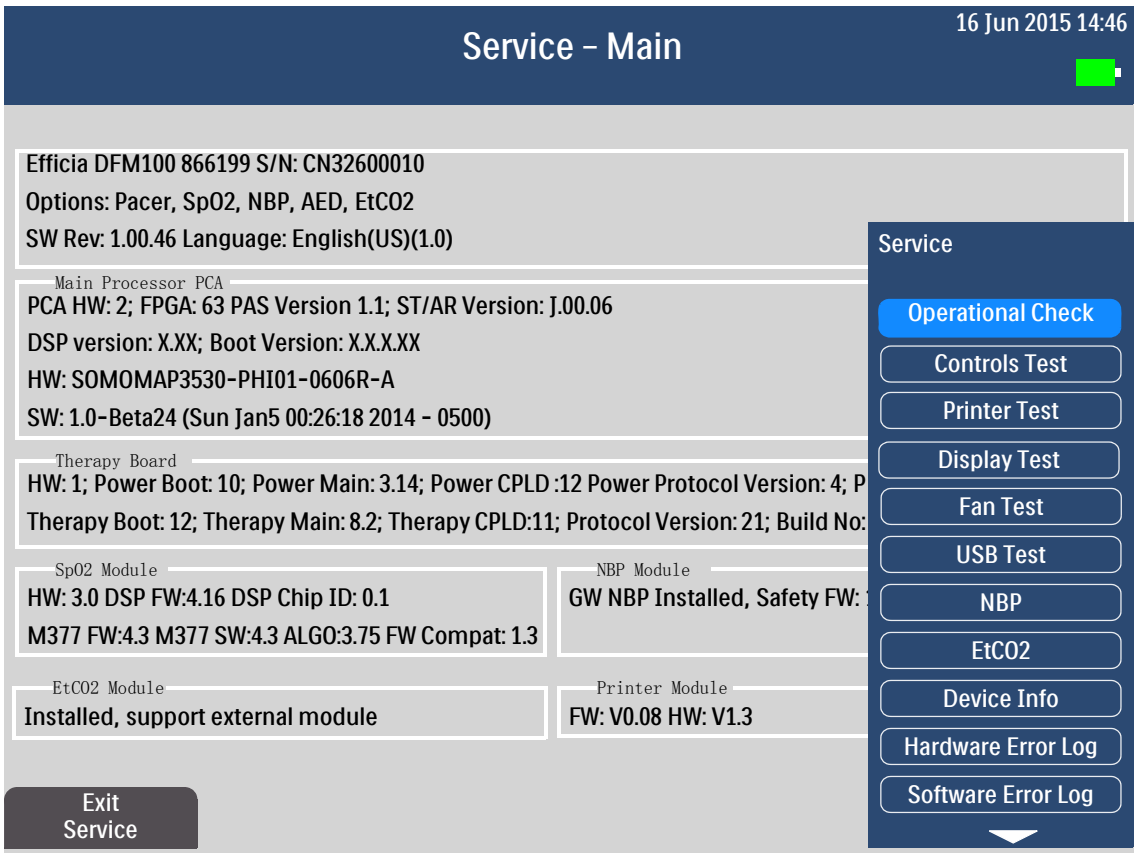
WARNING: Be sure that the defibrillator/monitor is not connected to a patient when performing any function in Service Mode.

NOTE: Make sure that you insert a sufficiently charged battery (at least two LEDs light up) into the device or connect to AC power when you are performing functions in Service Mode.

To access Service Mode:

1. Turn the Therapy Knob to **Monitor**.
2. Press the Smart Select knob to bring up the Main Menu.
3. Navigate to **Other** and press the Smart Select knob.
4. From the **Other** menu, select **Service**.
   The message appears: **Leaving clinical mode. Patient monitoring will be turned off.**
5. Navigate to **Yes** and press the Smart Select knob to confirm the **Exit Clinical Mode?** request.
   You are prompted to enter a password.
6. Enter the password (73275) by scrolling through the list until the desired digit is highlighted.
7. Press the Smart Select knob to enter each digit.
8. Select **Done** when you have entered all the digits.
9. Press the Smart Select knob to display the Service Mode Main menu, as shown in Figure 18.

Figure 18 **Service Mode Main Menu**



Navigating in Service Mode

Service Mode uses the same navigation controls as normal operating mode:

- To select a menu item, use the Smart Select knob to highlight your choice, then select that choice by pressing the Smart Select knob.
- To exit Service Mode and return to clinical mode, press the **Exit Service** soft key.
- To return to the Service Mode Main menu from any service screen press the **Main Service** soft key.

NOTE: The device's default configuration settings are restored when you return to clinical mode after exiting Service Mode.

Service Mode Functions

You can perform a variety of activities from Service Mode, as follows:

- Run an Operational Check (Op Check), see "Operational Check" on page 36 for details.
- Print and update the Device Info, see "Device Information" on page 17, "Entering the Serial Number" on page 124, and "Enabling Options" on page 126.
- View, print, and clear the Hardware and Software Error logs, see "Error Log Messages" on page 44.
- Perform test on the NBP module — See "NBP Monitoring Problems" on page 65.
- Perform maintenance on the $EtCO_2$ module — See "EtCO2 Maintenance" on page 25.
- Run the Controls test, see "Controls Test" on page 160.
- Run the Printer test, see "Printer Test" on page 160.
- Run the Display test, see "Display Test" on page 162.
- Run the Fan test, see "Fan Test" on page 162.
- Run the USB test, see "USB Test" on page 163.
- Install software and change the device's language using the Software Support Tool — See "Software Upgrades" on page 19.
- View information about the device, such as model number, serial number, options enabled on the device, and the device's language — See "Device Information" below. Use the Device Info menu to enter the serial number and to enable options on the device after a SOM PCA repair. See "Entering the Serial Number" on page 124 for more information. Use the Device Info menu to export Hardware Error Log, Software Error Log, RFU and OpCheck Logs, Event Summary, or Events Details. See "Export Device Info" on page 18.

NOTE: You can print detailed information about your Efficia DFM100 defibrillator/monitor software version, circuit boards, and module levels through the Print Device Info option, available in clinical operating mode. See "Device Information" on page 17.

Device Information

You can print all detailed information of the Efficia DFM100 on serial number, software versions, options, printer, boards and module levels, and internal memory card capacity from the Print Device Info menu option.

You can also check all the information in Service-Main screen in service mode.

To print the device information:

1. Make sure a battery charged to at least 20% is in place, or that external power is connected.
2. Turn the Therapy Knob to Monitor.
3. Press the Smart Select knob to access the Main menu.
4. From the Main menu, select Other.
5. From the Other menu, select Print Device Info.
   Detailed information about the device is printed.

NOTE: Run an Operational Check after you have updated software, enabled an option, or performed a repair to update the device information.

Primary Label

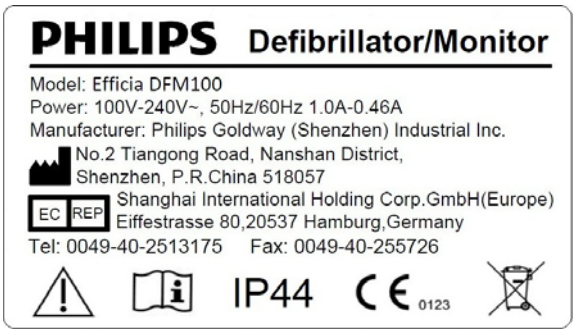
The Efficia DFM100 ships with a primary label shown in Figure 19 affixed to the bottom or the back of the Rear Case.

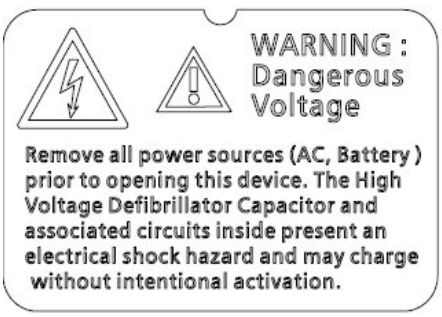
Figure 19 **Primary Label**

SN: CN*ywwnnnnn:*
y – last digit of the year of manufacturing
ww – week numbers of the year of manufacturing
nnnnn – unique number

OPT:
List of options installed on the device

OPT Key:
unique number matches the current options installed on the device
Input after software upgrade or language setting





Export Device Info

You can export all device logs (hardware error log, software error log, Op Check summary, Op Check details and Auto Test Summary) of the Efficia DFM100 from the **Export Device Info** menu option.

To export the device information:

1. Make sure a battery charged to at least 20% is in place, or that external power is connected.
2. Insert the Philips USB Data Drive (989803171261) to the DFM100.
3. Access the Service Mode Main menu as described in "Accessing Service Mode" on page 15.
4. From the Service Mode Main menu, select **Device Info**.
5. From the Main menu, select **Export Device Info**.
6. From the **Export Device Info** menu, select the option you prefer.

Other Resources

For additional information on the Efficia DFM100, refer to the following Learning Products:

- *Efficia DFM100 Instructions for Use*
- Efficia DFM100 *Service Web-based Training*

Other documents can be found on the Philips website at: http://www.philips.com/ProductDocs.

Maintenance

Introduction

This chapter describes routine maintenance on the Efficia DFM100 defibrillator/monitor.

Most routine maintenance, including periodic operational checks, paper replacement, cleaning, etc. is performed by the user. Refer to the *Instructions for Use* for detailed information on these maintenance procedures.

Service personnel are responsible for the following maintenance:

Software Upgrades . . . . . p. 19
EtCO2 Maintenance . . . . . p. 25

Software Upgrades

Perform Software upgrades when:

- Replacing Printer or Printer Assembly
- Replacing Processor, SOM, or Therapy PCA.
- Installing software or changing the device's Language
- Instructed by Goldway Customer Support or a Service Bulletin.

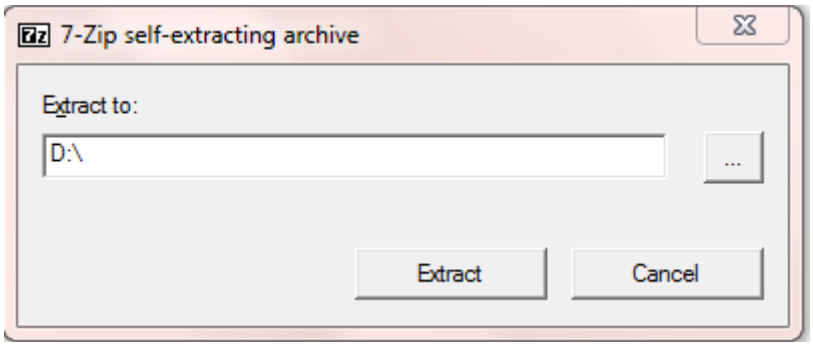
You may download software from the InCenter. Upload the software on a Philips USB Data Drive (989803171261) for Efficia DFM100 software upgrade.

NOTE: The RFU indicator may display a "red X" at some point during Software Upgrade. This is normal behavior, as long as an "hourglass" is displayed after the installation.

To choose proper language and upgrade files:

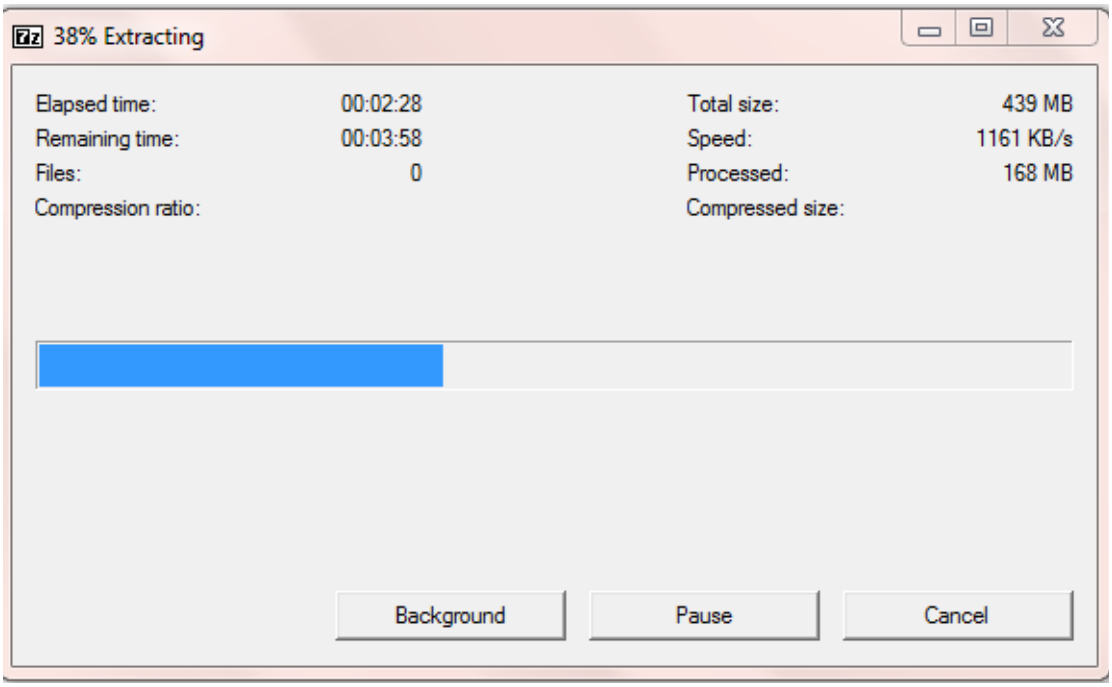
1. Download the latest revison software release_1.00.XX-XXXX from InCenter to local PC.
2. Connect Philips USB Data Drive (989803171261) to local PC.
3. Double click the icon 7z, a pop-up self-extracting window will be displayed. See Figure 20.

Figure 20 **Software Self-extracting Screen**



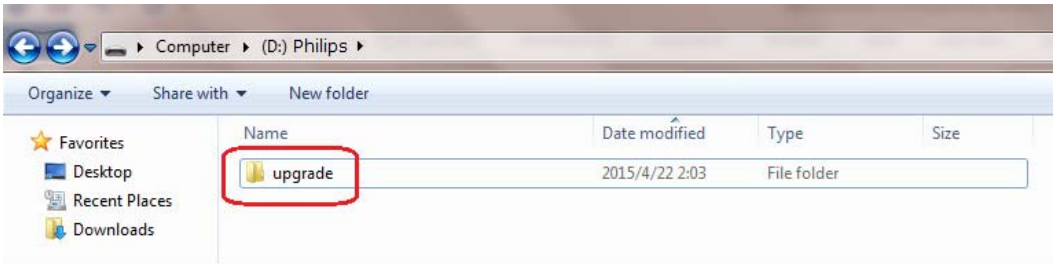
4 Extract the compressed software to the USB Drive. A pop-up progress indicator window will be displayed. See Figure 21.

Figure 21 **Software Extracting Progress Indicator**



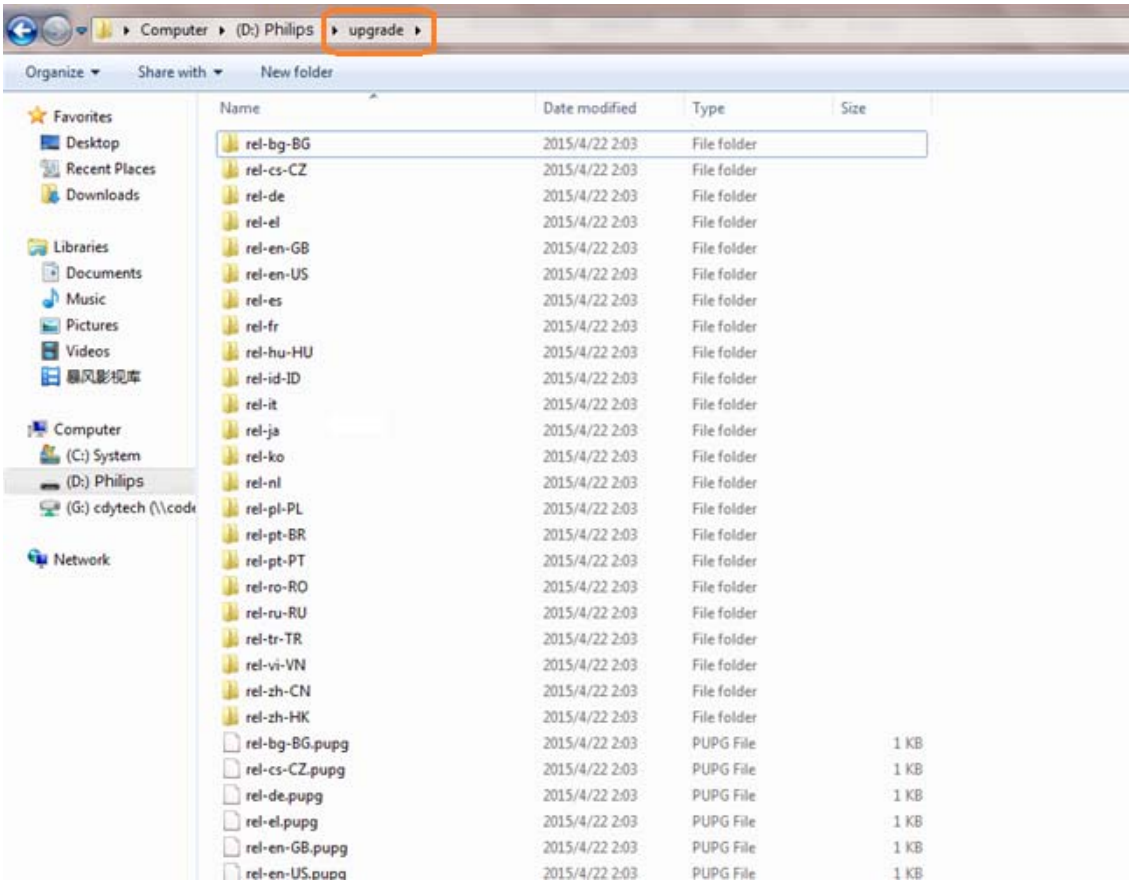
5 After the software extraction is done, a folder named “Upgrade” will be displayed in the USB driver. See Figure 22.

Figure 22 **Software Upgrade Folder**



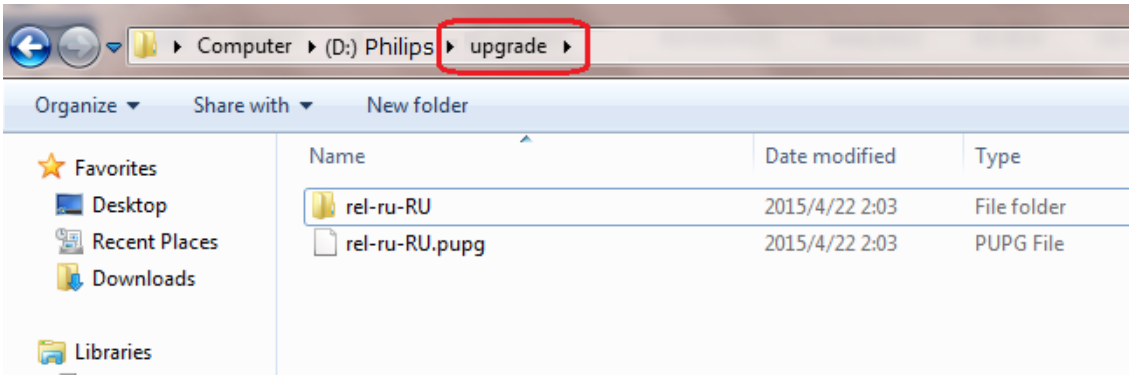
6 Open the “Upgrade” folder. All avaialbe languages will be displayed. See Figure 23.

Figure 23 **Software Upgrade Languages**



7 Choose the desired language folder and the **.pupg** file under the Upgrade folder. Delete all the other languages. See Figure 24.

Figure 24 **Software Upgarde Files**

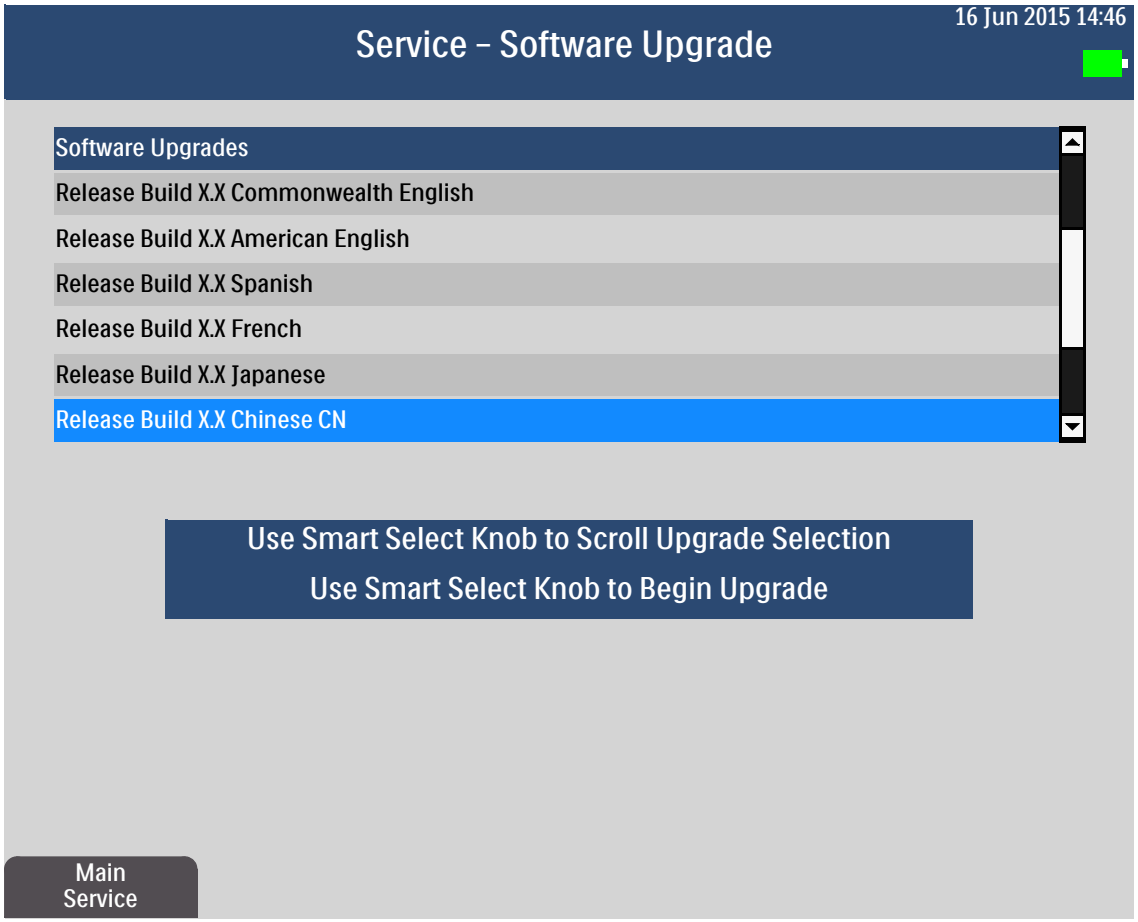


8 Unplug the USB Drive from your PC.

To install software onto the device or to change the device's language:

1. Make sure that you insert both a sufficiently charged battery (at least two LEDs light up) into the device and connect to AC power when you are performing functions in Service Mode. Be sure both AC power and charged battery are well connected.
2. Insert the USB flash drive with the desired software.
3. Access the Service Mode Main menu as described in "Accessing Service Mode" on page 15.
4. From the Service Mode Main menu, select **Software Upgrade**.
5. The screen displays the menu of available software releases and languages on the flash drive. See Figure 25.

Figure 25 **Software Upgrade Selection Screen**

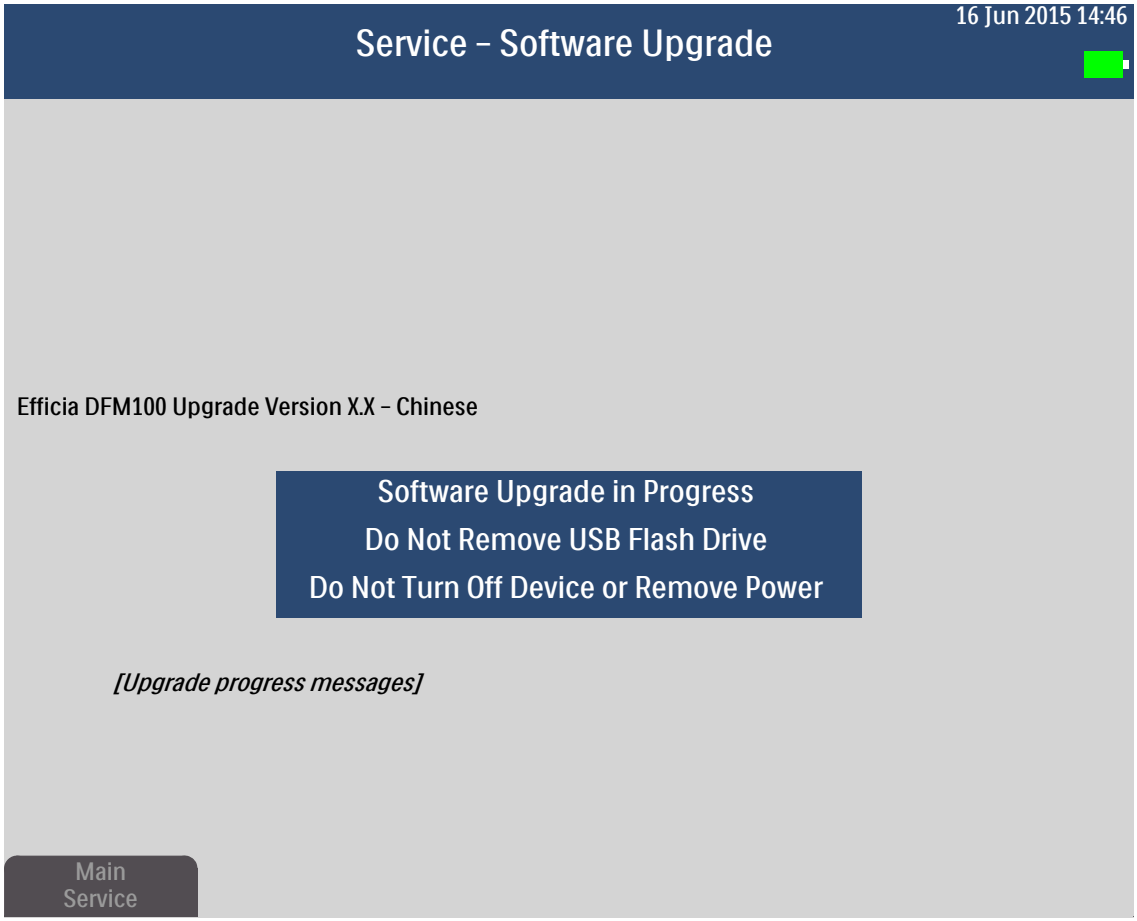


6. Rotate the **Smart Select Knob** to select the desired software release and language.
7. Press the **Smart Select Knob** to begin the upgrade.
   Press the **Main Service** soft key to exit the upgrade screen. Do not attempt to cancel the upgrade after it has started.

CAUTION: **Power interruption during software installation may disable the device and require an extensive repair.** After the upgrade starts, be careful not to interrupt the software installation process by removing the USB drive or power source or turning the Therapy Knob.

8. The software is installed on the device. This process takes a few minutes. While the software is being updated, progress messages are displayed and the soft keys are disabled. See Figure 26.

Figure 26 **Software Upgrade Progress Screen**



9 When the software or language installation process is complete, press the Smart Select Knob to select Acknowledge to restart the device.

10 Perform the Operational Check to ensure that every programmable chip of the device is updated. See "Operational Check" on page 36.

Software Upgrade Errors

If your software upgrade is terminated with the Upgrade Failed: Error *nn* message, then see Table 2 for solutions:

Table 2 **Software Upgrade Errors**

Error ID	Possible Causes	Suggested Solutions
1 or 2	• USB drive removed during upgrade • Intermittent USB drive contact	Make sure the USB drive is securely inserted and retry the upgrade.
3 or 4	Unsupported USB drive	Use a 2.0-compatible, ≤ 32 Gb USB drive,
	• Defective upgrade set • Tampered with the upgrade set	1. Re-download the software. 2. Make sure the upgrade set is not tampered with. 3. Retry the upgrade. 4. Note the attempted upgrade set and call for service if persists.
5	Software upgrade is attempted while the device is active (e.g. prints a report)	1. Remove the battery and AC. 2. Wait 10 sec. 3. Restore the battery and AC. 4. Retry the upgrade.
6	The upgrade set is incompatible with the current version of the device software.	Note the attempted upgrade set and call for service, see “Calling for Service” on page 76.
7 - 13	Defective USB drive	Replace the USB drive.
	Unsupported USB drive	Use 989803171261 Philips Brand USB drive.
	• Invalid upgrade set • Tampering with the upgrade set • Device error • Device memory corruption	Re-download the software and retry the upgrade. If persists, then export Hardware and Software Error Logs, note the attempted upgrade set, and call for service, see “Calling for Service” on page 76.

$EtCO_2$ Maintenance

To perform the Efficia DFM100 EtCO2 sensor flow rate check and accuracy check, you need:

$EtCO_2$ Calibration service tool (453564501951)

The Efficia DFM100 $EtCO_2$ option allows you to use two CO_2 sensor types:

- Mainstream (Capnostat series, requires a Capnostat airway adapter)
- Sidestream (LoFlo series, requires a LoFlo airway adapter)

Figure 27 **$EtCO_2$ Sensor and Adapters**

NOTE: To connect the adapter to an $EtCO_2$ Sensor, refer to Efficia DFM100 Defibrillator/Monitor IFU.

The $EtCO_2$ maintenance procedures consists of:

- Setting Ambient Pressure
- Flow Rate Check, and
- Accuracy Check

You will need the following supplies:

- 5% CO_2 gas cylinders
- Gas flow valve providing a flow rate of 2 liters per minute
- Flowmeter (for Flow Rate Check only)
- Modified airway adapter matching the CO_2 sensor to be checked. If no modified adapter is available, then, depending on your sensor type, you may create one similar to the one shown on Figure 29 on page 28 or Figure 30 on page 29.

Servicing $EtCO_2$

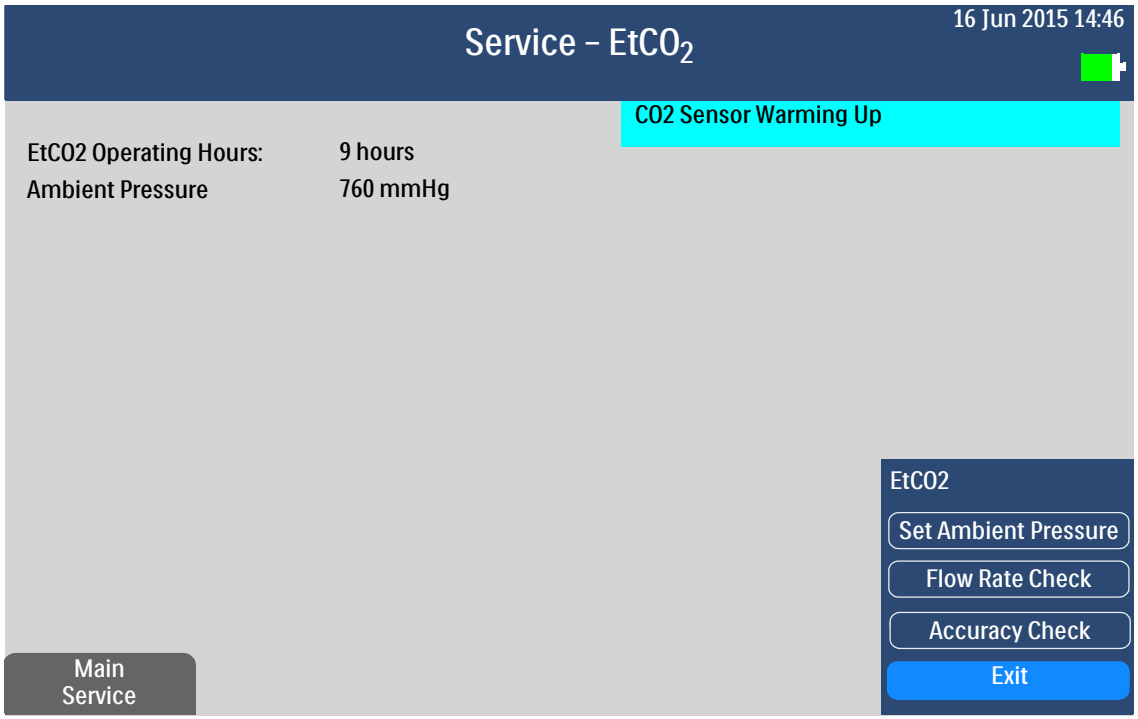
To service the $EtCO_2$ equipment:

1. Contact your sensor to the device.
2. Connect the modified airway adapter to your sensor.
3. Enter the Service Mode as directed in "Accessing Service Mode" on page 15.
4. Press the Smart Select Knob.
5. Navigate to the $EtCO_2$ and press the Smart Select knob again.

The Service - $EtCO_2$ screen appears. See Figure 28 on page 26.

Servicing $EtCO_2$ Sensor

Figure 28 **$EtCO_2$ Service Screen**



Setting Ambient Pressure

Ambient pressure depends on your facility's altitude above the sea level. If your healthcare facility is located in a tall building, then you may consider the floor altitude influence on the ambient pressure. The ambient pressure variations due to the weather and air temperature changes usually are not significant enough and may be ignored.

Verify and, if necessary, adjust the Ambient Pressure setting after your DFM100 gets moved to a different location, especially to a different altitude.

WARNING: Wrong Ambient Pressure settings can lead to incorrect $EtCO_2$ readings which may alter the clinical picture.

Set the Ambient Pressure to the prevalent normal atmospheric pressure for your location. If this value is not known, use the approximate values from Table 3 on page 27.

To set the Ambient Pressure:

1. Use Table 3 or obtain a reliable measurement of local atmospheric pressure by using a barometer or by getting the local atmospheric pressure data from the Internet, local airport, or weather station located at the same altitude as your facility.
   Some of the weather stations may provide pressure values normalized to the sea level; be sure to use the value for your altitude.
2. Enter the Service Mode and select **$EtCO_2$** to access the $EtCO_2$ maintenance menu.
3. Select **Set Ambient Pressure**.
4. Rotate the Smart Select Knob to set the pressure.

Table 3 **Approximate Ambient Pressure at Different Altitudes**

Altitude above the Sea Level		Ambient Pressure (mmHg)	Comment, Example
meters	feet		
5000	16400	400	DFM100 lower pressure limit
4200	13800	450	El Alto, Bolivia
3250	10700	500	La Paz, Bolivia
2700	8850	540	Bogota, Columbia; Quito, Ecuador
2300	7540	570	Addis Ababa, Ethiopia; Mexico City, Mexico
1900	6230	600	
1550	5100	630	Nairobi, Kenya
1170	3840	660	Calgary, Alberta;Yerevan, Armenia
810	2660	690	Mean land elevation. 90% of the world population live below this altitude.
690	2260	700	Almaty, Kazakhstan; Madrid, Spain
570	1870	710	Bern, Switzerland; Tbilisi, Georgia
460	1500	720	Munich, Germany; Zurich, Switzerland
340	1100	730	
220	720	740	Delhi, India; Lahore, Pakistan; Vienna, Austria
110	360	750	DFM100 default value; Seoul, Korea
0	0	760	low-rise building on a seashore; Beijing, Berlin, Paris
-100	-330	770	
-210	-690	780	Tiberias, Israel
-320	-1050	790	
-650	-2100	820	
-950	-3100	850	DFM100 upper pressure limit

Flow Rate Check

Perform the $EtCO_2$ Flow Rate check to validate the values provided by your CO_2 sensors.

To perform the $EtCO_2$ Flow Rate Check:

1. Enter the Service Mode and select **$EtCO_2$** to access the $EtCO_2$ maintenance menu.
2. Select **Flow Rate Check**.
3. Follow the screen instructions to perform the check.

Accuracy Check

To perform an accuracy check:

1. Set up the equipment for accuracy check.
   a. For the LoFlo sensor:
      - Modify the adapter using a T-shaped joint.
        Keep the open end short (about 5cm).
      - Connect the modified adapter to the sensor.
      - Connect the tube to the 5% CO_2 gas cylinder.
        Leave the other end of the tube open to air, do not block.

   b. For the Capnostat sensor:
      - Modify the adapter by sealing an airtube inside an adapter using a silicone or another airtight plug. The airtube end should not enter the sensor.
      - Connect the modified adapter to another adapter and to the sensor.
      - Connect the tube on the 5% CO_2 gas cylinder.
2. Enter the Service Mode and select **$EtCO_2$** to access the $EtCO_2$ maintenance menu.
3. Select the **Main Menu** and select **Accuracy Check**.
4. Follow the on-screen instructions. Do not allow excessive gas flow.
5. If the $EtCO_2$ Accuracy Check Failed. Module not ready message appears, the let the sensor warm up for about 1 minute and restart accuracy check.

Figure 29 **CO_2 Accuracy Check Setup, LoFlo Sensor**

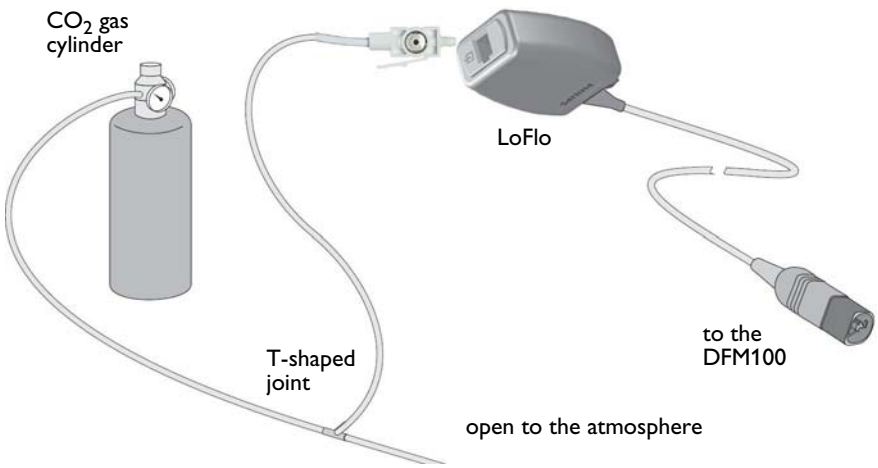
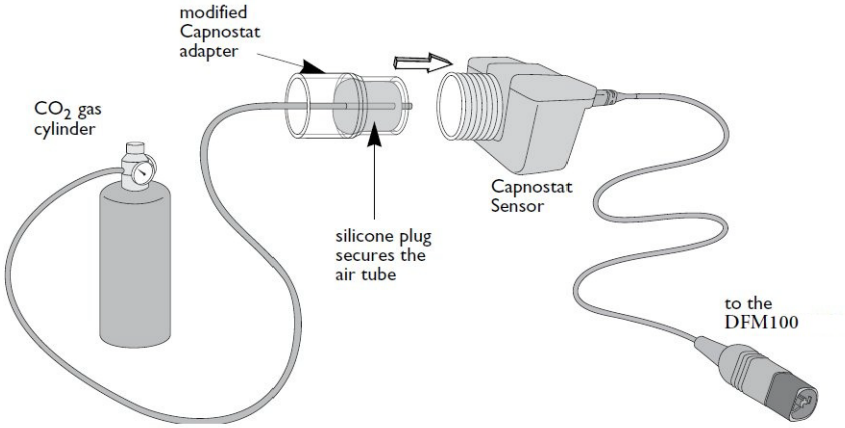


Figure 30 **CO2 Accuracy Check Setup, the Capnostart Sensor**



NOTES

3

Troubleshooting

This chapter describes how to troubleshoot the Efficia DFM100 monitor/defibrillator.

Overview

The topics covered in this chapter are:

- Troubleshooting Tools and Equipment . . . . . p. 31
- Ready For Use Indicator . . . . . p. 32
- Automated Tests . . . . . p. 33
- Shift Check and Weekly Shock Test . . . . . p. 35
- Operational Check . . . . . p. 36
- Error Log Messages . . . . . p. 44
- Troubleshooting Process . . . . . p. 46
- Troubleshooting Flowcharts . . . . . p. 48
- Components Troubleshooting . . . . . p. 50

Troubleshooting Tools and Equipment

You need the following tools and equipment:

- Defibrillator Test Plug (989803171271) or
- 50-ohm Defibrillator Test Load (M3725A)

Obtaining Replacement Parts

See Appendix A “Parts and Accessories” on page 177 for details on replacement parts.

Ready For Use Indicator

The Ready For Use (RFU) indicator, located in the left side of the front panel of the DFM100, reports the status of critical functions of the device as determined by the Automated Tests and Op Check. These Automated Tests run periodically while the device is turned off (but has a power source) and check the following critical functions of the device:

- defibrillation and cardioversion
- pacing
- pads/paddles ECG
- 3-lead/5-lead ECG
- battery

The RFU indicator also reports failures in critical functions detected at run time and during an Op Check and Service Mode tests. Always check the RFU indicator when troubleshooting the device.

Automated test failures of non-critical components (such as the NBP or printer) are not reflected in the RFU indicator, but are reported through Technical Alarm messages when the device is turned on.

The RFU indicator displays the status of the device using the following definitions:

Table 4 **RFU Indicator Status**

RFU Status		Meaning	Required Action
Blinking black hourglass		Shock, pacing, and ECG functions are ready for use and sufficient battery power is available.	None
Blinking red "X" without periodic audio chirp		Low battery is being charged. The device can be used, but run time is limited.	Make a replacement battery available. If a replacement battery is not available, then charge the battery for two hours.
Blinking red "X" with periodic audio chirp		Low battery not charging or no battery. No battery installed and the device is running on AC power only.	Charge the battery as soon as possible by connecting Efficia DFM100 to AC power and/or replace the battery with a charged battery. If both the battery and AC power are present, then troubleshoot the battery as described in "Battery Testing and Troubleshooting" on page 50.
Solid red "X" with periodic audio chirp		A critical failure has been detected that may prevent the delivery of a shock, pacing, or ECG acquisition.	Turn the Therapy Knob to **Monitor.** A Technical Alarm describing the failure is displayed. Begin troubleshooting as described in "Troubleshooting Process" on page 46.
Solid red "X" without periodic audio chirp		No power, or device failure (cannot power on).	Insert a charged battery and connect to AC power. If red "X" without a chirp persists for more than 10 seconds, then refer to "Troubleshooting Process" on page 46.

NOTE: The RFU indicator may briefly display a solid red "X" when initially turning on the device, switching between clinical and non-clinical operating modes, and at the start of any Automated test.

Automated Tests

The Efficia DFM100 performs many maintenance activities independently, including three tests that run automatically at regularly scheduled intervals *while the device is off* to assess operational performance and alert you if a problem exists. Results of tests associated with critical functionality of the device are reported through the RFU indicator and the Automated Test Summary report. Results are also reported through Technical Alarm messages on the display when the Efficia DFM100 is turned on. Table 5 provides a brief explanation of the tests and lists the frequency with which each test is performed.

Table 5 **Automatic Self-Tests**

Test Type/Frequency	Components and Parameters Tested
Hourly (short)	• power supplies, • charge level of the battery, • internal communication across all critical modules and components • device's internal temperature.
Daily after midnight (medium)	Performs an Hourly Test, plus: • internal clock battery • defibrillation (including low-energy internal discharges) • pacing • ECG • SpO_2 (if installed) • NBP (if installed) • $EtCO_2$ (if installed) • USB • Printer • 3- or 5-lead ECG cable (if connected).
Sunday early mornings (long)	Performs a Daily Test, plus a 150-J internal discharge to exercise the entire defibrillation circuitry.

NOTE: Automated tests do not test the therapy cables, paddles, buttons, audio, or the display.

Automated Test Summary

An Automated Test Summary (ATS), showing the results of recent tests, may be viewed or printed as evidence that the Efficia DFM100 is tested regularly.

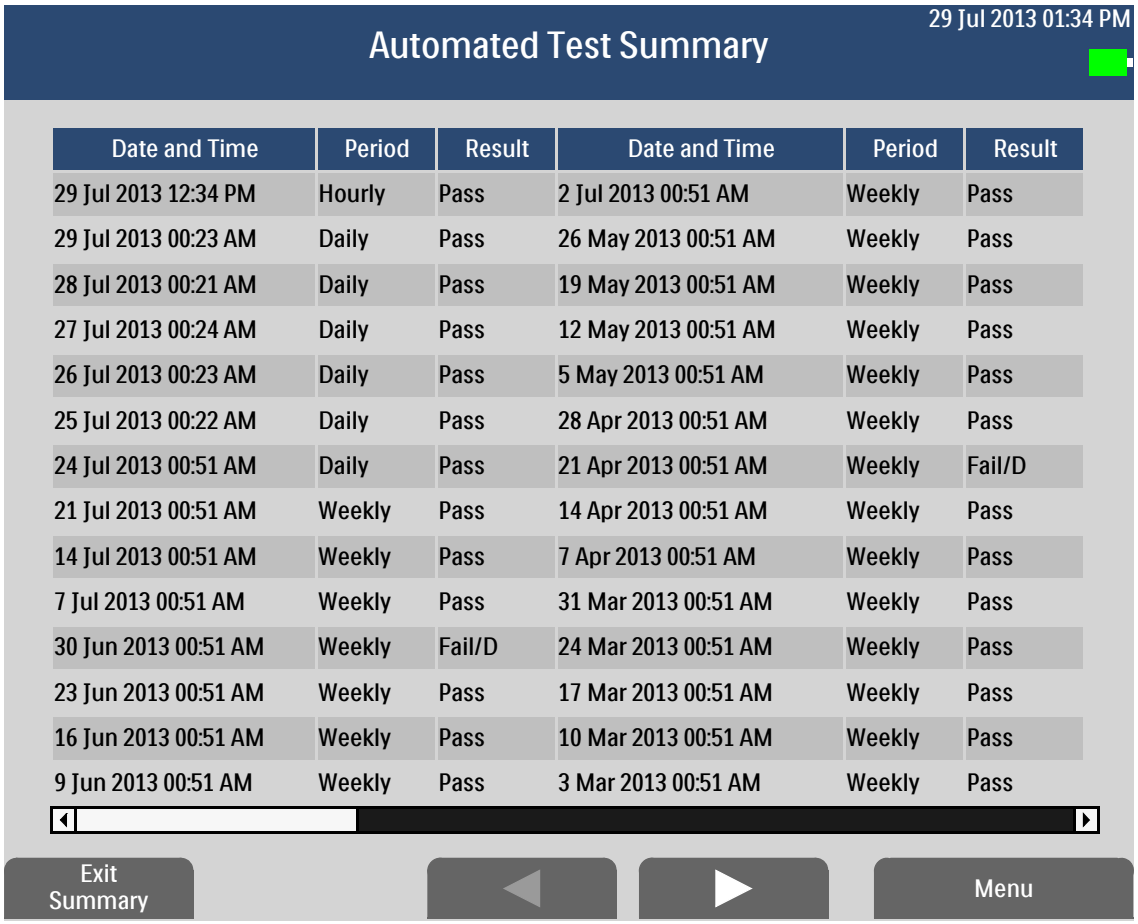
To view the ATS:

1. Turn the Therapy Knob to **Monitor.**
2. Press the Smart Select button.
3. Using the Smart Select button, select **Other** and press the Smart Select button.
4. Select **Operational Check** and press the Smart Select button.
5. Using the Navigation buttons, select **Auto Test Summary** and press the Smart Select button. The message appears: **Leaving clinical mode. Patient Monitoring will be turned off.**
6. Navigate to **Yes** and press the Smart Select button to confirm the **Exit Clinical Mode?** request.
7. Press the **Print** soft key to print the report.

The report shows the results of the most recent hourly test, the daily tests that have run since the last weekly test, and the last several weekly tests. Test results are reported, as described in Table 6 on page 35.

NOTE: The number of weekly tests which can be printed out is configurable. Refer to *Efficia DFM100 Instructions for Use* -> Chapter 14 Configuration -> Printing Settings for details on how to configure the number.

Figure 31 **Automated Test Summary Screen**



Date and Time	Period	Result	Date and Time	Period	Result
29 Jul 2013 12:34 PM	Hourly	Pass	2 Jul 2013 00:51 AM	Weekly	Pass
29 Jul 2013 00:23 AM	Daily	Pass	26 May 2013 00:51 AM	Weekly	Pass
28 Jul 2013 00:21 AM	Daily	Pass	19 May 2013 00:51 AM	Weekly	Pass
27 Jul 2013 00:24 AM	Daily	Pass	12 May 2013 00:51 AM	Weekly	Pass
26 Jul 2013 00:23 AM	Daily	Pass	5 May 2013 00:51 AM	Weekly	Pass
25 Jul 2013 00:22 AM	Daily	Pass	28 Apr 2013 00:51 AM	Weekly	Pass
24 Jul 2013 00:51 AM	Daily	Pass	21 Apr 2013 00:51 AM	Weekly	Fail/D
21 Jul 2013 00:51 AM	Weekly	Pass	14 Apr 2013 00:51 AM	Weekly	Pass
14 Jul 2013 00:51 AM	Weekly	Pass	7 Apr 2013 00:51 AM	Weekly	Pass
7 Jul 2013 00:51 AM	Weekly	Pass	31 Mar 2013 00:51 AM	Weekly	Pass
30 Jun 2013 00:51 AM	Weekly	Fail/D	24 Mar 2013 00:51 AM	Weekly	Pass
23 Jun 2013 00:51 AM	Weekly	Pass	17 Mar 2013 00:51 AM	Weekly	Pass
16 Jun 2013 00:51 AM	Weekly	Pass	10 Mar 2013 00:51 AM	Weekly	Pass
9 Jun 2013 00:51 AM	Weekly	Pass	3 Mar 2013 00:51 AM	Weekly	Pass

Table 6 **Automated Test Summary Results**

Result	RFU Indicator	Definition	Required Action
Pass	Hourglass	All tests passed	None
Fail/D		A non-critical failure has been detected. Affected component does not affect therapy delivery.	Turn the Therapy Knob to **Monitor.** A Technical Alarm indicating the failed component is displayed. Troubleshoot as described in "Troubleshooting Process" on page 46.
Fail/BW	Blinking Red X	Battery low or malfunctioning.	Charge the battery as soon as possible and/or replace the battery with a charged battery.
Fail/CX	Solid Red X, chirp	An ECG cable failure has been detected	Replace the ECG cable and run Op Check. Troubleshoot as described in "Troubleshooting Process" on page 46 if persists.
Fail/DX		A critical device failure has been detected.	Turn the Therapy Knob to **Monitor.** A Technical Alarm indicates a problem has occurred. Troubleshoot as described in "Troubleshooting Process" on page 46.

Shift Check and Weekly Shock Test

In addition to the hourly, daily, and weekly Automated Tests, there are three manual tests that help ensure your Efficia DFM100 readiness:

- Shift Check
- Weekly Shock Test, and
- Operational Check

WARNING: Disconnect the ECG leads set from the cable and confirm the Efficia DFM100 is not connected to a patient when performing a Weekly Shock Test or Operational Check.

