English

Instructions for Use

Efficia DFM100

Defibrillator/Monitor

866199

PHILIPS

Notice

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Medical Device Directive

CE 0123

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

Manufacturer:

Philips Goldway (Shenzhen) Industrial Inc.
Registered/Production address:
No.2 Keji North 3rd Road, Nanshan District,
Shenzhen, P.R. China 518057
Tel: +86 755 26980999
Fax: +86 755 26980222

Authorized EU-representative:

Shanghai International Holding Corp. GmbH (Europe)
Eiffestraße 80, 20537
Hamburg, Germany
Tel: 0049-40-2513175
Fax: 0049-40-255726

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 this product.

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

"Voice"	represents voice prompt messages
Text	represents messages that appear on the display
[soft key]	represents soft key labels that appear on the display above the button to which they correspond
"See "Introduction" on page 1"	represents hypertext links; click on the blue link to go to that destination (Computer screen viewing only)

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Introduction

Overview

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

In Monitor mode, depending on the ECG cable used, you can view 3 different ECG waveforms at one time on the display. Using a 3-lead ECG cable, you can view either Lead I, II or III. With a 5-Lead ECG cable, you can view leads from Leads I, II, III, aVR, aVL, aVF or V. Optional monitoring of SpO_2 (numeric and pleth wave), $EtCO_2$ (numeric and Capnogram) and NBP are available. Measurements and waves are presented on the display and alarms are available to alert you to a change in the patient's condition. You can also display the Vital Signs Trending report to view all key monitoring parameters and their measurements at a glance.

Manual Defibrillation mode provides simple 1-2-3 defibrillation. You analyze the patient's ECG and, if appropriate: 1) select an energy setting; 2) charge; and 3) deliver the shock. Defibrillation is performed using paddles (internal or external) or multifunction electrode pads. You can also perform synchronized cardioversion in Manual Defibrillation mode.

In the optional AED mode, 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, while easy-to-follow instruction and patient information (including Adult and Infant/Child patient categories) appear on the display. Voice prompts are reinforced by messages on the display.

Optional Pacing mode offers non-invasive transcutaneous pacing therapy. Pace pulses are delivered through multifunction electrode pads in Demand or Fixed modes.

The Efficia DFM100 incorporates low energy SMART Biphasic waveform for defibrillation.

The device automatically stores critical event data such as Event Summaries and Vital Signs Trending.

In clinical mode, the Efficia DFM100 continually records data about a patient in an Event Summary record. The recorded data includes vital signs (such as SpO_2, and heart rate), ECG wave data, and therapy events (such as shock delivered). The Event Summary can be printed or exported after the patient event is completed.

You can also transfer the data to a USB drive and download it to a compatible version of the Philips data management solution – HeartStart Event Review Pro.

The Efficia DFM100 is powered by a rechargeable Lithium Ion battery. Available battery power is determined by viewing the battery power indicators located on the front of the device, the icon on the display, or by checking the gauge on the battery itself. Additionally, AC Power may be applied as a secondary power source and for continual battery charging.

The Ready For Use (RFU) Indicator provides a constant status update, indicating the Efficia DFM100 is ready for use, needs attention or is unable to deliver therapy. The device performs automated tests on a regular basis and displays results on the RFU Indicator. In addition, performing specified operational checks ensures the Efficia DFM100 is functioning properly.

The Efficia DFM100 is highly configurable to better meet the needs of diverse users, including the EMS (Emergency Medical Services) environment. Be sure to familiarize yourself with your device's configuration before using the Efficia DFM100. See "Configuration" on page 139 for more details.

Intended Use

Use Environment

The DFM100 may be used by Advanced Life Support (ALS) personnel in the following use environments:

- General hospital crash-cart use, in which the defibrillator/monitor is typically placed on a cart that includes other life-saving supplies and medications that can be wheeled to the patient's bedside in a cardiac emergency. The defibrillator/monitor geared for crash cart applications would commonly be used in general care areas and critical care units (CCUs), as well as in specialized areas such as the operating room, emergency department, and cardiac catheterization laboratory. AED capability may be advantageous for crash-cart and in-hospital transport applications because it would expand the number of potential users for a resuscitation attempt to include Basic Life Support (BLS) personnel, who may arrive at the bedside before the ALS resuscitation team.
- In the prehospital environment, a defibrillator/monitor may be used by ALS responders who would be called to the scene of a medical emergency through the emergency medical response system. This application also encompasses some other out-of-hospital uses, such as critical care patient transport in an ambulance to a higher acute care facility. In addition, some EMS organizations may choose to train their BLS personnel on the use of defibrillators/monitors in AED mode.

Intended Use of the Efficia DFM100

The Efficia DFM100 is intended for use in a hospital or EMS setting by users trained in the operation of the device and qualified by training in BLS and ALS. The Efficia DFM100 is intended for use for emergency resuscitation as follows:

- In AED mode, the Efficia DFM100 is intended to detect a shockable rhythm and deliver a shock.
- In Manual mode, the Efficia DFM100 is intended to deliver synchronized and asychronized defibrillation.
- In Pacing mode, the Efficia DFM100 is intended to deliver external cardiac pacing.
- In Monitor mode, the Efficia DFM100 is intended to measure heart rate and heart rhythm via ECG, measure blood oxygen saturation via SpO_2, measure exhaled CO_2 via $EtCO_2$, and measure systolic, diastolic, and mean blood pressure via NBP.

Intended Use Population

The Efficia DFM100 is intended to be used with the following populations as defined by the European Resuscitation Council (ERC) according to Maconochie, I.K., et al. (2015):

- A newborn is a child just after birth.
- A neonate is a child in the first 28 days of life.
- An infant is a child under 1 year.
- A child is between 1 year and puberty.
- From puberty, children are referred to as adolescents, and adult guidelines apply.
- Adult guidelines continue to be applied after adolescence.

Indications for Use and Contraindications

Advanced Cardiac Life Support (ACLS) often starts with analyzing the patient's heart rhythms with a manual ALS monitor/defibrillator, such as the Efficia DFM100. In contrast to an AED in BLS, where the machine makes the determination as to when to defibrillate (shock) a patient, the user makes those decisions based on the rhythms on the monitor and the patient's vital signs. The next

steps in ACLS are to provide defibrillation, pacing, insertion of intravenous (IV) lines, and placement of various airway devices, such as an endotracheal tube (an advanced airway used in intubations). Commonly-used ACLS drugs, such as epinephrine and amiodarone, are then administered between defibrillations in cardiac arrest. Users trained in the operation of the device and qualified by training in basic life support, advanced life support, or defibrillation often use the Efficia DFM100 in the following modes.

AED Mode

In AED mode, the Efficia DFM100 is a semi-automatic defibrillator that uses the patented SMART Analysis AED algorithm. This software algorithm analyzes the patient's electrocardiographic (ECG) rhythm and indicates whether or not it detects a shockable rhythm. The Efficia DFM100 in AED mode requires user interaction to defibrillate the patient.

- **Indications for Use:** AED mode is indicated only on patients in cardiopulmonary arrest. The patient must be unconscious, pulseless, and not breathing before you can use the defibrillator to analyze the patient's ECG.
- **Contraindications:** The Efficia DFM100 is contraindicated for asynchronous defibrillation in AED mode for patients who are conscious, have a pulse, and are breathing.

Manual Defibrillation

A direct current defibrillator applies a brief intense pulse of electricity to the cardiac muscle. The Efficia DFM100 delivers this energy through disposable electrode pads, external paddles applied to the patient's chest, or internal paddles applied to the heart. Defibrillation is one aspect of the medical care required to resuscitate a patient with a shockable ECG rhythm. Depending on the situation, other supportive measures may include CPR, oxygen administration, and/or drug therapy. Successful resuscitation is related to the length of time between the onset of a heart rhythm that does not circulate the blood (ventricular fibrillation, pulseless ventricular tachycardia) and defibrillation. The American Heart Association (AHA) and ERC identified the following links in the chain of survival from cardiac arrest:

- Early access
- Early CPR
- Early defibrillation
- Early advanced life support

The physiological state of the patient may affect the likelihood of successful defibrillation. Thus, failure to resuscitate a patient is not a reliable indicator of Efficia DFM100 performance. Patients will often exhibit a muscular response during energy transfer. The absence of such a response is not a reliable indicator of actual energy delivery or device performance.

Unsynchronized defibrillation involves the use of a high-energy shock (delivered as soon as the Shock button is pushed) to treat conditions such as ventricular fibrillation and pulseless ventricular tachycardia. Synchronized defibrillation, or cardioversion, involves the delivery of a low-energy shock that is timed at a specific point on the QRS complex to avoid inducing ventricular fibrillation. Cardioversion is used to treat cardiac arrhythmias such as atrial fibrillation, atrial flutter, or supraventricular tachycardia when medications have failed to convert the rhythm or when the patient is unstable and the rhythm must be terminated. The Efficia DFM100 in Manual mode requires user interaction to assess the ECG and decide whether to defibrillate the patient.

- **Indications for Use:** Manual defibrillation in the unsynchronized mode is indicated for terminating certain potentially fatal arrhythmias, such as ventricular fibrillation and symptomatic ventricular tachycardia. Delivery of defibrillation in the synchronized mode is indicated for treating atrial fibrillation, atrial flutter, supraventricular tachycardia, and ventricular tachycardia.

- **Contraindications:** The Efficia DFM100 is contraindicated for asynchronous defibrillation in manual mode for patients who are conscious, have a pulse, and are breathing, or who do not have a pulse but are in a non-shockable rhythm, such as asystole or pulseless electrical activity. The Efficia DFM100 is also contraindicated for synchronous defibrillation in patients that are pulseless and unresponsive with rhythms consistent with ventricular fibrillation, pulseless ventricular tachycardia, asystole, or pulseless electrical activity.

Transcutaneous Pacing

Non-invasive pacing in the Efficia DFM100 delivers an electrical impulse to the heart, causing cardiac depolarization and myocardial contraction. The energy is delivered through electrode pads placed on the chest. The AHA and ERC recognize that successful pacing of a patient is related to the length of time between the onset of a bradydysrhythmia and the initiation of pacing. The physiological state of the patient may affect the likelihood of successful pacing or skeletal muscle activity. The failure to successfully pace a patient is not a reliable indicator of pacemaker performance. The patient's muscular response to pacing is also not a reliable indicator of energy delivered. The Efficia DFM100 in Pacing mode requires user interaction to set the mA and rate and start pacing the patient.

- **Indications for Use:** Non-invasive transcutaneous pacing is indicated for hemodynamically unstable bradycardia in patients with a pulse who are unresponsive to atropine.
- **Contraindications:** The Efficia DFM100 is contraindicated for prolonged bradyasystolic cardiac arrest.

ECG Monitoring

The electrocardiogram (ECG) is a recording of the electrical activity of the heart. ECG monitoring allows for the identification and interpretation of cardiac rhythms or dysrhythmias and the calculation of heart rate. ECG on the Efficia DFM100 is obtained by placing electrodes or pads/paddles on the patient and allowing the heart's electrical activity to be monitored and recorded. The Efficia DFM100 in Monitoring mode requires user interaction to assess the patient's ECG.

- **Indications for Use:** The Efficia DFM100 is indicated for monitoring and recording 3-5 lead ECG waveforms and heart rate in patients with and without cardiac dysfunction.
- **Contraindications:** There are no known contraindications for ECG monitoring.

Pulse Oximetry (SpO_2) Monitoring

Pulse oximetry is a noninvasive method that checks the saturation of oxygen in the arterial blood. The pulse oximetry functionality in the Efficia DFM100 uses an optical sensor that detects light through the patient's finger and then measures the received light with a detector. The received light is translated into a saturation percentage and is displayed as an SpO_2 reading. The Efficia DFM100 in Monitoring mode requires user interaction to assess the patient's SpO_2.

- **Indications for Use:** Pulse oximetry is indicated for any patient who is at risk of developing hypoxemia.
- **Contraindications:** There are no known contraindications for SpO_2 monitoring.

Non-Invasive Blood Pressure (NBP) Monitoring

The Efficia DFM100 measures the blood pressure of patients by automatically inflating an occluding cuff and using oscillometer measurement techniques to determine systolic, diastolic, mean arterial pressures, and pulse. You can manually initiate this measurement, or you can set it to recur at a predetermined interval. The Efficia DFM100 in Monitoring mode requires user interaction to assess the patient's NBP.

- **Indications for Use:** Non-invasive blood pressure is indicated for detection of trends in hypertension and hypotension. These include patient conditions indicated by abnormalities in physiological parameters such as shock, perfusion during dysrhythmias, responses to fluid therapy, titration of vasoactive and cardiotonic medications, and post-defibrillation recovery.
- **Contraindications:** NBP is contraindicated for patients with an upper arm circumference of less than 13 cm.

End-Tidal CO_2 Monitoring

The $EtCO_2$ functionality in the Efficia DFM100 is a capnometric device that uses non-dispersive infrared spectroscopy to continuously measure the amount of carbon dioxide (CO_2) during each breath and report the amount present at the end of exhalation. The sample is obtained by the sidestream method and can be used with intubated and non-intubated patients. Respiration rate is also measured and displayed in breaths per minute. The Efficia DFM100 in Monitoring mode requires user interaction to assess the patient's $EtCO_2$.

- **Indications for Use:** $EtCO_2$ monitoring is indicated for the detection of trends in the level of expired CO_2. It is used for monitoring breathing efficacy and treatment effectiveness in acute cardiopulmonary care (for example, to determine the adequacy of chest compressions during CPR, or to detect endotracheal tube placement or misplacement).
- **Contraindications:** There are no known contraindications for $EtCO_2$ monitoring.

Safety Considerations

General warnings and cautions that apply to the use of the Efficia DFM100 are provided in "Safety Considerations" on page 45. Additional warnings and cautions specific to a particular feature are provided in the appropriate sections of these instructions.

WARNINGS: The Efficia DFM100 is not intended to be deployed in settings or situations that promote use by untrained personnel. Operation by untrained personnel can result in injury or death.

Electric shock hazards exist internally. Do not attempt to open the device. Refer servicing to qualified personnel.

Use only supplies and accessories approved for use with your Efficia DFM100. Use of non-approved supplies and accessories could affect performance and results.

Use the Efficia DFM100 on one patient at a time.

Use single-use supplies and accessories only once.

Getting Started

The Efficia DFM100 comes from the factory ready to use. However, before putting the device into clinical use for the first time, it is recommended you:

- Read these *Instructions for Use* in their entirety.
- Fully charge the battery. See "Power" on page 29.
- Run an operational check. See "Operational Check" on page 153.
- Perform a shift check. See "Shift Check" on page 151.

NOTES

2

Device Basics

Introduction

Combining Philips' experience in resuscitation with the current wants and needs of today's medical environment, the Efficia DFM100 was designed with the user in mind.

Philips pioneered 1-2-3 defibrillation for you to defibrillate a patient and save a life quickly and easily. Efficia DFM100 controls, indicators, menus and icons were carefully designed and organized to facilitate ease of use. Display information is designed to present key information for the current task.

This chapter provides a basic orientation on the Efficia DFM100's external features, including the various color-coded cable ports, installing the battery and printer paper, and optional external paddles.

See "Operating the Device" on page 25 for instructions on how to operate the device.

If your Efficia DFM100 includes additional features for the EMS environment, review the section related to "Additional Features" on page 21 as well as the rest of the chapter.

NOTES: If your Efficia DFM100 does not have some of the optional functionality listed in this chapter, disregard these controls and the related information described throughout this manual.

Pictures of the Efficia DFM100 display appearing throughout this manual are for illustration purposes only. The content of these areas varies with the display view, the options on your device and the function being performed.

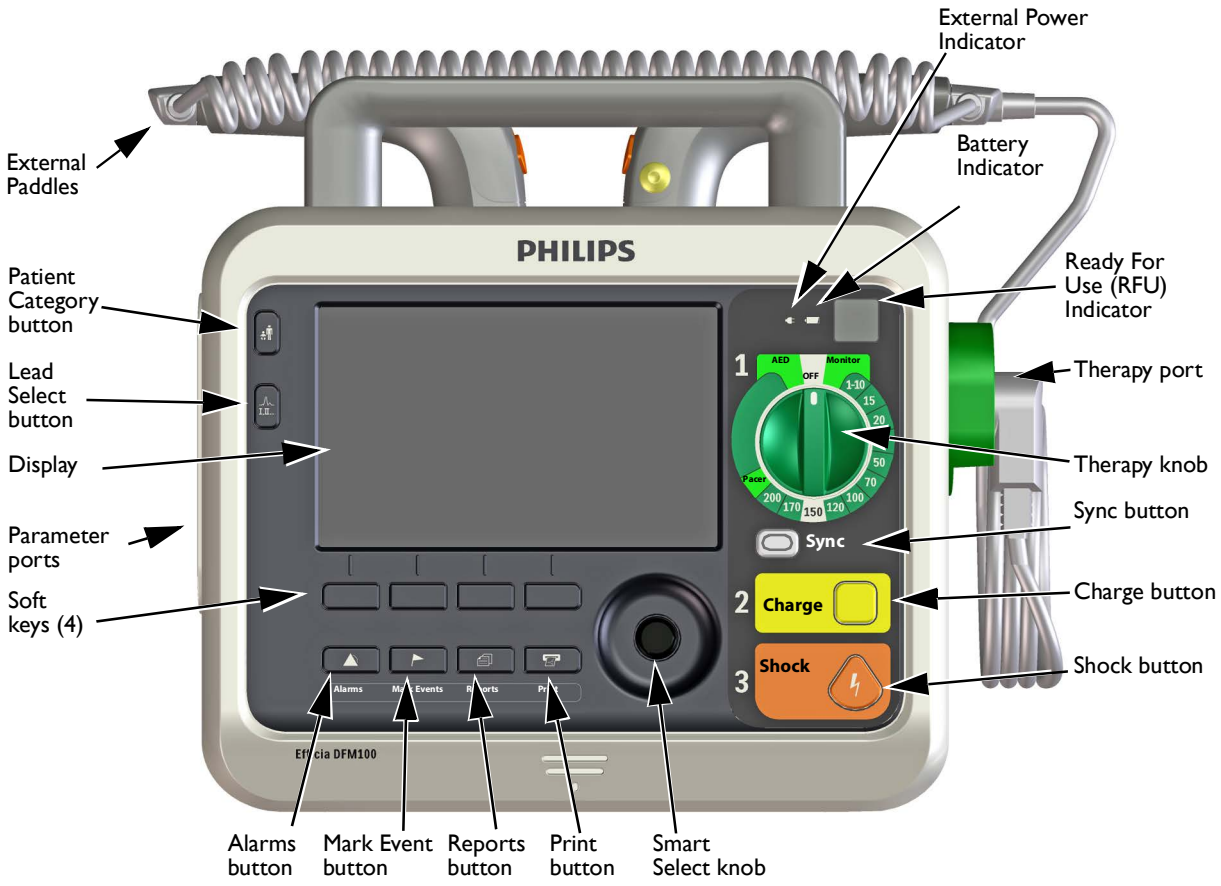
Basic Orientation

This section provides an overview of the Efficia DFM100, options and accessories.

Front of the Device

The front of the device contains operational controls and indicators as shown in Figure 1.

Figure 1 **Efficia DFM100**

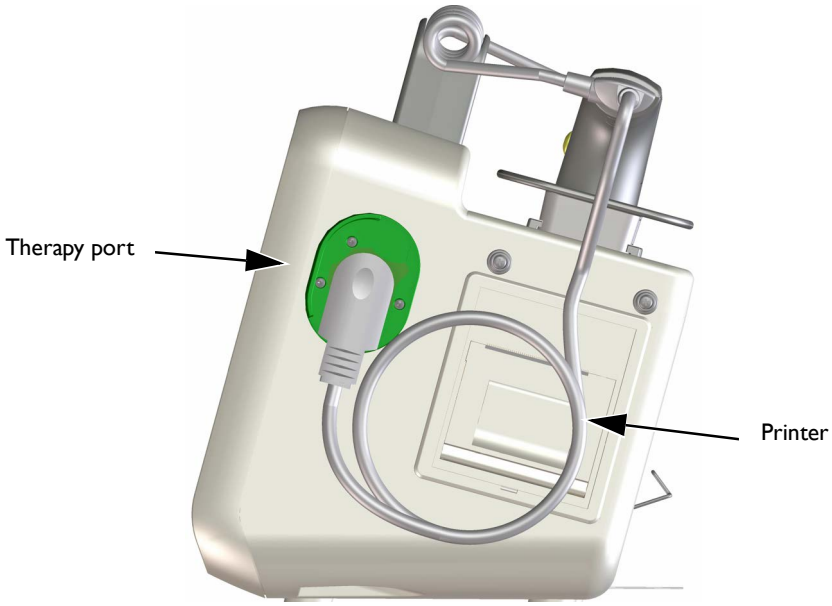


Additional controls and indicators are located on the external paddles (see “External Paddles” on page 14) and the Lithium Ion battery (see “Battery Fuel Gauge” on page 17).

Right 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 **Therapy Port and Printer**



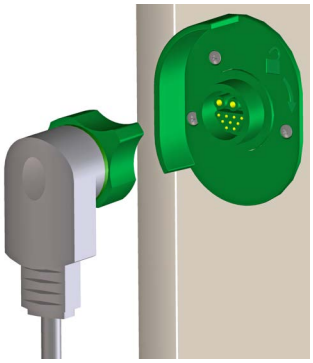
Connecting the Therapy Cable

If your device also has the Therapy Cable Collar, see "Therapy Cable Collar" on page 21.

To connect the Therapy Cable:

1. Align the white pointer on the cable with the white arrow on the green Therapy port. See Figure 3.
2. Insert the cable into the green Therapy port and push until you hear it click into place. Confirm the connection by gently tugging on the cable to make sure it does not come loose.

Figure 3 **Connecting the Therapy Cable**



To detach the Therapy Cable:

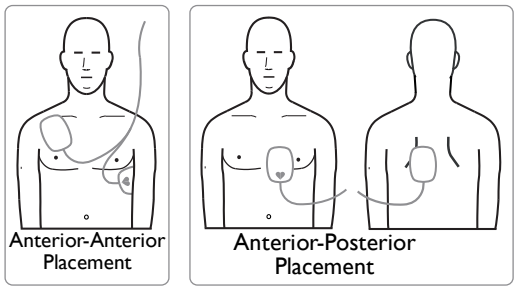
1 Rotate the green knob in a clockwise direction as indicated by the unlock symbol  next to the Therapy port.

2 Pull the cable away from the device.

Multifunction Electrode Pads

You can use multifunction electrode pads to monitor and deliver therapy to patients with the Efficia DFM100.

Figure 4 **Multifunctional Pads**



Connecting Multifunction Electrode Pads

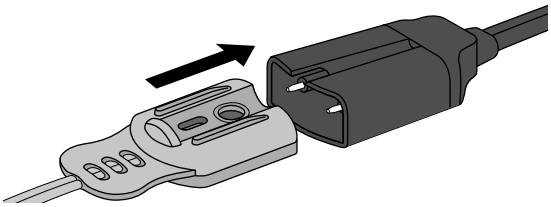
To connect multifunction electrode pads:

1 Check the expiration date on the pads package and inspect the package for any damage. Discard expired or damaged pads.

2 Connect the Therapy cable to the Efficia DFM100 (see "Connecting the Therapy Cable" on page 9).

3 Open the package and connect the pads connector to the end of the Therapy cable (see Figure 5).

Figure 5 **Connecting Multifunctional Pads**



4 Apply the pads to the patient as directed on the pads packaging or according to your organization's protocol.

Left (Monitor) Side.

The left side of the Efficia DFM100 is dedicated to monitoring key vital signs (see Figure 6). It has ports for ECG, SpO_2, CO_2 and NBP.

Figure 6 **Monitoring Side**

Connecting the ECG Cable

To connect a 3- or 5-Lead cable:

1. Align the ECG cable with the white ECG port (see Figure 7). The white key marker on the ECG cable faces the top of the device.
2. Push the ECG cable firmly into the ECG port.

Figure 7 **Connecting the ECG Cable**

Connecting the CO_2 Cable and Sample Line

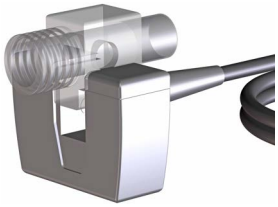
To connect the CO_2 cable:

1. Hold the cable connector with the flat side facing the front of the Efficia DFM100, insert the cable into the gray CO_2 port (see Figure 8) and push completely in.
2. Attach the Sample line to the sensor (see Figure 8) and then to the patient. See "Monitoring $EtCO_2$" on page 100.

Figure 8 **Connecting the CO_2 Cable**

Connecting a Sidestream Module

Connecting a Mainstream Module

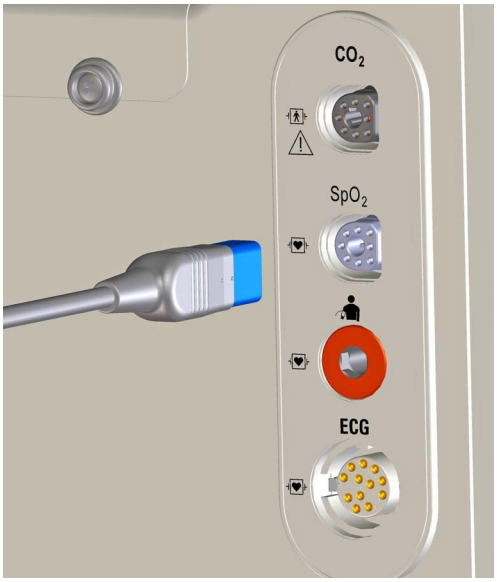


Connecting the SpO_2 Cable

To connect the SpO_2 cable:

1. Hold the cable connector with the flat side and blue marking facing the front of the Efficia DFM100 (see Figure 9).
2. Insert the cable into the blue SpO_2 port and push the blue portion of the connector into the device until it is no longer visible.

Figure 9 **Connecting the SpO_2 Cable**



Connecting the NBP Cable

To connect the NBP cable:

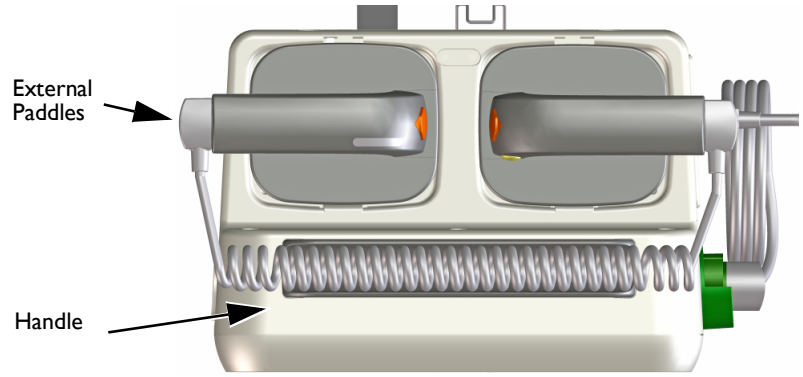
1. Insert the NBP cable into the red NBP port (see Figure 10) and push completely in.
2. Attach the NBP cable to the NBP cuff.

Figure 10 **Connecting the NBP Cable**

Top Panel

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 (see Figure 11).

Figure 11 **Top Panel**



External Paddles

The Efficia DFM100 has two options for external paddles - part numbers M3543A and 989803196431. While the paddle sets look slightly different, they function the same in a clinical environment.

Each External Paddle set can be used on both adult/child (≥ 10kg) and infant (< 10kg) patients. Each apex paddle has a yellow button to remotely charge the defibrillator. Both paddles in each set have orange shock buttons that flash when the defibrillator is charged. Press both orange buttons simultaneously to administer a shock. Each sternum paddle contains a Patient Contact indicator (PCI) with PCI icons . Orange or red lights on the PCI indicate poor patient contact. Adjust paddle pressure and placement to optimize patient contact. Green lights on the PCI indicate that good contact is established.

Figure 12 **External Paddle Features - M3543A**

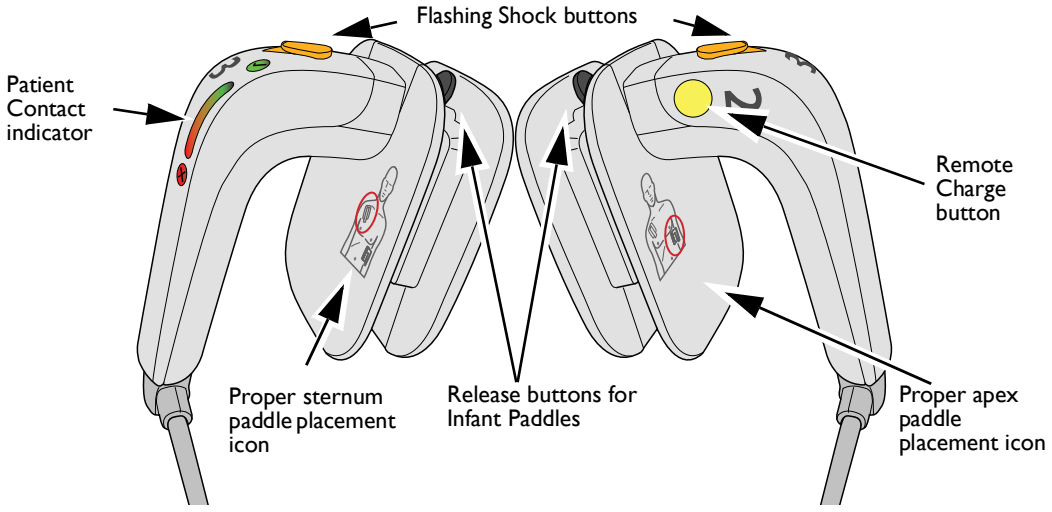
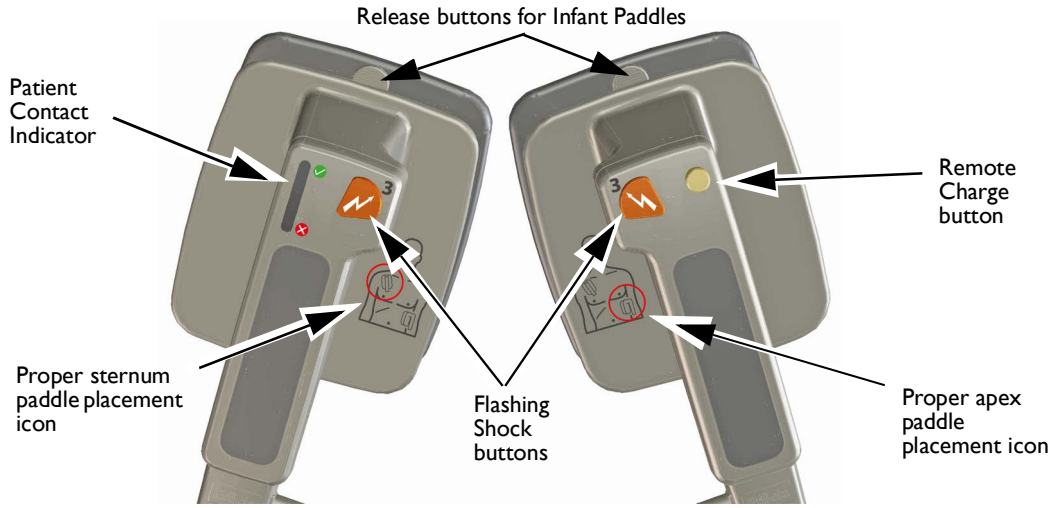


Figure 13 **External Paddle Features - 989803196431**



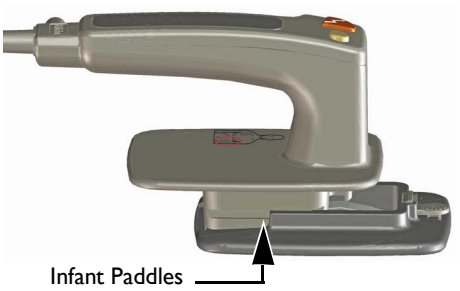
Accessing Infant Paddles

Accessing the Infant Paddles is the same on both the M3543A and 989803196431 external paddle sets.

To access the infant paddles:

1. Press down on the release buttons located on the front of the external paddles.
2. Slide the adult electrode clip off and away from the paddle exposing the infant-sized surface underneath.

Figure 14 **Infant Paddles**

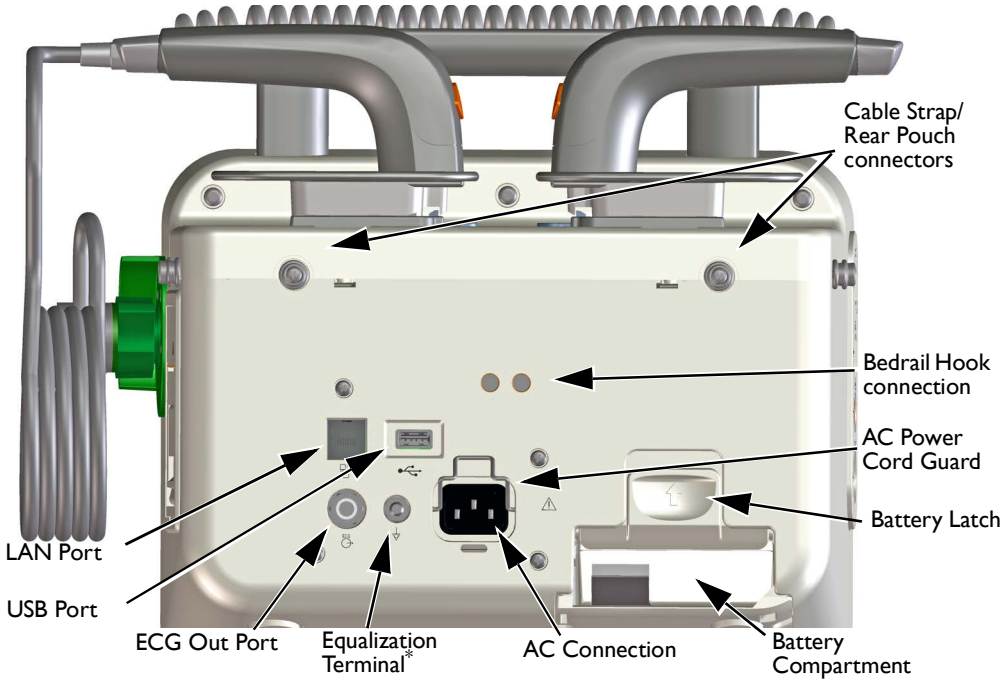


WARNING: Make sure the defibrillator is not charged before accessing the infant paddles.

Back Panel

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 and the LAN port. See Figure 15. For more information on ECG Out, see "ECG Out Cable" on page 18.

Figure 15 **Back Panel**



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

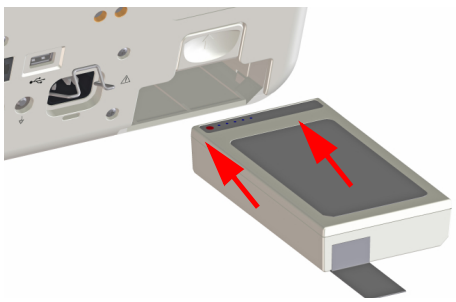
WARNING: Do not connect a LAN cable to the Efficia DFM100 while in a clinical mode. Incorrect ECG diagnosis may result due to excessive electrical background noise. The LAN port should only be used by production line staff or for servicing the device. It is not for customer use.

Installing the Battery

To install the Efficia DFM100 Lithium Ion battery (see Figure 16):

1. Align the battery in the battery compartment. Confirm the arrow on the Battery Tab is pointed up.
2. Push the battery into the battery compartment until you hear the Battery Latch lock into place.

Figure 16 **Installing the Battery**



NOTE: You can also lift the latch while pushing the battery into the battery compartment. Once the battery is in the compartment, let the battery latch down to secure the battery inside the compartment.

Removing the Battery

To remove the Efficia DFM100 Lithium Ion battery:

1. Push the Battery Latch up in the direction of the arrow.
2. The battery will eject out of the compartment. If it does not, pull on the Battery Tab to completely remove the battery.

Battery Fuel Gauge

To check the power remaining in your Lithium Ion battery when it is not installed in the Efficia DFM100, press the Battery Power Gauge (see Figure 17) located on the end of the battery opposite the battery tab. Each solid blue light indicates approximately 20 percent charge. A flashing blue light farthest to the button indicates the battery is too weak and must be recharged before use.

Figure 17 **Battery Gauge**

To check the battery power remaining when the battery is inserted in the device, look at the battery gauge on the display (see "Battery Charge Level" on page 32).

WARNING: Use only approved batteries to power the Efficia DFM100. Use of non-approved batteries could affect performance and results.

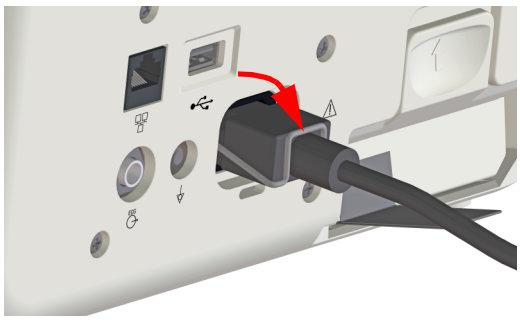
AC Power Cord Guard

Your Efficia DFM100 is equipped with an AC power cord guard.

To put the power cord guard in proper position:

1. Plug the AC power cord into the AC connection on the back of the device. Push it snugly into place.
2. Lower the power cord guard into place, confirming it catches on the back of the AC power cord (see Figure 18).
3. Confirm a snug fit by lightly tugging on the cord.

Figure 18 **AC Power Cord Guard**



ECG Out Cable

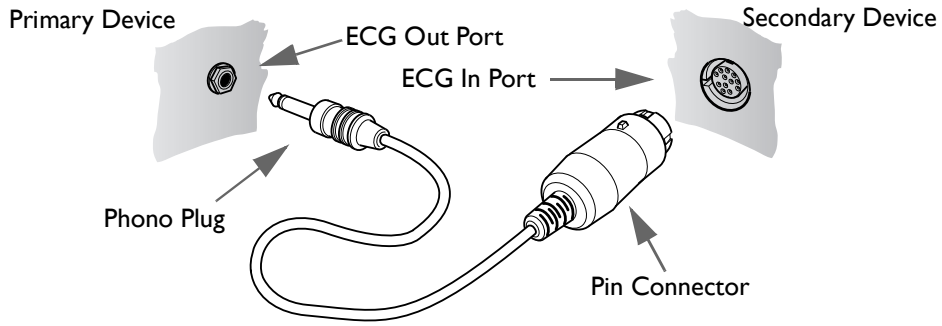
Also referred to as a Sync Cable, the Philips ECG Out Cable is used to establish a connection between the Efficia DFM100 and a bedside monitor to send ECG signals between the two devices. The cable sends one analog ECG waveform from the sending device to the receiving device.

To connect the ECG Out Cable:

1. Plug the phono plug into the ECG Out Port on the device you want to send the ECG from - now known as the primary device.
2. Plug the Pin Connector into the white ECG In Port on the receiving device - now known as the secondary device.

The ECG waveform from the primary device appears as Lead II on the secondary device's display.

Figure 19 **Connecting ECG Out Cable**



WARNINGS: If you use an external monitor as the ECG source during synchronized cardioversion, a biomedical technician **MUST** verify that the combination of the external monitor and the Efficia DFM100 can 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.

When pacing in Demand mode, the ECG cable must be directly connected from the patient to the Efficia DFM100.

NOTES: Lead II is the only lead selection on the secondary device that accurately displays the waveform sent from the primary device. The secondary device lead selection should remain on Lead II. To avoid confusion, the primary device lead selection should also be set to Lead II, if clinically possible.

If you are using the ECG Out Cable to send an ECG signal from the Efficia DFM100 to a bedside monitor, the ECG signal and alarms on the Efficia DFM100 should be considered primary. The bedside monitor ECG is ancillary/secondary.

If the device is pacing or if it detects internal pacemaker pulses, the ECG Out waveform includes pace pulse markers at the appropriate points.

Do not use a Philips SureSigns monitor connected to the Efficia DFM100. The devices are not compatible.

Installing Paper

The Efficia DFM100 uses 50 mm paper for printing.

To install printer paper:

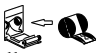
1. Open the printer door by pulling up on the door latch. Allow the door to fall open (see Figure 20).
2. If there is an empty or almost empty paper roll in the printer, pull up on the roll to remove it.
3. Examine the new roll of printer paper and remove any remaining adhesive residue from the outer layer of paper.
4. Place the new roll of paper in the paper well, positioning the roll so that the end of the roll is on the bottom as indicated by the symbol  inside the printer.
5. Pull the end of the paper out past the roller.
6. Close the printer door.
7. Test the printer before putting the defibrillator back into service. See "Operational and Shift Check" on page 151.

Figure 20 **Installing Printer Paper**

Test Plug & Test Load

Your Efficia DFM100 comes with a defibrillator Test Plug to assist in performing a weekly shock test. You can also use the M3725A or M1781A Test Load, ordered separately, to perform a weekly shock test.

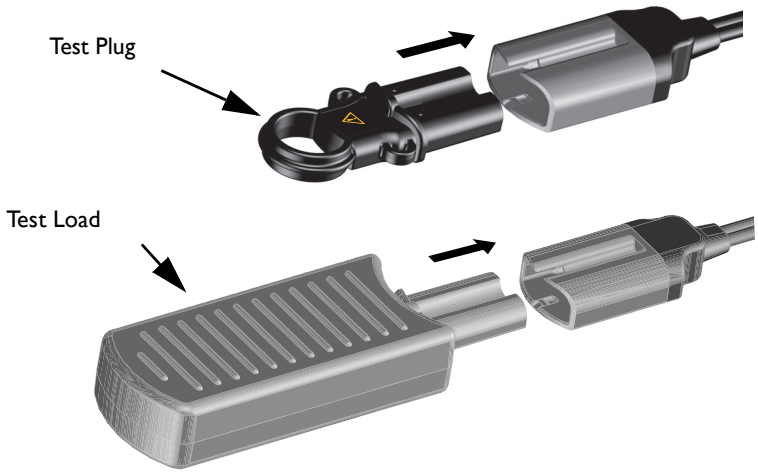
To use either the Test Plug or Test Load during a weekly shock test, insert the plug or load into the Therapy cable (see Figure 21).

The Test Plug and Test Load behave differently during the weekly shock test. Similar successful weekly shock test results appear differently on the device:

- The Test Plug creates an electrical "short" so the device does not deliver a shock into it. You hear a "Shock Canceled" audio message, see a Shock Aborted alarm on the display and the printed strip indicates Test Passed.
- The Test Load applies an impedance at the end of the Therapy cable such that the device delivers a shock. You hear a "Shock Delivered" audio message and the printed strip indicates Test Passed.

For more on the weekly shock test, see "Weekly Shock Test" on page 152.

Figure 21 **Connecting Defibrillator Test Plug/Load**



CAUTION: The defibrillator test plug is not for use with the HeartStart MRx or HeartStart XL.

NOTE: Using the tie provided, tie the test plug about 50 cm (18 inches) from the end of the therapy cable tight enough to prevent the plug from sliding along the cable. The plug should be oriented such that it can easily be inserted into the cable while you have the cable stowed.

Additional Features

The additional features of the Efficia DFM100 may include:

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

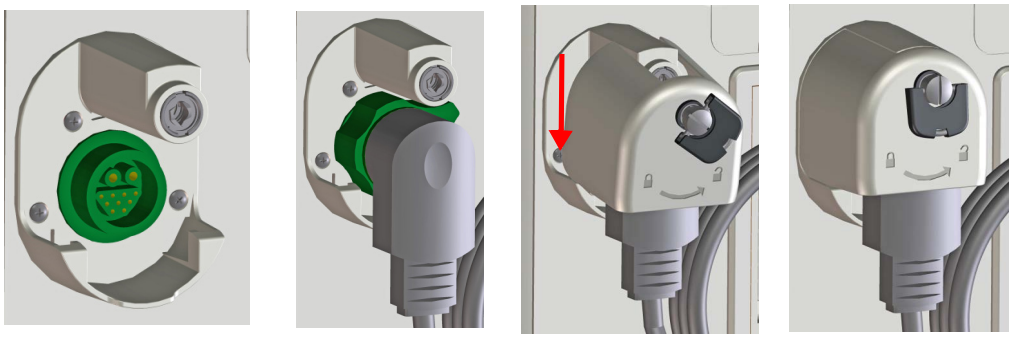
Therapy Cable Collar

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 being placed 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 Therapy Cable Collar base comes installed from the factory.

To connect the Therapy Cable and install the Collar Lid:

1. With the base already installed, plug the Therapy Cable into the green connector port.
2. Slide the feet of the Collar Lid into the grooves on the Collar base and push the top of the Lid into place. See Figure 22.
3. Grab the Locking Key and push in while turning clockwise until the Key locks into place.
4. To remove the cover, 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 22 **Locking the Collar Lid into Place**



WARNINGS: If you use the Efficia DFM100 in a transport or high-vibration environment without the Therapy 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 Carry Bags

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

To install the cradle and 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. Using a Phillips-head screwdriver, screw two of the snaps provided into the predefined holes on the cradle and into holes on the device. See Figure 23.
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. Snap 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 23.
8. **Optional tray cover pouch:** If you want to install the tray cover pouch, use the hook and loop strip to fasten one edge 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 using the cradle.

Figure 23 **Attaching the Cradle and Side Carry Bags**

EMS Environment

Use in the EMS Environment

The Efficia DFM100 with the X01 option is designed for use in the Emergency Medical Services (EMS) environment and is delivered with the carry case and with the Ambulance Docking Station. The Ambulance Docking Station (part number 989803199241) must be installed by qualified service personnel using special tools. Also, the Efficia DFM100 should be docked into the Ambulance Docking Station by qualified service personnel using special tools. Prior to installation, service personnel must install or confirm the presence of a mains isolation switch.

See the Efficia DFM100 *Service Manual* for instructions on how to install the Ambulance Docking Station and the Efficia DFM100 into the Ambulance Docking Station.

With the Ambulance Docking Station and Efficia DFM100 installed in an ambulance, all maintenance on the dock or the Efficia DFM100, including replacement of the power supply cord and mains isolation switch, should only be performed by qualified service personnel, including the use of tools to remove the Efficia DFM100 from the dock and the disconnection of the power supply cord to safely isolate the device from all power sources.

See the Efficia DFM100 *Service Manual* for all installation, maintenance and service instructions.

While the DFM100 has been designed for use in the EMS environment, use in these conditions can put stresses on the device and its accessories that could potentially affect essential performance. Users in these environments should be aware of the following:

- Direct sunlight and other sources of excessive illumination can affect SpO_2 readings. For more information see “Understanding Pulse Oximetry” on page 108.
- The device has been built to withstand lint and dust. After an event where the DFM100 was exposed to lint and dust, you should thoroughly clean it. See “Cleaning Instructions” on page 171 for more information.
- Cellular telephones, 2-way radios and other radio frequency-emitting devices could cause interference problems and potentially affect the behavior of the device. Users should abide by the recommended separation distances found on page 216.
- Check all accessories frequently. Confirm that all sensors, electrodes, ports and the Therapy cable are in working order. Replace all that are not in good working order.
- Make sure that the Therapy Cable Collar is installed on devices in high-vibration environments. See “Therapy Cable Collar” on page 21.
- Devices in the EMS environment may require a power converter to convert vehicle DC power to AC power for the Efficia DFM100.

NOTES

Operating the Device

Operating Modes

The Efficia DFM100 has four clinical modes and four non-clinical modes:

- Clinical modes are listed in Table 1. They are used by trained clinicians to monitor patients and provide therapy. These modes do not require passwords.
- Non-clinical modes are listed in Table 2. User information is included in the Description column.

Table 1 **Clinical Modes**

Mode	Description	For more information
Monitor	This mode is used to monitor ECG, optional NBP, $EtCO_2$, and SpO_2 parameters and for viewing Vital Signs Trends data.	"ECG Monitoring" on page 47; "Monitoring CO_2" on page 97; "Monitoring SpO_2" on page 107; "Monitoring NBP" on page 115; "Trending" on page 121.
AED	This optional mode is used to analyze ECG and if necessary, administer semi-automated external defibrillation. You can also monitor HR, $EtCO_2$, and SpO_2.	"AED Mode Option" on page 61.
Manual Defibrillation	This mode is used to perform asynchronous and synchronous cardioversion (defibrillation).	"Manual Defibrillation" on page 75.
Pacer	This optional mode is used to perform demand or fixed pacing.	"Pacing" on page 89.

Table 2 **Non-Clinical Modes**

Mode	Description	For more information
Operational Check	This mode is typically used by clinicians to perform routine maintenance activities related to operational and shift checks. This mode does not require a password.	"Operational and Shift Check" on page 151.
Data Management	This mode is typically used by hospital administrators to review Event Summary information after clinical use. This mode has an optional password.	"Data Management" on page 125.
Configuration	This mode is used to display and change configuration options. Hospital administrators use this mode to set up configuration options, which requires a password. Clinicians, service personnel, and hospital administrators may use this mode to view, print, or export configuration information.	"Configuration" on page 139.
Service	This mode is used by service personnel to service the device and install software upgrades. This mode requires a password.	The Efficia DFM100 *Service Manual*

Controls

Operating controls are organized by function with the defibrillation controls to the right of the display, soft keys under the display, and general function buttons under the soft keys and to the left of the display.

Therapy Knob and Controls

The Efficia DFM100 Therapy knob is customized for the options included in your device. If you have the Pacing and/or the AED Option, those positions are included on the knob. The knob enables AED mode, Pacing mode, Monitor mode or selects an energy for Manual Defibrillation mode to deliver defibrillation or cardioversion.

Regardless of the options, the knob and controls function the same:

Turning the Efficia DFM100 on – Turn the Therapy knob to the right for Monitor mode, Manual Defibrillation or Pacing; turn to the left for AED mode.

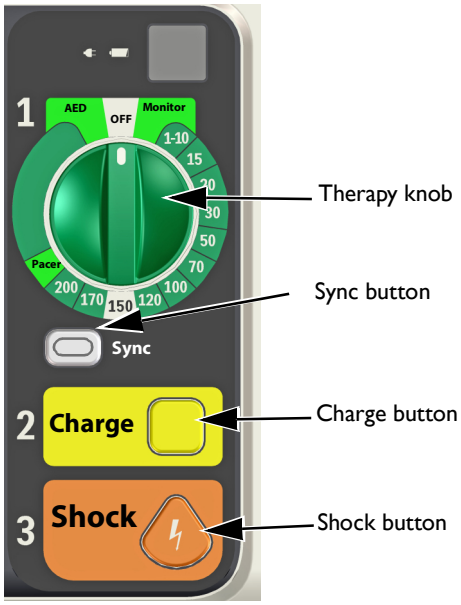
Charge button – Charges the defibrillator to the selected Manual Defibrillation energy setting. It is used only in Manual Defibrillation mode. The defibrillator charges automatically in AED mode.

Shock button – Delivers a shock through multifunction electrode pads or switchless internal paddles. In Manual Defibrillation mode, the shock is delivered at the selected energy. In AED mode, if the patient category is Adult, you have the ability to preconfigure the energy delivered. The factory default is 150J. If the patient category is Infant/Child, 50J is delivered. The button flashes when charged.

NOTE: When you use external paddles or switched internal paddles (internal paddles that have Shock buttons, as opposed to switchless internal paddles where you administer the shock by pressing the Shock button on the device), the Shock button(s) on the paddles delivers the shock.

Sync button – Toggles between synchronized energy delivery used during cardioversion and asynchronous energy delivery used during defibrillation. The Sync button lights blue when Sync is active.

Figure 24 **Therapy Controls**



Smart Select Knob

Use the Smart Select knob (see Figure 1 "Efficia DFM100" on page 8) to navigate through menus and options and make selections. You can:

Press the knob - If there is no menu on the display, the **Main** menu is displayed. If there is a menu on the screen, then the highlighted entry is selected.

Twist the knob - Turn the Smart Select knob clockwise to scroll down a menu's list or counter clockwise to scroll up the list. The scroll skips over any unavailable entries in the menu. If you have a numeric selection window open, turning the knob clockwise increases the numerical value; counter clockwise decreases the value.

General Function Buttons

The General Function buttons control monitoring or non-critical resuscitation activity. See "Efficia DFM100" on page 8 for the location of the buttons and below for their definitions.

Table 3 **General Function Buttons**

Name	Button	Description
Lead Select		Changes the ECG lead in Wave Sector 1. Pressing this button cycles through the available ECG waves, changing the displayed wave and label. The list of available ECG waves is based on the connected lead set and your device configuration, including pads, if the corresponding cable is connected. See "Lead Selection" on page 50.
Patient Category		Allows you to change the patient category from adult (≥ 25kg or ≥ 8 years old) to infant/child (<25kg or < 8 years old) and back again.
Alarms		When pressed, the Alarms button pauses all audible physiological and technical alarms for the configured time interval. At the end of the pause interval, each alarm returns to its previous setting. Pressing the Alarms button during the pause interval returns the alarms to their previous setting. When in AED mode, pressing the Alarms button activates alarms. See "Alarms" on page 37.

Table 3 **General Function Buttons *(Continued)***

Name	Button	Description
Mark Event		The Mark Event button allows you to insert a time-stamped annotation in the Event Summary report to note events as they occur, including the administration of certain drugs. See "Mark Events" on page 43.
Reports		When pressed, the Reports button will bring up the **Reports** menu. From the **Reports** menu, you can print an Event Summary or Trends report. See "Printing Data" on page 137.
Print		The Print button begins a continuous printout of the primary ECG and other selected waveforms in real time or with a 10-second delay, depending upon your configuration. Pressing the Print button while printing is in progress stops the printing. See "Printing Data" on page 137.

Soft Keys

The soft keys perform the function displayed directly above it on the display. The display and function change for the various modes of operation. Functionality of the soft keys are described in their appropriate chapters throughout these *Instructions for Use*.

Ready For Use Indicator

The Ready For Use (RFU) Indicator is located in the upper right section on the front of the device. It indicates the status of the therapy delivery functions using the following conventions:

Table 4 **Ready For Use Indicator and Status**

Type	Indicator	Status Description
Blinking Hourglass		Indicates the shock, pacing and ECG functions of the device are ready for use. Sufficient battery power is available for device operation.
Blinking red "X" with periodic audio chirp		Indicates either: • A low battery condition exists and the battery is not charging. • There is no battery installed and the device is running on AC power only.
Blinking red "X" without periodic audio chirp		Indicates a low battery power condition but the battery is currently charging. The device can be used but its battery-only operation time is limited.
Solid red "X" with periodic audio chirp		Indicates that a critical failure has been detected that may prevent the delivery of defibrillation therapy, pacing or ECG acquisition.
Solid red "X" without periodic audio chirp		Indicates no power available or the device cannot power on. If, after power is returned, the indicator reverts to the blinking black hourglass symbol, the device is ready for use.

Power

The Efficia DFM100 is powered by a Lithium Ion battery or AC power. The battery should always be installed so the device is ready for use whether AC power is available at the point of care. A **Switched to Battery** message is displayed when AC power is removed and a battery is installed. When pacing, AC power should be connected if possible to prevent the battery from eventually becoming depleted and interrupting the pacing operation.

The Efficia DFM100 can also be powered through a DC power converter which takes DC power and converts it to AC to power the device. When using this converter, the device is fully operational.

Keep your battery charged at all times. For more information on your battery, see "The Display" on page 31, and "Battery Maintenance" on page 168.

WARNING: To avoid the risk of electric shock, the Efficia DFM100 must be plugged into a hospital-grade outlet with protective ground. To remove AC power, disconnect the power cord from the outlet.

NOTES: If AC power is used as the only power source during defibrillation (for instance, when no battery is installed or when the battery is fully discharged), the Efficia DFM100 may take longer to charge to the desired energy level, and, in the event of power loss longer than 30 seconds, all settings reset to configured settings and a new event is created when power is returned. However, all saved data remains intact (up to the device's memory capacity) and can be found by retrieving the previous event. Keep your battery installed and charged.