Shift Check

In order to help ensure that defibrillators are ready for use when needed, Philips recommends that users complete a check list, often referred to as a shift check, at the beginning of each change in personnel. Refer to *Efficia DFM100 Instructions for Use* for details on shift check.

Weekly Shock Test

Verify the ability to deliver defibrillation therapy once a week by performing *one of the following:*

- Operational Check (see below).
- Weekly Shock Test. Refer to *Efficia DFM100 Instructions for Use* for details.

Operational Check

Perform Operational Check (Op Check) at regular intervals to supplement the hourly, daily, and weekly Automated Tests executed by the Efficia DFM100 and to troubleshoot the device. Automated Tests provide adequate assurance that the device is in a functional state of readiness. Op Check supplements the Automated Tests by verifying therapy cables, the ECG cable, paddles, audio, the **Charge, Shock** and **Sync** buttons, and Therapy Knob.

To run the Operational Check:

1. Insert a battery displaying at least two blue LEDs.
2. Turn the **Therapy Knob** to **Monitor**.
3. Press the **Smart Select knob**.
4. Rotate the **Smart Select knob**, select **Other** and press the **Smart Select knob**.
5. Select **Operational Check** and press the **Smart Select knob**.
6. Select **Run Op Check** and press the **Smart Select knob**.
   Exit Clinical Mode? prompt appears.
7. Select **Yes** and press the **Smart Select knob** to start the Op Check.
   Select **No** and press the **Smart Select knob** to return to the Clinical mode.
8. When a response is required, rotate the **Smart Select knob** to select your answer and press the **Smart Select knob** to confirm your choice. "Operational Check Tests" on page 38 shows the tests, in the order in which they are performed, explains the prompts that may appear, and describes the actions you should take (if any).

NOTE: If testing paddles, make sure that they are secured in their pockets. If the patient contact indicator (PCI) LEDs light, adjust the paddles in the pockets to improve the electrical contact. If the LEDs continue to light, clean the paddle electrode surfaces.

Operational Check Setup

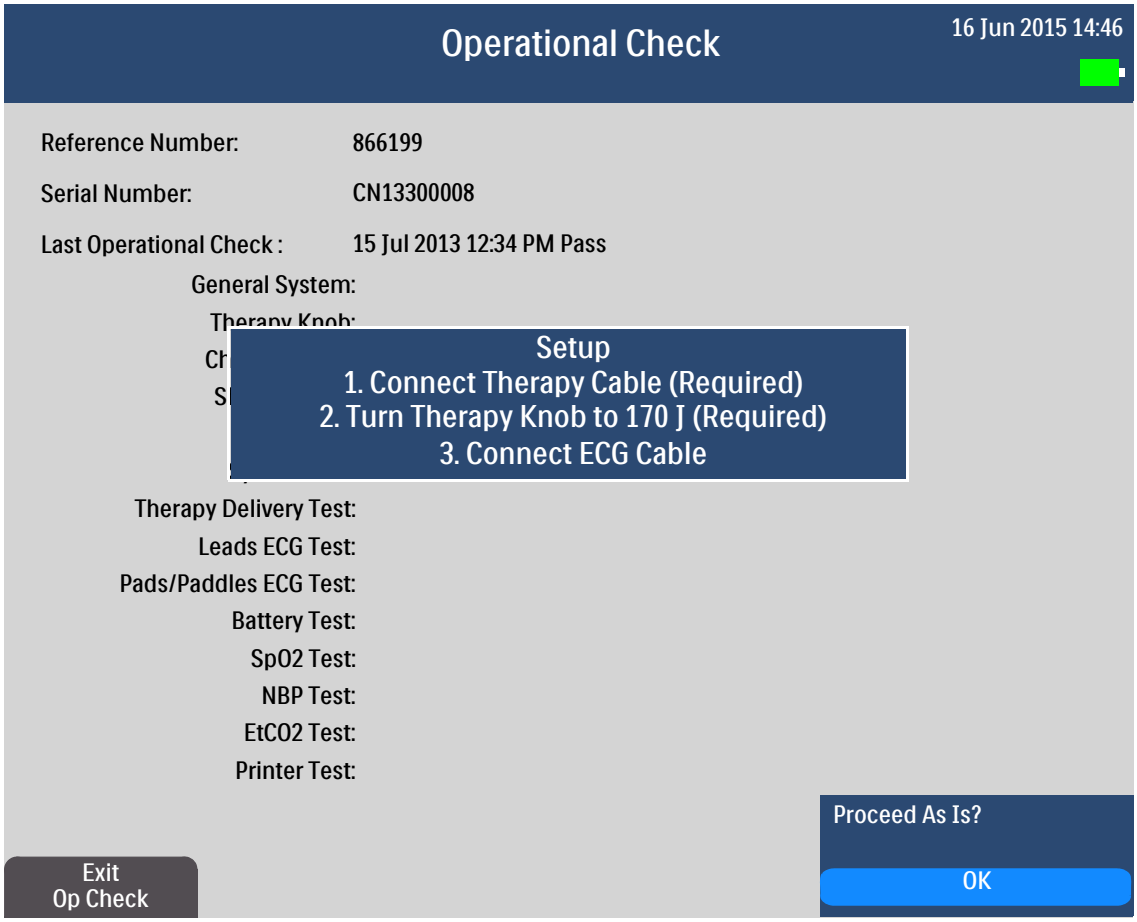
The Efficia DFM100 performs the readiness check, and when all readiness conditions are satisfied begins to run Op Check tests.

Carefully read the setup instructions on the screen, see Figure 32 for a sample. Once the Efficia DFM100 is set up properly, you can proceed with the Op Check.

You cannot perform the Op Check without a sufficiently charged battery. If there is no battery in the device then the prompt message **Insert Charged Battery or Exit** appears. If the battery charge is low, then the prompt message **Battery Charge Low, Replace Battery or Exit** appears.

Options are tested only if present.

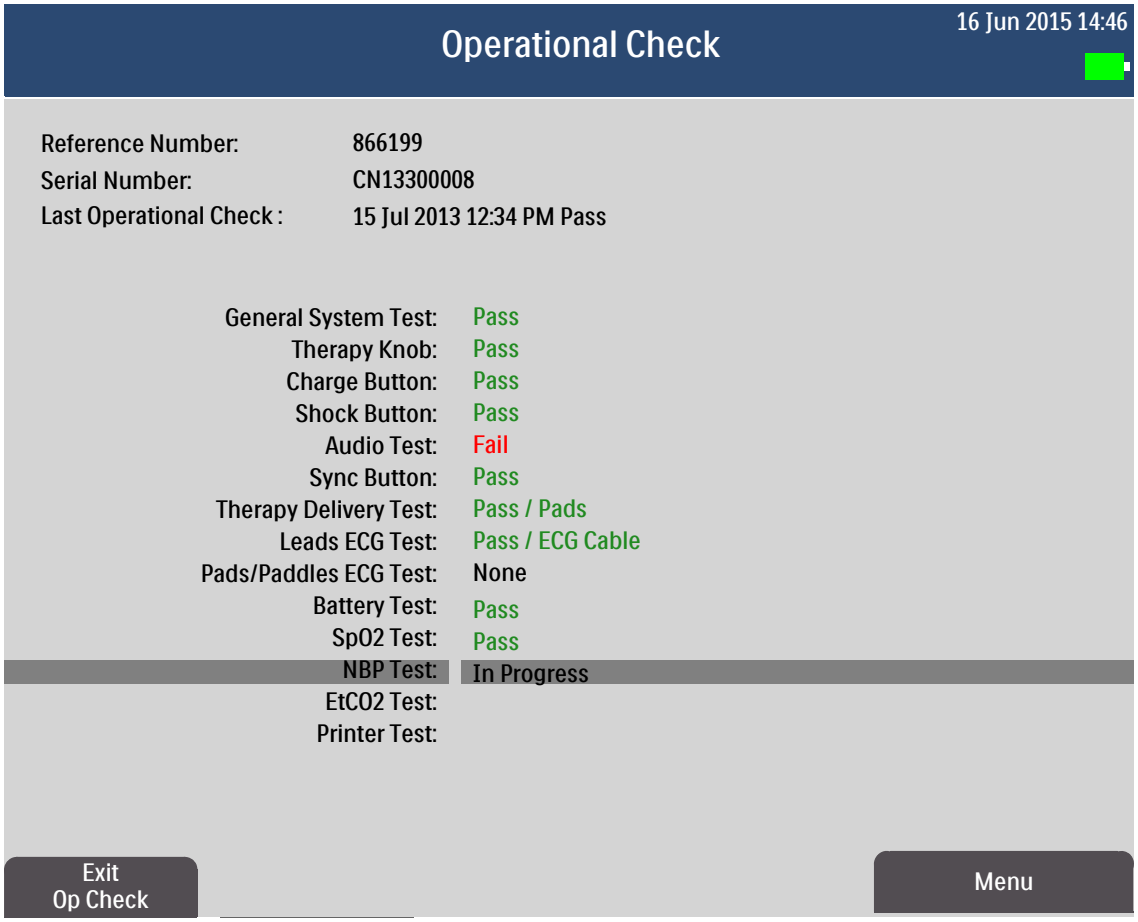
Figure 32 **Operational Check Screen — Setup**



Operational Check Flow

Follow the screen instructions and respond to the prompts. Once you have answered the last prompt (Sync button), you can leave the Efficia DFM100 unattended, and the Op Check will complete.

Figure 33 **Operational Check Screen — in Progress**



WARNING: Be sure to safely discharge paddles tested during the Op Check, as described in "Operational Check Tests" below.

Operational Check Tests

General System Test: Tests the following parameters and features:

- internal case temperature
- internal voltages of the power supplies and the clock battery
- read / write access between PCAs, modules, and programmable components
- executable device software and file system integrity, etc.

Therapy Knob: Tests if the Therapy Knob is reading the correct position.

Charge Button: Tests the Charge button function.

If no cable is attached, the test is skipped.

If the Pads cable is attached, you are prompted to Verify Test Load is Attached and Press the Charge Button. Follow the prompt.

If external paddles are attached, you are prompted to Verify Paddles are in Holders and Press the Charge Button. Follow the prompt.

If the device does not detect a press of the Charge button within 10 seconds, the message If the Charge Button Does Not Work, Select Charge From the Menu Below is displayed. If the Charge button is not working, press Charge from the No Button Response menu. The test is marked Fail, and the Op Check fails.

Shock Button: Tests the Shock button (or the Shock buttons on the external paddles) function.

If a pads cable and test load are not attached, or if external paddles are not attached and in the paddle holder, the test is skipped and marked Not Tested.

Once charged, the Shock button(s) flash(es) and you are prompted to Press Shock button or Press Shock Buttons on Paddles. Follow the prompt.

If the device does not detect a press of the Shock button within 10 seconds, the prompt If the Shock Button Does Not Work, Select Shock From the Menu Below is displayed. If the Shock button(s) is (are) not working, press Shock from the No Button Response menu. The test is marked Fail, and the Op Check fails.

NOTE: The device automatically disarms after the time specified in the configuration is reached. The message Defib Disarmed is displayed in this case.

Audio Test: Plays a voice prompt and asks you to reply whether the prompt was heard.

If a shock was delivered during the Shock test, the prompt Shock Delivered or local language is annunciated. If a shock was not delivered, then the prompt No Shock Delivered or local language is annunciated. When you hear the prompt, use the Smart Select button to select Yes, then press the Smart Select button.

Sync Button: Follow the Press and Release Sync Button prompt.

If the device does not detect a press of the Sync button within 10 seconds, the prompt If the Sync Button Does Not Work, Select Sync From the Menu Below is displayed. If the Sync button is not working, press Sync from the No Button Response menu. The test is marked Fail, and the Op Check fails.

TIP: Once you have responded to the Sync Button prompt, you can leave the Efficia DFM100 unattended, and the Op Check will complete.

Therapy Delivery Test: If the Pacing option is installed, this test will test pacing as well. Depending on your configuration and attached cables, the test may display:

- Pass/Pads
- Pass/External Paddles
- Fail/No Cable
- Fail/Pads
- Fail/External Paddles
- Fail/Internal Paddles
- Fail/Battery
- Fail

Leads ECG Test: Depending on your configuration and attached cables, the test may display:

- Pass/ECG Cable
- Pass/No Cable
- Fail/ECG Cable
- Fail/No Cable
- Fail

If a possible reason of the test failure might be a faulty cable connection, then the following prompt is displayed at the end of all remaining tests:

Leads ECG Test Failed With Cable.
Disconnect ECG Cable to Rerun Test Without Cable.

Disconnect the ECG cable or acknowledge the Proceed Without Rerunning Test prompt.

Pads/Paddles ECG Test: Depending on your configuration and attached cables, the test may display:

- Pass/Pads
- Pass/External Paddles
- Pass/No Cable
- Fail/Pads
- Fail/External Paddles
- Fail/Internal Paddles
- Fail/No Cable

Battery Test: The test may display:

- Pass
- Fail
- None (if battery is not inserted)
- Low Battery (charge the battery)

SpO_2 Test: Performed only if the SpO_2 option is installed.

The test may display:

- Pass
- Fail

NBP Test: Performed only if the NBP option is installed.

The test may display:

- Pass
- Fail

$EtCO_2$: Performed only if the $EtCO_2$ option is installed.

The test may display:

- Pass
- Fail
- Replace Sensor
- No Sensor Detected

Printer Test: The test may display:

- Pass
- Fail

Among other actions, Printer tests determines if the correct font is installed in the printer. If the Printer Font is not installed in the printer, but is available in the device memory, then the Printer Font is installed in the printer, while the message Printer Font Download in Progress is displayed.

Depending on the AutoPrint Opcheck Report configuration setting, a successful Printer Test (Printer Test passed) displays either the Check Printed Report (set AutoPrint to Yes) or Print Opcheck Report to Check Printer (set AutoPrint to No) prompt.

Operational Check Completion

At completion of the Op Check:

- The message **Operational Check Passed** is displayed if all of the tests pass.
- If any test fails, the message **Operational Check Failed** is displayed along with one or more of the following messages, depending upon the nature of the failed functionality:
  - Service Device
  - Replace Battery
  - Replace Pads Cable
  - Replace Paddles Cable
  - Replace Therapy Cable
  - Replace ECG Cable

Fix the problem and successfully run the Operational Check to clear the failure.

Operational Check Report

At the end of an Op Check, depending on the **AutoPrint** configuration setting, either the Op Check report is printed, or **Print Op Check Report to Check Printer** prompt is displayed.

To export to a USB flash drive or print a copy of the report:

- Select **Export** or **Print** from the Main Menu.

You may export or print any number of copies while in the Op Check mode. After you exit Op Check, the Op Check report is no longer available, but you still may find the result of the Op Check in the Op Check summary (see "Operational Check Summary" on page 42).

Figure 34 shows a sample Op Check report. The first part of the report lists test results. The second part lists checks to be performed by the user.

Figure 34 **Operational Check Report**

```
Operational Check Report                Current Test Results:
                                          General System Test: Pass          Battery Test: Pass
Efficia DFM100 866199                            Therapy Knob: Pass            SpO2 Test: Pass
S/N: CN13300008                                Charge Button: Pass             NBP Test: Pass
SW Rev: 1.00.46 American English               Shock Button: Pass            EtCO2 Test: Pass
                                                 Audio Test: Pass          Printer Test: Pass
Current Operational Check:                       Sync Button: Pass
17 Jan 2014 16:22 Pass                 Therapy Delivery Test: Pass/Pads
                                              Leads ECG Test: Pass/ECG Cable
Last Operational Check:                Pads/Paddles ECG Test: Pass/Pads
15 Jul 2013 12:34 Pass
```

```
Qty/Check List:                    Comments:
___ Defibrillator Inspection
___ ECG Cables/Connectors
___ Paddles/Pads
___ Monitoring Electrodes
___ Charged Battery
___ AC Power Cord
___ Printer Paper
___ SpO2 Sensor
___ EtCO2 Sensor
___ EtCO2 Sampling Line
___ NBP Cuff(s) & Tubing
___ USB Connector                  Inspected By:_____
```

Operational Check Summary

The Op Check summary lists the results from the last 60 operational checks. Test results are reported as described in Table 7.

Operational Check Summary Report

To access the Op Check summary report:

1. From the service Main Menu, navigate **Other** > **Operational Check** > **Op Check summary**.
2. Respond **Yes** to the **Exit Clinical Mode?** prompt.
3. Select **Export** or **Print** from the Main Menu to export to a USB drive or print a copy of the report.

Figure 35 shows a sample Op Check summary:

Figure 35 **Operational Check Screen — Summary**

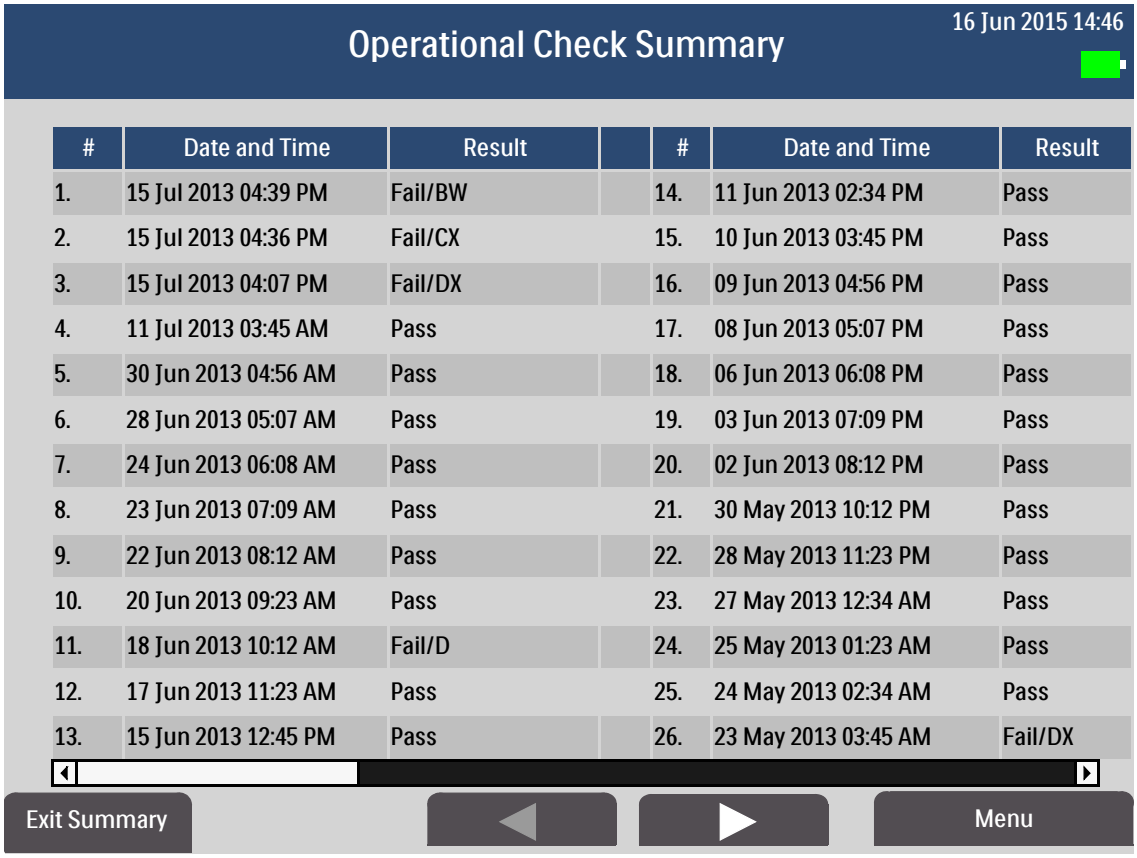


Table 7 **Operational Check Summary Results**

Result	RFU Indicator	Definition	Required Action
Pass	Hourglass	All tests passed	None
Fail/DX	Solid red X, chirp	A critical device failure has been detected. The failure may prevent the delivery of a shock, pacing, or ECG acquisition.	Exit Op Check Summary. A Technical Alarm indicating the problem is displayed. Troubleshoot as described in "Troubleshooting Process" on page 46.
Fail/CX	Solid red X, chirp.	A critical cable failure has been detected.	Exit Op Check Summary. A Technical Alarm indicating the failed cable is displayed. Replace the failed cable.
Fail/BW	Varies *	A battery failure was detected.	Troubleshoot the battery.
Fail/D	Hourglass	A problem has been detected with a component that does not affect therapy delivery.	Exit Op Check Summary. A Technical Alarm indicating the failed component is displayed. Troubleshoot as described in "Troubleshooting Process" on page 46.

* The Automated Tests continually check for a low battery condition and set the RFU Indicator appropriately.

Additional Notes about the Operational Check

Keep in mind the following points about the Operational Check:

- You can run Op Check from the **Other** menu in Clinical Mode or from the Service Mode Main menu – the Op Check is the same in both modes, with the following exceptions:
  - The Op Check in Service Mode runs in English, while in Clinical Mode it runs in the installed language.
  - When you exit the Op Check from Service Mode, you remain in the Service Mode.
- The Op Check runs the Therapy Delivery test on battery power to reflect typical operating conditions for defibrillation. The device automatically disconnects AC power for the time of this test.
- If the Efficia DFM100 is equipped with multifunction defib pads only and does not have a paddle tray, you cannot test paddles during an Op Check.
- Options that are not on the device do not appear on the screen or printed report.
- The message **In Progress** is displayed as each test is run. The test result (Pass or Fail) is displayed at the completion of each test and failures are logged in the Hardware Error Log. If you cancel the Operational Check before it completes, it is not recorded in the Operational Check Summary.

Service Mode Tests

These tests include manual interaction with the display and controls and help you isolate problems with the device. See "Service Mode Tests" on page 159 for more information on Service Mode tests.

Error Log Messages

Error Log menus allow you to review, print, export to USB memory, and clear the log entries.

The Error Logs include entries for all messages logged during normal operating mode (**Clinical**), Configuration mode (**Config**), Data Management mode (**DataMgmt**), boot sequence (**PowerUp**), Automated tests (**AutoTest**), Service Mode tests (**Service**), Operational Checks (**OpCheck**), and Software Upgrades (**SWUpgrade**). The message indicates the error severity and may provide additional information, such as error code and a verbal explanation.

The Efficia DFM100 defibrillator/monitor maintains two error logs: one for software and one for hardware.

Each log can contain up to 50 critical and up to 50 non-critical (up to 100 total) entries. Up to 14 entries may be displayed on a single screen. Each entry includes:

- the date and time of the message
- severity
- device operating mode at the time of the message (**AutoTest, Clinical, Config, DataMgmt, OpCheck, PowerUp, Service,** or **SWUpgrade**)
- numeric error code (software error log only) and optional informational string

When you call the Support Center, you may be asked to check or export the Error Logs.

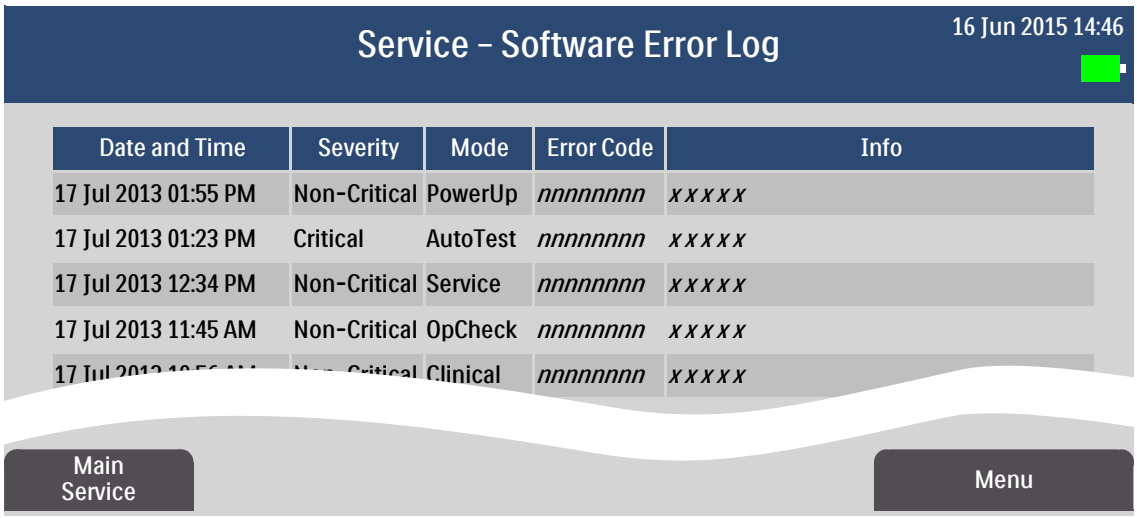
To view the Error Logs:

1. Access the Service mode. See "Accessing Service Mode" on page 15.
2. Select **Hardware Error Log** or **Software Error Log** from the Service Main Menu and press the **Smart Select knob**.
3. Press the **Smart Select knob** again to print, export, or clear the log.

Software Error Log

The Software Error Log is used by the Philips Healthcare software development team. There are no field service actions related to the Software Error Log messages, but the Response Center may ask you to provide the Software Error Log content. Figure 36 shows the layout of the Software Error Log.

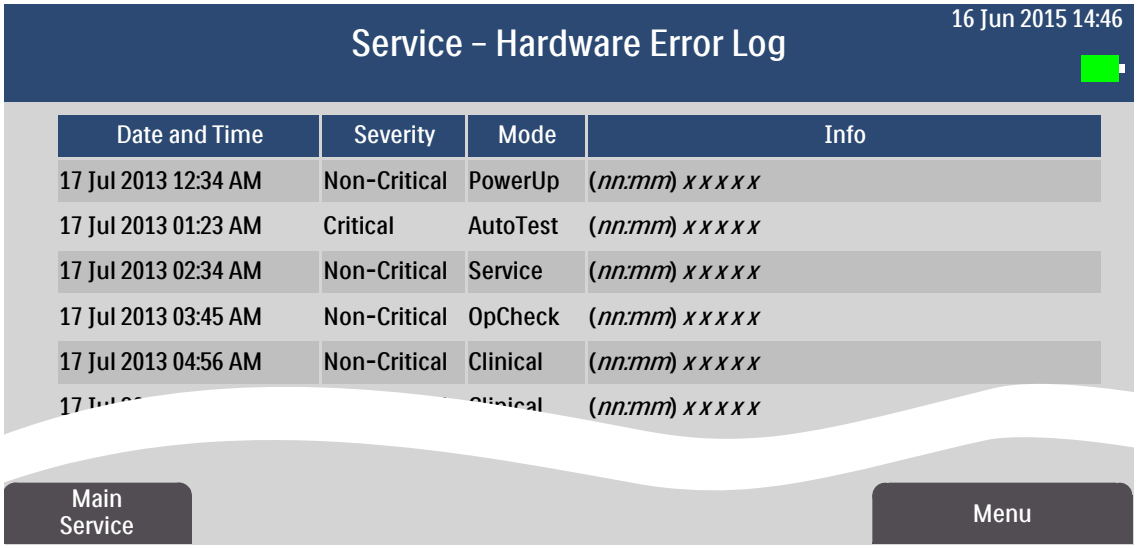
Figure 36 **Software Error Log Screen**



Hardware Error Log

Figure 37 shows the layout of the Hardware Error Log.

Figure 37 **Hardware Error Log Screen**



The Info column of the Hardware Error Log contains unique numeric IDs of the messages. The numeric ID has a format of (***nn:mm***), where ***nn*** is the group code, and ***mm*** is the message number within the group. Some numeric IDs of the Therapy group have a (7:***mm:ll***) format. Some of the Hardware Error Log messages along with their possible causes and suggested solutions are listed in the corresponding subsections of the "Components Troubleshooting" section. Table 8 lists the groups of the Hardware Error Log messages and pointers to the troubleshooting table for that section.

Table 8 **Hardware Error Log Message Groups**

Group ID	Group Name	See Subsection
(1:*mm*)	General System	Table 14 "General Problem Diagnostic with the Hardware Error Log" on page 57
(2:*mm*)	Therapy Encoder	"Controls Problems" on page 70
(3:*mm*)	Charge Button	
(4:*mm*)	Shock Button	
(5:*mm*)	Audio	"Audio Problems" on page 72
(6:*mm*)	Sync Button	"Controls Problems" on page 70
(7:*mm*) or (7:*mm:ll*)	Therapy Defib	Table 20 "Defibrillation Diagnostic with the Hardware Error Log" on page 62
(8:*mm*)	reserved	
(9:*mm*)	Lead ECG	Table 17 "ECG Diagnostic with the Hardware Error Log" on page 59
(10:*mm*)	Pads ECG	
(11:*mm*)	Battery	Table 10 "Battery Diagnostic with the Hardware Error Log" on page 53
(12:*mm*)	SpO_2	"SpO_2 Monitoring Problems" on page 64
(13:*mm*)	NBP	"NBP Monitoring Problems" on page 65
(14:*mm*)	Printer	Table 29 "Printer Diagnostic with the Hardware Error Log" on page 74
(15:*mm*)	$EtCO_2$	Table 23 "EtCO2 Monitoring Problems" on page 68.
(16:*mm*)	Startup	"Startup and OpCheck Messages" on page 55

Troubleshooting Process

Use the process described here to isolate problems and repair your Efficia DFM100.

To troubleshoot Efficia DFM100:

1. Decontaminate the device using local decontamination procedures.
   Refer to the *Efficia DFM100 Instructions for Use*.
2. Check the Ready for Use (RFU) indicator. See "Ready For Use Indicator" on page 32.
3. Perform a visual inspection.
   Thoroughly examine the device and its cables and accessories. Refer to "Visual Inspection" on page 158. If no further troubleshooting is needed, proceed to Step 12 to repair the device. Otherwise continue with Step 4.
4. Turn the Therapy Knob to Monitor.
   Failures and messages appear on the display when you turn on the defibrillator/monitor. Technical Alarms appear below the status area, see Figure 38. The Technical Alarms could be red, yellow or blue background. Red is high priority, yellow is medium priority and blue is low priority. If multiple Technical Alarms of the same priority are present, then they alternate, and a ▲ symbol appears on in the Technical Alarm text box.
5. Run the Operational Check (Op Check).

The Op Check tests the functionality of all PCAs and modules present on the device. For example, if the Efficia DFM100 is equipped with the NBP option, the Op Check performs a self-test on that module, and includes the results both on the screen and on the printed report. The Op Check results indicate the area of the device that is experiencing problems. Use this information to troubleshoot and repair the device. See "Operational Check" on page 36 for detailed instructions.

Figure 38 **Technical Alarm Sample**

6 Check the Hardware error log.

Export the Hardware, Software error logs, Event Summary, and Events Details in case you call the Response Center. See "Error Log Messages" on page 44 for more information. See "Export Device Info" on page 18 for exporting device info.

7 Use the Troubleshooting tables to identify the problem.

Use the "Components Troubleshooting" on page 50 to find information on messages and common troubleshooting issues. If several solutions are offered for your problem, *always* try the solutions in the order they are listed, and apply the next solution only if the previous solutions did not fix the problem. If no further troubleshooting is needed, proceed to Step 12 to repair the device. Otherwise, continue with Step 8.

8 Interview the user. Gather the external components or accessories.

If possible, talk directly with the user who reported the problem. Identify what they were doing when the problem occurred, and exactly what happened. What was on the display? Were any sounds noticed? Were there operational problems?

If possible, obtain the cables, paddles, battery, etc., that were in use when the problem occurred and use them in your evaluation. If no further troubleshooting is needed, proceed to Step 12 to repair the device. Otherwise, continue with Step 9.

9 Try to reproduce the problem.

Use the Troubleshooting tables to identify the symptoms and possible solutions, then proceed to Step 12. If the problem cannot be reproduced, an intermittent condition or operator error is likely.

10 Examine the device's repair history.

Some intermittent problems cannot be reproduced. If the device was returned before for the same problem, replace the most likely subassembly.

11 Run the Service Mode tests, if needed.

Use the tests available in Service Mode to focus in on possible causes. See "Service Mode Tests" on page 44 for more information.

12 Repair any problems found.

Follow the procedures in the "Repair" chapter to replace defective parts or subassemblies. When the repair is complete, continue with Step 13.

13 Verify the device's performance.

Use the procedures described in the "Performance Verification" chapter to verify that the device is operating properly. Be sure the testing you perform is appropriate for the level of repair. The requirements for testing are described in "Required Testing Levels" on page 151.

Troubleshooting Flowcharts

Figure 39 and Figure 40 show the troubleshooting steps for different states of the RFU Indicator.

Figure 39 **RFU Indicator: Hourglass**

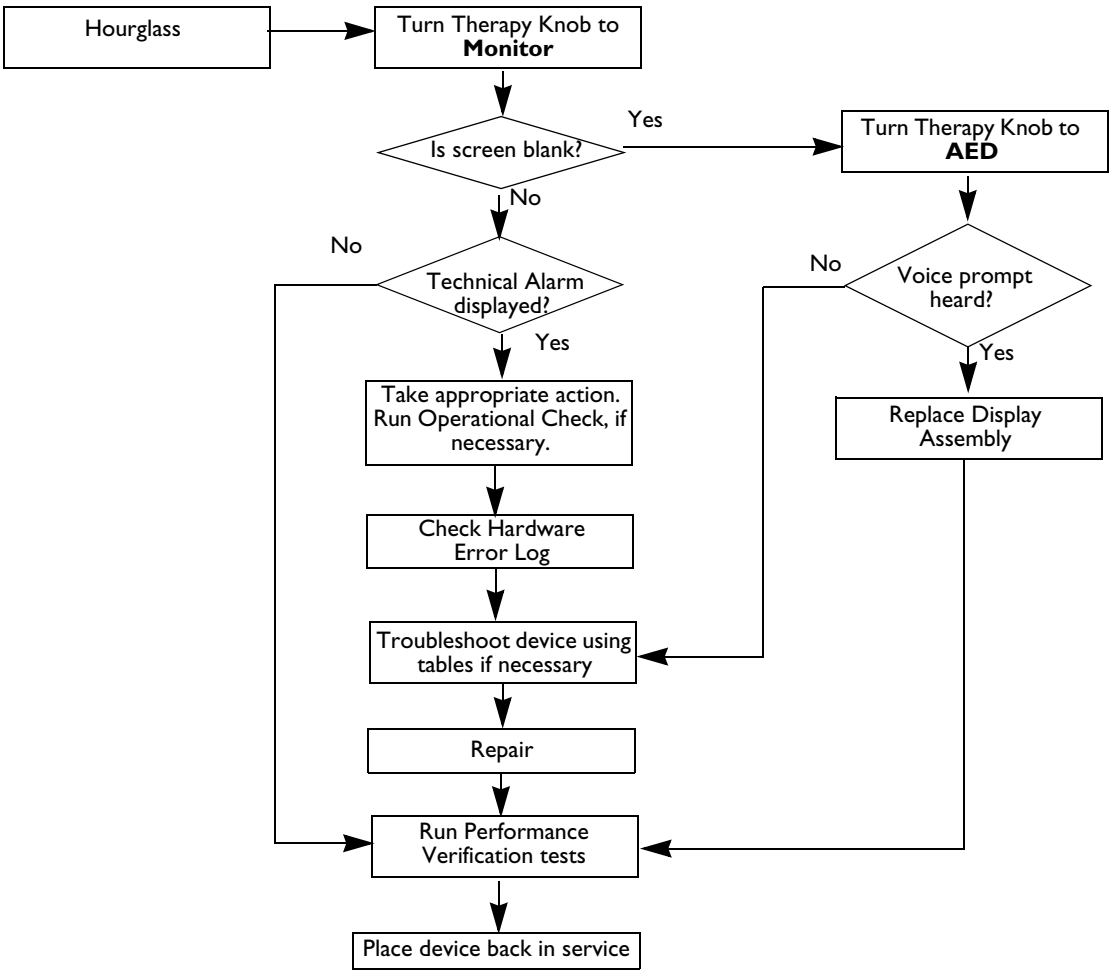
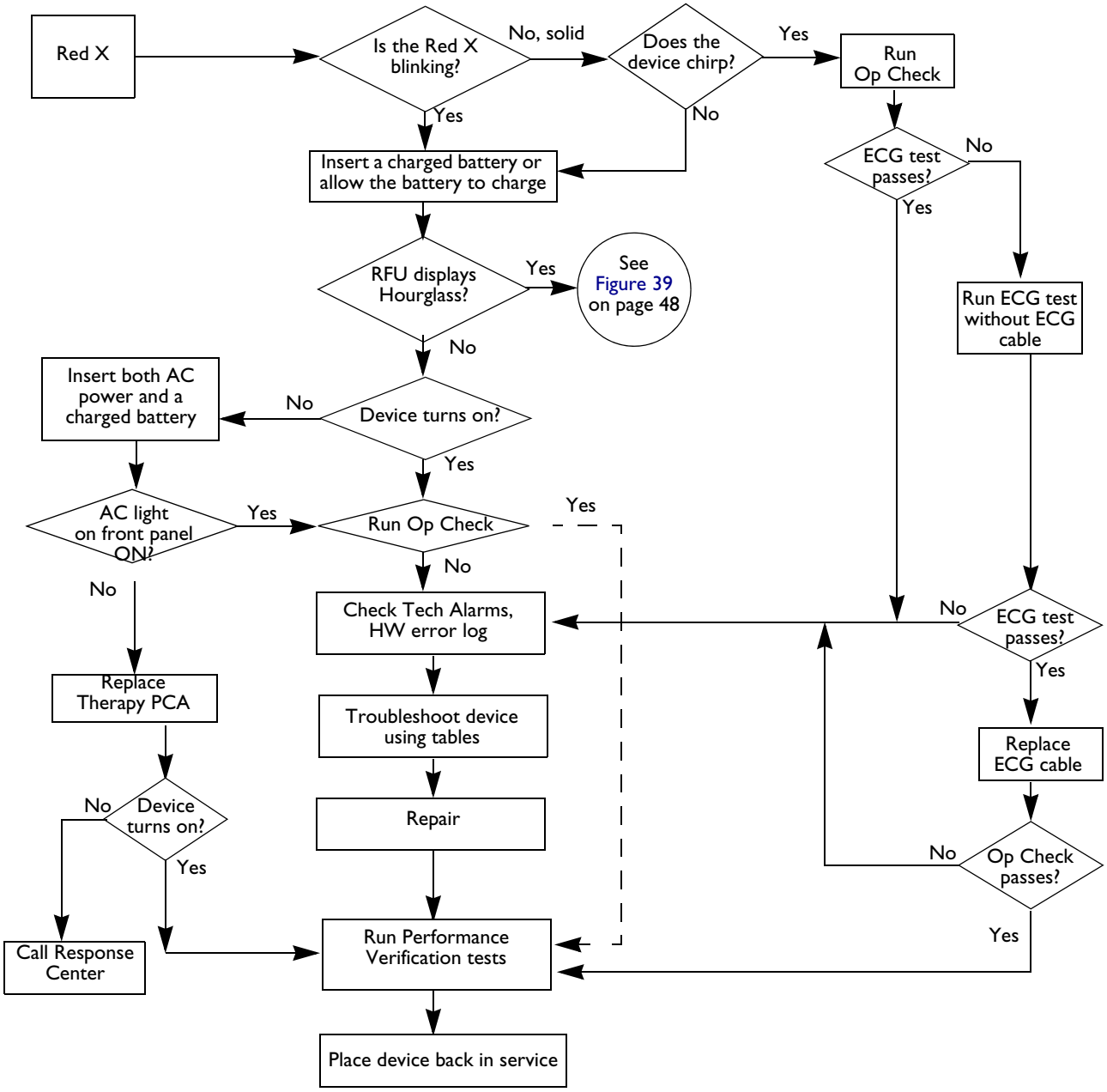


Figure 40 **RFU Indicator: Red X**



Components Troubleshooting

The Troubleshooting tables provide information on messages and common troubleshooting issues.

NOTE: Before replacing any components, *always* run an Operational Check and check the Error Logs for messages. Before replacing any parts, check to see if all the cables and flex circuits are properly connected See "Repair Notes" on page 77.
If several solutions are offered for your problem, *always* try the solutions in the order they are listed, and apply the next solution only if the previous solutions did not fix the problem.

This section is organized into the following subsections:

- Power and Battery . . . . . p. 50
- Audio Tones . . . . . p. 54
- Startup and OpCheck Messages . . . . . p. 55
- General Problems . . . . . p. 56
- Pacing Problems . . . . . p. 58
- ECG Monitoring Problems . . . . . p. 58
- Defibrillation Problems . . . . . p. 60
- SpO_2 Monitoring Problems . . . . . p. 64
- NBP Monitoring Problems . . . . . p. 65
- EtCO2 Monitoring Problems . . . . . p. 68
- Controls Problems . . . . . p. 70
- USB Problems . . . . . p. 71
- Display Problems . . . . . p. 72
- Audio Problems . . . . . p. 72
- Printing Problems . . . . . p. 73

Power and Battery

The Efficia DFM100 lithium-ion battery provides the power necessary to operate your Efficia DFM100 monitor/defibrillator. Proper battery maintenance described in the "Battery Maintenance" section of *Efficia DFM100 Instructions for Use* ensures your Efficia DFM100's readiness and uninterrupted power supply.

Battery Testing and Troubleshooting

An Efficia DFM100 battery is suspect if you do not know when it was last checked.

To test a suspect battery:

1. Check the battery's fuel gauge.
2. If fewer than two battery fuel gauge LEDs are on, then partially recharge the battery:
   a. Insert the suspect battery into the Efficia DFM100.
   b. Connect the Efficia DFM100 to an AC power source.
   c. On the Efficia DFM100, make sure the green AC Power indicator is on and the battery charging indicator is flashing.
   d. Turn off the Efficia DFM100 and charge for 20 minutes.

3 Remove AC power and turn the Efficia DFM100 on.
If the Efficia DFM100 shuts down immediately or does not turn on, then the battery is faulty.

4 Attempt a shock using the Defibrillator Test Plug (Select the 150 J energy, charge, and shock).
If the Efficia DFM100 shuts down or restarts, then the battery is faulty.

5 Test the battery fuel gauge.
If at least one battery fuel gauge LED lights steady, then charge and use the battery as needed. Otherwise the battery is faulty.

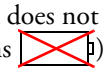
Table 9 and Figure 41 on page 53 discuss the battery problems that can occur. The messages may appear in the Technical Alarm or Battery Status area of the Efficia DFM100 screen, as shown in Figure 38 on page 47.

Faulty Batteries

CAUTION: A battery that can deliver power may be faulty. Do not use faulty batteries for any purposes. If a faulty battery is connected to the device along with AC power source, the faulty battery may not be revealed until the device attempts and fails to draw power from the battery.

Recycle or discard faulty batteries according to local regulations.

Table 9 **Battery Troubleshooting**

Symptom	Possible Causes	Possible Solutions
• Battery power indicator displayed in the Battery Status area shows less than 90% capacity. • Fewer than five battery fuel LEDs are on.	The battery charge is low	• Charge the Battery.
Battery does not seem to be charging.	AC power is not present	• Check that the AC Power indicator is lit and the Battery Charging indicator is flashing • Replace the I/O Assembly • Replace the Power Supply Assembly
	Bad electrical contact	Reinsert the Battery. Push until you hear it click into place. Make sure that the battery indicator and AC lights on.
External Power Indicator is off even though the AC power is connected.	No power in the outlet	Check the AC Power outlet
	AC power supply is disrupted	• Replace the I/O Assembly • Replace the Power Supply Assembly
• Battery fuel gauge LEDs are on, but the device shuts down when powered by the battery alone. • Battery fuel gauge LEDs are off or blinking even after the battery has been charged for several hours. • The General Status area does not recognize the battery (the icon remains )	Faulty Battery	Replace the Battery
	Faulty Therapy PCA	• Try the Battery in another device. If there are no problems with the Battery, then replace the Therapy PCA, otherwise replace the Battery. • Replace Battery PCA.
Replace Battery message*	The Battery has reached end of life.	Discard or recycle the Battery
Switched to Battery message*	Loss of AC power	• Acknowledge • Check AC power connection • Replace the Power Supply Assembly
Shutting Down in 1 min or **Shutting Down Now** message* in the Battery Status area	Low Battery	Charge the Battery
Fail/BF Automated Test Summary result		
Battery Communication Failure message	Communication between the device and the battery fails	• Replace the Battery • Replace the Battery PCA • Replace the Therapy PCA
Equipment Disabled: System Failure message	Out-of-range voltage detected	• Replace the Battery • Replace the Power Supply Assembly
Power Equipment Malfunction message		• Replace the Battery • Replace the Power Supply Assembly • Replace the Clock Battery • Replace the Processor PCA
Power Test Failure message	The Battery cannot charge the Capacitor	Replace the Battery

* In your local language

Figure 41 **Power and Battery Troubleshooting Flowchart**

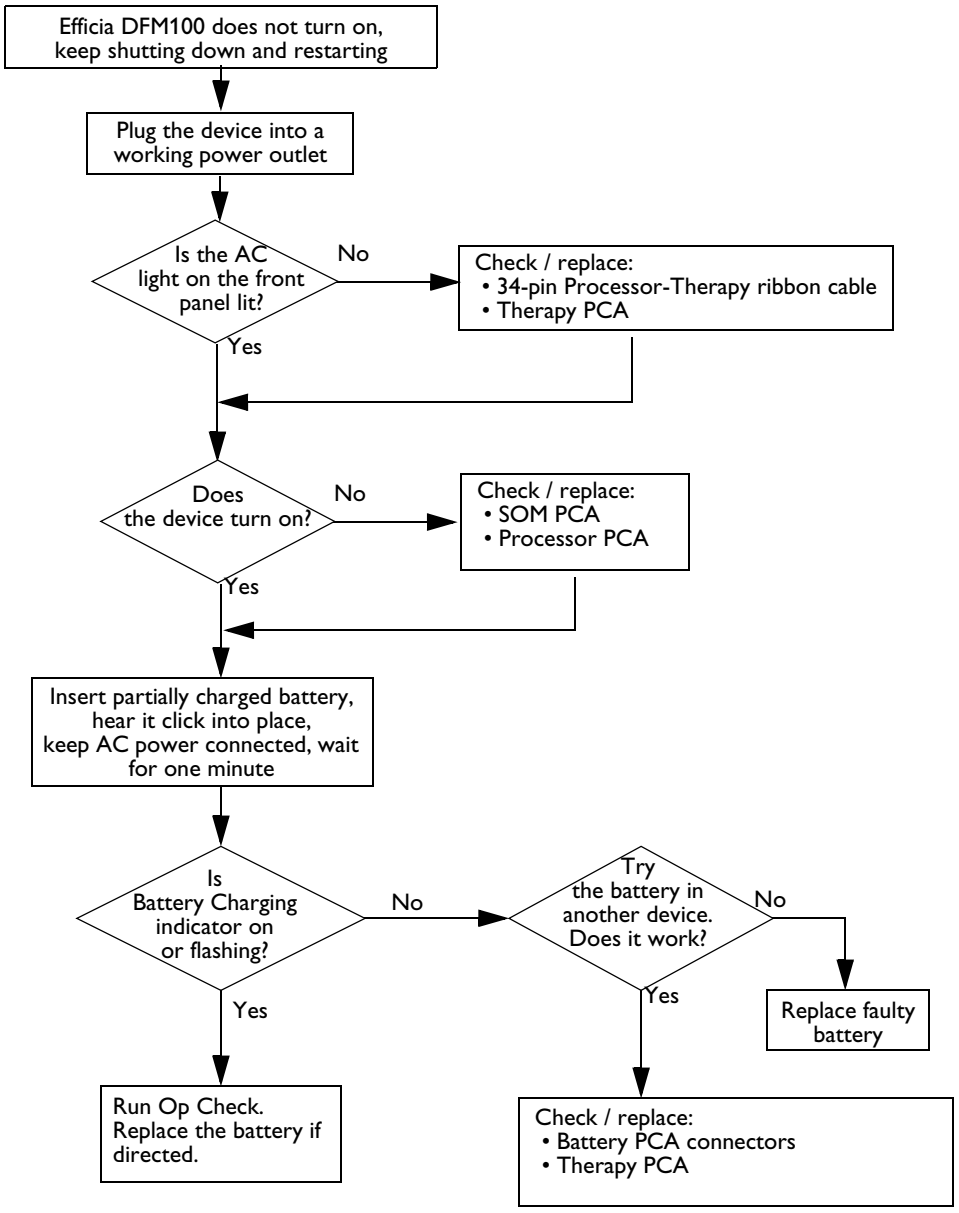


Table 10 **Battery Diagnostic with the Hardware Error Log**

Numeric ID	Info String	Possible Cause	Suggested Solutions
(11:1)	RFU Test Timed Out	Test is not completed in time.	Run Op Check
(11:2)	No status received from battery	Battery communication failure	Replace Battery
(11:3)	Battery is not working	Battery low	Charge Battery
(11:4)	Battery is at end of life	Battery is no longer usable	Replace Battery
(11:6)	Battery low	Battery low	Charge Battery
(7:37)	Battery Test Failure	SOM PCA failure during Battery test	Replace SOM PCA

Audio Tones

The Efficia DFM100 emits tones to alert you to its status. The sound pressure range is based on measurements taken 1 meter from the front of the device at its vertical center and horizontally in front of the speaker. The sound pressure measured according to IEC 60601-1-8 ranges between 45 dB at the **Very Soft** and 85 dB at **Very Loud** settings.

Table 11 **Audio Tones**

Tone Group	Tone	Description	Indication
Information Tones	Message Tone	Single 0.5 sec 2000 Hz beep	Accompanies a new message on the display.
	"Charging" Tone	Continuous 1333 Hz tone	Generated when the **Charge** button is pressed and continues until the device is fully charged.
	"Charged" Tone	Continuous 2042 Hz tone	Generated when the selected defibrillation energy is reached and continues until the **Shock** button is pressed, the **Disarm** soft key is pressed, or the device disarms automatically.
	Periodic Chirp	Short chirp every 30 seconds	Low battery or RFU failure. Repeated periodically while the condition exists.
	QRS Tone	Short 667 Hz beep	Sounds synchronously with each heart beat.
Philips Alarm Tones	Imminent Shutdown	Continuous tone alternating between 1000 and 2100 Hz.	Device will shut down in one minute.
	High Priority Alarm	A 960 Hz tone repeated every second	Generated while at least one high priority alarm is occurring.
	Medium Priority Alarm	A 480 Hz tone repeated every 2 seconds	Generated while at least one medium priority alarm and no high priority alarm is occurring.
	Low Priority Alarm	A short 480 Hz tone repeated every 2 seconds	Generated while at least one low priority alarm and no high or medium priority alarm is occurring.
Philips' Technical Alarm Tone		Cyan indicator message for low priority Technical Alarm	Repeats every two seconds, lower pitch then yellow alarm tone. Generated while at least one Technical Alarm condition is occurring.
IEC Technical Alarm Tone			Generated while at least one Technical Alarm condition is occurring. Lower pitched tone is repeated twice, followed by a pause.
Voice Prompts		N/A	N/A

Startup and OpCheck Messages

Table 12 lists the messages that can occur at startup or Operational Check.

Table 12 **Startup and OpCheck Messages**

Message	Possible Causes	Suggested Solution
Critical Device Failure Detected. Service Required	Critical failure. The device cannot deliver therapy; service immediately.	• Acknowledge • Run an Op Check • Check the HW Error Log and troubleshoot accordingly
Critical Component Test Failure		
Clinical Mode Not Available due to Equipment Malfunction. Service Required		
AutoTest Failure		
Non-critical Device Failure Detected. Service Required	Non-critical failure. The device can deliver therapy; service at a nearest opportunity.	
Non-Critical Component Test Failure		
• Equipment Disabled: Therapy • Equipment Disabled: System Failure • Power Test Failure	Hardware failure	
Power Equipment Malfunction	Power Supply or Battery failure	Troubleshoot power and battery, see "Power and Battery" on page 50.
Replace Battery	Battery failure	
Configuration Error. All Settings Reset to Factory Default Values	Attempt to import an invalid Configuration	Reconfigure the device to the user's settings. See the *Instructions for Use* for details.
All Settings Reset To Default Values		
Previous Event Data Record Has Been Closed	An error caused the device to restart	Troubleshoot the device
• Therapy Knob Failure • Therapy Knob Timing Error	Therapy Knob failure during Op Check	• Make sure the Knob was positioned at 170 J and 150 J as directed. • Replace the Therapy Knob • Replace the Therapy Encoder
(16:1) RFU Test Deadline Failure - current time *xx* later than deadline time *xx* error log message	RFU Test is not completed in time	Run Op Check
(16:2) RFU Test Deadline Failure - unable to get valid current time error log message	RFU Test failure	• Restart the device (turn off, wait 10 sec., turn on) • Replace Processor PCA
(16:3-6) RFU Test Deadline Failure... error log message		• Restart the device (turn off, wait 10 sec., turn on) • Replace SOM PCA
(16:7)AutoTest started but failed to complete		• Restart the device (turn off, wait 10 sec., turn on • Replace SOM PCA

General Problems

Table 13 discusses general problems that can occur. Table 14 discusses the Hardware Error Log entries related to the general problems.

Table 13 **General Monitoring Problems**

Symptom	Possible Causes	Suggested Solution
Replace Clock Battery message	The clock battery on the Processor PCA failure	Replace clock battery on the Processor PCA
One or more buttons (**Charge, Shock, Sync, select lead, patient category or soft keys**) do not respond	Bad connection between buttons and detection circuits	Run Controls Test in Service Mode to confirm. Check connections between UI PCA and Processor PCA
	Failure in detection or processing	• Replace SOM PCA • Replace Processor PCA
	Failure in keys	Replace UI PCA
Device Temp High message	The internal device temperature is over 65°C	If you continue to use the device, it may become inoperable. Let the device cool when possible.
		Run Fan Test, replace fans as needed
Equipment Malfunction: System Failure message	A critical failure. Device restarts.	If persists, run an Op Check, save the Error Logs contents, and report to the Support Center, see "Calling for Service" on page 76.
Equipment Malfunction: Therapy message		
Device Restarted Due to Error message		
Device Management Error message		
ECG Error message		
Therapy Controller Error message		
User Interface Error message		

Table 14 **General Problem Diagnostic with the Hardware Error Log**

Numeric ID	Info String	Possible Cause	Suggested Solutions
(1:1)	RFU Test Timed Out	Test is not completed in time.	• Reinstall software • Replace SOM PCA • Replace Processor PCA • Replace Therapy PCA
(1:2)	Invalid ADC/RTC Data: *xx*	Voltage is not reported within specified time or voltage is out of limited value. Wrong clock signal.	• Reinstall software • Replace Processor PCA
(1:3-9)	*n.n* V processor supply out of range, Value = *m.m*	Voltage value out of range	Replace Processor PCA
(1:10)	RTC Battery voltage out of range, Value = *mm.m*	Clock Battery voltage value out of range	• Replace Clock Battery • Replace Processor PCA
(1:11)	Switched supply out of range, Value = *mm.m*	Switched voltage value out of range	Replace Therapy PCA
(1:12)	Switched supply low on battery power, possible battery failure, Value = *mm.m*		• Replace Battery • Replace Therapy PCA
(1:13-16)	*n.n* V therapy supply out of range, Value = *m.m*	Voltage value out of range	Replace Therapy PCA
(1:17)	*nn* V therapy supply out of range, Value = *mm*	Voltage value out of range	• Replace AC Power Supply • Replace Therapy PCA
(1:18)	Serial Number Check Failed	Invalid serial number	Reenter Serial Number
(1:19)	File System Initialization Failure	Invalid file path or DSP file format mismatch	Replace SOM PCA
(1:20)	Localization Checksum/File System Check Failed	File check code mismatch	• Reinstall software • Replace SOM PCA
(1:21)	Fan Failure - Fan *x*	Fan 1 (close to Power Supply Assembly) failure	Replace Fan connected to Therapy PCA at J12
		Fan 2 (close to Internal Resistors) failure	Replace Fan connected to Therapy PCA at J13
(1:22)	Software Image Check Failed	Invalid software	• Reinstall software • Replace SOM PCA
(1:24)	RFU Status Redundancy Failure	RFU status mismatch	Run Op Check
(1:26)	Localization Initialization Failure	Invalid localization data	• Reinstall software • Upgrade software • Replace SOM PCA
(1:30-34)	Power MCU problems	Software is corrupted	• Reinstall software • Replace Therapy PCA
(1:40, 41)	Watchdog problems	Software is corrupted	Reinstall software
(1:42-49)	Initialization failures	Software is corrupted	Replace SOM PCA

Pacing Problems

Table 15 **Pacing Problems**

Symptom	Possible Cause	Suggested Solution
Does not deliver correct current into pacer tester or delivers no current at all	Therapy PCA failure	• Run Op Check • Inspect the Hardware Error Log • Replace Therapy PCA
Equipment Disabled: Therapy message		
Pacing Stopped. Device Error message	Pacer hardware failure	

ECG Monitoring Problems

TIP: When troubleshooting problems with paddles or pads, try replacing the paddles or pads first. When troubleshooting ECG problems, try replacing the ECG cable first.

Table 16 **ECG Monitoring Problems**

Symptom	Possible Causes	Suggested Solution
Flat line – no waveform, no **Leads Off,** or **Pads Off,** or **Paddles Off** message	Short in ECG cable or leads	• Replace ECG cable • Replace Measurement Module
	Short in Therapy Cable	• Replace Therapy Cable • Replace Therapy Port
	Processor PCA failure (if using ECG Leads)	Replace Processor PCA
	Therapy PCA failure (if using Pads)	Replace Therapy PCA
Poor ECG signal quality – (noisy trace, wandering baseline, etc.) from signal acquired from monitoring electrodes.	Poor skin preparation or electrode contact	Ensure that the user is properly connecting electrodes and preparing patient's skin
	Radio frequency interference (RFI) is causing artefact	Relocate or turn off equipment that may be causing RFI
	Defective ECG cable or leads	Replace ECG cable and leads
Equipment Malfunction: ECG message	ECG cable or leads failure	Replace ECG cable and leads
	Internal cables failure	Replace Measurement Module
	Processor PCA failure	Replace Processor PCA
Equipment Malfunction: Pads ECG message	Bad connection from Therapy Port to Therapy PCA	Replace Therapy PCA High Voltage cable
	Therapy Port failure	Replace Therapy Port
	Therapy PCA failure	Replace Therapy PCA
Leads Off / Pads Off / Paddles Off message even though ECG cable and leads are properly connected. **Cannot Analyze ECG** message	Poor skin preparation or electrode contact	Ensure that the user is properly connecting electrodes and preparing patient's skin
	Excessive motion artifact	Ensure that the user reduces patient movement
Pads/Paddles Type Undetermined message	Wrong pads or paddles type	Use only Philips-approved pads or paddles
	Pads or paddles failure	Replace pads or paddles

In Table 17 "ECG Diagnostic with the Hardware Error Log", the Numeric IDs of the (9:*nn*) format indicate problems with Leads ECG, and the ones of the (10:*nn*) format indicate problems with Pads ECG.

Table 17 **ECG Diagnostic with the Hardware Error Log**

Numeric ID	Info String	Possible Cause	Suggested Solution
(9:1) (10:1)	RFU Test Timed Out	ECG test is not completed in time	Run Op Check
(9:2) (10:2)	Comm Failure: *nn (n=0 -6)*	Communication failure	Replace SOM PCA
(9:2) (10:2)	Comm Failure: *nn (n=7 - 11)*		• Reinstall software • Replace SOM PCA
(9:3) (10:3)	DSP File CRC Check Failure - *xxx*		
(9:4) (10:4)	Communications Failure: Test Timeout		
(9:5) (10:5)	DSP POST missing at start of test	Self-test result is not received	
(9:6-8, 20) (10:6-8)	Bad number of channels from DSP: *xxx*	Leads / Pads calibration failure	
(9:9) (10:9)	DSP POST failure, test data unavailable	Leads / Pads test failure	
(9:10), (10:10)	Bad IDS revision from DSP. *xxx*		
(9:11)	ECG Leads Calibration Fail	ECG Leads gain failure	Replace Processor PCA
(9:12)	ECG Leads PLL Time Fail	ECG Leads clock failure	
(9:13)	ECG Leads Volts Fail	ECG Leads voltage failure	
(9:14)	ECG Failure - Lead: *n,* Type: Gain, *xxx*	ECG leads failure	
(9:15)	ECG Failure - Lead: *n,* Type: Noise, *xxx*		
(9:16)	ECG Failure - Lead: *n,* Type: Bias *xxx*	ECG leads failure	• Replace leads cable • Replace Measurement Module • Replace Processor PCA
(9:21)	Leads Off ECG Common Leakage Current: *nn*	ECG circuit failure	Replace Processor PCA
(9:22)	ECG Failure - Lead: <*reason*> ECG Common Leakage Current: *nn*		• Replace Leads Cable • Replace Connect Block • Replace Processor PCA
(9:23)	ECG Failure - Lead Right Leg Drive offset		
(9:24)	ECG Leads Test Rerun Skipped by User	Op Check performed without ECG cable	Run Op Check
(10:11)	ECG Pads Calibration Fail	ECG Pads gain failure	Replace Therapy PCA
(10:12)	ECG Pads PLL Time Fail	ECG Pads clock failure	
(10:13)	ECG Pads Reference Error	ECG Pads reference error	
(10:14)	ECG Failure - Pad: *n,* Type: Gain, *xxx*	ECG pads failure	
(10:15)	ECG Failure - Lead: *n,* Type: Noise, *xxx*		
(10:16)	ECG Failure - Lead: *n,* Type: Bias *xxx*	ECG pads failure	• Replace Therapy cable • Replace Therapy Port • Replace Therapy PCA

Table 17 **ECG Diagnostic with the Hardware Error Log *(Continued)***

Numeric ID	Info String	Possible Cause	Suggested Solution
(10:20)	Pads Common Mode Impedance:	Therapy PCA failure	Replace Therapy PCA
(10:21)	Pads PCI Impedance Failure: *xx*		
(10:22)	Cannot run ECG tests with internal paddles	ECG test failure	Run Op Check
(10:23)	Pads/Paddles current source error detected		Replace Therapy PCA

Defibrillation Problems

Table 18 **Defibrillation Charging Problems**

Symptom	Possible Cause	Suggested Solution
Charge Button Failure Op Check message	During Op Check, the user pressed the No Button Response menu instead of the Charge button	• Run Op Check and be sure to press the Charge button • Run Controls test to confirm • Check buttons for mechanical operation • Replace UI PCA
Does not charge in Manual Defib Mode using Charge button on paddles	Paddles not connected properly	Check/restore connection
	Paddles failure	• Confirm paddles problem by connecting Pads and attempting to charge device using Charge button on the Efficia DFM100 • Replace paddles if needed
	Problem with internal connections	Check/restore connections between Therapy port and Therapy PCA, and between Therapy PCA and Processor PCA
	Therapy Port failure	Replace Therapy Port
	Processor PCA failure	Replace Processor PCA
Does not charge in Manual Defib Mode using Charge button on Efficia DFM100	Therapy cable failure	Replace Therapy cable
	Front panel button failure	Run Controls Test in Service Mode to confirm, replace Front Case if needed
	Therapy PCA failure	Replace Therapy PCA
	Processor PCA failure	Replace Processor PCA
Does not charge in AED Mode, but charges in Manual Defib Mode	Shock not advised	Make sure ECG wave is displayed and shock is advised
	Pads ECG front end failure	Replace Therapy PCA
	Processor PCA failure	Replace Processor PCA
Does not charge to energy setting on Therapy Knob	Therapy Knob has been replaced and installed incorrectly	• Confirm by rotating Therapy Knob back and forth to check travel and alignment • Run Controls test in Service Mode to test Therapy Knob. Reinstall Therapy Knob, if necessary
	Therapy Encoder failure	Replace Therapy Encoder

Table 18 **Defibrillation Charging Problems *(Continued)***

Symptom	Possible Cause	Suggested Solution
The Capacitor charges too slowly	The device is being operated with AC power (no battery) or the battery power is low	Install a fully charged battery
	Battery not fully charged, or defective	
	Therapy PCA defective	Replace Therapy PCA
Equipment Malfunction: Shock and Pacing message	• Unable to charge to selected energy • Unable to determine energy	• Run Op Check • Check Hardware Error Log • Replace Therapy PCA

Table 19 **Defibrillation Discharging Problems**

Symptom	Possible Cause	Suggested Solution
Shock Button Failure Op Check message	During Op Check the **No Button Response** menu pressed instead of the **Shock** button	• Run Op Check and be sure to press the Shock button • Run Controls Test to confirm • Check buttons for mechanical operation
	During Op Check the device disarmed before the user pressed the **Shock** button	
Does not shock in Manual Defib mode using **Shock** buttons on paddles	Paddles failure	Confirm paddles problem by connecting Pads and attempting to discharge device using **Shock** button on the Efficia DFM100. Replace paddles if needed.
	Therapy Port defective	Replace Therapy Port
	Processor PCA failure	Replace Processor PCA
Does not shock in Manual Defib or AED mode using **Shock** button on Efficia DFM100	Front panel button failure	Run Controls Test to see if the button is operating. Replace UI PCA if needed.
	UI PCA failure	Replace UI PCA
• Does not deliver correct energy into defibrillator analyzer or delivers no energy at all. • **Abnormal Shock Dose Delivered** message	Therapy PCA failure	Replace Therapy PCA
Charges OK, but aborts the shock when press **Shock** or paddle buttons	Patient impedance sensed as too high or too low during energy delivery due to: • Pads/paddles losing contact with patient • Pads/paddles failure • Therapy cable failure	• Press the paddles firmly and check the PCI LEDs • Replace paddles, pads, or therapy cable, as needed
	Therapy PCA failure	Replace Therapy PCA

Table 19 **Defibrillation Discharging Problems *(Continued)***

Symptom	Possible Cause	Suggested Solution
Charges OK, but disarms spontaneously	Device sensed Pads Off or Cable Off due to pads losing contact with patient	• Observe screen messages • Make sure loss of contact is not due to patient movement
	Pads / cable failure	Replace pads or pads cable
	Therapy PCA failure	Replace Therapy PCA
	Processor PCA failure	Replace Processor PCA
Disarm Failure message	Internal Resistors failure	Replace Internal Resistors
	Therapy PCA failure	Replace Therapy PCA
Paddles Power Overload message	An overload is detected in the paddles circuitry	• Replace paddles • Replace Therapy Port • Replace Processor PCA

Table 20 **Defibrillation Diagnostic with the Hardware Error Log**

Numeric ID	Info String	Possible Cause	Suggested Solution
(7:0)	Therapy RFU Test Passed	Test passed after a failure	None, not an error
(7:1)	RFU Test Timed Out	Test is not completed in time	Run Op Check and be sure to press the **Charge** button
(7:2)	TPC_ *xxx* Arrived Late		
(7:3)	Therapy MCU Msg *xxx* Checksum Error	Data transmission error	• Reinstall software • Replace Processor PCA
(7:4)	Therapy MCU Failed to Respond to Reset	Therapy PCA failure	• Replace Therapy PCA • Replace Processor PCA
(7:5)	Therapy MCU Msg *xxx* Timed Out	Test is not completed in time	Run Op Check and be sure to press the **Charge** button
(7:6)	Therapy MCU Error during Receiving Data	Data transmission error	• Run Op Check • Replace Therapy PCA
(7:7)	Therapy MCU: Protocol Mismatch (Host=*xxx*, MCU=*xxx*)	Software versions mismatch	Reinstall software
(7:8)	Therapy MCU: Fail to transmit *xxx*	Software failure	
(7:9)	Therapy MCU: Failed to enter CPLD programming state	Therapy PCA failure	• Replace the Battery • Replace Therapy PCA
(7:10)	Flash Programming Failed		
(7:11:*nn*)	Therapy MCU: *nn xxx*		• Run Op Check • Replace Therapy PCA
(7:12)	Therapy MCU Flash Upgrade File contained no program data	Corrupted software upgrade file	Reinstall software
(7:13)	Therapy MCU Flash Upgrade File invalid		

Table 20 **Defibrillation Diagnostic with the Hardware Error Log *(Continued)***

Numeric ID	Info String	Possible Cause	Suggested Solution
(7:14)	Defib Test | not run: *xx*	Therapy Cable or connection failure	• Run Op Check • Replace Therapy Cable • Replace Therapy Port • Replace Processor PCA • Replace Therapy PCA
(7:15-17)	Therapy MCU: *xxx*	Therapy PCA software upgrade failure	• Reinstall software • Replace Therapy PCA
(7:20)	Battery brown-out test failed	Battery failure	Replace the Battery
		Therapy PCA failure	Replace Therapy PCA
(7:19)	Patient Safety Relay test failed	Therapy PCA failure	Replace Therapy PCA
(7:21-24)	Power MCU failed to *xxx*		
(7:25)	Therapy MCU: Failed to charge to *nn* J		
(7:26)	Failed to load therapy CPLD program data		
(7:27)	Not Run, Therapy MCU Error	Therapy Cable not detected	• Replace Test Plug/Load • Replace Therapy Cable • Replace Therapy Port • Replace Therapy PCA
(7:28:1)	Op Check Shock test aborted	Shock test failed	• Run Op Check • Replace Test Plug/Load • Replace Therapy Cable • Replace Therapy PCA
(7:28:4)	Op Check Shock Impedance Out Of Range		
(7:28:2)	Therapy MCU: Failed to charge for Op Check	Failure to reach the requested charge level in time	
(7:28:3)	Final Capacitor Voltage after Op Check Shock High	Failure to fully discharge	Replace Therapy PCA
(7:31:25)	Final Capacitor Voltage after HV Inhibit RFU High		
(7:29:*nn*)	Therapy ADC Test: *xxx*	Therapy PCA failure	
(7:30:*nn*)	LV Inhibit Test: *xxx*		
(7:31:*nn*)	HV Inhibit Test: *xxx*		
(7:32:*nn*), (7:33:*nn*)	RFU Shock *xxx*	Autotest failed	
(7:34:*nn*)	Pacer RFU *xxx*		
(7:35)	xx| not run: Defib	Therapy Defib test failed	Rerun Op Check, Replace Therapy PCA
(7:36)	Proceed Button pressed	"Proceed As Is" soft key pressed during Op Check	Rerun Op Check
(7:37)	Battery Test Failure	SOM PCA failure	Replace SOM PCA
(7:38)	xx Failure/ xxx have failed	Therapy RFU or Opcheck test failed	Replace SOM PCA

SpO_2 Monitoring Problems

Table 21 **SpO_2 Monitoring Problems**

Symptom	Possible Causes	Suggested Solution
SpO2 Sensor Malfunction message.	SpO_2 sensor or cable failure	• Try another sensor and cable • Replace Measurement Module Panel • Replace SpO_2 PCA
SpO2 Equipment Malfunction message	SpO_2 PCA failure	Replace SpO_2 PCA
SpO2 Interference message	SpO_2 light interference	• Shade the SpO_2 sensor from bright light • Replace the SpO_2 sensor
• No response – no value on screen, no pleth bar. • **SpO2 Error** message. • The SpO_2 value is obviously wrong. • Noisy/intermittent signal.	Defective SpO_2 sensor or cable	Try another sensor and cable.
	Bad internal connection.	Carefully re-seat the flex circuit between SpO_2 port and SpO_2 PCA. Check that SpO_2 PCA is properly seated on Processor PCA.
	SpO_2 PCA failure	Replace SpO_2 PCA
(12:1) RFU Test Timed Out error log message	Test is not completed in time	Run Op Check
(12:2) SpO2 Communication Failure error log message	SpO_2 communication failure	Replace SpO_2 PCA
(12:3) SpO2 Self Test Failure error log message	SpO_2 self-test failure	
(12:4) SpO2 Malfunction InOp	SpO_2 PCA failure	
(12:5) SpO2 sensor malfunction	SpO_2 sensor failure	• Replace the SpO_2 sensor • Replace the SpO_2 PCA

NBP Monitoring Problems

Test the Efficia DFM100 NBP module if indicated by the troubleshooting, or if there is an uncertainty about the module performance. Experienced and trained Efficia DFM100 users (e.g. nurses or biomedical and clinical engineers) may perform the NBP test using the NBP testing service tool. The training material is included in the kit.

To perform the Efficia DFM100 NBP module tests, you need:

- NBP testing service tool (453564501961)

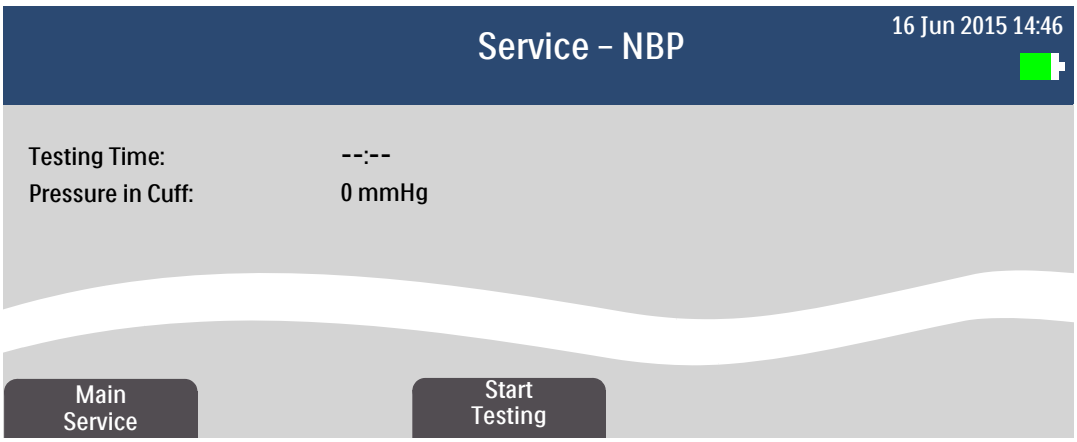
CAUTION: Only qualified service personnel should perform the NBP testing procedures.

NBP Accuracy Test

To perform the NBP accuracy test:

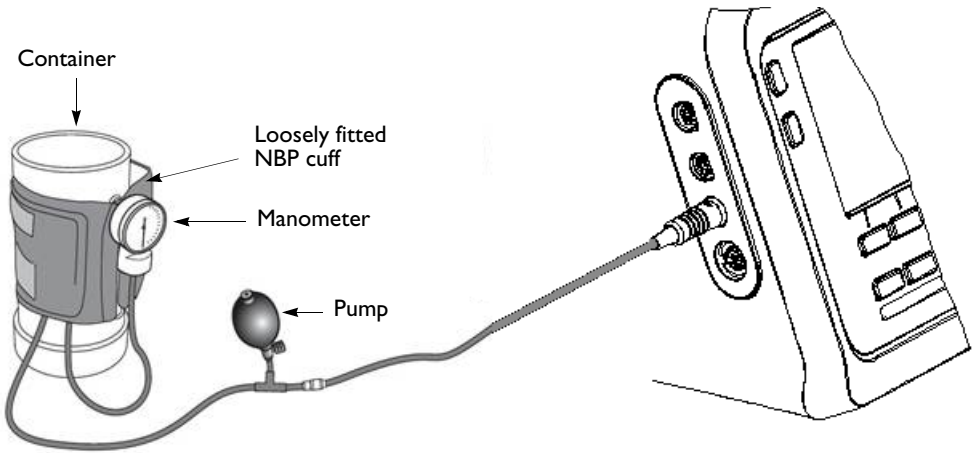
1. Access the Service Mode Main menu as described in "Accessing Service Mode" on page 15.
2. From the Service Mode Main menu, select NBP.
3. The NBP Service screen is displayed (see Figure 42). You may hear a soft, high-pitch tone, this is normal NBP pump operation.

Figure 42 **NBP Service Screen**



4. Connect the NBP testing kit to DFM100, see Figure 43.

Figure 43 **NBP Accuracy Test Connetion**



5 Squeeze the manometer pump and apply a pressure of 150mmHg.

6 Observe the pressure displayed on the screen and record this result as X1. The value should be 150mmHg ± 3mmHg.

7 Squeeze the manometer pump and apply a pressure of 250mmHg.

8 Observe the pressure displayed on the screen and record this result as X2. The value should be 250mmHg ± 3mmHg.

9 Press **Stop Testing** to stop the test.

10 If the difference between the manometer and the displayed value is greater than 3 mmHg, replace the NBP module.

11 If the results is as described, the device passes accuracy test. Return to the Service Mode Main menu by pressing the Main Service soft key.

NBP Safety Features

The NBP module is equipped with the Overpressure safety features that prevent injury to the patient and damage to the device.

NBP Overpressure

The NBP module overpressure occurs when the cuff pressure reaches 295 mmHg. Do not raise the pressure in the cuff to more than 280 mmHg during the test.

The safety features cause the valve to open and the pressure to drop.

Leakage Test

Regardless of your configuration settings, millimeters of mercury are the unit of measure for pressure in the Efficia DFM100 calibration.

To test the NBP module for leaks:

1 Squeeze the manometer pump and apply a pressure of 250mmHg/33.3Kpa/333mb/4.83psi/0.329atm/9.84inHg.

2 Wait for 30 seconds to allow the pressure in the unit to equalize.

3 Watch the displayed pressure for 60 seconds.

4 Record the pressure drop at the end of 60 seconds.

5 If the pressure decreases by more than 6 mmHg, there is a leak. Replace the tubing and chamber assembly and try the leakage test again. If the pressure still decreases by more than 6 mmHg, begin troubleshooting and repairing the device as needed.

Release the pressure in the chamber before proceeding to the next test.

Table 22 **NBP Monitoring Problems**

Symptom	Possible Causes	Suggested Solution
NBP Measurement Failed message	• Excessive patient movement • Hose or cuff kinked or leak	Ensure the user applies correct procedure
	• Air tube inside the device failure • Defective NBP hardware • Defective I/O PCA	• Reconnect the air tube • Replace NBP module • Replace I/O PCA
NBP Cuff Overpressuremessage	External pressure on the cuff during the measurement	Do not touch the cuff during the measurement

Table 22 **NBP Monitoring Problems** ***(Continued)***

Symptom	Possible Causes	Suggested Solution
NBP Error message	Defective NBP hardware	Replace NBP module if persists
NBP Equipment Malfunction message	NBP Module autotest failure	
NBP Cuff Not Deflated message	NBP cuff blockage	• Check tubes for kinks • Replace NBP cuff
• Measurement cycle does not start. • Pump operates, cuff inflates normally, but does not deflate. • **NBP Cuff Not Deflated** message	Failure of front panel button	Run Controls test in Service Mode to confirm. Replace Front Case if needed.
	NBP Module failure	Replace NBP Module
	Processor PCA failure	Replace Processor PCA
Reading inaccurate	NBP Module failure	Check accuracy as described in "NBP Monitoring Problems" on page 65. Replace NBP Module if needed.
Liquid inside the tubing	A spill	If the liquid is clean water, and it did not reach the NBP Module, then drain the water and dry the tube. Otherwise replace NBP Module.
(13:1) RFU Test Timed Out error log message	Test is not completed in time	Run Op Check
(13:2) RFU Test -BP Message not received	NBP communication failure	Replace NBP Module
(13:3) Self Test Failure error log message	NBP self-test failure	
(13:4) NBP Equipment Malfunction error log message	NBP Module failure	

$EtCO_2$ Monitoring Problems

When troubleshooting $EtCO_2$ problems, it is recommended to replace the $EtCO_2$ sensor first. If the problem still exists, try to replace internal tubing, and tubing of the $EtCO_2$ module.

If the $EtCO_2$ module does not start work when you connect a sampling line, try to repeat the standard testing sequence, for example:

1 Return to the Main Menu
2 Reconnect the sampling line
3 Reenter the Service $EtCO_2$ screen
4 Reenter the Test screen

Table 23 **$EtCO_2$ Monitoring Problems**

Symptom	Possible Causes	Suggested Solution
Failure to display measurement	$EtCO_2$ Module failure	• Replace the sampling line • Replace $EtCO_2$ module
	Processor PCA failure	Replace Processor PCA
	Therapy PCA failure	Replace Therapy PCA
Reading inaccurate	Sampling line is blocked or damaged	• Replace sampling line • Replace $EtCO_2$ module
The $EtCO_2$ Module does not start when the sampling line is connected to the DFM100. There is no $EtCO_2$ waveform on the display	• Sampling line is damaged • $EtCO_2$ module failure or sensor failure	• Replace sampling line • Run an OpCheck. If the $EtCO_2$ test fails, replace the $EtCO_2$ Module. If the $EtCO_2$ test passes, examine the sensor for dirt or foreign objects and clean the sensor. If the problem still exists, replace Processor PCA.
CO2 Replace Sensor tech. alarm	Sensor end of useful life	Replace the sensor
CO2 Sensor ver Temp tech. alarm	The sensor temperature is over 40°C	• Move sensor away from heat. • Let the sensor cool down. • Replace the sensor if persists
CO2 Service Required tech. alarm	Hardware Error	• Unplug sensor from the device for 10s and reconnect • Replace the sensor if persists
CO2 Communication Failure tech. alarm	Unexpected module behavior	• Unplug sensor from the device for 10s and reconnect. • Repeat OpCheck • Replace the sensor if persists
CO2 Zero Required tech. alarm	Zero required	• Perform an adapter zero • Replace the sensor if persists
CO2 Sensor Warming Up tech. alarm	It may take a few seconds for the sensor to warm up	Wait until completion
CO2 Check Line tech. alarm	Sampling line may be occluded or kinked	Check the sampling line
CO2 Check Airway Adapter tech. alarm	Airway Adapter not installed or dirty	• Check the airway adapter and clean or replace as necessary • Replace the sensor if persists

Table 23 **$EtCO_2$ Monitoring Problems** ***(Continued)***

Symptom	Possible Causes	Suggested Solution
CO2 Error tech. alarm	Unexpected module behavior. Philips asks you to report this unexpected software problem	**1** Disconnect sensor and reboot. **2** Reconnect sensor. **3** Export error logs and report to the Response Center.
CO2 Out of Range tech. alarm	The calculated value is over the upper limit (99mmHg)	• Check the airway adapter and clean or replace as necessary • Perform an adapter zero • Replace the sensor if persists
CO2 Tube Unplugged tech. alarm	Sensor/Sampling line unplugged	Re-insert sensor /sampling line.
CO2 Sensor Unplugged tech. alarm		
CO2 Power Overload tech. alarm	Sensor voltage overload	• Replace the sensor • Replace Processor PCA if persists
(15:1) Test Timed Out error log message	Test is not completed in time	• Run Op Check • Replace $EtCO_2$ Module
(15:2) EtCO2 OpCheck Communications Failure error log message	$EtCO_2$ Op Check Communication Failure	• Check the sensor connection • Replace $EtCO_2$ Module • $EtCO_2$ Module needs service • Replace Processor PCA
(15:3) EtCO2 OpCheck Service Required error log message	Service required. Possible sensor's end of useful life	• Check the sensor connection • Replace $EtCO_2$ Module • $EtCO_2$ Module needs service
(15:4) EtCO2 Clinical Service Required error log message		
(15:5) EtCO2 Clinical Communications Failure error log message	Communications failure. Flultry sensor or connection	• Check the sensor connection • Replace $EtCO_2$ Module • $EtCO_2$ Module needs service • Replace Processor PCA

Controls Problems

If the controls performance becomes a suspect, run the controls tests as described in "Controls Test" on page 160. Table 24 discusses control problems that can occur.

Table 24 **Controls Problems**

Symptom	Possible Cause	Suggested Solution
Therapy Knob Failure message	During Operational Check, the Therapy Knob was not set to 170 J as directed	• Run an Operational Check setting the Knob to 170 J as directed. • Check the Therapy Knob for mechanical operation. • If the Therapy Knob is not responding, run the Controls Test, if fails replace the Therapy Encoder.
One or more of the buttons on the front panel do not respond correctly	UI PCA failure	• Run Controls Test to confirm. • Check button pieces for mechanical operation. • Check connections to the UI PCA. • Replace UI PCA.
	Processor PCA failure	Replace Processor PCA
The Therapy Encoder does not respond correctly	Therapy Knob misaligned	Reseat / replace Therapy Knob
	Therapy Encoder failure	Replace Therapy Encoder
	Processor PCA failure	Replace Processor PCA
Test Time Out error log message	Test is not completed within the specified time	Run Op Check
(2:2) **Therapy Knob Test** error log message	Control Test failure	• Run Op Check (ensure the Knob is at 170 position) • Replace Therapy PCA • Replace Processor PCA
(3:2) **Charge Button Test** error log message		• Run Op Check • Replace UI PCA
(4:2) **Shock Button Test** error log message		• Run Op Check • Replace Paddles (if the paddle Shock button fails) • Replace UI PCA (if the device Shock button fails)
(6:2) **Sync Button Test** error log message		• Run Op Check • Replace UI PCA
(2:3) **Therapy Knob Rotary energy setting decode is degraded**	Therapy Encoder failure	Replace Therapy PCA
(2:4) **Therapy Knob On/Off decode is degraded**		

USB Problems

Test the USB if indicated by the troubleshooting. The USB test is safe for the data on the USB drive.

The USB test verifies both the USB flash drive and Efficia DFM100 USB Port performance. If in doubt, test the suspect USB flash drive on different Efficia DFM100 devices or different USB flash drives on the suspect device.

To test the USB:

Refer to "USB Test" on page 163 in Chapter 5 "Performance Verification" .

Table 25 **USB Messages**

Screen Message	Possible Cause	Suggested Solution
Configuration Item Name Setting Not Supported	An imported configuration item is not compatible with the device current software version and is ignored	• Upgrade your Efficia DFM100 software • Ignore the missing item if not applicable
Do Not Remove USB Flash Drive	USB Read or Write operation in progress	Do not touch the USB flash drive or any other controls
Error Reading Configuration Data	A corrupted file or another error prevents reading of the configuration file	• Run the USB Test • Check the USB flash drive content
Insert Compatible USB Device	• No USB device in the drive. • The USB device is not fully inserted. • USB device is not compatible with the Efficia DFM100	Fully insert a standard USB 2.0-compatible flash drive, no more than 32 Gb capacity.
No Configuration Data on USB Flash Drive	Attempt to read configuration data from a USB flash drive, but no configuration data found	• Check the USB flash drive content • Check the product version
No Software Upgrades Available	Attempt to read software upgrades from a USB flash drive, but no software upgrades found	• Check the USB flash drive is inserted • Check the USB flash drive contains a valid software upgrade
USB Error	USB failure	Run the USB Test
USB Flash Drive Error	USB device removed while read or write in progress, or error in data transfer	Repeat the operation
Upgrade Failed, Error *nn*	See "Software Upgrade Errors" on page 24	
USB Flash Drive Full	Not enough memory available on the USB flash drive	Insert a new flash drive or erase data from the flash drive
USB Power Overload	USB power overload is detected	Replace the USB flash drive and restart the device

Display Problems

Run the Display Test (see "Display Test" on page 162) to inspect the screen for defective pixels, random lines or dots, visible permanent patterns, or flickering.

Table 26 **Display Problems**

Symptom	Possible Cause	Suggested Solution
Display is all dark, no response to controls. Turn the Therapy Knob to Monitor or Therapy, press the **Sync** button. Does it light up?	Yes: Failure of backlight Display failure	• Replace Display Assembly • Replace Processor PCA
	No: Device does not turn on	Troubleshoot the device
Display is all light, no response to controls.	• SOM PCA failure • Processor PCA failure • Display failure	• Replace SOM PCA • Replace Processor PCA • Replace Display Assembly
Display unusually dim.	Display failure	• Replace Display Assembly • Replace Processor PCA
Display Test failure in Service Mode (other than the symptoms above)	• Display failure • SOM PCA failure • Processor PCA failure	• Replace Display Assembly • Replace SOM PCA • Replace Processor PCA

Audio Problems

Table 27 **Audio Problems**

Symptom	Possible Cause	Suggested Solution
No audio at all	Speaker failure	• Check speaker connections • Replace Speaker Assembly
	UI PCA failure	Replace UI PCA
	Processor PCA failure	Replace Processor PCA
Audio is distorted	• Audio is too loud • Speaker damage or failure • UI PCA failure • Processor PCA failure	• Reduce the volume • Replace Speaker Assembly • Replace UI PCA • Replace Processor PCA
Buzzing noise when audio active	• Speaker hardware loose • Speaker failure • UI PCA failure • Processor PCA failure	• Tighten hardware as needed • Replace Speaker Assembly • Replace UI PCA • Replace Processor PCA
Tones present but no voice prompt (in AED Mode)	Software error or failed localization upgrade	Reload the language
	SOM PCA failure	Replace SOM PCA
Audio Failure message	Audio failure during Op Check	• Repeat the Op Check. Make sure to acknowledge the audio prompt • Replace Speaker Assembly
(5:1) RFU Test Timed Out error log message	Test is not completed in time	Run Op Check

Table 27 **Audio Problems *(Continued)***

Symptom	Possible Cause	Suggested Solution
(5:2) **Audio Failure** error log message	Speaker failure	Replace Speaker Assembly
	UI PCA failure	Replace UI PCA
	Processor PCA failure	Replace Processor PCA

Printing Problems

Table 28 **Printing Problems**

Symptom	Possible Cause	Suggested Solution
Printer Malfunction message	Printer failure, or there is a problem communicating with the printer	If the message repeats, replace the printer assembly
Printer Out Of Paper message , or Paper does not move	Paper improperly loaded or jammed	Reload paper or clear jam
	Printer is out of paper	Replace paper with fresh dry roll
	Paper is wet	
	Printer failure	Replace printer
Paper moves, but printing is faint or absent	Door improperly latched	Check door latch
	Dirty printhead	Clean printhead according to the procedures in the *Instructions for Use*
	Wrong paper	Use Philips-approved paper
	Paper loaded backwards	Check paper position
	Operating temperature is beyond specified range	• Stop printing and allow the printer to cool • Run Fan Test, replace fans as needed • Relocate the device to continue printing
	Printer failure	Replace printer
Paper moves but print quality poor or some dots missing	Dirty printhead	Clean printhead according to the procedures in the *Instructions for Use*
	Printer failure	Replace printer
Printer Font Unavailable message	A special font for your language has not been installed on your device. The printer uses the default font.	• Run an Op Check • Reinstall the correct language software
Font does not look right		
Printer Door Open message	Door improperly latched	Check door latch
Loud buzzing or grinding noise		
Waveforms or text distorted even though they look OK on display	Moisture damage to the paper roll	Replace paper roll
	Printer failure	Replace printer
Black line running along paper	Dots (printhead elements) stuck on due to printer failure	Replace printer

Table 28 **Printing Problems *(Continued)***

Symptom	Possible Cause	Suggested Solution
White line running along paper	Dirt on printhead	Clean printhead
	Dots (printhead elements) stuck off due to printer failure	Replace printer
• **Printer Error** message	Printer failure	Replace printer
• Fails Printer Test in Service Mode (other than symptoms above)	Processor PCA failure	Replace Processor PCA

Table 29 **Printer Diagnostic with the Hardware Error Log**

# ID	Info String	Possible Cause	Suggested Solution
(14:1)	**RFU Test Timed Out** error log message	Test is not completed in time	Run Op Check
(14:2)	**CMx: Printer Comm Error** error log message	Printer communication failure	• Replace printer • Replace Processor PCA • Replace I/O PCA (rarely)
(14:3)	**CEx: Printer Command Error** error log message	Invalid printer command	• Reinstall software • Replace printer
(14:4)	**FAx: Printer Fault Detected** error log message	Printer failure	Replace printer
(14:5)	**TE1: Printer Temp exceeds threshold** error log message	Printer overheated	• Stop printing to allow the printer to cool • Relocate the device to continue printing
(14:6)	**VL1: Printer Voltage Low** error log message	Voltage out of the range	• Replace printer • Replace Processor PCA
(14:7)	**VH0: Printer Voltage High** error log message		
(14:8-13), (14:22)	Various error log messages	Printer hardware failure	• Replace printer • Replace Processor PCA
(14:14-21)	Various error log messages	Printer software failure	Reinstall software

4

Repair

This chapter describes how to repair the Efficia DFM100. Details are provided on disassembling the device, removing and replacing subassemblies, and reassembling the device.

These instructions are intended for use only by the service providers who are specifically trained to service the Efficia DFM100 defibrillator/monitor.

Overview

This chapter is organized into the following sections:

- Who Should Perform Repairs . . . . . p. 75
- Repair Philosophy . . . . . p. 76
- Calling for Service . . . . . p. 76
- Key Components . . . . . p. 76
- Repair Notes . . . . . p. 77
- External Assemblies . . . . . p. 79
- Internal Assemblies — Introduction . . . . . p. 90
- Internal Assemblies — Front Case . . . . . p. 93
- Internal Assemblies — Rear Case Assembly . . . . . p. 107
- Internal Assemblies — Main Chassis . . . . . p. 112
- Internal Assemblies — Rear Case . . . . . p. 147
- Closing the Case . . . . . p. 149

Who Should Perform Repairs

Only qualified technical personnel who have been trained in the safe and proper servicing of the Efficia DFM100 should open the defibrillator/monitor case, remove and replace components, or make adjustments.

WARNING: Efficia DFM100 service should only be performed by qualified service personnel, in accordance with this document, the *Efficia DFM100 Service Manual*.

Repair Philosophy

The repair philosophy of the Efficia DFM100 is subassembly replacement.

Examples of subassemblies are the printer, the Processor PCA, and selected connectors and other items. Repairs that involve replacing individual components on a PCA are not supported.

CAUTION: Individual component replacement should not be attempted. Component level repair is not supported due to the extensive use of surface mount technology and the high parts-density on the circuit boards. Unauthorized component replacement can impair performance of the Efficia DFM100 and void the warranty.

Calling for Service

To download the latest documentation go to:
http://www.philips.com/ProductDocs.

To download other technical information go to:
http://www.healthcare.philips.com/main/support/InCenter/.

For product support, contact your local Philips representative.

Before calling for service, note the following information:

- Serial number of the DFM100
- Problem description
- Save operation check logs, error logs etc.

To order service parts, contact Philips Shenzhen customer service department. Opening hours may vary and subject to change:

Monday – Friday (except Chinese statutory holidays)
BJT 08:30 – 12:00, 13:00 – 17:30 (GMT+8)

Tel: +86 755 86278308
Fax: +86 755 86278392

Or via E-mail: goldway.service@philips.com

Service and support are available in Chinese and English only.

Mailing address:

Philips Customer Service Department of Philips Goldway (Shenzhen) Industrial Inc.
No. 2 Tiangong Road, Nanshan District, Shenzhen, P. R. China 518057

Key Components

Replacement assemblies marked with an asterisk (*) in the Replacement Parts tables contain one or more Key Components. Key Components require detailed tracking, by recording the key component part number and the key component's date code, its serial number, or both. Record this information on the Customer Service Order (CSO) for both the failed assembly and the replacement assembly.

The Key Components that are part of the replacement assemblies are listed in Table 43 "Key Components" on page 184.

Repair Notes

The following sections provide details of how to successfully work with the internal assemblies of the Efficia DFM100 defibrillator/monitor.

Safety Precautions

WARNING: Remove all power sources (AC and battery) before opening the Efficia DFM100. Failure to do so may allow the device to charge without warning and could result in serious injury or death.

CAUTION: Take the necessary precautions against shock or injury before you conduct defibrillator/monitor tests or repairs.

- Only properly trained engineers and technicians should service the device.
- The device can contain deadly voltages even if the device is turned off.
- Make sure the device is disarmed.
  To disarm the defibrillator, press the **Cancel Charge** soft key. If the **Shock** button has not been pressed within the time period specified in the **Time to Auto Disarm** configuration setting, the defibrillator disarms automatically. Additionally, you can disarm the Efficia DFM100 any time by turning the Therapy Knob to the **Off** position.
- Make sure that you disconnect all power before opening the device.
- Make sure you discharge the device before working with it.
- Make sure you work in a static-safe environment. Use a static control wrist band, in conjunction with an antistatic pad grounded per the manufacturer's instructions.
- Special cleaning technologies are used during the manufacturing of the PCAs. Be careful not to touch the surface areas of the PCAs with bare hands because skin oil can affect product performance. Use anti-static or cotton gloves or rubber finger tips.
- Keep replacement PCAs in antistatic pouches until ready to install.
- Note that the edges of the metal brackets and display metal protection enclosure may be sharp. Take care not to cut yourself or shear the wires.

Internal Connections

Whenever troubleshooting indicates a particular PCA may be at fault, it is always good practice to check all the connections to that PCA and retest before replacing the PCA.

Cable and Assembly Placement

How the wires and cables are routed and dressed inside the main plastic frame plays an important role in two areas: in preventing long-term wear and potential pinching problems, and in reducing electromagnetic and radio frequency interference emitted by the defibrillator/monitor.

- When you disassemble any part of the device, pay special attention to how cables and wires are routed.
- When you reassemble the device, be sure to route and dress all cables and wires as they were originally.
- Return all components to their original position within the case.

Device Reassembly

If your repair kit contains new accessories like shields, screws, etc., then install the new accessories and discard the old ones.

If you do not reassemble the device correctly, it may no longer be properly sealed. This could result in dust and moisture damage to the device. To ensure the adequate seal:

- Place all gaskets in their proper locations.
- Correctly assemble all parts that mate with gaskets (make sure the gaskets are not wrinkled, pinched, or torn).
- Replace all screws.
- If installing several screws at a time, always install all the screws lightly, and then tighten in a criss-cross pattern.
- Make sure that screws are not cross-threaded and firmly tightened.

Disposal

Prior to disposal, remove the external and internal batteries. Then dispose of the device in accordance with your country's regulations for equipment containing electronic parts.

WARNING: To avoid contaminating or infecting personnel, the environment, or other equipment, make sure you disinfect and decontaminate the defibrillator/monitor appropriately prior to disposal.
Properly dispose of or recycle depleted batteries according to local regulations. Do not puncture, disassemble, or incinerate batteries. Be careful not to short the battery terminals because this could result in a fire hazard. Disposal of the device with the battery inserted presents a potential shock hazard.

Repair Tools and Equipment

The following tools are needed to perform the procedures in this chapter:

- Torx T-8 driver only for the System-on-Module (SOM) PCA replacement.
- M3 Phillips driver (at least 100mm long).
- M4 Phillips driver (at least 100mm long).
- Therapy Port Replacement Tool (453564500151)
- Slip-joint Pliers or Adjustable open-end wrench.
- Straight-tip needle-nose pliers or tweezers.
- 75% Isopropanol Alcohol for Therapy PCA High Voltage Cable, LCD Display Cable & Fan.
- Hot Melt Glue (3M) (453564507081) only for Therapy PCA High Voltage Cable and LCD Display Cable
- Hot Melt Glue Gun (453564507071) (3M Scotch-weld hot melt applicator 0.15kW/240V)only for Paddle Connection Cable and LCD Display Cable.
- Flat head screw driver.
- Software Support tool for upgrades and SOM PCA repairs (see Table 35 "Software Support Tool" on page 178 for part numbers).
- Defibrillator Discharge Tool (453564500141).
- Gloves and ESD protection for PCA handling.

External Assemblies

This section describes how to remove and replace assemblies that are external to the case. You *do not* need to open the case for any of these procedures.

NOTE: See the *Efficia DFM100 Instructions for Use* for information on attaching the carrying case and accessory pouches.

This section is organized into the following topics:

- Battery Compartment Cover and Latch . . . . . p. 79
- Bedrail Mount . . . . . p. 81
- Labels . . . . . p. 82
- Handle Assembly . . . . . p. 84
- Paddle Tray and Plates . . . . . p. 85
- Printer . . . . . p. 87
- Therapy Knob / Smart Select Knob . . . . . p. 89

Battery Compartment Cover and Latch

Preparation

1. Turn the device off and remove the battery and the AC.
2. Position the device.
   Lay the device on a work surface with the display facing down and the bottom facing you.

Removal

1. Loosen and remove the four 3.3 x 8 self-tapping screws.
2. Insert a flat-head screwdriver to loosen the compartment cover. See Figure 44.

Figure 44 **Battery Compartment Cover-1**

3 Pull out and remove the compartment cover. See Figure 45.

Figure 45 **Battery Compartment Cover-2**

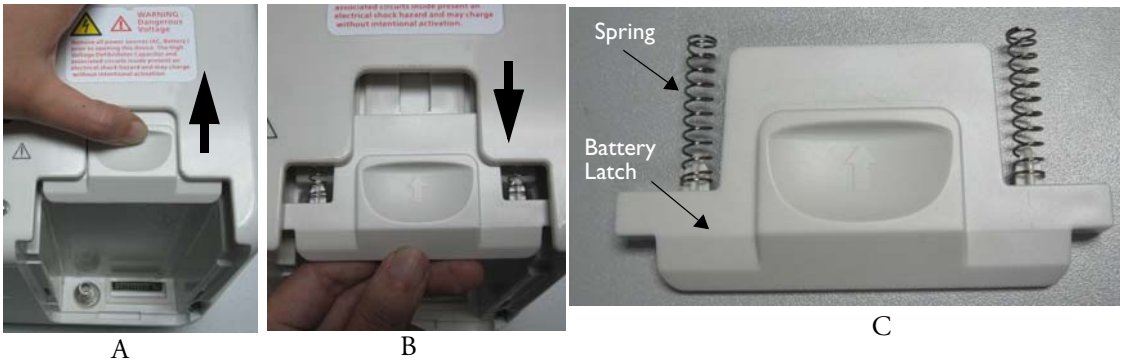
Removal Battery Latch

1 Press the latch in the direction of the arrow. See Figure 46A.

2 Quickly release the latch. The latch will be ejected. See Figure 46B.

3 Pull out the latch in the direction of the arrow. See Figure 46B.

Figure 46 **Battery Latch**



A B C

Replacement

1 Install the new latch and the springs. Press the new latch until you hear a click. Do not reuse old parts. Position the latch as shown in Figure 46C.

2 Replace the compartment cover.

3 Install the four 3.3 x 8 self-tapping screws. Do not cross-thread or overtighten the screws.

To Complete the Replacement

1 Visually inspect the device to ensure that you installed the latch and cover correctly.

2 Insert and remove a battery to verify the latch performance.

It is not necessary to run any Performance Verification and Safety testing.