If you question the AC power cord's functionality, disconnect it from the device and operate on battery power. Replace the cord before reconnecting to AC power.

For information on power-related alarms, see "Power-Related Alarms" on page 170.

Lithium Ion Battery

The Efficia DFM100 uses a Lithium Ion battery for power.

Battery Capacity

A new fully-charged battery, at 20 °C (68 °F), provides power for at least:

- 100 full-energy charge/shock cycles.

  or

- 2.5 hours of monitoring (ECG, $EtCO_2$ and SpO_2 continuously monitored and NBP sampled every 15 minutes) followed by 20 full-energy charge/shock cycles.

  or

- Two hours of pacing (180ppm at 140mA with 40msec pulse) and monitoring (ECG, $EtCO_2$ and SpO_2 continuously monitored and NBP sampled every 15 minutes).

Low Battery Conditions

The Efficia DFM100 enters a low battery condition when:

- The battery charge is low but contains sufficient power to provide at least six full-energy charge/shock cycles and at least 10 minutes of monitoring.
- The Efficia DFM100 cannot determine the battery's charge level.

To optimize performance, a battery that is in the low battery condition (less than 40% remaining) should be charged as soon as possible.

NOTE: The longer the battery stays in the Low Battery condition without charging, the ability to deliver six full-energy shocks and perform 10 minutes of monitoring diminishes.

Battery Charging

With AC power connected and the device turned off, the Efficia DFM100 recharges its battery to 80% capacity in less than 2 hours and to 100% capacity in less than 3 hours. Charge time can be substantially longer if the device is turned on.

Battery Maintenance

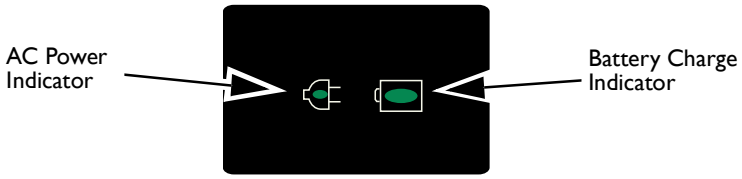
For information on battery maintenance, see "Battery Maintenance" on page 168.

Power Indicators

The Power Indicators are located in the upper right corner of the Efficia DFM100's front panel (see Figure 25). The green AC Power Indicator is lit whenever AC power is connected to the Efficia DFM100, even if the device is turned off.

The green Battery Charging Indicator flashes when the battery is charging. The indicator is solid green when the battery is fully charged and AC power is present. The light is off if no battery is installed, the battery is installed but not functioning properly or there is no AC power present.

Figure 25 **Power Indicators**



Turning the Efficia DFM100 On

To turn the Efficia DFM100 on, turn the Therapy knob to the desired mode of operation.

Turning the Efficia DFM100 Off

To turn the Efficia DFM100 off, turn the Therapy knob to the OFF position. If you turn the device off while in a clinical mode, the Efficia DFM100 enters the Continued Use Period (see "Continued Use" on page 43). The screen displays a 10-second countdown before turning off.

NOTE: You should leave the device plugged in to keep the battery charged and allow automated diagnostic tests to run periodically.

Device Shutdown

When no AC power is connected and the battery charge level drops to a critically low level, the Efficia DFM100 can no longer guarantee correct operation. The defibrillator generates an Imminent Shutdown alarm. You have approximately one minute to connect the device to AC power before it shuts down.

If power is returned within 30 seconds after a complete loss of power and the Therapy knob is not in the OFF position, the Efficia DFM100 automatically turns back on, user settings are restored to their values prior to the shutdown, the Efficia DFM100 continues to use the current Event Summary and the duration of the shutdown is recorded in the Event Summary.

WARNING: Pacing is not automatically restarted after the Efficia DFM100 recovers from a power loss. You must restart pacing manually.

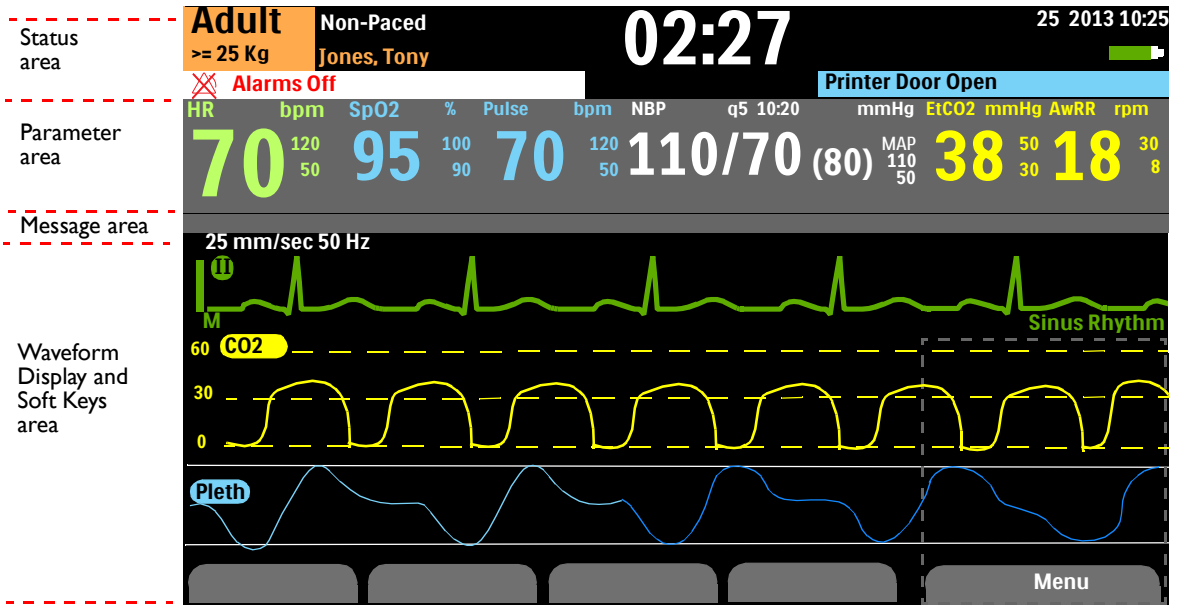
If the Efficia DFM100 restarts after 30 seconds and the Therapy knob is not in the OFF position, all settings are returned to their configured values, a new Event Summary starts and you are notified that the previous Event Summary was closed.

NOTE: Based on the software's status when power was lost, alarm settings in effect at the time of power loss may be restored in situations where power is returned up to 45 seconds after a power loss.

The Display

The Efficia DFM100's display layout is easily configurable. There are four basic segments of the display. See Figure 26.

Figure 26 **General Display Layout**

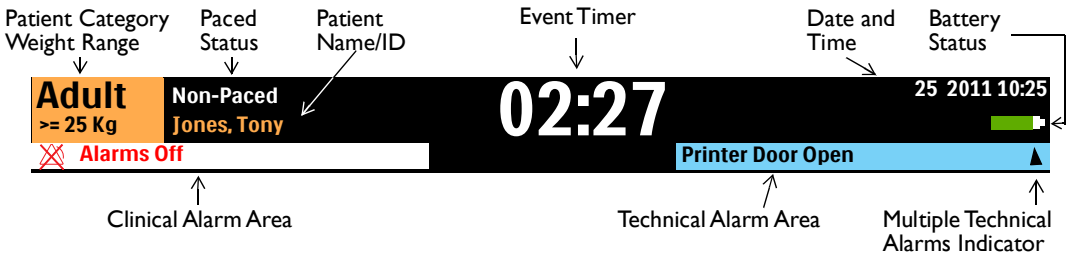


Dotted box indicates location of menu when displayed. See "Menus" on page 35.

Status Area

The Status Area contains device and patient information.

Figure 27 **Status Area**



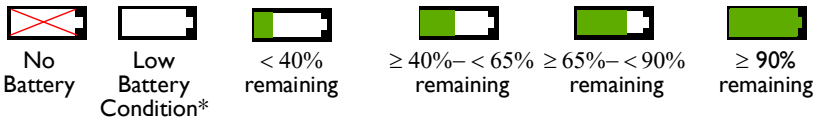
Patient information includes:

- Name/ID – If entered, displays the patient's name, patient's ID or nothing depending on the current configuration. See Table 36 "General Settings" on page 143.
- Date and Time – The current date and time.
- Paced Status – Internally paced or non-paced. The area remains blank if paced status has not been selected. (This information is not displayed in Pacing and AED modes.)
- Event Timer – The elapsed time for the current event, displayed in hours:minutes:seconds.
- Patient Category and Weight Range – Adult (defined as ≥ 25kg) or Infant/Child (defined as < 25kg). The background color changes with the selected patient category for Adult (orange) and Infant/Child (blue).

Device information includes:

- Clinical Alarm Indicator - Indicates the state of global alarms. If alarms are on and audio is not paused, the indicator is blank. If they are off, the indicator says **Alarms Off** and uses the Alarms Off icon .
- Technical Alarms - Technical alarms not related to the battery or pacing are displayed in the Technical Alarms area. A triangle ▲ indicates there are multiple alarms present, alternating on the display.
- Battery Status – If a battery is installed, the battery icon indicates the level of charge remaining. See Figure 28.

Figure 28 **Battery Charge Level**



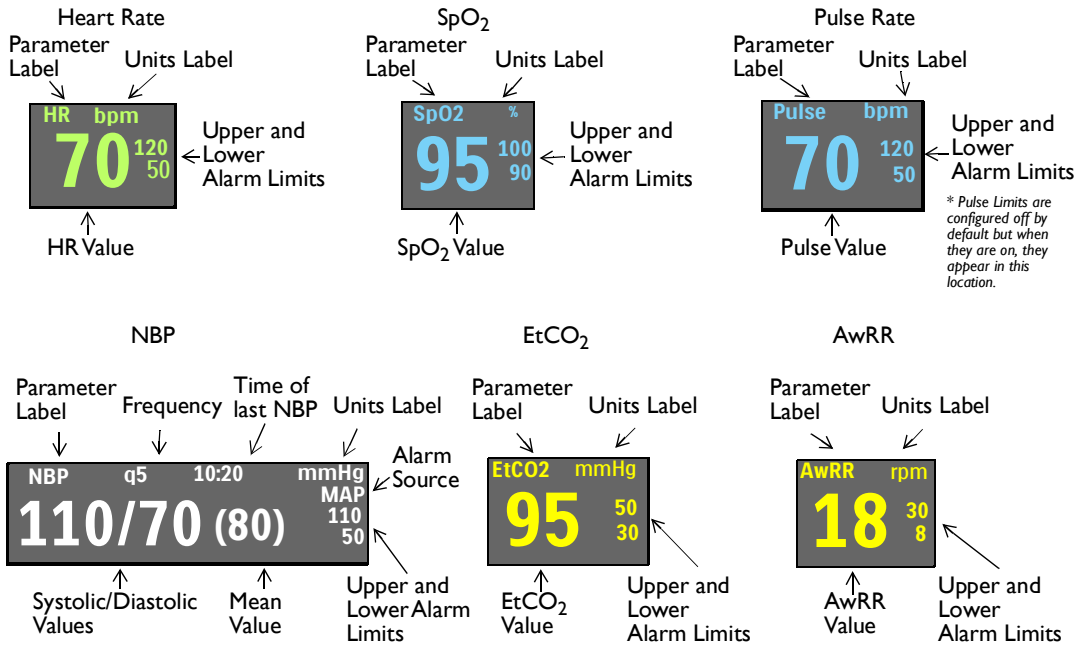
* - See "Low Battery Conditions" on page 29.

Parameter Area

The Parameter Area displays the physiological parameters currently being monitored. See Figure 29. Displayed values for each parameter include:

- Parameter Label
- Current value. Display:
  - Number – a valid value was obtained
  - **- ? -** – an invalid value was obtained
  - **?** with a number – the value obtained is questionable
  - blank – the parameter is unavailable or off
- Currently configured upper and lower alarm limits with the units label
- Alarm Off icon (visible when the alarm is disabled and the global alarm state is not set to off)

Figure 29 **Parameter Area**



Message Area

The message area displays key messages during an event. The type of message shown varies according to the current mode.

Figure 30 **Message Area**

Waveform and Display Soft Keys Area

The Efficia DFM100 is configured to populate each of its three wave sectors with a preconfigured waveform when powered on in Monitor, Manual Defibrillation (two wave sectors only), Pacing mode (two wave sectors only) and AED (one wave sector). A dashed line in an ECG wave sector indicates that the waveform source is invalid. Wave sectors may contain a variety of information as appropriate to the parameter, view and task currently being performed.

You can display one, two or three waveforms at one time on the display depending on which mode the Efficia DFM100 is currently in and how you have your device configured. The area also displays other key information including the number of shocks delivered and the selected energy.

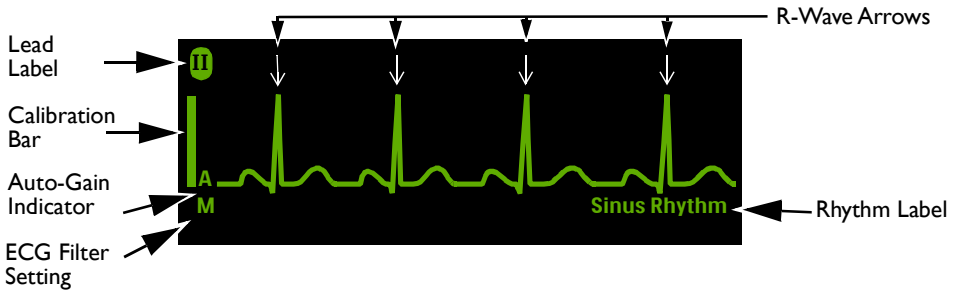
Wave Sector 1

Wave Sector 1 contains only an ECG waveform. This waveform is used by the arrhythmia, heart rate derivation and AED analysis algorithms. Available waveforms include: Paddles (unavailable in AED mode), Pads, I, II, III, aVR, aVL, aVF and V.

Wave Sector 1 also contains the ECG Calibration Bar, the Auto-Gain Indicator, Rhythm Label, ECG filter setting and R-Wave arrows. The Calibration Bar is used as a reference point to compare the actual ECG wave displayed to the selected size. The Auto-Gain Indicator is displayed when

auto-scaling is active. R-Wave arrows appear when the device is in Sync mode, Monitor mode, or Demand mode pacing.

Figure 31 **Wave Sector 1 Markings**



After the ECG analysis algorithm analyzes the waveform in Wave Sector 1, if the DFM100 is configured to display the rhythm, the waveform is labeled (in all clinical modes except AED). Possible labels include:

- Learning ECG
- Learning Rhythm
- Asystole
- V-Fib/Tach
- VTach
- Paced Rhythm
- Sinus Rhythm
- Sinus Brady
- Sinus Tachy
- SV Brady
- SV Rhythm
- SV Tachy
- Unknown ECG Rhythm
- Cannot Analyze ECG

If the Rhythm Label is configured off, the device only displays Learning ECG and Learning Rhythm labels. For more on configuring the label, see Table 37 “Heart Rate/ECG Settings” on page 144.

The ECG filter settings for the display are:

M - Monitor Bandwidth

E - EMS Monitor Bandwidth

S - ST Monitor Bandwidth

ECG filter settings can be changed in Configuration mode. See Table 37 “Heart Rate/ECG Settings” on page 144.

NOTES: In synchronized cardioversion mode, the R-Wave arrows indicate which R-Waves a shock would be triggered on if the shock button is pressed.

In Demand mode pacing, the time until the next delivered external pace pulse is from the previous pace pulse or the R-Wave arrow, whichever is the most recent. R-Waves immediately after an external pace pulse are not marked because they are likely caused by the pace pulse.

The displayed heart rate is determined by the arrhythmia analysis which is independent from R-Wave arrows for synchronized cardioversion or for Demand mode pacing.

Wave Sectors 2 and 3

Wave Sectors 2 and 3 are automatically populated when the parameter source’s cable is connected to the Efficia DFM100. If the parameter source is the configured choice of a particular wave sector, it is displayed in that wave sector when available. Available waveforms include: Paddles, Pads, I, II, III, aVR, aVL, aVF, V, Pleth, Capnogram, and a Cascade Wave from Wave Sector 1. If you select an ECG wave for sectors 2 or 3, the ECG filter setting is also displayed (except in cascade and annotated ECGs).

You can also select an annotated ECG for Wave Sector 2. See “Displaying an Annotated ECG” on page 54.

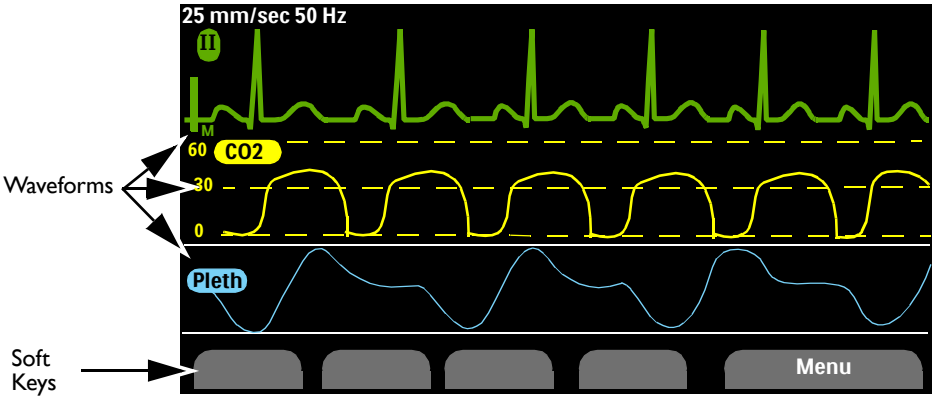
Changing Displayed Waveforms

Wave Sector 1 has a dedicated Lead Select button  (see "General Function Buttons" on page 27) to change the displayed lead/source. Waveforms displayed in the other sectors are changed for the current event using the Smart Select knob. See "Menus" on page 35.

Soft Key Labels

The four soft key labels correspond to the soft key buttons located immediately below. See Figure 32. These labels change, as appropriate, according to the current display view and function. Soft key labels appearing as gray text indicate the soft key is inactive.

Figure 32 **Waveform and Display Soft Keys Area**



Menus

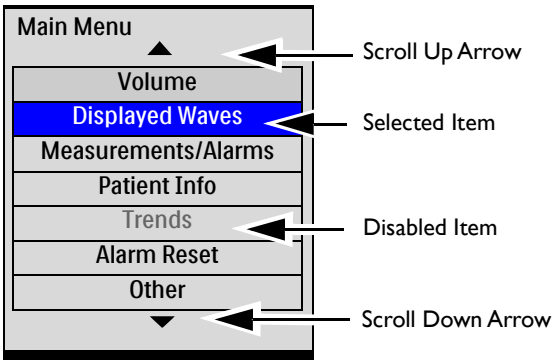
Menus with controls and options specific to each Efficia DFM100 function are easily accessible using the Smart Select knob on the front panel. Menus are used to adjust volume, select waveforms, select waves for printing, set alarms, enter patient information, generate reports and complete a variety of other tasks.

To display a menu, press the Smart Select knob, and then turn the Smart Select knob to scroll through the available choices. You can scroll in either direction continuously because the menu options will restart as you reach the end of the list.

To make a selection, highlight the menu entry you want and press the Smart Select knob. Select Exit to close the menu without making a selection. Arrows at each end of the menu indicate additional list options are available in that direction on the menu. Turn the Smart Select knob to scroll up or down to reveal the remaining options.

Depending upon your given situation, some options are unavailable for use. Menu choices are grayed out when they are unavailable. They cannot be highlighted or selected. See Figure 33.

Figure 33 **Sample Menu**

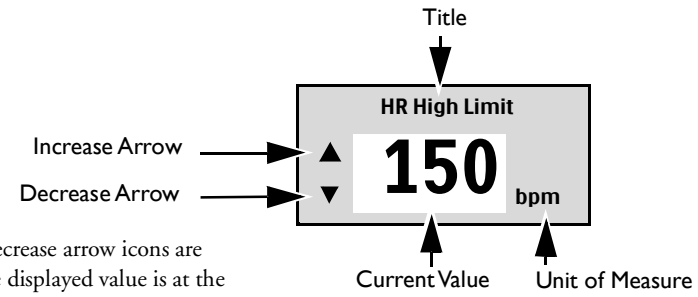


NOTE: Menus are removed from the display when the Charge button is pressed.

Adjusting Numeric Values

Using the Efficia DFM100 Smart Select knob, you can enter numeric values for several parameters, including high and low alarm limits. See Figure 34. The value initially displayed is the default value. Some values are adjustable in increments greater than 1. To exit, press the Smart Select knob.

Figure 34 **Setting Numeric Values**



The Increase/Decrease arrow icons are not shown if the displayed value is at the upper/lower limit of the range.

Adjusting Volumes

The volume levels for alarms, voice prompts, and the QRS Indicator are adjustable.

To adjust the volume for the current event:

1. Press the Smart Select knob.
2. Turn the Smart Select knob to highlight **Volume** and press the Smart Select knob.
3. Select the volume type (**Alarms**, **Voice**, **QRS**) you wish to adjust and press the Smart Select knob.

NOTE: You can adjust one volume type without affecting the other volume types. For example, adjusting the QRS volume does not affect the volumes for alarms and voice.

4. Select the new volume level and press the Smart Select knob.

The new volume level remains in place for the duration of the current event. Use Configuration mode to adjust the default volume levels. See "Configurable Parameters" on page 142.

Alarms

The Efficia DFM100 uses various alarms to indicate changes in patient condition or device/cable conditions that may require attention:

- Physiological alarms are detected in a clinical mode and result from a patient-related parameter being monitored. SpO2 Low is an example of a physiological alarm. These alarms are not detected in non-clinical modes.
- Technical alarms result from an equipment-related issue.

Alarm conditions are based on comparisons against preset limits and algorithm results. Alarms can be configured as latching or non-latching for Pulse Rate, NBP, $EtCO_2$ (excluding Apnea), and SpO_2 (excluding Desat):

- Non-latching alarms are automatically removed when the alarm condition no longer exists.
- Latching alarms remain active even when the alarm condition no longer exists. Apnea and Desat alarms are latching alarms and cannot be configured as non-latching.

For alarm priorities, see Table 5. For information on how to respond to alarms, see "Responding to Alarms" on page 41.

WARNING: Setting the alarm volume below the ambient noise level can result in missed alarm conditions.

Table 5 **Alarm Priority**

Alarm Priority		Condition
High Priority	V-Fib/Tach	An immediate response is required. A life-threatening alarm condition exists. The device displays a red alarm message and emits a high-priority alarm tone. High-priority alarms are latching.
Medium Priority	SpO2 Low	Prompt response is required. A non-life-threatening alarm condition exists. The device displays a yellow alarm message and emits a medium-priority alarm tone. Medium-priority alarms are latching or non-latching depending on your device's configuration, except two Pacer-related alarms that are always latching. See Table 36 "General Settings" on page 143.
Low Priority	Printer Door Open	Awareness is required. A non-life-threatening alarm condition exists. The device displays a cyan alarm message and emits a low-priority alarm tone. Low-priority alarms are non-latching.

NOTES: The presence of multiple alarm conditions at the same time is possible. To avoid confusion and help prevent a less serious condition from hiding a more serious condition, the Efficia DFM100 prioritizes and categorizes alarms. The highest priority alarm condition is announced. If multiple same-parameter, same-priority alarms occur, the alarms are displayed one at a time.

Physiological alarms are not detected or displayed in a non-clinical mode. Only technical alarms are displayed in non-clinical modes.

Clinical Mode Alarm Notification

When in a clinical mode, the Efficia DFM100 can be configured to react differently when an alarm condition occurs. See Table 6.

Table 6 **Alarm Notification Types**

Type	Alarm	Location	Alarm Status	Comments
Alarms On	None	None	Both visual and audio indications are on.	All alarms are on.
Alarm Audio Pause	 Alarm Audio Paused min (message includes duration of the pause)	Upper left corner of the display underneath the Patient Category.	Only visual indications are on for the configured Audio Pause timeframe. Audio returns when the pause timeframe is complete.	This message appears when you press the Alarms button and the configured alarm pause is set to something other than indefinite.
Alarm Audio Off	 Alarm Audio Off	Upper left corner of the display underneath the Patient Category.	Only visual indications are on.	This message appears when you press the Alarms button and the configured alarm pause is indefinite.
	 Audio Off	In the Menu area above the Smart Select knob.		When displayed, press the Smart Select knob to turn Audio off.
Alarm Audio Pause	 Audio Pause	In the Menu area above the Smart Select knob.	Only visual indications are on for the configured Audio Pause timeframe. Audio returns when the pause timeframe is complete.	When displayed, press the Smart Select knob to pause Audio.
Alarms Off	 Alarms Off	When in AED mode, upper left corner of the display underneath the Patient Category.	Both audio and visual alarm indications are off.	Press the Alarms button to activate alarms in AED mode.

All alarm conditions are cleared when you switch from a clinical mode to a non-clinical mode.

If you intentionally disconnect a sensor, an alarm sounds. Press the Smart Select knob to stop the alarm. The Efficia DFM100 prompts you to confirm your selection. Press the Smart Select knob again.

WARNINGS: Silencing either audio or audio and visual indications of active alarms can result in missed alarm conditions and also inhibit indications of new alarm conditions.

Confirm that alarm limits are appropriate for the patient each time there is a new patient event.

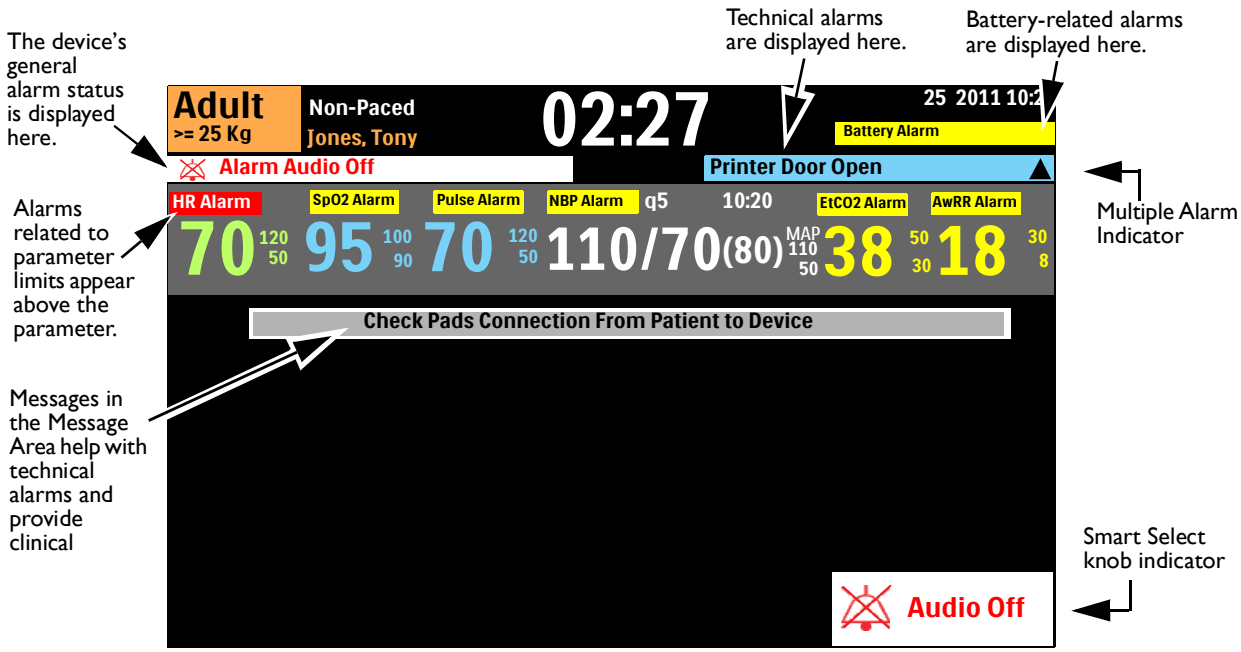
Do not set alarm limits to such extreme values that render the alarm system useless.

A potential hazard exists if different alarm limits are used for the same or similar equipment in any single area.

Alarm Notification Display Locations

Depending on the alarm type, the Efficia DFM100 displays notifications in various locations. See Figure 35.

Figure 35 **Alarm Notification Locations**



NOTE: Pacing alarms appear in the Pacing Bar. See "Pacing Alarms" on page 94.

Adjusting Alarm Limits

Alarm limits are preset on the Efficia DFM100 based on its configuration and the patient type. When alarms are on, alarm limits are visible next to the parameter's numeric value. At times, you might want to adjust an alarm limit for the current event.

To adjust an alarm limit:

1. Press the Smart Select knob.
2. Turn the Smart Select knob to highlight **Measurements/Alarms** and press the Smart Select knob.
3. Select the desired parameter and press the Smart Select knob.
4. Select the parameter limit and press the Smart Select knob.
5. Turn the Smart Select knob to adjust the limits. Press the Smart Select knob to finish.

Alarm Management

The Efficia DFM100 allows you to adjust alarm notifications when first powering the device on. In Configuration mode you can configure the alarms for HR/Arrhythmia, NBP, $EtCO_2$, AwRR, and SpO_2 to be on or off when the device first powers on.

If the Efficia DFM100 is in Monitor mode and the device's overall alarm audio sounds have been turned off (alarm audio pause set to indefinite), the device can be configured to remind you with an audio signal that these alarms are silent.

See Chapter 14 "Configuration" on page 139 and the individual parameter sections on alarms.

Audio Tones and Alarm Indications

The Efficia DFM100 uses a mixture of audio tones and alarm indications to communicate device and patient status. Table 7 describes the device's audio tones and alarm indications.

Table 7 **Tones and Alarms**

Tone/Indication	Description	Tone level
Single beep and Alarm Audio Reminder tone	Message. Accompanies a new message on the display - generally informational.	2000 Hz
Continuous tone	Charged. Generated when the selected defibrillation energy is reached and continues until the Shock button is pressed or the device is disarmed.	2042 Hz
Continuous tone - lower pitch than charged tone	Charging. Generated when the Charge button is pressed and continues until the device is fully charged.	1333 Hz
Periodic chirp	Attention. Generated in instances such as low battery and device failure.	1000 Hz
Tone synchronized with each heart beat	QRS. Single beeps aligned with the QRS. The volume of this tone can be set in Configuration. See "General Settings" on page 143.	667 Hz
Continuous tone with alternating pitch	Imminent shutdown. The device will shut down in one minute.	Alternating between 1000 and 2100 Hz
Philips tone lasting 0.5 second, repeated every second	High priority alarm condition.	960 Hz
IEC high priority alarm		Meets IEC 60601-1-8/ YY 0709
Philips tone lasting 1 second, repeated every 2 seconds	Medium priority alarm condition.	480 Hz
IEC medium priority alarm		Meets IEC 60601-1-8/ YY 0709
Philips tone lasting 0.25 second, repeated every 2 seconds	Low priority alarm condition	480 Hz
IEC low priority alarm		Meets IEC 60601-1-8/ YY 0709

Configuring Alarms

The Efficia DFM100 allows you to adjust alarm notifications. In Configuration mode you can configure alarms for HR/Arrhythmia, NBP, $EtCO_2$, AwRR and SpO_2 alarms to be on or off when the device first powers on. See the individual parameter's section of Chapter 14 "Configuration" on page 139.

Responding to Alarms

Alarm limits are displayed with each parameter, if alarms for the parameter are on. When an alarm condition occurs, there are several ways to respond. Initially:

1 Attend to the patient.

2 Identify the alarms indicated.

3 Silence (pause) the alarms. Press the Smart Select knob on the front panel of the Efficia DFM100 to pause/silence the alarm, and then press the knob again to acknowledge the alarm. The alarm is paused for the configured pause period while you attend to the patient. If the alarming condition continues to exist, it re-alarms after the configured pause period ends.

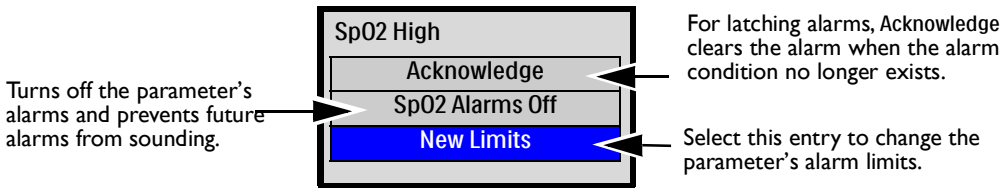
Silencing a specific alarm does not prevent another alarm from sounding. If you silence the second alarm, it resets the pause period for all active alarms.

If you press the Alarms button, you silence all parameter alarms for the configured pause period. No new alarms sound.

4 Address the alarm condition:

- To acknowledge an individual alarm, use the alarm response menu. See Figure 36.
- If you are in Monitor mode, you can use **[Alarm Reset]** in the **[Main Menu]** to clear all latched alarms that no longer have an associated condition. See Figure 33.

Figure 36 **Sample Alarm Response Menu**



NOTE: Alarm history can be accessed in the patient's Event Summary. This information is maintained after powering the device down and in the unlikely event of a power loss. To access this information, see "Event Summary" on page 125.

For more information on alarms and messages as they pertain to a particular functionality, see the specific alarm section in the Efficia DFM100 *Instructions for Use*:

- Heart rate and arrhythmia alarms - see "Heart Rate and Arrhythmia Alarms" on page 56
- AED alarms - see "AED Alarms" on page 72
- Defibrillation alarms - see "Manual Defibrillation Alarms" on page 81
- Cardioversion alarms - see "Cardioversion Alarms" on page 88
- Pacing alarms - see "Pacing Alarms" on page 94
- SpO_2 alarms - see "SpO_2 Alarms" on page 111
- Pulse alarms - see "Pulse Rate Alarms" on page 113
- NBP alarms - see "NBP Alarms" on page 118
- $EtCO_2$ and AwRR alarms - see "$ETC0_2$ and AwRR Alarms" on page 101
- Power alarms - see "Power-Related Alarms" on page 170

Entering Patient Information

In Monitor, Manual Defibrillation, and Pacer modes, you can add, change, or delete patient information using the **Patient Info** menu. You cannot add, change, or delete patient information in AED mode or non-clinical modes. If information was previously entered for the patient, those values are listed as appropriate.

Patient information includes the patient name, ID, sex, and paced status. The **Sex** field defaults to Male, and the **Paced** field defaults to No (not paced).

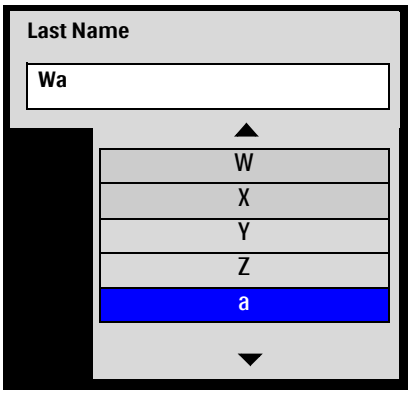
NOTES: Ensure the patient's paced status is correct to optimize ECG analysis.

Paced status does not appear in AED or Pacer modes.

To enter patient information on the device:

1. Press the Smart Select knob.
2. Turn the Smart Select knob to highlight **Patient Info**, and press the Smart Select knob.
3. Select the category you want, and press the Smart Select knob.
4. If you are entering the patient name, the **Last Name** field and menu appears (see Figure 37):
   - **a** Turn the Smart Select knob to highlight the character, and press the Smart Select knob to select it.
   - **b** Use the Smart Select knob to finish entering the characters of the last name. Up to 18 characters are allowed.
   - **c** When you finish entering the last name, select **Done**. The last name is saved, and you are prompted to enter the first name.
   - **d** Use Smart Select knob to enter the first name like you did for the last name (up to 18 characters), and select **Done**. The first name is saved, and you are prompted to enter the patient ID.
5. If you are entering the patient ID, the **ID** field and menu appears:
   - **a** Turn the Smart Select knob to highlight the character, and press the Smart Select knob to select it.
   - **b** Use the Smart Select knob to finish entering the patient ID. Up to 16 characters are allowed.
   - **c** When you finish entering the patient ID, select **Done**.
6. If you are entering the patient sex, use the Smart Select knob to highlight and select **Male** or **Female**.
7. If you are entering the patient's paced status, use the Smart Select knob to highlight and select **Yes** if the patient has an internal pacemaker.

Figure 37 **Entering Patient Name**



Continued Use

Once in a clinical mode, the Continued Use feature is activated. This feature facilitates continued treatment of the same patient by retaining the current settings and patient record when the Efficia DFM100 is turned off for less than 10 seconds. This could occur when turning the knob from Monitor mode to AED mode or when the Therapy knob is accidentally moved to the OFF position. If you turn the Efficia DFM100 back on within 10 seconds, it retains the most recent:

- Alarm settings and conditions
- Wave sector settings
- Event timing
- Volume settings
- Vital Signs Trending data
- Pacing settings
- Synchronized Cardioversion settings
- SpO_2 value
- $EtCO_2$ value
- AwRR value
- NBP value and measurement frequency
- Event Summary

NOTES: The Sync feature remains active if the Efficia DFM100 is turned off for less than 10 seconds. However, Sync is disabled when AED mode is activated and must be turned back on upon returning to Manual Defibrillation mode.

Pacing stops if you leave Pacer mode. It must be restarted manually.

The Continued Use feature does not function if both battery and external AC power are removed from the device, even briefly.

Mark Events

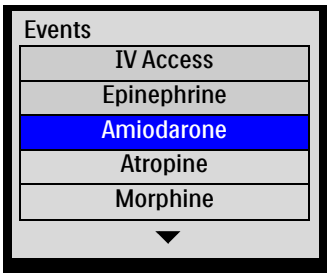
The Mark Events button allows you to annotate the Event Summary and ECG strip when the button is pressed. If configured, pressing the Mark Event button prints a 10-second ECG strip leading up to the event, the event itself, and the 5 seconds after the event.

To mark an event:

1. Press the Mark Event button. The **Events** menu (see Figure 38) is displayed.
2. Turn the Smart Select knob to select the desired event.
3. Press the Smart Select knob to mark the event. If configured, an ECG strip is printed, including the mark event symbol and the selected event label.

NOTE: If the Mark Event button is pressed and no event is selected from the **Events** menu within 5 seconds, the **Events** menu is removed from the screen and a generic event is logged. If the Mark Event button is pressed a second time within 5 seconds of the first event, a generic event is logged and the **Events** menu screen remains on the display for 5 seconds.

Figure 38 **Events Menu**



Passwords

Your organization is responsible for managing password and data access according to your organization's policies and practices.

For the default passwords, see the Efficia DFM100 Password Letter. For the Service mode password, see the Efficia DFM100 *Service Manual*. Philips recommends defining new passwords when first setting up the device.

Service Mode Password

Service mode requires a password. For instructions on how to set up and change the Service mode password, see the Efficia DFM100 *Service Manual*.

Configuration Mode Password

The Configuration mode password is changed in Service mode, and the Service mode password is required to change the Configuration mode password. For instructions on how to change the Configuration mode password, see the Efficia DFM100 *Service Manual*.

Data Management Mode Password

Data Management mode has an optional password. The device is initially set up to require a Data Management mode password. You can change the requirement in the **Configuration -General** view.

For instructions on how to change the Data Management Mode password, see "Changing the Data Management Mode Password" on page 141. The Configuration mode password is required to change the Data Management mode password.

Safety Considerations

The following general warnings and cautions apply to the use of the Efficia DFM100. Additional warnings and cautions specific to a particular feature are provided in the appropriate sections.

WARNINGS: The Efficia DFM100 is not intended to be deployed in settings or situations that promote use by untrained personnel. Operation by untrained personnel can result in injury or death.

Use of the Efficia DFM100 is restricted to a single patient at a time.

Algorithms in the Efficia DFM100 use the currently set Paced Status during rhythm analysis. Confirm that the patient's paced status is correct.

When transporting a patient or carrying the Efficia DFM100, it is important to position it with the display facing away from the body or other surfaces. If not, the Therapy and Smart Select knobs may be bumped and inadvertently moved from their desired position.

Never operate the Efficia DFM100 in standing water. Do not immerse or pour fluids on any portion of the Efficia DFM100. If the device does get wet, dry it with a towel.

Do not use the Efficia DFM100 in the presence of a flammable anesthetic mixture or oxygen concentrations greater than 25% (or partial pressures greater than 27.5 kPa/206.27 mmHg). This can cause an explosion hazard.

Avoid connecting the patient to several devices at once. Leakage current limits may be exceeded. Do not use a second defibrillator on the patient while pacing with the Efficia DFM100.

Operating the Efficia DFM100 or its accessories in conditions outside the environmental specifications can result in device or accessory malfunction. The Efficia DFM100 should be allowed to stabilize within the operating temperature range for 30 minutes prior to operation.

The Efficia DFM100 should not be used adjacent to or stacked with other equipment. If adjacent or stacked use is necessary, the Efficia DFM100 should be observed to verify normal operation in the configured use.

Use only 3-wire AC power cords with 3-pronged grounded plugs.

Do not touch the communication ports and a patient simultaneously.

CAUTIONS: Be aware of patient cables, including ECG monitoring equipment when used with high frequency surgical equipment.

Accessory equipment connected to the Efficia DFM100's data interface must be certified according to IEC Standard 60950/GB4943 for data-processing equipment or IEC Standard 60601-1/GB9706.1 for electromedical equipment. If in doubt, contact your local Customer Care Center or representative.

This device is suitable for use in the presence of high-frequency surgical equipment. Following electrosurgery interference, the equipment returns to the previous operating mode within 10 seconds without loss of stored data. Measurement accuracy may be temporarily decreased while performing electrosurgery or defibrillation. This does not affect patient or equipment safety. See the electrosurgery device's *Instructions for Use* for information on reducing hazards of burns in the event of a defect in its equipment.

Do not expose the Efficia DFM100 to x-ray or strong magnetic fields (MRI).

NOTES: This device and its accessories are not intended for home use.

If you use sterilizable paddles, confirm that they have not reached the end of their sterility before using in an event. See the sterilizable paddles' *Instructions for Use*.

Keep your Efficia DFM100 Lithium Ion battery charged and a spare battery nearby.

If a daylight saving time change occurs between the start and end of an event, the timestamps for that event are not adjusted. The next event does use the adjusted time.

The Efficia DFM100 does not require the practice of any special ElectroStatic Discharge (ESD) precautionary procedures.

4

ECG Monitoring

Overview

This chapter describes the Efficia DFM100's basic ECG and arrhythmia monitoring functions. The device uses Philips' ST/AR Algorithm for ECG analysis.

You can use the Efficia DFM100 to monitor your patient's ECG through:

- multifunction electrode pads.
- 3- or 5-lead ECG monitoring electrode sets.
- external paddles (for quick assessment only, not continuous monitoring).

If both pads and monitoring electrodes are connected, the Efficia DFM100 allows you to select a lead to monitor from either source.

Configurable heart rate and arrhythmia alarms clearly communicate patient status, both audibly and visually.

You can use the Efficia DFM100 to monitor both adult and infant/child ECGs. Use the Patient Category  button to switch categories.

When pressing the Patient Category button, all parameter alarm limits change to the new patient category. These changes are retained when you switch modes.

- For patients that are ≥ 25 kg or ≥ 8 years old, use the Adult patient category.
- For patients <25 kg or < 8 years old, use the Infant/Child patient category.

ECG waveforms can be acquired through the Therapy port for pads/paddles or the ECG Monitoring port for 3- or 5-lead sets. When you are using 3-lead ECG monitoring, only one ECG lead vector is available. If you are using 5-lead ECG monitoring, up to three ECG lead vectors are available at the same time for display.

WARNINGS: When monitoring neonatal ECGs, inaccurate measurements and alarms could result because of differences in the characteristics of the adult ECG compared to the neonatal ECG.

When an external pacemaker is being used on a patient, arrhythmia monitoring is severely compromised due to the high energy level in the pacer pulse. This may result in the arrhythmia algorithm's failure to detect pacemaker non-capture or asystole.

During complete heart block or pacemaker failure (to pace or capture) tall P-Waves (greater than 1/5 of the average R-Wave height) may be erroneously counted by the arrhythmia algorithm, resulting in missed detection of cardiac arrest.

Algorithms in the Efficia DFM100 use the currently set internal Paced Status during rhythm analysis. If the Paced Status is set to unknown, the algorithm uses Paced. In order to get a more accurate rhythm analysis, confirm that the patient's paced status is set correctly.

Preparing to Monitor ECG

You can monitor ECG through multifunction electrode pads or ECG electrodes and do a quick look with external paddles.

NOTE: If monitoring for an extended period of time, monitoring electrodes and multifunction electrode pads may need to be changed periodically. Refer to the manufacturer's documentation for how often to replace the monitoring electrodes or pads.

Skin Preparation

Skin is a poor conductor of electricity so proper skin preparation is important to achieving good electrode/pad-to-skin contact.

To prepare the skin:

1. Identify the appropriate locations:
   For pads – see the pads package.
   For electrodes – see "Electrode Placement" on page 49.
2. If necessary, clip hair at the site or shave if needed.
3. Clean and abrade skin at the site.
4. Dry the site briskly to increase capillary blood flow in the tissues and to remove oil and skin cells.

Monitoring ECG with Pads

To monitor ECG through multifunction electrode pads:

1. If not preconnected, connect the Therapy cable to the Efficia DFM100 as described in "Connecting the Therapy Cable" on page 9.
2. Connect the pads to the Therapy cable as described in "Connecting Multifunction Electrode Pads" on page 10.
3. Prepare the skin. See "Skin Preparation" on page 48
4. Apply the pads to the patient as described on the pads package.

Monitoring ECG with Electrodes

To monitor ECG through electrodes:

1. Prepare the skin. See "Skin Preparation" on page 48.
2. Attach the snaps or grabbers to the electrodes before placing them on the patient.
3. Apply electrodes by peeling them, one at a time, from the protective backing and sticking them firmly to the patient's skin. Press around the entire edge of each electrode to ensure they are secure. Make sure the lead wires do not pull on the electrodes. See "Electrode Placement" for proper electrode locations.
4. If not preconnected, connect the ECG cable as described in "Connecting the ECG Cable" on page 11.

WARNING: Be sure the electrodes do not come in contact with other conductive material, especially when connecting or disconnecting the electrodes to/from the patient.

NOTE: Use only approved lead-sets with the Efficia DFM100. Failure to do so may introduce noise and result in intermittent **Cannot Analyze ECG** messages.

Electrode Placement

Figure 39 shows the typical electrode placement for a 3-lead ECG set.

Figure 39 **3-Lead Placement**

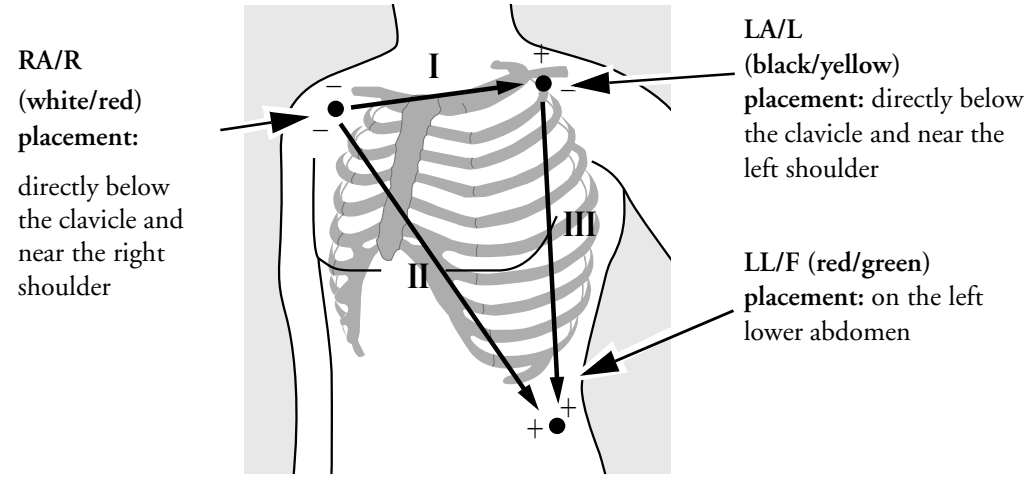
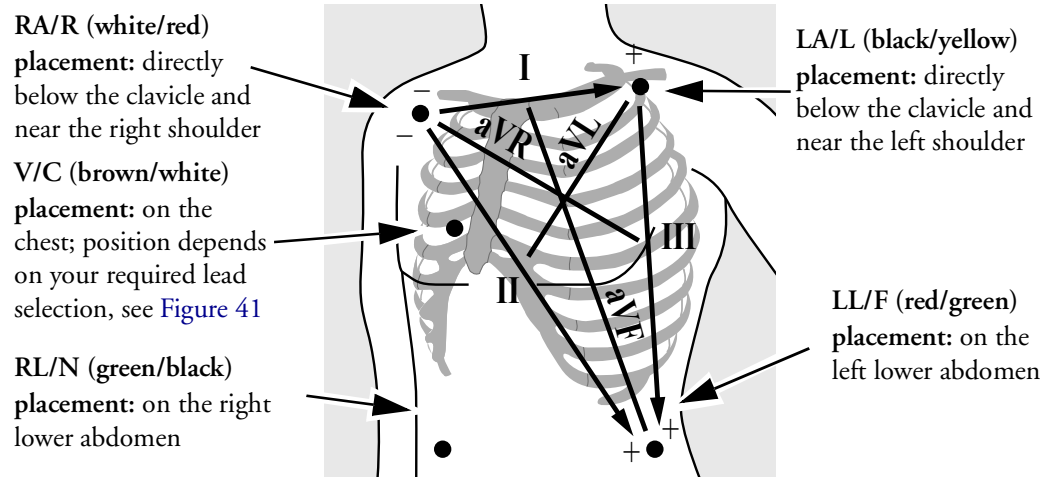


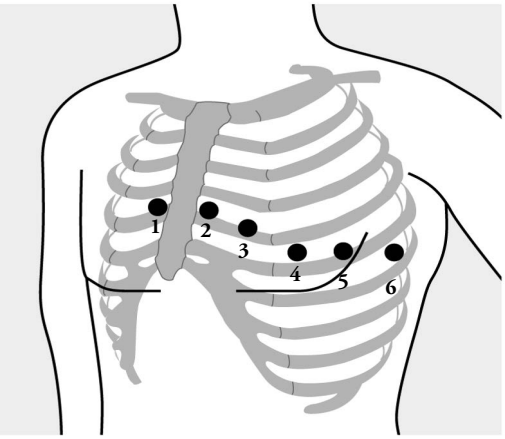
Figure 40 shows the typical electrode placement for a 5-lead ECG set.

Figure 40 **5-Lead Placement**



The single V/C lead may be placed in any of the precordial electrode positions as shown in Figure 41 (V1/C1 through V6/C6).

Figure 41 **V/C Electrode Placement**



V/C 1 placement: fourth intercostal space at right sternal margin

V/C 2 placement: fourth intercostal space at left sternal margin

V/C 3 placement: midway between V/C 2 and V/C 4

V/C 4 placement: fifth intercostal space at left midclavicular line

V/C 5 placement: same level as V/C 4 on anterior axillary line

V/C 6 placement: same level as V/C 4 at left mid axillary line

NOTES: No matter which V/C electrode placement you select, it appears as V on the Efficia DFM100.

If using a V electrode, it can act as a reference electrode if the RL electrode is unavailable.

For accurate V/C lead placement and measurement, it is important to locate the fourth intercostal space.

To locate the fourth intercostal space:

1. Locate the second intercostal space by first palpitating the Angle of Lewis (small bony protuberance where the body of the sternum joins the manubrium). This rise in the sternum is where the second rib is attached, and the space just below this is the second intercostal space.
2. Palpate and count down the chest until you locate the fourth intercostal space.

Lead Selection

It is important to select a suitable lead for monitoring so that a QRS complex can be accurately detected.

For non-paced patients:

- QRS complex should be tall and narrow (recommended amplitude > 0.5 mV).
- R-Wave should be above or below the baseline but not biphasic.
- P-Wave should be smaller than 1/5 R-Wave height.
- T-Wave should be smaller than 1/3 R-Wave height.

NOTE: To prevent detection of P-Waves or baseline noises as QRS complexes, the minimum detection level for QRS complexes is set at 0.15 mV, according to AAMI-EC 13/YY1079 specifications. If the ECG signal is too weak, you may get false alarms for asystole.

For paced patients with internal/transvenous pacemakers:

- Confirm paced status is set correctly on the Efficia DFM100. See "Entering Patient Information" on page 42.
- All four criteria for non-paced patients listed above.

- Large enough to be detected (half the height of the QRS complex), with no re-polarization artifact. Some unipolar pacemakers display pace pulses with re-polarization tails which may be counted as QRSs in the event of cardiac arrest or other arrhythmias. Choose a lead to minimize the size of re-polarization tails.

NOTE: Adjusting the ECG wave size on the display does not affect the ECG signal which is used for arrhythmia analysis.

Lead Choices

Available monitoring leads vary depending on what type of ECG cable is connected to the Efficia DFM100 and its configuration. See Table 8.

Table 8 **Lead Choices**

If you are using	These leads are available
a 3-Lead ECG set	I, II, III
a 5-Lead ECG set	I, II, III, aVR, aVL, aVF, V

To select leads to display on the Efficia DFM100, see "Selecting the Waveform" on page 52.

WARNING: Avoid touching monitoring electrodes and other measuring devices when they are applied to the patient. Doing so can degrade safety and may affect results.

CAUTIONS: Beware of patient cables, including ECG monitoring equipment when used with high frequency surgical equipment.

Line isolation monitor equipment may produce power line transients that may resemble actual cardiac waveforms and thus inhibit heart rate alarms. Keep electrode wires and cables away from power cords to minimize this problem.

Conductive parts of electrodes and associated connectors for applied parts, including the neutral electrode, should not contact other conductive parts including earth.

NOTES: Signals from TENS or ESU units can cause artifact.

For patients who exhibit intrinsic rhythm only, the risk of missing cardiac arrest may be reduced by monitoring these patients with low heart rate limit at or slightly above the basic/demand pacemaker rate. A low heart rate alarm alerts you when the patient begins pacing. Proper detection and classification of the paced rhythm can then be determined.

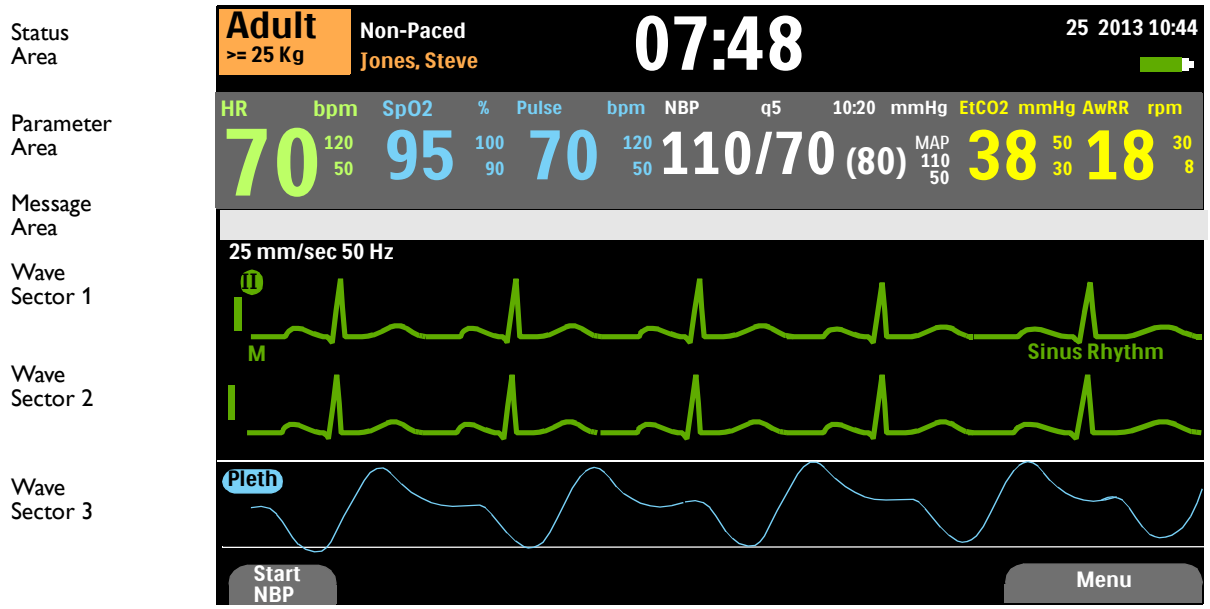
When using the ECG Analog Output, detected internal pacemaker pulses are inserted into the output as pulses of less than 3.5 ms in width when measured at 50% of the peak of the pulse. The amplitude of the inserted pulse is >40% and <70% of the detected pacemaker pulse amplitude for pulses widths of 0.5 ms to 2.0 ms.