Bedrail Mount

Preparation

1 Turn the device off and remove the battery and the AC.

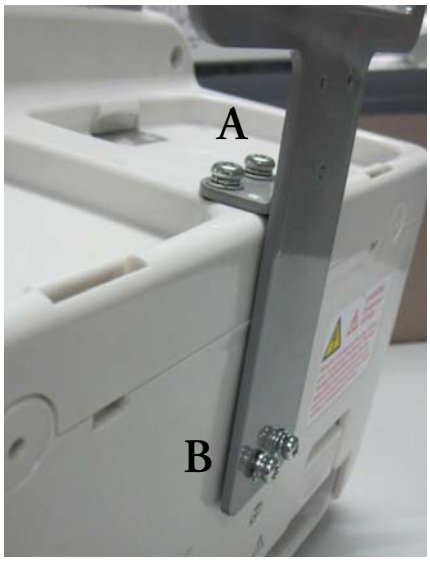
Removal

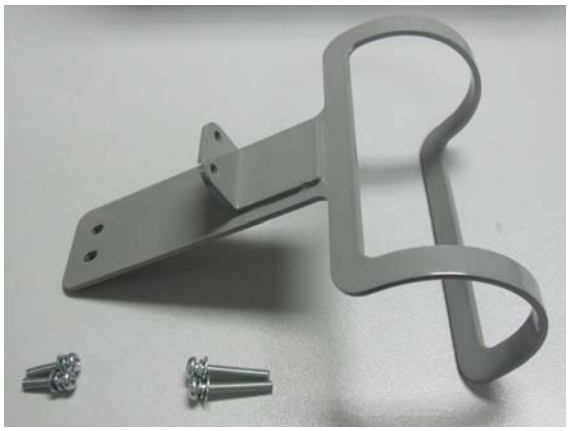
1 Loosen and remove the two M 4x25 screws with washers on A position.

2 Loosen and remove the two M 4x12 screws with washers on B position. See Figure 47.

3 Remove the bedrail mount.

Figure 47 **Bedrail Mount**





M 4x12 M 4x25

Replacement

1 Secure the bedrail mount to the back of the device.

- **a** Secure the top two M 4x25 screws with washers first (A position).
- **b** Secure the bottom two M 4x12 screws with washers (B position).
- **c** Do not cross-thread or overtighten the screws.

To Complete the Replacement

- Visually inspect the device to ensure that you installed the bedrail mount correctly. It is not necessary to run any Performance Verification or safety testing.

Labels

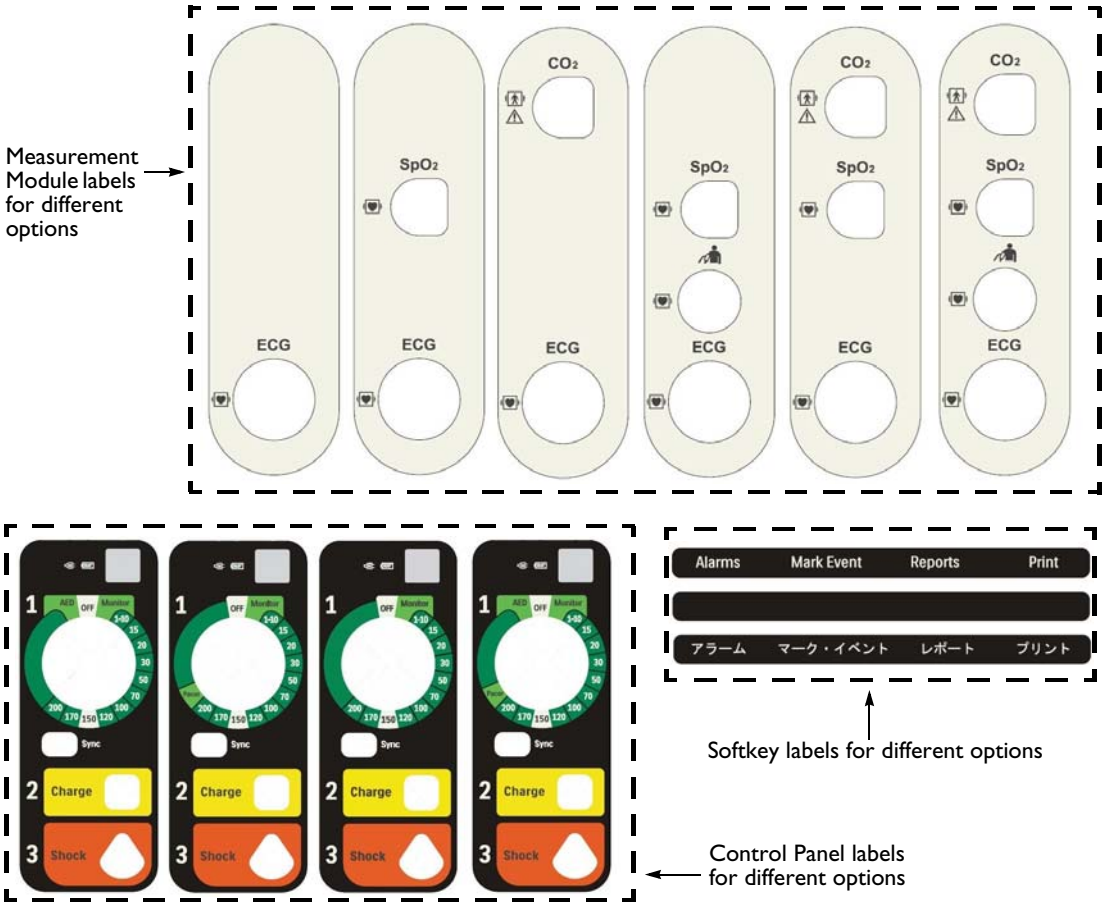
There are three groups of labels for the Efficia DFM100:

- the Instruction label
- the Primary label, and
- the Optional Key labels (optional)

Instruction Label

The Instruction Labels include Measurement Module Labels, Control Panel Labels and Softkey Labels. The Measurement Module Labels include six different Measurement Module labels for different option sets. The Control Panel Labels include four labels for devices with and without pacing or defibrillation. The Softkey Labels include two labels with or without characters on it. Make sure to order the correct localized label. (see "Label Sets" on page 183) and place the correct labels on the device.

Figure 48 **Instruction Labels**



NOTE: When perform the product upgrade in field, the new function measurement module label will pre-affixed to measurement assembly.

The Label Set contains the following three kinds of label for each language (see "Label Sets" on page 183 for part numbers):

- Die-cut Control Panel labels (Total 4)
- Softkey labels (Total 3)
- High Voltage Warning label (Total 1)

Primary Label

Primary label is not included in the label set and shipped with the device. It lists the Serial Number and the Options Key, and is affixed to the bottom of the device. See "Primary Label" on page 17.

Contact your local Response Center (see "Calling for Service" on page 76) if you replace the Rear Case for the primary label replacement. Be prepared to provide the information from the old primary label.

Option Key Label

Option Key labels are shipped with upgrade parts and are affixed to the bottom of the device. Contact your local Response Center (see "Calling for Service" on page 76) if you replace the Battery Compartment Cover for the Option Key labels replacement. Be prepared to provide the information from the old Option Key labels.

Removing and Replacing Labels

Preparation

1. Turn the device off.
2. Disconnect AC power and remove the battery.

Removal

1. Using a sharp tool such as a utility knife, pick up one corner of the old label.
2. Peel the label up by pulling slowly and evenly on the loosened corner.

Replacement

1. Clean the surface:
   a. Remove any adhesive residue by rubbing the dry surface with your finger and "rolling up" the adhesive residue.
   Solvents are ineffective, as is scraping with a tool.
   b. Clean the surface with isopropyl alcohol. Allow it to dry.
2. Peel the new label off the backing.
   Avoid touching the label adhesive, as this may prevent the label from bonding properly.
3. Apply the label:
   a. For the Control Panel label, align around the Buttons and Switch first.
   b. Align one edge of the label with the recess on the case, then roll the label slowly into position.
   c. Press firmly all over the label, especially the edges, to ensure it adheres to the case.

To Complete the Replacement

- Visually inspect the device to ensure that you applied the labels correctly. It is not necessary to run any Performance Verification and Safety testing.

Handle Assembly

Preparation

1. Turn the device off and remove the battery and the AC.
2. M4 Phillips screw driver.

Removal

1. Remove the two plastic handle plugs using tweezers.
2. Loosen and remove the four M 4 x16 screws with washers in the handle. See Figure 49.
3. Remove the handle.

Figure 49 **Handle Screws**

Replacement

1. Install the new handle into handle pockets in the Rear Case.
2. Install the four M 4x16 screws with washers.
   Do not cross-thread or overtighten the screws.

To Complete the Replacement

- Visually inspect the device to ensure that you installed the handle assembly correctly. It is not necessary to run any Performance Verification or Safety testing.

Paddle Tray and Plates

You need an M3 Phillips screwdriver for this repair.

Preparation

1. Turn the device off.
2. Disconnect AC power and remove the battery.
3. Place the device on the work surface with the top side facing you.

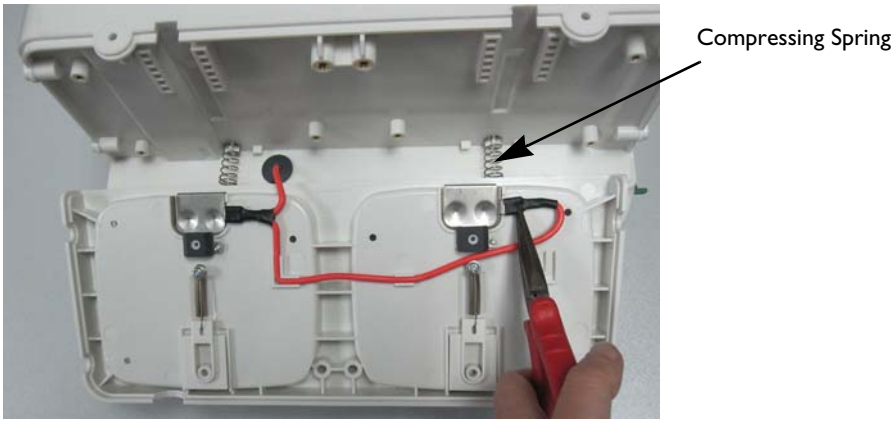
Removal

1. Remove the paddles from the tray.
   Disconnect the paddles from the Therapy port. Snap both paddles out of the paddle tray and lay them aside.
2. Remove the six M 3x10 flat head Phillips screws from the paddle tray. See Figure 50 ❶ to ❻.

Figure 50 **Removing the Paddle Tray-1**

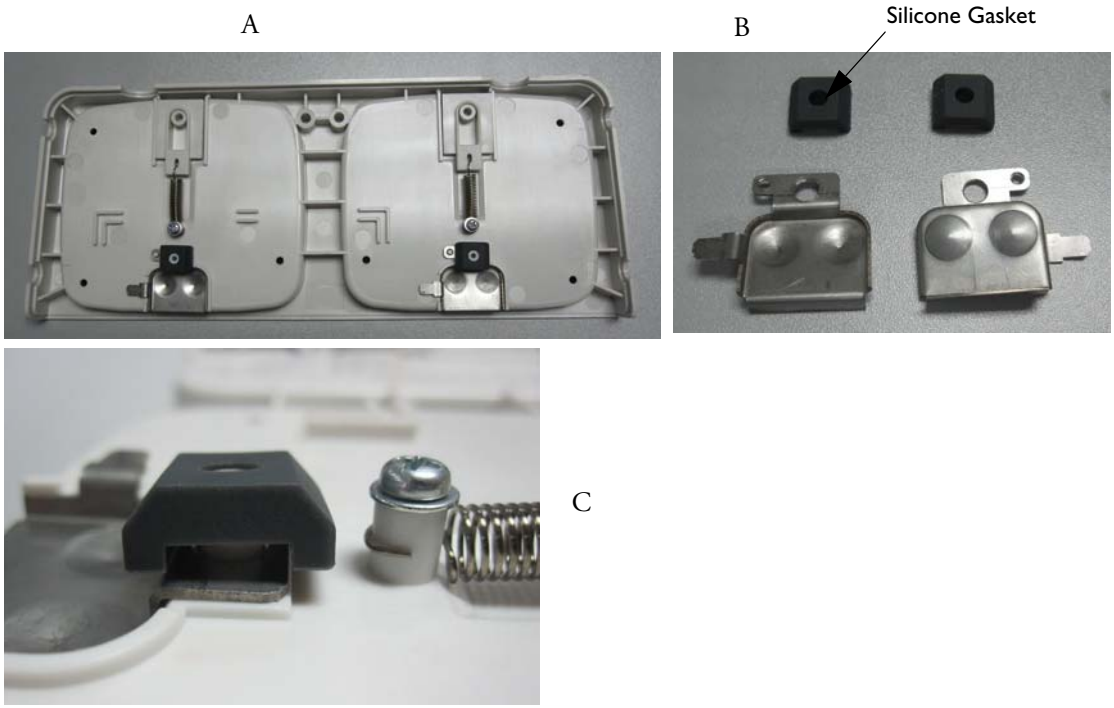
3. Gently open the paddle tray. Note the springs inside. Use the straight-tip needle-nose pliers to remove the two spade connectors. See Figure 51.

Figure 51 **Removing the Paddle Tray-2**



4 Remove the two silicone pads and remove the two metal plates. See Figure 52.

Figure 52 **Removing the Plates**



Replacement

1 If you are replacing the metal plates only, do following steps:
   - **a** Position the paddle tray up side down, the longer side of the tray is at horizontal position.
   - **b** Place the new metal plates into the left and right pockets and install the two silicone gaskets to lock the plates in position. Note that the two longer sides of the silicone gasket are at horizontal position. See Figure 52 A, B or C.
   - **c** Connect the spade connector and place the shorting circuit cable into the fixing slots. See Figure 51.
2 Place the paddle tray back on the device.
3 Replace the six M 3x10 flat head Phillips screws.
   When replacing the screws, press the paddle tray against the spring.
4 Make sure two plastic latches can be moved back and forth freely when press them back and forth.

To Complete the Replacement

1 Visually inspect the device to ensure that you installed the Paddle Tray assembly correctly.
2 Perform Performance Verification and Safety testing as described in the "Performance Verification" chapter.

Printer

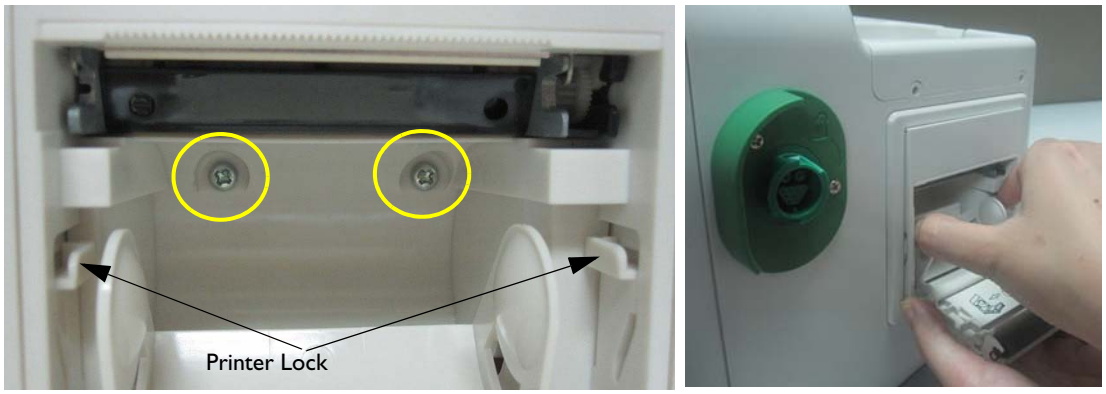
Preparation

1. Turn the device off.
2. Disconnect AC power and remove the battery.

Removal

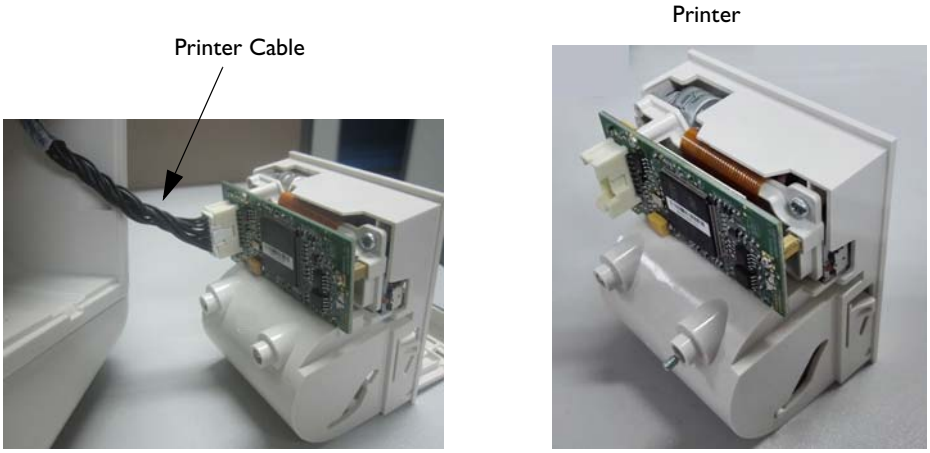
1. Pull up on the printer door latch and open the printer door.
2. Remove the paper roll.
3. Loosen the two captive M 3x10 screws inside, see Figure 53.
4. Remove the printer by pressing the printer lock inside and pulling it straight out of the printer well.

Figure 53 **Printer-1**



5. Unplug the printer cable. See Figure 54.
6. Remove the Printer out of printer compartment.

Figure 54 **Printer-2**



Replacement

1. Install the Printer Cable, see Figure 54.
2. Slide the Printer straight into the printer compartment and gently push until it clicks in place.
3. Open the Printer door and tighten the two pan head M 3x10 screws.
4. Replace the paper per illustration printed on the printer door, and close the door.

To Complete the Replacement

1. Perform Performance Verification and Safety testing as described in the "Performance Verification" chapter.
2. Perform the "Printer Test" on page 160.

Therapy Knob / Smart Select Knob

Preparation

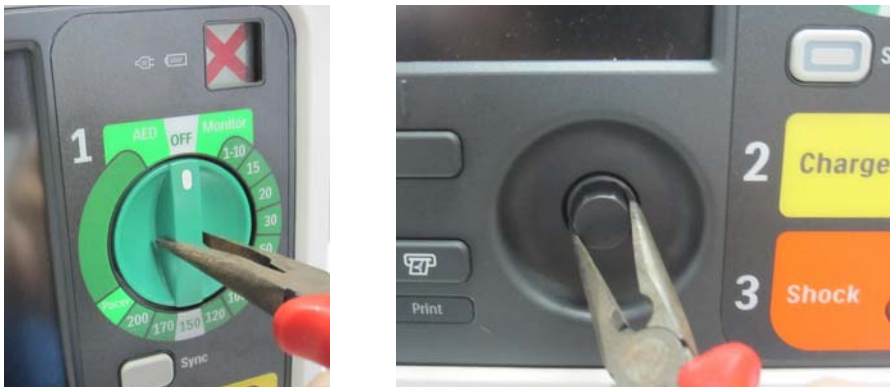
1. Turn the device off.
2. Disconnect all external power and remove the battery.

Removal and Replacement

1. Pull the Knob off its shaft.
   Use pliers to grab the center of the Knob and pull it straight out shaft. Make sure that the plier lips have smooth surface which will not damage the cosmetics of the Knob.

NOTE: Do not remove the screw under the Therapy Knob.

Figure 55 **Knob Replacement**



2. Align the flat side of the copper clip in the Knob with the flat surface on the shaft and press the Knob into place until it is fully seated.
   Make sure the Knob's rim is almost flush with the front panel.
3. Make sure the Knob rotates freely and that the Therapy Knob points to the correct markings on the front panel.

To Complete the Replacement

1. Perform Performance Verification and Safety testing as described in the "Performance Verification" chapter.
2. Perform the "Controls Test" on page 160.

Internal Assemblies — Introduction

This section is organized into the following topics:

Opening the Case . . . . . p. 90
Overview of the Internal Assemblies . . . . . p. 92

WARNING: Remove all power sources (AC, battery) before opening the device. Failure to do so may allow the device to charge without warning and could result in serious injury or death.

Opening the Case

To open the sealed case safely, perform the following steps, in the order listed.

Each step is described in more detail in following sections.

1. Separate the case (see "Separating the Case" below).
2. Discharge the Therapy Capacitor (see "Discharging the Therapy Capacitor" on page 92).

Separating the Case

Separate the Front and Rear Cases from each other by performing the following steps.

WARNING: Dangerous voltages may be present on components and connections exposed during device disassembly. Use extreme caution while the device is separated.

CAUTION: Be sure to work in a static-free environment. Use an electrostatic wrist band. The work surface and area surrounding it must be static-free. Use an antistatic pad which is grounded per the manufacturer's instructions.

To separate the Front and Rear Case from each other:

1. Remove accessory pouches and cradles, if present.
2. Remove the Bedrail Mount, if present. See "Bedrail Mount" on page 81.
3. Lay the device on a padded work surface with the display facing down and the bottom of the device facing toward you.
4. Remove the six M 4x16 case screws, see Figure 56 1 to 6.

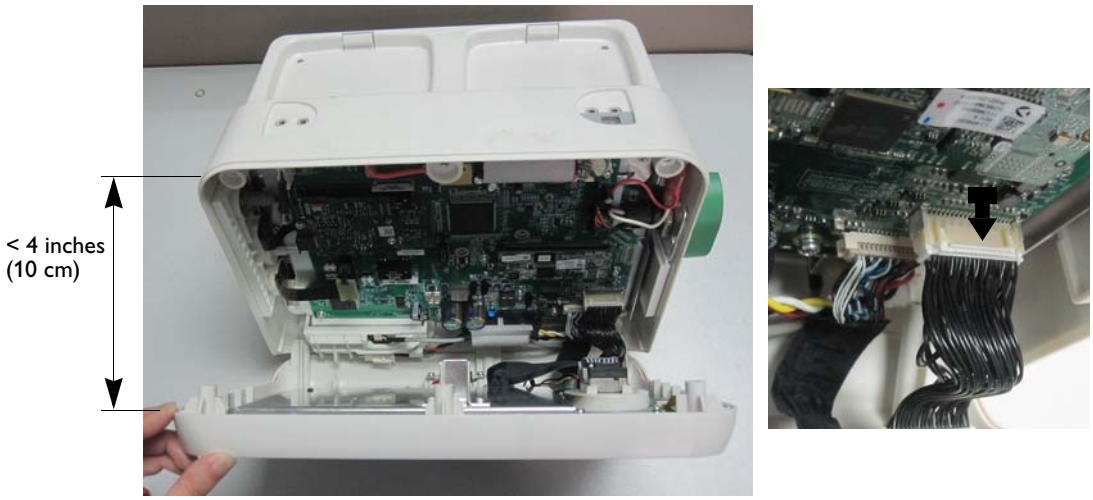
Figure 56 **Case Screws**

5 Put the device on a padded work surface with the display towards you.

6 Carefully open the Front Case no more than 10 cm.

7 Carefully unplug the UI PCA connection cable and the LCD Display connection cable and hold the Front Case while removing the cables, see Figure 57.

Figure 57 **Separating the Front Case Assembly**



8 Separate the Front Case.

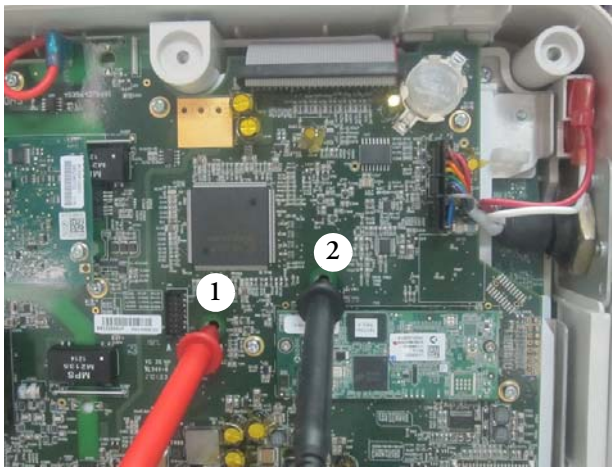
Discharging the Therapy Capacitor

WARNING: Use extreme caution in the following steps. Dangerous voltages may be present on components and connections. Do not touch any components or connections until you are sure the Therapy Capacitor is discharged.

To discharge the Therapy Capacitor:

1. Find two discharge holes on the Processor PCA. See Figure 58, 1, 2.
2. Insert the Defibrillator Discharge Tool into the holes till the two tips touch the two metal discharge studs on the therapy PCA.
3. Hold in place for at least 10 seconds.
4. Once you made a 10-second contact, the Therapy Capacitor is now safely discharged.

Figure 58 **Using the Discharge Tool**



Overview of the Internal Assemblies

The Internal Assemblies are organized in the following groups:

- Assemblies mounted directly on the Front Case
- Assemblies mounted on the Main Chassis
- Assemblies mounted directly on the Rear Case

Internal Assemblies — Front Case

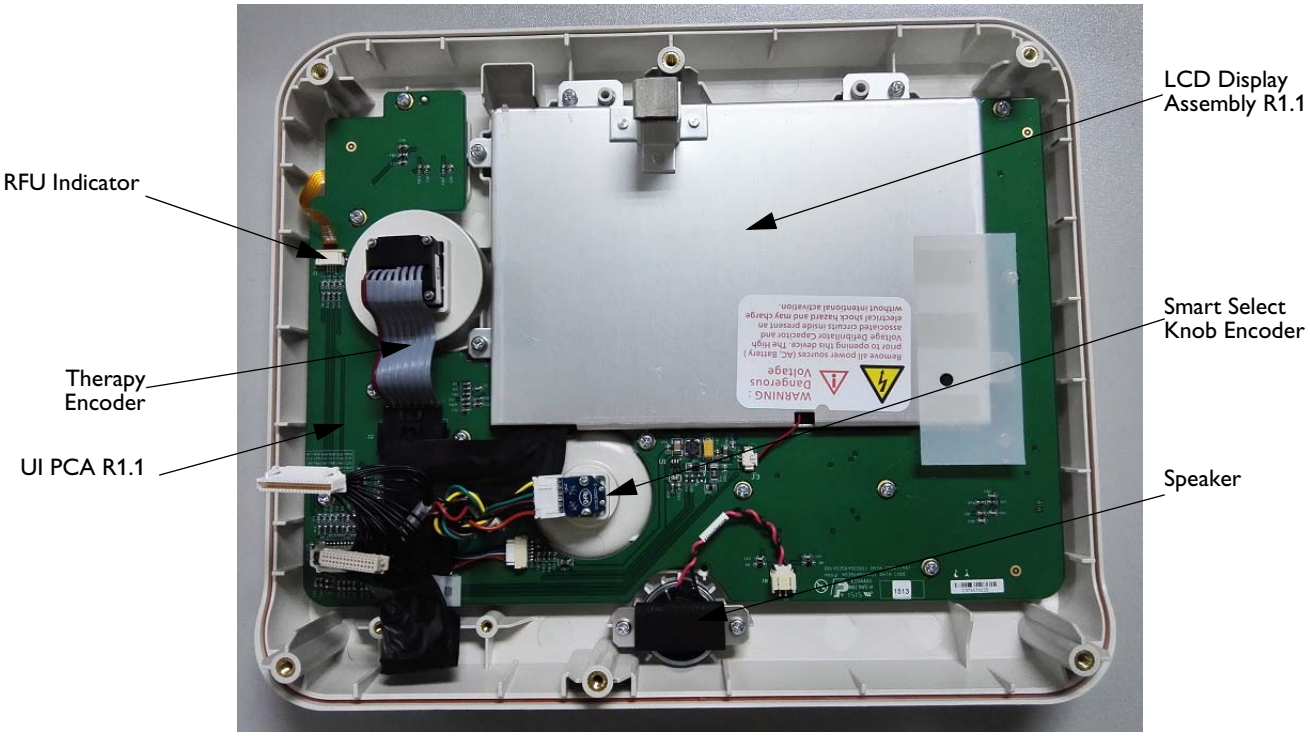
This section is organized into the following topics:

- LCD Display . . . . . p. 95
- Alarm Speaker . . . . . p. 100
- Therapy Encoder / Smart Select Knob Encoder . . . . . p. 101
- UI PCA . . . . . p. 102
- RFU Indicator . . . . . p. 105
- Silicon Buttons . . . . . p. 105
- Tubing Gasket Replacement . . . . . p. 106

CAUTIONS: Two versions UI PCAs are available for DFM100. Make sure you place the correct orders when replacing LCD Display Assembly or UI PCA Assembly. Refer to Table 36 on page 179 and Table 37 on page 179 for more inforamtion.

Figure 59 **Front Case Overview-1 R1.0**

Figure 60 **Front Case Overview-2 R1.1**



LCD Display

NOTES: There are two versions of the LCD Display available for DFM100. To find P/Ns of LCD Display Assembly, refer to Table 37 on page 179.

453564489521 DFM100 CBL LCD Display to Processor can be only used for 453564488961DFM100 Display ASSY.
No signal LCD Display cable is available for 453564587191 DFM100 Display ASSY 1.1.

You need the following tools for this repair:

1. 75% Isopropanol Alcohol
2. Hot Melt Glue (3M)
3. Hot Melt Glue Gun (3M Scotch-weld hot melt applicator 0.15KW/240V)

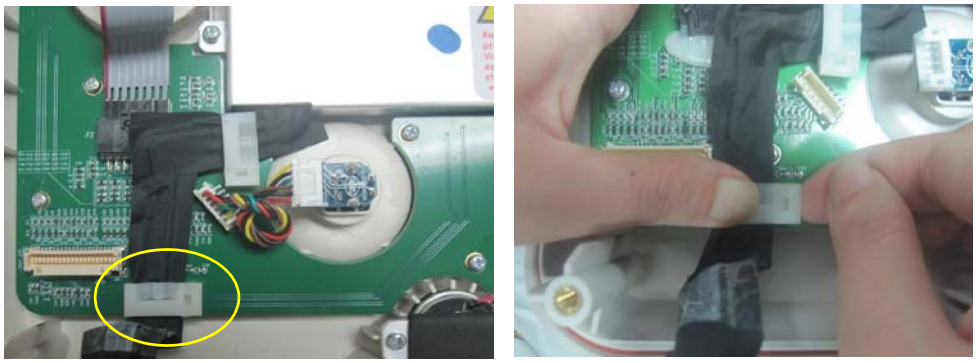
Preparation

1. Open the Case. See "Opening the Case" on page 90.
2. Position the Efficia DFM100 display side down.

Removal LCD Display R1.0

1. Press middle area and lift right side of the two plastic cable fasteners to loose the fasteners, see Figure 61.

Figure 61 **LCD Display Assembly-1**

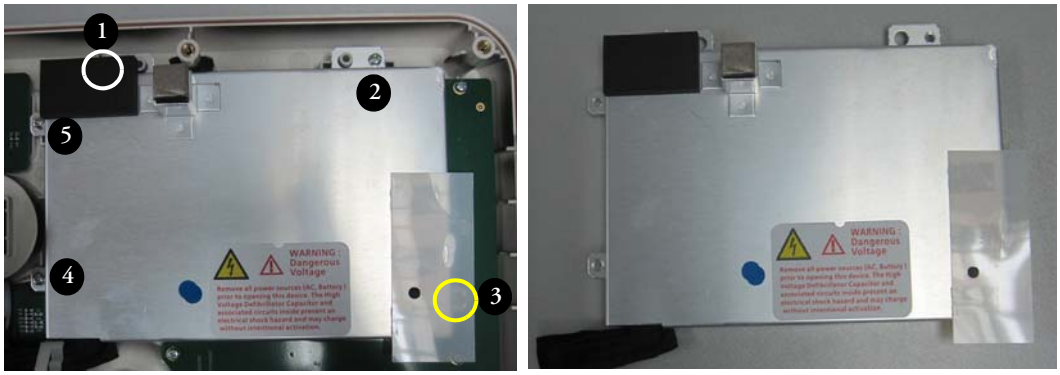


2. Remove the five M 3x10 screws with washers (1 to 5), see Figure 62 A. Screw 1 and 5 are underneath the cover.

NOTE: Screw 1 is under white circle and screw 3 is under yellow circle.

3. Remove the LCD Display R1.0 Assembly, see Figure 62 B.

Figure 62 **LCD Display Assembly-2**



A B

4 Remove the metal housing and the LCD protective silicone cover, see Figure 63 A and B.

Figure 63 **LCD Display Assembly-3**

5 Use 75% Isopropanol Alcohol to clean the hot melt glue. See Figure 64 A.

6 Carefully remove the LCD Display cable, see Figure 64 B.

Figure 64 **LCD Display Assembly-4**

A | B

NOTE: Individual LCD Display cable 453564489521 is **ONLY** used for LCD Display R1.0.

Replace LCD Display R1.0

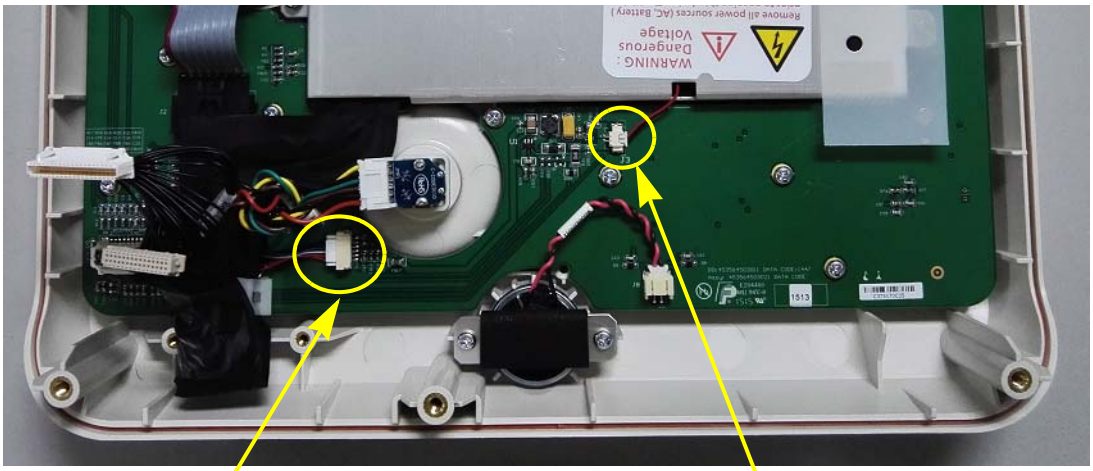
1. Install the LCD Display Cable, see Figure 64B.
2. Use hot melt glue and hot melt glue gun to seal the LCD Display Cable, see Figure 64 A. Wait until it cools
3. Install the LCD protective cover and metal shield, see Figure 63B.
4. After installing the LCD protective cover, place the LCD Display cable into the cable slot. See Figure 63 C.
5. Remove the protective thin film on the LCD screen.
6. Install and tighten the five M 3x10 screws with washers, see Figure 62.
7. Put the LCD Display Cable into the two plastic cable fasteners on UI PCA, see Figure 61.
8. Close the Case. See "Closing the Case" on page 149.

NOTE: Do not touch the LCD screen.

Remove LCD Display R1.1

1. Press middle area and lift right side of the plastic cable fastener to loosen the fastener, see yellow circle in Figure 65.
2. Unplug the 6-pin connector on LCD Display cable and the 2-pin LCD Display Wire from the UI PCA, see Figure 65.

Figure 65 **LCD Display Assembly-5**



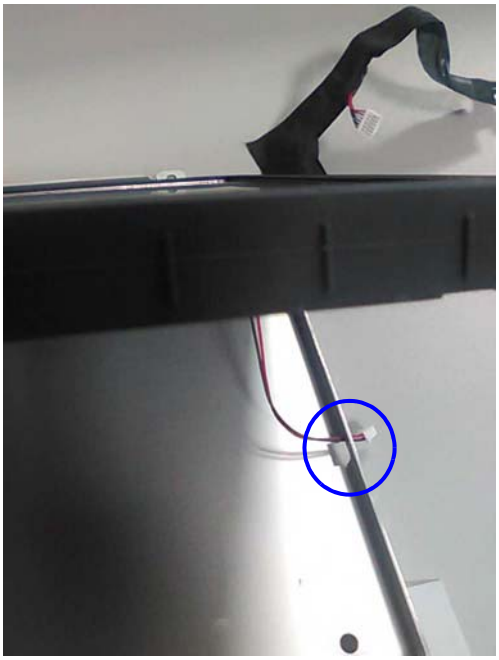
3. Remove the five M 3x10 screws with washers (1 to 5), see Figure 62 A. Screw 1 and 5 are underneath the cover.
4. Remove the LCD Display R1.1 Assembly, see Figure 62 B.
5. Remove the metal housing.

NOTE: No individual LCD Display cable is available as service part for LCD Display R1.1.

Replace LCD Display R1.1

1 Put the LCD Display R1.1 assembly into the metal shield. Put the 2-pin LCD Display wire through the small metal hole on the shield, see Figure 66.

Figure 66 **LCD Display Assembly-6**



Insert the 2-pin LCD Display Cable Wire rough the small hole on the metal shield

2 Remove the protective thin film on the LCD screen.

3 Install and tighten the five M 3x10 screws with washers, see Figure 62.

4 Put the LCD Display Cable into the plastic cable fastener on UI PCA, see Figure 65.

5 Plug the 6-pin connector on LCD Display Cable into the UI PCA, see Figure 65.

6 Plug the 2-pin LCD Display Wire into the UI PCA, see Figure 65.

7 Close the Case. See "Closing the Case" on page 149.

NOTE: Do not touch the LCD screen.

To Complete the Replacement:

- Run Performance Verification and Safety testing as described in the "Performance Verification" chapter.

Alarm Speaker

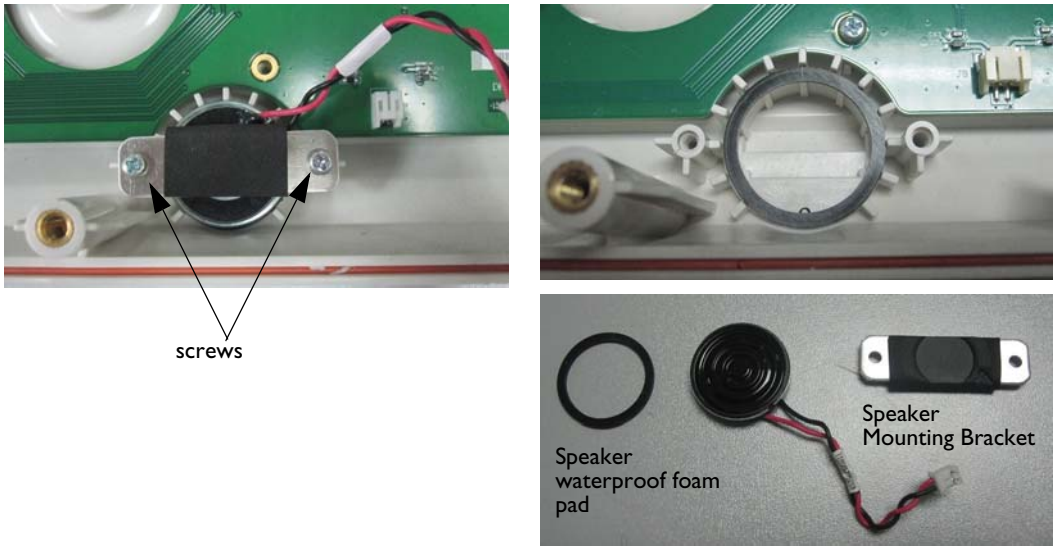
Preparation

1. Open the Case. See "Opening the Case" on page 90.
2. Put the front case assembly on the table with the back facing towards you.

Removal

1. Unplug the Alarm Speaker cable from the UI PCA.
2. Remove the two 3x8 self-tapping screws to remove the **speaker mounting bracket**, see Figure 67.
3. Remove the Alarm Speaker. Do not discard the **speaker waterproof foam pad** under the speaker.

Figure 67 **Alarm Speaker**



Replacement

1. Install the **speaker waterproof foam pad.**
2. Install the Alarm Speaker.
3. Install the **speaker mounting bracket.**
4. Install the two 3 x 8 self-tapping screws, see Figure 67.
5. Plug in the Alarm Speaker cable.
6. Close the Case. See "Closing the Case" on page 149.

To Complete the Replacement

Run Performance Verification and Safety testing as described in the "Performance Verification" chapter.

Therapy Encoder / Smart Select Knob Encoder

The removal steps of the Therapy Encoder and the Smart Select Knob Encoder are the same. Here, take Therapy Encoder as an example.

Preparation

1. Remove the Therapy Knob/Smart Select Knob. See "Therapy Knob / Smart Select Knob" on page 89.
2. Loosen and remove the 9/16-inch nut and washer, see Figure 68.
3. Open and separate Case. See "Opening the Case" on page 90.
4. Position the Efficia DFM100 with the display facing down.

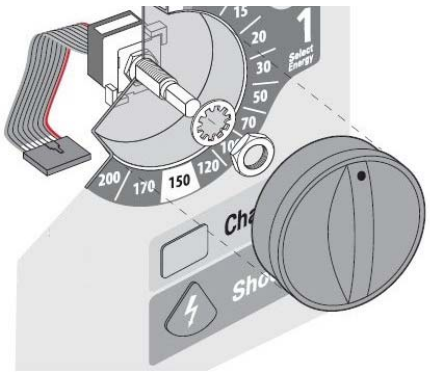
Removal

1. Unplug the cable from the UI PCA.
2. Remove the Therapy Encoder from the front case.

Replacement

1. To replace the Therapy Encoder, position the switch, as shown in Figure 68.
   Position the red stripe on the ribbon cable on the edge closest to the Therapy Port.

Figure 68 **Therapy Encoder**



2. Connect the ribbon cable to the UI PCA without twisting or kinking the cable.
3. Install the washer and nut. Tighten the nut.
4. Install the Therapy Knob. See "Therapy Knob / Smart Select Knob" on page 89.
5. Close the Case. See "Closing the Case" on page 149.

To Complete the Replacement

- Run Performance Verification and Safety testing as described in the "Performance Verification" chapter.

UI PCA

NOTE: There are two versions of UI PCAs available for DFM100. To find P/Ns of UI PCA Assembly, refer to Table 36 on page 179.

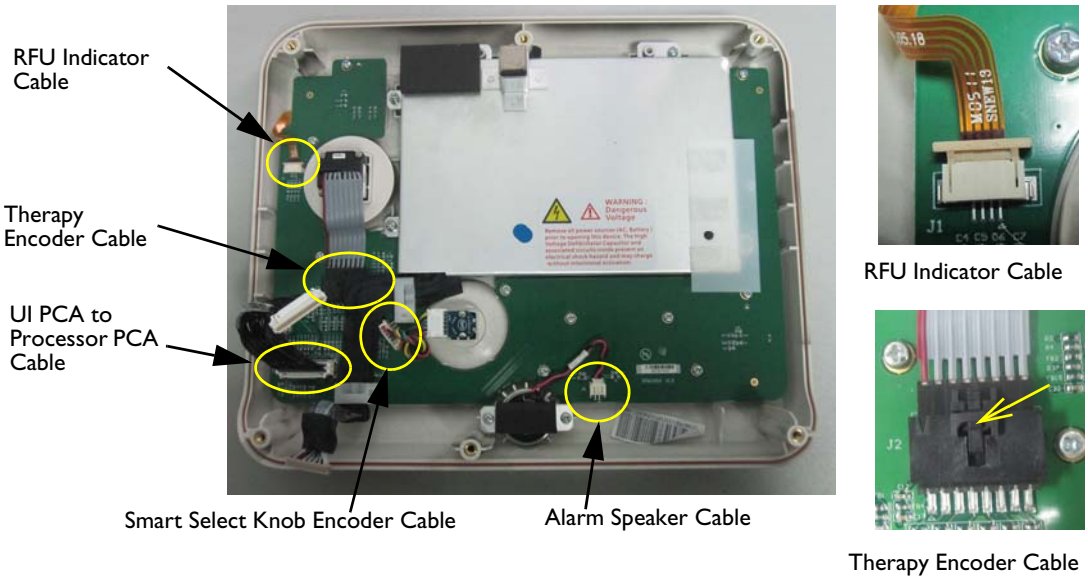
Preparation

1. Open the Case. See "Opening the Case" on page 90.
2. Position the Efficia DFM100 display side down.

Removal UI PCA R1.0

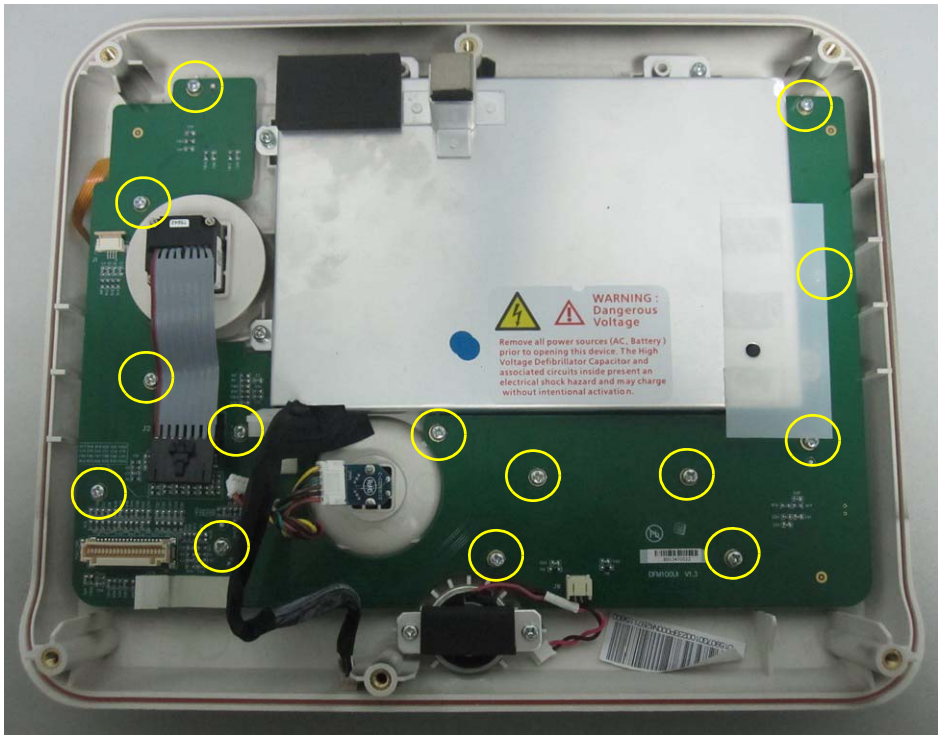
1. Unplug the five cables, see Figure 69.

Figure 69 **UI PCA-1**



2. Loosen the LCD Display Cable from the two plastic cable fasteners, see Figure 61.
3. Remove the fourteen 3x8 self-tapping screws, see Figure 70.

Figure 70 **UI PCA-2**

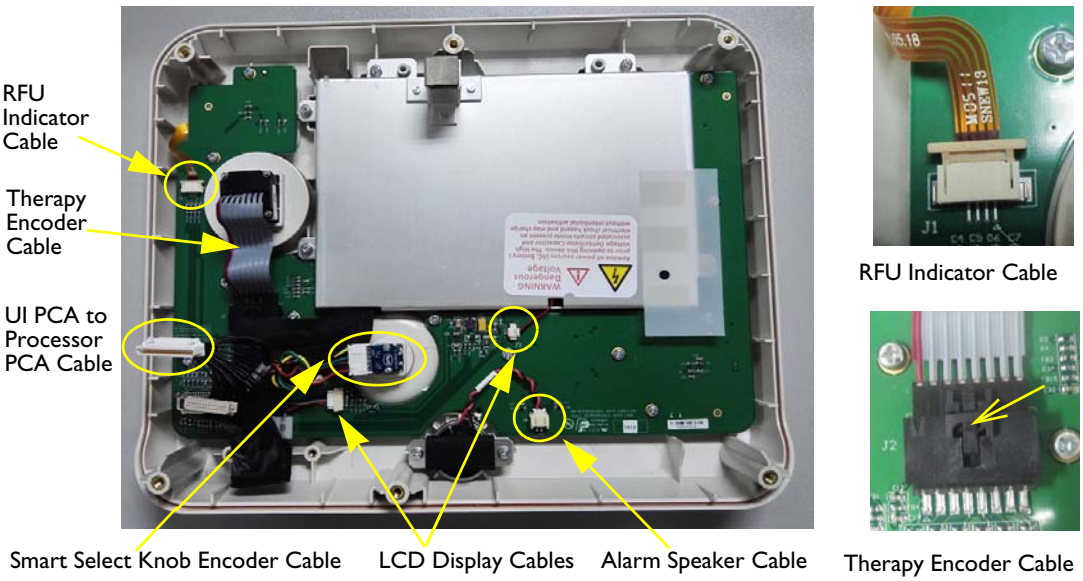


4 Remove the UI PCA.

Removal UI PCA R1.1

1 Unplug the seven cables, see Figure 71.

Figure 71 **UI PCA-3**



2 Refer to step 2 to 4 to remove the UI PCA.

Replacement

1. Install the UI PCA.
2. Install the fourteen ST 3x8 self-tapping screws, see Figure 70.
3. Plug in the cables, see Figure 69 for UI PCA R1.0 or Figure 71 for UI PCA R1.1.
4. Put the LCD Display Cable into the two plastic cable fasteners on UI PCA, see Figure 61.
5. Close the Case. See "Closing the Case" on page 149.

To Complete the Replacement

- Run Performance Verification and Safety testing as described in the "Performance Verification" chapter.

RFU Indicator

Preparation

1. Open the Case. See "Opening the Case" on page 90.
2. Position the Efficia DFM100 display side facing down.
3. Remove the UI PCA. See "UI PCA" on page 102.

Removal

1. Remove the RFU Protective Silicone Cover.
2. Remove the RFU Indicator.

Replacement

1. Install the RFU Indicator into the RFU Protective Silicone Cover.
2. Install the RFU Indicator with the RFU Protective Silicone Cover onto the front case.
3. Install the UI PCA. See "UI PCA" on page 102.

To Complete the Replacement

- Run Performance Verification and Safety testing as described in the "Performance Verification" chapter.

Silicon Buttons

Preparation

1. Open the Case. See "Opening the Case" on page 90.
2. Position the Efficia DFM100 display side down.
3. Remove the UI PCA. See "UI PCA" on page 102.

Removal

- Remove the three Silicon Button Key Pads:
  - Lead Select/Patient Category Key Pad (2-Key)
  - Therapy Key Pad (3-Key)
  - User interface Key Pad (8-Key).

Replacement

1. Install the Silicon Buttons.
2. Install the UI PCA. See "UI PCA" on page 102.
3. Install the LCD Display Assembly. See "LCD Display" on page 95.
4. Close the Case. See "Closing the Case" on page 149.

To Complete the Replacement

- Run Performance Verification and Safety testing as described in the "Performance Verification" chapter.