Monitor View

You primarily monitor your patient's ECG waveform in Monitor View by turning the Therapy knob to Monitor.

In Monitor View, you can review three waves simultaneously while monitoring all current vital sign parameters. See Figure 42.

Figure 42 **Monitor View Layout**



Selecting the Waveform

The Efficia DFM100 allows you to configure the lead displayed as the primary ECG lead in Wave Sector 1 when the device is turned on. The factory default is Lead II. See "Waves Settings" on page 147.

When you first turn the Efficia DFM100 on in Manual Defibrillation, Synchronized Cardioversion or Monitor modes or switch into one of those modes, the default lead is displayed in Wave Sector 1. If the default lead is not available or is of poor quality, the device automatically searches for the ECG lead with the best quality and displays that new lead in Wave Sector 1. The device searches for an active ECG source in the following order: default lead, II, Pads (or Paddles), I, III.

You can also change the waveform for each sector during a patient event. How to change a waveform differs depending if you are in AED mode or not.

Non-AED Mode

The ECG wave for Wave Sector 1 is selected through the Lead Select button  (see "General Function Buttons" on page 27) or through the **Displayed Waves** menu. The waves for Wave Sectors 2 and 3 are selected through the **Displayed Waves** menu only.

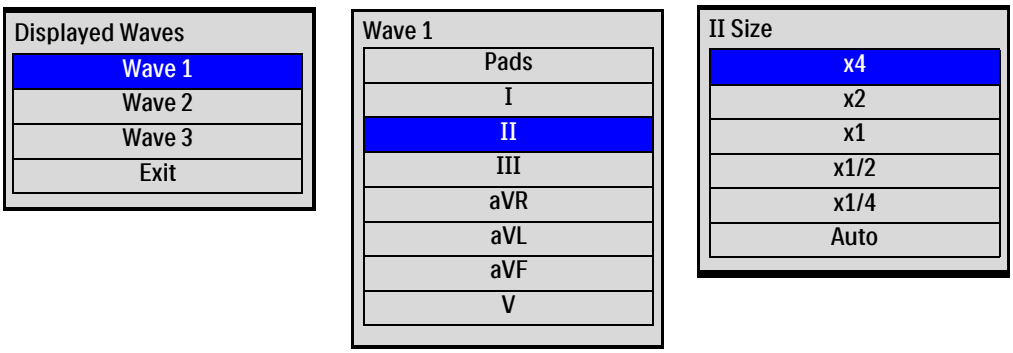
To select a waveform using the Displayed Waves menu:

1. Press the Smart Select knob.
2. Turn the Smart Select knob to highlight **Displayed Waves** and press the Smart Select knob (see Figure 43).
3. Select the wave sector you want to modify and press the Smart Select knob.
4. Select the new wave type you want and press the Smart Select knob.

5 If needed, select the appropriate ECG wave size and press the Smart Select knob.

NOTE: When you select the ECG wave size for a certain lead, all instances of that lead adjust to the selected size. For example, if you have Lead II selected for both Wave Sectors 1 and 2, and you change the size in Wave Sector 1, Wave Sector 2's size changes automatically.

Figure 43 **Wave Menus**



NOTES: Selecting the Auto size, automatically adjusts the ECG size to the maximum size allowed without clipping the wave sector.

Adjusting the ECG wave size on the display only affects the wave size on the display for viewing. It does not affect the ECG signal used for arrhythmia analysis. Detected R-Waves for Synchronized Cardioversion and Demand Pacing are also unaffected by the ECG wave size.

In AED Mode

The Pads ECG wave is automatically populated in Wave Sector 1 in AED mode. The waves configured for use in AED mode are placed in Wave Sector 2 using the Smart Select knob.

To select a waveform for Wave Sector 2 in AED mode:

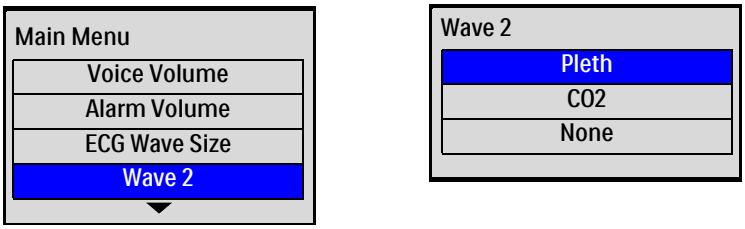
1 Confirm your device is configured to monitor CO_2 and/or SpO_2 in AED mode.

2 From AED mode, press the Smart Select knob.

3 Turn the Smart Select knob to highlight Wave 2 and press the Smart Select knob.

4 Select the wave you want placed in Wave Sector 2 and press the Smart Select knob.

Figure 44 **Wave 2 Menu in AED mode**



Dashed Lines

A dashed line on your ECG display indicates that you have an invalid ECG signal in the wave sector. You can either troubleshoot the currently selected lead to solve the problem (see Table 54 “ECG Problems” on page 177) or select a different lead.

To replace a dashed line with a different lead:

In Wave Sector 1 - use the Lead Select button to cycle through available leads and select an appropriate lead.

OR

Use the displayed wave menu to select an appropriate lead.

NOTE: When using a 3-Lead cable, dashed lines will briefly occur with a change of the selected lead.

Displaying an Annotated ECG

You may choose to display an annotated ECG with arrhythmia beat labels in Wave Sector 2. The same ECG source appearing in Wave Sector 1 is displayed in Wave Sector 2 with a six-second delay. **Delayed** appears near the waveform. White arrhythmia beat labels also appear. See Table 9 for beat label classifications.

Table 9 **Arrhythmia Beat Labels**

Label	Description	Where Displayed
N	Normal	Above QRS
V	Ventricular Ectopic	
P	Paced	
L	Learning Patient’s ECG	
?	Insufficient information to classify beats	
'	Pacer Spike	Above waveform, where pacer spike was detected (If the patient is both atrially and ventricularly paced, the display shows two marks above the waveform aligned with the atrial and ventricular pacing.)
"	Biventricular Pace Pulse	Above waveform where the biventricular pace pulse was detected
A	Artifact (noisy episode)	Above waveform where noise was detected
I	Inoperative condition (for example, a lead is off)	Above waveform; at start of a technical alarm, every second of the alarm and at the end
M	Pause, Missed Beat, No QRS	Above waveform where condition was detected

To display an annotated ECG:

1. Press the Smart Select knob.
2. Turn the Smart Select knob to highlight **Displayed Waves** and press the Smart Select knob.
3. Select **Wave 2** and press the Smart Select knob.
4. Select **Annotated ECG** and press the Smart Select knob.

Arrhythmia Monitoring

The Efficia DFM100 uses the ST/AR Algorithm. Arrhythmia analysis provides information on your patient's condition, including heart rate and arrhythmia alarms. The Efficia DFM100 uses the ECG lead appearing in Wave Sector 1 for single-lead arrhythmia analysis.

During arrhythmia analysis, the monitoring function continuously:

- Optimizes ECG signal quality to facilitate arrhythmia analysis. The ECG signal is continuously filtered to remove baseline wander, muscle artifact and signal irregularities. Also, if the patient's paced status is set to yes, pace pulses are filtered out to avoid processing them as QRS beats.
- Measures signal features such as R-Wave height, width and timing.
- Creates beat templates and classifies beats to aid in rhythm analysis and alarm detection.
- Examines the ECG signal for ventricular arrhythmias and asystole.

NOTE: Because the ST/AR Algorithm is the Efficia DFM100's cardiotach source and is needed to generate heart rate and heart rate alarms, the algorithm can never be disabled. However, if desired, arrhythmia and heart rate alarms can be turned off. See "Setting Alarms" on page 59.

ST/AR cardiotach and alarms, when activated, also work in AED mode for ECG monitoring.

Aberrantly-Conducted Beats

As P-Waves are not analyzed, it is difficult and sometimes impossible for the algorithm to distinguish between an aberrantly-conducted supraventricular beat and a ventricular beat. If the aberrant beat resembles a ventricular beat, it is classified as a ventricular beat. You should always select a lead where the aberrantly-conducted beats have an R-Wave that is as narrow as possible to minimize incorrect classifications.

Intermittent Bundle Branch Block

Bundle branch and other fascicular blocks create a challenge for the arrhythmia algorithm. If the QRS complex changes considerably from the learned normal due to bundle branch block, the blocked beat may be incorrectly identified as ventricular, and may cause false PVC alarms. You should always select a lead where bundle branch block beats have an R-Wave that is as narrow as possible to minimize incorrect classifications.

Arrhythmia Learning/Relearning

When arrhythmia monitoring starts, a "learning" process is initiated. The goal is to learn the patient's normal complexes and/or paced complexes (if the patient with an internal/transvenous pacemaker is in paced rhythm). The learning process involves the first 15 valid (non-noisy) beats encountered during the learning phase.

The QRS selected to represent the "normal" complex includes the beat that is the most frequently seen, narrowest, on-time beat. For this reason, learning should not be initiated when the patient's rhythm is primarily ventricular.

Arrhythmia learning/relearning automatically occurs when:

- The Therapy knob is turned to Monitor, Pacer, AED or a Manual Defibrillation setting.
- Any time there is a change in the lead selection for Wave Sector 1.
- After the correction of a leads or pads off condition that has been active longer than 60 seconds.

Initiate manual relearning if the beat detection is not occurring or if beat classification is incorrect and results in a false alarm. Remember if the same signal condition which caused the algorithm to

perform poorly still exists, relearning does not correct the problem. The problem can only be corrected by improving the signal quality (e.g., selecting a different lead).

To initiate relearning manually:

1. Press the Smart Select knob.
2. Turn the Smart Select knob to highlight **Measurements/Alarms** and press the Smart Select knob.
3. Select **HR/Arrhythmia** and press the Smart Select knob.
4. Select **Relearn Rhythm** and press the Smart Select knob.

Learning ECG and **Learning Rhythm** messages appear in the bottom portion of Wave Sector 1.

WARNINGS: If arrhythmia relearning takes place during a ventricular rhythm or during a period of poor ECG signal quality, ectopic beats may be incorrectly learned as the normal QRS complex. This may result in missed detection of subsequent events of V-tach and high PVC rates. For this reason you should:

- Take care to initiate arrhythmia relearning only when the ECG signal is noise-free.
- Be aware that arrhythmia relearning can happen automatically.
- Respond to any messages (e.g., if you are prompted to reconnect electrodes).
- Display an annotated wave to ensure the beat labels are correct.

Pacemaker Pulse Rejection: When arrhythmia monitoring paced patients who exhibit only intrinsic rhythm, the monitor may erroneously count paced pulses as QRS complexes when the algorithm first encounters them, resulting in missed detection of cardiac arrest. Be sure that the paced status is set correctly on the device.

Some pace pulses can be difficult to reject. When this happens, the pulses are counted as a QRS complex, and could result in incorrect HR and failure to detect cardiac arrest or some arrhythmias. Keep pacemaker patients under close observation. See Chapter 19 “Specifications” on page 193 for details on Pacemaker Pulse Rejection Capability.

NOTE: It is important to set the patient’s correct paced status in order to optimize ECG analysis.

Heart Rate and Arrhythmia Alarms

The Efficia DFM100 detects HR and arrhythmia alarm conditions by comparing ECG data to a set of pre-defined criteria. An alarm can be triggered by a rate exceeding a threshold (e.g., HR > configured limit), an abnormal rhythm (e.g., Ventricular Tachycardia) or an ectopic event (e.g., PVC > configured limit).

HR/Arrhythmia alarms can be generated for the conditions shown in Tables 10 and 11. Once generated, they appear as alarm messages in the HR alarm status area above the HR numeric. When ECG alarms are off an **ECG Alarms Off** message appears above the HR numeric. There are both audio and visual alerts. For more information on alarms, see “Alarms” on page 37.

NOTE: Alarm notification is configurable. See “Alarm Management” on page 39.

Table 10 **HR/Arrhythmia Physiological Alarms**

Alarm Message	Condition	Type of Alarm	Indication
Asystole	No detectable beats for four seconds in the absence of V-Fib.	High Priority Latching Alarm	Red Alarm message with alarm tone
VFib/VTach	A fibrillatory wave detected for four seconds.		
VTach	Consecutive PVCs and HR exceed configured limits.		
Extreme Brady	Extreme Brady - 10 bpm below HR low limit, capped at 30 bpm.		
Extreme Tachy	Extreme Tachy - Adult: 20 bpm above HR High limit, up to 180 bpm, 200 bpm for limits between 180-200. Extreme Tachy - Infant/Child: 20 bpm above HR High limit, up to 220 bpm, 240 bpm for limits between 220-240. For higher rates, the limit is equal to the HR High limit.		
Pacer Not Capture	No QRS following internal pacer pulse.	Medium Priority Latching Alarm	Yellow Alarm message with alarm tone
Pacer Not Pace	No QRS or pacer internal pulse detected.		
PVC > /min. (detected rate > limit)	The number of detected PVCs in a minute exceed the limit.	Medium Priority Latching Configurable Alarm	
HR High	The HR exceeds the configured HR High limit.		
HR Low	The HR is below the configured HR Low limit.		

NOTE: The high HR alarm condition is not detected when the HR High limit is configured greater than the maximum Extreme Tachy threshold. You get the Extreme Tachy alarm. The low HR alarm condition is not detected when the HR Low limit is configured less than or equal to the minimum Extreme Brady threshold.

Table 11 **HR/Arrhythmia Technical Alarms**

Alarm Message	Condition	Type of Alarm	Indication
Leads Off Pads Off Paddles Off	The multifunction electrode pad/paddles or leads used as the source for Wave Sector 1 during Synchronized Cardioversion may be disconnected or not attached securely.	High Priority Non-Latching Alarm	Red Alarm message with alarm tone
Cannot Analyze ECG	ECG data in Wave Sector 1 cannot be analyzed – an electrode used is disconnected/not attached securely.		
	The analyzing algorithm cannot analyze the ECG signal.		
ECG Equipment Malfunction	A malfunction has occurred in the ECG hardware.		
Pads ECG Equipment Malfunction	A malfunction has occurred in the Pads ECG hardware.		
Therapy Disabled: Run Op Check	Therapy is disabled due to an equipment failure.		

Figure 45 **Basic Mode Arrhythmia Alarm Priority Chain**

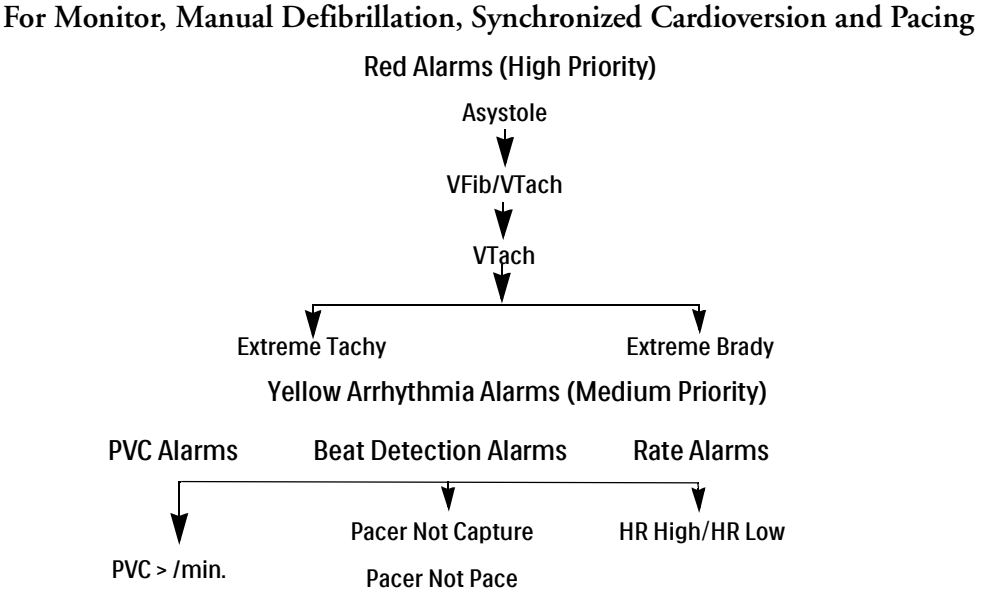
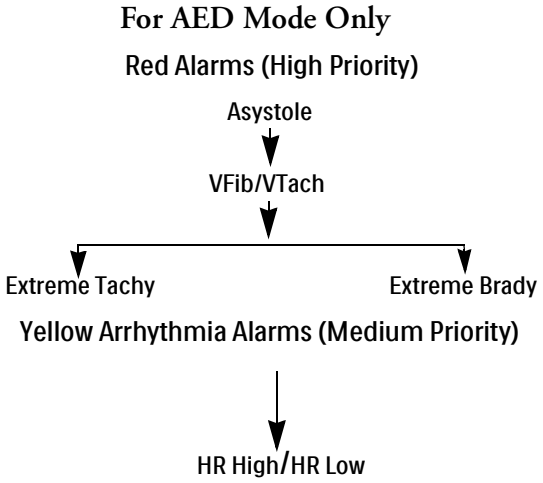


Figure 46 **Cardiotach Mode Arrhythmia Alarm Priority Chain**



Setting Alarms

Alarm settings for Heart Rate (HR), VTach and PVC Rate Limit for the current patient event can be changed via the Smart Select knob during the event. Settings for other HR and arrhythmia alarms may not be changed.

Changing Alarm Limits

To change HR, VTach or PVC Rate Limits:

1. Press the Smart Select knob.
2. Turn the Smart Select knob to highlight **Measurements/Alarms,** and press the Smart Select knob.
3. Select **HR/Arrhythmia,** and press the Smart Select knob.
4. Select the limit you want to adjust, and press the Smart Select knob.
5. Select the new value, and press the Smart Select knob.

Enabling/Disabling Alarms

To enable/disable the HR and Arrhythmia alarms:

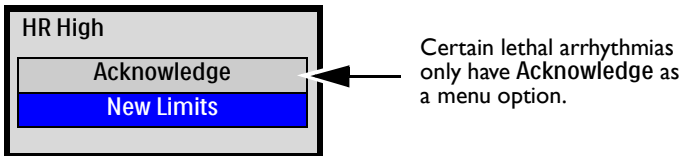
1. Press the Smart Select knob.
2. Turn the Smart Select knob to highlight **Measurements/Alarms,** and press the Smart Select knob.
3. Select **HR/Arrhythmia,** and press the Smart Select knob.
4. Select **Alarms On** (**Alarms Off**), and press the Smart Select knob.

Responding to Alarms

When an alarm occurs, the audio pause label appears above the Smart Select knob. Press the knob to silence the alarm audio while you attend to the patient. The alarm sounds again if the condition continues to exist beyond the configured alarm pause period or another alarm condition occurs.

After pausing the audio on the Efficia DFM100, attend to the patient and press the Smart Select knob to acknowledge the alarm condition. If required, adjust the alarm limits using the Smart Select knob.

Figure 47 **Sample Alarm Response Menu**



HR/Arrhythmia Alarms in AED Mode

If alarms are turned on in AED mode, all Technical Alarms listed in Table 11 and the following Physiological Alarms from Table 10 are generated when the condition exists:

- Asystole
- Extreme Tachy
- HR High
- VFib/VTach
- Extreme Brady
- HR Low

For more information on AED mode, see “AED Mode Option” on page 61.

For more information on Alarms, see “Alarms” on page 37.

Troubleshooting

If your Efficia DFM100 does not operate as expected during ECG and Arrhythmia monitoring, see “ECG Problems” on page 177.

5

AED Mode Option

Defibrillation therapy is the definitive method for termination of lethal arrhythmias. The Efficia DFM100's optional Semi-Automated External Defibrillation (AED) mode is designed to guide you through standard treatment algorithms for cardiac arrest. If your device has this option, the Efficia DFM100 provides therapy through the application of a brief biphasic pulse of current to the heart. This energy is transferred through disposable multifunctional pads applied to the patient's bare chest.

This chapter describes how to use AED mode. It explains the voice and visual prompts that guide you through the defibrillation process and describes how prompts vary depending upon the condition of the patient and the configuration of your device. Configuration choices allow you to customize AED mode to better meet the unique needs of your institution or resuscitation team.

The Efficia DFM100 uses Philips' SMART Analysis algorithm as the basis for making a shock decision in AED mode. The SMART Analysis algorithm was designed to make aggressive shock decisions concerning ventricular fibrillation. Because ventricular tachycardia rhythms may have an associated pulse, SMART Analysis is more conservative when making shock decisions with these rhythms.

In AED mode you can also monitor the patient's ECG, SpO_2, pulse, $EtCO_2$ and AwRR. Certain ECG alarms can also be displayed in AED mode. Even though ECG alarms, which are obtained through the ST/AR Algorithm, can be viewed in AED mode, the SMART Analysis algorithm is used as the only basis for determining a shock. See "Other Alarms in AED Mode" on page 73.

AED mode can be used on both adult and infant/child patients. Use the Patient Category  button to switch categories.

When pressing the Patient Category button, all parameter alarm limits change to the new patient category. These changes are retained when you switch modes.

- For patients that are ≥ 25 kg or ≥ 8 years old, use the Adult patient category.
- For patients <25 kg or < 8 years old, use the Infant/Child patient category.

For information on annotating, storing, exporting and printing event information acquired in AED mode, see "Data Management" on page 125.

For guidance on setting AED configuration choices, see "AED Settings" on page 148.

Optional CO_2, AwRR, SpO_2 and Pulse monitoring are also available in AED mode. For more information, see:

- "CO_2 and AwRR" on page 73
- "SpO_2 and Pulse" on page 73
- Chapter 9 "Monitoring CO_2" on page 97
- Chapter 10 "Monitoring SpO_2" on page 107

Precautions for AED Therapy

WARNINGS: The AED algorithm is not designed to handle erratic spiking problems caused by a properly or improperly functioning pacemaker. In patients with cardiac pacemakers, the Efficia DFM100 may have reduced sensitivity and not detect all shockable rhythms.

Use only pads that are approved for use with the Efficia DFM100. Use of non-approved pads could affect performance and results. See Table 61 "Approved Supplies and Accessories" on page 189 for a list of supported pads.

For adults in AED mode, the multifunction electrode pads must be in the anterior-anterior position shown on the packaging. For infant/child patients, the pads can be in the anterior-posterior position.

Do not allow multifunction electrode pads to touch each other or to touch other ECG monitoring electrodes, lead wires, dressings, etc. Contact with metal objects may cause electrical arcing and patient skin burns during defibrillation and may divert current away from the heart.

During defibrillation, air pockets between the skin and multifunction electrode pads may cause patient skin burns. To help prevent air pockets, make sure the pads completely adhere to the skin. Do not use dried out pads. Do not open pads package until just prior to use.

Never touch the patient or any equipment connected to the patient (including the bed or gurney) during analysis and defibrillation.

Avoid contact between the patient and conductive fluids and/or metal objects such as the gurney.

Medical electrical equipment which does not incorporate defibrillator protection should be disconnected before defibrillation.

NOTES: Successful resuscitation depends on many variables specific to the patient's physiological state and the circumstances surrounding the patient event. Failure to have a successful patient outcome is not a reliable indicator of defibrillator/monitor performance. The presence or absence of muscular response to the transfer of energy during electrical therapy is not a reliable indicator of energy delivery or device performance.

Impedance is the resistance found between the defibrillator's pads when applied to the patient's body the device must overcome to deliver an effective discharge of energy. The degree of impedance differs from patient to patient and is affected by several factors including the presence of chest hair, moisture, lotions, or powders on the skin. The low-energy SMART biphasic waveform is an impedance-compensating waveform that is designed to be effective across a wide range of patients. However, if you receive a **Shock Aborted** message on the display, check that the patient's skin has been washed and dried and that any chest hair has been clipped. If the message persists, change the pads and/or Therapy cable.

The SMART Analysis algorithm detects internal pacemaker pulses that are 2.5 ms or less in duration and removes these pulses so that they are not counted by the algorithm.

Perform all routine diagnostic tests to verify that voice prompts are operational during the operational check and according to your organization's protocol.

AED View

When the Therapy knob is moved to AED, AED View is displayed (see Figure 48). AED mode-related information includes:

AED Message Area: Displays important messages for the user while in AED mode.

Shock Counter: Displays the number of shocks for the current event (including shocks delivered in Manual Defibrillation mode).

Delivered Energy: Displays the energy amount that was delivered for the most recent shock. Replaces the Shock Counter for 15 seconds after the shock is delivered.

Selected Energy: Displays the configured energy for the current patient category.

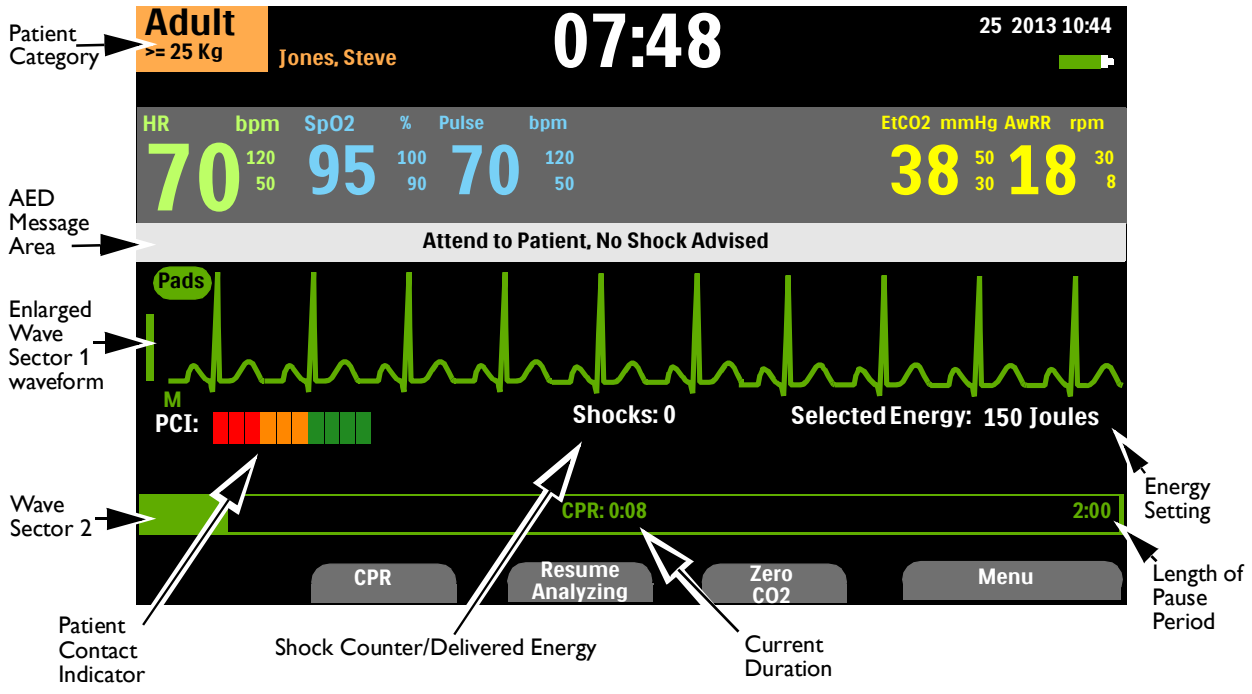
Wave Sector 2: Displays the Capnogram or the SpO_2 waveform depending upon which combinations of options you have configured (see Table 43 on page 148) or the AED Pause/CPR Progress Bar.

Patient Contact Indicator: Graphical representation of the contact quality between the patient and the multifunction electrode pads. Orange or red lights on the PCI indicate poor patient contact. Adjust pads to optimize patient contact. Multiple green lights on the PCI indicate good contact is established. The PCI is displayed when pads are attached and the device is charging or is charged. It is not displayed when using paddles. When using paddles, use the PCI on the paddles as a patient contact indicator.

AED Pause/CPR Progress Bar: When in use, replaces the wave in Wave Sector 2 and tracks the progress of the analysis pause and CPR periods.

Patient Category: Displays the current patient category. The patient category triggers specific alarm limits and AED energy settings for defibrillation. The background color changes with the selected patient category for Adult (orange) and Infant/Child (blue).

Figure 48 **AED View Layout**



NOTE: Only the ECG acquired through multifunction electrode pads is displayed in AED mode.

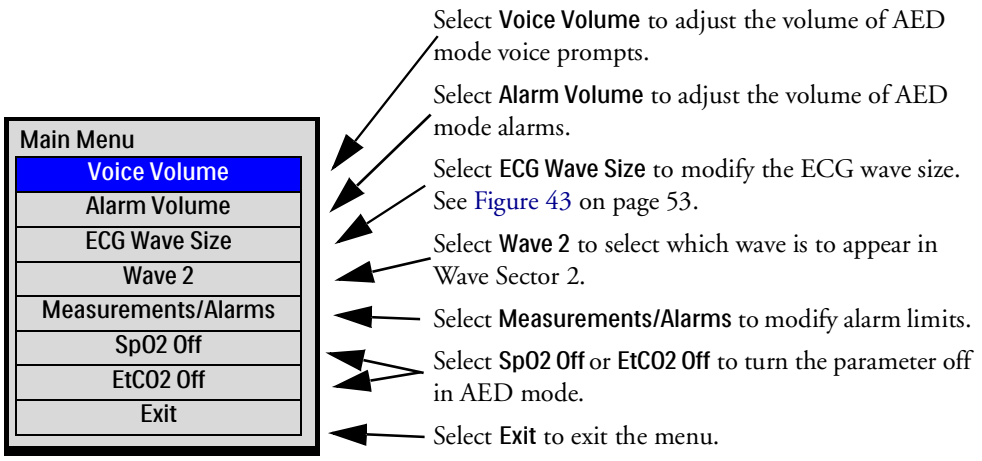
AED Soft Keys

AED mode has multiple soft keys available for use (see Figure 48):

- **CPR** - Pressing the **[CPR]** soft key initiates the configured pause period to perform CPR.
- **Resume Analyzing** - Pressing the **[Resume/Analyzing]** soft key initiates the AED analysis algorithm to resume or restart analysis.
- **Zero CO2** - Available if you have the CO_2 option installed and AED CO_2 monitoring enabled. Pressing the **[Zero CO2]** soft key zeros the sensor.
- **Background Analysis** - This key is available if your device is configured for No Shock Advised (NSA) Monitoring and you have activated NSA Pause. Press it to begin NSA monitoring.

Pressing the Smart Select knob brings up the main menu for AED mode. See Figure 49.

Figure 49 **AED Main Menu**



NOTE: SpO_2 **Off** and $EtCO_2$ **Off** will not display as menu options if they are not configured to be available in AED mode.

For more information on menus, see "Menus" on page 35.

NOTE: In loud environments, use the display prompts in addition to the voice prompts.

Using AED Mode to Defibrillate

Preparation

◎ **To prepare for defibrillation in AED mode:**

1. Confirm the patient is:
   - Unresponsive
   - Not breathing
   - Pulseless
2. Expose patient's bare chest. Wipe moisture from the patient's chest and, if necessary, clip or shave excessive chest hair.

3 Check the expiration date on the pads package and inspect the package for any damage.

4 Connect the Therapy cable to the Efficia DFM100 (see "Connecting the Therapy Cable" on page 9).

5 If the pads are not expired and package is undamaged, open the package and connect the pads connector to the end of the Therapy cable (see "Connecting Multifunction Electrode Pads" on page 10).

6 Apply the pads to the patient as directed on the pads packaging or according to your organization's protocol.

CAUTION: Aggressive handling of multifunction electrode pads in storage or prior to use can damage the pads. Discard the pads if they become damaged.

Operation

To operate the Efficia DFM100 in AED mode:

1 Turn the Therapy knob to AED. The Efficia DFM100 announces and displays the current patient category.
If not correct, use the Patient Category button to select the appropriate patient category.
- For patients that are ≥ 25 kg or ≥ 8 years old, use Adult patient category.
- For patients <25 kg or < 8 years old, use Infant/Child patient category.

2 Follow the voice and screen prompts.

3 Press the orange Shock button if prompted.

See the following sections for more information.

NOTE: While operating in AED mode, the capabilities of the device are limited to those essential to the performance of semi-automated external defibrillation. Only the ECG acquired through pads is displayed. If you have the CO_2 and/or SpO_2 option, based on your configuration, the numeric and related waveform is also displayed in AED mode. Previously set alarms and scheduled NBP measurements are indefinitely paused and entry of patient information (with the exception of patient category) is disabled. Additionally, the Sync, Lead Select and Alarm Pause buttons are inactive.

Step 1 - Turn the Therapy Knob to AED

When the Efficia DFM100 is turned to AED, it announces and displays the patient category.

Confirm you have the correct category active for the patient. If not, use the Patient Category button to select the correct category.

The device also checks to see if the Therapy cable and multifunction electrode pads are properly connected. If the:

- Therapy cable is not properly attached, you are prompted to "Plug in Connector" with a Connect Pads Cable prompt and graphic illustration on the screen.
- Multifunction electrode pads are not connected to the Therapy cable, pads are not applied to the patient or pads are not making proper contact with the patient's skin, you are prompted to "Insert connector firmly. Apply pads."

Follow the audio and visual prompts to correct the issues. When properly connected, AED mode automatically begins shock analysis. If the patient category is changed when shock analysis is in progress, you do not need to abort the analysis in progress and restart a new one. The algorithm is not sensitive to patient category.

Step 2 - Follow Screen and Voice Prompts

Once an ECG is detected through the multifunction electrode pads, the Efficia DFM100 warns you not to touch the patient and automatically analyzes the patient's heart rhythm.

NOTE: The AED algorithm only looks at the ECG for analysis. It does not use any other data, even if the option is active in AED mode.

WARNING: Handling or transporting the patient during ECG rhythm analysis can cause an incorrect or delayed diagnosis. Under these circumstances, if the Efficia DFM100 issues a "Shock Advised" command, keep the patient as still as possible for at least 10 seconds so the device can reconfirm the rhythm analysis before pressing the orange Shock button to deliver a shock.

The AED mode algorithm can return one of the following results:

- **Shock Advised** - If a shockable rhythm is detected, the Efficia DFM100 automatically charges to the preconfigured Joule setting (default is 150J) if the Adult patient category is selected (see "AED Settings" on page 148) or 50 J if in the Infant/Child category. Charging is accompanied by voice and screen prompts. When the device is fully charged, a steady high-pitched tone sounds, and the orange Shock button flashes.

  Heart rhythm analysis continues while the Efficia DFM100 charges. If a rhythm change is detected before the shock is delivered, and a shock is no longer appropriate, the defibrillator disarms itself.

NOTE: When fully charged, you can disarm the device at any time by turning the Therapy knob off the AED position. Resume AED monitoring by turning the Therapy knob back to AED.

- **No Shock Advised (NSA)** - If a shockable rhythm is not detected, the Efficia DFM100 tells you "No shock advised." Follow your institution's protocol for a No Shock Advised alert. The device's next steps are determined by the No Shock Advised Action configuration choice. If the configuration is set to:

  - **Monitor** - The Efficia DFM100 monitors the ECG and automatically resumes analysis if a potentially shockable rhythm is detected. You are periodically prompted to press **[CPR]** and to begin CPR if CPR is indicated. The frequency of these prompts is defined in the Monitor Prompt Interval configuration choice. You may press **[CPR]** to suspend monitoring and administer CPR. The pause period is defined by the CPR Timer configuration choice. See "AED Settings" on page 148.

  - **Pause Time** - Analysis is suspended for the specific period which is defined by the NSA Action configuration choice. You may attend to the patient and administer CPR if indicated. The Pause Status Bar is displayed (see "AED View Layout" on page 63). At the end of the pause period, the Efficia DFM100 resumes analyzing.

- **ECG cannot be analyzed** - If artifact interferes with analysis, the device alerts you and attempts to continue analyzing. If artifact persists and the device announces that the ECG can't be analyzed, it enters a pause period.

  While paused, analysis is suspended. Check that the pads are making proper contact with the patient's skin and minimize movement. Analysis resumes automatically in 30 seconds or when you press the **[Resume Analyzing]** soft key. You should always use the analyze function to determine if a rhythm is shockable.

For more information on AED messages, see "AED Mode User Messages" on page 67.

Step 3 - Press Shock Button if Prompted

Once charging is complete, the Efficia DFM100 prompts you with "Deliver shock now." Make sure no one is touching the patient or anything connected to the patient. Call out clearly and loudly "Stay Clear!' Then press the flashing orange Shock button to deliver a shock to the patient.

WARNINGS: The Shock button must be pressed to deliver a shock. The Efficia DFM100 does not automatically deliver a shock.

Defibrillation current can cause operator or bystander injury. Do not touch the patient or equipment connected to the patient during defibrillation.

Delivery of the shock is confirmed by an **Attend to Patient, Shock Delivered** visual message and the shock counter is updated to reflect the number of shocks given. The defibrillator then announces "**Begin CPR**" and enters the configured CPR Timer period. Prompts may be brief or detailed as defined by the Voice Prompt configuration choice. Analysis begins again at the end of the pause period or when you press the **[Resume Analyzing]** soft key. If you switch to Manual Defibrillation during the CPR Pause period, the device continues the CPR period. If you switch to Monitor or Pacer modes, the CPR Pause period exits.

NOTES: Once prompted to administer the shock, if you do not do so within the configured Auto Disarm time interval, the Efficia DFM100 disarms itself and enters a pause period for CPR. The device resumes analyzing at the end of the pause period or when you press the **[Resume Analyzing]** soft key.

Rhythm monitoring is intended to provide a backup or secondary measure of potentially shockable rhythms in various environments but is not a substitute for being attentive to the patient's state.

AED Mode User Messages

AED mode guides you through the defibrillation process. Depending upon the given situation, voice prompts and display messages are presented to assist you in using the mode. See Tables 12-19.

Table 12 AED Mode Connect Pads Messages

These messages may appear when the Therapy cable is not connected properly to the Efficia DFM100.

Audio Message	Display Text	Condition	User Action
"Plug in Connector."	Connect Pads Cable	The Therapy cable is not connected to the Efficia DFM100.	Securely connect the Therapy cable to the device.
None	Disconnect Paddles Cable	A paddles cable is attached to the Efficia DFM100.	Disconnect the paddles cable and attach the pads Therapy cable.

Table 13 AED Mode Messages

These messages may appear during normal AED mode operation.

Audio Message	Display Text	Condition	User Action
"Adult mode."	Adult >= 25 Kg	The current AED mode patient category is Adult.	None
"Infant/Child mode."	Infant/Child < 25 Kg	The current AED mode patient category is Infant/Child.	None
"Low battery."	See battery icon in upper right of the display.	The Efficia DFM100 battery charge level is low.	Charge the battery or replace it with a charged battery.

Table 14 AED Mode Analysis Related Messages

These messages may appear during AED analysis.

Audio Message	Display Text	Condition	User Action
"Stay clear of patient. Analyzing. Stay clear."	Stay Clear of Patient, Analyzing	ECG analysis is underway.	Do not touch the patient.
"No shock advised."	Attend to Patient, No Shock Advised	ECG analysis has determined the rhythm is not shockable.	Attend to the patient. Begin CPR if indicated.
"Shock advised."	Stay Clear of Patient, Shock Advised	ECG analysis has determined the rhythm is shockable.	Once the device is charged, press the flashing orange Shock button.
"Shock advised, Stay clear."			
"Analyzing Interrupted. Stay clear of patient. Stop all motion."	Stay Clear of Patient, Analyzing Interrupted	ECG analysis was interrupted because of a bad ECG signal.	Stop patient movement and reanalyze.
"Cannot analyze."	Cannot Analyze	ECG analysis cannot determine if the rhythm is shockable or not.	Check pads connection. Attend to patient, begin CPR if indicated.

Table 15 AED Mode Pads Off Messages

These messages may appear when the multifunction electrode pads are not secured to the patient.

Audio Message L = long prompts S = short prompts Not noted = Both	Display Text	Condition	User Action
L - "Insert connector firmly. Apply pads to patient's bare chest." S - "Insert connector firmly. Apply pads." "Apply Pads" is repeated four times or until the connection is made.	Insert Connector, Apply Pads	With Adult patient category selected, there is no connection between the pads and the Therapy cable.	Securely connect the Therapy cable and the pads connector. See "Connecting Multifunction Electrode Pads" on page 10.
"Insert connector firmly. Look carefully at the screen for Infant/Child pad placement."		With Infant/Child patient category selected, there is no connection between the pads and the Therapy cable.	
"Apply pads as shown on screen. Apply first pad to child's chest. Apply second pad to child's back. Apply pads as shown on screen."		With Infant/Child patient category selected, if pads remain disconnected, more audio prompts follow.	

Table 15 **AED Mode Pads Off Messages *(Continued)***

These messages may appear when the multifunction electrode pads are not secured to the patient.

Audio Message L = long prompts S = short prompts Not noted = Both	Display Text	Condition	User Action
"Press pads firmly to patient's bare skin. Pads must not be touching clothing or each other. If needed, remove hair from patient's chest."	Press Pads Firmly	The Therapy cable is connected. A pads off condition still exists.	Securely connect the Therapy cable and the pads connector. See "Connecting Multifunction Electrode Pads" on page 10. Confirm there is a good pads contact with the skin.
"Be sure pads connector is completely inserted."			
"Poor pads contact, Replace pads."	Poor Pads Contact		Replace the pads.
"Begin CPR."	Press The CPR Button And Begin CPR		Begin CPR, if indicated.

Table 16 **AED Mode Marginal Impedance Messages**

These messages may appear when the Efficia DFM100 detects a higher pad impedance than expected in the average patient. The cause could be excessive hair on the chest, expired or dried out pads, or poor pad placement/contact on the patient.

Audio Message	Display Text	Condition	User Action
"Press pads firmly to patient's bare skin."	Press Pads Firmly	When the device is not charged, charging or delivering a shock or in a pause period, pads impedance condition is marginal.	Recheck pads. Confirm they are securely connected to the patient.
"Press pads firmly to patient's bare skin. Pads must not be touching clothing or each other. If needed remove hair from patient's chest."			
"Poor pads contact, Replace pads."	Poor Pads Contact		Recheck pads. Confirm they are securely connected to the patient. If they are, remove them and replace with new pads.
"Begin CPR."	None or Press The CPR Button And Begin CPR		Good pads contact cannot be established. If CPR is indicated, begin CPR.

Table 17 AED Mode Low Impedance Messages

These messages may appear when the Efficia DFM100 detects a lower pad impedance than expected in the average patient. The cause could be that the pads are touching or there is too much moisture on the patient.

Audio Message	Display Text	Condition	User Action
"Poor pads contact. Apply pads as shown on screen."	Reapply Pads to Dry Chest	When the device is not in a pause period, the pads are detecting a low impedance.	Confirm there is good pads contact with the skin.
"Poor pads contact, Replace pads."	Poor Pads Contact		Recheck pads. Confirm they are securely connected to the patient. If they are, remove them and replace with new pads.
"Begin CPR."	None or Press The CPR Button And Begin CPR		Good pads contact cannot be established. If CPR is indicated, begin CPR.

Table 18 AED Mode Shock Related Messages

These messages may appear when a shock is advised or immediately after a shock is delivered in AED mode.

Audio Message	Display Text	Condition	User Action
"Deliver shock now."	Deliver Shock Now	The defibrillator is charged and waiting for you to press the Shock button.	Press the flashing orange Shock button.
"Press the flashing orange button now."	Press Orange Button		
"Shock cancelled."	Shock Cancelled	After charging, the device detected a non-shockable rhythm and automatically disarmed.	Attend to the patient.
"Shock cancelled, No shock advised."			
"Shock cancelled. Pads must not be touching clothing or each other."		A shock was aborted due to low impedance.	Confirm pad placement is correct and pressed firmly against the chest then try shocking again.
"Shock cancelled. Press pads firmly to patient's bare skin."		A shock was aborted due to high impedance.	
"Shock button not pressed."	Charge Cancelled	A shock was aborted because the shock button was not pressed.	Re-analyze and press the Shock button when told to do so.
"Shock delivered."	None	A shock has been delivered to the patient.	Attend to the patient.

Table 18 **AED Mode Shock Related Messages *(Continued)***

These messages may appear when a shock is advised or immediately after a shock is delivered in AED mode.

Audio Message	Display Text	Condition	User Action
"Press pads firmly to patient's bare skin."	None	Shock delivered abnormal energy due to marginal impedance.	Confirm pad placement is correct and pressed firmly against the chest.
None	Attend to Patient, Shock Delivered	The final shock in a series has been delivered.	Attend to the patient.
None	Stay Clear of Patient, Shock Delivered	A shock in a yet-to-be-completed series has been delivered.	Stay clear of patient.

Table 19 **AED Mode Forced Pause Related Messages**

These messages may appear during a forced pause time period when analysis is not taking place and you can attend to the patient.

Audio Message	Display Text	Condition	User Action
"Begin CPR."	Attend to Patient	A shock series has ended and the device has entered a pause period for CPR.	Attend to the patient. Begin CPR if indicated.
		A no-shock decision has been made and the device has entered a pause period for CPR.	
	Attend to Patient, Monitoring	A no-shock decision has been made and during monitoring, artifact has been detected.	
"Attend to patient."	Attend to Patient	You have paused the device.	
"No shock advised."	Attend to Patient, No Shock Advised	A no-shock decision has been made and the device has entered a pause period for CPR.	
"Begin CPR, Check patient."	Press The CPR Button And Begin CPR		
"Stop CPR."	None	The CPR pause period has ended.	Attend to patient. Resume analysis if indicated.

Using AED Mode to Monitor

You can use AED mode to monitor your patient's ECG, SpO_2, pulse, $EtCO_2$ and AwRR. Related alarms can also be activated for the parameters.

To monitor ECG in AED mode and activate alarms:

1 Turn the Therapy knob to AED. The Efficia DFM100 announces the patient category currently set.

If not correct, use the Patient Category button  to select the appropriate patient category.

- For patients that are ≥ 25 kg or ≥ 8 years old, use the Adult patient category.
- For patients <25 kg or < 8 years old, use the Infant/Child patient category.

2 After performing an initial ECG rhythm analysis, if the rhythm is not shockable, the Efficia DFM100 begins to monitor the patient.

3 To activate ECG alarms in AED mode, press the Alarms button on the front of the Efficia DFM100.

To monitor optional SpO_2 and pulse in AED mode and activate alarms:

1 Once in AED mode, attach an SpO_2 sensor to the device and patient (see "Applying the Sensor" on page 109).

2 If you have the device configured to monitor SpO_2 in AED mode, SpO_2 monitoring begins once a pulsatile reading is obtained. For more information on SpO_2, see Chapter 10 "Monitoring SpO_2" on page 107.

3 To activate SpO_2 and Pulse alarms in AED mode, press the Alarms button on the front of the Efficia DFM100.

To monitor optional $EtCO_2$ and AwRR in AED mode and activate alarms:

1 Once in AED mode, attach an CO_2 sensor to the device and the patient (see "Connecting the CO2 Cable and Sample Line" on page 12).

2 If you have the device configured to monitor CO_2 in AED mode, CO_2 monitoring begins once a reading is obtained. For more information on CO_2, see Chapter 9 "Monitoring CO_2" on page 97.

3 To activate CO_2 and AwRR alarms in AED mode, press the Alarms button on the front of the Efficia DFM100.

Configurable Resuscitation Protocols

In AED mode, you have the flexibility to configure the Efficia DFM100 to match your institution's resuscitation protocols. You can:

- Customize the device for the number of shocks (1-4) in a series.
- Select the energy setting within a given shock series (Adult patient category only).
- Set the CPR Pause interval from 1-3 minutes.
- Select the level of detail you want while in AED mode.
- Select what the device does after a No Shock Advised decision.

For more information, see Tables 43 and 44 in the Configuration chapter.

AED Alarms

The SMART Analysis algorithm generates AED Defibrillation alarms for the conditions shown in Table 20. There are both audio and visual alerts, when turned on.

When monitoring a patient, the ST/AR ECG Monitoring Algorithm generates ECG alarms in AED mode, if turned on. See "Other Alarms in AED Mode" on page 73.

For more information on alarms, see "Alarms" on page 37.

Table 20 **AED Defibrillation Alarms**

Alarm Message	Condition	Type of Alarm	Indication
Pads Off	With pads in use, the connection between the device and patient has been lost.	High Priority Non-Latching Alarm	Red Alarm message with alarm tone
Shock Aborted	A shock has been automatically aborted.	High Priority Latching Alarm	
Abnormal Shock Dose Delivered	Abnormal shock dose delivered due to marginal patient impedance.		
Pads/Paddle Type Unknown	The device detected a change in paddles or pads type or the therapy cable identification is invalid.		
Therapy Disabled: Run Op Check	Therapy is disabled due to an equipment failure.		

Other Alarms in AED Mode

ECG

If ECG alarms are turned on in AED mode, all Technical Alarms listed in "HR/Arrhythmia Technical Alarms" on page 58 and the following Physiological Alarms from "HR/Arrhythmia Physiological Alarms" on page 57 are generated when the condition exists:

- Asystole
- Extreme Tachy
- HR High
- VFib/VTach
- Extreme Brady
- HR Low

Once generated, all alarms appear as messages in the HR alarm status area above the HR numeric. There are both audio and visual alerts. For more information on ECG alarms, see "Arrhythmia Monitoring" on page 55.

SpO_2 and Pulse

If SpO_2 and Pulse alarms are turned on, the alarm messages appear in the SpO_2 or Pulse status area above their respective numeric. For more information, see "SpO_2 Alarms" on page 111 and "Pulse Rate Alarms" on page 113.

CO_2 and AwRR

If $EtCO_2$ or AwRR alarms are turned on, the alarm messages appear in their respective status areas above the numeric. For more information, see "$ETC0_2$ and AwRR Alarms" on page 101.

Troubleshooting

If your Efficia DFM100 does not operate as expected during AED mode, see "Defibrillation and Pacing Problems" on page 179.

If there is a delay in delivering therapy, start CPR if indicated.

NOTES

6

Manual Defibrillation

This chapter explains how to prepare for and perform defibrillation or asynchronous cardioversion on the Efficia DFM100 using multifunction electrode pads, external paddles and internal paddles.

See Chapter 7 “Synchronized Cardioversion” on page 83 for information on synchronized cardioversion.

Overview

Defibrillation therapy is the definitive method for termination of lethal arrhythmias.The Efficia DFM100 provides this therapy through the application of a biphasic pulse of current to the heart. This electrical energy is transferred through attached paddles or disposable multifunction electrode pads applied to the patient’s bare chest. Internal paddles for open-chest intrathoracic defibrillation can also be used.

In Manual Defibrillation mode, the entire defibrillation process is under your control. You must assess the ECG, decide if defibrillation or cardioversion is indicated, select the appropriate energy, charge the Efficia DFM100 and deliver the shock. Text messages on the display provide relevant information throughout the process. Be attentive to these messages.

The ECG strip and Event Summary are easily annotated with information using the Mark Event button. See “Mark Events” on page 43.

Monitoring alarms are available in Manual Defibrillation mode but they are turned off by default.

To activate alarms, press the Alarm button  . Alarms are reactivated once the Therapy knob is moved to Monitor, an energy setting or Pacer or the Sync button is pressed.

Manual Defibrillation mode can be used on both adult and infant/child patients. Use the Patient Category  button to switch categories.

Precautions for Manual Defibrillation

WARNINGS: Defibrillating asystole can inhibit the recovery of natural pacemakers in the heart and completely eliminate any chance of recovery. Asystole should not be routinely shocked. Begin CPR.

Remain attentive to the patient during the delivery of therapy. Delay in delivering a shock may result in a rhythm that was identified as shockable converting spontaneously to non-shockable and could result in inappropriate shock delivery.

Keep hands and feet clear of the paddle electrode edges. Use your thumbs to depress the shock buttons on the paddle handles.

Use only pads that are approved for use with the Efficia DFM100. Use of non-approved pads could affect performance and results. See "Approved Supplies and Accessories" on page 189 for a list of supported pads.

Do not allow multifunction electrode pads to touch each other or to touch other ECG monitoring electrodes, lead wires, dressings, etc. Contact with metal objects may cause electrical arcing and patient skin burns during defibrillation and may divert current away from the heart.

When monitoring neonatal ECGs, inaccurate measurements and alarms could result because of differences in the characteristics of the adult ECG compared to the neonatal ECG.

During defibrillation, air pockets between the skin and multifunction electrode pads may cause patient skin burns. To help prevent air pockets, make sure the pads completely adhere to the skin. Do not use dried out pads. Do not open pads package until just prior to use.

Never touch the patient or any equipment connected to the patient (including the bed or gurney) during defibrillation.

Avoid contact between the patient and conductive fluids and/or metal objects such as the gurney.

Medical electrical equipment which does not incorporate defibrillator protection should be disconnected during defibrillation.

CAUTION: Do not discharge the defibrillator with the paddles shorted together.

NOTES: Successful resuscitation depends on many variables specific to the patient's physiological state and the circumstances surrounding the patient event. Failure to have a successful patient outcome is not a reliable indicator of defibrillator/monitor performance. The presence or absence of muscular response to the transfer of energy during electrical therapy is not a reliable indicator of energy delivery or device performance.

Defibrillation is always performed through paddles or pads. However, during defibrillation you may choose to monitor the ECG using an alternate ECG source (3- or 5-Lead monitoring electrodes). If an alternate ECG source is connected, any available lead may be displayed.

Do not use medical gels or pastes of poor electrical conductivity.

Use only approved lead sets and monitoring electrodes with the Efficia DFM100. Failure to do so may introduce noise and result in intermittent **Cannot Analyze ECG** messages.

Code View

In Manual Defibrillation mode, when an energy is selected, Code View is displayed. Code View is optimized to clearly communicate data associated with a resuscitation event (see Figure 50). Code-related information in Code View includes:

Enlarged Wave Sector 1: The waveform in Wave Sector 1 is larger for easier viewing.

Shock Counter: Displays the number of shocks for the current event (including shocks delivered in AED mode).

Selected Energy: Displays the currently selected energy.

Delivered Energy: Displays the energy amount that was delivered for the most recent shock. Replaces the Shock Counter for 15 seconds after the shock is delivered.