Tubing Gasket Replacement

The Tubing Gasket protects the internal assemblies of the Efficia DFM100 from moisture and dust. There are three Tubing Gaskets inside the Efficia DFM100:

- on the perimeter of the Front Case to seal off the gaps between Front Case and Rear Case assembly.
- on the perimeter of the Measurement Module
- on the perimeter of the Printer Module

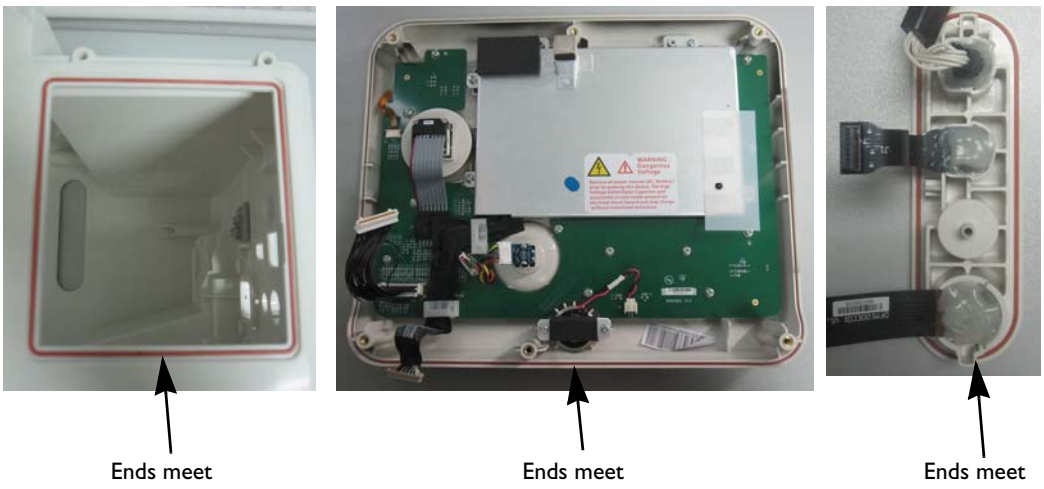
Inspect the Tubing Gasket whenever you open the box or the Measurement Module. Replace the Tubing Gasket if dirty, cracked, frayed, pinched, or there is a gap between the ends of the tubing.

To remove and replace the Tubing Gasket

1. Use tweezers to remove the old gasket.
2. Clean the groove.
3. Prepare the tubing:
   - For the Front Case, tubing length is about 97 cm tubing.
   - For the Measurement Module, tubing length is about 28 cm tubing.
   - For the Printer Installation Position, tubing length is about 37 cm.

   Do not stretch the tubing while measuring.
4. For the Front Case, install tubing gasket around perimeter but ensure the two ends meet at the bottom of the device. and gently press the gasket into the groove till it is seated.
   For the Measurement Module, start opposite to the ECG Connector (so that the Gasket ends meet at the bottom of the Measurement Module).
   For the Printer Installation Position, start in the middle of the bottom line.
   Leave the ends out. Do not stretch the tubing.

Figure 72 **Tubing gasket Replacement**



5. Precisely cut the ends and make sure that there is no gap or overlap at where the ends meet.
6. Tuck the ends into the groove.
7. Slightly spread or stretch the gasket to remove any residual overlap or cover a gap.

Internal Assemblies — Rear Case Assembly

This section is organized into the following topics:

- Rear Case Assembly Overview . . . . . p. 107
- Measurement Module . . . . . p. 107
- Therapy Port . . . . . p. 109
- Printer Assembly . . . . . p. 111

Rear Case Assembly Overview

The Rear Case Assembly of the Efficia DFM100 includes:

- Main Chassis (See "Internal Assemblies — Main Chassis" on page 112)
  - Main PCA Module
  - Back Part Assemblies
- Rear Case Assembly
- Measurement Module
- Therapy Port
- Printer Assembly

Measurement Module

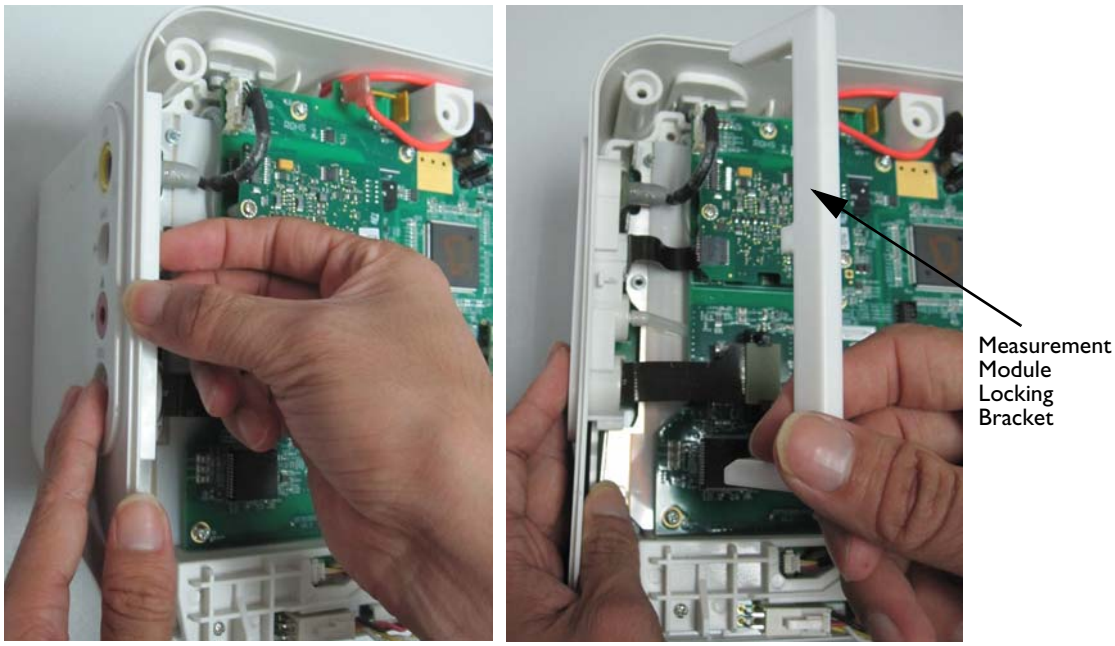
Preparation

▶ Open the Case. See "Opening the Case" on page 90.

Removal:

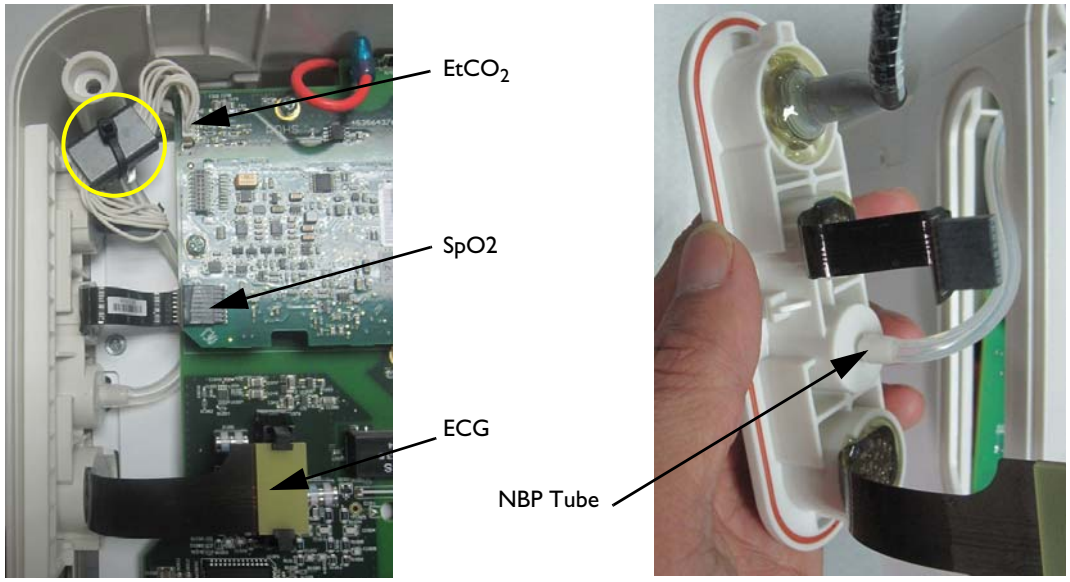
1 Remove the Measurement Module Locking Bracket, see Figure 73.

Figure 73 **Measurement Module-1**



2 Remove cable tie and unplug the connectors and NBP tube, see Figure 74.

Figure 74 **Measurement Module-2**



Replacement

1 Install the Measurement Module and make sure it seats flat against the side wall of the Rear Case at tis designated place.

2 Install the NBP tube and plug in $EtCO_2$, SpO_2, and ECG cables onto process PCA, and use the cable tie to fasten the $EtCO_2$ cable, see Figure 74.

3 Install the Measurement Module Locking Bracket into the locking groove on connector block and against inner side wall of the Rear Case, see Figure 73.

4 Close the Case. See "Closing the Case" on page 149.

To Complete the Replacement

- Run Performance Verification and Safety testing as described in the "Performance Verification" chapter.

Therapy Port

You need the following tools for this repair:

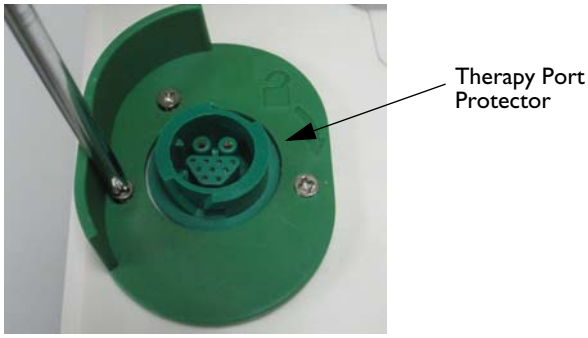
- Therapy Port Replacement Tool (453564500151)

Removal

1 Open the Case. See "Opening the Case" on page 90.

2 Remove the three M 3x10 screws, see Figure 75.

Figure 75 **Therapy Port-1**

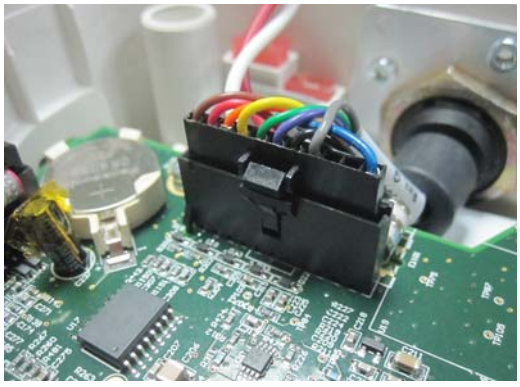


3 Use the straight-tip needle-nose pliers to unplug the two spade connectors, see Figure 76.

Figure 76 **Therapy Port-2**

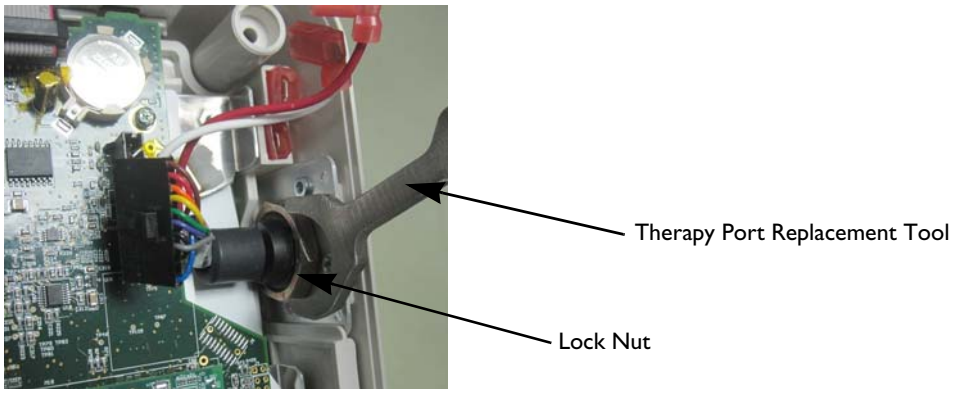
4 Unplug the therapy port connector from the Processor PCA, see Figure 77.

Figure 77 **Therapy Port-3**



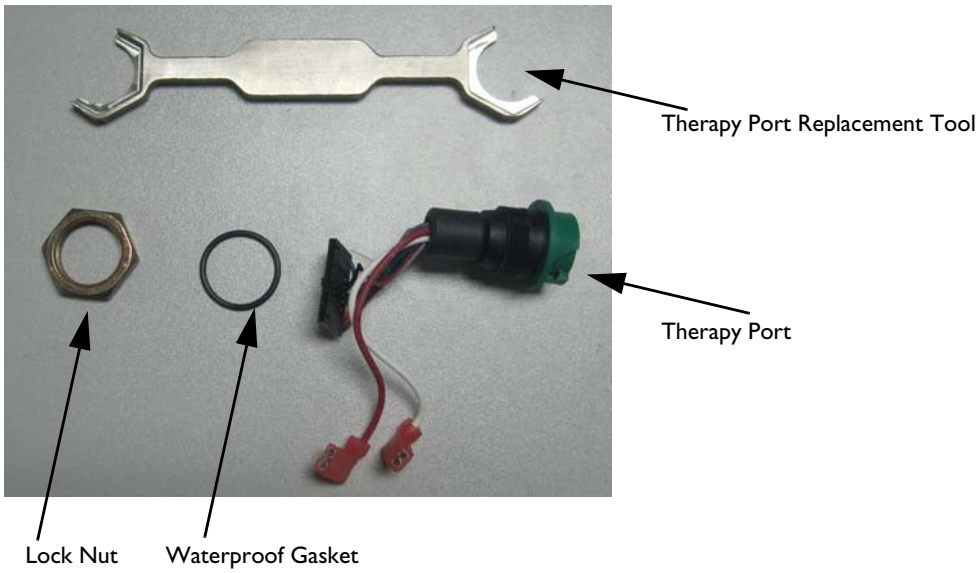
5 Use the Therapy Port Replacement Tool (P/N: 453564500151) to loosen the nut completely, see Figure 78.

Figure 78 **Therapy Port-4**



6 Pull out the Therapy Port. Notice the waterproof gasket and the nut.

Figure 79 **Therapy Port-5**



Replacement

1 Insert the Therapy Port with the gasket into the Rear Case.

2 Install the Lock Nut and tighten the Lock Nut till it can not be rotate further. See Figure 78

3 Connect the therapy port cable to the Processor PCA, see Figure 77.

4 Install the two spade connectors, see Figure 76.

5 Install the three sunk screws (2.0±0.5Kgf.cm), see Figure 75.

6 Close the Case. See “Closing the Case” on page 149.

To Complete the Replacement

- Run Performance Verification and Safety testing as described in the “Performance Verification” chapter.

Printer Assembly

The Printer Assembly is composed of the thermal Printer and the Printer Compartment.

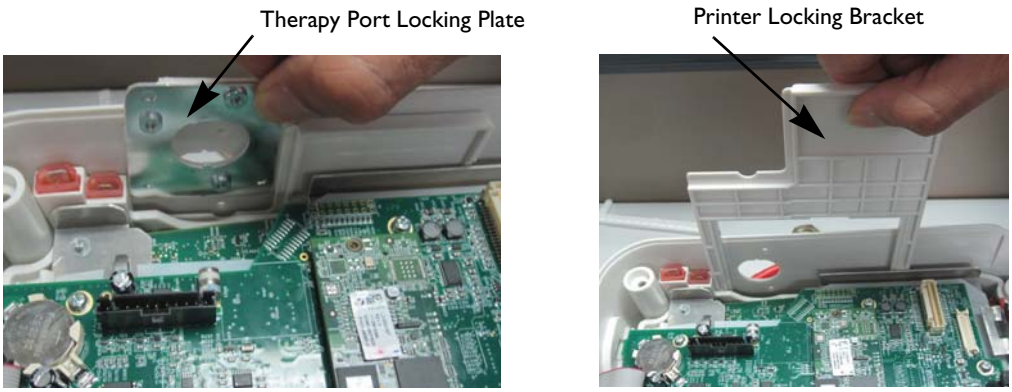
Preparation

1. Open the Case. See "Opening the Case" on page 90.
2. Remove the Therapy Port. See "Therapy Port" on page 109.

Removal

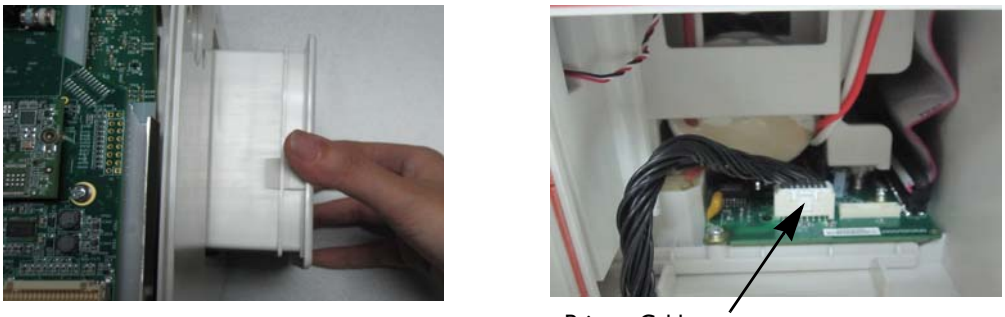
1. Remove the therapy port locking plate with the waterproof pad (left) and the printer locking bracket (right), see Figure 80.

Figure 80 **Unlocking Printer Assembly**



2. Pull out the Printer Assembly and unplug the printer cable, see Figure 81.

Figure 81 **Unplugging Printer Assembly**



Replacement

1. Install the printer cable and insert the Printer Assembly into the correct position, see Figure 81.
2. Install the printer Locking Bracket to secure printer.
3. Install the Therapy Port, see "Therapy Port" on page 109.
4. Close the Case. See "Closing the Case" on page 149.

To Complete the Replacement

- Run Performance Verification and Safety testing as described in the "Performance Verification" chapter.

Internal Assemblies — Main Chassis

This section is organized into the following topics:

Separating Main Chassis and Rear Case . . . . . p. 113
Disassembling Main Chassis . . . . . p. 115
Assembling the Main Chassis . . . . . p. 118

Main PCA Module:

SpO2 PCA . . . . . p. 119
SpO2 PCA Standoffs . . . . . p. 120
Processor PCA . . . . . p. 121
System-on-Module (SOM) PCA . . . . . p. 123
Button Battery . . . . . p. 129
Therapy PCA . . . . . p. 130

Back Part Assemblies:

I/O Assembly . . . . . p. 132
I/O PCA . . . . . p. 134
NBP Module . . . . . p. 135
Internal Resistors Module . . . . . p. 138
Power Supply Assembly . . . . . p. 139
Fans . . . . . p. 141
Therapy Capacitor . . . . . p. 143
Therapy PCA High Voltage Cable . . . . . p. 145

Separating Main Chassis and Rear Case

Preparation

1 Open the Case. See “Opening the Case” on page 90.

2 Remove the Measurement Module. See “Measurement Module” on page 107.

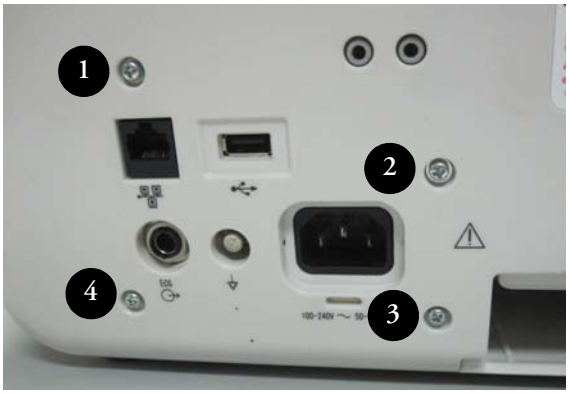
3 Remove the Therapy Port. See “Therapy Port” on page 109.

4 Remove the Printer Assembly. See “Printer Assembly” on page 111.

Removal

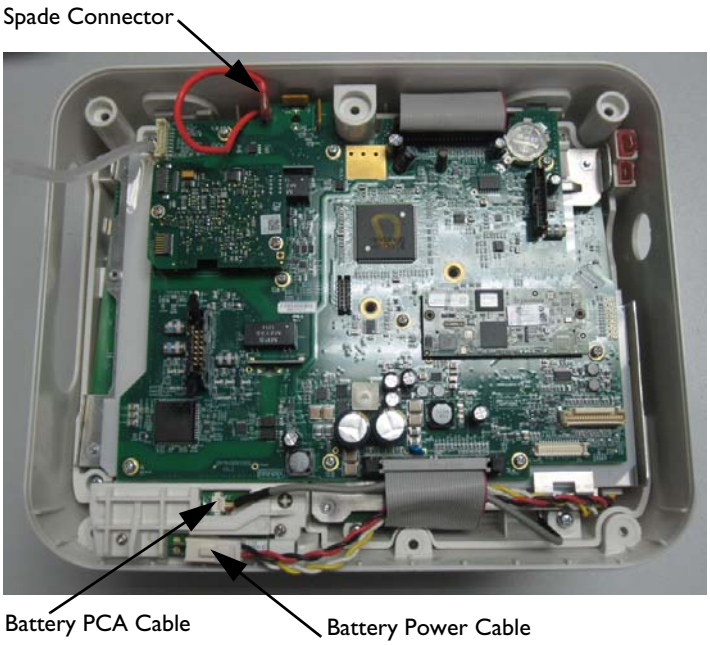
1 Position the Efficia DFM100 back side towards you. Remove the four M 3x10 screws with washers, see Figure 82.

Figure 82 **Main Chassis-1**



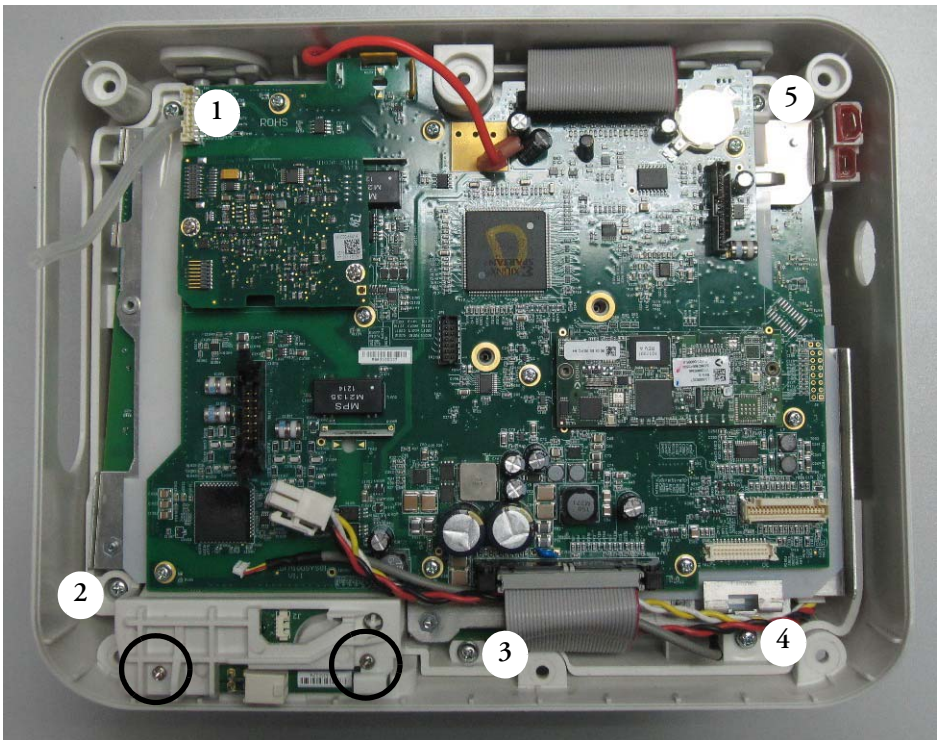
2 Turn the Efficia DFM100 front side towards you. Use the straight-tip needle-nose pliers to remove the spade connector and unplug the Battery PCA Cable and Battery Power Cable, see Figure 83.

Figure 83 **Main Chassis-2**



3 Remove the five M 4x16 screws with washers (1 to 5)and two M 3x10 screws in black circle, see Figure 84.

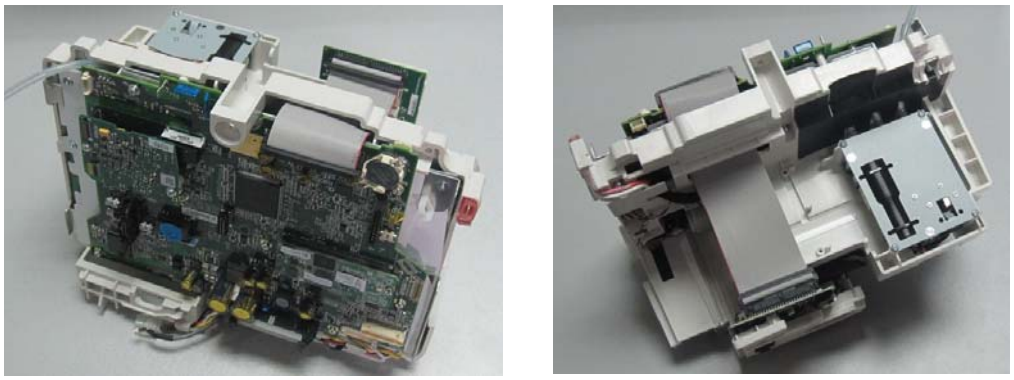
Figure 84 **Main Chassis-3**



4 Position the Rear Case Assembly of the Efficia DFM100 bottom side down.

5 Hold the plastic part of the Main Chassis and pull out the Main Chassis.

Figure 85 **Main Chassis-4**



Main Chassis

Disassembling Main Chassis

The Main Chassis contains the Main PCA Module and the Back Part Assembly.

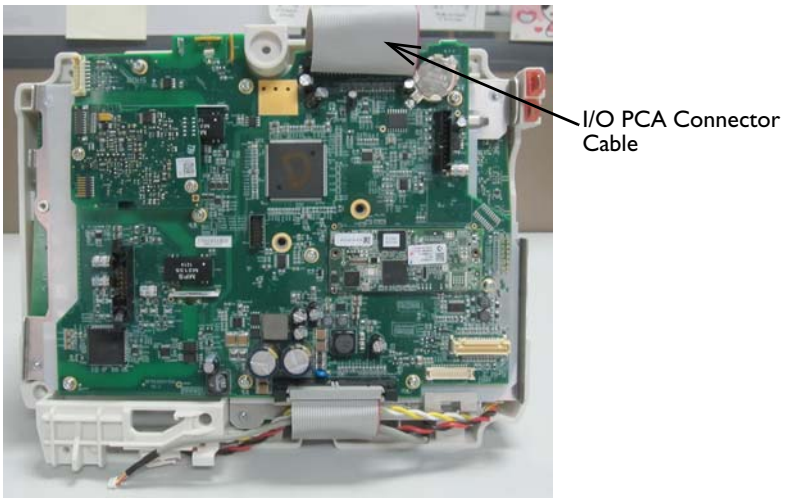
Preparation

1. Open the Case. See "Opening the Case" on page 90.
2. Remove the Measurement Module. See "Measurement Module" on page 107.
3. Remove the Therapy Port. See "Therapy Port" on page 109.
4. Remove the Printer Assembly. See "Printer Assembly" on page 111.
5. Remove the Main Chassis. See "Separating Main Chassis and Rear Case" on page 113.

Removal

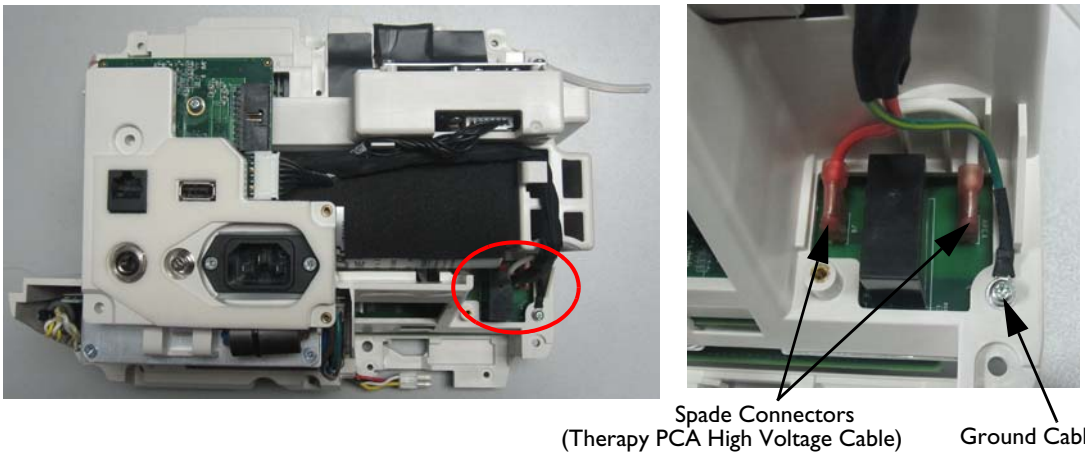
1. Unplug the I/O PCA Connector cable on I/O Assembly. See Figure 86.

Figure 86 **Main Chassis Disassembly-1**



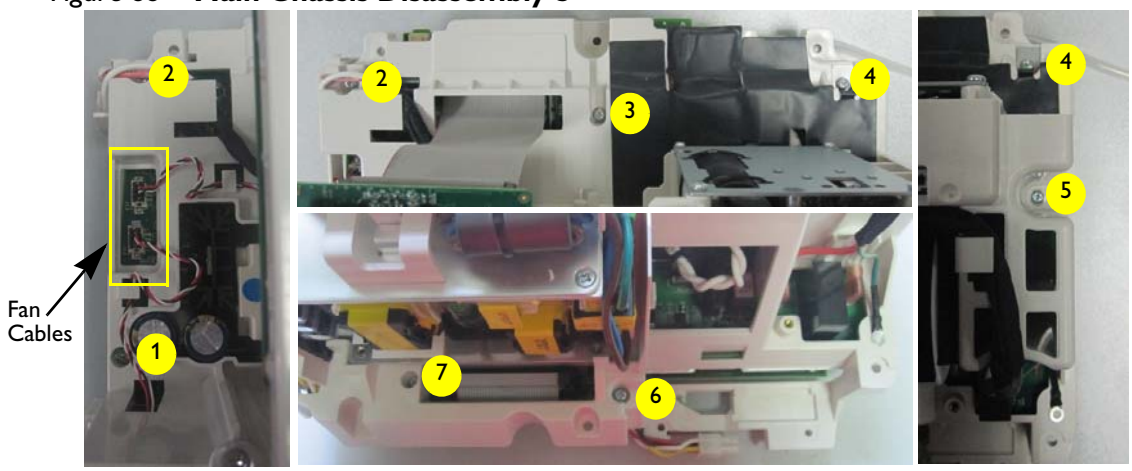
2. Use the straight-tip needle-nose pliers to wiggle and pull the two spade connectors, and use Philips head screw driver to remove M 3x23 screw with washers to loosen the ground cable, see Figure 87.

Figure 87 **Main Chassis Disassembly-2**



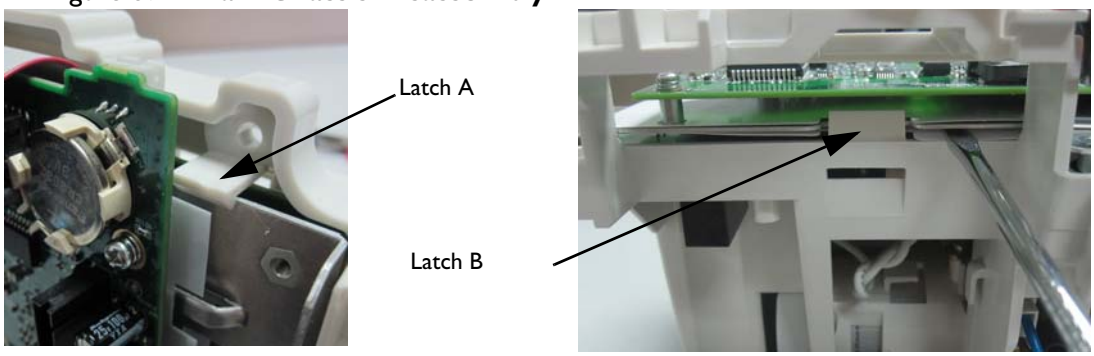
3 Unplug the two fan cables and remove the seven M 3x23 screws with washers, see Figure 88.

Figure 88 **Main Chassis Disassembly-3**



4 Release the front part latches A and B, use flat head screw driver if need, see Figure 89.

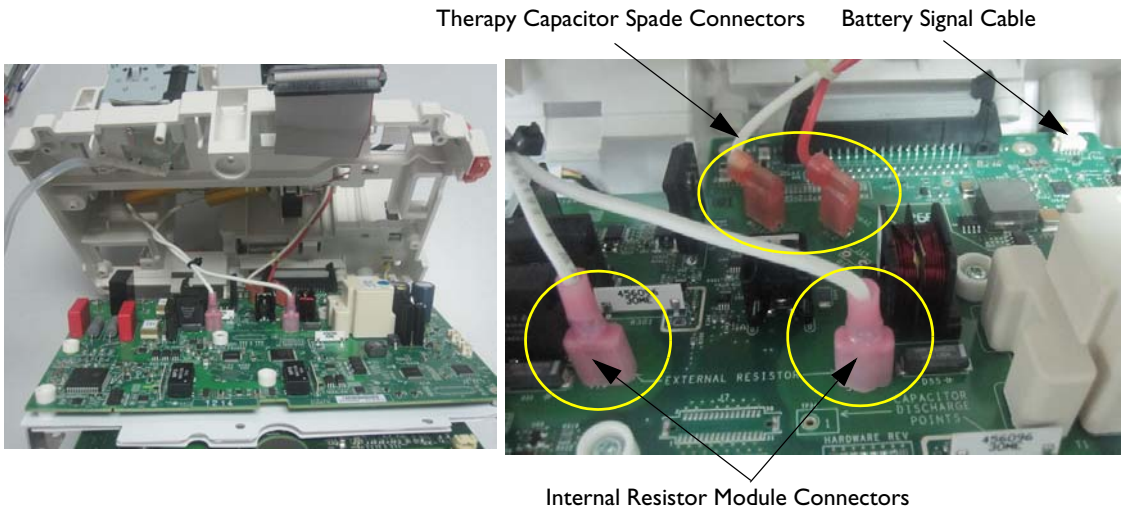
Figure 89 **Main Chassis Disassembly-4**



5 Carefully remove the Main PCA Module (Therapy-Metal Frame-Processor-PCA) away from the Main Chassis.

6 Use the straight-tip needle-nose pliers wiggle and pull to remove the two Therapy Capacitor spade connectors and the two Internal Resistor Module Connectors, see Figure 90.

Figure 90 **Main Chassis Disassembly-5**



7 Remove the two power cables and one Battery Signal Cable, see Figure 91.

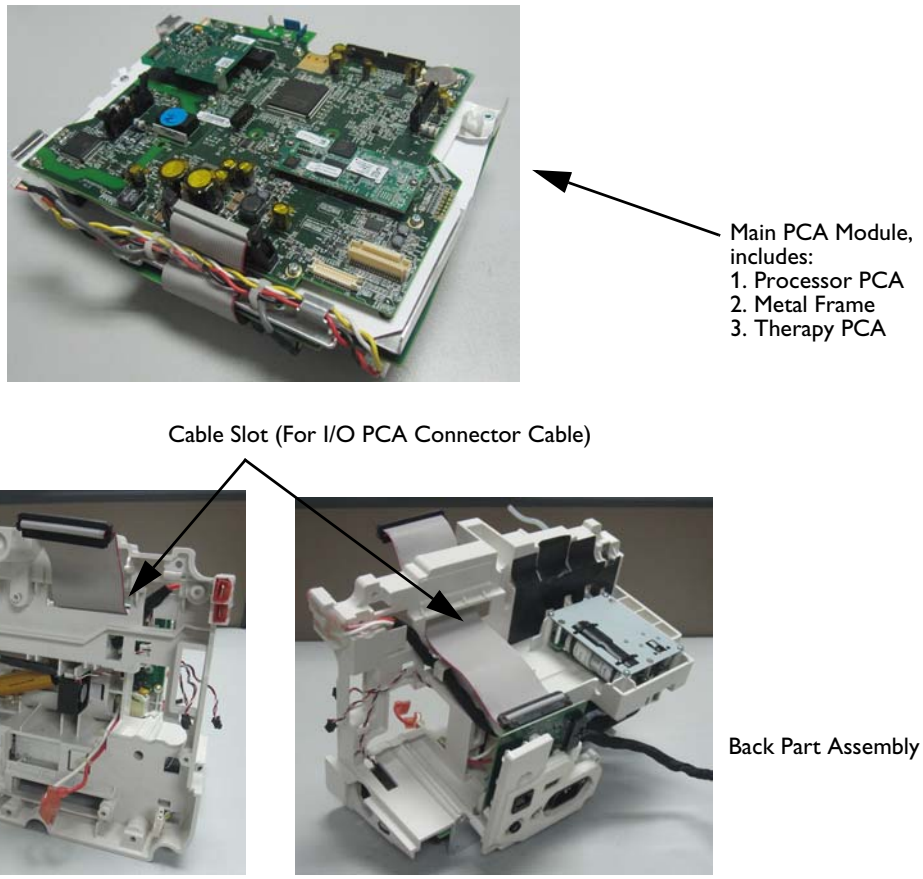
a two-pin DC Power Output Cable connects the AC Power Module and the Therapy PCA.

b four-pin Battery Power Cable connects the Therapy PCA and the Battery PCA.

Figure 91 **Main Chassis Disassembly-6**

8 Separate the Main PCA Module and Back Part Assembly of the Main Chassis, see Figure 92.

Figure 92 **Main Chassis Disassembly-7**



Assembling the Main Chassis

When assembling the Main PCA Module, there are numbers of cables need to connect to the Therapy PCA. See Table 30.

To assemble the Main PCA Module and the Back Part Assembly of the Main Chassis:

1. Connect the two power cables to **J1** and **J2** sockets on the Therapy PCA. See Figure 91.
2. Connect the Battery Signal cable to **J5** sockets on the Therapy PCA. See Figure 91.
3. Connect the Therapy Capacitor cables (two spade connectors) to **J9** and **J11** sockets on the Therapy PCA. See Figure 90.
   Note the tab marking on the Therapy PCA. The **J9** socket Tab marked "Red" connects to red cable. The **J11** socket Tab marked "White" connects to white cable.
4. Connect the Internal Resistors Module cables to the **J18** and **J19** sockets on the Therapy PCA. See Figure 90.
5. Place the Main PCA Module into the Back Part Assembly.
6. Press the metal part of the middle metal frame and push the Main PCA Module until the Middle Frame latches snap on the metal frame of the Main PCA Module firmly. See Figure 93 and Figure 89.
   When you place the Front Part Assembly:
   - **a** place the I/O PCA Connector Cable through the cable slot, see Figure 92.
   - **b** place the NBP tube through the Front Part Assemblies, see Figure 85.

Figure 93 **Install the Main PCA Module**

7. Connect the two fan cables to **J12** and **J13** sockets on the Therapy PCA. See Figure 88.
   - **a** connect the fan 1 (close to the AC Power Assembly) cable to **J12**
   - **b** connect the fan 2 (close to the Internal Resistor Module) cable to **J13**.
8. Install the seven M 3x23 screws with washers, see Figure 88.
9. Install the Therapy PCA High Voltage Cable and the Ground Cable, see Figure 87.
   - **a** Place the white spade connector to **J10** socket on the Therapy PCA.
   - **b** Place the red spade connector to **J8** socket on the Therapy PCA.
10. The Main Chassis Assembling completed.

Table 30 **Therapy PCA Cable Connection Sockets**

PCA Mark	Description	Connects To	Disconnect By
J1	2-wire buddle	AC Power Assembly	Loosen latch, pull
J2	4-wire buddle	Battery PCA	Loosen latch, pull
J5	4-pin buddle	Battery PCA	Gently unplug
J9	spade connector	Therapy Capacitor Cable (red)	Pull, wiggle
J11	spade connector	Therapy Capacitor Cable (white)	Pull, wiggle
J8	spade connector	Therapy PCA High Voltage Cable (red)	Pull, wiggle
J10	spade connector	Therapy PCA High Voltage Cable (white)	Pull, wiggle
J12	3-pin buddle	Fan1 (close to AC Power Module)	Gently unplug
J13	3-pin buddle	Fan2 (close to Internal Resistors)	Gently unplug
J18	spade connector	Internal Resistors Module	Pull, wiggle
J19	spade connector	Internal Resistors Module	Pull, wiggle

SpO2 PCA

Preparation

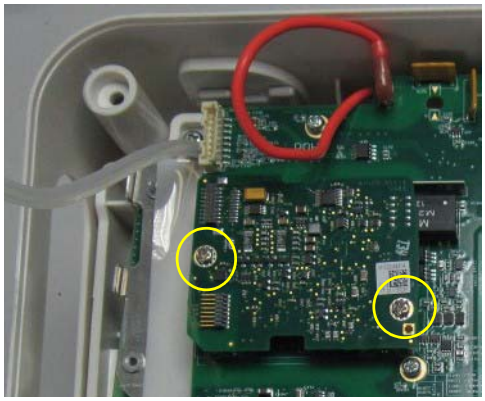
1 Open the Case. See "Opening the Case" on page 90.

2 Remove the Measurement Module. See "Measurement Module" on page 107.

Removal

1 Remove the two M 3x6 screws on SpO_2 PCA, see Figure 94.

Figure 94 **SpO2 PCA**



2 Unplug the SpO_2 PCA from the Processor PCA.

CAUTION: Be careful not to bend or damage the pins when you removing the SpO2 cable and PCA.

Replacement

1 Plug in the SpO_2 PCA on the Processor PCA until fully seated.

2 Install the two M 3x10 screws.

3 Install the Measurement Module. See "Measurement Module" on page 107.

4 Close the Case. See "Closing the Case" on page 149.

To Complete the Replacement

- Run Performance Verification and Safety testing as described in the "Performance Verification" chapter.

NOTE: You can also remove the SpO2 PCA after you opening the Main Case. See "Opening the Case" on page 90.

SpO_2 PCA Standoffs

There are two plastic SpO_2 PCA Standoffs installed on the Processor PCA. They are used for supporting the SpO_2 PCA installation. The standoffs are screwed on the processor PCA directly.

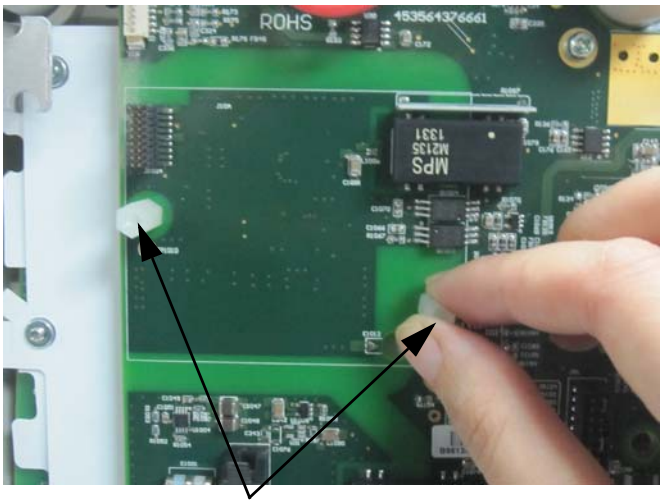
Preparation

1. Open the Case. See "Opening the Case" on page 90.
2. Remove the Measurement Module. See "Measurement Module" on page 107.
3. Remove the SpO_2 PCA. See "SpO2 PCA" on page 119.

Removal

1. Use your hand to remove the two SpO_2 PCA standoffs on the Processor PCA, see Figure 95.

Figure 95 **SpO2 PCA Support Pillar**



Replacement

1. Use your fingers to install new nylon standoffs. Do not overtighten the standoffs. See Figure 95.
2. Install the SpO_2 PCA. See "SpO2 PCA" on page 119.
3. Install the Measurement Module. See "Measurement Module" on page 107.
4. Close the Case. See "Closing the Case" on page 149.

To Complete the Replacement

- Run Performance Verification and Safety testing as described in the "Performance Verification" chapter.

Processor PCA

The Processor PCA contains the SOM PCA that stores the device software and configuration data. When you install a new Processor PCA, you must also:

- Enter the device's serial number and enable options using the Service Mode menus.
- Install the most recent software in the appropriate language using the Software Support tool. See Table 35 on page 178 for part numbers.

Give the user the *README* document that contains instructions for downloading the most recent *Efficia DFM100 Instructions for Use* from the Philips' Documentation and Download web site (http://www.philips.co.in/healthcare/product/HCNOCTN294/efficia-dfm100).

CAUTION: Never touch the Processor PCA surface with your fingers, always use gloves.
Keep the new Processor PCA in an antistatic pouch until ready to install.
Do not attempt to reuse the old SOM PCA with the new Processor PCA.

Note that the edges of the metal chassis may be sharp. Take care not to cut yourself or shear the wires.

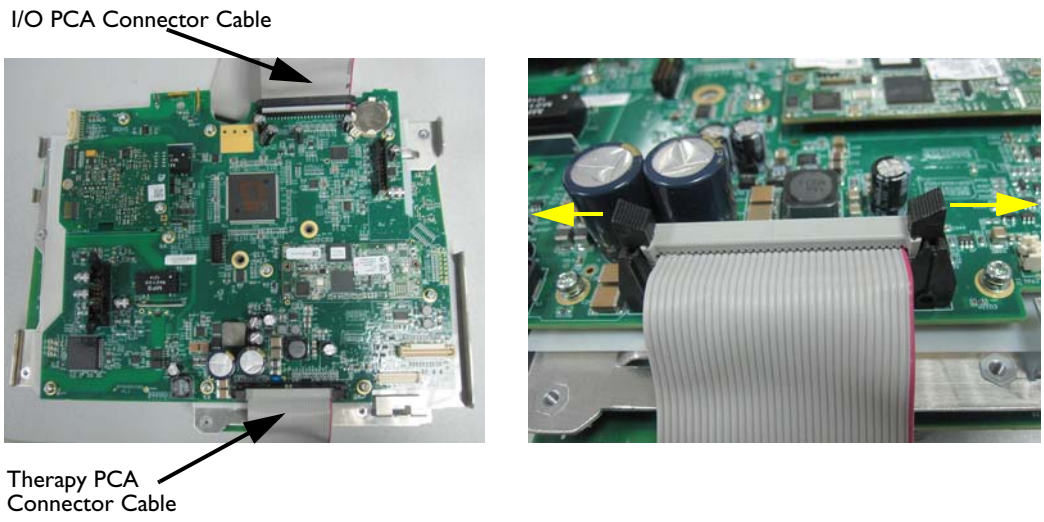
Preparation

1. Open the Case. See "Opening the Case" on page 90.
2. Remove the Measurement Module. See "Measurement Module" on page 107.
3. Remove the Therapy Port. See "Therapy Port" on page 109.
4. Remove the Printer Assembly. See "Printer Assembly" on page 111.
5. Remove the Main Chassis. See "Separating Main Chassis and Rear Case" on page 113.
6. Remove the Main PCA Module out of the Main Chassis. See "Disassembling Main Chassis" on page 115.
7. Remove the SpO2 PCA. See "SpO2 PCA" on page 119.

Removal

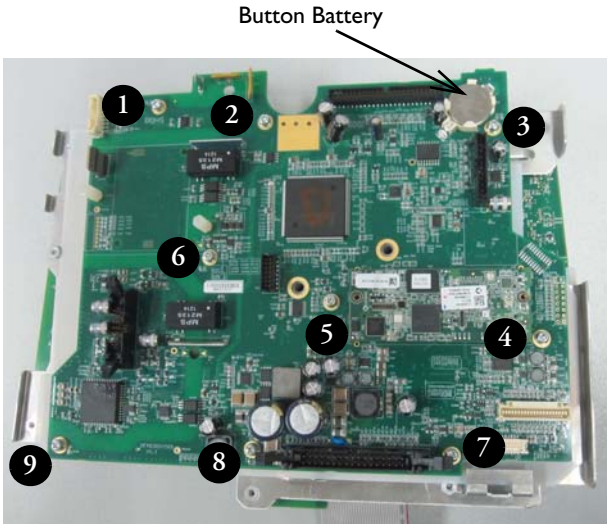
1. Unplug the I/O PCA Connector cable on Processor PCA and the Therapy PCA connector cable, see Figure 96.

Figure 96 **Processor PCA-1**



2 Remove the nine M 3x10 screws with washers, see Figure 97.

Figure 97 **Processor PCA-2**



3 Remove the Processor PCA.

4 Remove the two SpO_2 PCA Support Pillars, see "SpO2 PCA Standoffs" on page 120.

Replacement

1 Install the SpO_2 PCA Support Pillars, see "SpO2 PCA Standoffs" on page 120.

2 Install the Processor PCA.

3 Install the nine M 3x10 screws with washers, see Figure 97.

4 Install the I/O PCA Connector Cable and the Therapy PCA Connector Cable, see Figure 96.

5 Install the SpO_2 PCA. See "SpO2 PCA" on page 119.

6 Install the Main PCA Module. See "Disassembling Main Chassis" on page 115.

7 Install the Main Chassis. See "Separating Main Chassis and Rear Case" on page 113.

8 Install the Therapy Port. See "Therapy Port" on page 109.

9 Install the Printer Assembly. See "Printer Assembly" on page 111.

10 Install the Measurement Module. See "Measurement Module" on page 107.

11 Close the Case. See "Closing the Case" on page 149.

To Complete the Replacement

- Run Performance Verification and Safety testing as described in the "Performance Verification" chapter.

NOTE: You can also remove the Processor PCA after you separate the Main Chassis. See "Separating Main Chassis and Rear Case" on page 113.

System-on-Module (SOM) PCA

The System-on-Module (SOM) PCA memory stores the device software and configuration data. When you install a new SOM PCA, you must also:

- Enter the device's serial number and enable options using the Service Mode menus.
- Install the most recent software in the appropriate language using the Software Support tool. See Table 35 on page 178 for part numbers.
- Give the user the *README* document that contains instructions for downloading the most recent *Efficia DFM100 Instructions for Use* from the Philips' Documentation and Download web site (http://www.philips.com/ProductDocs).

You need a T-8 screwdriver to detach or attach the SOM PCA.

Preparation

1. Save the customer's configuration settings to a USB flash drive so the configuration can be restored after the repair is complete. See the *Efficia DFM100 Instructions for Use* for information.
2. Open the Case. See "Opening the Case" on page 90.
3. Remove the Measurement Module. See "Measurement Module" on page 107.
4. Remove the Therapy Port. See "Therapy Port" on page 109.
5. Remove the Printer Assembly. See "Printer Assembly" on page 111.
6. Remove the Main Chassis. See "Separating Main Chassis and Rear Case" on page 113.
7. Remove the Main PCA Module of the Main Chassis. See "Disassembling Main Chassis" on page 115.