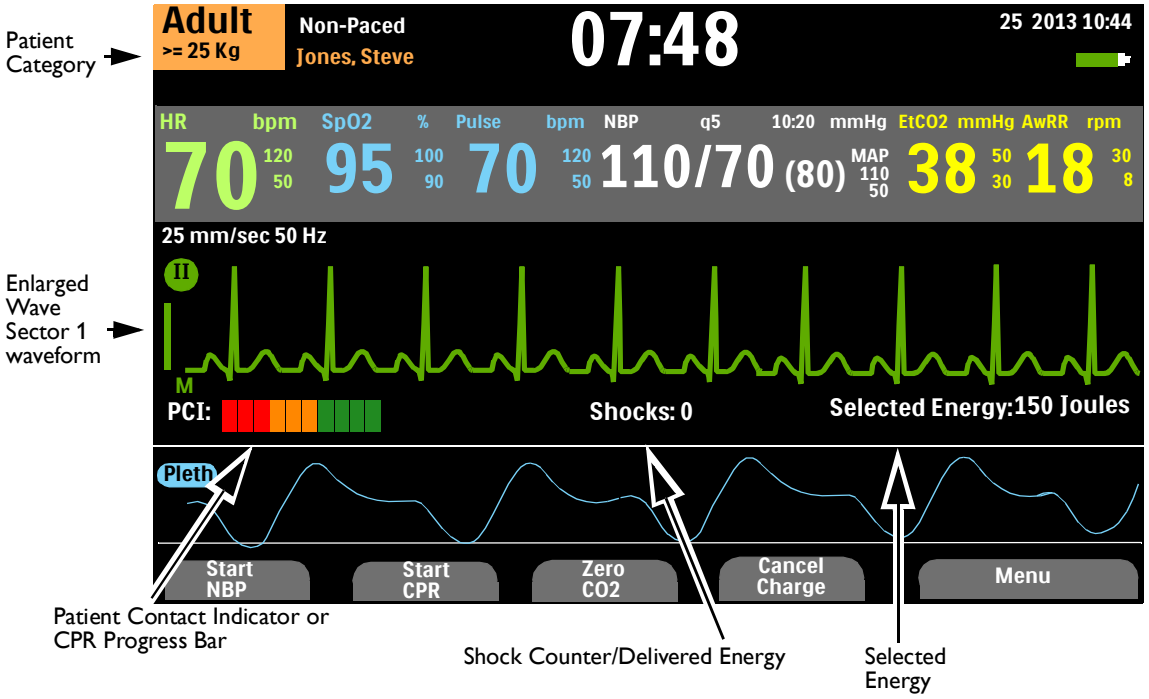
Wave Sector 2: Displays the currently configured waveform. If Cascade is selected, depending on the ECG size, parts of the wave may be clipped due to the smaller sector size.

Patient Contact Indicator: Graphical representation of the contact quality between the patient and the multifunction electrode pads. Orange or red lights on the PCI indicate poor patient contact. Adjust pads to optimize patient contact. Multiple green lights on the PCI indicate good contact is established. The PCI is displayed when pads are attached and the device is charging or is charged. It is not displayed when using paddles. Use the PCI on the paddles as a patient contact indicator.

CPR Progress Bar: When in use, replaces the Patient Contact Indicator and tracks the progress of the analysis pause and CPR periods.

Patient Category: Displays the current patient category. The patient category triggers specific alarm limits and AED energy settings for defibrillation. The background color changes with the selected patient category for Adult (orange) and Infant/Child (blue).

Figure 50 **Code View Layout**



Preparing for Defibrillation

To prepare for defibrillation:

1. Prepare the patient's skin to improve skin contact. See "Skin Preparation" on page 48.
2. Connect the appropriate therapy cable. See "Connecting the Therapy Cable" on page 9.
3. Apply paddles or pads as described in the following sections.

Using Multifunction Electrode Pads

To set up for defibrillation using multifunction electrode pads:

1. Check the expiration date on the pads package and inspect the package for any damage.
2. If not preconnected, connect the Therapy cable to the Efficia DFM100 (see "Connecting the Therapy Cable" on page 9).
3. If the pads are not expired and package is undamaged, open the package and connect the pads connector to the end of the Therapy cable (see "Connecting Multifunction Electrode Pads" on page 10).
4. Apply the pads to the patient as directed on the pads packaging or according to your institution's protocol.
5. Follow the defibrillation steps in "Defibrillation" on page 79.

Using External Paddles

To set up for defibrillation using external paddles:

1. After connecting the paddles cable to the Efficia DFM100, remove the paddle set from the paddle tray by pulling the paddles straight up and out of the paddle tray. Confirm you are using the correct size paddles for the patient and verify there is no debris or residue (including dried electrode gel) on the surface of the paddles. Clean if necessary.
2. Apply conductive matter as per your organization's protocol.

CAUTION: Do not distribute conductive matter by rubbing the paddle electrode surfaces together. Surfaces could get scratched or damaged if you do.

3. Apply the paddles to the patient's bare chest using the anterior-anterior placement (or in accordance with your organization's protocol).
4. Use the Patient Contact Indicator (PCI) lights on the sternum paddle handle to adjust paddle pressure and placement to optimize patient contact. Once proper contact is made, the PCI turns green. See "External Paddles" on page 14.

NOTE: Reasonable effort should be made to obtain at least one green PCI light. Due to size of the patient or other physical factors, this might not be possible for some patients. Orange lights may be the best that can be achieved.

5. Follow the defibrillation steps in "Defibrillation" on page 79.

Quick Look

You can use external paddles for a "Quick Look" to assess the patient's ECG rhythm and then, if necessary, deliver therapy. Use this process only when multifunction pads and monitoring electrodes are not immediately available.

To view a patient's ECG using external paddles:

1. Make sure the device is turned on to Monitor.
2. Apply external paddles to the patient's chest, minimizing any unnecessary movement.
3. After the Efficia DFM100 detects the ECG, view the waveform on the display.

NOTE: Viewing the patient's ECG through paddles is not recommended for long-term monitoring.

Using Infant Paddles

The Efficia DFM100 external paddle set comes with infant paddles included. The American Heart Association recommends using the smaller paddles on children weighing less than 10 kg. Larger paddles may be used as long as contact between the paddles is avoided.

To set up for defibrillation using infant paddles:

1. Expose the infant paddle surfaces. See "Accessing Infant Paddles" on page 15.
2. Store the adult paddle surfaces in the paddle tray pockets.
3. Follow the steps for using external paddles. See "Using External Paddles" on page 78.
4. Follow the defibrillation steps in "Defibrillation" on page 79.

Using Internal Paddles

To set up for defibrillating using internal paddles:

1. Select the appropriate paddle electrode size.
2. If using switchless internal paddles, connect the paddles to the M4740A Paddle Adapter Cable.
3. Connect the paddles cable (or the paddle adapter cable) to the Efficia DFM100. See "Connecting the Therapy Cable" on page 9.
4. Follow the defibrillation steps in "Defibrillation" on page 79.

NOTE: The Efficia DFM100 has a built-in limit of 50 J when you are using internal paddles.

Defibrillation

After performing the necessary preparation, defibrillation with Efficia DFM100 is a simple 1-2-3 process.

1. Select an energy.
2. Charge the device.
3. Administer the shock.

See the following sections for more information.

Step 1 - Select Energy

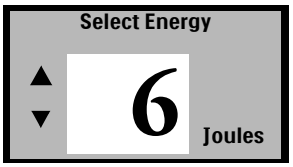
Rotate the Therapy knob to the desired energy level. The current energy selection is displayed on the device in the Select Energy section. The recommended energy dose for adult patients is 150 J. Follow your institution's guidelines for Infant/Child patients.

Energy choices range from 1 to 200J with 150J highlighted as the recommended level for defibrillating adult patients. Selecting the 1-10 energy setting brings up the **Select Energy** menu. See Figure 51. Use the Smart Select knob to increase or decrease the desired setting. The Efficia DFM100 automatically knows your energy setting.

To re-adjust a low energy setting:

1. Press the Smart Select knob.
2. Turn the Smart Select knob to highlight **Energy 1-10 Joules** and press the Smart Select knob.
3. Turn the Smart Select knob to increase or decrease the energy level and press the Smart Select knob.

Figure 51 **Select Energy**



WARNINGS: For manual defibrillation of infant/child patients follow your institution's policy (guidelines are 2 to 4 J/kg first shock and 4 J/kg per subsequent shocks).

The Efficia DFM100 has a built-in limitation of 50 Joules when you are using internal paddles.

Do not leave patients unattended when the Efficia DFM100 is in Manual Defibrillation mode with pads applied to the patient.

Step 2 - Charge

Press the Charge button on the front panel. See "Therapy Knob and Controls" on page 26. If using external paddles, the Charge button on the side of the apex paddle may be used instead. As the defibrillator charges, the energy selection shown on the display changes to show the current charge state. A continuous low-pitch charging tone sounds until the desired energy level is reached, at which point a continuous high-pitch charged tone sounds.

You may increase or decrease the selected energy at any time during or after charging. Move the Therapy knob to the desired energy level. The Efficia DFM100 charges to the selected energy level automatically.

If you need to disarm the defibrillator, press the **[Cancel Charge]** soft key. Also, the defibrillator disarms automatically when the Shock button has not been pressed within the time period specified in the Time to Auto Disarm configuration setting.

NOTE: Do not change the energy level while pressing the Shock button.

Step 3 - Shock

Confirm that a shock is still indicated and the defibrillator is charged to the selected energy level. Make sure no one is touching the patient or anything connected to the patient. Call out loudly and clearly, "Stay Clear!"

If using:

- **Pads or switchless internal paddles** - Press the flashing Shock button on the front of the Efficia DFM100 to deliver a shock.

- **External paddles** - Simultaneously press the flashing Shock buttons located on the paddles to deliver a shock.
- **Switched internal paddles** - Press the orange Shock button located on the paddle to deliver a shock.

If the shock is the last in a configured shock series, "Begin CPR" is announced and displayed on the screen.

WARNINGS: Defibrillation current can cause operator or bystander injury. Do not touch the patient, or equipment connected to the patient, during defibrillation.

Alarm audio is turned off when an energy setting is selected for defibrillation, and the Alarm Audio Off message is displayed. Audio remains off until turned back on by pressing the Alarm button, Sync mode is turned on or the Therapy knob is turned to Monitor or Pacer.

Manual Defibrillation Alarms

Defibrillation alarms can be generated for the conditions shown in Table 21. There are both audio and visual alerts when activated by the Alarms button. When you switch patient categories, all parameter alarm limits change to the new patient category. These changes are retained when you switch modes.

- For patients that are ≥ 25 kg or ≥ 8 years old, use the Adult patient category.
- For patients <25 kg or < 8 years old, use the Infant/Child patient category.

For more information on alarms, see "Alarms" on page 37.

Table 21 **Defibrillation Alarms**

Alarm Message	Condition	Type of Alarm	Indication
Pads Off	With pads in use, the connection between the device and patient has been lost.	High Priority Non-Latching Alarm	Red Alarm message with alarm tone
Shock Aborted	A shock has been automatically aborted.	High Priority Latching Alarm	
Abnormal Shock Dose Delivered	Abnormal shock dose delivered due to marginal patient impedance.		
Pads/Paddle Type Unknown	The device detected a change in paddles or pads type or the therapy cable identification is invalid.		
Therapy Disabled: Run Op Check	Therapy is disabled due to an equipment failure.		
Paddles Power Overload	A power overload has been detected in the paddles.	Medium Priority Latching Configurable Alarm	Yellow Alarm message with alarm tone

Troubleshooting

If your Efficia DFM100 does not operate as expected during Manual Defibrillation, see "Defibrillation and Pacing Problems" on page 179.

If there is a delay in delivering therapy, start CPR if indicated.

7

Synchronized Cardioversion

This chapter explains how to prepare for and perform synchronous cardioversion on the Efficia DFM100.

See Chapter 6 “Manual Defibrillation” on page 75 for information on asynchronized cardioversion.

Overview

The Efficia DFM100 provides synchronized cardioversion therapy by delivering a biphasic pulse of current to the heart immediately following an R-Wave detected in the ECG waveform. The waveform utilized in the Efficia DFM100 has undergone clinical testing demonstrating its effectiveness for cardioversion of atrial fibrillation.

You can perform synchronized cardioversion with:

- Multifunction electrode pads or external paddles and 3 or 5-Lead set monitoring electrodes directly connected to the Efficia DFM100.
- Only the multifunction electrode pads directly connected to the Efficia DFM100.
- Multifunction electrode pads directly connected to the Efficia DFM100 and an ECG signal coming from a Philips bedside monitor into the Efficia DFM100.

NOTE: The best quality source for cardioversion is a 3 or 5-Lead set connected to the Efficia DFM100.

No matter what your monitoring source is, cardioversion is still delivered through pads or paddles.

Precautions for Cardioversion

WARNINGS: Cardioversion should only be delivered by trained healthcare professionals.

When performing synchronized cardioversion through external paddles, you should not use paddles as your monitoring lead in Wave Sector 1. Artifact introduced by paddle movement may resemble an R-Wave arrow and trigger a defibrillation shock. Use external paddles as a monitoring lead for Synchronized Cardioversion only if no other lead source is available and you are in an emergency situation.

Incorrect timing of Synchronized Cardioversion could occur if the patient has an internal pacemaker with pacemaker tails large enough to be detected as an R-Wave.

Use only pads that are approved for use with the Efficia DFM100. Use of non-approved pads could affect performance and results. See Table 61 “Approved Supplies and Accessories” on page 189 for a list of supported pads.

Remain attentive to the patient during the delivery of therapy.

Keep hands and feet clear of the paddle electrode edges. Use your thumbs to depress the shock buttons on the paddle handles.

Do not allow multifunction electrode pads to touch each other or to touch other ECG monitoring electrodes, lead wires, dressings, etc. Contact with metal objects may cause electrical arcing and patient skin burns during defibrillation and may divert current away from the heart.

During defibrillation, air pockets between the skin and multifunction electrode pads may cause patient skin burns. To help prevent air pockets, make sure the pads completely adhere to the skin. Do not use dried out pads. Do not open pads package until just prior to use.

Never touch the patient or any equipment connected to the patient (including the bed or gurney) during defibrillation.

Avoid contact between the patient and conductive fluids and/or metal objects such as the gurney.

Medical electrical equipment which does not incorporate defibrillator protection should be disconnected during defibrillation.

NOTES: Successful cardioversion depends on many variables specific to the patient’s physiological state and the circumstances surrounding the patient event. Failure to have a successful patient outcome is not a reliable indicator of defibrillator/monitor performance. The presence or absence of muscular response to the transfer of energy during electrical therapy is not a reliable indicator of energy delivery or device performance.

Synchronized Cardioversion should be turned off unless you specifically intend to perform synchronized cardioversion. Sync mode can prevent the delivery of defibrillation in situations involving cardiac arrest.

If you enter Pacing mode, Sync settings are turned off.

Use only approved lead sets with the Efficia DFM100. Failure to do so may introduce noise and result in intermittent **Cannot Analyze ECG** messages.

Preparing for Synchronized Cardioversion

To prepare for synchronized cardioversion:

1. Perform tasks as described in "Preparing for Defibrillation" on page 78.
2. If monitoring through a 3- or 5-Lead ECG cable, plug the ECG cable into the ECG port on the Efficia DFM100 and apply monitoring electrodes to the patient (see "Lead Selection" on page 50).
3. Use the Lead Select button  to select the waveform you want in Wave Sector 1. The selected ECG source should have a clear signal and a large QRS complex. Use external paddles as the monitoring lead only if no other lead source is available. See "With External Paddles" on page 87.

NOTES: When a patient is already connected to Philips bedside monitoring equipment, an external ECG Out (Sync) cable can plug into the bedside's ECG Output jack and into the Efficia DFM100's ECG port. This connects the ECG signal from the monitor into the Efficia DFM100 where it is displayed and synchronization occurs.

The signal from the bedside monitor is displayed as Lead II on the Efficia DFM100 even though it may not necessarily be Lead II coming from the bedside monitor.

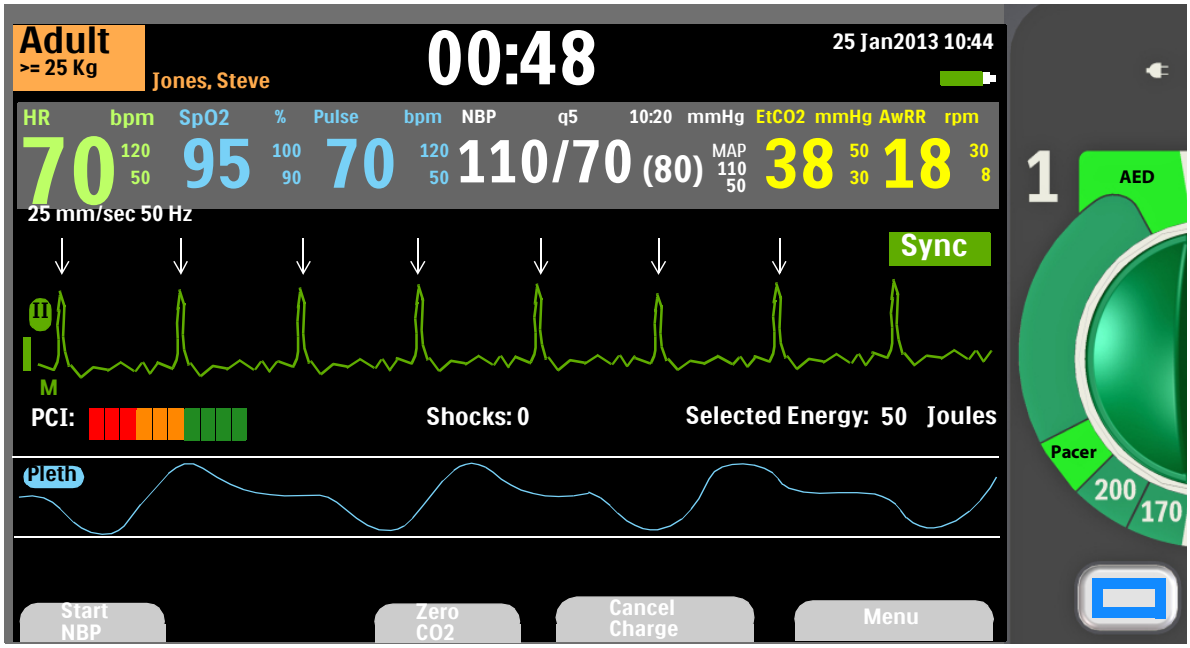
Do not use a Philips SureSigns monitor connected to the Efficia DFM100. The devices are not compatible.

WARNING: If you use an external monitor as the ECG source, a biomedical technician MUST verify that the combination of the external monitor and Efficia DFM100 can deliver a synchronized shock within 60ms 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.

Code View and Cardioversion

When Synchronized Cardioversion is active, Code View adds R-Wave arrows and a Sync notification to the display. The Sync button is also backlit. See Figure 52.

Figure 52 **Code View With Sync Layout**



Delivering a Synchronized Shock

To perform synchronized cardioversion:

1. Turn the Therapy knob to the desired energy setting
2. Press the Sync button (see Figure 1 on page 8).
3. Confirm that the Sync button lights up, the Sync indicator is present and R-Wave arrows appear only with each R-Wave.

   R-Wave arrows do not always appear at the peak of the R-Wave but always appear on the R-Wave. Use the Lead Select button to change leads if the R-Wave arrows do not appear correctly.
4. Press the yellow Charge button on the Efficia DFM100, or if using paddles, the yellow charge button located on the apex paddle.

   You may increase or decrease the selected energy at any time during charging or after charging. Move the Therapy knob to the desired energy level. The Efficia DFM100 charges to the selected energy level automatically. Wait until the charge reaches the selected energy level before proceeding.

   If you need to disarm the defibrillator, press the **[Cancel Charge]** soft key. Also the defibrillator disarms automatically when the Shock button has not been pressed within the time period specified in the Time to Auto Disarm configuration setting.
5. When the defibrillator has reached its charge level, make sure no one is touching the patient or anything connected to the patient. Call out clearly and loudly “Stay Clear”.

6 Check your ECG and then re-confirm your energy dose and waveform. Press and hold the Shock button on the Efficia DFM100 or, if using external paddles, press and hold the orange buttons on both paddles. It is important to continue to hold the Shock button (or the paddle buttons) until the shock is delivered. The defibrillator shocks with the next detected R-Wave. Once the shock is delivered, release the shock button. The Shock counter increases by one.

WARNINGS: Defibrillation current can cause operator or bystander injury. Do not touch the patient, or equipment connected to the patient, during defibrillation.

Do not change the energy level while holding the Shock button down.

NOTES: If an ECG or pads technical alarm occurs while performing synchronized cardioversion, the Efficia DFM100 does not charge, and if charged, disarms automatically.

If the Efficia DFM100 does not detect an ECG lead when you press Charge, a **Check ECG Lead** message is displayed. Fix the lead problem before pressing Charge again.

With External Paddles

Carefully review the waveform immediately prior to administering synchronized cardioversion and confirm that you have a non-paddles wave label.

WARNING: When performing synchronized cardioversion through external paddles, you should not use paddles as your monitoring lead in Wave Sector 1. Artifact introduced by paddle movement may resemble an R-Wave arrow and trigger a defibrillation shock. Use external paddles as a monitoring lead for Synchronized Cardioversion only if no other lead source is available and you are in an emergency situation.

To perform synchronized cardioversion using external paddles:

1 Prepare your patient for synchronized cardioversion as stated above.

2 Place paddles on the patient's chest prior to charging the defibrillator.

3 Look at the wave label appearing in Wave Sector 1.

If the label is Paddles:

- Change the monitoring lead in Wave Sector 1 by pressing the Lead Select button multiple times to cycle through available leads. Select the waveform you wish to use.
- Confirm a non-paddles monitoring leads appears in Wave Sector 1. Check for R-Wave arrows.
- Proceed with the normal protocol for synchronized cardioversion.

If the label is not Paddles:

- Proceed with the normal protocol for synchronized cardioversion.

Delivering Additional Shocks

There are times when additional synchronized shocks are clinically indicated.

To deliver additional synchronized shocks:

1 Confirm the Sync function is still enabled, the Sync button is lit, the Sync indicator is present and the R-Wave arrows are still visible.

2 Repeat steps 3-5 under "Delivering a Synchronized Shock" on page 86.

NOTE: The Efficia DFM100's Sync function can be configured to either be enabled or disabled after each synchronized shock is delivered.

Turning Sync Off

To turn the Sync function off, press the Sync button again. The button light turns off and Sync indications are removed from the display.

Cardioversion Alarms

Alarms can be generated for the conditions shown in Table 22. There are both audio and visual alerts. When you switch patient categories, all parameter alarm limits change to the new patient category. These changes are retained when you switch modes.

- For patients that are ≥ 25kg or ≥ 8 years old, use Adult patient category.
- For patients <25kg or < 8 years old, use Infant/Child patient category.

For more information on alarms, see "Alarms" on page 37.

Table 22 **Defibrillation Alarms**

Alarm Message	Condition	Type of Alarm	Indication
Pads Off	With pads in use, the connection between the device and patient has been lost.	High Priority Non-Latching Alarm	Red Alarm message with alarm tone
Shock Aborted	A shock has been automatically aborted.	High Priority Latching Alarm	
Abnormal Shock Dose Delivered	Abnormal shock dose delivered due to marginal patient impedance.		
Pads/Paddle Type Unknown	The device detected a change in paddles or pads type or the therapy cable identification is invalid.		
Therapy Disabled: Run Op Check	Therapy is disabled due to an equipment failure.		

Troubleshooting

If your Efficia DFM100 does not operate as expected during Cardioversion, see "Defibrillation and Pacing Problems" on page 179.

8

Pacing

This chapter explains the noninvasive transcutaneous pacing option available with the Efficia DFM100 and describes how to perform pacing.

Overview

Noninvasive transcutaneous pacing therapy is used to deliver monophasic pace pulses to the heart. Pace pulses are delivered through multifunction electrode pads that are applied to the patient's bare chest. Pacing with paddles is not supported.

While in Pacing mode, the ECG strip and Event Summary are easily annotated using the Mark Event button. See "Mark Events" on page 43.

Pacing mode can be used on both adult and infant/child patients. Use the Patient Category button to switch categories.

WARNING: Pacing therapy should only be delivered by trained healthcare professionals.

CAUTION: Pacing must be turned off before defibrillating with a second defibrillator. Failure to do so could damage the Efficia DFM100.

NOTES: Use only approved lead sets when pacing with the Efficia DFM100. Failure to do so may introduce noise and result in intermittent **Cannot Analyze ECG** messages.

For treatment of patients with implantable devices, such as permanent pacemakers or cardioverter-defibrillators, consult a physician and the instructions for use provided by the device's manufacturer.

Waveforms, ECG monitoring, measurements and most alarms remain active and retain their settings when you transition from Monitor or Manual Defibrillation mode to Pacing mode. However, the waveform displayed in Wave Sector 3 is replaced by the Pacing Status Bar.

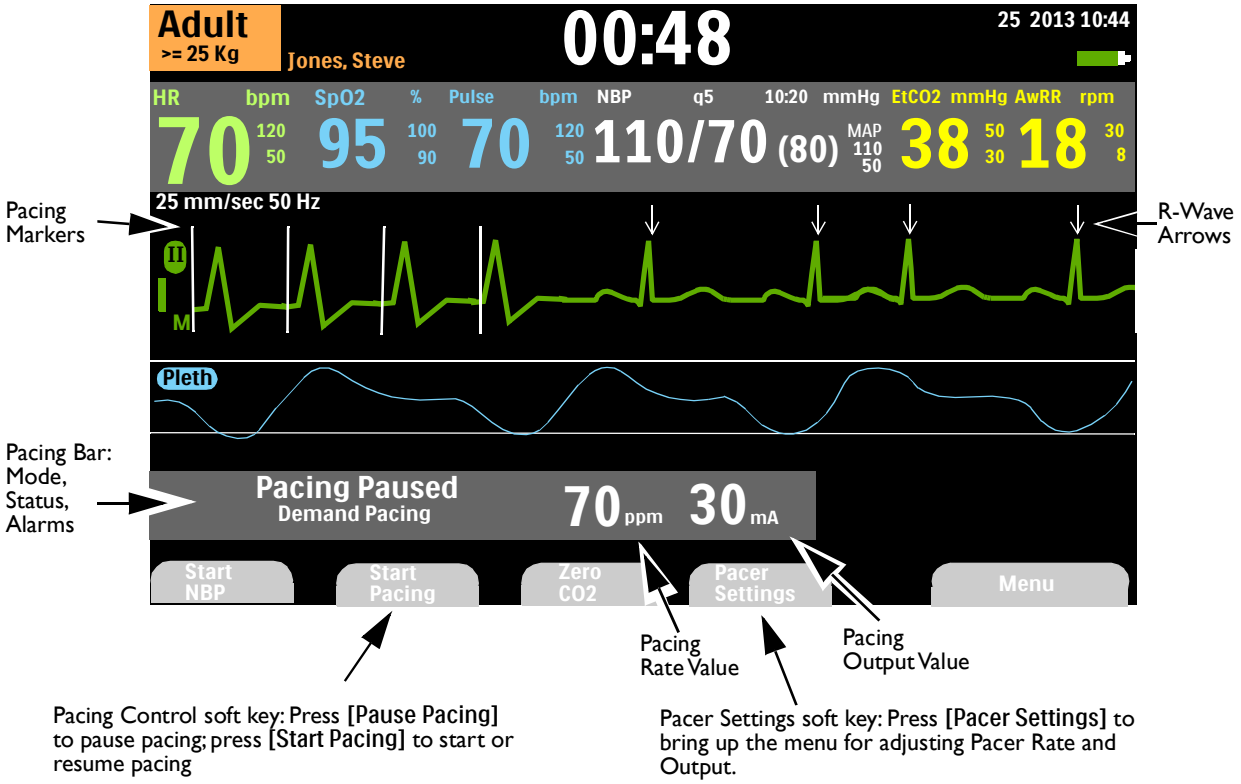
Pacing View

Pacing View appears when the Therapy knob is turned to the Pacer position. Pacing View includes a status block which appears in Wave Sector 3 of the display (see Figure 53). The patient's internal paced status is not displayed. Pacing-related information in Pacing View includes:

- **Pacing Markers:** Markers, indicating a pace pulse was delivered, appear in Wave Sector 1 (and in Wave Sector 2, if the wave is cascading) each time a pacer pulse is delivered.
- **R-Wave Arrows:** R-Wave arrows appear in Wave Sector 1 (and in Wave Sector 2, if the wave is cascading) when in Demand mode pacing. R-Wave arrows do not appear on paced beats.
- **Pacing Status:** Indicates the current pacing status.
  - When pacing is active, **Pacing** is displayed when the device is on AC power.
  - If the device is running on battery, **Pacing on Battery** is displayed.
  - If pacing is not active, **Pacing Paused** is displayed.

- **Pacing Alarm:** If there is a pacing-related alarm during pacing, the current pacing status is replaced with an alarm message. See "Pacing Alarms" on page 94.
- **Pacing mode:** Indicates if the device is in Demand or Fixed mode pacing.
- **Pacing Rate:** Indicates the current pacing rate, including unit of measure.
- **Pacing Output:** Indicates the current output, including unit of measure.
- **Alarms:** Are on automatically.

Figure 53 **Pacing View Layout**



WARNING: If pacing is interrupted for any reason, you must press the **[Start Pacing]** soft key to resume pacing.

Demand Mode Versus Fixed Mode

The Efficia DFM100 can deliver paced pulses in Demand mode or Fixed mode.

- In Demand mode, the pacer only delivers synchronous paced pulses when the patient's heart rate is lower than the selected pacing rate.
- In Fixed mode, the pacer delivers asynchronous paced pulses at the selected rate.

WARNING: Use Demand mode pacing whenever possible. Use Fixed mode pacing when artifact or other ECG noise makes R-Wave detection unreliable, when monitoring electrodes are not available or at your clinical discretion.

The Efficia DFM100 requires a 3- or 5-Lead ECG cable and monitoring electrodes as the source of the ECG during Demand mode pacing. Pace pulses are delivered through multifunction electrode pads. However, during Demand mode pacing, the pads cannot be used to monitor ECG and deliver paced pulses simultaneously.

NOTES: The ECG derived from pads does not need to be displayed in a wave sector in order to deliver pacing therapy.

When using the Efficia DFM100 for pacing in the operating room in the presence of cautery tools, use Fixed mode only.

When using Demand mode, pads are not an available choice for display in Wave Sector 1, through either the Lead Select button or the **Displayed Waves** menu.

Preparing for Pacing

To prepare for pacing:

1. If not already connected, connect the Therapy cable to the Efficia DFM100. See "Connecting the Therapy Cable" on page 9.
2. Prepare the patient's skin to achieve good contact. See "Skin Preparation" on page 48.
3. Connect the multifunction electrode pads. See "Connecting Multifunction Electrode Pads" on page 10.
4. If pacing in Demand mode, apply monitoring electrodes (see "Electrode Placement" on page 49) and connect the ECG cable to the Efficia DFM100 (see "Connecting the ECG Cable" on page 11).

WARNING: Do not reverse pad position on the patient. Reversing the pads' positions increases the pacing threshold which means more current is needed to capture the heart, resulting in greater patient discomfort.

NOTES: Pacing Therapy should be administered while connected to AC power with a battery installed for backup so that pacing will not be interrupted in the event of either an AC power failure or the battery losing its charge.

If you enter Pacing mode, Sync settings are turned off.

If Paddles is selected for display in Wave Sector 2 and the device enters Pacer mode, the Wave Sector 2 waveform automatically switches to None.

If Paddles is selected for display in Wave Sector 1 and the device enters Pacer mode, the Wave Sector 1 waveform switches to Lead II.

If Pads is selected for the display in Wave Sector 2 and the device enters Demand mode pacing, the Wave Sector 2 waveform automatically switches to None.

If monitoring for an extended period of time, monitoring electrodes and multifunction electrode pads may need to be changed periodically. Refer to the manufacturer's documentation for replacement frequency.

Signals from TENS or ESU units can cause interference with the ECG which may impact pacing.

Pace Pulse Duration

You can configure the duration of the paced pulse in Configuration mode to either 20 or 40 msec. Confirm with your organization which setting best meets your clinical needs. If you select 20 msec, you can select a current setting between 10-200 mA. If you select 40 msec, you can select a current setting between 10-140 mA. See "Pacer Settings" on page 149.

Demand Mode Pacing

To pace in Demand mode:

1. Turn the Therapy knob to the Pacer position.

   The message **Pacing Paused** appears in the Pacing Bar, indicating that the pacing function is enabled but pace pulses are not being delivered. Pacing is enabled in Demand mode with the configured lead in Wave Sector 1 used for R-Wave detection.

2. Press the Lead Select button  to select the best lead with an easily detectable R-Wave.
3. Verify white R-Wave arrows appear above or on the ECG waveform. A single arrow should be associated with each R-Wave. If the R-Wave arrows do not appear, are incorrectly labeling beats, or do not coincide with the R-Wave, select another lead.
4. Select the Pacer Rate by pressing the **[Pacer Settings]** soft key and then selecting **Pacer Rate** from the menu. Use the Smart Select knob to adjust the rate, then press the Smart Select knob to confirm the value and close the Pacer Rate window. Repeat and select **Pacer Output** to adjust the Pacer Output.
5. Press **[Start Pacing]**. **Pacing** appears in the Pacing Bar.
6. Verify white pacing markers or white R-Wave arrows appear on the ECG waveform.
7. Press the **[Pacer Settings]** soft key, and then select **Pacer Output**. Use the Smart Select knob to increase the output until cardiac capture occurs. Capture is indicated by the appearance of a QRS complex after each pacing marker. Decrease the output to the lowest level that still maintains capture, and then press the Smart Select knob to confirm the value and close the Pacer Output window.
8. Assess the patient for a peripheral pulse.

To stop pacing:

- Press the **[Pause Pacing]** soft key. A message asks you to confirm your action. Using the Smart Select knob, select **Yes** to pause pacing; select **No** to continue pacing. Once paused, press the flashing **[Start Pacing]** soft key to resume pacing.

  OR

- Move the Therapy knob away from the Pacer position.

WARNINGS: Use care when handling the multifunction electrode pads on the patient to avoid shock hazard during pacing.

Use multifunction electrode pads prior to their expiration date. Discard pads after use. Do not reuse pads. Do not use for more than 8 hours of continuous pacing.

If pacing is interrupted for any reason, you must press the **[Start Pacing]** soft key to resume pacing.

When pacing in Demand mode, the ECG cable from the patient must be directly connected to the Efficia DFM100.

If you are using the pacing function with battery and the Low Battery alarm sounds, connect the device to external power to avoid interrupted pacing therapy.

NOTES: Pacing does not start if there is a problem with the multifunction electrode pads connection or patient contact. Pace pulses are not delivered if there is a problem with the ECG monitoring electrode connections. If either situation occurs, a system message is displayed.

The **[Start Pacing]** soft key is grayed out for Demand mode pacing until a leads-on condition is detected for the ECG lead used for R-Wave detection and the pads-on condition is detected. In Fixed mode, the soft key is grayed out until pads are detected.

Fixed Mode Pacing

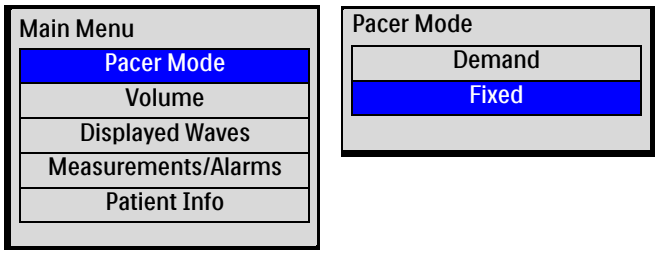
To pace in Fixed mode:

1. Turn the Therapy knob to the Pacer position.

   The message **Pacing Paused** appears in the Pacing Bar, indicating that the pacing function is enabled but pace pulses are not being delivered. Demand pacing is the default pacer mode.

2. Change to Fixed mode pacing, as shown in Figure 54.
   a. Press the Smart Select knob.
   b. Turn the Smart Select knob to highlight **Pacer Mode** and press the Smart Select knob.
   c. Select **Fixed** and press the Smart Select knob.

Figure 54 **Fixed Pacer Mode**



3. Press the Lead Select button to select the desired lead for viewing.
4. Select the Pacer Rate by pressing the **[Pacer Settings]** soft key and then selecting **Pacer Rate** from the menu. Use the Smart Select knob to adjust the rate, and then press the Smart Select knob to confirm the value and close the Pacer Rate window. Repeat and select **Pacer Output** to adjust the Pacer Output.
5. Press the **[Start Pacing]** soft key. **Pacing** appears in the Pacing Bar.
6. If you have an ECG waveform, verify white pacing markers appear.
7. Verify the presence of a peripheral pulse and increase the output if required.
8. Press the **[Pacer Settings]** soft key and then select **Pacer Output**. Use the Smart Select knob to increase the output until cardiac capture occurs. Capture is indicated by the appearance of a QRS complex after each pacing marker. Decrease the output to the lowest level that still maintains capture, and then press the Smart Select knob to confirm the value and close the Pacer Output window.
9. Assess the patient for a peripheral pulse.

To stop pacing:

- Press the **[Pause Pacing]** soft key. A prompt message asks you to confirm your action. Using the Smart Select knob, select **Yes** to pause pacing; select **No** to continue pacing. Once paused, press the flashing **[Start Pacing]** soft key to resume pacing.

  OR

- Move the Therapy knob away from the Pacer position.

WARNINGS: Use care when handling the multifunction electrode pads on the patient to avoid shock hazard during pacing.

Use multifunction electrode pads prior to their expiration date. Discard pads after use. Do not reuse pads. Do not use for more than 8 hours of continuous pacing.

If pacing is interrupted for any reason you must press the **[Start Pacing]** soft key to resume pacing.

If you are using the pacing function with battery and the Low Battery alarm sounds, connect the device to external power to avoid interrupted pacing therapy.

Defibrillating During Pacing

If you need to defibrillate the patient during pacing, refer to the procedure for defibrillation in Manual Defibrillation mode (see Chapter 6 “Manual Defibrillation” on page 75) or AED mode (Chapter 5 “AED Mode Option” on page 61). Once the Therapy knob is moved from the Pacer position to a Manual Defibrillation mode energy setting or AED, pacing is stopped.

To resume pacing after defibrillation, repeat the pacing procedure as described in “Demand Mode Pacing” on page 92 or “Fixed Mode Pacing” on page 93. When pacing is resumed, pacing settings selected prior to defibrillation (mode, rate and output) are retained. Be sure to confirm cardiac capture has been retained.

CAUTION: Pacing must be turned off before defibrillating with a second defibrillator. Failure to do so could damage the Efficia DFM100.

Pacing Alarms

Pacing alarms can be generated for the conditions shown in Table 23. Once generated, they appear as alarm messages in the Pacer Bar. There are both audio and visual alerts. When you switch patient categories, all parameter alarm limits change to the new patient category. These changes are retained when you switch modes.

- For patients that are ≥ 25 kg or ≥ 8 years old, use the Adult patient category.
- For patients <25 kg or < 8 years old, use the Infant/Child patient category.

For more information on alarms, see “Alarms” on page 37.

Table 23 **Pacing Alarms**

Alarm Message	Condition	Type of Alarm	Indication
Pacing Stopped. Power Interrupted.	Pacing has stopped. There has been a power failure during pacing.	High Priority Non-Latching Alarm	Red Alarm message with alarm tone
Pacing Stopped. Pads Off.	Pacing has stopped. A pads off condition has been detected during pacing.		
Pacing Stopped. Device Error.	Pacing has stopped. The Efficia DFM100 has detected an error which prevents delivery of pacing therapy.		
Pacing Stopped. Pads Cable Off.	Pacing has stopped. The Therapy cable is disconnected from the device.		
Therapy Disabled: Run Op Check	Therapy is disabled due to an equipment failure.		
Pacing Stopped. Leads Off.	Pacing has stopped. The primary ECG lead has become invalid in Demand mode pacing.		
Pacer Output Low	The actual delivered pace pulse current is less than the selected output.		
Pacing on Low Battery	The battery’s charge level is low.		

NOTE: Once the reason for the Pacing Stopped alarm has been resolved, that part of the alarm message is removed from the display. The audio alarm continues. Press the **[Start Pacing]** soft key to resume pacing, remove the remainder of the alarm text from the display and silence the audio alarm.

WARNING: Observe the patient closely while pacing. Heart rate displays and alarms function during pacing but can be unreliable. Do not rely on the indicated heart rate or heart rate alarms as a measure of the patient's perfusion status.

Troubleshooting

If your Efficia DFM100 does not operate as expected during pacing, see "Defibrillation and Pacing Problems" on page 179.

NOTES

9

Monitoring CO_2

This chapter describes how to monitor carbon dioxide (CO_2) and measure end-tidal carbon dioxide ($EtCO_2$) and Airway Respiration Rate (AwRR) with the Efficia DFM100. You can use one of two sensor types:

- Philips Mainstream
- Philips Sidestream

Overview

The carbon dioxide monitoring function of the Efficia DFM100 measures the partial pressure of carbon dioxide in a sample of the patient's exhaled breath. The Efficia DFM100 may be used to monitor carbon dioxide in both intubated and non-intubated patients.

The partial pressure of carbon dioxide is derived by multiplying the measured carbon dioxide concentration with the ambient pressure. From the partial pressure measurement, the end-tidal carbon dioxide ($EtCO_2$) is derived.

$EtCO_2$ is the peak CO_2 value measured during expiration. It is used to monitor the patient's respiratory status. The $EtCO_2$ measurement uses a technique based on the absorption of infrared radiation by some gases. It indicates the change in:

- The elimination of CO_2.
- The delivery of O_2 to the lungs.

The CO_2 monitoring function of the Efficia DFM100 provides an $EtCO_2$ value, a CO_2 waveform (Capnogram), and an airway respiration rate (AwRR). The AwRR relies on CO_2 functionality to identify valid breaths for numeric display and alarm conditions such as Apnea.

CO_2 monitoring is available in AED, Monitor, Pacer and Manual Defib modes and on both adult and infant/child patients. Use the Patient Category button to switch categories.

When pressing the Patient Category button, all parameter alarm limits change to the new patient category. These changes are retained when you switch modes.

- For patients that are ≥ 25 kg or ≥ 8 years old, use Adult patient category
- For patients <25 kg or < 8 years old, use Infant/Child patient category
  The neonatal patient category is not supported.

Precautions for Measuring $EtCO_2$

WARNINGS: The $EtCO_2$ readings do not always correlate closely with blood gas values, especially in patients with pulmonary disease, a pulmonary embolism or inappropriate ventilation.

$EtCO_2$ and AwRR measurements may be inaccurate when the CO_2 sensor needs to be zeroed, has not been set to the correct barometric pressure or has not had sufficient time to warm up. Sensor application errors and environmental conditions may also affect measurements.

Check for physical occlusions such as a kink in the sample line or the patient lying on the sample line before measuring $EtCO_2$.

Danger - explosion hazard - do not use in the presence of flammable anesthetics mixture with air or with oxygen or nitrous oxide. Sampling line may ignite in the presence of oxygen when directly exposed to laser, ESU devices or high heat. When performing head and neck procedures involving laser, electrosurgical devices or high heat, use caution to prevent flammability of the sampling line or the surrounding environment.

CO_2 measurements may be inaccurate when measured in the presence of aerosolized pharmaceuticals or anesthetic gases.

The Sidestream CO_2 sensor port should vent into open air. Do not block the exhaust port on your Sidestream sensor. If the port is blocked, there could be a significant delay in measurement readings with no indication of a problem.

When using a nasal sample line, if one or both nostrils are partially or completely blocked, or the patient is breathing through the mouth, the displayed $EtCO_2$ values may be significantly low.

When measuring $EtCO_2$ on patients who are receiving or have recently received anesthetics, connect exhaust tubing from the CO_2 Outlet port to a scavenging system or to the anesthesia machine/ventilator to prevent exposing medical staff to anesthetics. Use an exhaust tube attached to the CO_2 outlet port to remove the sample gas to a scavenging system.

To avoid risk of patient cross-infection, do not connect the exhaust to the patient airway.

Use only accessories listed in the supplies chapter to ensure correct functioning of the CO_2 measurement.

Carefully route the sampling line to reduce the possibility of patient entanglement or strangulation.

Reflux of gastric contents, mucus, pulmonary edema fluid or endotracheal epinephrine introduced into the detector can increase airway resistance and affect ventilation. Discard accessory if this occurs.

The presence of carbonated beverage or antacids in the stomach may cause incorrect readings and unreliable capnography in identifying esophageal intubation.

CAUTIONS: If the Sidestream sensor is used in close proximity to the ECG monitoring electrodes, you may see noise on the ECG waveform. If this occurs, move the sensor away from the monitoring electrodes.

The Efficia DFM100 is not equipped with automatic barometric pressure compensation. The device needs to be set to the local atmospheric pressure before being used to monitor $EtCO_2$. An incorrect pressure setting results in an incorrect reading. See your Efficia DFM100 *Service Manual* for more information on setting the atmospheric pressure.

Preparing to Measure $EtCO_2$

Sensors

There are two sensors that can be used with the Efficia DFM100 to measure $EtCO_2$:

- Mainstream
- Sidestream

Figure 55 **$EtCO_2$ Sensors**

NOTE: See your individual sensor's *Instructions for Use* for further warnings, cautions and other instructions.

Selecting the Accessories

There are some factors to consider when selecting accessories for your particular sensor:

- the type of patient, adult or pediatric (Neonate is not supported.)
- airway status of the patient, ventilated or not ventilated.
- if a ventilated patient, whether humidified or non-humidified ventilation is used.

Do not re-use, clean, or sterilize single-use CO_2 accessories as they are intended for single-patient, one-time use. Clean reusable accessories according to the manufacturer's recommendations.

See Chapter 18 "Supplies and Accessories" on page 189 for a listing of approved CO_2 accessories.

WARNING: Use only accessories listed in the supplies chapter to ensure correct functioning of the CO_2 measurement.

Monitoring $EtCO_2$

To monitor $EtCO_2$:

1. Connect the sensor to the Efficia DFM100 and the sampling line to the sensor (see "Connecting the CO2 Cable and Sample Line" on page 12).
2. Apply the sampling line to the patient.
3. If the Efficia DFM100 is not turned on, turn the Therapy knob to Monitor.
   - $EtCO_2$ needs to be configured to appear in AED mode.
4. Check that the patient category is appropriate for the patient. If necessary change the Patient Category to select the appropriate category. See "General Function Buttons" on page 27.

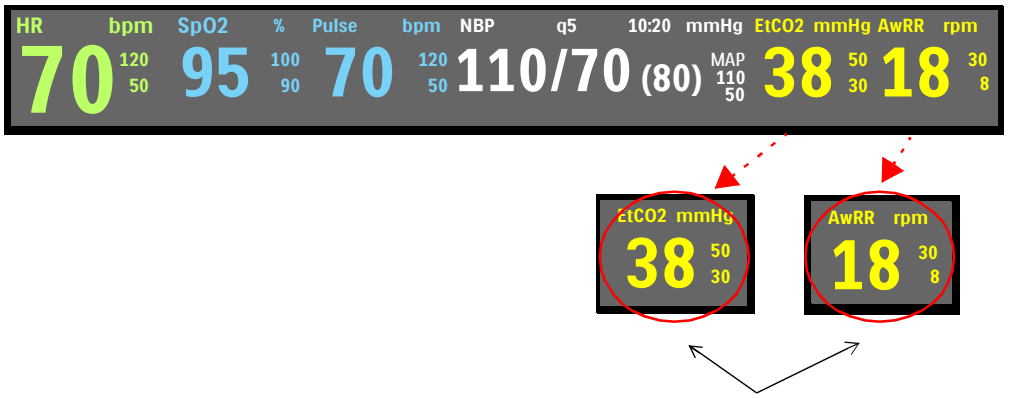
The $EtCO_2$ measurement automatically turns on when you connect a sensor to the CO_2 port. The Capnogram is displayed in the configured Wave Sector if available. The measurement values for $EtCO_2$ and AwRR are displayed.

Question marks:

- If there is a **-?-** in the parameter block and a dashed line in place of the Capnogram on the display, the waveform source is invalid. Check patient, confirm airway status and examine the cable and sensor for a good connection. Also check the sampling line to make sure it is connected to the sensor and not kinked or pinched.

- If there is a **?** before the measurement and a Capnogram on the display, the sensor is warming up. As soon as the sensor is warmed up, the **?** is removed from the display.

Figure 56 $EtCO_2$ and AwRR



Alarm Limits - If alarms are turned on, the alarm limits are displayed. If alarm limits are turned off, the alarms off symbol is displayed.

WARNING: Leakages in the breathing system or sampling system may cause the displayed $EtCO_2$ values to be significantly too low. Always connect all components securely and check for leaks according to standard clinical procedures. Displacement of the nasal or combined nasal oral cannulas can cause lower than actual $EtCO_2$ readings. Even with combined nasal oral cannulas, the $EtCO_2$ readings may be slightly lower than actual in patients breathing through the mouth only.

NOTE: Mainstream and Sidestream sensors detect breaths down to 5 mmHg. For values below 5 mmHg, you see a **-?-** in place of the $EtCO_2$ measurement in the parameter bar.

$EtCO_2$ and AwRR Alarms

Alarms behave the same regardless of which sensor is attached to the Efficia DFM100. Alarms sound if measurements fall outside the configured limits for high or low $EtCO_2$, high or low Airway Respiration Rate (AwRR) and Apnea time.

$EtCO_2$ alarms can be generated for the conditions shown in Table 24 and Table 25. Once generated, they appear as alarm messages in the $EtCO_2$ alarm status area above the numerics. There are both audio and visual alerts. For more information on alarms, see "Alarms" on page 37.

NOTE: Alarm notification is configurable. See "Alarm Management" on page 39.

Table 24 **$EtCO_2$ Physiological Alarms**

Alarm Message	Condition	Type of Alarm	Indication
Apnea	No detectable breaths for the configured number of seconds.	High Priority, Latching Alarm	Red alarm message with audio tone
EtCO2 High	The $EtCO_2$ value exceeds the high alarm limit.	Medium Priority, Latching Configurable Alarm	Yellow alarm message with audio tone
EtCO2 Low	The $EtCO_2$ value has fallen below the low alarm limit.		
AwRR High	The AwRR value exceeds the high alarm limit.		
AwRR Low	The AwRR value has fallen below the low alarm limit.		

Table 25 **$EtCO_2$ Technical Alarms**

Alarm Message	Condition	Type of Alarm	Indication
CO2 Replace Sensor	CO_2 sensor has reached its end of service life.	High Priority Non-Latching Alarm	Red alarm message with audio tone.
CO2 Sensor Over Temp	CO_2 sensor is reporting an over temperature condition.		
CO2 Service Required	CO_2 sensor requires service.		
CO2 Communication Failure	CO_2 sensor is connected but the Efficia DFM100 cannot communicate with it.		

Table 25 **$EtCO_2$ Technical Alarms *(Continued)***

Alarm Message	Condition	Type of Alarm	Indication
CO2 Zero Required	CO_2 sensor needs to be zeroed.	Low Priority Non-Latching Alarm	Cyan alarm message with audio tone.
CO2 Sensor Warming Up	CO_2 sensor has not warmed up to operating temperature range.		
CO2 Check Line	The sampling line is kinked or blocked. For Sidestream only.		
CO2 Check Airway Adapter	The airway adapter is blocked. For Mainstream only.		
CO2 Error	A non-critical failure has been detected.		
CO2 Out of Range	CO_2 is out of range. A Zero Required prompt appears after one minute.		
CO2 Tube Unplugged	Sampling line is disconnected.		
CO2 Sensor Unplugged	CO_2 sensor is unplugged.		
EtCO2 Power Overload	CO_2 sensor has a power problem.		

NOTE: $EtCO_2$ and AwRR alarms are on (except AED mode) unless you turn them off or alarms for the entire device are off. Once disabled, alarms remain off until they are turned back on.

WARNING: Turning off alarms prevents all alarms associated with $EtCO_2$ or AwRR measurements from annunciating. If an alarm condition occurs, NO alarm indication will be given.

Changing the $EtCO_2$ Alarm Limits

To change the $EtCO_2$ alarm limits:

1 Press the Smart Select knob.

2 Turn the Smart Select knob to highlight the **Measurements/Alarms** menu and press the Smart Select knob.

3 Select **EtCO2** and press the Smart Select knob.

4 Select **EtCO2 Limits** and press the Smart Select knob.

5 Turn the Smart Select knob to select the new high limit value then press the Smart Select knob.

6 Set the new low limit value and press the Smart Select knob.

Enabling/Disabling the $EtCO_2$ Alarms

To enable or disable the $EtCO_2$ alarms:

1 Press the Smart Select knob.

2 Turn the Smart Select knob to highlight the Measurements/Alarms menu and press the Smart Select knob.

3 Select EtCO2 and press the Smart Select knob.

4 Select Alarms On (Alarms Off) and press the Smart Select knob.

Changing the AwRR Alarm Limits

To change the AwRR alarm limits:

1 Press the Smart Select knob.

2 Turn the Smart Select knob to highlight the Measurements/Alarms menu and press the Smart Select knob.

3 Select AwRR and press the Smart Select knob.

4 Select AwRR Limits and press the Smart Select knob.

5 Turn the Smart Select knob to select the new high limit value then press the Smart Select knob.

6 Set the new low limit value and press the Smart Select knob.

Changing the Apnea Time Alarm Limit

To change the apnea time alarm limit:

1 Press the Smart Select knob.

2 Turn the Smart Select knob to highlight the Measurements/Alarms menu and press the Smart Select knob.

3 Select AwRR and press the Smart Select knob.

4 Select Apnea Time and press the Smart Select knob.

5 Turn the Smart Select knob to select the new high limit value then press the Smart Select knob.

6 Set the new low limit value and press the Smart Select knob.

Enabling/Disabling AwRR Alarms

1 Press the Smart Select knob.

2 Turn the Smart Select knob to highlight the Measurements/Alarms menu and press the Smart Select knob.

3 Select AwRR and press the Smart Select knob.

4 Select Alarms On (Alarms Off) and press the Smart Select knob.

WARNING: The safety and effectiveness of the respiration measurement method in the detection of apnea, particularly the apnea of infancy, has not been established.

Zeroing Sidestream and Mainstream Sensors

To avoid inaccurate readings, Sidestream and Mainstream sensors need to be reset and require a valid zero be performed when:

- attaching a new sample line
- there has been a significant change in environmental conditions
- when the accuracy of the reading is questionable
- requested by the Efficia DFM100

NOTES: Do not zero Sidestream and Mainstream CO_2 sensors without a sampling line installed.

Wait 20 seconds after removing the sampling line from the patient's airway before zeroing the CO_2 sensor, so any lingering CO_2 in the line can dissipate.

Keep the sampling line away from all sources of CO_2, including exhaled breaths (yours and the patient's) and ventilator exhaust.

During zeroing, $EtCO_2$ data is invalid. A **-?-** is displayed in the parameter block and a dashed line appears in the wave sector.

Zeroing Using the Soft Key

To zero the CO_2 sensor using the soft key:

1. Confirm the Efficia DFM100 is in a clinical mode.
2. Press the **[Zero CO2]** soft key.
3. The **CO2 Zero in Progress** message appears on the display. The message disappears when zeroing is finished.

Zeroing Using the Smart Select knob

To zero the CO_2 sensor using the Smart Select knob:

1. Confirm the Efficia DFM100 is in a clinical mode.
2. Press the Smart Select knob.
3. Turn the Smart Select knob to highlight **Measurements/Alarms** menu and press the Smart Select knob.
4. Select **EtCO2** and press the Smart Select knob.
5. Select **Zero** and press the Smart Select knob.
6. The **CO2 Zero in Progress** message appears on the display. The message disappears when zeroing is finished.

See Table 26 for messages which might appear during zeroing.

Table 26 **Zeroing Messages**

Message	Situation	Possible Solution
CO2 Zero in Progress	The CO_2 sensor is being zeroed.	No action required.
Unable to zero: CO2 in the Tube	There is CO_2 in the sample line.	If patient is not breathing into the tube, zero again.
Unable to zero: CO2 Sensor Not Ready	The CO_2 sensor is still attached to a patient.	
	The CO_2 sensor is warming up.	Allow the sensor to finish warming up and re-try zeroing

NOTES: The [Zero CO2] soft key is grayed out when the device is in the process of zeroing the sensor.

The [Zero CO2] soft key does not appear while the Trends table is displayed.

Disabling the $EtCO_2$ Monitoring Function

To disable the $EtCO_2$ monitoring function, disconnect the sensor's cable from the Efficia DFM100. The message CO2 Sensor Unplugged - Turn Off EtCO2? appears. Select Yes and press the Smart Select knob.

Should the sensor and cable be disconnected accidentally, the message CO2 Sensor Unplugged - Turn Off EtCO2? appears to notify you of the disconnection. Select No and press the Smart Select knob. Secure the connection. The CO_2 monitoring function is enabled again.