Removal

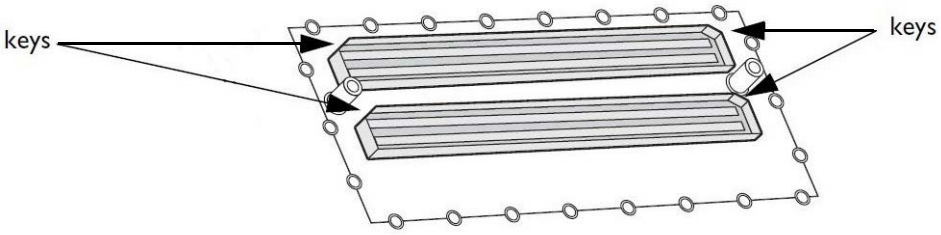
1. Loosen and remove the two T-8 screws. See Figure 98.
2. Hold the two shorter sides of the SOM PCA next to the screw holes.
3. Using equal force on each side, gently detach the SOM PCA from the Processor PCA.
   Do not wiggle or twist the SOM PCA to avoid excessive stress on the connectors between the SOM PCA and Processor PCA.

Figure 98 **SOM PCA Removal**

Replacement

1. There is a key-in feature on the rectangular connectors. Align the key-in during installation, see Figure 99.

Figure 99 **Processor PCA's Keyed Connectors**



2 Position your thumbs in the location between the screw holes by the arrows, so that the pressure will be distributed evenly.

3 Using equal pressure, press straight down with your thumbs until the SOM PCA connectors mate completely with the Processor PCA connectors.

If you cannot make the connectors mate, then check the key positions and alignment, and make sure no debris are in the connectors.

CAUTION: Do not apply too much force to avoid damaging the SOM or Processor PCAs.
Do not apply pressure to the corners of the SOM PCA.
Do not seat one side before the other.

4 Install and tighten the two T-8 screws. Do not overtighten the screws.

5 Install the Processor PCA. See "Processor PCA" on page 121.

6 Install the I/O PCA connector cable and the Therapy PCA connector cable, see Figure 97.

7 Install the SpO2 PCA. See "SpO2 PCA" on page 119.

8 Install the Main PCA Module of the Main Chassis. See "Disassembling Main Chassis" on page 115.

9 Install the Main Chassis. See "Separating Main Chassis and Rear Case" on page 113.

10 Install the Therapy Port. See "Therapy Port" on page 109.

11 Install the Printer Assembly. See "Printer Assembly" on page 111.

12 Install the Measurement Module. See "Measurement Module" on page 107.

13 Close the Case. See "Closing the Case" on page 149.

Entering the Serial Number

After you have replaced the SOM PCA and reassembled the device, you must enter the device's serial number to make the Efficia DFM100 operational. If the serial number is not entered, the device powers up with the message **Equipment Disabled: Therapy**. *Normal operation is not possible,* and the device powers up into Service Mode, where you can enter the serial number.

To enter the serial number

1 Turn the device off.

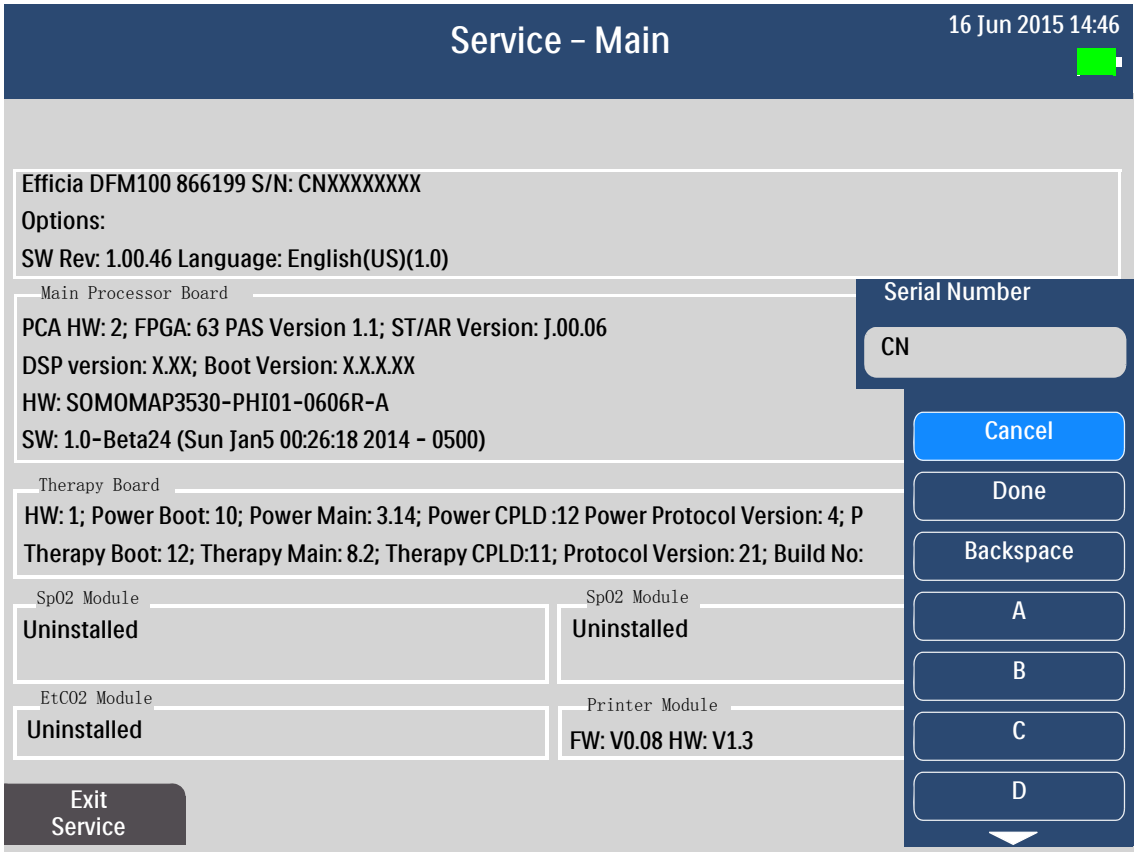
2 Record the model number, serial number, and options key(s) from the bottom of the device.

3 Insert the AC power and a battery (charged to at least 20%) and turn the Therapy Knob to **Monitor**. The device powers up into Service Mode.

4 From the Service Mode Main menu, select **Device Info**.

5 From the **Device Info** menu, select **Serial Number**. An alphanumeric menu is displayed, see Figure 100.

Figure 100 **Entering Serial Number**



6 Enter the serial number using the Smart Select Knob to scroll through the letters and numbers. Press the Smart Select button to complete each selection.
Select **Cancel** or **Backspace** to cancel a selection.

7 Scroll through the list and select **Done** when you have finished entering the serial number.

CAUTION: Once you have entered the correct serial number, do not change it. If you clear or change the serial number, the options are cleared and you must re-enter the correct serial number and the options key.

Installing Software

See "Software Upgrades" on page 19 for details on software installation.

To install software onto the device or to change the device's language:

1 Be sure both an AC power module and battery charged to at least 20% are in place.

2 Turn the Therapy Knob to **Monitor**.

3 Enter the Service Mode

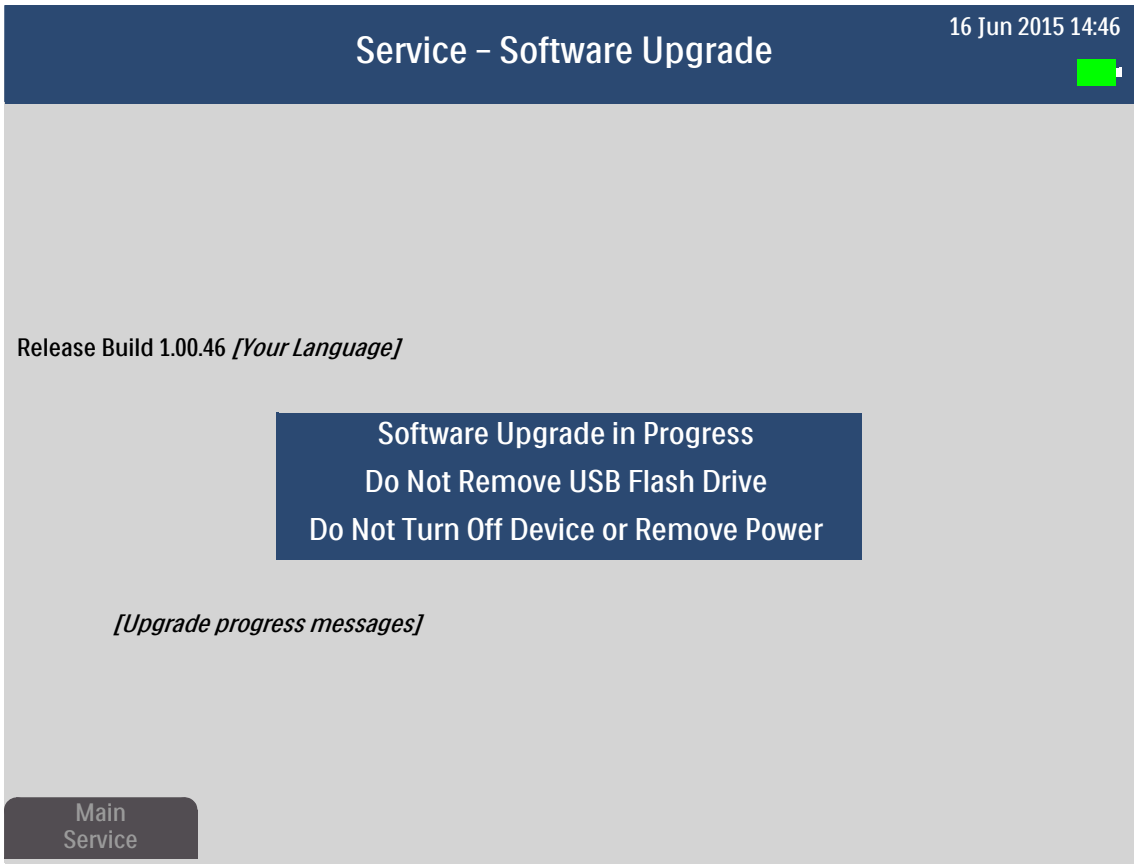
4 Insert the Software Support flash drive into the USB port.

5 From the Service Mode Main menu, select **Software Upgrade**.
Make sure the software release and language displayed on the screen are correct.

6 Press the **Smart Select Knob**. The software installation starts.

CAUTION: After the upgrade start, be careful not to interrupt the software installation process by removing the USB flash drive or power source or turning the Therapy Knob.

Figure 101 **Software Upgrade Progress Screen**



7 The software is installed on the device. This process takes a few minutes. While the software is being updated, progress messages are displayed and the soft keys are disabled.

8 When the software or language installation process is complete, press the Smart Select Knob to select Acknowledge to restart the device.

9 Remove the Software Support flash drive from the USB port.

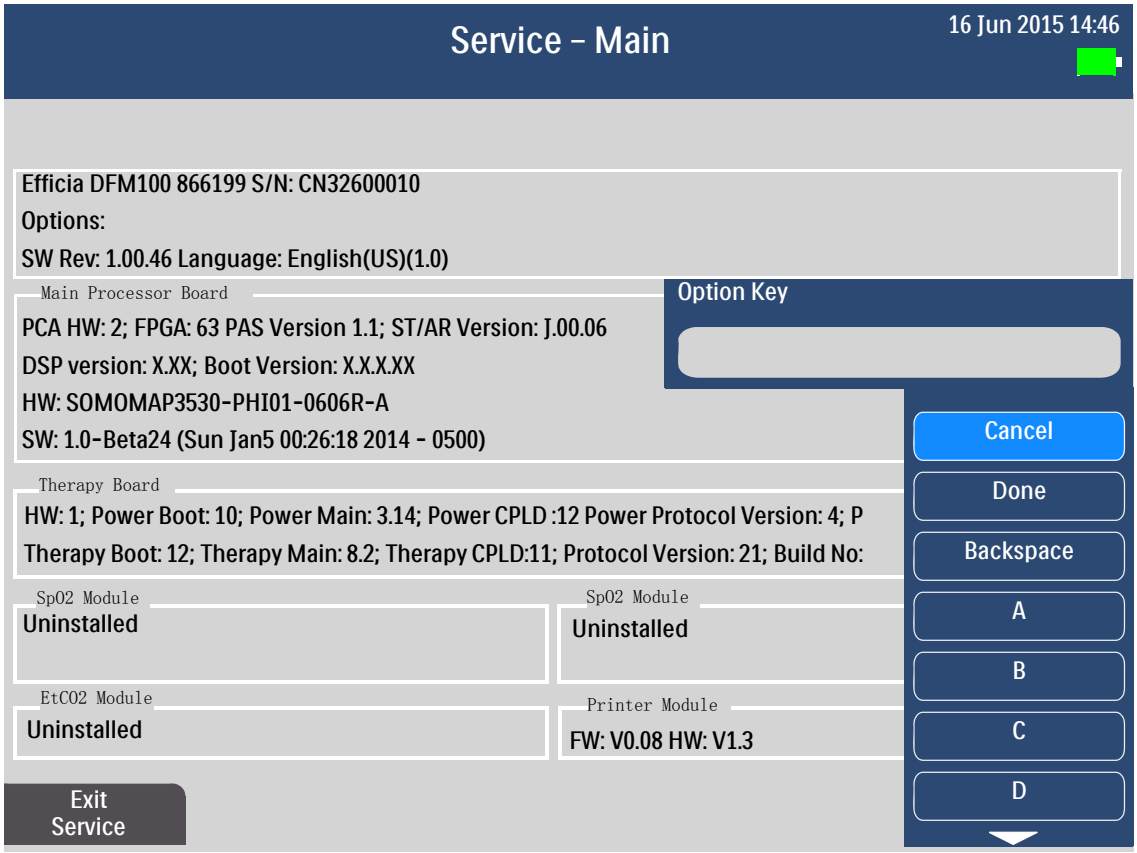
Enabling Options

Once you enter the serial number and install software, you need to enable the options. If you enter the options key incorrectly, the device's options will not function.

To enable options:

1 From the Device Info menu, select Options Key. An alphanumeric menu is displayed, see Figure 102.

Figure 102 **Enabling Options**



2 Enter the options key using the Smart Select Knob to scroll through the letters and numbers. Press the Smart Select Knob to complete each selection.
Select **Cancel** or **Backspace** to cancel a selection.
When the options key has been entered, the corresponding product options are displayed.

3 Select **Done** when you have finished entering the options key.

4 Repeat Step 2 through Step 3 for each options key.

5 Check the information on the screen to ensure it is correct.

CAUTION: Once you have entered the correct serial number, do not change it. If you clear or change the serial number, the options are cleared and you must re-enter the correct serial number and the options key.

6 Run an Operational Check.

7 Review the Operational Check results to ensure all tests have passed.
See "Operational Check" on page 36.

8 Print the Device Info to ensure the product version and language are correct.
See "Device Information" on page 17.

Completing the Repair

To complete the SOM PCA replacement

1. Give the user the *README* document.

   If you are upgrading the device's software, it is *essential* that the customer gets the latest Instructions for Use. Make sure the customer gets the *README* document, which provides instructions for downloading the latest *Efficia DFM100 Instructions for Use* from the Philips Documentation and Downloads web site at: http://www.philips.com/ProductDocs.

2. Set the correct date and time. See the *Instructions for Use* "Configuration" chapter for details.
3. Restore the customer's configuration settings from the USB flash drive.
4. Run Performance Verification and Safety Testing as described in the "Performance Verification" chapter.

Button Battery

The Button Battery resides on the Processor PCA, next to the Therapy Knob connector, see Figure 97 on page 122. Make sure you clean the contact clips and the new battery with isopropyl alcohol wipes. The operating time of the Button Battery is at least 5 years. Replace the Button Battery when it is exhausted.

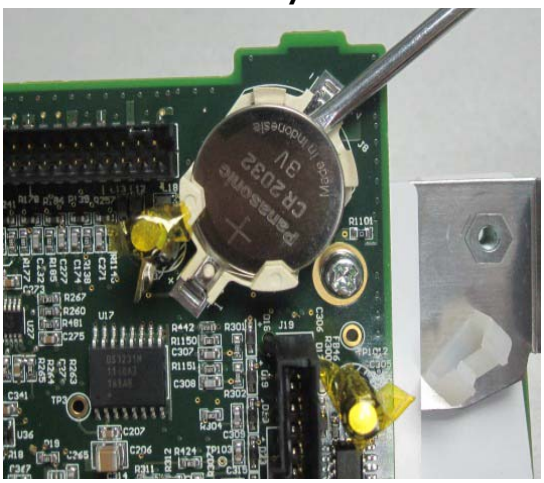
Preparation

1. Open the case. See "Opening the Case" on page 90.
2. Position the device with the back side down and the Measurement Module to your left.

Removal and Cleaning

1. Remove the battery from the Processor PCA.
   a. Insert a flat head screw driver at the right of the Button Battery and push the Button Battery to the left until it can't be push further, pry the Button Battery out of the battery clip. See Figure 103.

Figure 103 **Button Battery**



   b. Remove the battery from the holder.
   c. Follow local rules and regulations regarding battery disposal.

Replacement

1. Thoroughly clean the contact clips and new battery terminals with the wipes included in the kit.
2. Insert the new battery into the holder.

CAUTION: Make sure that you install the new battery with the correct orientation. Follow the polarity markings on the battery holder (under the battery).

3. Close the case. See "Closing the Case" on page 149.

To Complete the Replacement

- Run Performance Verification and Safety testing as described in the "Performance Verification" chapter.

Therapy PCA

Removing the Therapy PCA involves disconnecting many cables and removing many screws. Take your time and be methodical.

CAUTION: Never touch the Therapy PCA surface with your fingers.
Keep the replacement Therapy PCA in the antistatic pouch until ready to install.

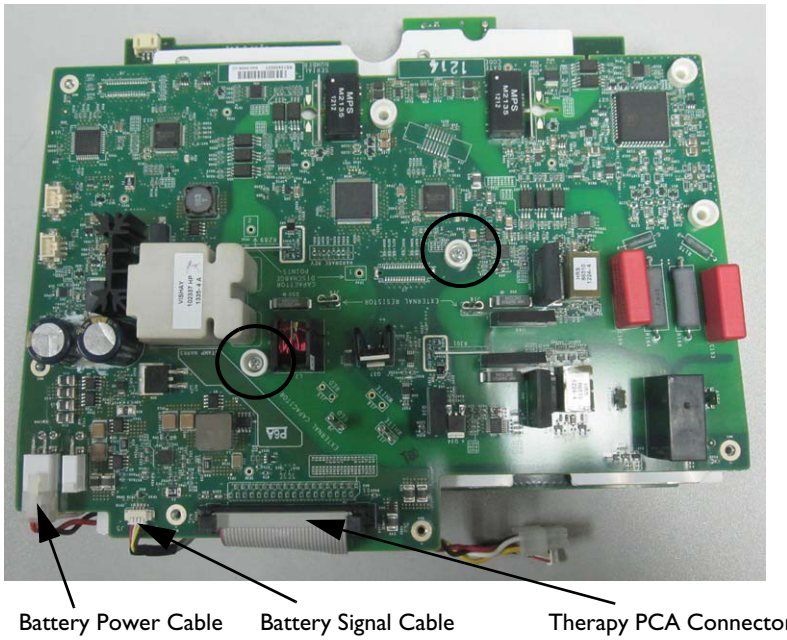
Preparation

1. Open the Case. See "Opening the Case" on page 90.
2. Remove the Main Chassis. See "Internal Assemblies — Main Chassis" on page 112.
3. Remove the Main PCA Module of the Main Chassis. See "Disassembling Main Chassis" on page 115.
4. Position the Therapy PCA facing you.

Removal

1. Disconnect the Therapy PCA connector cable, the Battery Power Cable, and the Battery Signal Cable.
2. Remove the two M 3x15 screws with Isolation gasket, see Figure 104.

Figure 104 **Therapy PCA**



3. Carefully but firmly grasp the two edges of the Therapy PCA and lift the Therapy PCA.

NOTE: Do not touch any electronic parts and components on the Processor PCA.
There are two plastic shields under the Processor PCA and Therapy PCA. Make sure you reuse both of them in the replacement procedure.

Replacement

1. Align the screw holes on the Therapy PCA with the screw holes on the metal plate.
2. Secure the two M 3 x 15 screws with washers, and connect the Therapy PCA Connector Cable, Battery Signal Cable and Battery Power Cable, see Figure 104, to the Therapy PCA.
3. Assemble the Main Chassis. See "Assembling the Main Chassis" on page 118.
4. Install the Main Chassis. See "Separating Main Chassis and Rear Case" on page 113.
5. Install the Therapy Port. See "Therapy Port" on page 109.
6. Install the Printer Assembly. See "Printer Assembly" on page 111.
7. Install the Measurement Module. See "Measurement Module" on page 107.
8. Close the Case. See "Closing the Case" on page 149.

To Complete the Replacement:

1. Upgrade the software to ensure the Therapy PCA firmware is compatible with the software installed on the SOM and Processor PCAs. See "Software Upgrades" on page 19.
2. Run Performance Verification and Safety testing as described in the "Performance Verification" chapter.

I/O Assembly

Preparation

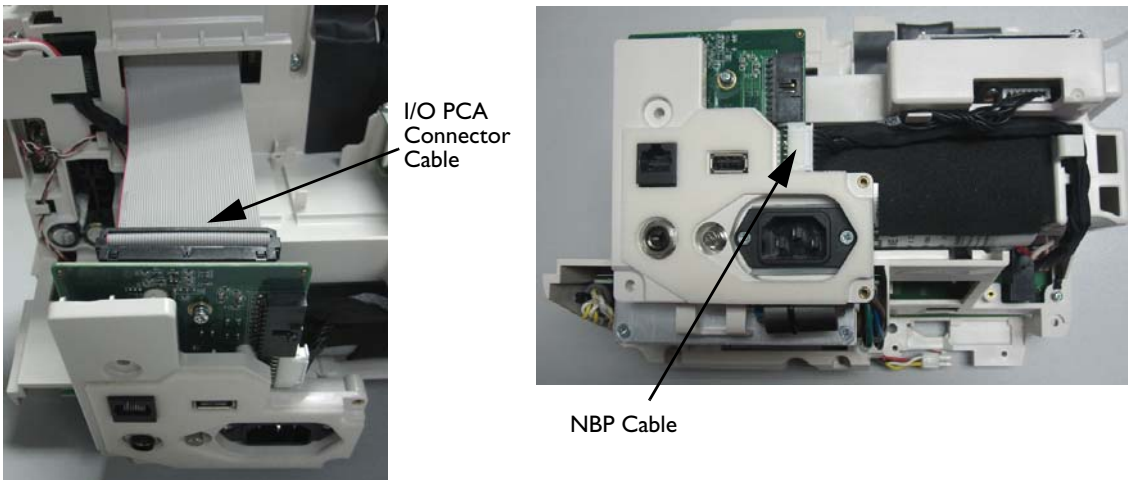
1 Open the Case. See "Opening the Case" on page 90.

2 Remove the Main Chassis. See "Separating Main Chassis and Rear Case" on page 113.

Removal

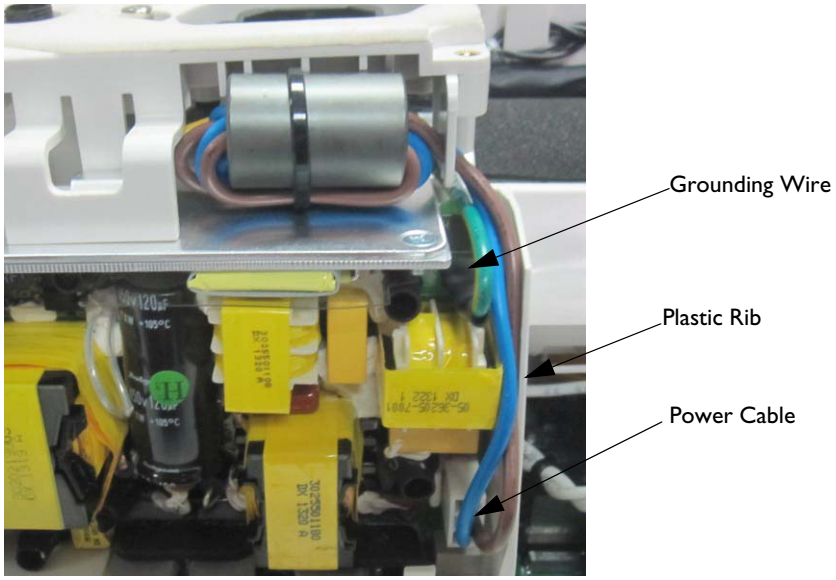
1 Unplug the I/O PCA Connector Cable and the NBP Cable, see Figure 105.

Figure 105 **I/O Assembly-1**



2 Unplug the cables. See Figure 106. (Viewing from button up)

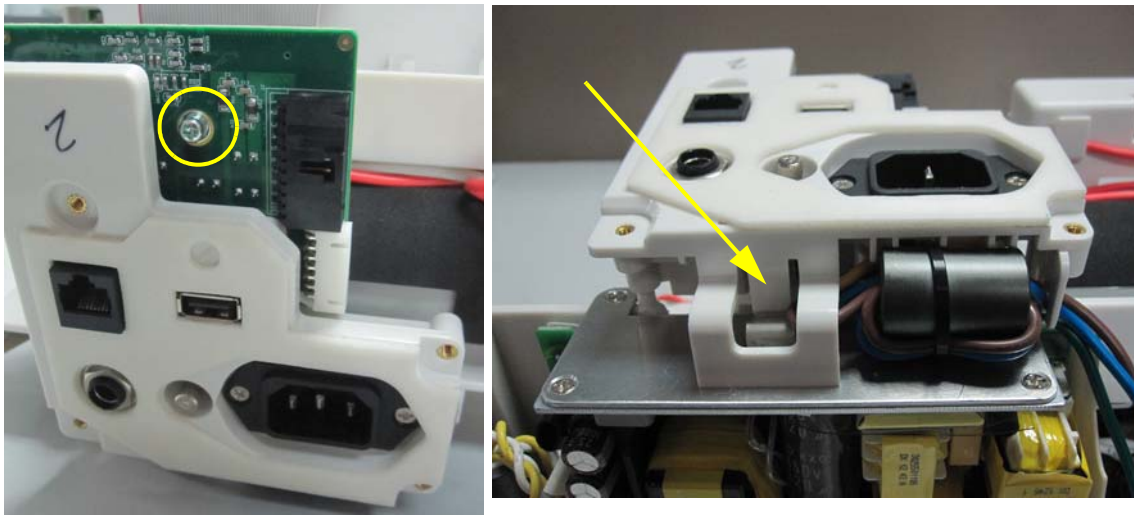
Figure 106 **I/O Assembly-2**



3 Remove the M 3x23 screws with washers, see Figure 107.

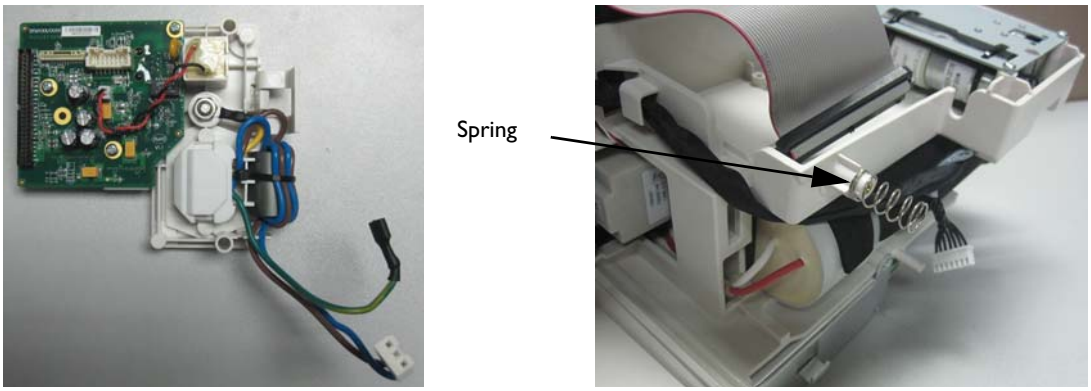
4 Loosen the I/O Assembly Lock, see Figure 107.

Figure 107 **I/O Assembly-3**



5 Remove the I/O Assembly, see Figure 108. Note the spring behind the I/O PCA.

Figure 108 **I/O Assembly-4**



Replacement

1 Replace the new I/O Assembly, snap the new I/O Assembly onto the Main Chassis, and tighten the M 3x23 screws with washers. See Figure 107.

2 Install the Main Chassis. See "Separating Main Chassis and Rear Case" on page 113.

3 Close the Case. See "Closing the Case" on page 149.

To Complete the Replacement

- Run Performance Verification and Safety testing as described in the "Performance Verification" chapter.

I/O PCA

Preparation

1 Open the Case. See "Opening the Case" on page 90.

2 Remove the Main Chassis. See "Separating Main Chassis and Rear Case" on page 113.

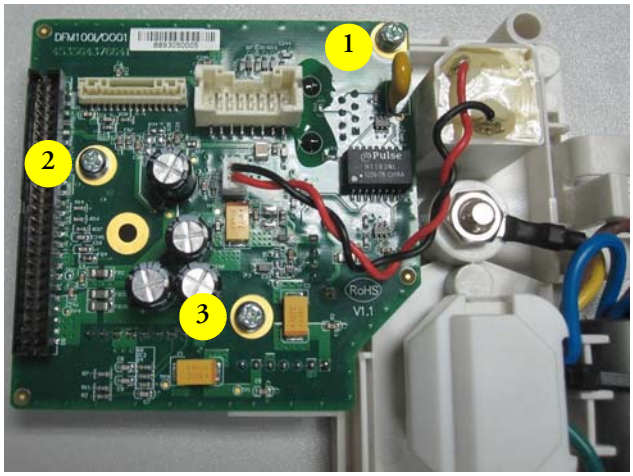
3 Remove the I/O Assembly. See "I/O PCA" on page 134.

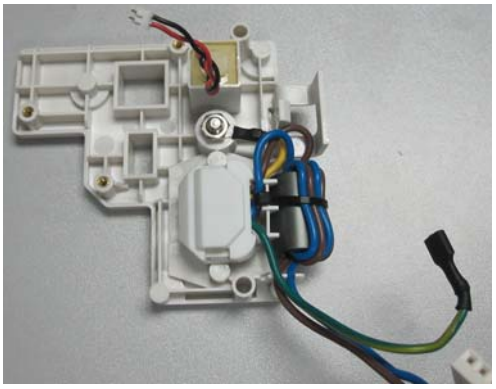
Removal

1 Remove the three M 3x10 screws with washers and unplug the connect cable.

2 Remove the I/O PCA from the I/O Assembly, see Figure 109.
Note the white foam pad on the other side of the I/O PCA.

Figure 109 **I/O PCA**





AC Power Socket Assembly

Replacement

1 Replace the new I/O PCA on the AC Power Socket Assembly.

NOTE: You can not order the AC Power Socket Assembly separately. If needed, order the I/O Assembly (453564489191).

2 Tighten the three M 3x10 screws with washers. See Figure 109.

3 Install the I/O Assembly. See "I/O Assembly" on page 132.

4 Install the Main Chassis. See "Separating Main Chassis and Rear Case" on page 113.

5 Close the Case. See "Closing the Case" on page 149.

To Complete the Replacement

- Run Performance Verification and Safety testing as described in the "Performance Verification" chapter.

NBP Module

Preparation

1 Open the Case. See "Opening the Case" on page 90.

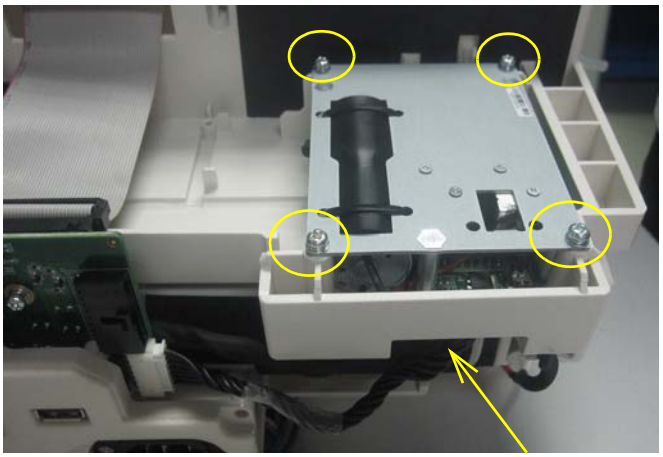
2 Remove the Main Chassis. See "Separating Main Chassis and Rear Case" on page 113.

3 Remove the Main PCA Module. See "Disassembling Main Chassis" on page 115.

Removal

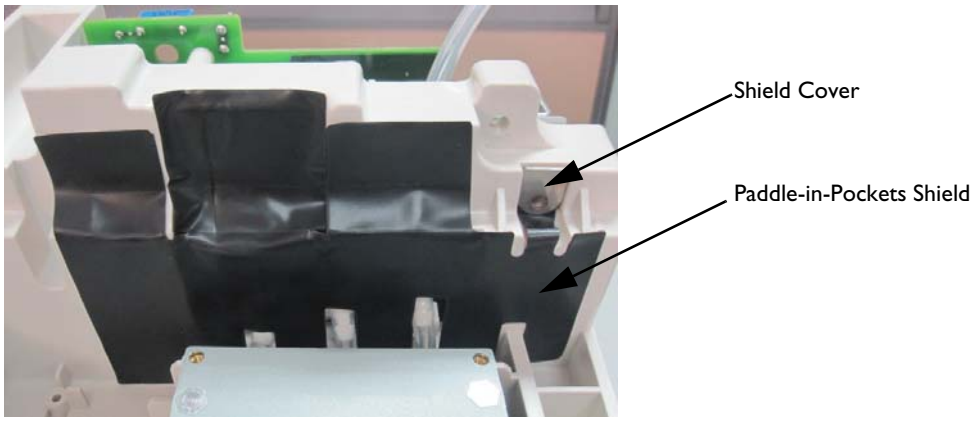
1 Remove the NBP cable and the four M 3x10 screws with washers, see Figure 110.

Figure 110 **NBP Module-1**



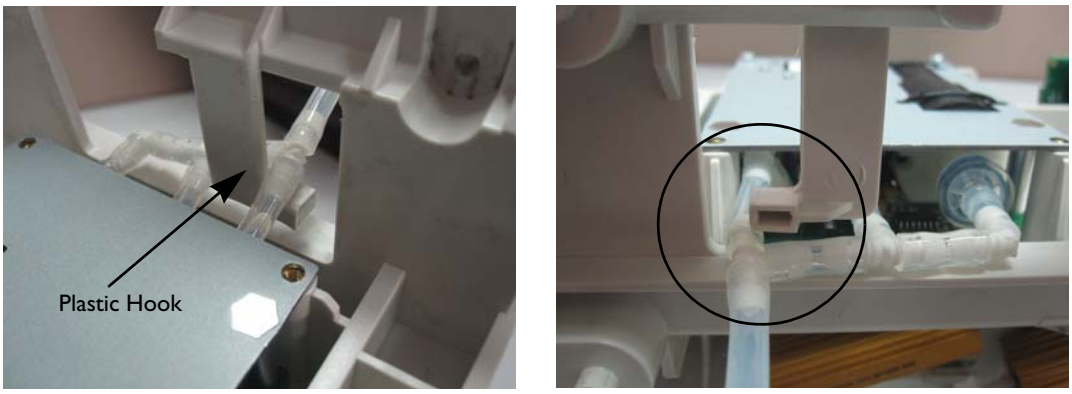
2 Remove the Shield Cover. Remove and discard the Paddle-in-Pockets Shield, see Figure 111.

Figure 111 **NBP Module-2**



3 Loosen the NBP tube from the plastic hook and remove the NBP module, see Figure 112.

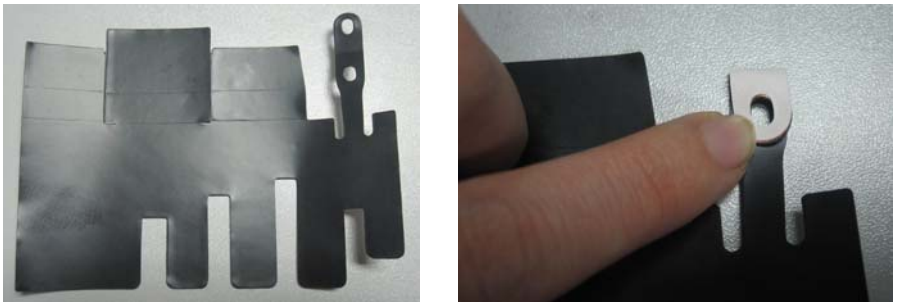
Figure 112 **NBP Module-3**



Replacement

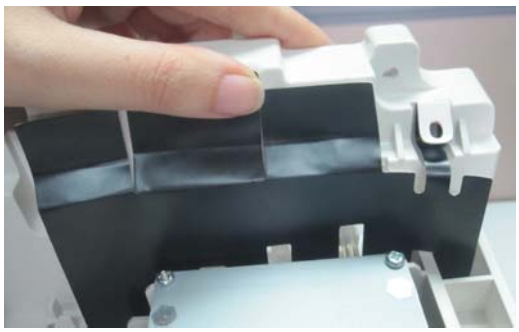
1. Use alcohol remove the adhesive pad remained on plastic chassis.
2. Install the new NBP module and place the tube onto the plastic hook. See Figure 112.
3. Tighten the four M 3x10 screws with washers and connect the NBP cable to NBP module. See Figure 110.
4. Take a new Paddle-in-Pockets Shield, and fold the right corner of the shield and make the two screws holes overlapped. See Figure 113.

Figure 113 **NBP Module Install-1**



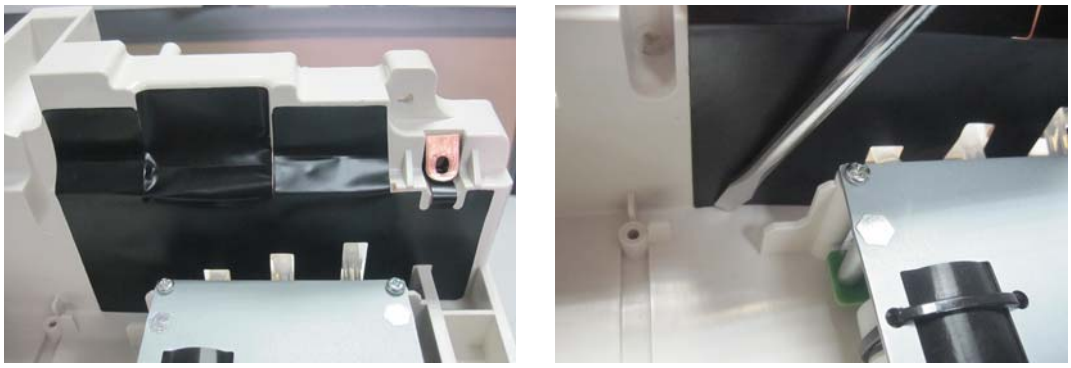
5. Before you remove the cover paper, place the Paddle-in-Pockets Shield into the correct place and adjust the shield according to the shape of the plastic chassis. See Figure 114.

Figure 114 **NBP Module Install-2**



6 Remove the cover paper on the other side of the Paddle-in-Pockets Shield, hold the edge of the shield and use a flat head screw driver to help you adhere the Paddle-in-Pockets Shield. See Figure 115.

Figure 115 **NBP Module Install-3**



a The top edge of the Paddle-in-Pockets Shield should not exceed the edge of the plastic chassis.

b The bottom edge of the Paddle-in-Pockets Shield should reach the bending area of the plastic chassis.

c The overlapped screw holes should be consistent with the screw hole on the plastic chassis.

7 Install the Shield Cover and make sure the screw hole is consistent with the screw holes on the shield and the plastic chassis. See Figure 116.

Figure 116 **NBP Module Install-4**

8 Install the Main PCA Module. See "Assembling the Main Chassis" on page 118.

9 Install the Main Chassis. See "Separating Main Chassis and Rear Case" on page 113.

10 Close the Case. See "Closing the Case" on page 149.

To Complete the Replacement

- Run Performance Verification and Safety testing as described in the "Performance Verification" chapter.

Internal Resistors Module

Preparation

1. Open the Case. See "Opening the Case" on page 90.
2. Remove the Main Chassis. See "Separating Main Chassis and Rear Case" on page 113.
3. Remove the Main PCA Module from the Main Chassis, See "Disassembling Main Chassis" on page 115.

Removal

1. Remove the four M 3x10 screws with lock washers, see Figure 117.

Figure 117 **Internal Resistors**

2. Remove the Internal Resistors Module.

Replacement

1. Install the Internal Resistors Module.
   Note the short cable resistor should be placed on left side.
2. Install the four M 3 x 10 screws with lock washers, see Figure 117.
3. Twist the wires and bundle them with a cable tie.
4. Install the Internal Resistors Module connectors to J18 and J19 on the Therapy PCA, see Figure 90 and Table 30.
5. Install the Main PCA Module. See "Assembling the Main Chassis" on page 118.
6. Install the Main Chassis. See "Separating Main Chassis and Rear Case" on page 113.
7. Close the Case. See "Closing the Case" on page 149.

To Complete the Replacement

- Run Performance Verification and Safety testing as described in the "Performance Verification" chapter.

Power Supply Assembly

You need one cable tie for this repair.

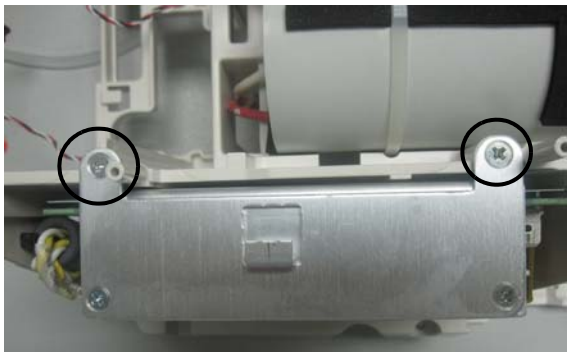
Preparation

1. Open the Case. See "Opening the Case" on page 90.
2. Remove the Main Chassis. See "Separating Main Chassis and Rear Case" on page 113.
3. Remove the Main PCA Module from the Main Chassis, See "Disassembling Main Chassis" on page 115.
4. Remove the I/O Assembly. See "I/O Assembly" on page 132.

Removal

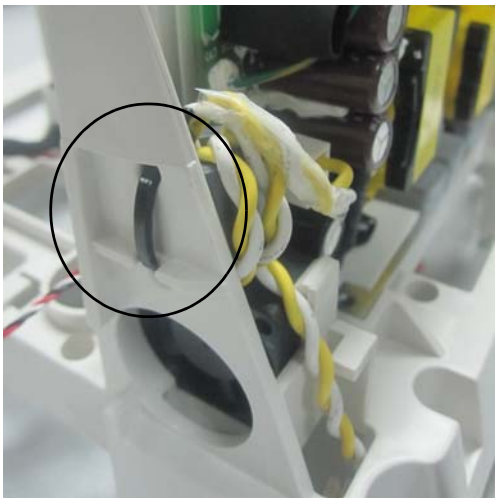
1. Remove the two M 3 x 4 Phillips screws. See Figure 118.

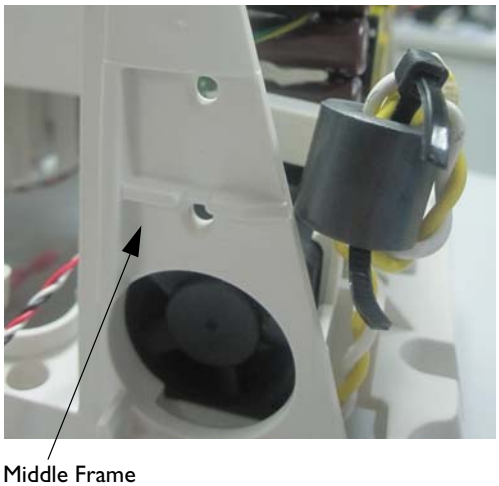
Figure 118 **Power Supply-1**



2. Remove the cable tie on the left side of the Power Supply Assembly to loosen the magnet ring. See Figure 119.

Figure 119 **Power Supply-2**





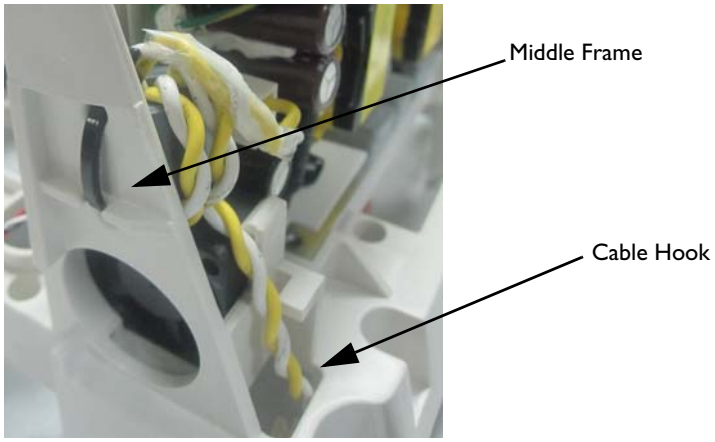
3. Remove the DC Power Output Cable. See Figure 120.

Figure 120 **Power Supply-3**

Replacement

1. Replace a new Power Supply Assembly and install the two M 3x4 flat head screws. See Figure 118.
2. Use a new cable tie to bound the magnet ring on the Middle Frame.See Figure 119.
3. Place the DC Power Output cable into the cable hook below the lower fan as shown. See Figure 121.

Figure 121 **Power Supply-4**



4. Plug the DC Power Output Cable to J1 on the Therapy PCA, see Figure 90 and Table 30.
5. Install the Main Chassis. See “Separating Main Chassis and Rear Case” on page 113.
6. Close the case. See “Closing the Case” on page 149.

To Complete the Replacement:

- Run Performance Verification and Safety testing as described in the “Performance Verification” chapter.

Fans

This procedure is written to replace both fans. You may need to replace one at time.

Read the fan descriptions before the repair:

Table 31 **Fan Descriptions**

Name	Location	Therapy PCA Mark	Disconnect By
Fan 1	Close to Power Supply Assembly	J12	Gently unplug
Fan 2	Close to Internal Resistors	J13	Gently unplug

You may need a flat head screw driver for this repair.

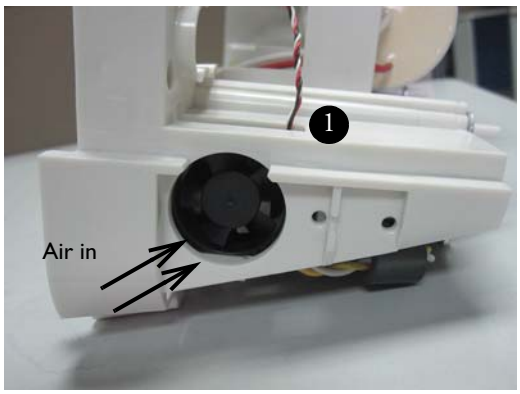
Preparation

1. Open the Case. See "Opening the Case" on page 90.
2. Remove the Main Chassis. See "Separating Main Chassis and Rear Case" on page 113.
3. Remove the Main PCA Module from the Main Chassis, See "Disassembling Main Chassis" on page 115.
4. For Fan 1, cut the cable tie to loosen the magnet ring on the DC Power Output Cable. See Figure 119.

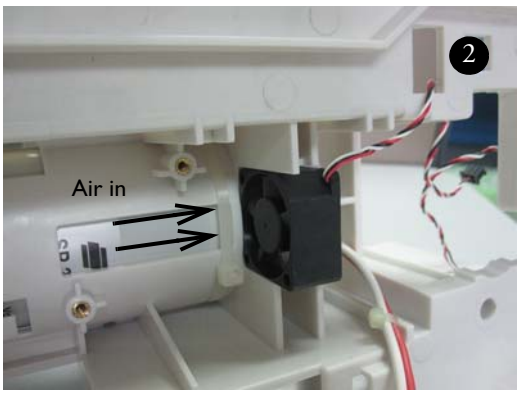
Removal

1. Pull out the fan, use a flat head screwdriver if necessary, see Figure 122.

Figure 122 **Fan**



Fan 1



Fan 2

Replacement

1. Clean off the residual adhesive pad, you may need to use isopropyl alcohol.
2. Install the new fan with new adhesive pad.
   Note the installation directions of the fans. see Figure 122.
3. Make sure the new fan is seated firmly in its designated place.
4. Thread the Fan 2 cable through the hole (1), see Figure 122.
5. Thread the Fan 1 cable through the hole (2), see Figure 122.
6. For Fan 1, use the cable tie to secure the magnet ring, see Figure 121.

7 Connect the fan cables to J12 and J13 on the Therapy PCA, see Figure 88 and Table 30.

8 Install the Main PCA Module. See "Assembling the Main Chassis" on page 118.

9 Install the Main Chassis. See "Separating Main Chassis and Rear Case" on page 113.

10 Close the Case. See "Closing the Case" on page 149.

To Complete the Replacement

- Run Performance Verification and Safety testing as described in the "Performance Verification" chapter.

Therapy Capacitor

Preparation

1. Open the Case. See “Opening the Case” on page 90.
2. Remove the Main Chassis. See “Separating Main Chassis and Rear Case” on page 113.
3. Remove the Main PCA Module from the Main Chassis, See “Disassembling Main Chassis” on page 115.
4. Remove the I/O Assembly. See “I/O Assembly” on page 132

Removal

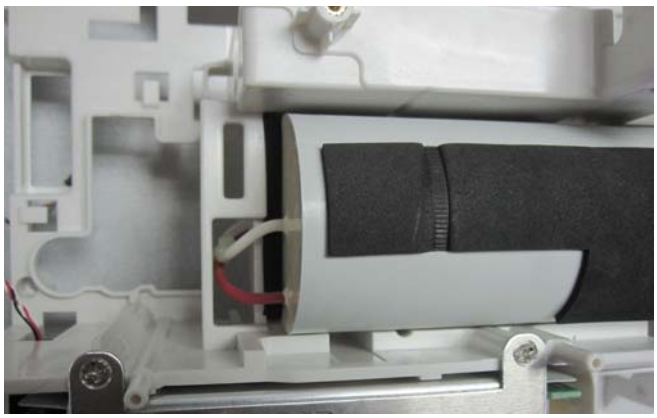
1. Cut the cable tie. Be careful not to cut the surface of the Therapy Capacitor. See Figure 123.
2. Remove the Therapy Capacitor.

Figure 123 **Therapy Capacitor**

Replacement

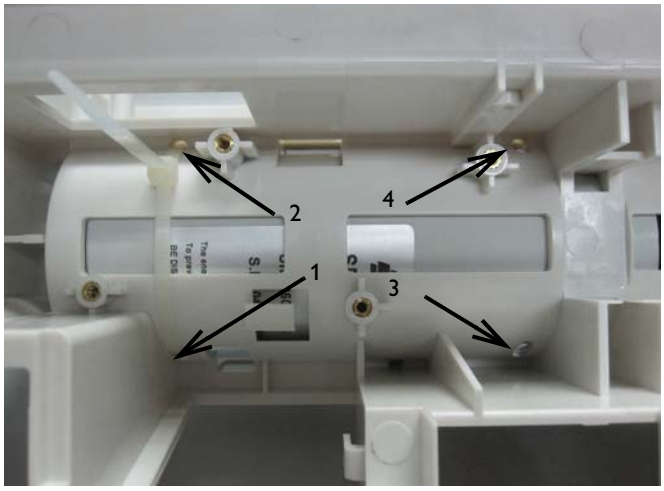
1. Install the new Capacitor.
   a. Insert the Capacitor cable into the holes.
   b. Install the Capacitor cable side first.
   c. Press the other side of the Capacitor until it installed completely. See Figure 124.