Troubleshooting

If your Efficia DFM100 does not operate as expected during CO_2 Monitoring, see Table 57 "$EtCO_2$ Problems" on page 183.

NOTES

10

Monitoring SpO_2

Pulse Oximetry (SpO_2) is one of the tools available to assist in assessing a patient's cardiac and respiratory systems. This chapter explains how Pulse Oximetry works and how to use the Efficia DFM100 to monitor SpO_2.

Overview

Pulse oximetry is a non-invasive method of continuously measuring functional oxygen saturation (SpO_2) in arterial blood. SpO_2 readings indicate the percentage of hemoglobin molecules in arterial blood which are saturated with oxygen.

You can monitor SpO_2 in all Efficia DFM100 clinical modes and on both adult and infant/child patients. Use the Patient Category button to switch categories.

When pressing the Patient Category button, all parameter alarm limits change to the new patient category. These changes are retained when you switch modes.

- For patients that are ≥ 25 kg or ≥ 8 years old, use Adult patient category
- For patients <25 kg or < 8 years old, use Infant/Child patient category
  The neonatal patient category is not supported.

WARNINGS: Do not leave an SpO_2 sensor on a patient undergoing an MRI.

For patients with an intra-aortic balloon pump, access peripheral pulses according to your institution's protocol.

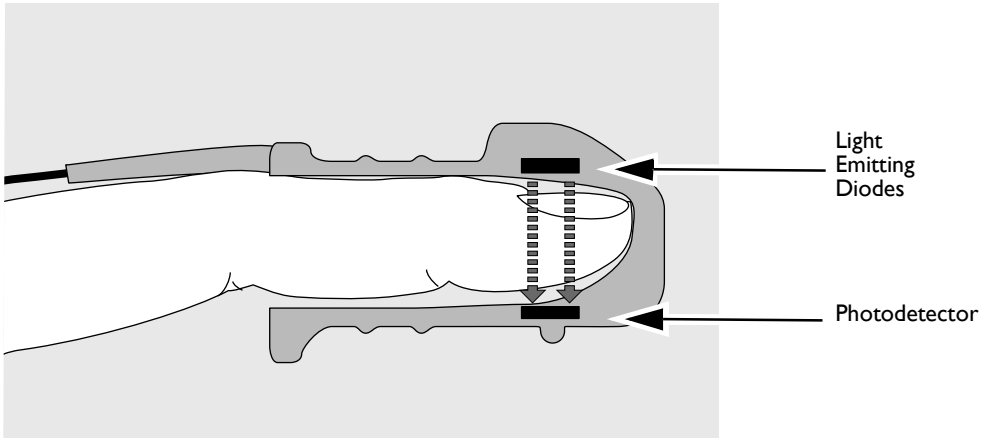
Do not rely solely on SpO_2 readings; assess the patient at all times. Inaccurate measurements may be caused by:

- Incorrect sensor application or use
- Significant levels of intravascular dyshemoglobins such as carboxyhemoglobin or methemoglobin in patient
- Patients with other disorders of hemoglobin
- Patients with restricted blood flow to the extremities (such as those in severe shock or hypothermia)
- Injected dyes such as methylene blue
- Exposure to excessive illumination such as surgical lamps (especially those with a xenon light source), bilirubin lamps, fluorescent lights, infrared heating lamps or direct sunlight

Understanding Pulse Oximetry

A pulse oximetry sensor sends light through patient tissue to a receiver on the other side of the sensor. Light-emitting diodes transmit red and infrared light through the peripheral areas of the body such as a finger. See Figure 57.

Figure 57 **Pulse Oximetry Sensor**



A photodetector positioned opposite the light emitting diodes compares the light absorption before and after pulsation. The amount of light getting through reflects the blood flow in the arterioles. This measurement of light absorption during pulsation is translated into an oxygen saturation percentage. The SpO_2 value and wave are displayed.

WARNING: SpO_2 readings may be inaccurate in patients that:

- Are hypothermic
- Are receiving a photosensitive drug
- Are receiving vasoconstrictor medications
- Have poor circulation

NOTE: For accurate SpO_2 measurements, the following conditions must apply:

- The patient must have perfusion in that extremity.
- The light emitter and photodetector must be directly opposite each other.
- All of the light from the emitter must pass through the patient's tissue.
- The sensor site should be free of vibration and excessive motion.
- The sensor cable and connector should be positioned away from power cables to avoid electrical interference.

Selecting a Sensor

The most important factor when selecting a sensor is the position of the light emitting diodes in relation to the photodetector. When the sensor is applied, the diodes and the photodetector must be opposite each other. Sensors are designed for patients with a specific weight range and for specific sites. Be sure to:

- Select a sensor appropriate for the patient's weight.
- Select a sensor site with adequate perfusion.
- Avoid application to sites with edematous tissue.

SpO_2 sensors are either reusable or disposable. Reusable sensors can be reused on different patients after they have been cleaned and disinfected (see the manufacturer's instructions supplied with the sensor). Disposable sensors should only be used once and then discarded. They may be relocated to another appropriate site on the same patient but not reused on different patients.

See Table 61 "Approved Supplies and Accessories" on page 189 for a list of SpO_2 sensors and accessories that can be used with the Efficia DFM100.

CAUTIONS: Do not use more than one extension cable (M1941A).

Do not use the ear transducer on patients with small ear lobes as incorrect measurements may result.

Applying the Sensor

Follow the manufacturer's directions for applying and using the sensor, making sure to observe any warnings or cautions. For best results:

- Make sure the sensor is dry.
- If the patient is moving, secure the sensor cable loosely to the patient.
- Make sure the sensor is not too tight. Too much pressure can cause venous pulsation or can impede blood flow, resulting in low readings.
- Keep power cables away from the sensor cable and connection.
- Avoid placing the sensor in an environment with bright lights. If necessary, cover the sensor with opaque material.
- Avoid placing the sensor on an extremity with an arterial catheter, blood pressure cuff or intravenous infusion line.

WARNINGS: Failure to apply the sensor properly may reduce the accuracy of the SpO_2 measurement.

Inspect the sensor application site at least every two hours for changes in skin quality, correct optical alignment and proper sensor application. If skin quality is compromised, change the sensor site. Change the application site at least every four hours. More frequent checking may be required due to an individual patient's condition.

Do not use a damaged sensor or one with exposed electrical circuits.

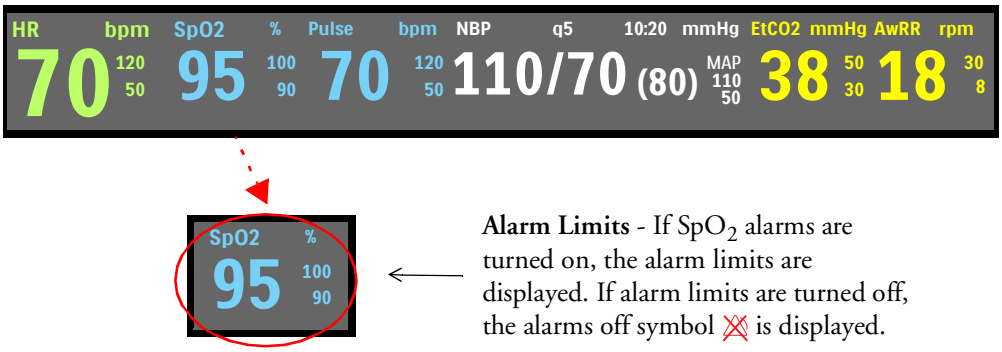
Monitoring SpO_2

To monitor SpO_2:

1. Connect the appropriate sensor cable to the Efficia DFM100 (see "Connecting the SpO_2 Cable" on page 13).
2. Apply the sensor to the patient.
3. If the Efficia DFM100 is not turned on, turn the Therapy knob to a clinical mode.
   - SpO_2 needs to be configured to appear in AED mode and does not display unless it is pulsatile.
4. Check that the patient category is appropriate for the patient. If necessary, change the Patient Category to select the appropriate category. See "General Function Buttons" on page 27.

Once the sensor cable is connected and the device is turned on, an SpO_2 measurement begins. A **-?-** is displayed for the SpO_2 value in the Parameter Area while the oxygen saturation is initially measured and value calculated. In a few seconds a value replaces the **-?-**. See Figure 58.

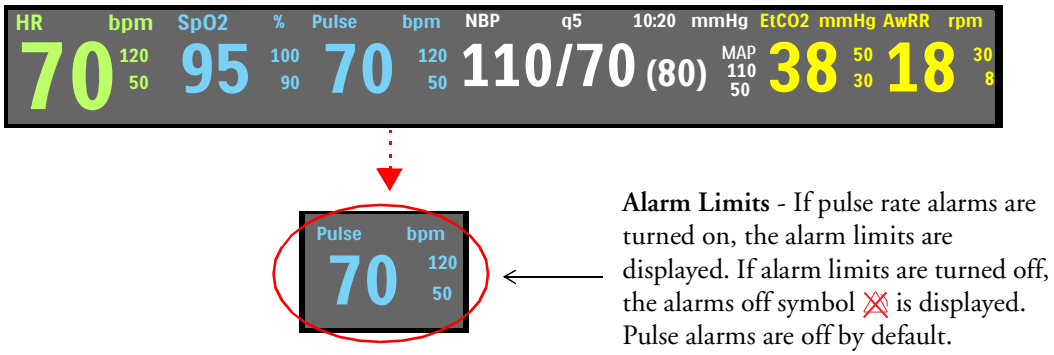
Figure 58 **SpO_2 Value**



Pulse Rate

The patient's pulse rate, as derived from pulse oximetry, is displayed in the Parameter Area. See Figure 59.

Figure 59 **Pulse Rate Value**

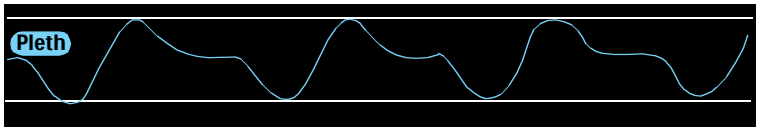


Pleth Wave

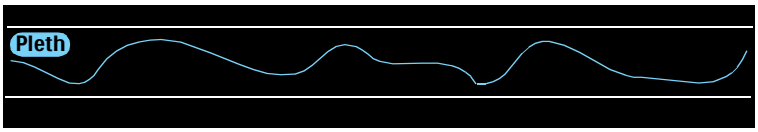
When the sensor is connected to the Efficia DFM100, the pleth wave is displayed in the configured Wave Sector. Grid lines are displayed to indicate signal quality. When the signal quality is good, the pleth wave is auto-scaled to the grid lines. When the signal is poor, the size of the wave is proportionally decreased and appears not to reach the grid lines.

Figure 60 **Pleth Waves**

Good Pleth Signal Quality



Poor Pleth Signal Quality



SpO_2 Alarms

Alarms activate if measurements fall outside the configured limits for high or low SpO_2, or if the measurement falls below the configured SpO_2 Desat Limit.

SpO_2 alarms can be generated for the conditions shown in Tables 27 and 28. Once generated, they appear as alarm messages in the SpO_2 alarm status area above the SpO_2 numeric. There are both audio and visual alarms. For more information on alarms, see"Alarms" on page 37.

NOTE: Alarm notification is configurable. See "Alarm Management" on page 39.

Table 27 **SpO_2 Physiological Alarms**

Alarm Message	Condition	Type of Alarm	Indication
Desat	The SpO_2 value has fallen below the Desat low limit.	High Priority Latching Alarm	Red alarm message with audio tone
SpO2 High	The SpO_2 value exceeds the high alarm limit.	Medium Priority Latching Configurable Alarm	Yellow alarm message with audio tone
SpO2 Low	The SpO_2 value has dropped below the low alarm limit.		

Table 28 **SpO_2 Technical Alarms**

Alarm Message	Condition	Type of Alarm	Indication
SpO2 Sensor Malfunction	The device is unable to detect a Pleth waveform due to a SpO_2 sensor malfunction.	Low Priority Non-Latching Alarm	Cyan alarm message with audio tone
SpO2 Unplugged	The SpO_2 sensor is disconnected.		
SpO2 Noisy Signal	A noisy SpO_2 sensor signal has been detected.		
SpO2 Interference	Light interference has been detected at the SpO_2 sensor.		
SpO2 Non-Pulsatile	A non-pulsatile SpO_2 signal has been detected.		
SpO2 Equipment Malfunction	A problem with the SpO_2 module has been detected.		
SpO2 Erratic	An erratic measurement has been detected.		
SpO2 Extended Update	The SpO_2 measurement has not been updated within the last 30 seconds.		
SpO2 Low Perfusion	The device has detected low perfusion.		
SpO2 Error	A non-critical failure has been detected.		

NOTES: SpO_2 alarms are on in all clinical modes (except AED and Manual) unless you specifically turn them off or alarms for the entire device are off. Once disabled, alarms remain off until they are turned back on.

While an NBP measurement is in progress, SpO_2 alarms are suppressed.

SpO_2 Desat Alarm

The SpO_2 Desat alarm provides an additional limit setting below the low limit setting to notify you of potentially life-threatening decreases in oxygen saturation. This additional limit is preset through Configuration mode.

NOTE: If the SpO_2 Low Limit alarm value is set below the configured SpO_2 Desat Limit, the Desat Limit is automatically adjusted to the SpO_2 Low Limit value. Should the SpO_2 reading fall below this value, the SpO_2 Desat Limit Alarm is announced.

Changing SpO_2 Alarm Limits

◎ **To change the SpO_2 high and low alarm limits:**

1 Press the Smart Select knob.

2 Turn the Smart Select knob to highlight Measurements/Alarms and press the Smart Select knob.

3 Select SpO2 and press the Smart Select knob.

4 Select SpO2 Limits and press the Smart Select knob.

5 Turn the Smart Select knob to select the new high limit value then press the Smart Select knob.

6 Select the new low limit and press the Smart Select knob.

Enabling/Disabling SpO_2 Alarms

To enable/disable SpO_2 alarms:

1 Press the Smart Select knob.

2 Turn the Smart Select knob to highlight Measurements/Alarms and press the Smart Select knob.

3 Select SpO2 and press the Smart Select knob.

4 Select Alarms On (Alarms Off) and press the Smart Select knob.

WARNING: Turning alarms off prevents all alarms associated with the SpO_2 measurement from being annunciated. If an alarm condition occurs, no alarm indication is announced.

Pulse Rate Alarms

You can turn on/off Pulse Rate alarms in all clinical modes where SpO_2 is available. The configured alarm limits may be changed during use. Alarms are annunciated if measurements fall outside the configured limits for high or low pulse rate.

Pulse Rate alarms can be generated for the conditions shown in Table 29. Once generated, they appear as alarm messages in the Pulse status area right above the Pulse numeric. There are both audio and visual alerts. For more information on alarms, see "Alarms" on page 37.

Table 29 **Pulse Rate Alarms**

Alarm Message	Condition	Type of Alarm	Indication
Pulse High	Pulse value is greater than the Pulse high alarm limit.	Medium Priority Latching Configurable Alarm	Yellow alarm message with audio tone
Pulse Low	Pulse value is less than the Pulse low alarm limit.		

NOTE: Pulse alarms are off by default except when the Efficia DFM100 enters Pacing mode.

Changing Pulse Rate Alarm Limits

To change the Pulse high and low alarm limits:

1 Press the Smart Select knob.

2 Turn the Smart Select knob to highlight Measurements/Alarms and press the Smart Select knob.

3 Select Pulse and press the Smart Select knob.

4 Select Pulse Limits and press the Smart Select knob.

5 Turn the Smart Select knob to select the new high limit value then press the Smart Select knob.

6 Select the new low limit and press the Smart Select knob.

Enabling/Disabling Pulse Rate Alarms

◎ **To enable/disable Pulse alarms:**

1. Press the Smart Select knob.
2. Turn the Smart Select knob to highlight **Measurements/Alarms** and press the Smart Select knob.
3. Select **Pulse** and press the Smart Select knob.
4. Select **Alarms On** (**Alarms Off**) and press the Smart Select knob.

Disabling SpO_2 Monitoring

◎ **To disable SpO_2 monitoring:**

1. Disconnect the sensor cable from the SpO_2 port. The message **SpO2 Unplugged - Turn Off SpO2?** appears.
2. Select **Yes** and press the Smart Select knob.

NOTE: If the sensor cable is disconnected accidentally, the message **SpO2 Unplugged - Turn Off SpO2?** appears. Select **No** and press the Smart Select knob. Secure the sensor connection to begin SpO_2 monitoring again.

Caring for Sensors

Refer to the manufacturer's instructions for care and cleaning of your sensors. To get the best results from your reusable sensors, always handle the sensors and cable with care and protect them from sharp objects. The sensor houses a sensitive electronic device that can be damaged. Harsh treatment of the sensor reduces their useful life.

Troubleshooting

If your Efficia DFM100 does not operate as expected during SpO_2 Monitoring, see Table 56 "SpO_2 Problems" on page 182.

Monitoring NBP

This chapter explains how to monitor blood pressure (NBP) using the Efficia DFM100.

Overview

The Efficia DFM100 measures blood pressure for both adult and infant/child patients using the oscillometric method. Systolic, diastolic and mean measurements are provided. Alarms are available to alert you to changes in the patient's condition.

NBP measurements can be taken in Monitor, Manual Defibrillation (including Synchronized Cardioversion), and Pacing modes. NBP is not available in AED mode. NBP measurements can be taken automatically on a pre-set schedule or manually on demand.

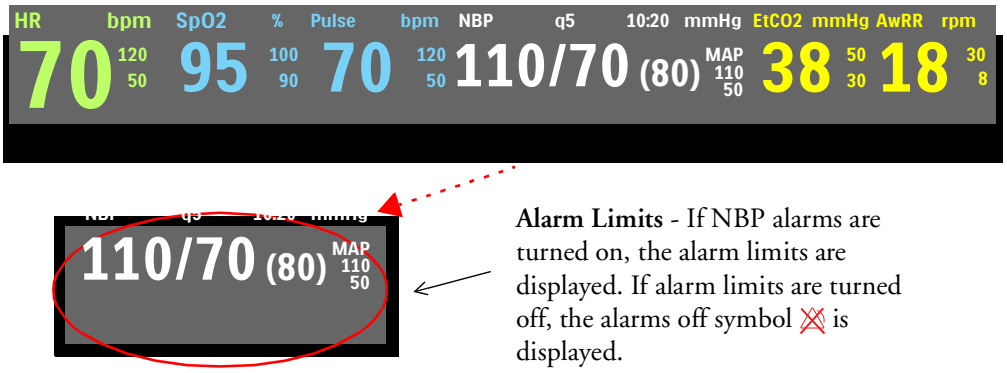
Use the Patient Category button to switch between patient categories.

When pressing the Patient Category button, all parameter alarm limits and initial inflation pressures change to the new patient category. These changes are retained when you switch modes.

- For patients that are ≥ 25 kg or ≥ 8 years old, use Adult patient category.
- For patients <25 kg or < 8 years old, use Infant/Child patient category.
  The neonatal patient category is not supported.

While an NBP measurement is in progress, the current cuff pressure is displayed in the Parameter area. Once the measurement is complete, the values for systolic, diastolic and mean pressure are displayed along with the measurement schedule (manual or automatic intervals) and a time stamp (see Figure 61.)

Figure 61 **NBP Values**



WARNING: Do not perform NBP monitoring on patients whose upper arm circumference is less than 13cm. Doing so may result in inaccurate measurements.

Measuring NBP

The first time an NBP measurement is taken, the cuff's initial inflation pressure is 160 mmHg/21.3 kPa for adults and 120 mmHg/16 kPa for infant/child. The device aborts a measurement, deflates the cuff and generates an alarm before the inflation pressure exceeds 290 mmHg/38.6 kPa.

NOTE: For pediatric and adult patient populations, blood pressure measurements made with the Philips Goldway NBP Module are equivalent to those obtained by trained observers using the cuff/stethoscope auscultatory method within limits prescribed by ANSI/AAMI SP10: 1992 & 2002/YY 0670-2008 (mean error difference of ±5 mmHg or less, standard deviation of 8 mmHg or less).

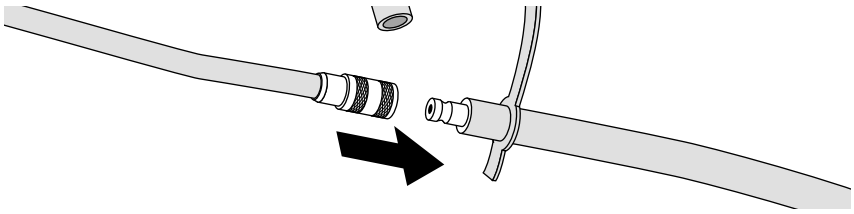
To measure NBP:

1 Select the appropriately sized cuff for the patient. The cuff width should be either 40% of the limb circumference or 2/3 of the upper arm length. The inflatable part of the cuff should be long enough to encircle 50-80% of the limb.

NOTE: Selecting the right cuff size for the patient is important. The wrong cuff size may give false and misleading results. If you do not have the correct cuff size, use a larger one to minimize error.

2 Attach the cuff to the NBP tubing, making sure that air can pass through the tubing and the tubing is not squeezed or kinked. See Figure 62.

Figure 62 **Connecting the NBP Cuff/Tubing**



NOTE: Securely attach the cuff and tubing to prevent accidental disconnections.

3 Insert the NBP tubing into the NBP port as described in "Connecting the NBP Cable" on page 13.

4 Apply the blood pressure cuff to the patient's arm or leg as follows:

a Ensure that the cuff is completely deflated.

b Wrap the cuff around the arm, making sure that the artery marker is aligned over the brachial artery. Ensure that:

- The cuff is not placed on the same extremity as an SpO_2 sensor.
- The cuff is not wrapped too tightly around the limb. Excessive tightness may cause discoloration and eventual ischemia of the extremities.
- The NBP tubing from the defibrillator to the cuff is not compressed, crimped or damaged.
- The edge of the cuff falls within the range identified by the <----> markings. If it does not, use a cuff that fits better.

5 Place the limb used for taking the measurement at the same level as the patient's heart.

6 Press the [Start NBP] soft key. As the cuff begins to inflate and then deflate, the pressure is displayed.

7 When the measurement is complete, the NBP values are displayed.

To stop an NBP measurement in progress, press the [Stop NBP] soft key.

Assessment of Hypertension

To make a measurement for use in the assessment of hypertension:

1 Ensure the patient is comfortably seated with their legs uncrossed and feet flat on the floor. Their back and arm should be supported.

2 Ask the patient to relax as much as possible and not talk during the measurement.

3 Confirm, the middle of the cuff is at the level of the right atrium of the heart.

4 If possible, wait five minutes before making the first measurement.

WARNINGS: Do not perform noninvasive blood pressure measurements on patients with sickle-cell disease or any condition where skin damage has occurred or is expected.

Do not use in a hyperbaric chamber.

Care should be taken when using an oscillometric NBP device on patients with decreased consciousness, neuropathy, irregular cardiac rhythm, labile high blood pressure, increased arm activity, or arterial insufficiency especially if the unit is utilized for a prolonged period. A safeguard of the NBP system is that the device incorporates a softkey that can be pressed to deflate the cuff if the cuff is causing patient pain. Pay particular attention to unconscious patients since they cannot alert you if the pain is present.

Use clinical judgement to decide whether or not to perform automatic blood pressure measurements on patients with severe blood clotting disorders because of the risk of hematoma in the limb wearing the cuff.

Do not apply the cuff to a limb that has an intravenous infusion or arterial catheter in place. This could cause tissue damage around the catheter when the infusion is slowed or blocked during cuff inflation.

Use only approved cuffs and tubing in order to prevent inaccurate data, injury or damage. All specified cuffs are protected against the effects of the discharge of a defibrillator.

Prolonged series of NBP measurements in automatic mode may be associated with purpura, ischemia and neuropathy in the limb wearing the cuff. When monitoring a patient, examine the extremities of the limb frequently for normal color, warmth and sensitivity. If any abnormality is observed, stop the blood pressure measurements immediately.

Blood pressure readings may be affected by the position of the patient, their physiologic condition, the presence of arrhythmia and other factors.

Kinked or otherwise restricted tubing can lead to a continuous cuff pressure, causing blood flow interference and potentially resulting in injury to the patient.

Do not apply the cuff over a wound as this can cause further injury.

Avoid applying the cuff on the same side as a mastectomy as the pressure increases the risk of lymphedema. For patients with a bilateral mastectomy, use clinical judgement to decide whether the benefit of the measurement outweighs the risk.

To obtain accurate blood pressure readings, the cuff must be the correct size and also be correctly fitted to the patient. Incorrect size or incorrect fitting may result in incorrect readings.

NBP measurements may be impacted if there is excessive motion or vibration, such as when the patient is being transported in a moving vehicle.

CAUTIONS: Do not compress or restrict pressure tubes during an NBP measurement.

If a spill occurs and liquid appears inside the tubing, contact your service personnel.

NOTE: When utilizing NBP, use your clinical judgment on appropriate application for patient's clinical status.

NBP Schedule

NBP measurements can be taken on a manual or predetermined automatic basis, depending on how the device is configured and the patient's needs:

Manual - There is no schedule for additional measurements. One measurement is taken each time you press the **[Start NBP]** soft key. Take additional measurements by pressing the **[Start NBP]** soft key.

Automatic - A measurement is attempted at configured intervals - every 1, 2.5, 5, 10, 15, 30, 60 or 120 minutes. In order for a measurement to successfully begin, any previous measurement has to have ended, the cuff must be deflated and 30 seconds of rest time elapsed.

NOTE: All criteria must be met in order for an automatic NBP to be taken. For example, if you have the automatic measurement setting set to every 1 minute, the device attempts to take an NBP every 60 seconds. However, for the measurement to successfully begin, the previous measurement must have ended, cuff must be deflated and 30 seconds must have elapsed after cuff deflation. If these criteria are not met, the device waits the 60 seconds to attempt another measurement.

Additional manual measurements can be taken without affecting the automatic measurement schedule by pressing the **[Start NBP]** soft key.

The configured NBP measurements schedule may be changed during an event.

To change the NBP schedule and/or the interval of automatic measurements for the current patient:

1. Press the Smart Select knob.
2. Turn the Smart Select knob to highlight **Measurements/Alarms** and press the Smart Select knob.
3. Select **NBP** and press the Smart Select knob.
4. Select **NBP Frequency** and press the Smart Select knob.
5. Select the desired interval and press the Smart Select knob.

NOTES: Interval choices are listed in the format "qx" indicating measurements are taken every "x" minutes from the time you first press the **[Start NBP]** soft key.

When cuff measurements are set to be taken at an automatic interval, there is a forced 30-second minimum period in between measurements, even if a measurement is due to be taken. The Efficia DFM100 display shows the last NBP (if obtained in the last 60 minutes), time obtained and frequency.

If no subsequent measurements are taken, NBP values are removed from the display after 60 minutes but can still be obtained through Vital Sign Trending and the Event Summary.

NBP Alarms

Alarms are annunciated when a measurement for the configured source (systolic, diastolic or mean) falls outside the configured high or low limits. Both the source of the alarm and the limits may be changed during an ongoing patient event.

NBP alarms can be generated for the conditions shown in Tables 30 and 31. Once generated, they appear as alarm messages in the NBP alarm status area above the NBP numeric. There are both audio and visual alerts. For more information on alarms, see "Alarms" on page 37.

NOTE: Alarm notification is configurable. See "Alarm Management" on page 39.

Table 30 **NBP Physiological Alarms**

Alarm Message	Condition	Type of Alarm	Indication
NBPs High	The NBP systolic value exceeds the high alarm limit.	Medium Priority Latching Configurable Alarm	Yellow alarm message with audio tone
NBPd High	The NBP diastolic value exceeds the high alarm limit.		
NBPm High	The NBP mean value exceeds the high alarm limit.		
NBPs Low	The NBP systolic value has fallen below the low alarm limit.		
NBPd Low	The NBP diastolic value has fallen below the low alarm limit.		
NBPm Low	The NBP mean value has fallen below the low alarm limit.		

Table 31 **NBP Technical Alarms**

Alarm Message	Condition	Type of Alarm	Indication
NBP Cuff Overpressure	The cuff pressure exceeded 300 mmHg/40 kPa.	Low Priority Non-Latching Alarm	Cyan alarm message with audio tone
NBP Cuff Not Deflated	The cuff has failed to deflate.		
NBP Measurement Failed	The device is unable to complete a measurement.		
NBP Equipment Malfunction	A problem with the NBP module has been detected.		
NBP Error	A non-critical failure has been detected.		

Changing NBP Alarm and Source Limits

To change the NBP alarm source and/or limits:

1. Press the Smart Select knob.
2. Turn the Smart Select knob to highlight **Measurements/Alarms** and press the Smart Select knob.
3. Select **NBP** and press the Smart Select knob.
4. Select **NBP Limits** and press the Smart Select knob.

5 Select the desired source for the alarm (Systolic, Diastolic or Mean) and press the Smart Select knob.

6 Turn the Smart Select knob to select the new high limit value then press the Smart Select knob.

7 Select the new low limit and press the Smart Select knob.

Enabling/Disabling NBP Alarms

To enable/disable NBP alarms:

1 Press the Smart Select knob.

2 Turn the Smart Select knob to highlight Measurements/Alarms and press the Smart Select knob.

3 Select NBP and press the Smart Select knob.

4 Select Alarms On (Alarms Off) and press the Smart Select knob.

WARNING: Turning alarms off prevents all alarms associated with the NBP measurement from being annunciated. If an alarm condition occurs, no alarm indication is announced.

NOTES: NBP alarms are on unless you specifically turn them off or alarms for the entire device are off. Once disabled, alarms remain off until they are turned back on. The Efficia DFM100 allows you to adjust alarm notifications.

Taking a manual NBP measurement also acknowledges any latched NBP alarm from the previous measurement.

Caring for Cuffs

Refer to the manufacturer's instructions for care and cleaning of your NBP cuffs. To get the best results from your cuffs, handle them with care and protect them from sharp objects.

Troubleshooting

If your Efficia DFM100 does not operate as expected during NBP Monitoring, see Table 58 "NBP Problems" on page 185.

12

Trending

This chapter describes how to review patient data using Efficia DFM100 Trending.

Overview

In Monitor mode your Efficia DFM100 provides the ability to view and print numeric vital signs trending data for the current incident. Trending data are automatically acquired if parameters are on.

When viewing trending data, the Trends report is displayed in the Efficia DFM100's lower two wave sectors and takes over the soft key functions. Trend data can be displayed at selected intervals for up to 8 hours of monitoring. You can set your trend interval to 1, 5, 10, 15, 30 or 60 minutes.

Trending data displayed for parameters continuously measured (heart rate, SpO_2, $EtCO_2$ and pulse) are the average of multiple measurements over the trend time period. Trending data for NBP appear with the timestamp of the measurement.

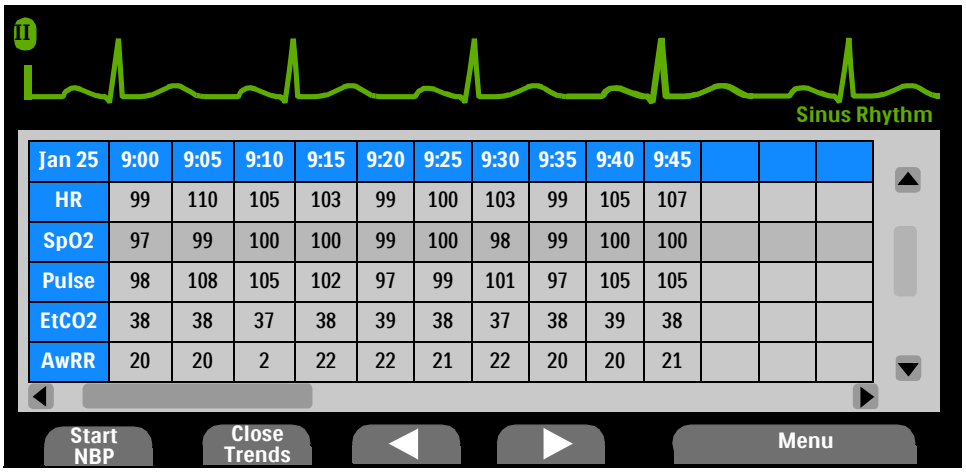
Viewing Trend Data

To view trending data:

1. Confirm your Efficia DFM100 is in Monitor mode.
2. Press the Smart Select knob.
3. Turn the Smart Select knob to highlight **Trends** and press the knob in. The Trends report takes over the bottom two wave sectors. See Figure 63.

To close the Trends report, press the **[Close Trends]** soft key.

Figure 63 **Trends Report**



About the Data Displayed

- When trending is initially displayed, the most recent trending data appear in the far right column.
- The display automatically updates as new data become available, with the newest data appearing in the far right column of the display and older data moving over to the left. If the display is full, the oldest displayed data is removed.
- If you scroll horizontally to view older data, the Efficia DFM100 updates the newest data when you scroll back.
- If a parameter data point has invalid information, a **-?-** is displayed. Questionable data are indicated by a question mark just before the numeric value. Unavailable data are indicated by a blank space.
- If a parameter has not been measured during the display period, it is not listed in the far left column.
- The Heart Rate parameter is always the top entry in the Trends report. If your device has the SpO_2 Option and values for SpO_2 and Pulse are available, they are listed second and third in the Trends report. If your device has the $EtCO_2$ option and values are available, the $EtCO_2$ and AwRR values are listed next. If your device has the NBP option and values for NBP are available, they are listed after AwRR in the Trends report.
- For continuous trend data (HR, $EtCO_2$, SpO_2, pulse) the displayed number is the average of the valid values during the time period.
- NBP measurements are displayed with a timestamp.
- The units of measure for trend data are not displayed in the Trends table and report.

Setting Trend Intervals

Trending data can be shown at selected intervals for up to the last 8 hours of monitoring. You can adjust the display's time interval for the current incident to 1, 5, 10, 15, 30 or 60 minutes. The default is 5 minutes.

To adjust the Trend Interval:

1. Confirm there is a Trends report on the Efficia DFM100 screen.
2. Press the Smart Select knob.
3. Turn the Smart Select knob to highlight **Trend Interval** and press the knob.
4. Select the interval you want and press the knob.

Navigating Around the Trends Report

Use the horizontal scroll soft keys to scroll left and right (backward and forward in time) in the Trends report. The soft key is inactive (grayed out) if there is no more data to be viewed in that direction.

If there are more lines of data than can be shown on the screen, turn the Smart Select knob to scroll up and down the display.

NOTE: Make sure there are no active menus before using the Smart Select knob to scroll up and down the Trends report. If you do have an active menu, exit the menu before trying to scroll up or down in the Trends report.

Printing the Trends Report

You can print a Trends report with or without a Trends report on the Efficia DFM100's display.

To print a Trends report from Monitor mode:

1 Press the Report button .

2 Turn the Smart Select knob to highlight **Trends** and press the Smart Select knob.

3 Select the appropriate interval and press the knob.

A report for the entire event period is printed. See Figure 64.

Figure 64 **Sample Trends Printed Report**

Trends Header Page:

Trend Report
Event ID: 123456
SMITH, FRED
Patient ID: 65432
Patient Sex: M
(25 Jan2014 9:45)
Efficia DFM100 866199
S/N: CN01235
SW Rev: 1.0

Trends Data Page:

25		9:45	9:40	9:35	9:30	9:25	9:20	9:15	9:10	9:05	9:00
HR	bpm	107	105	99	103	100	99	103	105	110	99
SpO2	%	100	100	99	98	100	99	100	100	99	97
Pulse	bpm	107	105	99	103	100	99	103	105	110	99
EtCO2	mmHg	39	39	38	36	35	39	39	38	39	39
AwRR	rpm	12	12	12	12	12	12	12	12	12	12
NBPs	mmHg		120		120		117		120		118
NBPd	mmHg		70		60		64		70		65
NBPm	mmHg		82		80		81		82		81
			9:39		9:29		9:19		9:09		8:59

Trends reports can also be printed from Data Management mode. See "Data Management" on page 125.

NOTE: Do not enter Data Management mode while monitoring a patient.

Troubleshooting

If your Efficia DFM100 does not operate as expected during trending, see "Troubleshooting" on page 173.

NOTES

13

Data Management

This chapter describes the data management features of the Efficia DFM100, including Data Management mode, Event Summary, and printing functionality.

Overview

The Efficia DFM100 automatically generates an Event Summary for each patient event. Each Event Summary is assigned a unique event identification number, is date/time stamped and stored in the device's internal memory. Data related to the current event is available for viewing, reporting, and printing. Vital sign parameters are part of the Event Summary but are also available in the Trends report.

The current Event Summary or Trends report may be printed by pressing the Reports button on the front of the Efficia DFM100.

When the internal memory is full, each additional summary causes one or more of the oldest event summaries to be overwritten.

Event Summaries stored in internal memory can be:

- Printed.
- Copied to a USB flash drive in Data Management mode for transfer to a data management application.

Event Summary

A new Event Summary is initiated the first time one of the following occurs after the device is powered on:

- The arrival of a valid ECG signal either through electrodes or pads/paddles.
- The arrival of valid SpO_2 data.
- The arrival of valid CO_2 data
- The arrival of valid NBP data.
- The Charge button is pressed.
- The Mark Event button is pressed.

An Event Summary ends when the device is turned off or enters a non-clinical mode.

NOTE: There is an 8-hour data limit per incident for an Event Summary. When the 8-hour limit is reached, the Efficia DFM100 stops recording and a message is displayed on the Efficia DFM100. The number of Event Summaries that can be stored is related to the duration of each individual Event Summary. For example, the Efficia DFM100 can store approximately 50 Event Summaries of approximately 30 minutes in length or 5 Event Summaries of approximately 8 hours in length.

Event Summary Data Collected

Patient data collected, if available, includes:

- Two ECG waveforms with beat labels

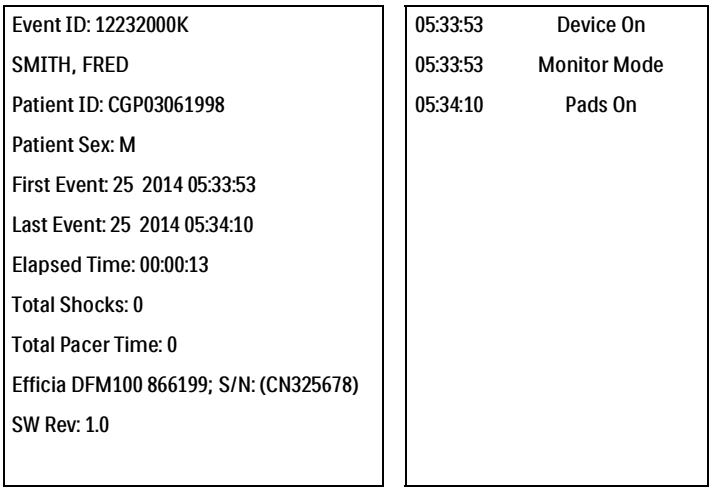
- One pleth waveform
- One CO_2 waveform
- Patient event information including:
  - Patient name, sex, category, ID
  - Parameter information/Trends data
  - Physiological alarms and alarm limits
  - Defibrillation and pacing events
  - Mark events
- Technical/device event information including:
  - Power on/off
  - Technical alarms
  - Initial mode and mode changes
  - Initial battery status and subsequent changes
  - Print Strip
- Research data, including waves (AED mode only) and shock/no-shock decisions

You can configure the Efficia DFM100 to save short or long Event Summaries. Short Event Summaries include all the above information except waveforms. Long Event Summaries contain everything.

Printing an Event Summary

You can print an Event Summary report (see Figure 65) during a patient event or from Data Management mode after the event has concluded. See "Printing While in Data Management Mode" on page 138.

Figure 65 **Sample Printed Event Summary Report**



Two waves can be included when printing an Event Summary:

- First printed wave is always the primary ECG

- Second printed wave is:

- A Capnogram if you are measuring $EtCO_2$

- A Pleth wave if you are measuring SpO_2 and not $EtCO_2$
- A second ECG if you are not measuring either $EtCO_2$ or SpO_2 and there is a valid second ECG wave available
- Empty if there is no valid $EtCO_2$, SpO_2 or a second ECG wave available.

Events Stored in an Event Summary

Events and wave segments can be stored in an Event Summary. Table 32 lists events and related information stored in an Event Summary. Not all events listed are possible, based on your device's configuration. Text in parenthesis are replaced by an appropriate value.

To have waves stored in the Event Summary you must have the Efficia DFM100 configured for long Event Summaries. See Table 47 on page 149. Segments include a header, waveform and events.

NOTES: If an Event Summary stops printing because the paper runs out, the report resumes printing if a new roll of paper is installed within 3.5 minutes.

If a Daylight Savings Time change occurs during an event, the timestamps for that event are not adjusted. The next Event Summary uses the adjusted time.

Values listed on a printed Event Summary also include the parameter's unit of measurement.

Table 32 **Event Information**

Logged Event	Frequency
Power-related events	
Device On	Logged when device first turns on.
Continued Use	Logged when device is turned on after being turned off for less than 10 seconds.
Device Off	Logged when the Therapy knob is turned to the Off position.
Autotest Failure	Logged when a critical device failure has been reported.
!!!Equipment Disabled: System Failure	Logged when any out-of-range voltages are detected.
!!System Failure. Service Required	Logged when the device determines that one or more subsystems is not functioning properly.
!!!Autotest Error. Run Op Check	Logged when the device cannot determine when the last Autotest was run.
Autotest Overdue: Run OpCheck	Logged when power was not available (for a week or longer) to run a scheduled Autotest.
Power Test Failure	Logged during RFU testing if the battery can't sufficiently charge the device.
Mode and Energy Positions	
AED Mode	Logged at the start of an event and when mode or selected energy changes.
Monitor Mode	
Pacer Mode	
Defib Mode	
Sync Mode	
(value) J	
Exit Clinical Mode	Logged when exiting a clinical mode.

Table 32 **Event Information *(Continued)***

Logged Event	Frequency
Patient Info	
Adult or Infant/Child	Logged when patient category is set or changed.
Paced, Non-Paced, Pacing Status Unknown	Logged when internal paced status is set or changed.
Battery Status	
Low Battery	Logged when battery is low.
Pacing on Low Battery	Logged when you are pacing and the battery is low.
Shutting Down in 1 min	Logged when imminent shutdown warning is issued.
Shutting Down Now	Logged when shutdown warning is issued.
Battery Charge Good	Logged when the battery charge level is good.
Battery Not Present	Logged when the battery is not present.
Battery Communication Failure	Logged when communication with the battery has failed.
Replace Battery	Logged when the battery has reached its end of life.
Incompatible Battery	Logged when an incompatible battery is connected.
Pads/Paddles/Leads	
Pads On	Logged when pads are applied to the patient.
Pads Off	Logged after a Pads On event if the multifunction electrode pads are removed from the patient or the Therapy cable is disconnected.
Pads Shorted	Logged when a pad impedance is low.
Pads Marginal	Logged when pad impedance is minimal.
External Paddles On	Logged when external paddles make contact with the patient.
External Paddles Off	Logged after External Paddles On if paddles lose contact with the patient.
Internal Paddles On	Logged when internal paddles make contact with the patient.
Internal Paddles Off	Logged after Internal Paddles On if paddles lose contact with the patient.
Leads On	Logged when monitoring electrodes for primary ECG are attached to the patient.
Leads Off	Logged after Leads On if a monitoring electrode for the primary wave loses contact with the patient.
Vitals	
HR (value), SpO2 (value), EtCO2 (value), AwRR (value), Pulse (value), NBP (value)	Values logged when measurement is taken - a minimum of every 5 minutes.

Table 32 **Event Information *(Continued)***

Logged Event	Frequency
HR/ECG	
***Asystole	Logged when a high priority latching physiological alarm is generated.
***V-Fib/Tach	
***V-Tach	
***Extreme Brady < (value, limit	
***Extreme Tachy > (value, limit)	
**Pacer Not Capture	Logged when a medium priority latching physiological alarm is generated and Pacer mode is selected.
**Pacer Not Pace	
**PVC > /min	Logged when a medium priority non-latching physiological alarm is generated.
**HR High > (value, limit)	
**HR Low < (value, limit)	
Cannot Analyze ECG	Logged when there is ECG data that cannot be analyzed.
ECG Equipment Malfunction	Logged when there has been an ECG equipment malfunction.
Pads ECG Equipment Malfunction	Logged when there has been a ECG pads (or paddles) equipment malfunction.
ECG Alarms On/ECG Alarms Off	Logged when ECG alarms are turned off or on and any subsequent change.
HR Limits (low) (high)	Logged when HR alarms are turned on and when there is a change in alarm limits.
VTACH Limits HR Run (with limits)	Logged when VTACH alarms are turned on and when there is a change in alarm limits.
PVC/min Limit (limit)	Logged when PVC rate alarms are turned on and when there is a change in alarm limits.
Learning ECG	Logged when the Efficia DFM100 is evaluating the ECG signal.
Learning Rhythm	Logged when the Efficia DFM100 is evaluating the ECG rhythm.
ECG Bandwidth for Display , for Printing (with settings)	Initial ECG bandwidth for display, printing and storage are logged.
Therapy Disabled: Run Op Check	Logged when the device detects a therapy equipment failure.
SpO_2	
SpO2 On/SpO2 Off	Logged when SpO_2 monitoring is connected and any subsequent disconnect/connect.
**SpO2 High > (value, limit)	Logged when the patient's SpO_2 value is higher than the configured limit.
**SpO2 Low < (value, limit)	Logged when the patient's SpO_2 value is lower than the configured limit.
***Desat < (value, limit)	Logged when the patient's Desat value is lower than the configured limit.
SpO2 Sensor Malfunction	Logged when the device is on and unable to acquire a Pleth waveform.
SpO2 Unplugged	Logged when SpO_2 monitoring is on and the sensor is disconnected.
SpO2 Noisy Signal	Logged when SpO_2 is on and a noisy signal is detected.
SpO2 Interference	Logged when SpO_2 is on and light interference is detected at the SpO_2 sensor.

Table 32 **Event Information *(Continued)***

Logged Event	Frequency
SpO2 Non-Pulsatile	Logged when SpO_2 is on and a non-pulsatile SpO_2 sensor signal is detected.
SpO2 Equipment Malfunction	Logged when SpO_2 is on and an SpO_2 equipment malfunction is detected.
SpO2 Erratic	Logged when SpO_2 is on and an erratic measurement condition occurs.
SpO2 Extended Update	Logged when SpO_2 is on and the SpO_2 measurement update period exceeds 30 seconds.
SpO2 Low Perfusion	Logged when SpO_2 is on and low perfusion occurs.
SpO2 Error	Logged when a non-critical SpO_2 error is detected.
SpO2 Alarms On/SpO2 Alarms Off	Logged when SpO_2 alarms are turned on or off and any subsequent change.
SpO2 Limits (low) (high) Desat (limit)	Logged when SpO_2 alarms are turned on and when there is a change in alarm limits.
Pulse	
**Pulse High > (value, limit)	Logged when the patient's pulse is higher than the configured limit.
**Pulse Low < (value) < (limit)	Logged when the patient's pulse is lower than the configured limit.
Pulse Alarms On/Pulse Alarms Off	Logged when pulse alarms are turned on or off and any subsequent change.
Pulse Limits (low limit) (high limit)	Logged when pulse alarms are turned on and when there is a change in alarm limits.
$EtCO_2$	
EtCO2 On/EtCO2 Off	Logged when $EtCO_2$ monitoring is connected and any subsequent disconnect/connect.
**EtCO2 High > (value, limit)	Logged when the patient's $EtCO_2$ value is higher than the configured limit.
**EtCO2 Low < (value, limit)	Logged when the patient's $EtCO_2$ value is lower than the configured limit.
CO2 Sensor Plugged In -(type)	Logged when a CO_2 sensor is connected to the Efficia DFM100.
CO2 Sensor Warming Up	Logged when the CO_2 sensor has not warmed up to operating temperature range.
CO2 Tube Unplugged	Logged when the CO_2 sensor is unplugged or the filter line is disconnected.
CO2 Sensor Unplugged	Logged when the CO_2 sensor is unplugged.
EtCO2 Alarms On/EtCO2 Alarms Off	Logged when CO_2 alarms are turned on or off and any subsequent change.
EtCO2 Limits (low value) (high value)	Logged when CO_2 alarms are turned on and when there is a change in alarm limits.
CO2 Zero In Progress	If using the Mainstream or Sidestream sensor, logged when the sensor is zeroing.
CO2 Zero Required	If using the Mainstream or Sidestream sensor, logged when the sensor needs to be zeroed.
CO2 Zero Complete	If using the Mainstream or Sidestream sensor, logged when the sensor zeroing is complete.
CO2 Zero Failed -(reason)	If using the Mainstream or Sidestream sensor, logged when the sensor zeroing failed.
CO2 Replace Sensor	Logged when the CO_2 sensor has reached its end of life.

Table 32 **Event Information *(Continued)***

Logged Event	Frequency
CO2 Service Required	Logged when the CO_2 sensor needs servicing.
CO2 Check Line	Logged when the CO_2 sensor detects a kinked or blocked filter line.
CO2 Check Airway Adapter	Logged when the CO_2 sensor detects the airway adapter is blocked.
CO2 Sensor Over Temp	Logged when the CO_2 sensor detects that it is over temperature.
CO2 Out of Range	Logged when the CO_2 sensor detects its result is out of range.
CO2 Error	Logged when a non-critical $EtCO_2$ error is detected.
CO2 Communication Failure	Logged when the Efficia DFM100 cannot communicate with the CO_2 sensor.
AwRR	
AwRR Alarms On/AwRR Alarms Off	Logged when AwRR alarms are turned on or off and any subsequent change.
AwRR Limits (low value) (high value)	Logged when AwRR alarms are turned on and when there is a change in alarm limits.
**AwRR High > (value, limit)	Logged when the patient's AwRR value is higher than the configured limit.
**AwRR Low < (value, limit)	Logged when the patient's AwRR value is lower than the configured limit.
***Apnea > (value)	Logged when the Apnea alarm is displayed.
Apnea Time (time)	Logged when there is a change to the Apnea alarm Limit setting.
NBP	
NBP On Manual	Logged when a manual NBP measurement is requested.
NBP On (frequency value)	Logged when an automatic NBP measurement is requested (including frequency value).
NBP Frequency Manual	Logged when an automatic NBP measurement is changed to manual (including frequency value).
NBP Frequency (frequency)	Logged when the NBP frequency is changed.
NBP Alarms On/NBP Alarms Off	Logged when NBP alarms are turned on or off and any subsequent change.
NBP Limits Systolic (low value, high value)	Logged when the Systolic NBP alarm limit is changed.
NBP Limits Diastolic (low value, high value)	Logged when the Diastolic NBP alarm limit is changed.
NBP Limits Mean (low value, high value)	Logged when the Mean NBP alarm limit is changed.
**NBPs High > (value, limit)	Logged when the patient's Systolic NBP is higher than the configured limit.
**NBPs Low < (value, limit)	Logged when the patient's Systolic NBP is lower than the configured limit.
**NBPd High > (value, limit)	Logged when the patient's Diastolic NBP is higher than the configured limit.
**NBPd Low < (value, limit)	Logged when the patient's Diastolic NBP is lower than the configured limit.
**NBPm High > (value, limit)	Logged when the patient's Mean NBP is higher than the configured limit.
**NBPm Low < (value, limit)	Logged when the patient's Mean NBP is lower than the configured limit.
NBP Cuff Not Deflated	Logged when the NBP cuff fails to deflate after 3 minutes.
NBP Cuff Overpressure	Logged when the NBP cuff pressure reaches 300 mmHg/40 kPa.

Table 32 **Event Information *(Continued)***

Logged Event	Frequency
NBP Measurement Failed	Logged when an NBP measurement fails to complete.
NBP Error	Logged when the device detects a non-critical NBP failure.
NBP Equipment Malfunction	Logged when the NBP module detects a malfunction.
Defibrillation	
Charging to (value) J	Logged when charging is initiated.
Disarm Manual	Logged when the device is disarmed manually.
Disarm Auto - (reason)	Logged when the device disarms automatically. Reasons include: Pads Off: Logged when the automatic disarm is caused by a bad connection between the device and the patient. Shock Equipment Malfunction: Logged when the device is unable to reach the selected energy during charging. Timeout: Logged when the device reaches its configured auto-disarm period. No Shock Advised: Logged when, in AED mode, the algorithm determines the rhythm is not shockable. Device Off: Logged when the device is turned off while charged. Leads Off: Logged in Synchronized Cardioversion mode when a leads off condition is detected in the synchronizing lead. Pads/Paddle Type Unknown: Logged when, with the therapy cable connected, the device detects a change in the paddles or pads type or if the therapy cable type identification is not valid.
Shock # (number) (energy) J (impedance) (peak current) A	Logged when a shock is delivered.
Shock Aborted (impedance)	Logged when a shock is initiated but aborted before a full shock dose is delivered.
Sync On/Sync Off	Logged when Sync is turned on or off and any subsequent change.
Abnormal Shock Dose Delivered	Logged when a shock is initiated and completed but the full dose is not delivered.
Therapy Malfunction	Logged when a a critical failure has occurred, preventing therapy delivery.
AED Mode	
Analyzing	Logged when the algorithm begins analysis.
Artifact Detected	Logged when artifact has been detected.
Shock Advised	Logged when the algorithm detects a shockable rhythm.
No Shock Advised	Logged when the algorithm detects a non-shockable rhythm.
Cannot Analyze ECG	Logged when the algorithm is unable to make a shock/no-shock decision.
Forced Pause	Logged when the device enters or exits a forced pause.
NSA Pause	Logged when the device enters or exits a NSA pause.
NSA Monitoring	Logged when the device enters or exits NSA monitoring.
CPR Pause	Logged when the device enters or exits CPR pause.
Pacing	

Table 32 **Event Information *(Continued)***

Logged Event	Frequency
Pacer Mode Demand/Pacer Mode Fixed	Logged when pacing starts and when the mode is changed.
Pacer Rate (value)	Logged when the Pacer Rate is changed.
Pacer Output (value)	Logged when the Pacer Output is changed.
Pacing Paused	Logged when pacing is paused.
Pacer Started (rate) (current) (width)	Logged when pacing starts.
Pacing Stopped. Power Interrupted.	Logged when power is restored if pacing is interrupted or stopped due to a power loss and the Therapy knob remains in the Pacer position.
Pacer Output Low (value) < (value)	Logged when the Pacer Output is less than the selected setting by 20 percent or 10mA (whichever is greater).
Pacing stopped with reason	Logged when the device stops pacing. Reasons include: Pacing Stopped. Pads Off.: Logged when a pads-off condition is detected. Pacing Stopped. Device Error.: Logged when a device error that prevents delivery of pacing therapy is detected. Pacing Stopped. Pads Cable Off.: Logged when the Therapy cable is disconnected from the device. Pacing Stopped. Leads Off.: Logged when there is a leads-off condition with the primary ECG lead for pacing.
Mark Event	
Mark Event	Logged when the Mark Event button is pressed.
(Configured Event Text)	Logged when you select an entry from the Mark Event menu.
Printing	
PrintStrip	Logged when you hit the Print button on the front of the device.
Printer Test Failure	Logged when there is a printer failure during an operational check.
Alarms	
Alarms On/Alarms Off	Logged when alarms are enabled/disabled.
All Alarms Audio Paused	Logged when alarm audio is paused.
All Alarms Audio Off	Logged when alarm audio is turned off.
Active Alarms Audio Paused	Logged when an active alarm's audio is paused.
Active Alarms Audio Off	Logged when an active alarm's audio is turned off.

Data Management Mode

Data Management mode is a non-clinical mode used to manage event data records. You can print or export an individual Event Summary or export all Event Summaries. You can also configure the Efficia DFM100 to remove patient information from Event Summaries before exporting them. And you can also manage Event Summary data on the external USB drive.

NOTE: Do not enter Data Management mode while monitoring a patient.