Figure 124 **Therapy Capacitor Installation-1**



2 Use a new cable tie to fix the Capacitor.
   a Make the smooth side of the cable tie facing you.
   b Insert the cable tie into the holes 1 and 2 in sequence and tighten the cable tie. See Figure 125.
   c Insert the other cable tie into the holes 3 and 4, then tighten the cable tie. See Figure 125.
   d Cut the cable tie ends.

Figure 125 **Therapy Capacitor Installation-2**



3 Install the two Therapy Capacitor spade connectors to J9 and J11 on the Therapy PCA, see Figure 90 and Table 30.

4 Install the Main PCA Module. See "Assembling the Main Chassis" on page 118.

5 Install the Main Chassis. See "Separating Main Chassis and Rear Case" on page 113.

6 Close the case. See "Closing the Case" on page 149.

To Complete the Replacement

- Run Performance Verification and Safety testing as described in the "Performance Verification" chapter.

Therapy PCA High Voltage Cable

You need following tools for this repair:

- 75% Isopropyl Alcohol
- Hot Melt Glue
- Hot Melt Glue Gun

Preparation

1 Open the Case. See "Opening the Case" on page 90.

2 Remove the Main Chassis. See "Separating Main Chassis and Rear Case" on page 113.

Removal

1 Use 75% isopropyl alcohol remove the hot melt glue, see Figure 126.

Figure 126 **Therapy PCA High Voltage Cable-1**

2 Remove the Therapy PCA High Voltage Cable.

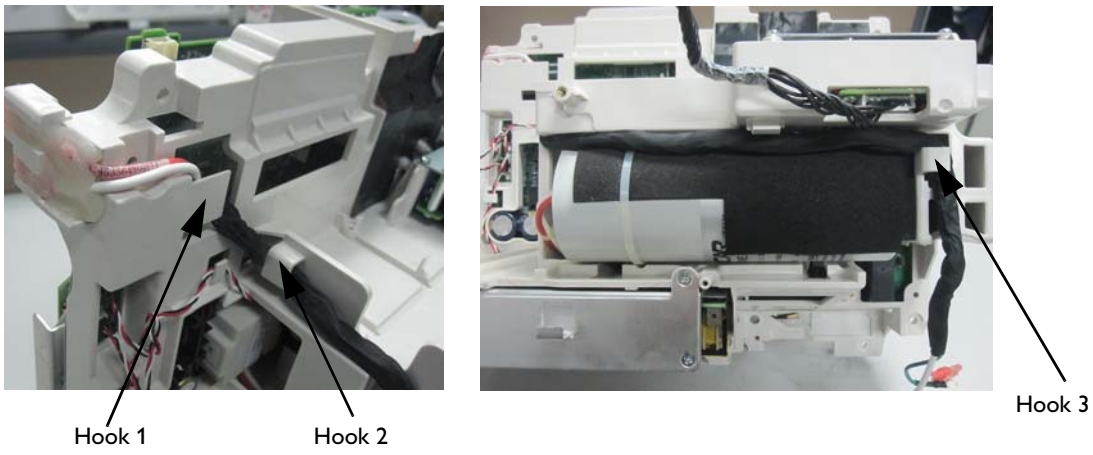
Replacement

1 Replace the New Therapy PCA High Voltage Cable. Install the red wire above and white wire below. See Figure 126.

2 Use hot melt glue to fix the Therapy PCA High Voltage Cable. See Figure 126.

3 Place the PCA High Voltage Cable into correct position. See Figure 127.

Figure 127 **Therapy PCA High Voltage Cable-2**



4 Connect the two spade connectors of the Therapy PCA High Voltage Cable to J8 and J10 on the Therapy PCA, see Figure 87 and Table 30.

5 Install the Main PCA Module. See "Assembling the Main Chassis" on page 118.

6 Install the Main Chassis. See "Separating Main Chassis and Rear Case" on page 113.

7 Close the case. See "Closing the Case" on page 149.

To Complete the Replacement

- Run Performance Verification and Safety testing as described in the "Performance Verification" chapter.

Internal Assemblies — Rear Case

This section is organized into the following topics:

Battery PCA . . . . . p. 147
Paddle Tray Short Circuiting Cable . . . . . p. 148

Battery PCA

Removal

1. Open the Case. See "Opening the Case" on page 90.
2. Remove the Main Chassis. See "Separating Main Chassis and Rear Case" on page 113.
3. Remove the Battery PCA. See Figure 128.

Figure 128 **Battery PCA**

Replacement

1. Replace the Battery PCA.
2. Install the Main Chassis. See "Separating Main Chassis and Rear Case" on page 113.
3. Close the case. See "Closing the Case" on page 149.

To Complete the Replacement

- Run Performance Verification and Safety testing as described in the "Performance Verification" chapter.

Paddle Tray Short Circuiting Cable

Preparation

1. Remove the Paddle Tray and Plates. See “Paddle Tray and Plates” on page 85.
2. Open the Case. See “Opening the Case” on page 90.
3. Remove the Main Chassis. See “Separating Main Chassis and Rear Case” on page 113.
4. Turn the back side of the device facing you.

Removal

1. Use a flat head screw driver to loosen the plastic end cap and remove the Paddle Tray Short Circuiting Cable. See Figure 129.

Figure 129 **Paddle Tray Short Circuiting Cable**

Replacement

1. Insert the Paddle Tray Short Circuiting Cable into the hole and install the plastic end cap onto the Rear Case.
2. Install the Main Chassis. See “Separating Main Chassis and Rear Case” on page 113.
3. Close the case. See “Closing the Case” on page 149.
4. Install the Paddle Tray and Plates. See “Paddle Tray and Plates” on page 85.

To Complete the Replacement

- Run Performance Verification and Safety testing as described in the “Performance Verification”.

Closing the Case

Preparation

1. Assemble the Front Case. See “Internal Assemblies — Front Case” on page 93.
2. Assemble the Rear Case Assembly. See “Internal Assemblies — Rear Case Assembly” on page 107.

Assembly

1. Connect the UI PCA connection cable and the LCD Display connection cable. See “Separating the Front Case Assembly” on page 91.
2. Close the Front Case and the Rear Case Assembly. See “Separating the Front Case Assembly” on page 91.
3. Install the six M 4x16 case screws. See “Case Screws” on page 91.
4. Install the Handle Assembly. See “Handle Assembly” on page 84.
5. Install the Bedrail Mount, if present. See “Bedrail Mount” on page 81.
6. Install accessory pouches, if present. See the *Efficia DFM100 Instructions for Use*.

To Complete the Repair

- Run Performance Verification and Safety testing as described in the “Performance Verification”.

NOTES

5

Performance Verification

Overview

This chapter describes how to verify the performance of the Efficia DFM100 monitor/defibrillator after repairs are complete. This chapter is organized into the following sections:

Required Testing Levels . . . . . p. 151
Verification Test Equipment . . . . . p. 152
Test and Inspection Matrix . . . . . p. 153
Performance Verification Procedures . . . . . p. 157

Required Testing Levels

The Performance Verification and Safety Tests are intended to verify proper operation of the device following repair. The level of testing required corresponds to the type of repair performed.

External Repairs/Replacements

External repairs/replacements are those involving the repair or replacement of one or more of the following items. The key point is that *the case has not been opened.*

- Battery Compartment Cover and Latch
- Bedrail Mount
- Labels
- Therapy Knob / Smart Select Knob
- Paddle Tray and Plates
- Handle

The following tests are required after an External Repair or Replacement when *the case has not been opened:*

- Perform the Visual Inspection (see "Visual Inspection" on page 158).
- Run the Operational Check (see "Operational Check" on page 159).
- Check the Error Logs for critical errors (see "Error Log Messages" on page 44).
- *After the **Therapy Knob** replacement only:* Run the Controls test (see "Controls Test" on page 160).
- *After the **Paddle Tray and Plates** replacement only:* Run the Paddle Safety Check (see "Paddles Safety Check" on page 168).

External Repairs (Printer Removed)

The Printer PCA is located inside the Printer Assembly. If the Printer was replaced or removed, *and the case was not opened,* the following tests are required:

- Perform the Visual Inspection (see "Visual Inspection" on page 158).
- Run the Operational Check (see "Operational Check" on page 159).
- Inspect the Error Logs for critical errors (see "Error Log Messages" on page 44).
- Run the Printer Test (see "Printer Test" on page 160).
- Run the Safety Tests (see "Safety Tests" on page 169).

Internal Repairs

If *the case was opened* (regardless of what else the repair involved), perform *all* the Performance Verification and Safety tests:

- Run the Performance Verification and Safety tests (see "Test and Inspection Matrix" on page 153 and "Performance Verification Procedures" on page 157).

Verification Test Equipment

Table 32 lists the equipment needed to perform the Performance Verification and Safety tests, and provides specifications for commercially available analyzers and simulators. Test equipment is called out within each test procedure when needed.

Table 32 **Verification Test Equipment**

Equipment	Specification
ECG Simulator (for Leads/Pads/Paddles)	
Leads simulated	3 and 5
Amplitude accuracy	±2%
Rate accuracy	±2%
Defibrillator Analyzer	
Waveform compatibility	Meets all specs below using biphasic truncated exponential waveform
Load resistance	50 Ω ±1% (non-inductive)
Maximum energy	≥ 200 J
Maximum voltage	≥ 2500 V
Maximum current	≥ 50 A
Energy measurement accuracy	< 20 J: ≤ ±0.4 J; ≥ 20 J: ≤ ±2% of reading
Cardioversion measurement range	–120 to +380 ms
Test Load	50 Ω ±1% (non-inductive)
Pacer test	
Load impedance	≤ 400 Ω
Current measurement accuracy	10 mA–50 mA: ≤ ±2 mA; 50 mA–175 mA: ≤ ±4%
Rate measurement accuracy	30–180 ppm: ≤ ±0.5%
Waveform duration measurement accuracy	30–180 ppm: ±1 ms

Table 32 **Verification Test Equipment *(Continued)***

Equipment	Specification
NBP test	
Pressure range	> 280 mmHg
Pressure measurement accuracy	±2%
Safety test	
Leakage current measurement range	0 – 5000 µA
Leakage current measurement accuracy	±2% or ±2 µA

Test and Inspection Matrix

Table 33 summarizes Performance Verification tests and inspections for the Efficia DFM100.

Table 33 **Test and Inspection Matrix**

Test Group Name	Test or Inspection to Perform	Expected Test Results	Data to Record x = p (pass) or f (fail)
Visual Insp. (V)	Inspect the device, accessories, cables, etc., see "Visual Inspection" on page 158.	If no unusual damage, no missing items, then Visual Inspection passes.	*V:x* Example V:p
Service Mode Tests			
Operational Check (OC)	Run the Op Check. See "Operational Check" on page 159.	If "Pass" reported on all tests applicable to the device configuration and options, then Op Check passes.	*OC:x* Example OC:p
Error Logs (EL)	Check the Error Logs after the Operational Check. See "Error Log Messages" on page 44.	If no critical errors after the last successful Op Check, then Error Logs pass.	*EL:x* Example EL:p
Controls test (C)	Run test to check buttons, Therapy Knob, Functional Keys, and soft keys. See "Controls Test" on page 160.	If all keys respond as expected, then Controls test passes.	*C:x* Example C:p
Display (DP)	Run Display test. See "Display Test" on page 162.	If pattern displays correctly, then Display test passes	*DP:x* Example DP:p
Fan (F)	Run Fan test. See "Fan Test" on page 162.	If both fans can rotate and stop, then Fan test passes	*F:x* Example F:p
USB (U)	Run USB test, See "USB Test" on page 163.	If the USB Test Passed message is displayed, then USE test passes	*U:x* Example U:p
Printer (Pr)	Run Printer test. See "Printer Test" on page 160.	If print quality is adequate; no stray marks or lines and print speed: 25 mm ± 5% (1.25 mm) then Printer test passes.	*Pr:x* Example Pr:p
NBP Cal Check (NC)	Run the "NBP Monitoring Problems" on page 65.	If all data passes within limits, then NBP calibration check passes.	*NC:x* Example N:p
$EtCO_2$ Cal Check (EC)	Run the "EtCO2 Maintenance" on page 25.		

Table 33 **Test and Inspection Matrix** ***(Continued)***

Test Group Name	Test or Inspection to Perform	Expected Test Results	Data to Record x = p (pass) or f (fail)
Functional Checks: In normal Clinical Mode, perform the following functional checks:			
ECG (E)	Using an ECG simulator, perform Leads ECG and Pads cable ECG test. See "ECG Check" on page 164.	If all checks pass, and all data within limits: • Waveform clear on display • HR correct on display and matches defib analyzer at 2 data points: 30 and 200 bpm • HR alarm works • Leads off indicators perform as expected • Cycles through different views then ECG test passes.	*E:x* Example E:p
SpO_2 (Sp)	Using the SpO_2 sensor, perform SpO_2 check. See "SpO_2 Check" on page 165.	If pleth wave is clear, pulse rate is displayed, and saturation reads between 95% -100%, then SpO_2 check passes.	*SP:x* Example Sp:p
NBP Measurement (NM)	Take a blood pressure measurement on yourself or another person. See "NBP Check" on page 165.	If you are able to complete a measurement, the NBP check passes.	*NM:x* Example: NM:p
Synchronized Cardioversion (SC)	Using an ECG simulator and defibrillator analyzer, perform the "Synchronized Cardioversion Test" on page 168.	If all checks pass, and all data within limits: • Sync markers appear on the display, at the peak or on the falling side of the QRS • Shock delivered on next QRS • Shock delivered 6 J ± 2 J • If applicable, strip prints with the correct information on it • Delay between the peak of the QRS and the delivered shock is ≤ 30 ms • If clinicians use an external monitor as the ECG source, verify that the external monitor and the device combination will deliver a synchronized shock within 60 ms of the peak of the R-wave. then Synchronized cardioversion test passes.	*SC:x* Example SC:p
Pacing Test (P)	Using a defibrillator analyzer, perform the "Pacer Test" on page 167. • (70 ppm) 30 mA • (180 ppm) 160 mA	If all checks pass, and all data within limits: • 30 mA ± 5 mA • 160 mA ± 16 mA then Pacing test passes.	*P:x* Example P:p

Table 33 **Test and Inspection Matrix *(Continued)***

Test Group Name	Test or Inspection to Perform	Expected Test Results	Data to Record x = p (pass) or f (fail)
Defibrillator Test — AC Power (DA) (if AC Power used in normal operation)	Using only AC power and a defibrillator analyzer, run the "Defibrillator Test (AC Power at 200 J)" on page 165.	If all checks pass, and all data within limits:	*DA:x* Example DA:p
	Energy measured by analyzer: Delivered into 50-ohm test load	200 ± 20 J	
	Setting displayed by Efficia DFM100:	200 J	
	Delivered energy	Actual delivered energy ± 10% then Defibrillator Measurement test passes	
Defibrillator Test — Battery Power (DB)	Using only battery power and a defibrillator analyzer, run the "Defibrillator Test (Battery Power at 200 J)" on page 166):	If all checks pass, and all data within limits:	*DB:x* Example DB:p
	Energy measured by analyzer: Delivered into 50-ohm test load	200 ± 20 J	
	Setting displayed by Efficia DFM100:	200 J	
	Delivered energy	Actual delivered energy ± 10% then Defibrillator Measurement test passes.	
Defibrillator Disarm Test (D)	Run the "Defibrillator Charge Cancellation Test" on page 167.	Verify that the device is disarmed Verify that the charge tone stopped then the Defibrillator Disarm test passes.	*D:x* Example D:p
Paddles Safety Check (Pa)	Perform "Paddles Safety Check" on page 168.	If PCI flashes as expected, then Paddles test passes.	*Pa:x* Example Pa:p
Safety Tests Using a Safety Analyzer **NOTE:** All leakage current tests include both Normal and Reverse Polarity Conditions. Report worst case values.			
Protective Earth Resistance (S1)	Protective Earth Resistance. See "Protective Earth Resistance" on page 170 — aaa	Maximum Impedance: ≤ 100 mΩ	*S1:x/aaa/* Example: S1:p/80
AC Mains (S2)	Earth Leakage Current NC (Normal Condition). See "AC Mains (Ground Leakage)" on page 171 — bbb	If Normal Condition Maximum leakage current: ≤300 µA (UL, 120 VAC) ≤ 500 µA (IEC, 240 VAC)	*S2:x/bbb/cccc* Example: S2:p/125/800
	Earth Leakage Current SF (Single Fault, open neutral) — cccc	If Single Fault Maximum leakage current: ≤ 1000 µA, then Earth Leakage Safety test passes	

Table 33 **Test and Inspection Matrix** ***(Continued)***

Test Group Name	Test or Inspection to Perform	Expected Test Results	Data to Record x = p (pass) or f (fail)
Chassis Leakage (S3)	Use ECG Out (Sync) jack as ground NC (Normal Condition). See "Chassis (Enclosure) Leakage" on page 171 — dd	If Normal Condition Maximum leakage current: < 100 µA	*S3:x/dd/eee* Example: S3:p/99/299
	Single Fault condition — eee	If Single Fault Maximum leakage current: < 300 µA (UL) < 500 µA (IEC) then Chassis Leakage test passes.	
Patient Lead Leakage (S4)	**ECG Patient Cable** (see "Patient Lead Leakage" on page 171). • Source (Normal Condition) — ff • Source (Single Fault condition — open earth, open neutral) — gg • With Mains on applied part (Single Fault condition) — hh	If readings are as expected: • ≤10 µA • ≤50 µA • ≤50 µA then ECG Cable Leakage test passes.	*S4: x/fff/gg/hh /ii/jj/kk/ll/mm/n n/ooo/ppp/qqq* Example: S4:p/9/49/49/ 9/49/49/ 9/49/49/ 99/499/499
	Pads Cable • Source (Normal Condition) — ii • Source (Single Fault Condition — open earth, open neutral) — jj • With Mains on applied part (Single Fault condition) — kk	If readings are as expected: • ≤ 10 µA • ≤ 50 µA • ≤ 50 µA then Pads Cable Leakage test passes	
	SpO_2 Cable • Source (Normal Condition) — ll • Source (Single Fault Condition — open earth, open neutral) — mm • With Mains on applied part (Single Fault condition) — nn	If readings are as expected: • ≤ 10 µA • ≤ 50 µA • ≤ 50 µA then SpO_2 Cable Leakage test passes	
	Paddles Cable • Source (Normal Condition) — ooo • Source (Single Fault Condition — open earth, open neutral) — ppp • With Mains on applied part (Single Fault condition) — qqq	If readings are as expected: • ≤ 100 µA • ≤ 500 µA • ≤ 500 µA then Paddles Cable Leakage test passes	

NOTE: When recording test results, separate results within a test by slashes (/); separate tests by semicolons (;); and use no empty spaces.

V:x;OC:x;EL:x;C:x;DP:x;Pr:x;NC:x;E:x;SP:x;NM:x;SC:x;P:x;DA:x;DB:x;D:x;Pa:x; S1:x/aaa;S2:x/bbb/cccc;S3:x/dd/eee;S4:x/fff/gg/hh/ii/jj/kk/ll/mm/nn/ooo/ppp/qqq

For example: V:p;OC:p;EL:p;C:p;DP:p;Pr:p;NC:p;E:p;SP:p;NM:p;SC:p;P:p;DA:p;DB:p;D:p;Pa:p; S1:p/80; S2:p/125/800; S3:p/99/299;S4:p/9/49/49/9/49/49/9/49/49/99/499/499

Performance Verification Procedures

This section gives instructions for performing inspections and running Performance Verification and Safety tests on the Efficia DFM100. If desired, you can make copies of the "Test and Inspection Matrix" on page 153 and use it to record results.

The Performance Verification procedures are divided into two levels:

- **Visual Inspection** — examining for damage, wear, contamination
- **Performance Verification and Safety tests** — consist of the following tests and checks:
  - Service Mode tests (including Operational Check), which consist of running the device in Service Mode, applying signals, measuring, observing behavior, and recording results.
  - Functional checks, which consist of running the device in its normal operating mode, applying signals, measuring, observing behavior, and recording results.
  - Safety tests, which consist of connecting the Efficia DFM100 to a safety analyzer and measuring results.

The Performance Tests are sequenced to check more basic functions first, and then build on that to check more complex functions. We recommend you perform these tests in this sequence.

This section is organized into the following topics:

Visual Inspection . . . . . p. 158
Service Mode Tests . . . . . p. 159
Functional Checks . . . . . p. 163
Safety Tests . . . . . p. 169

Visual Inspection

A thorough visual inspection of the device should include at least the checks described below.

Check Cables, Supplies and Accessories

1 Are they the right ones? Sometimes a problem can be resolved simply by using the cables and supplies with which the device was designed to operate.
   – Are they the correct Philips models recommended for use with the Efficia DFM100, or are they some other brand?

2 Are they all present? The device should have:
   – An undamaged, sufficiently charged battery.
   – A new, dry roll of Philips printer paper. The Printer may jam if the paper is wet. Also, the Printer may be damaged if wet paper is allowed to dry while in contact with the printhead elements.
   – Cables and sensors which are approved by Philips and known to be in working order. Also make sure that all external cables are fully inserted in their receptacles.
   – A new, empty USB flash memory drive.
   – All required documentation is available and reflects the current revision and configuration of the device.

3 Are the consumables fresh?

   Check the ECG electrodes and multifunction electrode pads for freshness (date code or expiration date) and condition.

PASS: Accessories and supplies are those specified by Philips. Electrodes and pads are within their expiration date and appear usable. For single-use items, packaging is unopened and shows no tears or punctures. No corrosion is visible on connector sockets, electrodes, or pads.

Check the Device

1 Inspect the device on all sides, looking for:
   - Signs of mechanical damage to the case, controls, display, or printer.
   - Loose or missing hardware.
   - Evidence of liquid spill, mechanical damage, pin corrosion, or debris:
     – Open the printer door and clean out any accumulation using gloves and an approved cleaner.
     – Inspect the battery connector using a flashlight.
     – Check for residue in the patient connectors on either side of the device (ECG, SpO_2, NBP, $EtCO_2$, Therapy port, USB port, ECG Out, network port, AC mains socket).
   - Residue on the thermal printhead.
   - Printer roller wear.
   - Safety related marking, labels and labeling are legible and complete.

2 Inspect the paddles, power cord, battery, cables, and sensors for signs of the following:
   - Wear or damage to paddles, cables, and adapters.
   - Wear or damage to patient cables and associated strain reliefs.
   - Wear or damage to power cord and associated strain relief.

PASS: Only normal wear, no damage serious enough to inhibit performance. No corrosion visible.

Service Mode Tests

The following tests are available from Service Mode:

- Operational Check . . . . . p. 159
- Printer Test . . . . . p. 160
- Controls Test . . . . . p. 160
- Display Test . . . . . p. 162
- Fan Test . . . . . p. 162
- USB Test . . . . . p. 163

Service Mode also allows you to view and print the Error Logs (see "Error Log Messages" on page 44); check and enter device information, such as serial number and options (see "Device Information" on page 17); and upgrade the software and set the device's language (see "Software Upgrades" on page 19).

CAUTION: Be sure that the defibrillator/monitor is not connected to a patient when performing any functions in Service Mode.

Operational Check

Operational Check (Op Check) should be performed at regular intervals to supplement the hourly, daily, and weekly Automated Tests executed by the Efficia DFM100. Automated Tests provide adequate assurance that the device is in a functional state of readiness. Op Check supplements the Automated Tests by verifying therapy cables, the ECG cable, paddles, and audio functionality, along with replicating the Weekly test.

Always run an Op Check and check the Error Logs after a repair.

To run the Op Check:

1. Insert a sufficiently charged battery (at least two LEDs light up).
2. Access Service Mode (see "Accessing Service Mode" on page 15).
3. From the Service Mode Main menu, select **Operational Check** and press the Smart Select Knob.

NOTE: You can run Op Check from the **Other** menu in Monitor Mode or from the Service Mode Main menu — the Op Check is the same in both modes.

4. When a response is required, use the Smart Select Knob to select your answer and the Smart Select Knob to confirm your choice.

See "Operational Check" on page 36 for more information on the Op Check procedure.

To check the Error Logs:

- Select **Hardware Error Log** or **Software Error Log** from the Service Mode Main menu.

The Error logs includes entries for all messages logged during all operating modes, Automated tests, Service tests, and Op Checks. See "Error Log Messages" on page 44 for more information.

Printer Test

The printer test checks printer parameters, and prints test patterns to check the print head and the paper drive mechanism.

To start the Printer Test:

1 Select **Printer Test** from the Service Mode Main menu and press the Smart Select Knob.
The printer prints a series of test patterns.

NOTE: It can take up to 30 seconds for the printout to start on devices that have Asian fonts.

2 Stop the printout.
Once the patterns have printed, press the **Print** button to stop the printout.

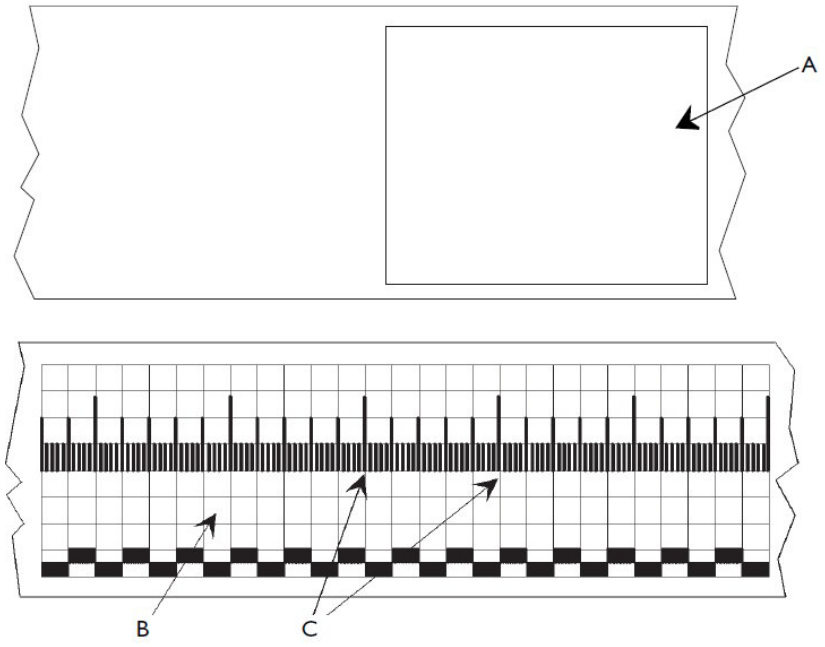
To inspect the test patterns:

1 Check the print quality. Verify that the test patterns on the strip are as indicated in Figure 130.
- **a** Area "A" contains printouts of all characters and symbols. Verify that they are readable.
- **b** Check Area "B" for stray marks or lines.
- **c** Check for white lines (printhead elements stuck off) or black lines (printhead elements stuck on).

To measure the print speed:

1 Verify the print speed.
Measure between the long tick marks (area "C") to verify paper speed. The distance should be 25 ± 1.25 mm (± 5%) matching the print speed of 25 mm/sec.

Figure 130 **Printer Test Output**



Controls Test

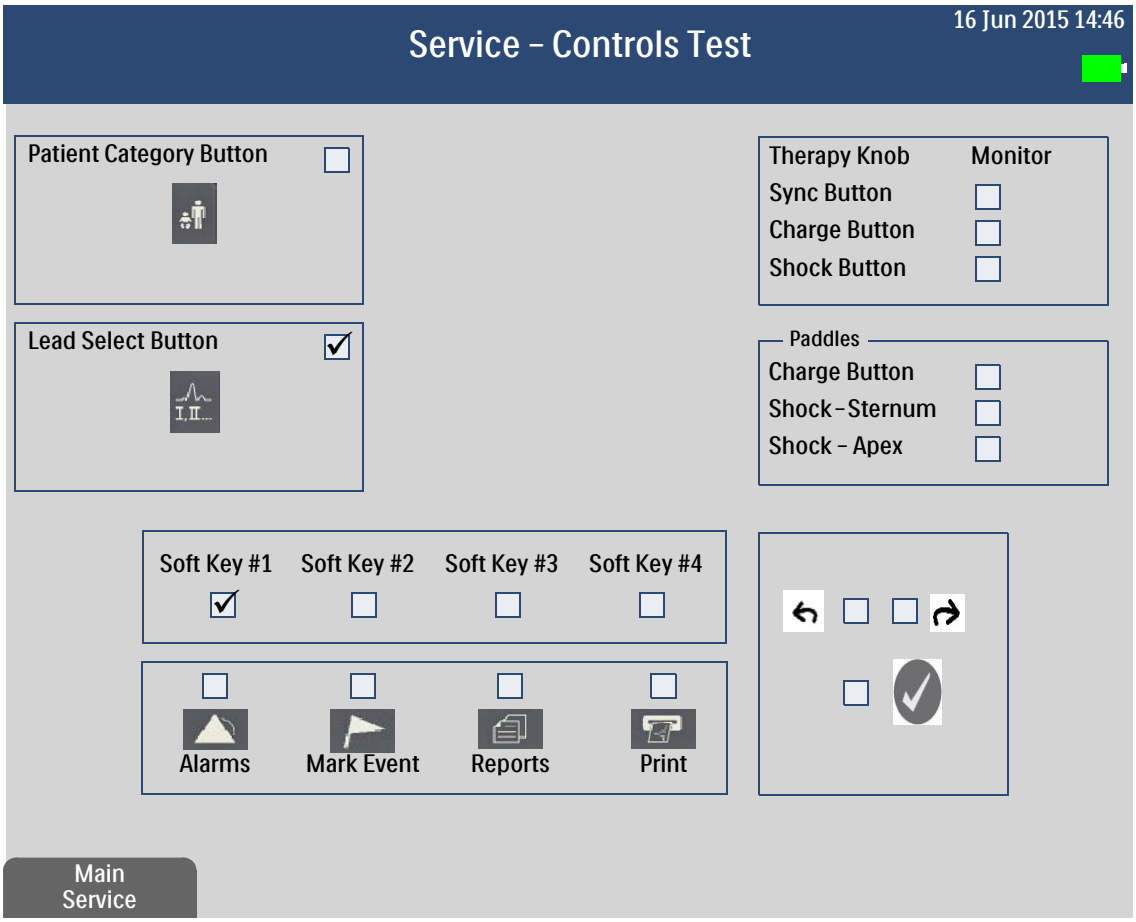
Run these tests when the controls performance becomes a suspect.

To perform controls test:

1 Access Service Mode

2 Select **Controls Test** from the Service Mode menu.
The controls test screen appears (Figure 131).

Figure 131 **Controls Test Screen**



3 Press all the indicated keys in turn and observe check marks appearing in the corresponding boxes. If after pressing a key, the corresponding check mark does not appear, or appears in a wrong box, note the malfunctioning key.

NOTE: Press the soft key #1 once to check the box and enable the **Main Service** function. If pressed again, soft key #1 returns you to the Main Service screen.

4 Turn the Therapy Knob to every position and observe the screen designation changing accordingly.

5 If there is a mismatch, then:

- If there is a mismatch in Therapy Knob, then check the Therapy Knob connections and replace the Therapy Knob or Therapy Switch as necessary.
- If there is a mismatch in the Paddles group, then check the Paddles connections and test the Paddles.
- If there is a mismatch in the Charge/Shock/Sync buttons, then check the UI PCA connections and replace the UI PCA if necessary.
- If there is a mismatch in other buttons or keys, then check the Front Case connections and replace the Front Case if necessary.

If all results pass, the device passes that portion of the test. Return to the Service Mode Main screen by pressing the Main Service soft key. If there is any failure, begin troubleshooting and repair the device as needed.

Display Test

These instructions tell you how to run the Display test.

If all results pass, the device passes that portion of the test. Return to the Service Mode Main screen by pressing the Main Service soft key. If there is any failure, troubleshoot and repair the device as needed. See "Display Problems" on page 72.

1 Access the Service Mode Main menu as described in "Accessing Service Mode" on page 15.

2 From the Service Mode Main menu, select Display Test.

3 Check for any defective pixels, random lines or dots, or flickering while test patterns are displayed:
   a the display is filled with white,
   b the display is filled with black,
   c red fills the display from top to bottom,
   d green fills the display from left to right,
   e blue fills the display from right to left,
   f intensity test pattern is displayed.

4 Inspect the intensity test pattern to ensure that 16 intensity levels are visible in each color.

5 Press the Main Service soft key to terminate the test.

6 There is no pass / fail result or message for the display test. Make your subjective decision based on your observations.

Fan Test

Use the Fan On/Off soft key to verify both fans can rotate and stop.

USB Test

Test the USB if indicated by the troubleshooting.

The USB test is safe for the data on the USB drive.

The USB test verifies both the USB flash drive and Efficia DFM100 USB port performance. If in doubt, test the suspect USB flash drive on different devices or different USB flash drives on the suspect device.

To test the USB:

1. Check the physical integrity of the connection:
   a. Verify there is no dirt, debris, rust, or liquid spill in the USB port or flash drive.
   b. Verify there is no physical damage to the USB port or flash drive.
   If any of these conditions present, then replace both the I/O PCA and USB flash drive to avoid damaging other ports and drives.
2. Access the Service Mode Main menu as described in "Accessing Service Mode" on page 15.
3. From the Service Mode Main menu, select **USB Test**.
4. Observe the **USB Test Passed** or **USB Test Failed** message.
5. Press the **Smart Select Knob** to acknowledge the **Test Done** message.

Functional Checks

The functional checks exercise the basic functions of the defibrillator/monitor. They are intended as a broad check of the device's performance and are used in conjunction with the Service Mode and Safety tests to verify the performance of the device.

Perform functional checks with the device in a normal clinical operating mode, not in Service Mode.

TIP: Perform functional checks only for the options installed on your device.

If all elements of a test pass, record that test as a PASS. If there is any failure, begin troubleshooting and repair as needed.

This section is organized into the following topics:

- ECG Check . . . . . p. 164
- SpO_2 Check . . . . . p. 165
- NBP Check . . . . . p. 165
- Defibrillator Measurement Test . . . . . p. 165
- Defibrillator Test (AC Power at 200 J) . . . . . p. 165
- Defibrillator Test (Battery Power at 200 J) . . . . . p. 166
- Defibrillator Charge Cancellation Test . . . . . p. 167
- Pacer Test . . . . . p. 167
- Synchronized Cardioversion Test . . . . . p. 168
- Paddles Safety Check . . . . . p. 168

ECG Check

This section describes how to check the operation of the ECG functions. Each of the ECG checks assumes the device and the simulator are still set up as they were at the end of the previous ECG check.

Setup

1 Set up the simulator:
   - **a** Connect a Therapy cable and ECG cable to the Efficia DFM100.
   - **b** Connect the ECG simulator to both the Therapy cable and the 3- or 5-lead ECG cable.
   - **c** Set the simulator for normal sinus rhythm (NSR), 1 mV amplitude, and 30 bpm.

2 Set up the Efficia DFM100:
   Turn the Therapy Knob to Monitor.

Check ECG Display, HR, Leads Off

1 Check the waveform.
   Using the Lead Select button, verify that the display shows a clear waveform for all Leads and Pads.

2 Check the Heart Rate (HR).
   Verify that the Heart Rate (HR) displayed is correct.

3 Check the alarms.
   - **a** Verify that the heart rate alarm sounds (assuming 30 bpm is below the configured lower limit).
   - **b** Set the simulator to 60 bpm.
     Verify that the heart rate alarm stops.

4 Check the Leads Off condition.
   - **a** Using the Lead Select button, select Pads (or Paddles).
   - **b** Disconnect the ECG simulator from the Therapy cable and verify that the display shows a dashed line in place of the waveform and that the device sounds an alert and displays the Press "I, II.." Button to Select Another ECG Lead message
   - **c** If you are testing a 3-lead cable, use the Lead Select button to select Lead II.

NOTE: If you are testing anything other than a 3-lead ECG cable, make sure an ECG waveform appears in Wave Sectors 1 and 2.

   - **d** If you are testing a 5-lead cable, select the V or V/C lead (depending on the electrode configuration).
   - **e** Disconnect each of the ECG electrodes from the simulator one at a time, and verify that the display shows a dashed line in place of the waveform when that electrode is disconnected.
   - **f** Verify that the device sounds an alert and displays the V Off, Check Limb Leads or Press "I, II.." Button to Select Another ECG Lead message.

5 Repeat the above test, setting the simulator for normal sinus rhythm (NSR), 1 mV amplitude, at 200 bpm.
   Verify that the heart rate alarm sounds (assuming 200 bpm is above the configured upper limit).

Check ECG Printing

1 Reconnect the simulator to the device as described in the Setup section above.

2 Press the Print button to print a strip.
   - **a** Verify that it shows a normal ECG with a clean baseline.
   - **b** Verify that the date, time, and configuration information printed at the top of the strip are correct.

3 Press the Print button again to stop printing.

SpO_2 Check

NOTE: A functional tester (i.e. simulator or safety analyzer) can not be used to assess the accuracy of an SpO_2 probe or an SpO_2 monitor.

1 Connect the sensor.
Attach the SpO_2 sensor to your finger and to the Efficia DFM100.

2 Turn the Therapy Knob to Monitor. Observe:
   a The pleth wave is clear.
   b The SpO_2 value displayed is in the range of 95-100%. If the value is less than 95%, check that your finger is fully inserted into the sensor and properly positioned.
   c The pulse rate is displayed.

NBP Check

1 Perform a non-invasive blood pressure check on yourself or another person.

2 Make sure the measurement completes.

3 Perform the NBP module tests only if you suspect a problem with the module. See "NBP Service Screen" on page 65 for information on these tests.

Defibrillator Measurement Test

These instructions describe how to test the defibrillation functions. The test sequence causes the Efficia DFM100 to:

- Charge and deliver a shock when powered by AC power alone.
- Charge and deliver a shock when powered by battery alone.
- Disarm when the Charge Cancelled soft key is pressed.

If all results are as described, the device passes that portion of the test. If there is any failure, troubleshoot and repair the device as needed. See "Troubleshooting" on page 31.

Defibrillator Test (AC Power at 200 J)

These instructions describe how to test the defibrillation function when powered only by AC power (no battery installed).

Setup

1 Configure the defibrillator analyzer for a 50-ohm load.

2 Turn the Efficia DFM100 off and remove the battery.

3 Plug the AC mains power cord into an outlet.

4 Connect the Pads cable to the Efficia DFM100.

5 Connect the defibrillator analyzer to the Pads cable.

6 Set the analyzer to measure delivered energy.

Test the Charge/Shock Functions

1. Charge and deliver a 200 J shock:
   a. Turn the Efficia DFM100's Therapy Knob to 200 J.
   b. Press the **Charge** button to charge the Efficia DFM100.
   c. Press the **Shock** button to deliver the shock to the defibrillator analyzer.
   d. If the device is not configured to print on the **Charge** command, press the **Print** button.
2. Check the analyzer readings.
   The delivered energy should be 200 J ± 30 J.
3. Check the printed strip from the Efficia DFM100.
   The selected energy should be 200 J. The delivered energy should be 200 J ± 30 J and will be printed on the strip if the device is configured to print on shock.
4. Repeat the test using paddles, pressing the **Shock** button on the paddles in Step 1c.

Defibrillator Test (Battery Power at 200 J)

These instructions describe how to test the defibrillation function when powered only by a battery with no AC power connected.

Setup

1. Configure the defibrillator analyzer for a 50-ohm load.
2. Insert a sufficiently charged battery (at least two LEDs light up) and disconnect the AC power cord.
3. Connect the Pads cable to the Efficia DFM100.
4. Connect the defibrillator analyzer to the Pads cable.
5. Set the analyzer to measure delivered energy.

Test the Charge/Shock Functions

1. Charge and deliver a 200 J shock.
   a. Turn the defibrillator/monitor's Therapy Knob to 200 J.
   b. Press the **Charge** button to charge the Efficia DFM100.
   c. Press the **Shock** button to deliver the shock to the defibrillator analyzer.
   d. If the device is not configured to print on the **Charge** command, press the **Print** button.
2. Check the analyzer readings.
   The delivered energy should be 200 J ± 10%.
3. Check the printed strip from the Efficia DFM100.
   The energy setting should be 200 J. The delivered energy should be 200 J ± 10% and will be printed on the strip if the device is configured to print on shock.
4. Repeat the test using paddles, pressing the **Shock** button on the paddles in Step 1c.

Defibrillator Charge Cancellation Test

These instructions describe how to test the disarm function.

Setup

1. Insert a sufficiently charged battery (at least two LEDs light up) and disconnect the AC power cord.
2. Connect the Pads cable to the Efficia DFM100.
3. Connect the defibrillator analyzer to the Pads cable.
4. Set the analyzer to measure delivered energy. If needed, reset the analyzer's display to read 0.

Test the Cancel Charge soft key

1. Charge to 200 J.
   a. Turn the Efficia DFM100's Therapy Knob to 200 J.
   b. Press the Charge button to charge the Efficia DFM100.
2. Press the **Cancel Charge** soft key.
   The Efficia DFM100 should disarm itself by discharging into an internal load resistor.
3. Check the results.
   Verify that the **Charge Cancelled** message appears on the Efficia DFM100. Verify that the charge tone stopped.
4. Check the analyzer readings.
   Read the delivered energy indicated by the defibrillator analyzer. It should be 0 or blank.

Pacer Test

These instructions describe how to test the pacing function. Only run this test if the Pacing option is installed on your defibrillator/monitor. If all results are as described, the device passes the test. If there is any failure, troubleshoot and repair the device as needed. See "Troubleshooting" on page 31.

Setup

1. Insert a sufficiently charged battery (at least two LEDs light up) and disconnect the AC power cord.
2. Connect the Pads cable to the Efficia DFM100.
3. Connect the defibrillator analyzer to the Pads cable.
4. Turn the Therapy Knob on the Efficia DFM100 to **Pacer**.
5. Set Pacer mode to **Fixed**.

Test Pacing

1. Generate a fixed pacing waveform on the Efficia DFM100 for 70 ppm @ 30 mA.
   a. Press the **Pacer Settings** soft key and rotate the Smart Select Knob to set the rate to 70 ppm.
   b. Rotate the Smart Select Knob again to set the rate to 30 mA.
   c. Press the **Start Pacing** soft key.
2. Check the default output on the defibrillator analyzer.
   The output should read 70 ± 1.5% ppm and 30 ± 5 mA.
3. Test the maximum output by generating a fixed pacing waveform on the Efficia DFM100 for 180 ppm @ 140 mA.
   a. Press the **Pacer Rate** soft key and rotate the Smart Select Knob to increase the rate to 180 ppm.
   b. Press the **Pacer Output** soft key and rotate the Smart Select Knob to increase the output to 140 mA.

4 Check the output on the defibrillator analyzer. The output should read 180 ± 1.5% ppm and 140 ± 14 mA.

Synchronized Cardioversion Test

This section describes how to check the synchronized cardioversion function.

NOTE: Whenever possible, we recommend that clinicians perform synchronized cardioversion procedures while directly monitoring the patient through the Efficia DFM100's electrodes or lead inputs.
If clinicians use an external monitor as the ECG source, you *must* verify that the external monitor and the Efficia DFM100 combination will deliver a synchronized shock within 60 ms of the peak of the R-wave. Use a 1 mV QRS complex with a QRS width of 40 ms. This performance cannot be guaranteed with all commercially available monitors.

Setup

1 Set up the defibrillator analyzer.
   - **a** Connect the ECG cable and the Pads cable to the Efficia DFM100.
   - **b** Connect the ECG cable to the analyzer.
   - **c** Connect the Pads cable to the analyzer.
   - **d** Set the analyzer to take a energy measurement, waveform NSR, 1 mV amplitude, 60 bpm).
   - **e** Set the analyzer to take a synchronized measurement, waveform NSR, 1 mV amplitude, 60 bpm).

2 Set up the Efficia DFM100.
   - **a** Turn the Therapy Knob to 1-10 J.
   - **b** Press the Sync button. Check that a Sync message appears in the upper right corner of Wave Sector 1.

Check Display, Shock, Print

1 Check the displayed waveform.

Verify that sync markers appear on the display, at or near the peak of the QRS complex. Adjust the size of the displayed ECG as needed to view it more clearly.

TIP: To adjust the size of the displayed ECG, navigate the following menus:
Menu –> Displayed Waves –> select Wave1 or Wave 2 –> I, II, or III –> select size.

2 Check shock delivery.
   - **a** Select an energy of 6 J.
   - **b** Press the Charge button.
   - **c** Press and hold the Shock button until the shock is delivered (at next QRS).
   - **d** Verify on the defibrillator analyzer that the shock was delivered, and was 6 ± 2 J. (see step d in set up the defibrillator analyzer.)
   - **e** If the device is configured to do so, verify that it prints a strip with the correct information on it (waveform, text, shock).
   - **f** Verify on the defibrillator analyzer that the delay between the peak of the QRS and the delivered shock was ≤ 30 ms. (see step e in set up the defibrillator analyzer.)

Paddles Safety Check

This section describes how to test the paddles to ensure they are connected correctly. This test checks the Patient Contact Indicator (PCI) function of the paddles. The PCI measurement is used to detect Pads Off and Paddles Off, and to illuminate the PCI LEDs on PCI-equipped paddle sets. If all results are as described, the device passes that portion of the test.

NOTE: Test internal paddles (IEC Type CF) only if the device is used for internal defibrillation.

1. Connect a set of external paddles to the device.
   a. Make sure the metal surfaces of the paddles and slide-on adapters are clean and dry. Also make sure the slide-on adapters are clean, shiny, and making good contact to the paddle surface.
   b. Put the paddles in the paddle tray.
2. Turn the Therapy Knob to Monitor.
3. Verify that the PCI is not lit.
4. Take one paddle out of the paddle tray.
5. Verify that one red LED of the PCI flashes.
6. Replace paddle in tray and remove other paddle.
7. Verify that one red LED of the PCI flashes.
8. Take both paddles from the paddle tray and hold them firmly together, face to face (metal to metal). Be sure the paddles are clean and are making good contact with one another.
9. Verify that all LEDs on the PCI are lit.

Safety Tests

This section discusses tests of the Efficia DFM100's electrical safety. The Philips Safety test designation for each test is provided for reference of Philips service personnel.

This section is organized into the following topics:

Test Notes . . . . . p. 169
Test Method . . . . . p. 169
AC Mains (Ground Leakage) . . . . . p. 171
Chassis (Enclosure) Leakage . . . . . p. 171
Patient Lead Leakage . . . . . p. 171

Test Notes

Efficia DFM100 complies with the international electrical safety standards:

– IEC 60601, Medical Electrical Equipment, General Requirements for Safety

To successfully complete Efficia DFM100 safety testing, please note the following:

- Use the procedures called out by the manufacturer of the safety analyzer in use.
- Only test the AC Mains (line) voltage used in the customer's facility — there is no need to test both 120 V AC and 240 V AC.
- Test both Normal and Reverse Polarity line connections for each test, and record the worst case value.
- If a chassis reference point is needed for the testing, connect to the inside metal shaft on the ECG Out (Sync) jack. (This is *not* earth ground).

Test Method

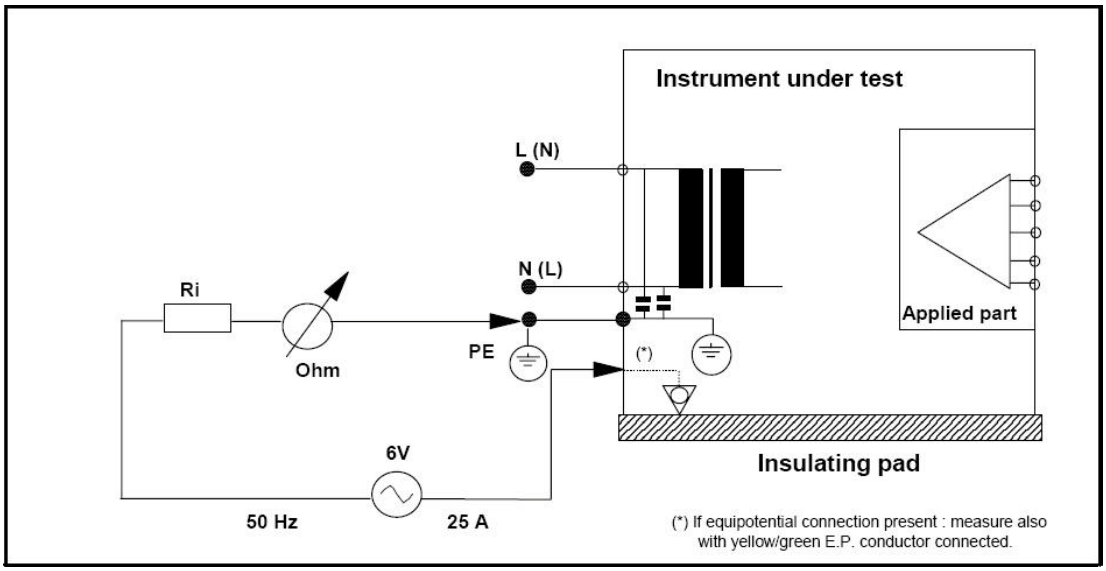
In order to establish a systematic maintenance plan, we recommend all safety tests and records shall be made under the following circumstances: Upon reception of the Efficia DFM100, every year, and the Efficia DFM100 is opened for repair.

The steps used for these tests and the acceptable ranges of values are derived from local and international standards but may not be equivalent. These tests are not a substitute for local safety testing where it is required for an installation or a service event.

Protective Earth Resistance

Figure 132 illustrates the protective earth resistance measurement of Efficia DFM100.

Figure 132 **Efficia DFM100 Protective Earth Resistance Test Diagram**



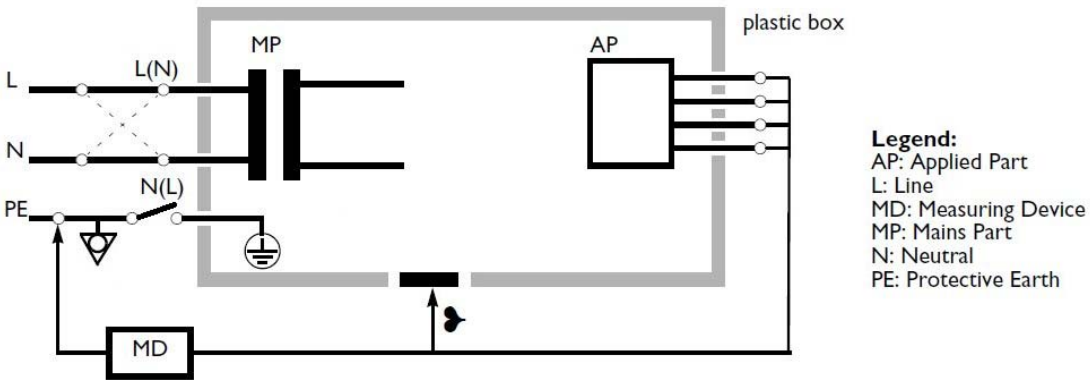
Acceptable test results:

Maximum impedance x ≤ 100mΩ (IEC 60601-1 and UL 60601-1). Records as “aaa”.

Leakage Currents

Figure 133 illustrates the Efficia DFM100 circuitry.

Figure 133 **Efficia DFM100 Leakage Current Test Diagram**



NOTE: ➧ Check accessible conductive parts for touch current (enclosure leakage current), but not for protective earth resistance because they are not protectively earthed.

AC Mains (Ground Leakage)

Leakage through earth (ground) wire of AC power cord.

- Normal Condition (Open ground), both AC line connections intact
  - Should be ≤ 300 µA (UL, 120 VAC).
  - Should be ≤ 500 µA (IEC 240 VAC).
  - Record as “bbb”.
- Single Fault Condition (Open ground line, open neutral line), one AC line connection open
  - Should be ≤1000 µA. Record as “cccc”.

Chassis (Enclosure) Leakage

Use ECG Out (Sync) jack to measure enclosure leakage current. (This is *not* earth ground.)

- Normal Condition
  - Should be <100 µA. Record as “dd”.
- Single Fault condition (Open neutral)
  - Should be <300 µA (UL)
  - Should be <500 µA (IEC)
  - Record as “eee”.

Patient Lead Leakage

Leakage out of (Source) or into (Sink) patient-connected inputs (Applied Parts).

CAUTION: Do not touch the leads during this test.

ECG leads (IEC Type CF)

- Source (out of leads into Efficia DFM100)
  - Normal Condition (both AC line connections and earth ground intact)
    Should be ≤ 10 µA. Record as “ff”.
  - Single Fault Condition (separately open neutral and open earth, each in turn)
    Should be ≤ 50 µA. Record as “gg”.
- Sink (Out of Efficia DFM100 into leads)
  - Single Fault Condition is with AC Mains voltage on Applied Parts (both AC line connections and earth ground intact)
    Should be ≤ 50 µA. Record as “hh”.

Internal Paddles/pads (IEC type CF)

NOTE: Test internal paddles only if the device is used in internal defibrillation.

- Source (Out of leads into Efficia DFM100)
  - Normal Condition (both AC line connections and earth ground intact)
    Should be ≤ 10 µA. Record as “ii”.
  - Single Fault Condition (separately open neutral and open earth, each in turn)
    Should be ≤ 50 µA. Record as “jj”.
- Sink (out of Efficia DFM100 into leads)

  - Single Fault Condition is with AC Mains voltage on Applied Parts (both AC line connections and earth ground intact)

Should be ≤ 50 µA. Record as “kk”.

External Paddles/Pads (IEC type BF)

- Source:
  - Normal Condition (both AC line connections and earth ground intact)
    Should be ≤ 100 µA. Record as “lll”.
  - Single Fault Condition (separately open neutral and open earth, each in turn)
    Should be ≤ 500 µA. Record as “mmm”.
- Sink
  - Single Fault Condition (with AC Mains voltage on Applied Parts)
    (both AC line connections and earth ground intact)
    Should be ≤ 5000 µA. Record as “nnn”.

IEC62353

Some countries require service personnel to follow IEC62353 when examining the device before returing it back to the user, after Maintenance, Inspection, or Repair. Service personnel must assess the safety of Medical Electrical Equipment And Medial Electrical System and comply with IEC60601-1.

This section describes the tests of Efficia DFM100's electrical safety based on the requirement of IEC62353. For those facilities which follow IEC62353, follow the instructions listed in this section.

This section is organized into the following topics:

- Test Method . . . . . p. 173
- Protective Earth Resistance . . . . . p. 173
- Insulation Resistance (Not Mandatory) . . . . . p. 174
- Leakage Currents . . . . . p. 176
- Chassis (Enclosure) Leakage . . . . . p. 176
- Patient Lead Leakage . . . . . p. 176

Test Method

In order to establish a systematic maintenance plan, Philips recommends all safety tests and records be made under the following circumstances:

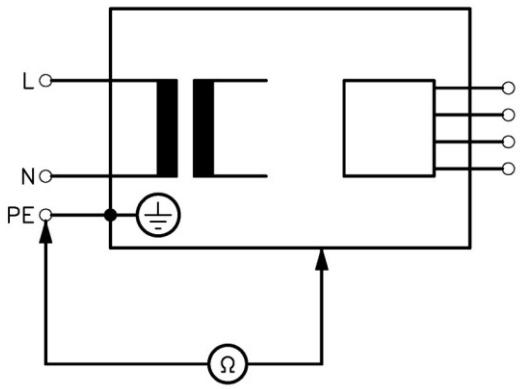
- Upon reception of the Efficia DFM100,
- Every year, and
- Whenever the Efficia DFM100 is opened for repair.

The steps used for these tests and the acceptable ranges of values are derived from local and international standards but may not be equivalent. These tests are not a substitute for local safety testing where it is required for an installation or a service event.

Protective Earth Resistance

Figure 134 illustrates the protective earth resistance measurement of Efficia DFM100.

Figure 134 **Efficia DFM100 Protective Earth Resistance Test Diagram**



Acceptable test results (Maximum impedance):

With detachable power supply cord, x ≤ 200mΩ (IEC 62353).

Detachable power supply cord, x ≤ 100mΩ (IEC 62353).

Insulation Resistance (Not Mandatory)

Figure 135 to Figure 139 illustrate the Insulation Resistance measurements of Efficia DFM100. For acceptable test results, see Table 34 “Acceptable Test Results” on page 175

Figure 135 **Efficia DFM100 Insulation Resistance Test Diagram - Mains Part and Protective Earth**

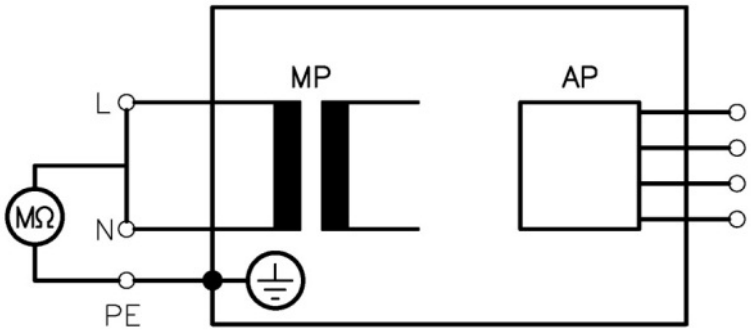


Figure 136 **Efficia DFM100 Insulation Resistance Test Diagram - Mains Part and Non-Earthed Accessible Conductive Parts**

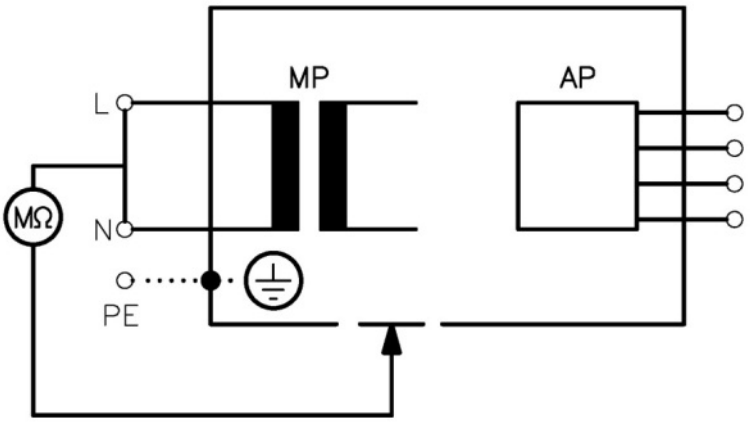


Figure 137 **Efficia DFM100 Insulation Resistance Test Diagram - Mains Part and Applied Parts**

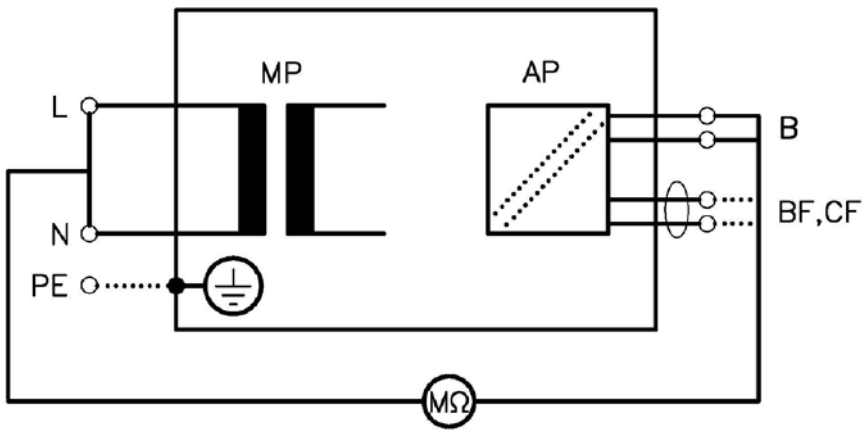


Figure 138 **Efficia DFM100 Insulation Resistance Test Diagram - F-Type Applied Parts and Protective Earth**

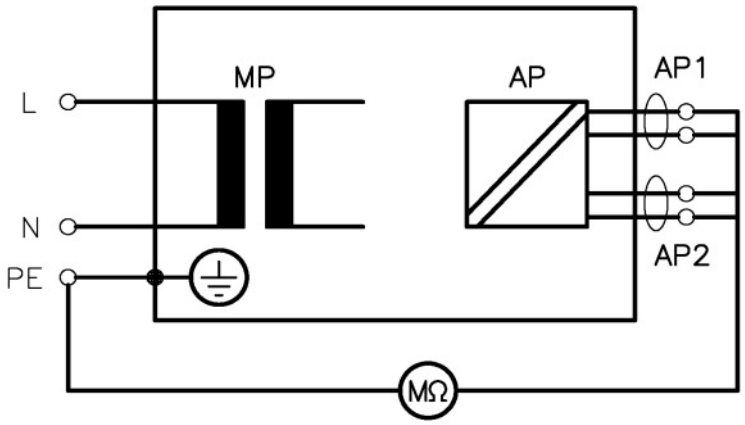


Figure 139 **Efficia DFM100 Insulation Resistance Test Diagram - F-Type Applied Parts and Non-Earthed Accessible Conductive Parts**

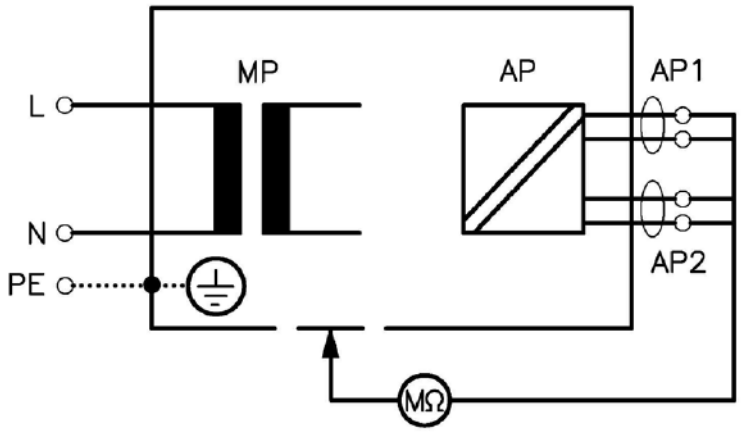


Table 34 **Acceptable Test Results**

Figure	Class I
135	≥ 2 M Ohms
136	≥ 7 M Ohms
137	≥ 70 M Ohms
138	≥ 70 M Ohms
139	≥ 70 M Ohms

Leakage Currents

Refer to Figure 133 “Efficia DFM100 Leakage Current Test Diagram” on page 170.

NOTE: ➧ Check accessible conductive parts for touch current (enclosure leakage current), but not for protective earth resistance because they are not protectively earthed.

AC Mains (Ground Leakage)

Leakage through earth (ground) wire of AC power cord.

- Normal Condition (Open ground), both AC line connections intact
  - Should be ≤ 1000 µA.

Chassis (Enclosure) Leakage

Use ECG Out (Sync) jack to measure enclosure leakage current. (This is *not* earth ground.)

- Normal Condition
  - Should be ≤ 100 µA.

Patient Lead Leakage

Leakage out of (Source) or into (Sink) patient-connected inputs (Applied Parts).

ECG leads (IEC Type CF)

- Source (out of leads into Efficia DFM100)
  - Normal Condition (both AC line connections and earth ground intact)
    Should be ≤ 50 µA.

Internal Paddles/pads (IEC type CF)

NOTE: Test internal paddles only if the device is used in internal defibrillation.

- Source (Out of leads into Efficia DFM100)
  - Normal Condition (both AC line connections and earth ground intact)
    Should be ≤ 100µA.

External Paddles/Pads (IEC type BF)

- Source:
  - Normal Condition (both AC line connections and earth ground intact)
    Should be ≤ 5000 µA.

Appendix A

Parts and Accessories

Overview

This appendix provides information on ordering replacement parts, supplies, and accessories for the Efficia DFM100 defibrillator/monitor. Information on Key Component tracking is also provided. This appendix is organized into the following sections:

Parts and Accessories Notes . . . . . p. 177
Electrical Assemblies . . . . . p. 178
Mechanical Assemblies . . . . . p. 181
Key Components . . . . . p. 184

Parts and Accessories Notes

The tables in this chapter list 12-digit "12NC" numbers for every component. Use these numbers when ordering replacement parts, kits, and accessories or calling the Response Center.

The following notes contain some important information relating to replacement parts.

Ordering Replacement Parts

To order replacement parts:

Contact Philips Goldway Customer Service Department
The international call center can be reached during the following time:

Monday – Friday (except Chinese statutory holidays)
BJT 08:30 – 12:00, 13:00 – 17:30 (GMT+8)

Tel: +86 755 86278308
Fax: +86 755 86278392
E-mail: goldway.service@philips.com

Ordering Supplies and Accessories

To order accessories and supplies:

- Visit Philips Healthcare web site at:
  http://www.healthcare.philips.com/main/products/resuscitation/products/als/index.wpd.
- Contact your local Philips Healthcare Sales Office or your authorized Philips Healthcare Dealer or Distributor.

Key Component Tracking

Replacement assemblies marked with an asterisk (*) contain one or more Key Components. Key Components require detailed tracking, by recording the Key Component part number and either the Key Component's date code or its serial number. This data must be recorded for both the failed assembly and the replacement assembly. Philips Healthcare service personnel must record this information on the Customer Service Order (CSO).

The Key Components that are part of the replacement assemblies are listed in Table 43 on page 184.

Electrical Assemblies

The following tables list all the electrical field-replaceable assemblies.

NOTE: Items marked with an asterisk (*) are Key Components that require tracking. See Table 43 on page 184.

Software Support Tool

Install the most recent software in the appropriate language using the Software Support tool whenever you replace the SOM PCA (replacement kit 453564206061), see Table 36 on page 179.

NOTE: The SOM PCA is a Key Component that requires tracking. See Table 43 on page 184.

Table 35 **Software Support Tool**

Description	12NC
DFM100 Software Support Tool-EN (US)	453564489631
DFM100-Software Support Tool-EN (UK)	453564489641
DFM100-Software Support Tool-Chinese CN (simplified)	453564489651
DFM100-Software Support Tool-Chinese HK (traditional)	453564489671
DFM100-Software Support Tool-Dutch	453564489681
DFM100-Software Support Tool-Bulgarian	453564489691
DFM100-Software Support Tool-French	453564489701
DFM100-Software Support Tool-German	453564489711
DFM100-Software Support Tool-Greek	453564489721
DFM100-Software Support Tool-Italian	453564489731
DFM100-Software Support Tool-Japanese	453564489741
DFM100-Software Support Tool-Bahasa Indonesian	453564489751
DFM100-Software Support Tool-Portuguese PT (Portugal)	453564489761
DFM100-Software Support Tool-Portuguese BR (Brazil)	453564489771
DFM100-Software Support Tool-Spanish	453564489781
DFM100-Software Support Tool-Vietnamese	453564489791
DFM100-Software Support Tool-Korean	453564489801
DFM100-Software Support Tool-Polish	453564489811
DFM100-Software Support Tool-Czech	453564489831
DFM100-Software Support Tool-Thai	453564489851

Table 35 **Software Support Tool *(Continued)***

Description	12NC
DFM100-Software Support Tool-Hungarian	453564489861
DFM100-Software Support Tool-Turkish	453564489871
DFM100-Software Support Tool-Russian	453564489881
DFM100-Software Support Tool-Romanian	453564489901

Replacement PCAs and Assemblies

These PCAs come with specific parts, as noted.

Table 36 **Replacement PCAs ASSY**

Description	
DFM100 Processor PCA ASSY *	453564489071
DFM100 Therapy PCA ASSY*	453564489061
DFM100 SOM PCA ASSY *	453564489051
DFM100 UI PCA ASSY*	453564489041
DFM100 UI PCA ASSY 1.1*	453564587201
DFM100 Battery Board ASSY	453564489231
DFM100 Code Board ASSY	453564489221
DFM100 I/O PCA ASSY	453564489251
DFM100 SpO2 PCA ASSY	453564489241

These assemblies come with specific parts, as noted.

Table 37 **Electrical Assemblies**

Description	Field Replacement ASSY#
DFM100 AC Power Module*	453564488951
DFM100 Display ASSY*	453564488961
DFM100 Display ASSY 1.1*	453564587191
DFM100 RFU Indicator ASSY	453564489121
DFM100 NBP Module ASSY	453564489201
DFM100 Resistor Module Assembly*	453564489021
DFM100 Fan ASSY (set of 2)	453564489321
DFM100 Speaker ASSY	453564489331
DFM100 Printer	453564489111
DFM100 ASSY Printer	453564489211
DFM100 Power Switch ASSY *	453564488981
DFM100 Capacitance ASSY *	453564489001

Table 38 **External Electrical Components**

Description	12NC
DFM100 Therapy Receptacle ASSY *	453564488971
Measurement Modules:	
ECG only	453564489131
ECG and SpO_2	453564489141
ECG, SpO_2, and NBP	453564489151
ECG, SpO_2, NBP and $EtCO_2$	453564489161
ECG, SpO_2, and $EtCO_2$	453564489171
ECG, and $EtCO_2$	453564489181
DFM100 I/O Assembly (With I/O PCA)	453564489191
DFM100 Paddle Tray ASSY	453564489291

Internal Cables

Table 39 lists the orderable cables.

Table 39 **Internal Cables**

Description	12NC	Connects …	and …
DFM100 CBL LCD Display to Processor	453564489521	LCD Display	Processor PCA
DFM100 CBL UI to Processor	453564489531	UI PCA	Processor PCA
DFM100 CBL Code Board to UI	453564489541	Code Board	UI PCA
DFM100 CBL Process to Therapy	453564489551	Processor PCA	Therapy PCA
DFM100 CBL Process to I/O	453564489561	Processor PCA	I/O PCA
DFM100 CBL Therapy high voltage	453564489571	Therapy PCA	Therapy Port
DFM100 CBL Battery Power cable	453564489581	Battery PCA	Therapy PCA
DFM100 CBL Battery Signal cable	453564489591	Battery PCA	Therapy PCA
DFM100 CBL NBP to I/O	453564489601	NBP PCA	I/O PCA
DFM100 CBL Printer to I/O	453564489611	Printer	I/O PCA
DFM100 CBL AC Power Module to Therapy	453564489621	AC Power Module	Therapy PCA

Paddles

For the convenience of Philips field personnel, the 453563476991 water-resistant paddle assembly* including labels is available through normal parts-ordering channels.

This number is for the use of Philips personnel only. Users and non-Philips repair personnel should refer to "Key Components" on page 184.

Mechanical Assemblies

These assemblies come with specific parts, as noted.

Replacement Mechanical Assemblies

Table 40 **Replacement Mechanical Assemblies**

Description	12NC
DFM100 Front Case ASSY*	453564489261
DFM100 Front Case ASSY 1.1*	453564587211
DFM100 Front Case ASSY 1.1 Gray* (China)	453564639901
DFM100 Rear Panel ASSY*	453564489271
DFM100 Battery Latch ASSY	453564489311
DFM100 Battery Compartment Cover ASSY	453564489391

* Also order an Instruction Label set for your language option, see "Label Sets" on page 183.

Individual Mechanical Parts

Table 41 **Individual Mechanical Parts**

Description	12NC	Comment
DFM100 Handle	453564489281	set of 1
DFM100 Therapy Select Knob	453564489301	set of 5
DFM100 Silicon 2 Key	453564489341	set of 5
DFM100 Silicon 3 Key	453564489361	set of 5
DFM100 Silicon 8 Key	453564489351	set of 2
DFM100 Gasket Ring	453564489381	set of 5.3
DFM100 Navigation Wheel Knob	453564489371	set of 4
DFM100 Conductive Foam	453564489401	set of 20
DFM100 Wire Saddle	453564489411	set of 50
DFM100 Rubber Foot	453564489421	set of 40
DFM100 Power Wire Prevented Latch	453564489431	set of 10
DFM100 APPL INTFC Fixed Holder	453564489441	set of 5
DFM100 Printer Fixing Bracket	453564489451	set of 5

Table 41 **Individual Mechanical Parts**

Description	12NC	Comment
DFM100 Processor Insulation Film	453564489461	set of 10
DFM100 Therapy Insulation Film	453564489471	set of 10
DFM100 Paddle Buckle	453564489481	set of 10
DFM100 Short Metal Slice	453564489491	set of 10
DFM100 Metal Slice Pressure Spring	453564489501	set of 30
DFM100 Battery Popup Spring	453564489511	set of 10

Labels

There are two groups of labels that are available to order for the Efficia DFM100: the Branding (or Nameplate) label 453564280551 and the Instruction Labels set. The Primary Label is only available as part of field replacement kits.

Label Sets

There is one Label set for each language. See "Labels" on page 82 for detailed description of the set.

Table 42 **Label Sets**

Language	12NC
DFM100-Label Set-English	453564489931
DFM100-Label Set-French	453564489941
DFM100-Label Set-German	453564489951
DFM100-Label Set-Italian	453564489961
DFM100-Label Set-Spanish	453564489971
DFM100-Label Set-Dutch	453564489981
DFM100-Label Set-Greek	453564490001
DFM100-Label Set-Japanese	453564490011
DFM100-Label Set-Simplified Chinese	453564490021
DFM100-Label Set-Traditional Chinese	453564490031
DFM100-Label Set-Brazilian Portuguese	453564490041
DFM100-Label Set-European Portuguese	453564490051
DFM100-Label Set-Korean	453564490061
DFM100-Label Set-Polish	453564490071
DFM100-Label Set-Bulgarian	453564490081
DFM100-Label Set-Czech	453564490091
DFM100-Label Set-Hungarian	453564490101
DFM100-Label Set-Romanian	453564490111
DFM100-Label Set-Russian	453564490121
DFM100-Label Set-Turkish	453564490131
DFM100-Label Set-Bahasa Indonesian	453564490141
DFM100-Label Set-Thai	453564490151
DFM100-Label Set-Vietnamese	453564490161

Key Components

Key Components require tracking, as indicated in Table 43. Record the part number and tracking method (the date code, serial number, or lot/batch#) for *both* the failed *and* replacement components.

Table 43 **Key Components**

Replacement Assembly Kit		Key Component		
Description	**Part Number**	**Description**	**Part Number**	**Tracking Method**
Replacement PCAs				
DFM100 Processor PCA ASSY	453564489071	Processor PCA	453564376661	Serial Number
DFM100 Therapy PCA ASSY	453564489061	Therapy PCA	453564357661	Date Code
DFM100 SOM PCA ASSY	453564489051	SOM PCA	453564081321	Date Code
DFM100 UI PCA ASSY	453564489041	UI PCA	453564376691	Serial Number
DFM100 UI PCA ASSY 1.1	453564587201	UI PCA	453564503021	Serial Number
Electrical Assemblies				
DFM100 Display ASSY	453564488961	LCD Display	453564395891	Serial Number
DFM100 Display ASSY 1.1	453564587191	LCD Display 1.1	453564568111	Serial Number
DFM100 Capacitance ASSY	453564489001	Therapy Capacitor	453564222111	Serial Number
DFM100 Power Switch ASSY	453564488981	Switch Encoder	453564128851	Serial Number
DFM100 AC Power Module	453564488951	Power Supply	453564399591	Date Code
DFM100 Resistor Module ASSY	453564489021	Internal Resistors	453564226541	Serial Number
Ports and Cables				
DFM100 Therapy Receptacle ASSY	453564488971	Therapy Receptacle	453564104981	Date Code
Supplies & Accessories				
External Defibrillation Paddles				
External Paddles	M3543A	External Paddles - Water Resistant	M3543A	Date Code
	M4759A	Paddle Adapter Assembly	M4759A	Date Code

Table 43 **Key Components** ***(Continued)***

Replacement Assembly Kit		Key Component		
Description	**Part Number**	**Description**	**Part Number**	**Tracking Method**
Internal Defibrillation Paddles				
Internal Defibrillation Paddles	M1741A	7.5-cm Switchless	M1741A	Date Code
	M1742A	6.0-cm Switchless	M1742A	
	M1743A	4.5-cm Switchless	M1743A	
	M4741A	7.5-cm Switched	M4741A	Two Date Codes: paddles, connector
	M4742A	6.0-cm Switched	M4742A	
	M4743A	4.5-cm Switched	M4743A	
	M4740A	Adapter Cable	M4740-61601	Date Code
Individual Electrical Parts				
DFM100 Lithium Ion Battery	989803190371	Lithium-Ion Battery	453564399791	Serial Number

NOTES

Appendix B

Theory of Operation

This chapter provides waveforms, system level interconnection schematics, and functional descriptions of the components contained in the Efficia DFM100.

Waveforms

The following diagrams show the waveforms of a 200-J shock and of a pacing pulse.

Figure 140 **Waveforms of a 200-J Shock**

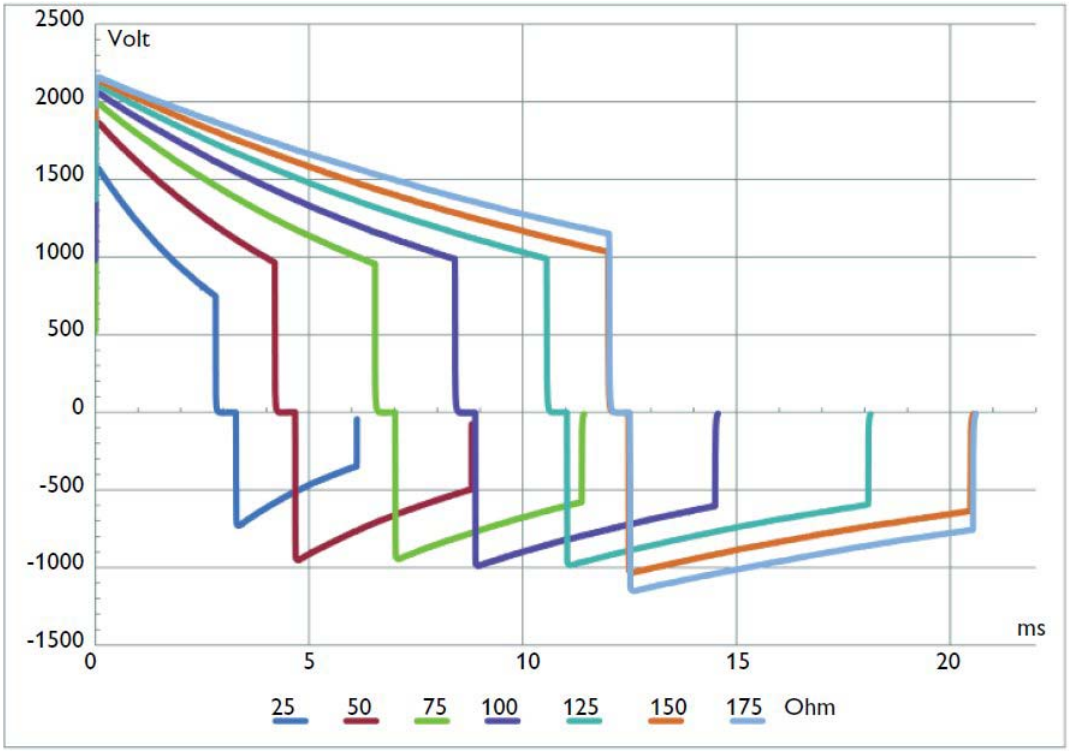
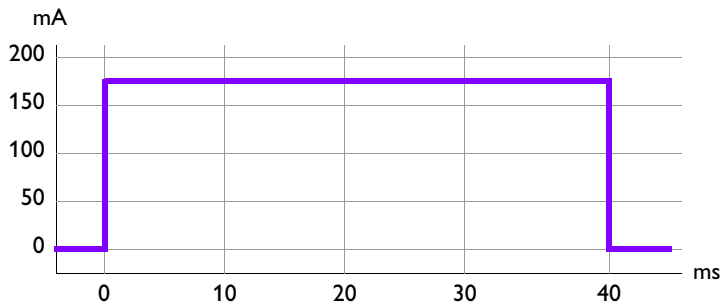
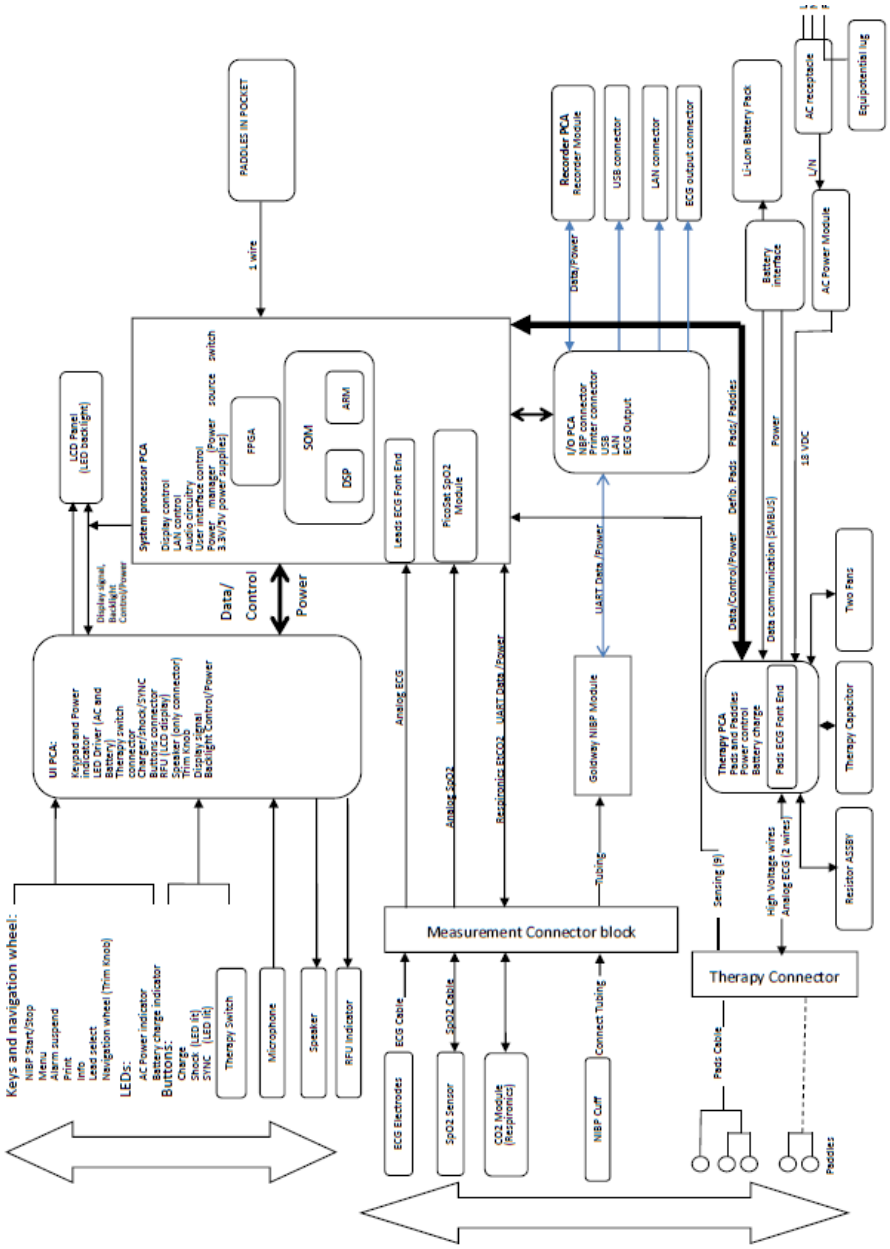


Figure 141 **Waveform of a 175-mA 40-ms Pacing Pulse into 100-ohm Load**



System Level Interconnections

Figure 142 **System Interconnection Schematic**



Assemblies Descriptions

The electrical core of Efficia DFM100 consists of custom-designed Processor and Therapy PCAs and several smaller PCAs such as the Printer PCA, Battery PCA, and UI PCA. The Processor PCA includes the System-on-Module (SOM) PCA. These PCAs functions are described below.

The Efficia DFM100 assemblies are completely lead-free.

This section is organized into the following sections:

- Processor PCA . . . . . p. 189
- Therapy PCA . . . . . p. 190
- Power and Battery . . . . . p. 191
- Display Assembly . . . . . p. 192
- Indicators . . . . . p. 192
- Controls . . . . . p. 192
- Clock Backup Battery . . . . . p. 193
- NBP Module . . . . . p. 194
- SpO_2 PCA . . . . . p. 194

Processor PCA

The Processor PCA, together with the SOM PCA, is the “brain” of the device. It provides all the general purpose computer resources needed for the overall functionality of the device including memory, human interface control, external communication ports, and interfaces to all the supporting modules and circuits not directly related to the therapy functions (Battery, AC Power, Defibrillation, Pacing, and Pads ECG.)

The Processor PCA performs the following functions:

- Overall system control.
- High-level control of all modules and subsystems.
- Control of power up and power down sequences.
- All user interface functions, including:
  - Generation and control of tones and audio prompts and detecting of front panel button presses.
  - Generation and formatting of information for the display and printer.
  - Control of indicator LEDs for Shock button backlight and External Power.
  - Alarm generation when the limits are violated.
- Exchange information via the USB port.
- Supervision of defibrillation functions on the Therapy PCA, including:
  - Initiating a capacitor charge sequence.
  - Secondary monitoring of capacitor voltage.
  - Initiating a shock delivery sequence.
  - Controlling therapy isolation and internal paddles relays.

- Control of pacing functions on the Therapy PCA, including:
  - Monitoring pacing current delivered.
  - Controlling enabling of pacing and pacing isolation relays.
- All ECG processing including filtering, beat detection, and rhythm analysis.
- Interconnection site for ECG leads cable, and SpO_2 PCA.
- ECG analog front end for ECG from 3- and 5-lead cables.
- Sensing the paddle ID resistor and identifying the type of paddles or pads connected.
- EtCO2 data processing.
- SpO_2 logic and patient isolation.
- Measurement of device temperature.
- Monitoring of overall system health.

SOM PCA

The System-on-Module (SOM) PCA provides the memory and computing power. It is located directly on the Processor PCA and stores user configuration selections, operating software (including data for generating display formats and graphics), alarm limits, etc.

It performs the following functions:

- Processing power
- Random Access Memory (RAM)
- Program Flash Memory
- Database Flash Memory
- USB Interface
- Audio Signals

Therapy PCA

If the Processor PCA is the “brain” of the device, the Therapy PCA is “senses” and “muscle”. It consists of three major sections: The Power circuit, the Therapy circuit, and the Pads ECG circuit. It performs the following functions, as directed by the Processor PCA:

- Charges and keeps the capacitor charged to the correct energy level.
- Delivers defibrillator shocks and controls the waveform.
- Disarms the Capacitor and controls the disarmed energy absorption into Internal Resistors.
- Generates pacing waveforms.
- Charges the battery.
- Provides analog front end for ECG from the pads/paddles.
- Measures impedance for the Patient Contact Indicator (PCI) function.
- Monitors the overall system power, including detecting the battery or the presence of external power.
- Control of the RFU indicator (the RFU signal is sent through the Processor PCA).

Power and Battery

The Efficia DFM100 can be powered by the Battery alone, AC supply alone, or by the Battery and AC supply together (this configuration is used to charge batteries). The device transitions between power sources as sources are added and removed without interrupting any operation as long as at least one source of power is always present.

Battery PCA

The Battery PCA provides the contacts with which the Battery mates. It is an interconnection PCA only, and has no active circuitry.

Power Supply Assembly

The Power Supply has a standard power connector and operates between 100-240 V AC at 50 or 60 Hz; it can power the device and charge the battery.

The Power Supply may draw up to 65 watt of AC power, which is then converted to regulated 18 V DC power. The primary purpose of this supply is to charge the battery, but it can also be used to power the entire device even in the absence of a battery.

The Power Supply is compatible with world-wide AC mains voltages and frequencies.

Battery

The batteries used in the Efficia DFM100 utilize lithium-ion chemistry. Lithium-ion batteries feature high energy density, allowing the use of smaller and lighter batteries to achieve high power levels. In addition, lithium-ion batteries are more environmentally friendly than nickel-cadmium or lead-acid batteries, and do not suffer from the “memory effect” that plagues nickel-cadmium chemistries.

Each battery pack includes built-in protective circuitry to prevent damage from overcharging, excessive discharge current, and other types of electrical abuse. It contains circuitry to monitor the amount of charge available in the battery. The Battery PCA communicates this information to the Therapy PCA which provides battery status information on the display. In addition, the battery pack has on-board temperature sensing which is monitored by the Therapy PCA for battery charging purposes.

WARNING: Never crush, penetrate or attempt to open these or any lithium-ion batteries. Never incinerate any lithium-ion batteries. High case temperatures resulting from abuse of the battery could cause physical injury. Rupture of the battery pack may cause venting and flame.

CAUTION: Due to their high energy density, the lithium-ion batteries can deliver significant power. Use care when working with or testing these or any lithium-ion batteries. Do not short-circuit the terminals.

NOTE: When the battery is removed from the Efficia DFM100, it disconnects power to the output terminal. Thus, it is not possible to test the battery with a voltmeter.

Display Assembly

The 7.0" color TFT LCD display support the WVGA (800(H) x 480(V) screen and 16.2M (RGB 8-bits) or 262k colors (RGB 6-bits) flat panel display illuminated by LED.

All display functions are handled by the Processor PCA. Display formats, graphics, waveforms, numeric values and messages are all generated and formatted by the Processor PCA. The LCD display accepts these digital data from the Processor PCA and maps it into pixels on the display.

Indicators

The Shock and Sync button backlight LEDs are mounted on the UI PCA and controlled by the Processor PCA. The External Power and Battery backlight LEDs are mounted on the UI PCA and controlled by the Therapy PCA.

The Shock button backlight illuminates only when the button is active (the device is shock-ready). When using pads or switchless internal paddles, the Shock button is active and lit when the device is charged and ready to deliver a shock. When using external or switched internal paddles, the Shock button is disabled and not lit — the Shock buttons on the paddles are active instead.

RFU Indicator

Displays the status of the device with an hourglass indicating the device is ready for use and a solid red "X" indicating a critical failure. This indicator is visible even when the device is turned off.

Controls

Front Panel Buttons

All of the buttons on the DFM100 front case (Charge, Shock, Sync, Alarms, Mark Event, Reports, Printer, Lead Select, and Patient Category) and the soft keys are the silicone keys that can be separated from the front case. All these buttons are operated by actuating the small switches mounted on the UI PCA directly behind each button.

Presses from all buttons and soft keys are detected and processed by the Processor PCA. The Processor PCA then interacts with the other parts of the system as needed to respond to the soft key or button press.

UI PCA

The UI PCA contains individual discrete switches for the buttons and soft keys. The Shock and Sync buttons are illuminated from behind by board-mounted LEDs.

Therapy Encoder

The Therapy Encoder selects operation in either AED Mode, Pacer Mode, or Manual Mode.

In Manual Defibrillation Mode, energy selection is made by rotating the Therapy Switch to the appropriate position. The Therapy Encoder operates an optical rotary switch. The signals pass through the switch's ribbon cable and then on to the Processor PCA. The Processor PCA then interacts with the other parts of the system as needed to respond to the setting of the Therapy Encoder.

The "OFF" position of the Therapy Encoder is monitored by the Therapy PCA.

Paddle Indicators and Controls

External and switched internal paddles have a Shock button located on the paddles. Additionally, external paddles have a Charge button on the right-hand paddle. When the paddles are connected to the defibrillator/monitor, the paddle Shock button is active and the Shock button on the

defibrillator/monitor is disabled. External paddles have a Patient Contact Indicator (PCI) located on the Sternum paddle. The contact quality is indicated on the PCI using red, orange, and green LEDs. Once proper contact has been made, the PCI illuminates a green LED.

Printer Assembly

The Printer Assembly provides hard copy output of text, waveforms, event data, etc. The printer module receives print commands from the Processor PCA and drives the printhead and paper motor accordingly. It senses when the paper is out, or the door is left open.

It transmits 3.3-V serial and logic communication signals and 7-V printhead power from the Processor PCA to the Printer Assembly.

Printing

All printing of data is handled by the Processor PCA. Waveforms, graphics, numeric values, and messages are all generated and formatted by the Processor PCA, using either data it has or data it receives from other parts of the device. This data is then passed to the I/O PCA in serial digital messages, via a ribbon cable, and then on to the printer assembly.

Contrast

The printing contrast is controlled automatically by the printer itself. The printer module senses printhead supply voltage, temperature and impedance, and adjusts drive voltage to the printhead (and thus contrast) based on these readings.

Paper Detection

The printer incorporates an optical sensor that detects when there is no paper left, or when the printer door is open. The information is passed to the Processor PCA in serial digital messages via the I/O PCA and the flex circuit, and the Processor PCA generates the appropriate screen message and tones to alert the user.

Clock Backup Battery

The Clock Backup Battery (lithium-ion battery located on the Processor PCA) provides standby power to maintain the system time and date during times when the main battery is either absent or discharged and no external power is supplied.

NBP Module

The NBP module handles the following functions:

- Inflation and deflation of the NBP cuff.
- Measurement of pressure in cuff.
- Detection of pressure waveform, and extraction of the systolic and diastolic values from that waveform.
- Calculation of mean pressure from waveform, systolic, and diastolic data.

The NBP module communicate with the Processor PCA via a full duplex 4800 baud serial link and uses 5 V signaling.

SpO_2 PCA

The SpO_2 PCA serves as the interface to the SpO_2 sensor, including:

- Generation and control of voltages to drive the LEDs in the sensor.
- Receiving and processing signals from the SpO_2 sensor.
- Derivation of the SpO_2 waveform, SpO_2 value, and pulse rate.
- Providing the digital SpO_2 value to the Processor PCA.

The SpO_2 signal from the sensor is carried by the external SpO_2 cable to the SpO_2 port, and then to the SpO_2 PCA. There it is analyzed to derive SpO_2 saturation level, pulse rate, and the waveform. This information is then passed to the Processor PCA via an 18-pin connector (power for the SpO_2 PCA and sensor is provided by the Processor PCA via the same 18-pin connector). The Processor PCA provides the patient isolation and power supply for SpO_2.

The Processor PCA is then responsible for:

- Formatting and presenting the O_2 saturation level, pulse rate and waveform to the display.
- Generating O_2 saturation level alarms.
- Reporting on the status of the sensor and its connections, and alerting the user to measurement problems.

Functional Descriptions

This section is organized into the following sections:

- ECG Monitoring Functions . . . . . p. 195
- Patient Impedance Functions . . . . . p. 196
- Defibrillation . . . . . p. 196
- Transcutaneous Pacing . . . . . p. 197
- EtCO2 . . . . . p. 198
- Audio . . . . . p. 198
- Data Storage . . . . . p. 198

ECG Monitoring Functions

There are two separate ECG front ends: one for signals coming in on the paddles or pads cable, and one for signals coming in on the 3- or 5-lead ECG cable.

Leads ECG

The ECG signal picked up by the ECG monitoring electrodes is carried by the ECG cable to the ECG port, and then to the Processor PCA, where it is amplified, filtered, and digitized.

The Processor PCA then performs digital signal processing on the ECG data, and is responsible for:

- Formatting and presenting the ECG to the display and to the printer.
- Counting heart rate and generating heart rate alarms.
- Reporting on the status of the patient connection, and alerting the user to measurement problems.
- Arrhythmia analysis and alarms.

Pads/Paddles ECG

The ECG signal picked up by the paddles or disposable defibrillation pads is carried by the cable to the Therapy port via the Therapy PCA, where it is amplified, filtered, digitized and passed across a patient isolation barrier before being passed to the Processor PCA.

The Processor PCA then performs digital signal processing on the ECG data, and is responsible for:

- ECG waveform analysis and Shock Advisory (in AED Mode).
- Formatting and presenting the ECG to the display and to the printer.
- Counting heart rate and generating heart rate alarms.
- Reporting on the status of the patient connection.

Patient Impedance Functions

The Efficia DFM100 measures patient impedance in two ways: an impedance measurement before the shock, and a impedance measurement during the shock.

Before the Shock

The Efficia DFM100 makes a small-signal AC impedance measurement (at 32 kHz) in the steady state situation before a shock is delivered. This measurement is used to detect Pads Off and Paddles Off. It is also used for the Patient Contact Indicator (PCI) function, in which the quality of the contact the paddles are making with the patient is indicated on an LED bar graph on the Sternum paddle.

During the Shock

The Efficia DFM100 also makes an impedance measurement during shock delivery. This impedance is derived from measurements of voltage and current, and is reported on the printed event summary. The device uses the value of the impedance to adjust the phase durations of the biphasic waveform and to provide the optimal waveform delivery. This information is also used to abort the shock if necessary.

Since the before-the-shock measurement is a small-signal AC measurement of impedance, and the during-the-shock one is a high-voltage/high-current measurement of impedance, it is normal and expected for the two measurements to produce slightly different numerical results. The high-current measurement is used in shock delivery, therefore it may seem inconsistent with the PCI indication.

Defibrillation

The following sections describe the defibrillation functions.

Charge

There are three basic events that can initiate a charging cycle:

- In AED Mode, when the Processor PCA shock advisory analysis algorithm determines from the pads ECG waveform that a shock is needed.
- In Manual Defibrillation Mode with either pads or paddles, when the front panel **Charge** button is pressed, the button press is then detected and processed by the Processor PCA.
- In Manual Defibrillation Mode with external paddles only, when the Apex paddle **Charge** button is pressed, the button press is transferred from the button to the Processor PCA. The button press is then detected and processed by the Processor PCA.

In all cases, the charging cycle is initiated by the Processor PCA. It directs the Therapy PCA to charge the Therapy capacitor to a specified level. A controller on the Therapy PCA is responsible for all aspects of charging the Therapy capacitor to the specified level. However, the Processor PCA monitors the voltage on the capacitor and aborts the shock if the capacitor voltage is not consistent with the specified level.

When the Therapy PCA detects that the selected energy (voltage) level has been reached, it stops charging. It then continues to monitor the voltage on the capacitor, and as the voltage bleeds down, it resumes charging to top up the charge to the correct level.

Should a decision be made to change the selected energy to a lower value, the user would turn the Therapy Knob to the desired setting. At the lower energy setting, the Processor PCA directs the Therapy PCA to charge to the new level. The Therapy PCA then discharges to the new (lower) level. At a higher energy setting, the Therapy PCA charges the capacitor until the new level is reached.

If the requested charge is not used within the configured “time to auto disarm” (30, 60, or 90 seconds), the Processor PCA automatically directs the Therapy PCA to disarm the capacitor as a safety precaution.

Shock Delivery

The discharging cycle (shock delivery) is initiated by any of the following three events:

- Pressing the front panel **Shock** button when using pads or switchless internal paddles. (The button is disabled when using external paddles or switched internal paddles). This button press is then detected and processed by the Processor PCA.
- Simultaneously pressing the **Shock** buttons on both the external Sternum and Apex paddles. These button presses are transferred from the buttons to the Processor PCA that detects and processes the signal.
- Pressing the **Shock** button on the switched internal paddles. This button press is transferred from the button to the Processor PCA that detects and processes the signal.

In any case, the Processor PCA directs the Therapy PCA to deliver the shock. Patient resistance is derived from the current and voltage delivered during the initial portions of the waveform, and the biphasic waveform timing is then adjusted as needed to deliver the correct shock energy, duration, and shape.

The Therapy PCA aborts delivery of the shock if during the impedance measurement, the impedance is outside of operating limits (too high or too low).

If this condition is detected, the Therapy PCA terminates delivery of the waveform and disarms the capacitor. The problem is reported to the Processor PCA, which displays and/or prints the appropriate messages.

Another safety feature is the presence of an identification resistor in the pads and paddles cables. If the device does not sense that resistance, it generates a **Cable Off** message and does not charge the capacitor.

Synchronized Cardioversion Delivery

Synchronized cardioversion operates the same as delivering a shock, except that the shock must be synchronized to the R wave of the ECG. The Processor PCA is responsible for detecting the R wave and placing markers on the printed strip and on the display to indicate the timing of the proposed cardioversion shock.

A synchronized shock can be delivered in either of two ways:

- First, when using pads, by pressing and holding the Shock button until the next time an R wave is detected.
- Second, by simultaneously pressing and holding the Shock buttons on both the Sternum and Apex paddles until the next time an R wave is detected.

When both events occur (either type of button press *and* detection of an R wave), then the Processor PCA directs the Therapy PCA to deliver the shock.

Transcutaneous Pacing

Pacing is initiated and controlled by pressing front panel buttons. These button presses are transferred from the buttons to the Processor PCA. The button presses are detected and processed by the Processor PCA.

The Processor PCA directs the Therapy PCA to deliver the pacing pulses at the rate and output current selected by the user. The Therapy PCA controls the output current and the pulse duration, and the Processor PCA provides the rate setting and the R-wave indications to the Therapy PCA, which controls the timing of the delivered pulses. The pacing pulses are delivered via the pads cable to the multifunction electrode pads. The pacing current delivered is reported back to the Processor PCA, which sends the information to the display and activates the printouts and messages as needed.

$EtCO_2$

The DFM100 supplies a 5V DC power to an external $EtCO_2$ sensor which performs all measurements and transfers the data to the DFM100. The DFM100 supports mainstream and sidestream CO_2 sensor.

Audio

The Efficia DFM100 has three types of audio output: voice prompts, tones, and “chirp” when there is a “Red X” RFU condition. The voice prompts and tones are generated and controlled by the Processor PCA, which also amplifies the signals and passes them directly to the speaker via a wire pair.

When the device is turned off, the audio controller on the Therapy PCA remains active and powers the audio amplifier on the Processor PCA as needed to produce the “chirps” through the same amplifier.

Data Storage

The Efficia DFM100 has the capability of storing the following information:

- Patient data — acquired during an event.
- Configuration data — set up by the user to define specific settings related to the behavior of the device.
- Support data — generated by the device to support the maintenance and service of the device.
- Device data — set up by the manufacturer to define installed options, serial numbers, etc.

The data are stored on the SOM PCA and can be imported or exported via a USB flash drive.

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