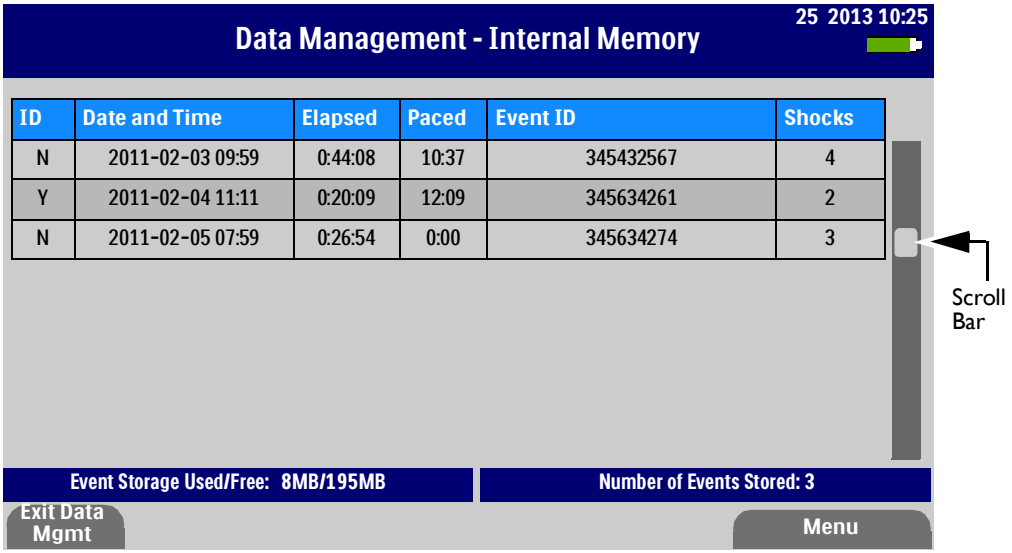
To enter Data Management mode:

1. Turn the Therapy knob to either Monitor, Pacer or Manual Defib.
2. Press the Smart Select knob.
3. Turn the Smart Select knob to highlight **Other** and press the Smart Select knob.
4. Select **Data Management** and press the Smart Select knob.
5. Confirm your selection. Use the Smart Select knob to select **Yes** and press the Smart Select knob. If you select **No**, you are returned to the mode you started from.

Internal Memory

When first entering Data Management mode, the Internal Memory screen is displayed. See Figure 66.

Figure 66 **Data Management Internal Memory**



The following information is listed on the display:

- **ID** – Indicates if the event data record contains any patient information which could uniquely identify the individual. **Y** indicates there is; **N** indicates there isn't.
- **Date and Time** – Date and time the event began.
- **Elapsed** – Duration of the event.
- **Paced** – Total paced time for the event.
- **Event ID** – The unique ID for the event.
- **Shocks** – Total number of shocks delivered during the event.
- **Event Storage Used/ Free** – The amount of space used/available in internal memory.
- **Number of Events Stored** – The number of events that are currently stored in internal memory.

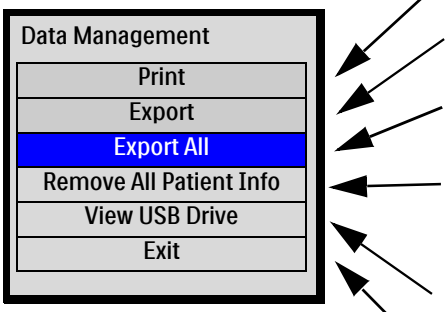
Internal Memory Menu

From the internal memory menu you can print, export, and remove all patient identification data. You can also view data on your USB drive.

To use the Internal Memory menu:

1. Confirm you are in Data Management mode.
2. Press the Smart Select knob.
3. Using the Smart Select knob, select your desired operation. See Figure 67.

Figure 67 **Data Management - Internal Memory Menu**



Select **Print** to print the currently selected Event Summary.

Select **Export** to export the currently selected Event Summary to the USB drive.

Select **Export All** to export all Event Summaries currently in Internal Memory to the USB drive.

Select **Remove All Patient Info** to de-identify all Event Summaries in Internal Memory. See "Removing All Patient Information" on page 135.

Select **View USB Drive** to view all Event Summaries on an external USB drive. See "Accessing Data on the USB Drive" on page 136.

Select **Exit** to exit the menu.

4. Press the Smart Select knob to perform the task. If your organization enabled the Data Management mode password, you are prompted to enter the password before performing certain tasks, such as printing and exporting.

NOTES: Select **Cancel Export** from the **Data Management** menu to cancel an export once it begins. The option appears in the menu after you have begun to print/export. To cancel printing, press the Print button.

If you change from Data Management mode to a clinical mode while data is exporting, the device alerts you that data export is in process and asks you whether you want to **Stop Exporting?** Select **Yes** to stop data export and continue to the new mode. Select **No** to continue exporting data.

If you turn the device off while exporting data, the export is stopped, and the exported data might be incomplete.

Removing All Patient Information

Patient information includes the patient name, medical record number, dates related to the individual, and other information that could uniquely identify an individual.

In Data Management mode, you have two methods to remove patient information from Event Summaries:

- When exporting Event Summaries, you may receive the message **Export Without Patient Info** before the data is exported. If this function is enabled, select **Yes** to export the data without the patient information or **No** to export the data with the patient information.
- In the internal memory menu (Figure 67), selecting **Remove All Patient Info** displays the message **Remove Patient Info from All Internal Event Data?**. Select **Yes** to remove the patient information from all the stored Event Summaries or **No** to keep the patient information.

CAUTION: All Efficia DFM100 users are responsible for protecting the use, disclosure, and exchange of electronic Protected Health Information (ePHI).

Accessing Data on the USB Drive

When you select the **View USB Drive** option from the internal memory menu, the Efficia DFM100 first checks that there is a compatible USB drive inserted into the USB port on the back of the device (see Figure 15 on page 16). If a compatible USB drive is not found, the Internal Memory screen remains on the display. If a compatible drive is found, then the USB Drive screen is displayed.

NOTE: The USB Drive screen's layout is similar to the Internal Memory screen (see Figure 66) except Internal Memory is replaced with USB Drive in the screen's title.

Using the Efficia DFM100, you are only able to save Event Summaries to and delete from the USB drive. Additional USB drive operations can be performed with a USB-compatible computer.

Saving Data to the USB Drive

You can save data to a USB drive from Data Management mode, Configuration mode, and after an operational check.

To save data to a USB Drive:

1. Confirm you have a USB drive inserted into the USB port.
2. Press the Smart Select knob and select **Export** from the menu. The Efficia DFM100 copies your data to the USB drive.

CAUTION: Use only the USB driver recommended by the manufacturer. Using other brands of USB drivers may cause damage or be incompatible with the Efficia DFM100.

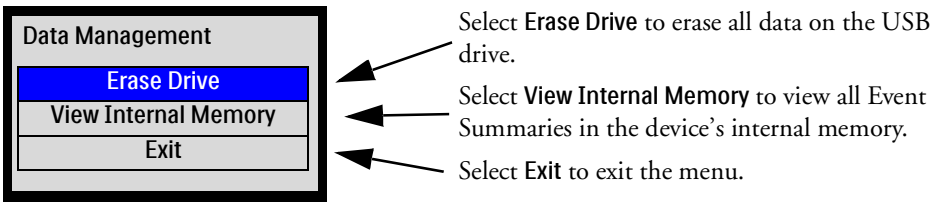
NOTE: If data exporting is in progress and you change from a non-clinical mode to a clinical mode or vice versa, the Efficia DFM100 asks you if you want to continue exporting. Select **Yes** to stop; **No** to continue with the export.

Deleting Event Summaries from the USB Drive

To delete Event Summaries from the USB drive:

1. Confirm you are in Data Management mode.
2. Press the Smart Select knob.
3. Turn the Smart Select knob to highlight **View USB Drive** and press the Smart Select knob.
4. Once in the USB Drive screen, press the Smart Select knob.
5. The USB Drive menu appears. See Figure 68.
6. Turn the Smart Select knob to select **Erase Drive**.
7. Press the Smart Select knob to erase all event summaries from the USB drive.
8. The device prompts you to confirm your selection. Select **Yes** to erase all data on the drive. Select **No** to leave all data on the drive.

Figure 68 **USB Drive Menu**



Printing Data

The Efficia DFM100 can print multiple pieces of information in both clinical and non-clinical modes. The device can be configured to print automatically when certain events occur or you can initiate a print request at any time during an event.

Printing During a Patient Event

The Efficia DFM100 allows you to print various data reports in a clinical mode during a patient event.

NOTE: If you attempt to change from a clinical mode to a non-clinical mode while printing, the device asks if you want to stop printing. Select **Yes** to stop printing and change to the non-clinical mode. Select **No** to continue printing and stay in the clinical mode.

To print a strip during an event:

1 Press the Print button .

The printed strip (see Figure 69) contains the header information, configured waveforms, wave markings (R-Wave Arrows, Pacing Markers) and events, including event markers. See Table 33.

Figure 69 **Sample Printed Strip**

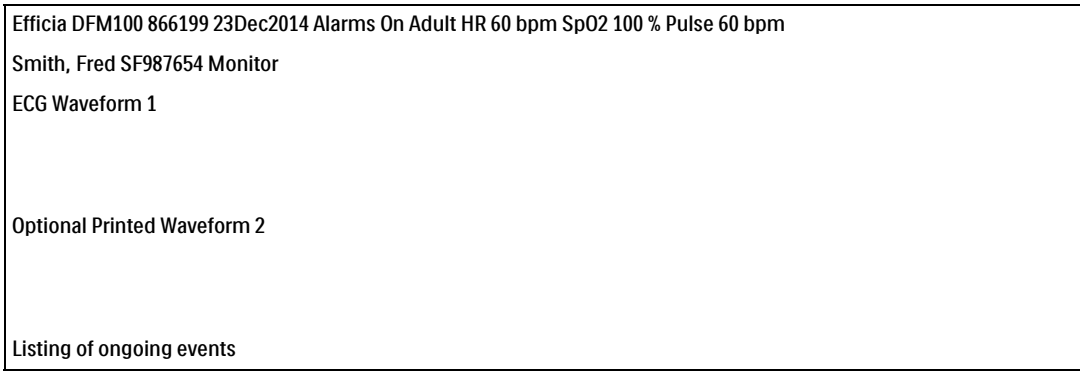


Table 33 **Event Markers**

Event	Symbol
Mark Event	▶
Physiological Alarm	△
Shock Delivered	ϟb

The Efficia DFM100 can also be configured to print a strip when an alarm, charge, shock, or mark event occurs. See Table 47 “Printing Settings” on page 149.

To print an Event Summary for the current event:

1 Press the Report button .

2 Turn the Smart Select knob to highlight **Event Summary**, and press the Smart Select knob.

Printing While in Data Management Mode

If your organization requires a Data Management mode password, you will be prompted to enter the password before printing begins.

To print an Event Summary contained in Internal Memory:

1. Use the Smart Select knob to select the Event Summary you wish to print.
2. Press the Smart Select knob and select **Print**.
   OR
   Press the Report button, select **Event Summary** from the list, and press the Smart Select knob to print.

To print a Trends report related to an Event Summary contained in Internal Memory:

1. Select the Event Summary that contains the Trends report you wish to print.
2. Press the Report button, select **Trends** from the list, and press the Smart Select knob.
3. Use the Smart Select knob to select the Trend Interval you want. Press the Smart Select knob to begin printing.

NOTES: For steps to install printer paper, see "Installing Printer Paper" on page 19.

If you manually started printing a strip and the Efficia DFM100 automatically tries to initiate a strip, the automated print strip is ignored.

If the Efficia DFM100 automatically initiates a print strip and then automatically initiates another print strip, the first strip is extended to include data through the end time of the second strip.

If you request to print a data report while the printer is printing another report, the Efficia DFM100 prompts you with questions. Your answers determine which report takes precedence for printing.

14

Configuration

This chapter describes the configurable parameters of the Efficia DFM100 and procedures for modifying configuration.

Overview

Configuration settings allow you to customize the Efficia DFM100 to meet your needs. Configuration is viewed and changed through the Configuration menu. The Configuration mode password is required to change your device's configuration.

NOTE: As you make configuration choices, consider all the clinical environments the Efficia DFM100 may be used in. Choices for one department might not be suitable for another department.

Entering Configuration Mode

In Configuration mode, you can view, change, print, save, or export configuration settings. For settings that change your device configuration, you are prompted to enter the Configuration mode password. If you change configuration settings, press the **[Save Changes]** soft key to save them.

WARNING: Do not perform configuration activities while the Efficia DFM100 is connected to a patient.

Accessing Configuration Mode

To access Configuration mode:

1. Turn the Therapy knob to Monitor, Manual Defibrillation or Pacer.
2. Press the Smart Select knob.
3. Turn the Smart Select knob to highlight **Other** and press the Smart Select knob.
4. Select **Configuration** and press the Smart Select knob.
5. To confirm your selection, select **Yes** and press the Smart Select knob. If you select **No**, you are returned to the mode you started from.

Once in Configuration mode, press the **[Exit Config]** soft key to return to clinical operation.

Setting Date and Time

To change the date and time in Configuration mode:

1. In Configuration mode, press the Smart Select knob.
2. Select **Date/Time** and press the Smart Select knob. The Configuration Date/Time screen appears. See Figure 70.

Figure 70 **Configuration Date/Time Screen**

Date/Time Format	Standard
Year	2013
Month	March
Day	6
Hour	1
Minute	09
am/pm	pm

3. Use the Smart Select knob to select the entry you want to change, and press the Smart Select knob.
4. Use the Smart Select knob to adjust the value. Press the Smart Select knob to accept your change and make it effective.
5. Select another value for modification, or press the **[Main Config]** soft key to return to the Main Configuration screen.

NOTE: To adjust the format of the date and time, you need to enter the Configuration mode password. See "Changing Settings" on page 140.

Changing Settings

To change default settings in Configuration mode:

1. Press the Smart Select knob, select the menu item, and then press the Smart Select knob.
2. Select the submenu item you want, and press the Smart Select knob.
3. Select a new value, and press the Smart Select knob to confirm the new value.
4. If necessary, use the **[Next Screen]** or **[Previous Screen]** soft key to advance to other configuration menus and repeat steps 1 – 3 to make more changes.
5. When your changes are complete, press the **[Main Config]** soft key to return to the Configuration Main screen.
6. Press the **[Save Changes]** soft key to save the new configuration.
7. Follow the prompt to enter the Configuration mode password:
   a. Use the Smart Select knob to select the first character, and press the Smart Select knob. Continue using the Smart Select knob to enter the rest of the password.
   b. When finished, select **OK** and press the Smart Select knob.
8. Press the **[Exit Config]** soft key to return to normal operating mode. If you made changes and press **[Exit Config]** before saving your changes, the **Configuration Not Saved -Exit Anyway?** dialog appears.
   - If you want to save the changes, select **No** press the Smart Select knob, and return to Step 6 to save the configuration.
   - If you do not want to save the configuration, select **Yes** and press the Smart Select knob to exit Configuration mode.

Changing the Data Management Mode Password

You can change the Data Management mode password from the **Change DataMgmnt Password** screen. The Data Management mode password must be at least eight characters.

To change the Data Management mode password:

1. In the **New Password** field, enter a new password.
2. In the **Confirm Password** field, re-enter the new password.
3. In the **Configuration Password** field, enter the Configuration mode password.
4. Press the **[Save]** soft key to save the password.

Table 34 **Configuration - Change DataMgmnt Password**

Parameter	Description	Setting Choices
New Password	8-14 characters	At least eight characters, blank
Password	8-14 characters	At least eight characters, blank
Configuration Password	8-14 character password for Configuration mode, required to change the Data Management mode password	At least eight characters, blank

Exporting Settings

To export configuration settings to a USB drive:

1. Confirm you have a USB drive inserted into the USB port and you are in Configuration mode.
2. Press the **[Export]** soft key.
3. The Efficia DFM100 copies your current configuration to the USB drive.

NOTE: If you already have a configuration stored on the USB drive, exporting another to the USB drive overwrites the one already on the drive.

Importing Settings

To import configuration settings from a USB drive:

1. Once in Configuration mode, insert the USB drive with the saved settings into the USB port.
2. Press the **[Change Config]** soft key and enter the Configuration mode password.
3. Press the **[Import]** soft key. The Efficia DFM100 copies the current configuration from the USB drive.
4. Make any device-specific configuration changes.
5. Press the **[Save Changes]** soft key.

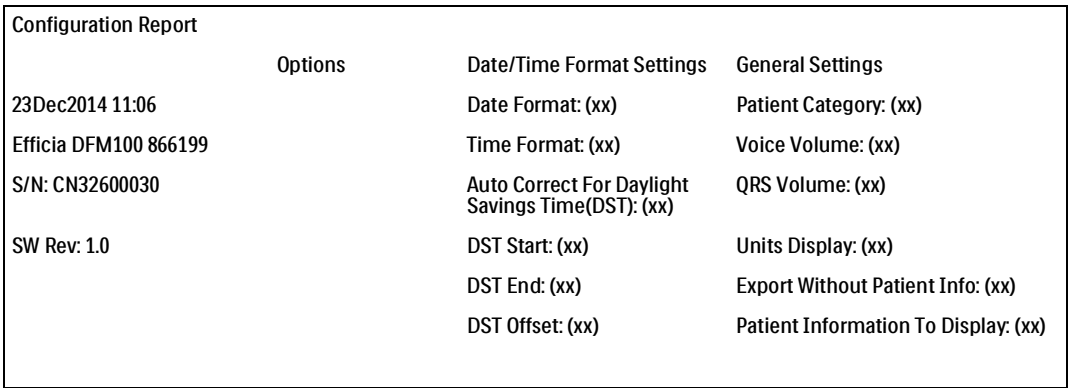
Printing Settings

To print the configuration settings:

1. In Configuration mode, press the Smart Select knob.
2. Using the Smart Select knob, select **Print Configuration**.
3. Press the Smart Select knob to print the report. See Figure 71.

NOTE: To stop printing, press the Print button.

Figure 71 **Sample Configuration Report**



Following the General Settings listing, the Configuration report continues to list the configured device settings in the order they are listed in Configuration mode. See "Configurable Parameters" on page 142.

NOTE: Configuration settings in parenthesis with "xx" in Figure 71 are replaced by the current settings when an actual Configuration report is printed. For example, Time Format: (xx) is replaced with the currently configured time format.

Restoring Default Settings

To return all configuration settings to those originally set during manufacturing:

1. Press the **[Change Config]** soft key.
2. Enter the Configuration mode password.
3. Press the **[Factory Defaults]** soft key.
4. Once you are prompted to save changes, select **Yes** and press the Smart Select knob.

Configurable Parameters

The following tables list configurable parameters for the Efficia DFM100. Default settings are in bold type. Values are adjusted in increments of 1 unless otherwise stated. Use the User Setting column to record your choice.

Table 35 **Date/Time Format Settings**

Parameter	Description	Setting Choices	User Setting
Time Format	Defines the time format.	12-Hour, **24-Hour**	
Date Format	Defines the date format.	**DD Mon YYYY**, YYYY-MM-DD (D = Day, M=Month, Y=Year)	
Auto Daylight Saving Time (DST)	Defines whether your device auto corrects for Daylight Savings Time.	Yes, **No**	

Table 35 **Date/Time Format Settings**

Parameter	Description	Setting Choices		User Setting
DST Offset	Defines the hour and minute time shift during DST.	±2 hours, **+ 1 hour** adjusted in 30 minutes increments		
Month	Defines the month DST begins/ends.	DST Start Settings	DST End Settings	
		Any of the 12 months, **Mar**	Any of the 12 months, **Nov**	
Week of Month	Defines the week DST begins/ends.	First, **Second**, Third, Fourth, Last	**First**, Second, Third, Fourth, Last	
Day of Week	Defines the day DST begins/ends.	**Sunday**, Monday, Tuesday, Wednesday, Thursday, Friday, Saturday	**Sunday**, Monday, Tuesday, Wednesday, Thursday, Friday, Saturday	
Hour	Defines the hour DST begins/end.	00-23 (if 24-hour format); 01-12 (if 12-hour format), **2**		
Minute	Defines the minute DST begins/end.	00-59, **00**		
am/pm	Shown is the 12-hour format is chosen.	**am**, pm		

NOTE: Daylight Saving Time changes occur when the next event is started. The time does not change in the middle of an event that crosses over the DST change.

Table 36 **General Settings**

Parameter	Description	Setting Choices	User Setting
Patient Category	Selects the default patient category.	**Adult**, Infant/Child	
Alarm Tone	Defines either traditional Philips or IEC standard alarm tones.	**Philips**, IEC	
Alarm Pause Time	Defines the interval of time during which alarms are paused after the Alarm button is pressed.	1 min, **2 min**, 3 min, 5 min, 10 min, Infinite	
Alarm Volume	Defines alarm volume level.	Very Soft, Soft, **Medium**, Loud, Very Loud	
Minimum Alarm Volume	Defines the minimum audible alarm level available within use.	Very Soft, **Soft**, Medium, Loud, Very Loud	
Voice Volume	Defines voice prompt levels.	Very Soft, Soft, **Medium**, Loud, Very Loud	
QRS Volume	Defines the volume level of audible beeps with each QRS complex detected.	Off, **Very Soft**, Soft, Medium, Loud, Very Loud	
Units Display	Defines if parameter values are displayed with or without the corresponding measurement units.	**On**, Off	

Table 36 **General Settings *(Continued)***

Parameter	Description	Setting Choices	User Setting
Export Without Patient Info	Defines if when exporting clinical data a prompt is displayed asking if you want to de-identify the data.	Prompt, **Disabled**	
Patient Information to Display	Defines what type of patient information is displayed.	**Name**, ID, None	
Latch All Physiological Alarms	Defines if all physiological alarms are latched when first displayed.	Yes, **No**	
Alarm Audio Off Reminder	Defines if the device automatically reminds you every 3 minutes when alarms are suspended indefinitely.	On, **Off**	
Data Management Password Required	Defines whether the Data Management mode password is required.	**On**, Off	

NOTE: The list of available alarm volumes is limited so that no choice less that the current setting for Minimum Alarm Volume is presented. If the Minimum Alarm Volume is changed and the current alarm volume is quieter than the new Minimum Alarm Volume, the current alarm volume is changed to match the setting for the Minimum Alarm Volume.

Table 37 **Heart Rate/ECG Settings**

Parameter	Description	Setting Choices	User Setting
Color	Selects the HR/ECG color.	Red, Yellow, Blue, **Green**, Cyan, Magenta, White	
Auto-Gain	Determines whether ECG size is automatically adjusted to the maximum wave size without clipping the wave sector. If auto-gain is off, the gain is set to x1 (10mm/mV).	On, **Off**	
NOTE: Adjusting the ECG wave size on the display does not affect the ECG signal which is used for arrhythmia analysis.			
AC Line Filter	Selects the setting used to filter out AC line noise from ECG data. Adjust setting to the power frequency of your country.	**50 Hz**, 60 Hz	
ECG Bandwidth For Display	Selects the display filter frequency for 3/5-Lead ECG cable.	0.15-40 Hz (Monitor), 0.05-40 Hz (ST Monitor), 2.0-20.0 Hz (EMS)	
ECG Bandwidth For Printer	Selects the display filter frequency for the attached therapy cable or 3/5-Lead ECG cable.	**0.05-150 Hz Diagnostic**, 0.15-40 Hz, 0.05-40 Hz, 2.0-20.0 Hz	
ECG Electrode Labels	Selects the electrode label format. AAMI: RA, LA, LL, RL, V; IEC: R, L, F, N, C.	**AAMI**, IEC	

Table 37 **Heart Rate/ECG Settings *(Continued)***

Parameter	Description	Setting Choices	User Setting
HR/Arrhythmia Alarms	Selects if HR/Arrhythmia alarms are on or off at start up.	**On**, Off	
Display Rhythm Status	Determines if the rhythm status is seen on the display with the primary ECG wave in all clinical modes (except AED).	**On**, Off	
HR/Pulse High Limit	Selects the default High Alarm Limit for the HR derived from the ECG and the pulse derived from SpO_2.	Adult: 35-300, **120** bpm Infant/Child: 35-300, **160** bpm adjusted in increments of 5	
HR/Pulse Low Limit	Selects the default Low Alarm Limit for the HR derived from the ECG and the pulse derived from SpO_2.	Adult: 30-295, **50** bpm Infant/Child: 30-295, **80** bpm adjusted in increments of 5	
VTACH HR Limit	Selects the VTach heart rate limit.	Adult: 95-150, **100** bpm Infant/Child: 95-150, **120** bpm adjusted in increments of 5	
VTACH Run Limit	Selects the VTach run limit.	Adult: 3-20, **5** Infant/Child: 3-20, **5**	
PVC Rate Limit	Selects the PVC limit.	Adult: 1-99, **10** Infant/Child: 1-99, **5**	

Table 38 **NBP Settings**

Parameter	Description	Setting Choices	User Setting
Color	Selects the NBP color.	Red, Yellow, Blue, Green, Cyan, Magenta, **White**	
Unit	Selects the measurements units.	**mmHg**, kPa	
NBP Alarms	Selects if NBP alarms are on or off at start up.	**On**, Off	
NBP Frequency	Selects the frequency for NBP measurement: manual or automatic on a selected schedule.	**Manual**, q1, q2.5, q5, q10, q15, q30, q60, q120	
NBP Alarm Source	Selects the alarm source.	**Systolic**, Diastolic, Mean	
Systolic High Limit	Selects the high limit alarm value when systolic is the selected alarm source.	Adult: 35-255, **160** (mmHg); 4.5-34, **21** (kPa) Infant/Child: 35-135, **120** (mmHg); 4.5-18, **16** (kPa) adjusted in increments of 5 mmHg/0.5 kPa	
Systolic Low Limit	Selects the low limit alarm value when systolic is the selected alarm source.	Adult: 30-250, **90** (mmHg); 4-33.5, **12** (kPa) Infant/Child: 30-130, **70** (mmHg); 4-17.5, **9** (kPa) adjusted in increments of 5 mmHg/0.5 kPa	

Table 38 **NBP Settings *(Continued)***

Parameter	Description	Setting Choices	User Setting
Diastolic High Limit	Selects the high limit alarm value when diastolic is the selected alarm source.	Adult: 15-220, **90** (mmHg); 2-29.5, **12** (kPa) Infant/Child: 15-110, **70** (mmHg); 2-15, **9** (kPa) adjusted in increments of 5 mmHg/0.5 kPa	
Diastolic Low Limit	Selects the low limit alarm value when diastolic is the selected alarm source.	Adult: 10-215, **50** (mmHg); 1.5-29, 7 (kPa) Infant/Child: 10-105, **40** (mmHg); 1.5-14.5, **5** (kPa) adjusted in increments of 5 mmHg/0.5 kPa	
Mean High Limit	Selects the high limit alarm value when mean is the selected alarm source.	Adult: 25-235, **110** (mmHg); 3.5-31.5, **15** (kPa) Infant/Child: 25-125, **90** (mmHg); 3.5-16.5, **12** (kPa) adjusted in increments of 5 mmHg/0.5 kPa	
Mean Low Limit	Selects the low limit alarm value when mean is the selected alarm source.	Adult: 20-230, **60** (mmHg); 3-31, **8** (kPa) Infant/Child: 20-120, **50** (mmHg); 3-16, 7 (kPa) adjusted in increments of 5 mmHg/0.5 kPa	

Table 39 **SpO_2 Settings**

Parameter	Description	Setting Choices	User Setting
SpO2 Alarms	Selects if SpO_2 alarms are on or off at start up.	**On**, Off	
Color	Selects the SpO_2 color.	Red, Yellow, Blue, Green, **Cyan**, Magenta, White	
SpO2 High Limit	Selects the high alarm limit value.	Adult: 51-100, **100**% Infant/Child: 51-100, **100**%	
SpO2 Low Limit	Selects the low alarm limit value.	Adult: 50-99, **90**% Infant/Child: 50-99, **90**%	
SpO2 Desat Limit	Selects the extreme low limit alarm value.	Adult: 50-SpO_2 Low Limit, **80**% Infant/Child: 30-SpO_2 Low Limit **80**%	

Table 40 **$EtCO_2$ Settings**

Parameter	Description	Setting Choices	User Setting
Color	Selects the $EtCO_2$ color.	Red, **Yellow**, Blue, Green, Cyan, Magenta, White	
Unit	Selects the measurements units.	**mmHg**, kPa	
EtCO2 Alarms	Selects if $EtCO_2$ alarms are on or off at start up.	**On**, Off	
AwRR Alarms	Selects if AwRR alarms are on or off at start up.	**On**, Off	
EtCO2 High Limit	Selects the high alarm limit value.	Adult: 20-145, **50** (mmHg); 2.7-19.3, **6.7** (kPa) Infant/Child: 20-145, **50** (mmHg); 2.7-19.3, **6.7** (kPa) adjusted in increments of 1 mmHg, 0.1 kPa	
EtCO2 Low Limit	Selects the low alarm limit value.	Adult: 10-140, **30** (mmHg); 1.3-18.7, **4.0** (kPa) Infant/Child: 10-140, **30** (mmHg); 1.3-18.7, **4.0** (kPa) adjusted in increments of 1 mmHg, 0.1 kPa	
AwRR High Limit	Selects the high alarm limit value.	Adult: 10-100, **30** rpm Infant/Child: 10-100, **60** rpm adjusted in increments of 1	
AwRR Low Limit	Selects the low alarm limit value.	Adult: 0-99, **8** rpm Infant/Child: 0-99, **12** rpm adjusted in increments of 1	
Apnea Time	Selects the length of time without respiration required to trigger an apnea alarm.	Adult: 10-40, **20** sec Infant/Child: 10-40, **20** sec adjusted in increments of 5	

Table 41 **Waves Settings**

Parameter	Description	Setting Choices	User Setting
Wave 1	Selects the waveform displayed in Wave Sector 1.	Pads, I, **II**, III, aVR, aVL, aVF, V	
NOTE: The default for Wave Sector 1 cannot be set to paddles.			
Wave 2	Selects the waveform displayed in Wave Sector 2.	Pads/Paddles, I, II, III, aVR, aVL, aVF, V, **Cascade**, Annotated ECG, Pleth, CO2, None	
Wave 3	Selects the waveform displayed in Wave Sector 3.	Pads/Paddles, I, II, III, aVR, aVL, aVF, V, Pleth, CO2, None. **Default:** CO2 if you have the $EtCO_2$ option; Pleth if you have the SpO_2 option but not the $EtCO_2$ option; None if you do not have either option.	

Table 42 **Defib Sync Settings**

Parameter	Description	Setting Choices	User Setting
1-10 Joules Default	Defines the device's low-energy setting.	1, 2, 3, 4, 5, **6**, 7, 8, 9, 10 J	
Remain In Sync Mode After Shock	Defines if the device remains in Sync mode after a delivered shock.	**Yes**, No	
Time To Auto Disarm	Defines the amount of time the device remains charged if a shock has not been delivered. Applies to Manual Defibrillation and Sync modes only.	**30**, 60, 90 sec	
Shock Series	Defines the number of shocks in a shock series.	**1**, 2, 3, 4	
Shock Protocol Timeout	Defines the time interval used to determine if a shock should be counted as part of a shock series.	**1 min**, 2 min, Indefinite	

Table 43 **AED Settings**

Parameter	Description	Setting Choices	User Setting
Voice Prompts	Defines the level of detail in AED mode voice prompts.	Long, **Short**	
NSA Action	Defines what the device does after a No Shock Advised decision.	NSA Monitor, **NSA CPR** (NSA Monitor allows you to initiate background shock advisory analysis; NSA CPR prompts you to initiate a CPR Pause period, if needed.)	
NSA Monitor Prompt Interval	Defines the interval for patient care prompts in NSA Monitor following a No Shock Advised decision.	**1**, 2, 3, Indefinite (no prompts at all) min	
SpO2 Monitoring	Defines whether SpO_2 monitoring is available in AED mode.	Enabled, **Disabled**	
EtCO2 Monitoring	Defines whether $EtCO_2$ monitoring is available in AED mode.	Enabled, **Disabled**	
Adult 1st Shock Energy Dose	Defines the energy dose for the first shock in a series in AED mode.	All energy settings ≥ 150J up to 200J, **150**	
Adult 2nd Shock Energy Dose	Defines the energy dose for the second shock in a series in AED mode.	All energy settings ≥ the first configured shock in the series up to 200J, **150**	
Adult 3rd Shock Energy Dose	Defines the energy dose for the third and subsequent shocks in a series in AED mode.	All energy settings ≥ the second configured shock in the series up to 200J, **150**	
Alarms Off	Defines whether the alarm state is off in AED mode.	**Enabled**, Disabled	

Table 44 **CPR Settings**

Parameter	Description	Setting Choices	User Setting
CPR Time	Defines the length of the CPR administration interval.	1, 1.5, **2**, 2.5, 3 min	

Table 45 **Pacer Settings**

Parameter	Description	Setting Choices	User Setting
Default Pacer Rate	Defines the delivery rate of paced pulses.	30-180, **70** pulses per minute Adjusted in increments of 10	
Pace Pulse Duration	Defines the paced pulse duration.	**20**, 40 msec	
Default Pacer Output	Defines the pacer output default setting at which paced pulses are delivered.	If Paced Pulse duration is 20 msec: 10-200, 30 mA If Paced Pulse duration is 40 msec: 10-140, 30 mA	

Table 46 **Mark Events Settings**

Parameter	Description	Setting Choices	User Setting
Mark Event 1	Defines the first mark event menu choice.	IV Access	
Mark Event 2	Defines the second mark event menu choice.	Epinephrine	
Mark Event 3	Defines the third mark event menu choice.	Amiodarone	
Mark Event 4	Defines the fourth mark event menu choice.	Atropine	
Mark Event 5	Defines the fifth mark event menu choice.	Morphine	
Mark Event 6	Defines the sixth mark event menu choice.	Nitroglycerin	
Mark Event 7	Defines the seventh mark event menu choice.	Aspirin	
Mark Event 8	Defines the eighth mark event menu choice.	Other	

NOTE: There is a 20 character limit when defining Mark Events. See "Mark Events" on page 43.

Table 47 **Printing Settings**

Parameter	Description	Setting Choices	User Setting
Print On Alarm	Defines the type of alarms that automatically print a strip.	High, High/Medium	
Print On Charge	Defines if a continuous strip is printed when the device is charged.	Yes, No	
Print On Shock	Defines if a continuous strip is printed when a shock is delivered or when a shock is attempted but not delivered.	Yes, No	

Table 47 **Printing Settings *(Continued)***

Parameter	Description	Setting Choices	User Setting
Print On Mark	Defines if a continuous strip is printed when the Mark Event button is pressed.	Yes, No	
Printer Delay	Defines whether printed strips include an additional 10 seconds of information which occurred prior to initiating the print.	0 sec, 10 sec	
Event Summary Report	Defines the information contained in an Event Summary. Short includes a log of events and vitals; Long adds waveforms.	Short, Long	
Auto Print OpCheck Report	Defines if an OpCheck report is automatically printed upon the completion of an operational check.	Yes, No	
Weekly Tests in AutoTest Summary	Provides a numerical value indicating the number of weekly tests in the auto text summary.	1-53, 53	

15

Operational and Shift Check

The Efficia DFM100 performs several automated tests to make sure it is ready for use (see "Automated Tests" on page 165). Two important checks you perform to supplement the automated tests are operational checks and shift checks. This chapter details both of these important tasks.

Shift Check

In order to ensure defibrillators are ready when needed, the American Heart Association (AHA) recommends that users complete a checklist, often referred to as a shift check, at the beginning of each change in personnel. These checks are performed in addition to the periodic checks performed by your facility's biomedical or clinical engineering team. The activities on this checklist include verifying that the appropriate supplies and accessories are present, the device is plugged in and has sufficient battery power, and the device is ready for use. Philips supports the AHA checklist recommendations and has provided a shift checklist document with the device and published a copy in this book. (See "Appendix 1 - Efficia DFM100 Shift Checklist" on page 217.)

As part of the shift check, you must verify the device's ability to deliver defibrillation therapy once a week by performing a shock test. You can complete this important requirement by performing one of the following:

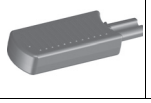
- Weekly shock test (see "Weekly Shock Test" on page 152)
- Operational check (see "Operational Check" on page 153)

WARNING: When performing an operational check or weekly shock test, confirm the Efficia DFM100 is not connected to a patient.

Weekly Shock Test

A weekly shock test is performed using either a test plug, test load, or paddles. The weekly shock test process and results differ depending which way you choose to perform the test. See the table below.

To perform a weekly shock test:

	If you are using pads with a test load: 	**If you are using pads with a test plug:** 	**If you are using paddles:**
1	Turn the device on by turning the Therapy knob to 150 J.		
2	Connect the Therapy cable to the defibrillator and test load to the end of the Therapy cable.	Connect the Therapy cable to the defibrillator and test plug to the end of the Therapy cable.	Make sure the paddles and the paddle tray are thoroughly clean and there is no debris or residue (including all conductive material) on the electrode surfaces of the paddles and tray. Secure paddles in tray and confirm Patient Contact Indicator (PCI) LEDs are not lit. If the LEDs are lit, adjust paddles in tray. If the LEDs continue to light, clean both the adult and infant paddle electrode surfaces.
3	Press the Charge button on the front panel. Confirm you hear the charging tone. If it becomes necessary to disarm the defibrillator, press **[Cancel Charge]**.		Press the Charge button on the paddles sitting in the tray. Confirm you hear the charging tone. If it becomes necessary to disarm the defibrillator, press **[Cancel Charge]**.
4	A strip prints, if configured to do so. If the strip does not print immediately, press the Print button.		A strip prints, if configured to do so. If the strip does not print immediately, press the Print button.
5	Press the Shock button on the Efficia DFM100.		Simultaneously press the Shock buttons located on the paddles.
6	Confirm the printed strip indicates **Test Passed** and the energy delivered is150 J, ±15 J (135 J to 165 J). If not, confirm you did the test properly before taking the device out of use and calling for service.	Confirm that you hear a "**Shock Cancelled**" audio message, see a **Shock Aborted** alarm on the display and the printed strip indicates **Test Passed**. If not, confirm you did the test properly before taking the device out of use and calling for service. **NOTE:** It is normal behavior that a shock is not delivered in this instance.	
7	Detach test load/plug from the Therapy cable so your device is ready for use when needed. Do not leave the test load/plug attached to the Therapy cable. Test complete.		Test complete.

NOTES: For more information on the differences between a test load and test plug, see "Test Plug & Test Load" on page 20.

If you perform a weekly shock test with internal paddles and corresponding test equipment, the Efficia DFM100 must be set to 50 J. Refer to the test equipment manufacturer's instructions for information on interpreting results of the test.

If you use external paddles and have the Pacing option, you should confirm pads functionality by performing an operational check.

Operational Check

Operational checks supplement automated tests by verifying therapy cables, the ECG cable, paddles, audio, charge and shock buttons, and the ability to deliver defibrillation and pacing therapy. Operational checks also check the printer and SpO_2, NBP, and $EtCO_2$ modules.

Operational checks should be performed weekly to supplement the hourly, daily and weekly tests the Efficia DFM100 performs automatically.

From the **Operational Check** menu, you can also print automated test and operational check results.

WARNING: When performing an operational check or weekly shock test, confirm the Efficia DFM100 is not connected to a patient.

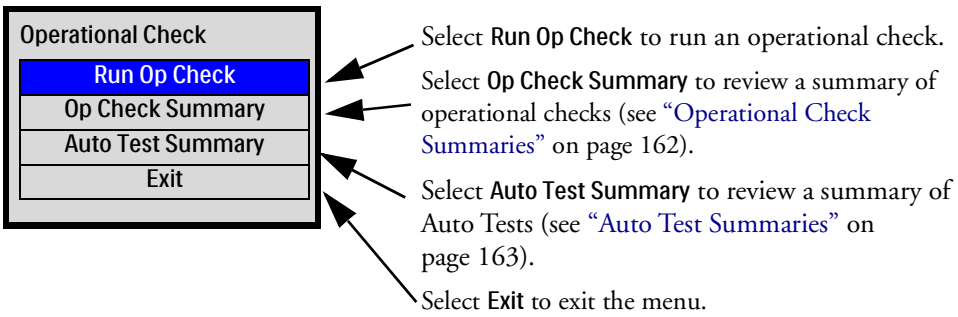
NOTES: Do not run an operational check with internal paddles attached. Perform a weekly shock test to test internal paddles.

To confirm the ECG cable used during an event is functioning properly, use that same cable during an operational check.

To access the Operational Check menu:

1. Turn the Therapy knob to Monitor.
2. Press the Smart Select knob.
3. Turn the Smart Select knob to highlight **Other** and press the Smart Select knob.
4. Select **Operational Check** and press the Smart Select knob. See Figure 72 for **Operational Check** menu options.

Figure 72 **Operational Check Menu**



5. Confirm your exit from a clinical mode. Select Yes and press the Smart Select knob.

The following tests are performed during an operational check (see "Operational Check Tests and Results" on page 157):

- General System
- Therapy Knob
- Charge button
- Leads ECG rerun (if necessary)
- Sync button
- Therapy
- Leads ECG
- SpO_2
- $EtCO_2$
- NBP
- Shock button
- Pads/Paddles ECG
- Printer
- Battery
- Audio

Performing an Operational Check

Prior to performing an operational check:

If you use external paddles: Make sure the paddles are connected to the device, paddles and the paddle tray are thoroughly clean and there is no debris or residue (including all conductive material) on the electrode surfaces of the paddles and tray. Secure the paddles in the tray and confirm the Patient Contact Indicator (PCI) LEDs are not lit. If the LEDs are lit, adjust the paddles in the tray. If the LEDs remain lit, clean both the adult and infant/child paddle electrode surfaces.

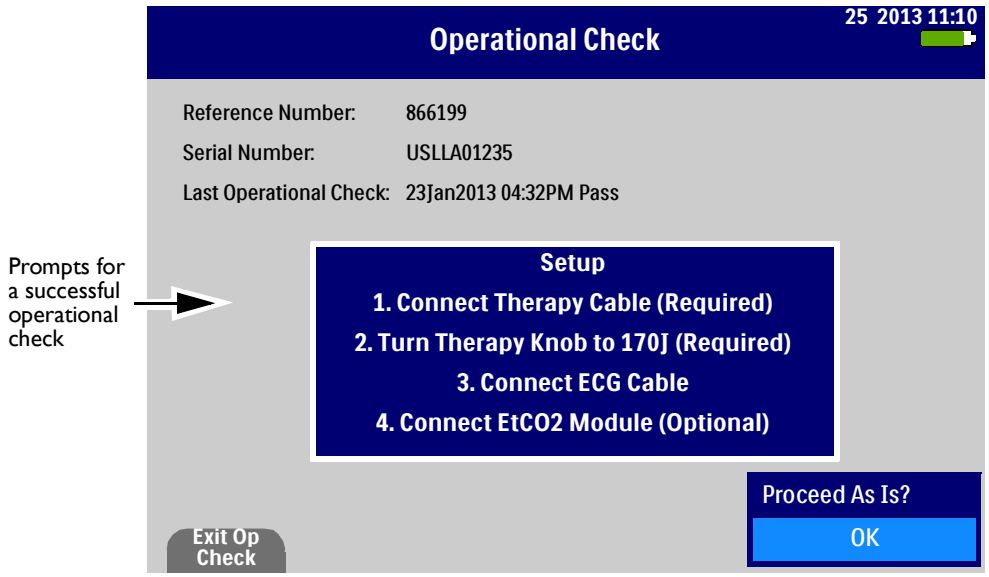
If you use multifunction electrode pads: Make sure the pads therapy cable is plugged into the defibrillator test plug or test load.

To begin an operational check:

1. Confirm your device has a charged battery and an ECG cable connected (but not connected to a patient or lead sets).
2. Turn the Therapy knob to Monitor.
3. Press the Smart Select knob.
4. Turn the Smart Select knob to highlight **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. The message **Leaving clinical mode. Patient monitoring will be turned off.** appears.
7. Select **Yes** if you wish to continue with an operational check. Select **No** to return to Monitor mode. Press the Smart Select knob to confirm your choice.
8. If you selected **Yes**, the Efficia DFM100 displays the **Operational Check** screen and starts the operational check automatically.

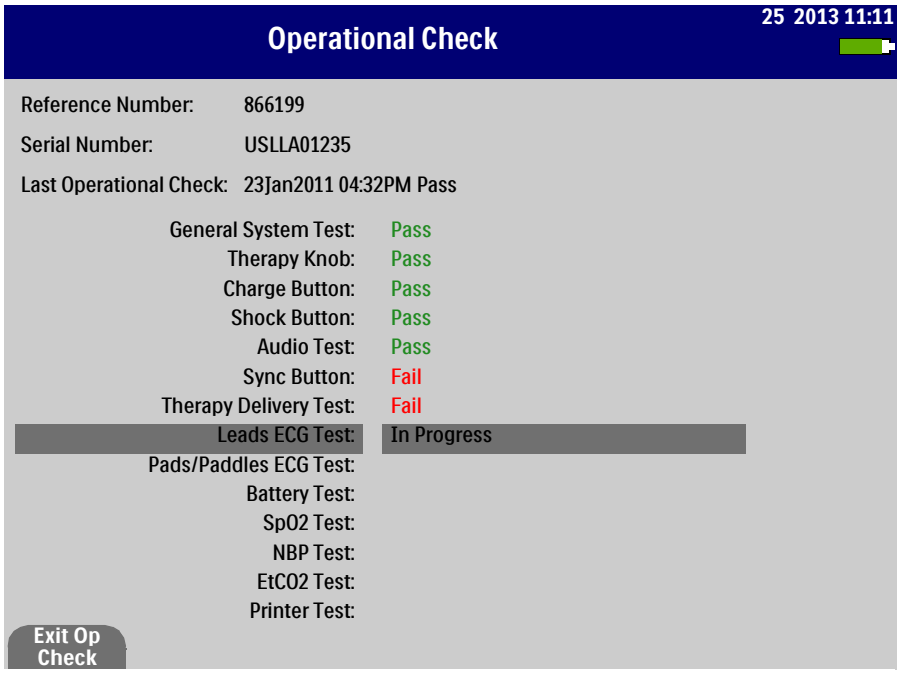
NOTE: If the Efficia DFM100 is not set up correctly, the display prompts you to make the required changes for a successful operational check (see Figure 73). The Therapy knob must be set to 170 J to begin the operational check. Once the check begins, set the knob back to 150 J when prompted to do so. The operational check runs automatically. If you choose to proceed without setting up properly, the operational check may fail.

Figure 73 **Operational Check Setup Screen**



9 During the operational check, when a response is required, use the Smart Select knob to select your answer and then confirm your choice. As each test runs, the name of the test appears highlighted on the display with the message **In Progress**. See Figure 74.

Figure 74 **Operational Check In Process Screen**



NOTE: Once you have pressed the Sync button, you can leave the Efficia DFM100 unattended as the operational check completes its process. If you cancel the operational check before it completes all tasks, there is no record of the check in the Operational Check Summary.

After the automated part of the operational check concludes, an operational check report is printed (see "Printing Operational Check Results" on page 160).

NOTE: It is important to complete all instructions listed on the Setup screen in order to successfully complete an operational check. Approximately 10 seconds after entering an operational check, a **Proceed As Is?** prompt appears in the lower right corner of the display. This prompt allows you to continue with the operational check if the device is not responding to actions you have taken during Setup. Selecting **Proceed As Is?** while there are still required items listed in the setup instructions causes operational check failures.

Operational Check Results

Each test that makes up the operational check either passes or fails (see Figure 74 for an example)

Once the operational check is completed, a summary note appears in the middle of the display. To remove the message from the screen press the **[Hide Messages]** soft key. To bring the messages back, hit the **[Show Messages]** soft key.

If you fail an operational check for a therapy-related problem (for example a failed Therapy knob or button), therapy is disabled. You receive messages on the display and the RFU Indicator is a solid Red X. After exiting operational check, the Efficia DFM100 restarts with therapy disabled.

NOTE: When exiting operational check, if the failure is related to the Therapy knob, you restart and remain in Monitor mode regardless of the knob's position on the dial. If the device does not turn off with the knob in the OFF position, take it out of use and call for service.

The failure may have been caused by an improperly performed operational check. To clear the failed operational check, successfully perform a proper operational check. If the device continues to fail the operational check and you have confirmed you are performing the operational check properly, take the device out of use and call for service.

Leads ECG Test Rerun

If the Leads ECG test fails, upon the completion of the operational check, the Efficia DFM100 prompts you with the message **Leads ECG Test Failed With Cable. Disconnect ECG Cable to Rerun Test Without Cable.** As soon as you remove the ECG cable, the device reruns an operational check to check if the problem is in the device itself. If you do not wish to rerun an operational check, press the Smart Select knob to proceed without rerunning the test.

Re-Running Operational Check

Once an operational check is completed, you can re-run an operational check by pressing the **[Rerun Op Check]** soft key.

Table 48 **Operational Check Tests and Results**

<table>
<tr><th>Test</th><th>Device Prompts</th><th>User Actions</th><th>Results</th><th>What to do for test failure</th></tr>
<tr><td>General System - tests internal clock battery, power supply and internal memory</td><td>None</td><td>None</td><td>Pass - All tested systems are functioning properly.
Fail - One or more of the tested systems is not functioning properly.</td><td>Take the device out of use and call for service.</td></tr>
<tr><td>Therapy Knob - tests if the Therapy knob is set to 170J and functioning properly</td><td>None</td><td>Confirm the Therapy knob is at 170 J.</td><td>Pass - The Therapy knob is set to 170 J and functioning properly.
Fail - The Therapy knob is not set to 170 J.
Fail - The Therapy knob is not functioning properly.
NOTE: When the Therapy knob fails, you restart and remain in Monitor mode regardless of the knob's position on the dial.</td><td>Confirm that the Therapy knob is set to 170 J and repeat the operational check. If the test continues to fail, take the device out of use and call for service.</td></tr>
<tr><td>Charge button - tests the Charge button's functionality</td><td colspan="2">Depending on the cable connected:
Therapy cable:
You are prompted to Turn the Knob to 150J Verify Test Load Is Attached Press the Charge Button — Move Therapy knob to 150. Confirm test load/defibrillator test plug is attached and press the Charge button.
External Paddles:
You are prompted to Turn the Knob to 150J Verify Paddles Are in Holders Press the Charge Button — Move Therapy knob to 150. Confirm the paddles are seated in their pockets and press the Charge button.
If the device does not detect a pressed Charge button within 10 seconds, you are prompted to use the Smart Select knob to charge.</td><td>Pass - Charge button passed.
Fail - Charge button is not functioning.
Fail - You used the Smart Select knob to charge.</td><td>Repeat the test and make sure you press the Charge button. If the operational check continues to fail, take the device out of use and call for service.</td></tr>
</table>

Table 48 **Operational Check Tests and Results *(Continued)***

Test	Device Prompts	User Actions	Results	What to do for test failure
Shock button - tests the Shock button's functionality	Once charged, the device prompts you to **Press Shock Button** or **Press Both Shock Buttons on Paddles**. If the device does not detect a pressed Shock button within 10 seconds, you are prompted to use the Smart Select knob to shock. NOTE: The device auto disarms when reaching the time specified in Configuration. A **Defib Disarmed** message is displayed.	Press the Shock button on the device or paddles.	Pass - Shock button passed. Fail - Shock button is not functioning. Fail - You used the Smart Select knob to shock. Fail - Device disarmed automatically.	Repeat the operational check and make sure you press the Shock button before the defibrillator disarms. If the operational check continues to fail, take the device out of use and call for service.
Audio - tests the speaker system	The device announces: "**Shock Delivered**" or "**No Shock Delivered**"	Using the Smart Select knob, select **Yes** or **No**. Press the Smart Select knob.	Pass - You responded that you heard the audio test prompt. Fail - You did not respond or responded that you did not hear the audio test prompt.	Repeat the operational check. If it continues to fail, take the device out of use and call for service.
Sync button - tests the Sync button's functionality	The device prompts you to **Press and Release Sync Button**. If the device does not detect a pressed Sync button within 10 seconds, you are prompted to use the Smart Select knob to proceed.	Press and release the Sync button	Pass - Sync button passed. Fail - Sync button is not functioning.	Repeat the operational check and make sure you press the Sync button. If it continues to fail, take the device out of use and call for service.
Therapy Delivery - tests defibrillation and pacing circuitry and delivers a shock	None	None	Pass - Therapy Delivery test passed with the specified cable type connected. Fail - Therapy Delivery test failed with the specified cable type connected.	Repeat the operational check using a different cable. Passing a second time indicates the previous cable is defective and should be removed from service. If it continues to fail, take the device out of use and call for service.

Table 48 **Operational Check Tests and Results *(Continued)***

Test	Device Prompts	User Actions	Results	What to do for test failure
Leads ECG - tests leads ECG acquisition and the ECG cable	None	None	Pass - Tested system is functioning properly. Fail - Tested system is not functioning properly.	Rerun the Leads ECG test when prompted at the end of the operational check. If it continues to fail, take the device out of use and call for service.
Pads/Paddles ECG - Checks ECG acquisition with pads/paddles	None	None	Pass/cable type - ECG acquisition and the cable are both functioning. Pass/No Cable - ECG acquisition is functioning; cable not tested. Fail/Cable type - ECG acquisition and/or the cable specified are not functioning.	If the operational check fails with a cable connected, replace the cable and run the test again. If it continues to fail take the device out of use and call for service.
Battery - tests battery capacity	None	None	None - there is no battery in the slot. Pass - Battery is functioning properly and charged. Pass/Low Battery.	Charge battery.
SpO_2 - tests internal SpO_2 functionality (cable is not tested)	None	None	Pass - SpO_2 passed test. Fail - SpO_2 failed test.	Call for service to repair the SpO_2 module. If SpO_2 monitoring is essential to patient care, take the device out of use.
NBP- tests internal NBP functionality	None	None	Pass - NBP passed test. Fail - NBP failed test.	Call for service to repair the NBP module. If NBP monitoring is essential to patient care, take the device out of use.
$EtCO_2$ - tests the external sensor and the device's ability to measure $EtCO_2$	None	None	Pass - $EtCO_2$ passed test. Fail - $EtCO_2$ failed test. Replace Sensor. No Sensor Detected.	If a failure is detected replace the sensor and call for service. Replace CO_2 sensor if it has reached its end of life. If no sensor is detected and you did plug a sensor in, confirm sensor is properly plugged in and rerun the operational check.
Printer - runs a printer self test	None	None	Pass - Printer passed its self-test. Fail - Printer failed its self-test.	Call for service.

Printing Operational Check Results

If configured to do so (see "Printing Settings" on page 149), the operational check report (see "Sample Operational Check Report" on page 161) automatically prints out after an operational check is completed. To manually print, press the Smart Select knob and select **Print**.

The first part of the printed operational check report lists test results. The second part lists checks performed by the user.

User Checks

Once the operational check report prints, perform the following manual checks to complete the operational check.

- Defibrillator Inspection – Make sure the Efficia DFM100 is clean (including the surfaces of the paddles and paddle trays), clear of objects and has no visible signs of damage.
- ECG Cables/Connectors/Paddles/Pads/Monitoring Electrodes – Make sure there are no visible cracks, broken wires or other visible signs of damage. Make sure all the connections are secure. Check expiration date and quantity of pads and monitoring electrodes.
- Charged Battery – Make sure a charged battery is installed in the Efficia DFM100. Another charged battery should be available or charging. Confirm the battery has no visible signs of damage.
- AC Power Cord – Check the AC power source by connecting the AC power cord to the Efficia DFM100 and plug it into a power outlet. Then verify that the external power indicator on the front panel is lit.
- Printer Paper – Make sure the printer has sufficient paper and is printing properly.
- SpO_2 Sensor – Inspect the sensor and cable for visible signs of damage.
- $EtCO_2$ Sensor – Inspect the sensor and cable for visible signs of damage.
- $EtCO_2$ Sampling Line – Inspect the tubing for blockages and visible signs of damage.
- NBP Cuffs and Tubing – Inspect the pressure cuffs and tubing for visible signs of damage.
- USB Connector – Inspect the port for visible signs of debris or damage.

NOTES: Upon completing the operational check and returning to a clinical mode, all settings are reset to the device's configured values.

If your institution's protocol requires periodic alarm verification and you wish to perform an alarm verification test (in a non-clinical environment), outside of operational check testing, you can connect the Efficia DFM100 to a simulator, then manually change the alarm limits to a setting which should cause the device to alarm. Look at the display and listen for the alarm. Be sure to reset the alarm limits to the appropriate settings before returning the device to a clinical environment.

Figure 75 **Sample Operational Check Report**

Operational Check Report	Current Test Results:				
	General System Test:	Pass	Pads/Paddles ECG Test:	Pass	
Efficia DFM100	Therapy Knob:	Pass	Battery Test:	Pass	
S/N: USLLA01235	Charge Button:	Pass	SpO2 Test:	Pass	
SW Rev: 1.0	Shock Button:	Pass	EtCO2 Test:	Pass	
Current Operational Check:	Audio Test:	Pass	NBP Test:	Pass	
25 2014 08: 55 Pass	Sync Button:	Pass	Printer Test:	Pass	
	Therapy Delivery Test:	Pass			
Last Operational Check::	Leads ECG Test:	Pass			
23 2014 06: 55 Pass					

Qty/Check List:		Comments:
_Defibrillator Inspection	_NBP Cuff(s) & Tubing	
_ECG Cables/Connectors	_USB Connector	
_Paddles/Pads		
_Monitoring Electrodes		
_Charged Battery		
_AC Power Cord		
_Printer Paper		
_SpO2 Sensor		
_EtCO2 Sensor		Inspected By:_____
_EtCO2 Sampling Line		

Operational Check Summaries

Selecting **Op Check Summary** from the **Operational Check** menu (see Figure 72) displays a summary of the last 60 operational checks stored in the Efficia DFM100 (see Figure 76). Press the Smart Select knob (see Figure 77) to print or export the summary.

Figure 76 **Operational Check Summary Screen**

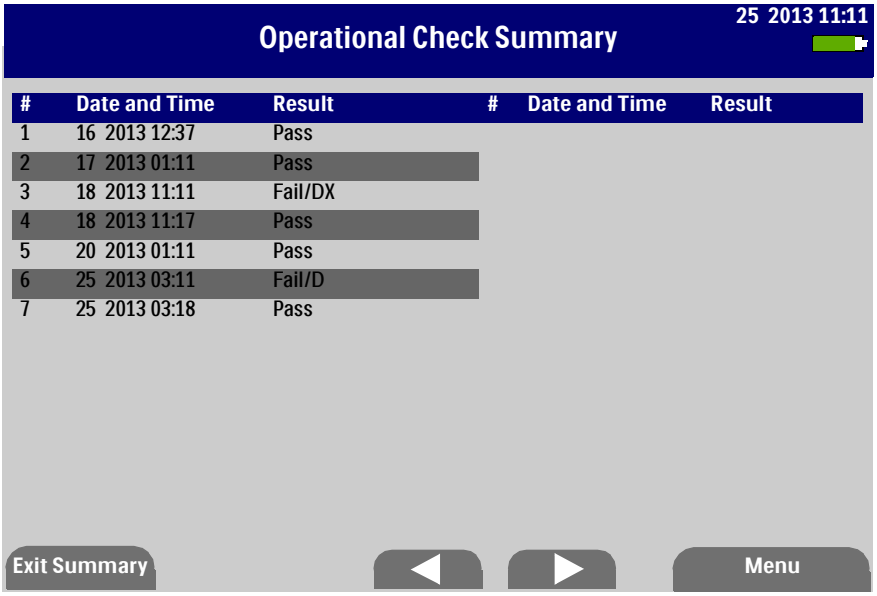
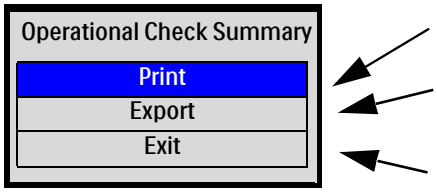


Figure 77 **Operational Check Summary Menu**



Select **Print** to print the Operational Check Summary.

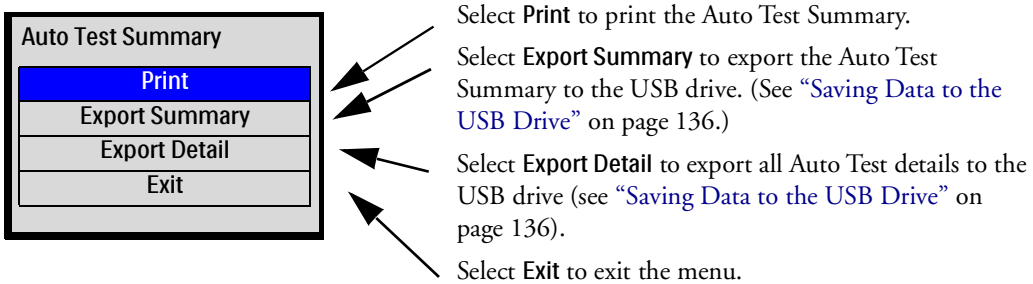
Select **Export** to export the Operational Check Summary to the USB drive (see "Saving Data to the USB Drive" on page 136).

Select **Exit** to exit the menu.

Auto Test Summaries

Selecting **Auto Test Summary** from the **Operational Check** menu (see Figure 72) displays a summary of automated test results currently stored in the Efficia DFM100.

Figure 78 **Auto Test Summary Menu**



For more information, see "Automated Tests" on page 165.

NOTE: If you try to print a summary or report while the printer is printing another report or summary, the Efficia DFM100 asks you if you want to stop the current printing and begin the second one. Use the Smart Select knob to select your answer and then press the Smart Select knob.

NOTES

16

Maintenance

This chapter describes how to care for your Efficia DFM100 and its accessories.

Overview

Proper maintenance of the Efficia DFM100 is a simple, yet important factor in dependability. Attending to routine maintenance is vital to keeping the Efficia DFM100 ready to respond in an emergency.

Routine maintenance involves:

- Providing power so automated tests can run (see "Automated Tests" on page 165).
- Observing the Ready For Use (RFU) Indicator to confirm the device's readiness (see "Ready For Use Indicator" on page 28).
- Performing operational checks and shift checks (see "Operational and Shift Check" on page 151).
- Caring for batteries (see "Battery Maintenance" on page 168).
- Cleaning the device and accessories (see "Cleaning Instructions" on page 171).
- Checking expiration dates on supplies and accessories, and ordering replacements (see Chapter 18 "Supplies and Accessories" on page 189).

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

Electric shock hazards exist internally. Do not open device.

Automated Tests

The Efficia DFM100 performs many maintenance activities including three tests that run automatically at regularly scheduled intervals when power is supplied and the device is off. The tests assess operational performance and alert you if a problem exists.

Results of tests associated with critical device functionality are reported through the RFU Indicator and the Automated Test Summary report. Results are also reported through statements on the Efficia DFM100's display when the device is turned on. Table 49 provides a brief explanation of the tests and lists each test's frequency.

Table 49 **Automated Tests**

Test	Frequency	Description
Hourly	Every hour	Tests power supply, charge level of the battery, internal communication across all critical modules and components and also the device's internal temperature.
Daily	Daily after midnight according to the device's internal clock	Tests all hourly components as well as defibrillation, ECG, pacing, SpO_2, NBP and the printer.
Weekly	Weekly, after midnight Sunday morning according to the device's internal clock	Tests all daily components as well as various electrical circuit tests and administers a 150 J shock internally to test the defibrillation circuitry.

NOTE: If the DFM100 is turned on in the middle of an automated test, the test stops and the device starts in normal operating mode.

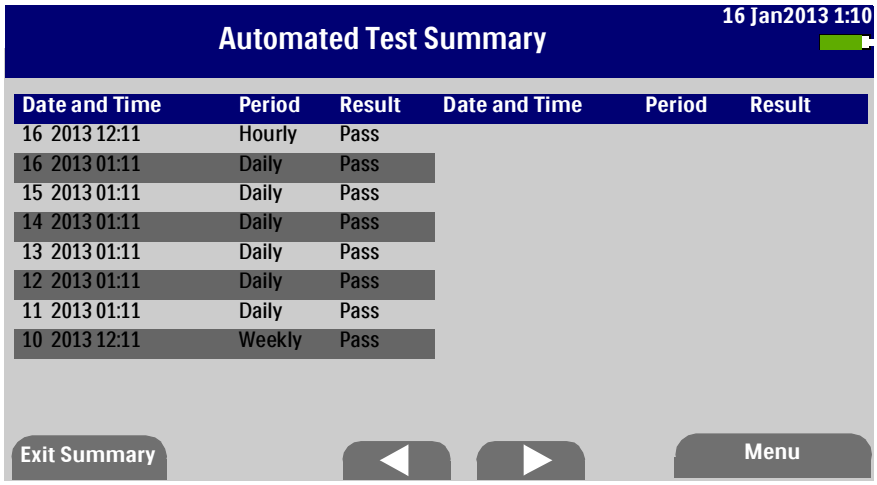
Auto Test Summaries

You can review, print and export all Auto Test Summaries the Efficia DFM100 performs.

To view a summary of automated tests:

1. Turn the Therapy knob to Monitor.
2. Press the Smart Select knob.
3. Turn the Smart Select knob to highlight **Other** and press the Smart Select knob.
4. Select **Operational Check** and press the Smart Select knob.
5. Select **Auto Test Summary** and press the Smart Select knob. The message **Leaving clinical mode. Patient monitoring will be turned off.** appears.
6. Select **Yes** if you wish to continue. Select **No** to return to Monitor mode. Press the Smart Select knob to confirm your choice.
7. If you selected **Yes**, the Efficia DFM100 displays the **Automated Test Summary** screen (see Figure 79).

Figure 79 **Automated Test Summary Screen**



Auto Test Summary Results

The Automated Test Summary lists results for the hourly, daily and weekly tests that have been performed. (See Table 50.) The AutoTest Summary lists the result of the most recent hourly test, the six most recent daily tests and the configured amount (1-53) of weekly tests. The table below describes each result and the corresponding RFU Indicator display. For more on the RFU Indicator see "Ready For Use Indicator" on page 28.

Table 50 **Auto Test Summary Results**

Result	RFU Indicator	Definition	Required Action
Pass	Hourglass	All tests passed.	None.
Fail/DX	Solid red X, chirp	Service required. A critical device failure has been detected.	Turn the Therapy knob to Monitor. A message indicating the problem is displayed. Refer to Chapter 17 "Troubleshooting" on page 173 for further action.
Fail/BW	Blinking red X	Service is not required but the battery is low or malfunctioning.	Charge the battery as soon as possible or replace it with a charged battery. You can charge the battery in the Efficia DFM100 by connecting the device to AC power.
Fail/CX	Solid red X, chirp	An ECG cable failure has been detected.	Replace the ECG cable and rerun the operational check.
Fail/D	Hourglass	A non-critical failure has been detected.	Turn the Therapy knob to Monitor. A message indicating the problem is displayed. Refer to Chapter 17 "Troubleshooting" on page 173 for further action.

Printing/Exporting Auto Test Summaries

You can print or export the Auto Test Summaries from **Operational Check**. See "Auto Test Summaries" on page 163.

Battery Maintenance

Battery maintenance is essential to ensure that the battery's charge state is accurately reported, there is sufficient charge and capacity to operate your Efficia DFM100, and battery life is optimized. Remove faulty batteries from service immediately. Battery maintenance begins when you first receive your device and continues throughout the life of the battery. To optimize performance, a battery that is in the low battery condition (less than 40%) should be charged as soon as possible. Table 51 lists battery maintenance activities and when they should be performed.

Table 51 **Battery Maintenance Activities**

Activity	When to perform
Visual inspection	As part of a standard operational check.
Charge the battery	Upon receipt; after use; if the **Low Battery** message is displayed.
Store the battery	When not in use for an extended period of time, store the battery at a 20-40% charge.
Discard the battery	When there are visual signs of damage or you receive a message to replace the battery.

When properly cared for and used in its intended environment, the Efficia DFM100 Lithium Ion battery has an approximate useful service life of 3 years in low use environments (5-10 hours per week) and 1.5 years in high use environments (25-30 hours per week). Use outside intended conditions could reduce battery life. To optimize performance, charge a low battery as soon as possible.

NOTE: The Efficia DFM100 rechargeable Lithium Ion battery automatically calibrates itself.

Initializing Batteries

When opening a new battery for the first time, it needs to first be charged before the fuel gauge lights activate.

Charging Batteries

The Efficia DFM100 Lithium Ion battery needs to be charged in the Efficia DFM100. Insert the battery to be charged in the battery compartment and then plug the device into an AC power outlet.

With AC power connected and the device turned off, the Efficia DFM100 recharges its battery to 80% capacity in less than 2 hours and to 100% capacity in less than 3 hours. Charge time can be substantially longer if the device is on.

Once AC power is supplied, the Battery Charging Indicator flashes green to indicate the battery is charging and the battery is ≤ 90 percent charged. The indicator turns solid green when the battery charge is > 90 percent of capacity and AC power is present. If no battery is installed or the installed battery is not functioning properly, the light remains off. Charging the battery at temperatures above 40°C (104°F) may reduce battery life.

Charge Status

You can check the current charge status of a Efficia DFM100 Lithium Ion battery by:

- Pushing the fuel gauge button on the battery to illuminate the fuel gauge (see "Battery Fuel Gauge" on page 17).

- Turning the Therapy knob to any position and observing the battery power indicators displayed in the Status Area (see "Status Area" on page 31).

Storing Batteries

Batteries should be rotated regularly to ensure even usage. When storing batteries, make sure the battery terminals do not contact metallic objects.

- Store the battery from 15°C to 35°C (59°F to 95°F) and from 25% to 75% relative humidity.
- For optimal battery life, the recommended charge level range of a stored battery is 20% to 40%. Check the charge level of the stored battery every two months, and recharge the battery if it is below 20%.
- For battery storage up to six months, the battery should be removed from the device and charged to approximately 60%. Check the battery at least every six months, and recharge the battery to 60% as needed.
- Charge the stored battery to full capacity before use.

CAUTION: Storing batteries in the Efficia DFM100, if the device is out of service for an extended period of time, drains the battery.

Discarding Batteries

Batteries should be discarded if there are visual signs of damage. They should be discarded in an environmentally safe manner.

WARNINGS: Properly dispose of or recycle 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.

General Battery Safety

The following general warnings and cautions apply to the Efficia DFM100 battery. Additional warnings and cautions specific to a particular battery feature are provided in the appropriate sections.

WARNINGS: Built-in safety circuits cannot protect against handling abuse. Adhere to all warnings and cautions in handling and using Lithium Ion batteries.

Keep batteries away from flame and other heat sources. Do not incinerate.

Do not short circuit or reverse polarity of the battery. Avoid placing batteries around metal objects that may short circuit the battery. Do not directly connect the negative and positive terminals.

Avoid getting batteries wet or using batteries in high humidity environments.

Do not puncture, crush, dent, drop, physically shock or allow any deformation of the batteries.

Do not disassemble or open batteries. Do not attempt to alter or bypass the safety circuit.

Use only in the Efficia DFM100 and charge only in the specified battery charger. Do not charge near a heater or in hot sunlight.

Do not connect the battery to any plug socket or to any other equipment.

CAUTIONS: Use caution when handling, using and testing batteries. Do not touch a leaking battery. Do not short circuit, crush, drop, mutilate, puncture, apply reverse polarity, expose to high temperatures or disassemble. Misuse or abuse could cause physical injury.

Do not drop or subject to strong physical shock.

Do not store your device for prolonged periods with the battery in.

Do not expose batteries to temperatures below -20°C (-4 °F) or greater than 50 °C (122 °F). Excess temperatures may result in battery damage.

Wash skin with large amounts of water in the event of electrolyte leakage to prevent skin irritation and inflammation.

Power-Related Alarms

Power-related alarms are generated for the conditions shown in Table 52. Once generated, they appear as alarm messages on the Efficia DFM100 display. There are both audio and visual alerts. For more information on alarms, see "Alarms" on page 37.

Table 52 **Power-Related Alarms**

Alarm Message	Condition	Type of Alarm	Indication and Location
Low Battery	Battery power is low.	High Priority if pacing otherwise, low priority non-latching alarm	Red alarm message if pacing, cyan if not with audio tone in Battery Status area.
Shutting Down in 1 min	Battery power is critically low. The device will shut down in 1 minute.	High Priority if pacing otherwise, medium priority non-latching alarm	Red alarm message if pacing, yellow if not with audio tone in Technical Alarm area.
Shutting Down Now	Battery power is critically low. The device is shutting down now.	High Priority Non-Latching	Red alarm message with audio tone in Technical Alarm area.
Equipment Disabled: System Failure	A low voltage has been detected.		
Battery Communication Failure	Communications between the device and the battery have failed.	Medium Priority Non-Latching	Yellow alarm message with audio tone in Battery Status area.
Replace Battery	The battery has reached its end of life.	Low Priority Non-Latching	Cyan alarm message with audio tone in Technical Alarm area.
Incompatible Battery	Logged when an incompatible battery is connected.	High Priority Non-Latching	Red alarm message with audio tone in Technical Alarm area.

Cleaning Instructions

Listed below are the recommended cleaning instructions for the Efficia DFM100 and its associated accessories.

CAUTIONS: The Efficia DFM100, along with its accessories and supplies, may not be autoclaved, steam sterilized, ultrasonically cleaned or immersed unless otherwise indicated in the *Instructions for Use* that accompany the accessory or supply.

Do not use abrasive cleaners or strong solvents such as acetone or acetone-based compounds.

Do not clean electrical contacts or connectors with bleach.

A soft cloth is recommended for cleaning the display window to prevent scratching.

Quaternary ammonium compounds such as Steris Coverage Plus NPD are not recommended for routine cleaning.

Disinfect the Efficia DFM100 as determined by your institution's policy to avoid damage to the device.

Defibrillator/Monitor, Paddles, Cables and Battery

You can clean the exterior of the Efficia DFM100, external paddles, therapy cables, ECG cables and battery by hand wiping with a clean cloth. Remove all soil (tissue, fluid, etc.) and wipe thoroughly with a water-dampened cloth before applying one of the following cleaning products:

- Isopropyl alcohol (70% solution in water)
- Mild detergent and water
- Chlorine bleach (containing 6% sodium hypochlorite), 3% solution in water
- Cleaning solutions/wipes with milder Isopropyl alcohol and chlorine bleach concentrations

CAUTIONS: When cleaning, do not immerse. Wring any excess moisture from the cloth before cleaning and be sure to avoid pouring fluids on the device. Do not allow fluids to penetrate the exterior surfaces of the device.

No parts of the device (except sterilizable internal paddles) may be ultrasonically cleaned, immersed, autoclaved or ETO sterilized.

The ECG cables may not be ultrasonically cleaned, immersed, autoclaved or steam sterilized.

NOTE: For information about cleaning and sterilizing internal sterilizable paddles, see the *Sterilizable Defibrillator Paddles Instructions For Use*.

Printer Printhead

If the printout has light or varying print density, clean the printhead to remove any buildup of paper residue.

To clean the printhead:

1. Open the printer door.
2. Move the paper out of the way.
3. Clean the printhead surface (top, front of the compartment) with a cotton swap dipped in isopropyl alcohol.
4. Replace roll of paper and close door.

Side Pouches

After removing from the device, the side pouches may be cleaned by hand with mild soap and water and air dried. Do not wash or dry by machine.

SpO_2 Sensor and Cable

Follow the manufacturer's instructions to clean the SpO_2 sensor and cable.

CO_2 Sensor and Cable

Follow the manufacturer's instructions to clean the CO_2 sensor and cable.

NBP Cuff

Follow the manufacturer's instructions to clean the cuff.

Service Life

Life expectancies for the Efficia DFM100 therapy cable and external paddles are related to the environment they are used in, their frequency of use and how they are cared for. Their service life is up to three years. To maintain reliable performance and reduce the possibility of failure during patient use, replace them every three years from the time they were initially placed into service or if they fail inspection. Extra care must be taken when using the Efficia DFM100 in transport and Emergency Medical Service (EMS) environments that place additional stress on the cable connection and increase the chance for wear, impacting its useful life.

Efficia DFM100 Disposal

Prior to disposal, clear all patient data in Service mode. For more information, refer to the Efficia DFM100 *Service Manual*.

After clearing all patient data, remove the battery, and then dispose of the device and accessories in accordance with your country's regulations for equipment containing electronic parts.

WARNINGS: Disposing of the device with the battery inserted presents a potential shock hazard.

To avoid contaminating or infecting personnel, the environment, or other equipment, make sure you disinfect and decontaminate the device and any appropriate accessories prior to disposal.

17

Troubleshooting

Overview

If the Efficia DFM100 detects an error or potential problem during use, it displays a textual message to guide you. These messages are often accompanied by a voice prompt or audible beeping tone. This chapter describes these statements that you see, along with other symptoms, and provides suggestions for what to do and resources for you to contact for further information.

Resolving Issues

If you are unable to resolve a problem using the suggestions in this chapter, run an operational check to determine if there is a malfunction requiring service. If a malfunction is identified, call for service and:

- If the malfunction is related to ECG monitoring, defibrillation or pacing, take the Efficia DFM100 out of service.
- If the malfunction is related to SpO_2, $EtCO_2$ or NBP, take the device out of service if the function is essential to patient care in your institution.

Responding to Test Results

Results of automated tests associated with critical functionality are reported through the Ready For Use Indicator and the Automated Test Summary report (see "Automated Tests" on page 165).

To respond to errors reported through operational check, see "Operational Check Tests and Results" on page 157).

For further technical and repair information, refer to the Efficia DFM100 *Service Manual*.

WARNING: Product servicing and repair should only be performed by qualified service personnel.

Device Info Report

While troubleshooting, it is often beneficial to know what versions of software and hardware your Efficia DFM100 contains. The Device Info report provides that information.

To print a Device Info report:

1. Press the Smart Select knob.
2. Turn the Smart Select knob to highlight **Other** and press the Smart Select knob.
3. Select **Print Device Info** and press the Smart Select knob to print the report.

The Device Info report contains information on:

- Serial Number
- Software Revision
- Main Processor PCA
- Processor Module
- Installed Options
- External Modules
- Therapy Board
- Printer

If there is a device failure and the Efficia DFM100 cannot determine a version number, a **-?-** is displayed in its place.

If your Efficia DFM100 does not have an option installed or, in the case of the CO_2 sensor, the module is not connected to the device, no information is printed.

NOTE: When first turning the Efficia DFM100 on or plugging the CO_2 sensor in, it needs to warm up for 10 seconds before information is ready for the Device Info report.

Symptoms

The following tables list symptoms, statements and messages that you may encounter while using the Efficia DFM100. The tables also provide possible causes and potential solutions. Symptoms are categorized by functionality.

When troubleshooting issues related to connecting the patient to the Efficia DFM100, it is recommended that one single person follow the connection path from the patient to the device to assure a proper end-to-end connection.

Table 53 **General Problems**

Symptom	Possible Cause	Potential Solution
The Efficia DFM100 does not turn on.	There is no power.	Check the battery pack. Insert a fully charged battery. Connect the device to AC power.
Short battery life (battery appears to lose its charge quickly).	Battery may be nearing its end of life.	Replace the battery.
When turning the device on, it displays a **Therapy Not Available Due to Disabled Equipment** message. If you turned the device to AED or Manual Defibrillation mode, **Begin CPR, If Needed.** is added to the message.	Therapy mode is not available because of a device failure.	Begin CPR if needed. Run an operational check. If it fails or the problem continues, take the device out of use and call for service.
Audio is too low or absent.	The **QRS**, **Voice** or **Alarms** volume is configured to a **Very Soft** or **Off** setting.	Use the **Volume** menu to adjust the volume of the prompt.
	There is a problem with the device's speaker.	Run an operational check to confirm the speaker is operating.
All Settings Reset To Default Values message on display.	A total power failure or critical software failure has occurred.	Reset alarms, waveforms, volumes and other settings previously defined for the current patient.
Configuration Error. All Settings Reset to Factory Default Values message on display.	An error has occurred which corrupted your configuration file.	Reset your Configuration settings to your customized settings.

Table 53 **General Problems *(Continued)***

Symptom	Possible Cause	Potential Solution
Critical Device Failure Detected. Service Required. message on display.	A critical device failure has been detected at startup or during RFU testing. Clinical modes are disabled.	Run an operational check. If it fails or the problem occurs repeatedly, take the device out of use and call for service.
Equipment Disabled: System Failure message on display.		
Therapy Disabled: Run Op Check message on display.	A device failure has been detected at startup or during RFU testing. The device is unable to deliver therapy.	
Non-critical Device Failure Detected. Service Required message on display.	A non-critical device failure has been detected at startup or during RFU testing.	Review error and alarm messages on screen. Call for service.
Pads/Paddle Type Unknown message on display.	There is a problem with the Therapy cable and/or the device's Therapy port.	When prompted, pick the correct cable type from the menu and press the Smart Select knob. (If you select the wrong cable type in error, unplug and re-plug in the cable.) Replace the Therapy cable. If problems persist, take the device out of use and call for service.
Replace Battery message on display.	The battery has reached its end of life.	Replace the battery.
Low Battery message on display.	The battery may not have enough remaining charge to provide six 200J shocks and 10 minutes of monitoring.	Connect to AC power. Insert a fully-charged battery.
Shutting Down in 1 min message on display.	Very low battery and the device is not connected to AC power.	
Shutting Down Now message on display.	Battery charge is depleted and the device is not connected to AC power.	Connect to AC power to restart the device.
Battery Communication Failure technical alarm.	The Efficia DFM100 is not able to communicate with the battery.	Connect to AC power. Insert a fully-charged battery. If problems persist, call for service. If battery power is essential to patient care, take the device out of use.
The power gauge on the side of the battery does not work when you first receive the battery.	Battery was shutdown to prolong its life during shipping.	Insert the battery in a Efficia DFM100 for about 1 minute to awaken it.
One or more controls do not respond as expected (e.g. Lead Select button does not function, soft keys do not work).	There is a faulty control or connection problem.	Remove the device from use and call for service.

Table 53 **General Problems *(Continued)***

Symptom	Possible Cause	Potential Solution
Trending data is not appearing on the display.	You might not be in Monitor mode.	Make sure your device is in Monitor mode before attempting to display trending information.
You receive a **Event Record Limit Reached**technical alarm.	You have reached the eight hour duration limit for the current event.	To continue event recording, you need to start a new event by powering the device off for 10 seconds and then turning it back on. Do not perform this function if patient safety is an issue.
You receive a **Event Storage Error** technical alarm.	A non-critical device failure has occurred.	Recording of events and waves has stopped. Restart device when it is appropriate to do so. If the alarm continues, call for service.
You receive a **USB Error** technical alarm.		Restart device when it is appropriate to do so. If the alarm continues, call for service.
You receive a **Device Temp High** technical alarm.	The device's internal temperature is above 65°C (149°F)	Turn the device off and allow to cool. If the problem persists, remove the device from use and call for service.
You receive a **Device Restarted Due to Error** technical alarm.	The previous shutdown was caused by an internal device error.	Run an operational check to diagnose the problem. If the problem persists, remove the device from use and call for service.
You receive a **Power Equipment Malfunction** technical alarm.	A power supply failure has occurred but no critical functions are affected.	
You receive an **Autotest Failure** technical alarm.	One of the Ready For Use tests failed to run to completion at its scheduled interval.	Run an operational check to diagnose the problem. If the problem persists, remove the device from use and call for service.
	The device has been without power for more than one week.	Run an operational check to diagnose the problem. If the problem persists, remove the device from use and call for service.
You receive a **Power Test Failure** technical alarm.	The installed battery is unable to charge the device for defibrillation.	Insert a fully charged battery. Run an operational check to diagnose the problem. If the problem persists, remove the device from use and call for service.
You receive a **Non-Critical Device Error** technical alarm.	A non-critical software error has occurred.	Restart device when it is appropriate to do so. If the alarm continues, call for service.
Your device's display remains in Monitor mode even when you switch to a different mode. Therapy is disabled.	The Therapy knob has failed an operational check.	Run a proper operational check to diagnose the problem. If the problem persists, remove the device from use and call for service.
System Failure. Service Required message on display.	A device failure has been detected at startup or during RFU testing. The device can still monitor and deliver therapy in an emergency.	If the device is not required for use on a patient, take it out of use and call for service.

Table 53 **General Problems *(Continued)***

Symptom	Possible Cause	Potential Solution
Autotest Overdue: Run OpCheck message on the display.	Autotest has not been run in over a week, possibly because the device was without power.	Run an operational check.
Autotest Error. Run Op Check. message on the display.	The device cannot determine if all subsystems are operational.	Run an operational check.
Device does not administer a shock during the weekly shock test.	You are using a test plug or paddles during the weekly shock test.	This is normal behavior. A shock is not delivered during a weekly shock test using a test plug or paddles.
	You are using a test load during the weekly shock test.	Confirm you did the test properly before taking the device out of use and calling for service.
Incompatible Battery alarm	An incompatible battery is connected.	Connect compatible battery.

Table 54 **ECG Problems**

Symptom	Possible Cause	Potential Solution
QRS beeper inaudible or beeps do not occur with each QRS complex.	The QRS volume is configured to **Off** or the setting is too low.	Configure the QRS beeper volume.
	The QRS volume was turned off or set too low through the **Volume** menu.	Adjust the volume through the **Volume** menu.
	The amplitude of the QRS complex is too small to detect.	Select a different lead.
Poor ECG signal quality (noisy trace, wandering baselines, etc.) from signal acquired through monitoring electrodes.	The monitoring electrodes are not making proper contact with the patient.	Check that the monitoring electrodes are properly applied. If necessary, prepare the patient's skin and apply new electrodes.
	The monitoring electrodes are out of date or dried out.	Check the date code on the electrodes. Do not open the electrode package until immediately prior to use.
	Radio frequency interference (RFI) is causing artifact.	Relocate or turn off equipment that may be causing RFI. Try repositioning the cables/leads.
	The ECG cable may be faulty.	Run an operational check with the ECG cable and check Leads ECG results. If the test fails, replace the ECG leadset and trunk cable.

Table 54 **ECG Problems *(Continued)***

Symptom	Possible Cause	Potential Solution
Poor ECG signal quality (noisy trace, wandering baselines, etc.) from signal acquired through pads.	The pads are not making proper contact with the patient.	Ensure proper skin preparation and correct application. If necessary, apply new pads. Paddles are only for a quick look, not long term monitoring.
	The pads are outdated or dried out.	Check the date code on the pads. Do not open the pads package until immediately prior to use.
	Radio Frequency Interference (RFI) is causing artifact.	Relocate or turn off equipment that may be causing RFI. Try repositioning the Therapy cable.
	The Therapy cable may be faulty.	Run an operational check with the Therapy cable and check pads ECG results. If the test fails, replace the Therapy cable.
When monitoring with pads, there is a dashed line on the display instead of an ECG.	ECG data is not being acquired.	Confirm that the desired lead is selected. Check the pads, paddles or ECG cable connection. Check that the pads, paddles, or monitoring electrodes are properly applied.

NOTE: Viewing a patient's ECG through paddles is not recommended for long-term monitoring. See "Quick Look" on page 79.

The Lead Select button does not respond as expected.	Device is in AED mode.	The Lead Select button is disabled in AED mode. To select a lead, exit AED mode and enter Monitor or Manual Defibrillation mode.
	Pads/paddles cannot be used for the primary ECG in Demand mode pacing.	Exit pacing or choose Fixed mode pacing.
	If a 3-Lead cable is in use or some wires in a 5-Lead cable are disconnected, augmented and V-leads may not be selectable.	Confirm all leads are connected.
Solid flat line - no waveform, no leads, **Cannot Analyze ECG** alarm	Short in the patient cable or leads.	Run an operational check with the ECG cable. If the test fails, run it without the ECG cable. If the test passes, replace the cable. If not, remove the device from use and call for service.
Pads Off or **Paddles Off** technical alarm	The multifunction electrode pads or paddles may be disconnected or not attached securely.	Check that the pads/paddles are properly applied. If necessary, replace the pads. Change the ECG in Wave Sector 1 to a lead derived from monitoring electrodes.
Cannot Analyze ECG technical alarm.	ECG data cannot be analyzed. An electrode may be disconnected or the analyzing algorithm cannot analyze the ECG signal.	Check ECG signal quality. If necessary, improve lead position or reduce patient movement.

Table 54 **ECG Problems *(Continued)***

Symptom	Possible Cause	Potential Solution
ECG Equipment Malfunction technical alarm.	A device hardware failure was detected.	Disconnect the ECG cable and perform an operational check. If the Leads ECG test fails, remove the device from use and call for service. If the Leads ECG test passes, replace the ECG cable and perform another operational check.
Pads ECG Equipment Malfunction technical alarm.	A device hardware failure was detected.	Perform an operational check. If the Pads/Paddles ECG test fails with Therapy cable, disconnect the Therapy cable from the device when prompted in order for the Pads/Paddles ECG Test to run without the cable connected. If the Pads/Paddles ECG Test passes without the cable connected, replace the Therapy cable. If the test fails, remove the device from use and call for service.
Therapy Disabled: Run Op Check technical alarm.	A device failure has been detected. The device is unable to deliver therapy.	Run an operational check. If it fails or the problem occurs repeatedly, take the device out of use and call for service.
Press "I,II.." Button to Select Another ECG Lead message on display.	The waveform in Wave Sector 1 is no longer valid and another ECG source is available.	Check that the monitoring electrodes/pads are properly applied. Use the Lead Select button to select another lead to monitor.
Lead wire off message on the display.	The specified monitoring electrode is off or not making proper contact with the patient.	Check that the monitoring electrodes are properly applied. If necessary, prepare the patient's skin and apply new electrodes.
Check Limb Leads message on the display.	Two or more limb lead electrodes are off or not making proper contact with the patient.	Check that the limb lead electrodes are properly applied. This message does not display when V and RL are off because the device assumes a 3-Lead cable is attached.

Table 55 **Defibrillation and Pacing Problems**

Symptom	Possible Cause	Potential Solution
Check Pads Connection From Patient to Device message on display.	A test load or defibrillator test plug is attached to the end of the Therapy Cable.	Remove the test load or defibrillator test plug and attach multifunction electrode pads.
	Pads impedance is less than 10 ohms.	Check pads connection with the patient.
Charge Cancelled message is displayed.	Therapy cable is not attached. Pads/paddles connection compromised.	Make sure the Therapy cable is connected and the pads/paddles are making proper contact with the patient.
	The Shock button was not pressed within the configured time period.	No action required. If desired, charge the device and press the Shock button.

Table 55 **Defibrillation and Pacing Problems *(Continued)***

Symptom	Possible Cause	Potential Solution
Press Paddles Firmly message is displayed.	A shock has been aborted due to high impedance.	Check paddles connection with the patient. Remove paste, moisture, or any other conductive material between the paddles and patient.
Press Pads Firmly message is displayed.		Check pads connection with the patient.
Connect Therapy Cable message is displayed.	The pads or paddles Therapy cable is not connected to the device.	Confirm all cables are properly connected.
Insert Connector, Apply Pads message is displayed.	The pads cable is not connected to the Therapy cable or pads are not properly applied to the patient.	Confirm all cables are properly connected and pads are correctly placed on the patient.
Energy Limited to 50J message is displayed.	An energy greater than 50J was selected with internal paddles connected.	Re-set energy setting to 50J or less.
Replace Pads message is displayed.	A shock has been aborted due to high impedance - second notice.	Replace the pads and check connection with patient.
Reapply Pads to Dry Chest message on display.	A shock has been aborted due to low impedance.	Confirm proper skin prep and reapply pads.
Paddles Must Not Be Touching Each Other message on display.		Confirm that paddles are not touching each other when placed on the patient's chest. Remove paste, moisture, or any other conductive material between the pads and patient.
Press Pads Firmly message on display.	A shock was delivered but there was marginal impedance.	Check pads connection with the patient.
Press Paddles Firmly For Next Shock message on display.		Check paddles connection with the patient.
Paddles Power Overload message on display.	The device has detected a power overload with the connected paddles.	Run an operational check to see if the message clears. If it doesn't, run an operational check with a different set of paddles. If the message still doesn't clear, take the device out of use and call for service.
Select Therapy Cable Type message on display.	The device can't detect the type of Therapy cable attached.	Select the proper Therapy cable from the list presented.
Therapy Not Available Due to Disabled Equipment message is displayed.	A device failure has occurred.	Run an operational check to diagnose the problem. If the device is in use at the time of the message, begin CPR if indicated.
Pacing Stopped. Power Interrupted. technical alarm.	Appears after power is restored to indicate there was a loss of power during pacing.	Pacing does not restart automatically. If indicated, resume pacing.

Table 55 **Defibrillation and Pacing Problems *(Continued)***

Symptom	Possible Cause	Potential Solution
Pacing Stopped. Pads Off. technical alarm.	Proper pads contact has been lost with the patient.	Check pads connection with patient. Confirm proper skin prep. Replace pads if necessary. Resume pacing.
Pacing Stopped. Device Error. technical alarm.	The Efficia DFM100 has detected an error which prevents pacing therapy delivery.	Replace the defibrillator. Remove the device from use and call for service.
Pacer Output Low technical alarm.	High impedance is causing less current to be delivered to the patient than specified in the output current setting.	Check that pads are applied properly.
Pacing Stopped. Pads Cable Off. technical alarm.	The Therapy cable is disconnected from the device.	Check all Therapy cable connections. Replace pads if necessary. Resume pacing.
Pacing Stopped. Leads Off. technical alarm.	The primary ECG lead has become invalid.	Check that the monitoring electrodes are applied properly to the patient. Check cable connections. Resume pacing.
Shock Aborted prompt but you see a physiological response from the patient and the Shock Counter remains unchanged.	Poor skin contact, pads are not properly connected to the patient. Minimal patient movement is possible in this situation as the defibrillator may deliver a small amount of energy.	Make sure the pads are applied properly. Replace pads if necessary.
Therapy Malfunction technical alarm	A device failure which prevented therapy from being delivered has occurred.	Re-attempt therapy. If it fails again, the device reboots. Re-try. If it fails for a third time, the message **Therapy Disabled: Run Op Check** appears. In an emergency situation, use another device. Run operational check to clear the error.
Re-attempt Therapy technical alarm	A therapy malfunction has occurred.	Re-attempt therapy.

NOTE: Once the reason for the Pacing Stopped alarm has been resolved, that part of the alarm message is removed from the display. You must press the **[Start Pacing]** soft key to resume pacing and remove the remainder of the alarm from the display

Table 56 **SpO_2 Problems**

Symptom	Possible Cause	Potential Solution
The SpO_2 waveform is not displayed.	The sensor is not properly connected or the sensor cable is damaged.	Check the sensor connection and cable. Try another sensor.
	The SpO_2 waveform is not configured to be displayed and there is not an unused wave sector.	Use the **Displayed Waves** menu to select a wave sector to display the SpO_2 waveform.
	You are in AED mode and SpO_2 waveform is not configured to be displayed or SpO_2 is non-pulsatile.	Configure AED mode to use SpO_2.
SpO2 Non-Pulsatile technical alarm.	The patient's pulse is absent or too weak to be detected or the sensor has come off.	Check perfusion at the measurement site. Check that the sensor is applied properly. Make sure the sensor site has a pulse. Relocate the sensor to another site with improved circulation. If the message occurs during an NBP measurement on the same limb, wait until the NBP measurement is finished. Try another sensor.
SpO2 Erratic technical alarm. The SpO_2 numeric value is replaced with a **-?-**.	SpO_2 measurements are erratic.	Check that the sensor is applied properly. Make sure the sensor site has a pulse. Relocate the sensor to another site with improved circulation. Try another sensor.
SpO2 Noisy Signal technical alarm.	Excessive patient movement or electrical interference.	Minimize patient movement. Make sure the sensor cable is not positioned too close to power cables.
SpO2 Interference technical alarm.	Ambient light is too high.	Cover the sensor with an opaque material to minimize ambient light. Make sure the sensor cable is not positioned too close to power cables. Make sure that the sensor cable is not damaged.
SpO2 Unplugged technical alarm.	The sensor is not connected.	Check the SpO_2 connection. Try another sensor.
	There is too much interference.	
	The sensor is damaged.	
SpO2 Sensor Malfunction technical alarm.	The SpO_2 sensor or cable is faulty.	Try another sensor. If the problem persists, call for service of the SpO_2 module. If SpO_2 monitoring is essential to patient care, take the device out of use.

Table 56 **SpO_2 Problems *(Continued)***

Symptom	Possible Cause	Potential Solution
SpO2 Equipment Malfunction technical alarm.	Faulty SpO_2 hardware.	Call for service of the SpO_2 module. If SpO_2 monitoring is essential to patient care, take the device out of use.
SpO2 Extended Update technical alarm. The SpO_2 numeric value is replaced with a **-?-**.	An NBP measurement or an excessively noisy signal is delaying display/update of the SpO_2 measurement for more than 30 seconds.	Wait until the NBP measurement is complete. Try another sensor site. Move sensor to a different limb than the NBP cuff.
SpO2 Low Perfusion technical alarm. The SpO_2 numeric value is replaced with a **-?-**.	The SpO_2 signal is too low to give an accurate reading.	Check that the sensor is applied properly. Make sure the sensor site has a pulse. Relocate the sensor to another site with improved circulation. Try another sensor.
SpO2 Error technical alarm.	A non-critical device failure has occurred.	Restart device when it is appropriate to do so. If the alarm continues, call for service of the SpO_2 module. If SpO_2 monitoring is essential to patient care, take the device out of use.

Table 57 **$EtCO_2$ Problems**

Symptom	Possible Cause	Potential Solution
The numeric value is replaced with a **-?-**.	The sensor is warming up.	No action required. As soon as the sensor has warmed up and there is a detectable breath, the question mark is removed from the display.
	See the remainder of this table for other possible causes.	Check the associated technical alarms and address the problem.
You have a Capnogram but the numeric has a question mark in front of it.	The sensor is warming up.	No action required. As soon as the sensor has warmed up, the question mark is removed from the display.
The Capnogram does not appear on the display.	The Capnogram is not configured to be displayed.	Use the **Displayed Waves** menu to select a wave sector to display the Capnogram.
The Capnogram has a dashed line.	The sampling line is not properly connected	Check all connections. Check sampling line for knots, kinks or pinches.
Unable to zero: CO2 Sensor Not Ready or **Unable to zero: CO2 in the Tube** prompts.	See Table 26 “Zeroing Messages” on page 105 for possible causes and solutions.	
CO2 Replace Sensor technical alarm.	The CO_2 sensor has reached its end of life.	Replace your sensor with a newer one.

Table 57 **$EtCO_2$ Problems *(Continued)***

Symptom	Possible Cause	Potential Solution
CO2 Sensor Over Temp technical alarm.	The CO_2 sensor is over heated.	Move any adjacent devices that may be heating the CO_2 sensor and remove anything covering the CO_2 sensor so that it is directly exposed to ambient air at a temperature below 40° C. Unplug the sensor and wait for it to cool down. If you still get an over temp alarm, replace the sensor.
EtCO2 Power Overload	The CO_2 sensor is malfunctioning.	Replace the sensor
CO2 Communication Failure	The CO_2 sensor is connected but cannot communicate with the Efficia DFM100.	Unplug the CO_2 sensor and wait 10 seconds. If the communication failure alarm remains, the Efficia DFM100 requires servicing. If the alarm changes, plug the sensor in firmly. If the Communication Failure returns, replace the CO_2 sensor.
CO2 Zero Required technical alarm.	Your sensor needs to be zeroed.	Disconnect sampling line from the patient and zero the sensor. See "Zeroing Sidestream and Mainstream Sensors" on page 104.
CO2 Sensor Warming Up technical alarm.	Your sensor has not reach its proper operating temperature.	No action required. The technical alarm is removed when the sensor reaches its operating temperature.
CO2 Out of Range technical alarm.	The CO_2 value is out of the measurement range.	Zero the sensor. If the error remains and you suspect a false high value, replace the CO_2 sensor.
CO2 Check Line technical alarm.	For Sidestream sensors - your sampling line is kinked or blocked.	Check the sampling line for kinks or blockages and remove if found. Replace sampling line.
CO2 Check Airway Adapter technical alarm.	For Mainstream sensors - your airway adapter is blocked or not mounted properly.	Clean airway adapter if mucus or moisture is seen. Mount sensor correctly on the adapter. Zero the sensor.
CO2 Tube Unplugged technical alarm.	The CO_2 sampling line is disconnected.	Confirm the sampling line is firmly connected to the CO_2 sensor.
CO2 Sensor Unplugged technical alarm.	The CO_2 sensor is unplugged.	Confirm that the CO_2 sensor is solidly connected to the Efficia DFM100. If the sensor is solidly connected to the Efficia DFM100 and the technical alarm remains on the display, try to re-zero the sensor to clear the alarm.
CO2 Error technical alarm.	A non-critical error was detected.	Restart device when it is appropriate to do so. If the alarm continues, replace the CO_2 sensor.

Table 58 **NBP Problems**

Symptom	Possible Cause	Potential Solution
Measurement cycle does not automatically start.	NBP is not configured for automatic measurements.	Check/modify the configuration as needed.
	Automatic measurements are not scheduled for the current patient.	Use the Measurements/Alarms menu to define an automatic schedule of measurements for the current patient.
	The **[Start NBP]** soft key has not been pressed.	Press the **[Start NBP]** soft key.
The pump operates but the cuff does not inflate or fails to inflate fully.	Defective cuff.	Replace the cuff.
	Poor connection between the cuff and the Efficia DFM100.	Check connections and replace tubing if needed.
NBP measurements appear high/low.	The cuff size is too small/large for the patient.	Use the correct cuff size and take another measurement.
NBP Cuff Not Deflated technical alarm. The NBP numeric value is replaced with a **-?-**.	The cuff has not fully deflated after 3 minutes.	Remove the cuff from the patient. Release pressure in the cuff (disconnect cuff from tubing). Replace the cuff. If the problem persists, call for service.
NBP Cuff Overpressure technical alarm. The NBP numeric value is replaced with a **-?-**.	The NBP cuff pressure has exceeded the overpressure safety limit of 300 mmHg/40 kPa.	The cuff should deflate automatically. If not, remove cuff from patient and deflate. Turn device off to reset the alarm and restart NBP.
NBP Measurement Failed technical alarm. The NBP numeric value is replaced with a **-?-**.	A measurement value could not be obtained.	Check cuff size and placement.
NBP Equipment Malfunction technical alarm.	Faulty NBP hardware.	Call for service. If NBP monitoring is essential to patient care, take the device out of use.
NBP Error technical alarm.	A non-critical device failure has occurred.	

Table 59 **Printing Problems**

Symptom	Possible Cause	Potential Solution
Paper will not move.	Paper improperly loaded, jammed, or wet.	Reload paper or clear jam. If paper is wet, replace with a fresh, dry roll.
Paper moves and then stops.	Door improperly latched.	Check door latch.
	Paper improperly loaded or jammed.	Reload paper or clear jam.

Table 59 **Printing Problems *(Continued)***

Symptom	Possible Cause	Potential Solution
Paper moves but printing is faint or absent.	Paper roll improperly installed.	Check that the paper is installed correctly.
	Incorrect paper type.	Use only recommended paper type.
	Printhead temperature approaching maximum recommended operating temperature.	Wait until the printer cools down to restart printing. If there is a lot of black printed on the paper, check ECG for excessive noise.
Paper moves but print quality is poor or some dots are missing.	Dirty printhead.	Clean the printhead.
White line running along paper.		
Loud buzzing or grinding noise.	Print door improperly latched.	Check door latch.
Printer Out Of Paper technical alarm.	The printer has run out of paper.	Reload with new fresh, dry roll of paper.
Printer Door Open technical alarm.	The printer door is not fully closed.	Open the printer door and reclose such that it snaps into place.
Printer Font Unavailable technical alarm.	The required font is unavailable for the currently installed language.	If printing is essential to patient care, take the device out of use and call for service.
Printer Malfunction technical alarm.	The printer is faulty or there is a problem communicating with the printer.	Turn the Efficia DFM100 off for 15 seconds and then turn it back on. If the problem persists, call for service. If printing is essential to patient care, take the device out of use.
Printer Error technical alarm.	A non-critical device failure has occurred.	Restart device. If the error continues and printing is essential to patient care, take the device out of use and call for service.

Table 60 **USB Problems**

Symptom	Possible Cause	Potential Solution
Insert Compatible USB Device message on display.	A non-compatible USB device has been inserted in the USB port.	Use only a compatible USB device to store data from the Efficia DFM100. See "USB Device" on page 204.
You cannot save data to the USB flash drive.	The USB flash drive is full.	Delete or remove files from the flash drive to free up space or use a different flash drive.
You cannot import a configuration file from the USB flash drive.	The flash drive does not contain a configuration file.	Save a new configuration file to the flash drive and re-try.
USB Flash Drive Error message on display.	The USB flash drive was removed during data transfer.	Re-insert the USB flash drive and retry.

Table 60 **USB Problems *(Continued)***

Symptom	Possible Cause	Potential Solution
Error Reading Configuration Data message on display.	The configuration file has become corrupted.	Save a new configuration file to the flash drive and retry.
USB Power Overload technical alarm.	A USB power overload has been detected at the USB port.	Turn the device off for 15 seconds. Replace the USB device. If the problem also occurs with a second USB device, call for service.
Setting Not Supported technical alarm.	The configuration file being imported contains an item that is not compatible with the device's current software version.	The configuration item in question is ignored. If this item is critical to your device, re-export a new configuration file from a device with a similar software revision and retry.

Servicing the DFM100

For product support, contact your local Philips Customer Care Solutions Center or local Philips representative.

Calling for Service

To download the latest documentation, go to:

https://incenter.medical.philips.com

For product support, contact your local Philips representative.

Before calling for service, prepare the following information:

- Serial number of the Efficia DFM100
- Problem description
- Information from operation check logs, error logs, and other applicable information

NOTES

18

Supplies and Accessories

This chapter provides information on the various supplies and accessories for the Efficia DFM100. Use of supplies or accessories other than those recommended by Philips may compromise product performance.

Ordering Replacement Supplies and Accessories

If you have any questions or would like to order accessories and supplies:

- Visit the website: http://www.philips.co.in/healthcare/product/HCNOCTN294/efficia-dfm100.
- Contact your local Philips sales office or your authorized Philips dealer or distributor.

Not all accessories and supplies are available in all countries. The list of accessories is subject to change without notice.

WARNINGS: Use only multifunction electrode pads, battery and accessories listed in this *Instructions for Use*. Substitutions may cause the Efficia DFM100 to function improperly and cause patient injury. For example, some electrodes may be subject to large offset potentials due to polarization.

Use single-use supplies and accessories only once.

Use multifunction electrode pads prior to their expiration date. Discard pads after use. Do not reuse pads. Do not use for more than 8 hours of continuous pacing.

Approved Supplies and Accessories

Table 61 **Approved Supplies and Accessories**

Part Number	Description
ECG Monitoring Electrodes	
M2202A	Radio Translucent Foam Monitoring Electrodes
3-Lead ECG Cable Set	
M1669A	3-Lead Trunk Cable, AAMI/IEC
M1671A	3-Lead Set, ICU Grabber, AAMI
M1672A	3-Lead Set, ICU Grabber, IEC
M1673A	3-Lead Set, ICU Snap, AAMI
M1678A	3-Lead Set, OR Grabber, IEC
M1674A	3-Lead Set, ICU, Snap, IEC
989803160641	Efficia 3/5 ECG Trunk Cable, AAMI/IEC
989803160651	Efficia 3-Lead Grabber, AAMI
989803160661	Efficia 3-Lead Grabber, IEC

Table 61 **Approved Supplies and Accessories *(Continued)***

Part Number	Description
989803170171	OR 3-Lead ECG Trunk Cable, AAMI/IEC
5-Lead ECG Cable Set	
M1644A	5-Lead Set, ICU Snap, Limb, AAMI
M1645A	5-Lead Set, ICU Snap, IEC
M1668A	5-Lead ECG Trunk Cable, AAMI/IEC
M1968A	5-Lead Set, ICU Grabber, Limb, AAMI
M1971A	5-Lead Set, ICU Grabber, IEC
M1974A	5-Lead Set, OR Grabber, IEC
989803160691	Efficia 5-Lead Grabber Limb, AAMI
989803160701	Efficia 5-Lead Grabber Limb, IEC
989803170181	OR 5-Lead ECG Trunk Cable, AAMI/IEC
989803176161	5-Lead Snap Limb, Shielded, AAMI
989803176181	5-Lead Snap Limb, Shielded, IEC
Internal Paddles	
M4741A	7.5 cm Switched Internal Paddles
M4742A	6.0 cm Switched Internal Paddles
M4743A	4.5 cm Switched Internal Paddles
M1741A	7.5 cm Switchless Internal Paddles
M1742A	6.0 cm Switchless Internal Paddles
M1743A	4.5 cm Switchless Internal Paddles
M4740A	Internal Paddles Adapter Cable
External Paddles	
M3543A	External Paddles with PCI (Water Resistant)
M4759A	Paddle electrode replacement for M3543A paddles
989803196431	Efficia External Paddles
989803197591	Paddle electrode replacement for 989803196431 paddles
Hands-free Pads Therapy Cables	
M3507A	Hands-free Cable Barrel Connector
M3508A	HeartStart Hands-Free Cable Connector
989803197111	Pads Adapter Cable
Multi-function Defibrillator Pads - Plug Connector	
M3713A	Adult/Child Plus Multifunction Electrode Pads
M3716A	Adult/Child Radiolucent Multifunction Electrode Pads
M3717A	Infant Plus Multifunction Electrode Pads
M3718A	Adult/Child Radiotransparent Multifunction Electrode Pads

Table 61 **Approved Supplies and Accessories *(Continued)***

Part Number	Description
M3719A	Infant Radiotransparent Multifunction Electrode Pads
989803158211	HS FR/FR2 Defib Pads (1 set)
989803158221	HS FR/FR2 Defib Pads (5 sets)
989803139261	SMART Pads II (1 set)
989803149981	SMART Pads III (1 set)
989803149991	SMART Pads III (5 sets)
$EtCO_2$ Mainstream Sensor	
M2501A	Mainstream CO_2 Sensor
$EtCO_2$ Mainstream Adapters	
M2513A	Reusable Adult/Pediatric Airway Adapter, ET tube size > 4.0 mm
M2533A	Single-Patient Use Adult Airway Adapter, ET tube size > 4.0 mm
$EtCO_2$ Sidestream Sensor	
M2741A	Sidestream CO_2 Sensor
$EtCO_2$ Sidestream Sampling Lines (10 per box)	
M2744A	CO_2 Nasal Cannula - Adult
M2745A	CO_2 Nasal Cannula - Pediatric
M2750A	CO_2/O_2 Nasal Cannula - Adult
M2751A	CO_2/O_2 Nasal Cannula - Pediatric
M2756A	CO_2 Oral-Nasal Cannula - Adult
M2757A	CO_2 Oral-Nasal Cannula - Pediatric
M2760A	CO_2/O_2 Oral-Nasal Cannula - Adult
M2761A	CO_2/O_2 Oral-Nasal Cannula - Pediatric
M2768A	Airway Adapter Set - Pediatric/Adult
M2776A	Straight Sample Line
989803144471	CO_2/O_2 Nasal Cannula - Infant
989803144531	Airway Adapter Set - Pediatric/Infant
SpO_2 Sensors and Cables	
M1191B	Adult Reusable SpO_2 Sensor, 2 m
M1191BL	Adult Reusable SpO_2 Sensor, 3 m
M1192A	Reusable Pediatric/Small Adult Finger SpO_2 Sensor, 1.5 m
M1196A	Adult Reusable SpO_2 Clip Sensor, 3 m
M1941A	SpO_2 Extension Cable, 2 m
Non-Invasive Blood Pressure Cuffs and Tubing	
989803177511	Reusable Blood Pressure Cuff - Pediatric (GCF1202)
989803177521	Reusable Blood Pressure Cuff - Adult (GCF1203)

Table 61 **Approved Supplies and Accessories *(Continued)***

Part Number	Description
989803177531	Reusable Blood Pressure Cuff - Adult Large (GCF1204)
989803177471	Reusable Blood Pressure Interconnect Tubing (3 m)
Data Management	
989803171261	USB Data Drive
989803202611	USB Data Drive
Cable Management	
989803190331	DFM100 Hospital Accessory Storage System
989803190341	DFM100 Prehospital Accessory Storage System
989803190351	Cable Management Straps
989803197571	Carry Case Shoulder Strap
989803197581	DFM100 Tray Cover Pouch
989803197671	DFM100 Tray Cover Pouch/Bag Shoulder Strap
Paper	
989803190381	50 mm Chemical Thermal Paper, No Gridlines (12 rolls)
Power	
989803190371	Rechargeable Lion Battery Pack
Mounting Solution	
989803190361	Bedrail Mount
989803199601	DFM100 Docking station bundle - EXCLUDES Australia
989803199661	DFM100 Docking station bundle - AUSTRALIA ONLY
989803199241	Docking station for DFM100 assembly
989803199251	3-terminal power cord for DFM100 docking station - EXCLUDES Australia
989803199611	3-terminal power cord for DFM100 docking station - AUSTRALIA ONLY
Therapy Cable Collar	
989803194281	Therapy Cable Collar
Test Loads and Shorting Plug	
M1781A	Test Load, 50 Ohms, barrel style
M3725A	Test Load, 50 Ohms, plug style
989803171271	Test Plug - Shorted

19

Specifications

This chapter includes:

- Efficia DFM100 specifications.
- Symbol and abbreviation definitions. See Tables 64 and 65.
- Electromagnetic Compatibility, see "Electromagnetic Compatibility" on page 207.

Specifications

General

Approximate Dimensions: 23.5 cm (H) x 29 cm (W) x 20.5 cm (D); 9.25 in (H) x 11.4 in (W) x 8 in (D)

Approximate Weight (without battery): 5.66 kg; 12.5 lbs

Standard Operator Position: Within one meter (3 feet) of the device.

Power: Rechargeable Lithium Ion battery; AC power using a protectively grounded outlet.

Alarm Tone and Voice Message Volume Range: Maximum - 85 dB(A), Minimum - 45 dB(A).

Alarm Tone Volumes:

Imminent Shutdown - Continuous tone alternating between 1000 and 2100 Hz.
High Priority - Tone of 960 Hz lasting 0.5 sec repeated every second.
Medium Priority - Tone of 480 Hz lasting 1 sec repeated every two seconds.
Low Priority - Tone of 480 Hz lasting 0.25 sec repeated every two seconds.

Visual Alarm Characteristics:

High Priority - Flashing at 2 Hz with 50% duty cycle (a .25-sec flash twice every second).
Medium Priority - Flashing at 0.5 Hz with 50% duty cycle (a 1-sec flash every other second).
Low Priority - Constant on.

Defibrillator

Waveform: Biphasic Truncated Exponential. Waveform parameters adjusted as a function of patient impedance.

Shock Delivery: Via multifunction electrode pads or paddles.

Shock Series: Configurable energy escalation in a series.

Leads Off Sensing and PCI Sensing for Pads/Paddles: Apply 500nA rms (571Hz); 200uA rms (32KHz)

Table 62 **Delivered Energy Accuracy**

Nominal Delivered Energy vs. Load Impedance							
Selected Energy	Load Impedance (ohms) ±2%						
	25	50	75	100	125	150	175
1 J	1.2	1.3	1.3	1.2	1.1	1.0	0.9
2 J	1.7	2.0	2.1	2.0	1.9	1.7	1.6
3 J	2.6	3.0	3.1	3.2	3.2	3.1	2.9
4 J	3.5	4.0	4.2	4.3	4.4	4.5	4.3
5 J	4.3	5.0	5.2	5.4	5.5	5.6	5.4
6 J	5.2	6.0	6.3	6.5	6.6	6.7	6.5
7 J	6.1	7.0	7.3	7.6	7.8	7.8	7.6
8 J	6.9	8.0	8.4	8.6	8.9	8.9	8.7
9 J	7.8	9.0	9.4	9.7	10	10	9.8
10 J	8.7	10	10	11	11	11	11
15 J	13	15	16	16	17	17	16
20 J	17	20	21	22	22	22	22
30 J	26	30	31	32	33	33	33
50 J	43	50	52	54	55	56	54
70 J	61	70	73	76	78	78	76
100 J	87	100	105	108	111	111	108
120 J	104	120	126	130	133	134	130
150 J	130	150	157	162	166	167	163
170 J	147	170	178	184	188	189	184
200 J	173	200	209	216	222	223	217

The delivered energy accuracy is ±10% or ±1J whichever is greater for all energy settings.

Charge times:

Less than 5 seconds to the recommended adult energy level (150 Joules) with a new fully charged battery installed.

Less than 6 seconds to the selected energy level (up to 200 Joules) with a new fully charged battery installed, even after the delivery of 15 discharges at maximum energy.

Less than 15 seconds to the selected energy level while connected to AC power only, even when operating on 90% of the rated mains voltage.

The device powers on in manual defibrillation mode ready to deliver shock in less than:

- 23 seconds with AC power only and at 90% of rated mains voltage.
- 15 seconds with a new, fully charged battery even after 15 discharges of maximum energy.

Time from the initiation of analysis in AED mode until ready to deliver shock is less than:

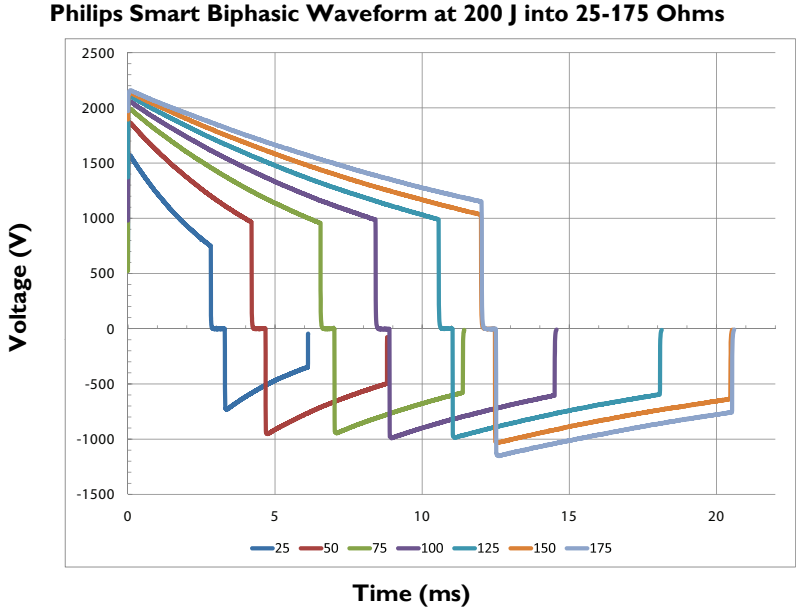
- 20 seconds with AC power only and at 90% of rated mains voltage.
- 20 seconds with a new, fully charged battery even after 15 discharges of maximum energy.

The device powers on in AED mode ready to deliver shock in less than:

- 32 seconds with AC power only and at 90% of rated mains voltage.
- 24 seconds with a new, fully charged battery even after 15 discharges of maximum energy.

Patient Impedance Range: Minimum: 25 ohm (external defibrillation); 15 ohm (internal defibrillation); Maximum: 250 ohm. Actual functional range may exceed these values.

Figure 80 **Smart Biphasic Waveform**



Manual Defibrillation Mode

Manual Output Energy (Selected): 1-10, 15, 20, 30, 50, 70, 100, 120, 150, 170, 200 Joules; maximum energy limited to 50 J with internal paddles.

Controls: On/Off Therapy knob, Charge, Shock, Sync, ECG Lead Select, Patient Selection, Print, Mark Events, Reports, Alarms, Smart Select knob.

Energy Selection: Front panel Therapy knob.

Charge Control: Front panel button; button on external paddles.

Shock Control: Front panel button; buttons on external or switched internal paddles.

Synchronized Control: Front panel Sync button.

Synchronized Shock Timing: Maximum time from R-Wave detected to shock delivered is 25ms, as measured with oscilloscope from peak of input QRS wave to leading edge of defibrillation discharge into a 50-ohm test load.

Indicators: Text prompts, audio alerts, QRS beeper, battery status, Ready For Use (RFU), External Power, Sync mode.

Armed Indicators: Charging/charged tones, flashing shock button on front of panel and on external paddles, energy level indicated on the display.

AED Mode

AED Energy Profile: 150 Joules (factory default) for Adult /50 J for Infant/Child nominal into a 50-ohm test load.

AED Controls: On/Off, shock.

Text and Voice Prompts: Extensive text/audible messages guide the user through a user-configured protocol.

Indicators: Monitor display messages and prompts, voice prompts, battery status, RFU, external power.

Armed Indicators: Charging/charged tones, flashing shock button, energy level indicated on the display.

ECG analysis: Evaluates patient ECG and signal quality to determine if a shock is appropriate and evaluates connection impedance for proper defibrillation pad contact.

Shockable Rhythms: SMART Analysis is designed to shock ventricular fibrillation, ventricular flutter and polymorphic ventricular tachycardia. It is designed to avoid delivering a shock for rhythms that are commonly accompanied by a pulse or rhythms that would not benefit from an electrical shock.

Shock Advisory Algorithm Sensitivity: Meets AAMI DF39 requirements and AHA recommendations; Adult: Ventricular Fibrillation - 90% with lower confidence limit (LCL) of 87%, Polymorphic Ventricular Tachycardia and Ventricular Flutter - 75% with LCL of 67%; Infant/Child: Ventricular Fibrillation - 90% with LCL of 87%.

Shock Advisory Algorithm Specificity: Meets AAMI DF39 requirements and AHA recommendations; Normal Sinus Rhythm - 99% with LCL of 97%; Asystole - 95% with LCL of 92%; Other non-shockable Rhythms - 95% with LCL of 88%.

ECG and Arrhythmia Monitoring

Inputs: Up to 3 ECG waves may be viewed on the display and up to 2 waves printed simultaneously. Lead I, II or III is obtained through the 3-wire ECG cable and separate monitoring electrodes. With a 5-Lead ECG cable, leads aVR, aVL, aVF and V can also be obtained. Pads ECG is obtained through two multifunction electrode pads.

Lead Fault: Messages and dashed lines appear on the display if an electrode or lead becomes disconnected.

Pad Fault: Dashed line appears on the display if a pad becomes disconnected.

Heart Rate Display: Digital readout on the display from 16 to 300 bpm (Adult Patient Category) or 16 to 350 bpm (Infant/Child), with an accuracy of ±10% or ±5 bpm whichever is greater.

Heart Rate/Arrhythmia Alarms: HR high/low, Asystole, VFIB/V-TACH, VTACH, Extreme Tachy, Extreme Brady, PVC rate, Pacer Not Capture, Pacer Not Pacing.

Common Mode Rejection: 105 dB for Leads ECG, 96 dB for pads ECG.

ECG Size: 1/4x, 1/2x, 1x, 2x, 4x, auto gain (1x gain is 10mm/mV on the printed strip).

ECG waveforms: Displayed at a fixed timebase of 25 mm/sec (printer) ±5%, 25 mm/sec (display) ±10%.

ECG Leads Off Sensing: 3- and 5-Lead wires apply a <35nA DC current patient electrodes, <1.0uA other electrodes.

Maximum T-Wave amplitude: Device rejects up to 80% of R-Wave amplitude for synchronized cardioversion; up to 55% of R-Wave amplitude for demand pacing; up to 34% of R-Wave amplitude for arrhythmia analysis. Maximum T-wave amplitude when a QRS test signal is 1 mV amplitude and 100 ms duration, with a heart rate of 80 1/min used: 18 mm.

Frequency Response:

- ECG AC Line Filter: 50 Hz or 60 Hz.
- ECG for Display: 0.15-40 Hz, 0.05-40 Hz (IEC 60601-2-27:2011 201.12.1.101.8 a, b), 2.0-20.0 Hz
- ECG for Printer: 0.05-150 Hz - Diagnostic, 0.05-40 Hz - ST Monitor (IEC 60601-2-27:2011 201.12.1.101.8 a, b), 0.15-40 Hz - Monitor, 2.0-20.0 Hz – EMS

Heart rate accuracy and response to irregular rhythm: Meets AAMI standard for ventricular bigeminy (HR=80 bpm); slow alternating ventricular bigeminy (HR=60 bpm); rapid alternating ventricular bigeminy (HR=120 bpm); bidirectional systoles (HR=90 bpm) as measured after a 20-sec stabilization time.

Heart rate averaging: For heart rates ≥ 50 bpm, heart rate is determined by averaging the 12 most recent R-R intervals. Beats N, P, and V are included. When heart rate drops below 50 bpm, the four most recent R-R intervals are used in the average. Note: For ventricular tachycardia alarms, which have a user-definable PVC run length limit, the heart rate is based on the user-selected PVC length up to 9 PVCs maximum. Heart rate display update time is 1 second maximum.

Pace Pulse Detection Sensitivity: 1 mV for a width of 100 µs; 200 µV for a 500-µs width and 200 µV for widths of 500 µs to 2 ms.

ECG Analog Output Bandwidth: 0.5 to 70 Hz

ECG Analog Output Gain: 1v output per 1 mV input ±10%

ECG Analog Output Delay: Propagation delay time is <25 ms from ECG input to ECG analog output.

Pacemaker Pulse Rejection Capability: Amplitude from ± 2 mV to ± 700 mV, width from 0.1 ms to 2.0 ms as per IEC 60601-2-27:2011 201.12.1.101.13/YY 1079 4.1.4.1, except the full overshoot range of IEC 60601-2-27 methods A and B.

Pacer Pulse Detector rejection of Fast ECG Signals: Slew Rate of 1.1 V/s.

Heart Rate Response Time: 7 sec for a High Heart Rate alarm when the rate changes from 80 to 120 bpm, with the alarm limit set at 100 bpm; 6 sec for a Low Heart Rate alarm when the rate changes from 80 to 40 bpm, with the alarm limit set at 60 bpm.

Time to Alarm for Tachycardia: 4 sec for 206 bpm (1 mV, halved amplitude and double amplitude) and 195 bpm (2 mV, halved amplitude and double amplitude) as measured following a normal 80 bpm rate with upper alarm limit set at 100 and lower alarm limit set at 60 bpm.

Patient Isolation (Defibrillation Proof):

- Lead ECG: Type CF
- SpO_2: Type CF
- CO_2: Type BF
- NBP: Type CF
- Pads/Paddles: Type BF
- Internal Paddles: Type CF

Other consideration: The Efficia DFM100 is suitable for use in the presence of electrosurgery. Burn hazard protection is provided via a 1K current-limiting resistor contained in each ECG lead wire. Proper lead placement (see “Electrode Placement” on page 49) is important to reduce burn hazards in the event of a defect in the electrosurgical equipment. Do not entangle the ECG cables with the electrosurgical equipment wires; do not place the ECG cabling near the electrosurgical equipment's grounding plate.

Display

Size: Approximately 7 in (17.8 cm) diagonal viewing area.

Type: Color TFT LCD.

Resolution: 800 x 480 pixels (VGA) with 32 brightness levels per color.

Sweep Speed: 25 mm/s ± 10% nominal (stationary trace; sweeping erase bar) for ECG and SpO_2; capnogram wave is 6.25 mm/s ± 10%.

Wave Viewing Time: 6.5 sec ± 10%.

Battery

Type: Rechargeable, Lithium Ion; See battery label for capacity information.

Approximate Dimensions: 28.5 mm (H) x 80 mm (W) x 145.7 mm (L); 1.1 in (H) x 3.1 in (W) x 5.7 in (L)

Approximate Weight: Approximately 0.44 kg (1 lb)

Capacity: With a new fully charged battery, at 20 °C (68 °F), one of the following:

- 100 full-energy charge/shock cycles.
- 2.5 hours of monitoring (ECG, EtCO2 and SpO2 continuously monitored and NBP sampled every 15 minutes) followed by 20 full-energy charge/shock cycles.
- Two hours of pacing (180ppm at 140mA with 40msec pulse) and monitoring (ECG, EtCO2 and SpO2 continuously monitored and NBP sampled every 15 minutes).

Charge Time with Device Turned Off and AC Power Connected: With temperature at 25°C (77° F), less than 3 hours to 100% capacity; less than 2 hours to 80% capacity.

Battery Indicators: Battery gauge on battery, capacity indicator on display, power indicators on front of device; flashing RFU indicator, audio beep and **Low Battery** messages on the display for low battery condition. When a low battery message first appears, there is still enough energy for at least 10 minutes of monitoring and 6 maximum energy discharges.

Thermal Array Printer

Continuous ECG Strip: The Print key starts and stops the strip. The printer can be configured to be run real time or with a 10-second delay. The strip prints the primary ECG lead and a second wave with event annotations and measurements.

Auto Printing: The printer can be configured to automatically print on Mark Events, Charge, Shock and Alarm.

Reports: The following can be printed:

- Event Summary (Long or Short)
- Vital Signs Trends
- Operational Check
- Configuration

- Status Log
- Device Information

Speed: 25 mm/s with an accuracy of ±5%

Amplitude Accuracy: 5% for offset voltages of ± 300 mV at 5Hz

Paper Size: 50 mm (W) x 20 m (L)

Noninvasive Pacing

Waveform: Monophasic

Current Pulse Amplitude: 10 mA to 200 mA if the pulse width is set to 20 ms (5 mA increments); accuracy ±10% or ±5 mA whichever is greater. For a 40 ms setting, the maximum pacing current is 140 mA.

Pulse Duration: 20 or 40 msec with ±10% accuracy

Rate: 30 ppm to 180 ppm (10 ppm increments); accuracy ±1.5%

Mode: Demand or Fixed

Refractory Period: 340 msec (30 to 80ppm); 240 msec (90 to 180 ppm) ±10%

Universal-function electrodes (Pads): After 60 minutes of pacing with approved defibrillators, the Multifunction Electrodes (Pads) exhibit a post-defibrillation DC Offset of less than ± 800 mV at ≥ 4 seconds post-shock.

SpO_2 Pulse Oximetry

SpO_2 Measurement Range: 0-100%

SpO_2 Resolution: 1%

SpO_2 Update Period: 1-2 sec typical; maximum of ≤ 30 sec

Table 63 **Sensor Accuracy***

Sensor	Accuracy	Sensor	Accuracy
M1191B	±2%	M1192A	±2%
M1191BL	±2%	M1196A	±3%
* - Specified accuracy is the root-mean-square (RMS) difference between the measured values and reference values.			

NOTES: Accuracy outside the range specified for each sensor is not indicated. The sensors in Table 63 were validated for use with the Efficia DFM100 using the Philips picoSAT II SpO_2 module with Fourier Artifact Suppression Technology (FAST).

While the SpO_2 module is able to report values below 70% and alarm limits can be set below 70%, the accuracy of measurements less than 70% has not been validated.

SpO_2 accuracy was validated in human studies against arterial blood sample references measured with a CO-oximeter. In a controlled desaturation study, healthy adult volunteers with saturation levels between 70-100% SaO_2 were studied. The population characteristics for those studies were approximately 50% male and 50% female, ranging in age from 19-39 with skin tone from light to dark.

Pulse oximetry equipment measurements are statistically distributed, therefore only two-thirds of pulse oximeter equipment measurements can be expected to fall within ±Arms of the value measured by a CO-oximeter.

Functional test equipment designed for SpO_2 testing cannot be used to assess the accuracy of the SpO_2 readings.

See the sensor's instructions for use for the maximum temperature possible at the sensor-skin interface and other information such as intended patient population, sensor application sites and use criteria.

The Efficia DFM100 is calibrated to display functional oxygen saturation.

Ambient Light Sensitivity: Interference from fluorescent light is <2% SpO2 under the following conditions: 0.3 and 1% perfusion, 50 nA/mA transmission, 10 to 1000 lx light intensity, 50/60Hz power line frequency ±0.5 Hz line frequency.

SpO_2 Alarm Range:

- Low Limit: 50-99% (Adult and Infant/Child)
- High Limit: 51-100% (Adult and Infant/Child)

SpO_2 and Pulse High/Low Alarm Signal Generation Delay: 10 seconds

SpO_2 Response Time (90 to 80%): average 18.9 seconds, standard deviation 0.88 seconds

SpO_2 and Pulse Averaging Time: 10 sec

Emitted Light Energy: ≤15 mW

Wavelength Range: 500-1000 nm (Information about wavelength range can be useful to users, especially those performing photodynamic therapy.)

Desat Alarm Signal Generation Delay: 20 sec

Pulse Rate Measurement Range: 30-300 bpm

Pulse Rate Resolution: 1 bpm

Pulse Rate Accuracy: ±2% or 1 bpm whichever is greater

Pulse Response Time (90 to 120 bpm): average 18.0 seconds, standard deviation 0.86 seconds

Pulse Alarm Range:

- Low Limit: 30-295 (Adult and Infant/Child)
- High Limit: 35-300 (Adult and Infant/Child)

$EtCO_2$

Weight: Mainstream: 78 g (2.75 oz.); Sidestream: 272 g (9.6 oz.)

Dimensions: Mainstream: 43 mm (W) x 33 mm (H) x 23 mm (L); 1.69 in (W) x 1.29 (H) x .90 in (L); Sidestream: 66 mm (W) x 38 mm (H) x 89 mm (L); 2.6 in (W) x 1.5 in (H) x 3.5 in (L)

Range: 0-150 mmHg

Resolution: 1 mmHg (0.1 kPa)

Accuracy: 0 - 40 mmHg ± 2 mmHg; 41 - 70 mmHg ± 5% of reading; 71 - 100 mmHg ± 8% of reading; 101 - 150 mmHg ± 10% of reading. Gas at 25C.

Drift of Measurement Accuracy: Over any 24 hour period, the specified measurement accuracy is maintained.

Warm-up time: 2 minutes at 25°C.

System Response Time: Sidestream: 3.5 seconds typical.

Alarm Delay Time: (after alarm condition has been met) Mainstream - less than 5 sec; Sidestream - less than 8 sec; Measurement Method: Peak $EtCO_2$ value within a 10 sec window.

Sample Flow Rate: Sidestream - 50 ml/min ±10 ml

Alarm Range:

- Low Limit: 10-140 mmHg (Adult, Infant/Child)
- High Limit: 20-145 mmHg (Adult, Infant/Child)

AwRR

Range: 0-150 rpm

Resolution: 1 rpm

Accuracy: ±1 rpm

Alarm Range:

- Low Limit: 0-99 rpm (Adult, Infant/Child)
- High Limit: 10-100 rpm (Adult, Infant/Child)

Alarm Delay Time: (after alarm condition has been met) Mainstream - less than 5 sec; Sidestream - less than 8 sec; Measurement Method: AwRR - based on the last 8 detected breaths; Apnea - Following the configured Apnea delay time.

NBP

Pressure Range:

Measurement	mmHg		kPa	
	Adult	Infant/Child	Adult	Infant/Child
Systolic	30-255	30-135	4-34	4-18
Diastolic	10-220	10-110	1.3-29.3	1.3-14.7
Mean	20-235	20-125	2.7-31.3	2.7-16.7

Initial Pressure: 160 mmHg/21.3 kPa (Adult); 120 mmHg/16 kPa (Infant/Child)

Maximum Pressure: 300 mmHg/40 kPa

Overpressure Safety Limit: 290 mmHg/38.6 kPa

Cuff Inflation Time: 75 sec maximum

Pressure Transducer Accuracy: ±3 mmHg over the range 0-300 mmHg/0-40 kPa

Alarm Range:

Measurement	mmHg		kPa	
	Adult	Infant/Child	Adult	Infant/Child
Systolic high limit	35-255, **160**	35-135, **120**	4.5-34, **21**	4.5-18, **16**
Systolic low limit	30-250, **90**	30-130, **70**	4-33.5, **12**	4-17.5, **9**
Diastolic high limit	15-220, **90**	15-110, **70**	2-29.5, **12**	2-15, **9**
Diastolic low limit	10-215, **50**	10-105, **40**	1.5-29, 7	1.5-14.5, **5**
Mean high limit	25-235, **110**	25-125, **90**	3.5-31.5,**15**	3.5-16.5, **12**
Mean low limit	20-230, **60**	20-120, **50**	3-31, **8**	3-16, 7

Auto Mode Repetition Time: 1, 2.5, 5, 10, 15, 30, 60 or 120 min

Maximum Measurement Time: 120 sec

Interconnect Tube Length:

989803177471 Connect tubing 3.0 m (9.24 ft.)

Environmental

Temperature: Operating temperature for the device: 0 °C to 45°C (32°F to 113°F); Operating temperature range for $EtCO_2$: 0°C to 40°C (32°F to 104°F); Storage/transport temperature range for the device without battery: -20°C to 70°C (-4°F to 158°F).

Settling Time to 20°C: Time required for device to warm from -20°C before use is 80 minutes; time required for device to cool from 70°C before use is 80 minutes.

Humidity: 15% to 95% relative humidity

- $EtCO_2$ measurements meet all specifications during and after exposure to humidity conditions from 10-90%
- Printer paper may jam if the paper is wet.
- Thermal printer may be damaged if wet paper is allowed to dry while in contact with printer elements.

Atmospheric Pressure Range/Operation and Storage: 1060 mbar to 572 mbar (-1253 to 14,986 ft.; -382 to 4,568 m).

Shock:

Operating: Half-sine waveform, duration ≤11 ms, acceleration ≥ 15.3 G, 3 shocks per face.

Non-operating: Trapezoidal waveform, acceleration 30G, velocity change 7.42 m/s ±10% 1 shock per face.

Vibration:

Operating Random			Non-Operating Random			Non-Operating Swept Sine	
Frequency (Hz)	**Slope (dB/octave)**	**PSD $(m/s^2)^2/Hz$**	**Frequency (Hz)**	**Slope (dB/octave)**	**PSD (g^2/Hz)**	**Frequency (Hz)**	**Amplitude**
10-100	—	1.0	10-20	—	0.05	10-57	± .15 mm
100-200	-3.0	—	20-150	-3.0	—	57-150	2 g
200-2000	—	0.5	150	—	0.0065	Test duration: 4 sweeps per axis x 3 axes; Each sweep: 10-150-10 Hz cycle at a sweep rate of 1 oct/min	
Test duration: 10 min/axis x 3 axes; 30 minutes total.			Total RMS acceleration: 1.6 g; Test duration: 30 minutes x 3 axes				

Bump: Half-sine, 15g peak, 6ms, 1000 hits (vertical with the device in its normal mounting position)

Free Fall: IEC 68-2-32 Free Fall. Once on each face, total 6 faces (excluding bedrail hook).

- 40 cm (16 in.) without cradle and side carry bags
- 75 cm (29.5 in.) with cradle and side carry bags

Water/Solids Ingress Resistance: Meets Ingress Protection level IP54 - protected against dust limited ingress (no harmful deposits) and against water sprayed from all directions (limited ingress permitted).

EMC: Complies with the requirements of standard IEC 60601-1-2:2014/EN 60601-1-2: 2015 and IEC 60601-1-2: 2007/EN60601-1-2:2007.

Transient Operating Conditions: The DFM100 meets all specifications for 20 minutes during transient operating conditions of a temperature range of -20°C to 50°C and a relative humidity range of 15% to 90%, non-condensing, but not requiring a water vapor partial pressure greater than 50 hPa.

Safety: Meets EN 60601-2-4:2011/GB9706.8-2009, EN 60601-1/A1:2013/GB9706.1-2007.

Other considerations:

- The Efficia DFM100 is not suitable for use in the presence of concentrated oxygen or a flammable anesthetic mixture with air, oxygen or nitrous oxide.
- Hazards arising from software errors are minimized by the product's compliance with the software requirements contained in IEC 62304.

Mode of Operation: Continuous

AC Line Powered: 100-240 VAC, 50 or 60 Hz, 1 - 0.46 A, Class I Equipment

Battery Powered: Minimum 14.4 V, Rechargeable Lithium Ion

Hazardous Waste:

Pb	Hg	Cd	Cr6+	PBB	PBDE
O	O	O	O	O	O
• = One or more of the device's raw materials has this harmful substance and concentration over the standard concentration limit. **O** = The raw material concentrations are within allowed limits.					

The EU REACH Regulation 1907/2006 requires Philips to provide chemical content information for Substances of Very High Concern (SVHC) if they are present in the relevant article above a concentration of 0.1% weight by weight.

For information on substances contained in Philips products, see www.philips.com/REACH.

WARNING: The base material of this product can expose you to chemicals such as arsenic, which is known to the State of California to cause cancer. For more information, see www.P65Warnings.ca.gov.

USB Device

Correct Drive: You can use the Philips USB Drive that came with your device, or you can order a new one using the part number listed under “Supplies and Accessories” on page 189.

Security and Privacy

To protect the device from unauthorized access and operation, Philips recommends that the owning organization maintains the physical security of the device at all times, including environmental considerations.

The DFM100 includes the following role-based security controls:

- Clinical modes (Monitor, AED, Manual Defibrillation, Synchronized Cardioversion, and Pacer) do not require a password because clinicians need to provide immediate patient care in emergency situations.
- Data Management mode has an optional password. The device is initially set up to require a Data Management mode password. You can change the requirement in the **Configuration - General** menu of Configuration mode.
- Configuration mode can be accessed without a password to view the configuration settings or change the date and time. To change configuration settings other than the date and time, the Configuration mode password is required.
- Service mode has the highest level of security and requires the Service mode password. In Service mode, you can perform various tasks, such as changing the Service and Configuration mode passwords and viewing the Access Log and Error Log files. For more information on Service mode functions, see the Efficia DFM100 *Service Manual*.

Internal Event Summary and Patient Data Storage

The Efficia DFM100 can store up to 8 hours of 2 continuous ECG waves, 1 pleth wave, 1 capnogram wave, research waves (AED mode only) events, and trend data per Event Summary. The device has a maximum capacity of approximately 50 events of approximately 30 minutes in length. The most recent patient information entered during the live event is retained as appropriate. All Event Summary records stored in the device are AES-256 encrypted.

Event Summaries are automatically deleted after 30 days. If the Event Summary storage is full, the oldest event summary records are deleted as new Event Summary records are stored.

In Data Management mode, you can export Event Summary records to an approved USB drive. The Event Summary records are AES-256 encrypted when exported, and you can remove patient data before exporting the records. Only the compatible Philips data management application can read the Event Summary data from the USB drive.

Philips recommends that you frequently export Event Summary records to a USB drive to back up the data. The USB drive should be securely stored to prevent data loss, unauthorized access, and damage to the USB drive.

Software Upgrades

The Philips Service organization distributes encrypted software upgrades that may include feature upgrades and security patches. Philips recommends keeping your devices current with the most recent software release.

All software upgrades are performed in Service mode. For more information, see the Efficia DFM100 *Service Manual*.

Symbol Definitions

Table 64 lists the meaning of symbols appearing on the Efficia DFM100, the Lithium Ion battery, and the shipping carton.

Table 64 **Symbol Definition**

Symbol	Definition	Symbol	Definition
	Meets IEC type CF leakage current requirements and is defibrillator protected. (Patient Applied part is isolated and defib-proof suitable for direct patient contact including the heart or major arteries.)		Meets IEC type BF leakage current requirements and is defibrillator protected. (Patient Applied Part is isolated and defib-proof suitable for direct patient contact except the heart or major arteries.
	Caution - See operating instructions in Instructions For Use.		Manufacture Date
	USB Port		Manufacturer
	Output	~	AC current
	RF Transmission Symbol		NBP port
	Recyclable	SN	Serial Number
OPT	Options installed	REF	Reference order number
	Consult Instructions for Use		Consult Instructions for Use
	Do not get wet		Atmospheric pressure range
	Relative humidity range		Temperature range
	RoHS exempt. Environmentally friendly for a use period of 50 years.		Fragile

Table 64 **Symbol Definition *(Continued)***

Symbol	Definition	Symbol	Definition
	This end up		Equalization Terminal
CE 0123	Device complies with the requirements of the Medical Device Directive 93/42/EEC		Warning: dangerous voltage
⎓	DC current		Rechargeable battery
	Dispose of in accordance to your country's requirements.		Consult Service Manual.
DANGER	A high level of risk exists.		

NOTE: For definitions of symbols which appear on the Efficia DFM100's front panel see "Basic Orientation" on page 8 and "General Function Buttons" on page 27. For definitions of symbols which appear on the external paddles see "External Paddles" on page 14.

Abbreviation Definitions

Table 65 lists various abbreviations used with the Efficia DFM100 and in these Instructions for Use.

Table 65 **Abbreviations**

Abbreviation	Definition	Abbreviation	Definition
%	percent	µs	microseconds
°C	degrees Celsius	µV	microVolt
°F	degrees Fahrenheit	mA	milliAmpere
AC	alternating current	mV	milliVolt
bpm	beats per minute	min	minutes
cm	centimeter	mmHg	millimeters of mercury
dB	Decibel	ms	millisecond
dB(A)	A-weighted decibels	mW	milliwatt
Hz	hertz	nM	nanometer
in	inches	NSA	No Shock Advised
J	Joules	PSD	Power Spectral Density
kg	kilograms	RFU	Ready For Use
kPa	kilo Pascal	rpm	respirations per minute
Lbs	Pounds	sec	seconds
m	meter	V	Volt

Electromagnetic Compatibility

When using the Efficia DFM100, electromagnetic compatibility with surrounding devices should be assessed.

A medical device can either generate or receive electromagnetic disturbances. Testing for electromagnetic compatibility EMC with the appropriate accessories has been performed according to national and international standard for EMC for medical devices.

The EMC standards describe tests for both emitted and received disturbances. Emission tests deal with electromagnetic disturbances generated by the device being tested.

WARNINGS: Electromagnetic interference coming from other devices may degrade or obstruct the performance of the Efficia DFM100. The interference may come from signals radiated through the air or it may also come from signals conducted through wired connections such as power cord, patient connections or device to device connections such as ECG analog output. Electromagnetic compatibility with surrounding devices should be assessed prior to using the Efficia DFM100.

When connected to a patient, symptoms of interference may include degraded performance of ECG signals from pads/paddles or ECG leadsets, unexpected technical alarms, or critical failure status on the RFU Indicator. Electromagnetic compatibility testing should include both radiated and conducted immunity. Testing in the presence of potentially interfering surrounding devices should assess typical Efficia DFM100 usage scenarios including powering on, monitoring and delivering therapy.

Fixed, portable, and mobile radio frequency communications equipment could affect the performance of medical equipment. See Table 74 for the minimum recommended separation distance between RF communications equipment and the Efficia DFM100.

Reducing Electromagnetic Interference

The Efficia DFM100 and associated accessories may be susceptible to interference from other RF energy sources and continuous, repetitive, power line bursts. Examples of other sources of RF interference are medical devices, cellular products, information technology equipment and radio/television transmission. Should interference be encountered, as demonstrated by error conditions, artifact on the ECG or dramatic variations in parameter measurement values, attempt to locate the source. Assess:

Is the interference intermittent or constant?

- Does the interference occur only in certain locations?
- Does the interference occur only when in close proximity to certain medical devices?
- Does the interference occur only when certain medical devices are turned on?
- Does the interference occur only when certain medical devices are connected to the same patient as the Efficia DFM100?
- Do parameter measurement values change dramatically when the AC line cord is unplugged?

Once the source is located, attempt to attenuate the EMC coupling path by distancing the monitor/defibrillator from the source as much as possible or by changing the location or routing of wired connections. If assistance is needed, call your local service representative.

Essential Performance Determinations

The essential performance of the Efficia DFM100 defibrillator/monitor is derived from the product's Safety Risk Assessment and includes:

- The ability to deliver defibrillation therapy (manual, AED and synchronized cardioversion).
- The ability to deliver pacing therapy (fixed and demand).

- The ability to monitor the patient parameters (ECG monitoring, pulse oximetry, end-tidal CO_2, non-invasive blood pressure).
- The ability to detect and generate physiological alarms.

All other functions are considered non-essential performance but were monitored for EMC.

Restrictions for Use

Artifact on the ECG and parameter waveforms caused by electromagnetic disturbances should be evaluated by a physician or physician-authorized personnel to determine if it will negatively impact patient diagnosis or treatment.

Emissions and Immunity

The Efficia DFM100 is designed and tested to comply with the radiated and conducted emissions requirements of international and national standards. The device is intended for use in the electromagnetic environments specified in the following tables. Given the electromagnetic emissions and immunity characteristics of the device, the customer or user should assure that the device is used within the specified environments. The EMC standards state that manufacturers of patient-coupled equipment must specify immunity and minimum separation distances between portable and mobile communications equipment. Refer to the tables below.

See Table 66 through Table 73 for detailed information regarding declaration and guidance.

WARNING: The use of accessories, transducers and cables other than those specified might result in increased emissions or decreased immunity of the Efficia DFM100.

The list of cables, transducers, and other accessories with which Philips claims compliance with the emissions and immunity requirements listed in “Supplies and Accessories” on page 189.

Immunity is defined in the standard as the ability of a system to perform without degradation in the presence of an electromagnetic disturbance. Degradation in ECG quality is a qualitative assessment which could be subjective. See Table 73 for this detailed immunity information. See Table 74 for recommended minimum separation distances between portable and mobile communications equipment and the Efficia DFM100.

Caution should be taken in comparing immunity levels of different devices. The criteria used for degradation is not specified by the standard and might vary with the manufacturer.

Table 66 **EMC Emissions**

Emissions Test	Compliance	Electromagnetic Environment - Guidance
RF emissions CISPR 11	Group 1, Class B	Emergency medical services environment Professional healthcare facility environment
Harmonic emissions IEC 61000-3-2	Class A	Emergency medical services environment Professional healthcare facility environment
Voltage fluctuations/flicker emissions IEC 61000-3-3	Complies	Emergency medical services environment Professional healthcare facility environment

Table 67 **Enclosure Ports**

Immunity Test	Immunity Test Level	Compliance Level	Electromagnetic Environment - Guidance
Electrostatic discharge (ESD) IEC 61000-4-2	±8 kV contact ±2, ±4, ±8, ±15 kV air	±8 kV contact ±2, ±4, ±8, ±15 kV air	Emergency medical services environment Professional healthcare facility environment
Radiated RF Electromagnetic Field IEC 61000-4-3	10 V/m 80 MHz - 2.7 GHz	10 V/m 80 MHz - 2.7 GHz	Emergency medical services environment Professional healthcare facility environment
Radiated RF Electromagnetic Field IEC 60601-2-4 (see Para. 202.6.2.3)	20 V/m (only defibrillation) 80 MHz to 2.7 GHz	20 V/m (only defibrillation) 80 MHz to 2.7 GHz	Emergency medical services environment Professional healthcare facility environment
Proximity fields from RF wireless communications equipment IEC 61000-4-3	See Table 68	See Table 68	Emergency medical services environment Professional healthcare facility environment
Power frequency magnetic field IEC 61000-4-8	30 A/m 50 Hz or 60 Hz	30 A/m 50 Hz or 60 Hz	Emergency medical services environment Professional healthcare facility environment

Table 68 **Proximity Fields from RF Wireless Communications Equipment**

Test Frequency (MHz)	Band a) (MHz)	Service a)	Modulation b)	Modulation b) (W)	Distance (m)	Immunity Test Level (V/m)
385	380-390	TETRA 400	Pulse modulation 18 Hz	1.8	0.3	27
450	430-470	GMRS 460, FRS 460	FM ± 5 kHz deviation 1 kHz sine	2	0.3	28
710 745 780	704-787	LTE Band 13, 17	Pulse modulation 217 Hz	0.2	0.3	9

Table 68 **Proximity Fields from RF Wireless Communications Equipment**

Test Frequency (MHz)	Band a) (MHz)	Service a)	Modulation b)	Modulation b) (W)	Distance (m)	Immunity Test Level (V/m)
810 870 930	800-960	GSM 800/900, TETRA 800, iDEN 820, CDMA 850, LTE Band 5	Pulse modulation 18 Hz	2	0.3	28
1720 1845 1970	1700-1990	GSM 1800; CDMA 1900; GSM 1900; DECT; LTE Band 1, 3, 4, 25; UMTS	Pulse modulation 217 Hz	2	0.3	28
2450	2400-2570	Bluetooth, WLAN, 802.11 b/g/n, RFID 2450, LTE Band 7	Pulse modulation 217 Hz	2	0.3	28
5240 5500 5785	5100-5800	WLAN 802.11 a/n	Pulse modulation 217 Hz	0.2	0.3	9

WARNING: The use of portable and mobile radio communications equipment can affect the operation of this device. Keep all portable and mobile radio communications equipment at a minimum distance of 30 cm (12 inches) from any part of the Efficia DFM100.

Table 69 **Input AC Power Ports**

Immunity Test	Immunity Test Level	Compliance Level	Electromagnetic Environment - Guidance
Electrical fast transient/burst IEC 61000-4-4	±2 kV	±2 kV	Emergency medical services environment Professional healthcare facility environment
Surge Line to line IEC 61000-4-5	±0.5 kV, ±1 kV	±0.5 kV, ±1 kV	Emergency medical services environment Professional healthcare facility environment
Surge Line to ground IEC 61000-4-5	±0.5 kV, ±1 kV, ±2 kV	±0.5 kV, ±1 kV, ±2 kV	Emergency medical services environment Professional healthcare facility environment

Table 69 **Input AC Power Ports *(Continued)***

Immunity Test	Immunity Test Level	Compliance Level	Electromagnetic Environment - Guidance
Conducted disturbances induced by RF fields IEC 61000-4-6	3 V 0.15 MHz - 80 MHz 6 V in ISM and amateur radio bands between 0.15 MHz and 80 MHz	3 V 0.15 MHz - 80 MHz 6 V in ISM and amateur radio bands between 0.15 MHz and 80 MHz	Emergency medical services environment Professional healthcare facility environment
Voltage dips, short interruptions, and voltage variations on power supply input lines IEC 61000-4-11	0% U_T; 0.5 cycle At 0°, 45°, 90°, 135°, 180°, 225°, 270°, and 315° 0% U_T; 1 cycle and 70% U_T; 25/30 cycles Single phase: at 0°	0% U_T; 0.5 cycle At 0°, 45°, 90°, 135°, 180°, 225°, 270°, and 315° 0% U_T; 1 cycle and 70% U_T; 25/30 cycles Single phase: at 0°	Emergency medical services environment Professional healthcare facility environment
Voltage interruptions IEC 61000-4-11	0% U_T; 250/300 cycle	0% U_T; 250/300 cycle	Emergency medical services environment Professional healthcare facility environment

Table 70 **Signal Input/Output Ports**

Immunity Test	Immunity Test Level	Compliance Level	Electromagnetic Environment - Guidance
Electrostatic discharge (ESD) IEC 61000-4-2	±8 kV contact ±2, ±4, ±8, ±15 kV air	±8 kV contact ±2, ±4, ±8, ±15 kV air	Emergency medical services environment Professional healthcare facility environment
Electrical fast transient/burst IEC 61000-4-4	±1 kV	±1 kV	Emergency medical services environment Professional healthcare facility environment
Conducted disturbances induced by RF fields IEC 61000-4-6	3 V 0.15 MHz - 80 MHz 6 V in ISM and amateur radio bands between 0.15 MHz and 80 MHz	3 V 0.15 MHz - 80 MHz 6 V in ISM and amateur radio bands between 0.15 MHz and 80 MHz	Emergency medical services environment Professional healthcare facility environment

Table 71 **Patient Coupling Ports**

Immunity Test	Immunity Test Level	Compliance Level	Electromagnetic Environment - Guidance
Electrostatic discharge (ESD) IEC 61000-4-2	±8 kV contact ±2, ±4, ±8, ±15 kV air	±8 kV contact ±2, ±4, ±8, ±15 kV air	Emergency medical services environment Professional healthcare facility environment
Conducted disturbances induced by RF fields IEC 61000-4-6	3 V 0.15 MHz - 80 MHz 6 V in ISM and amateur radio bands between 0.15 MHz and 80 MHz	3 V 0.15 MHz - 80 MHz 6 V in ISM and amateur radio bands between 0.15 MHz and 80 MHz	Emergency medical services environment Professional healthcare facility environment

The EMC standards state that manufacturers of medical equipment must specify the maximum lengths of any associated cables that are likely to affect the compliance of the device with emission and immunity tests. The following table lists the maximum lengths of these cables.

Table 72 **Applicable Cables with Maximum Lengths**

Part Number	Maximum Cable Length	Description
3-Lead ECG Cable Set		
M1669A	2.7 m	3-Lead Trunk Cable, AAMI/IEC
M1674A	1.0 m	3-Lead ICU Snap, IEC
M1678A	1.0 m	3-Leadset OR Grabber, IEC
M1672A	1.0 m	3-Leadset ICU Grabber, IEC
M1673A	1.0 m	3-Leadset ICU Snap, AAMI
M1671A	1.0 m	3-Leadset ICU Grabber, AAMI
989803160641	2.7 m	Efficia 3/5 ECG Trunk Cable, AAMI/IEC
989803160651	1.0 m	Efficia 3-Lead Grabber, AAMI
989803160661	1.0 m	Efficia 3-Lead Grabber, IEC
989803170171	2.7 m	OR 3-Lead ECG Trunk Cable, AAMI/IEC
5-lead ECG Cable Set		
M1645A	1.6 m	5-Lead ICU Snap, IEC
M1668A	2.7 m	5-Lead ECG Trunk Cable, AAMI/IEC
M1971A	1.6 m	5-Leadset, ICU Grabber, IEC
M1974A	1.6 m	5-Leadset, OR Grabber, IEC
M1644A	1.6 m	5-Leadset, ICU Snap Limb, AAMI
M1968A	1.6 m	5-Leadset, ICU Grabber Limb, AAMI
989803160691	1.6 m	Efficia 5-Lead Grabber Limb, AAMI

Table 72 **Applicable Cables with Maximum Lengths *(Continued)***

Part Number	Maximum Cable Length	Description
989803160701	1.6 m	Efficia 5-Lead Grabber Limb, IEC
989803170181	2.7 m	OR 5-Lead ECG Trunk Cable, AAMI/IEC
989803176161	1.6 m	5-Lead Snap Limb, Shielded, AAMI
989803176181	1.6 m	5-Lead Snap Limb, Shielded, IEC
Internal Paddles		
M4741A	3.9 m	7.5 cm Switched Internal Paddles
M4742A	3.9 m	6.0 cm Switched Internal Paddles
M4743A	3.9 m	4.5 cm Switched Internal Paddles
M1741A	3.9 m	7.5 cm Internal Paddles
M1742A	3.9 m	6.0 cm Internal Paddles
M1743A	3.9 m	4.5 cm Internal Paddles
M4740A	0.3 m	Internal Paddles Adapter Cable
External Paddles		
M3543A	4.8 m	External Paddles - Water Resistant
989803196431	4.8 m	Efficia External Paddles with PCI - Water Resistant
Hands-free Pads Therapy Cables		
M3508A	2.2 m	HeartStart Hands-free Cable
989803197111	2.1 m	DFM100 Pads Cable
Multifunction Defibrillator Pads - Plug Connector		
M3713A	1.2 m	HeartStart Pads Adult/Child (>10 kg) Plus (10 sets)
M3716A	1.2 m	HeartStart Pads Adult/child Radiolucent Multifunction Electrode Pads (10 sets)
M3717A	0.6 m	HeartStart Pads Infant (<10 kg) Plus (10 sets)
M3718A	1.2 m	HeartStart Pads Adult/child Radiotransparent Multifunction Pads (10 sets)
M3719A	0.6 m	HeartStart Pads Infant (<10 kg) Radiotransparent Multifunction Pads (10 sets)
989803158211	1.2 m	HS FR/FR2 Defib Pads (1 set)
989803158221	1.2 m	HS FR/FR2 Defib Pads (5 sets)
989803139261	1.2 m	SMART Pads II (1 set)
989803149981	1.2 m	SMART Pads III (1 set)
989803149991	1.2 m	SMART Pads III (5 sets)
$EtCO_2$ Mainstream Sensor		
M2501A	2.9 m	Mainstream CO_2 Sensor
$EtCO_2$ Sidestream Sensor		
M2741A	1.0 m	Sidestream CO_2 Sensor

Table 72 **Applicable Cables with Maximum Lengths *(Continued)***

Part Number	Maximum Cable Length	Description
SpO_2 Sensors and Cables		
M1191B	2.0 m	Adult Reusable SpO_2 Sensor, 2 m
M1191BL	3.0 m	Adult Reusable SpO_2 Sensor, 3 m
M1192A	1.5 m	Reusable Pediatric/Small Adult Finger SpO_2 Sensor, 1.5 m
M1196A	3.0 m	Adult Reusable SpO_2 Clip Sensor, 3 m
M1941A	2.0 m	SpO_2 Extension Cable, 2 m

Table 73 **Electromagnetic Immunity - Life Supporting Systems**

<table>
<tr><th>Immunity Test</th><th>Test Level</th><th>Compliance Level</th><th>Electromagnetic Environment - Guidance</th></tr>
<tr><td></td><td></td><td></td><td>Portable and mobile RF communications equipment should be used no closer to any part of the Efficia DFM100 including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter.</td></tr>
<tr><td rowspan="2">Conducted RF
IEC 61000-4-6/
GB/T17626.6</td><td>3 Vrms
150 kHz to 80 MHz outside ISM bands[a]</td><td>3 Vrms</td><td rowspan="2">Recommended Separation Distance:
$d = 1.2\sqrt{P}$</td></tr>
<tr><td>10 Vrms
150 kHz to 80 MHz in ISM bands</td><td>10 Vrms</td></tr>
<tr><td>Radiated RF
IEC 61000-4-3/
GB/T17626.3</td><td>3 V/m
80 MHz to 2.5 GHz
10 V/m
80 MHz to 2.5 GHz
20 V/m (only SpO_2, CO_2, defibrillation)
80 MHz to 2.5 GHz</td><td>3 V/m*
10 V/m, 20 V/m**
80 MHz to 2.5 GHz</td><td>Recommended Separation Distances
80 - 800 MHz:
$d = 1.2\sqrt{P}$
800 MHz - 2.5 GHz
$d = 2.3\sqrt{P}$
where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter's specified output power and d is the recommended separation distance in meters (m).[b]
Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey,[c] should be less than the compliance level in each frequency range.[d]
Interference might occur in the vicinity of equipment marked with the following symbol:
  </td></tr>
</table>

* Applies to functions that are not considered life-supporting.

** No inadvertent energy delivery (per IEC 60601-2-4/GB9706.8, ISO 80601-2-61/YY0784)

At 80 MHz and 800 MHz, the higher frequency range applies. These guidelines might not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

[a] The ISM (industrial, scientific, and medical) bands between 150 kHz and 80 MHz are 6.765 MHz to 6.795 MHz; 13.553 MHz to 13.567 MHz and 26.957 MHz to 27.283 MHz; and 40.66 MHz to 40.70 MHz. [b] The compliance levels in the ISM frequency bands between 150 kHz and 80 MHz and in the frequency range 80 MHz to 2.5 GHz are intended to decrease the likelihood that mobile/portable communications equipment could cause interference if it is inadvertently brought into patient areas. For this reason, an additional factor of 10/3 is used in calculating the recommended separation distance for transmitters in these frequency ranges. [c] Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the Efficia DFM100 is used exceeds the applicable RF compliance level above, the Efficia DFM100 should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the Efficia DFM100. [d] Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.

Recommended Separation Distances

The Efficia DFM100 is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the Efficia DFM100 can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the Efficia DFM100 as recommended below, according to the maximum output power of the communications equipment.

Table 74 **Recommended Separation Distances**

	Separation Distances According to Frequency of Transmitter (m)	
Rated Maximum Output Power of Transmitter (W)	150 kHZ to 800 MHz $d = 1.2\sqrt{P}$	800 MHz to 2.5 GHz $d = 2.3\sqrt{P}$
0.01	0.1 m	0.2 m
0.1	0.4 m	0.7 m
1	1.2 m	2.3 m
10	4 m	7 m
100	12 m	23 m
For transmitters rated at a maximum output power not listed above, the recommended separation distance *d* in meters (m) can be determined using the equation applicable to the frequency of the transmitter, where *P* is the maximum output power rating of the transmitter in watts (W) according to the transmitter's manufacturer. At 80 MHz and 800 MHz, the higher frequency range applies. These guidelines might not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.		

Appendix 1 - Efficia DFM100 Shift Checklist

Inspect your Efficia DFM100, accessories, and supplies at the change of every shift, per AHA guidelines. Place a check mark in the box as you check each item in the list below or place a dash (-) or N/A if not applicable. Then, initial the list to indicate the check was performed for that shift.

Device Name or Serial Number:_____Unit or Department:_____

Date:															
Shift:	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
RFU Indicator - Hourglass **If blinking red X** - Plug into AC power or insert charged battery **If solid red X** - Insert charged battery or plug into AC power. If condition persists, call for service															
Case - clean, free from spills and objects															
Cables/connectors - present and inspected															
Paddles/Therapy cable - present, inspected and paddles release from tray															
Multifunction pads - present, sufficient supply; check expiration date															
Monitoring Electrodes - present, sufficient supply; check expiration date															
Charged Batteries - one in device, spares. Check battery gauge															
AC Power Cord - plugged in, green light on															
Printer Paper - present, sufficient supply															
USB Drive - present															
SpO_2 **Sensors** - present, sufficient supply*															
NBP cuffs/tubing - present, sufficient supply*															
CO_2 **sensor** - present, clean and free from spills*															
CO_2 **Sample line** - present, sufficient supply*															
Initials															

* - if option is installed

Shift Checklist (Page 2) Efficia DFM100 Weekly Shock Test

Do one of the following checks at least once a week to verify the ability to deliver defibrillation therapy:

☐ Operational check (See the *Efficia DFM100 Instructions for Use* for details.)

☐ Deliver a 150 J shock into a test plug/load (if using multifunction electrode pads) or the paddle tray (if using paddles).

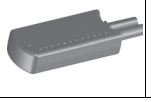
☐ Weekly shock test is not applicable for this shift check.

Check off which option you selected and sign/date below.

Signature:	Date:

NOTE: Test reusable sterilizable paddles (internal or external) prior to each use. See the *Sterilizable Defibrillator Paddles Instructions for Use*.

◎ **To perform the weekly shock test:**

	If you are using pads with a test load: 	**If you are using pads with a test plug:** 	**If you are using paddles:**
1	Turn the device on by turning the Therapy knob to 150 J.		
2	Connect the Therapy cable to the defibrillator and test load to the end of the Therapy cable.	Connect the Therapy cable to the defibrillator and test plug to the end of the Therapy cable.	Make sure the paddles and the paddle tray are thoroughly clean and there is no debris or residue (including all conductive material) on the electrode surfaces of the paddles and tray. Secure paddles in tray and confirm Patient Contact Indicator (PCI) LEDs are not lit. If the LEDs are lit, adjust paddles in tray. If the LEDs continue to light, clean both the adult and infant paddle electrode surfaces.
3	Press the Charge button on the front panel. Confirm you hear the charging tone. If it becomes necessary to disarm the defibrillator, press **[Cancel Charge]**.		Press the Charge button on the paddles sitting in the tray. Confirm you hear the charging tone. If it becomes necessary to disarm the defibrillator, press **[Cancel Charge]**.
4	A strip prints, if configured to do so. If the strip does not print immediately, press the Print button.		A strip prints, if configured to do so. If the strip does not print immediately, press the Print button.
5	Press the Shock button on the Efficia DFM100.		Simultaneously press the Shock buttons located on the paddles.
6	Confirm the printed strip indicates **Test Passed** and the energy delivered is150 J, ±15 J (135 J to 165 J). If not, confirm you did the test properly before taking the device out of use and calling for service.	Confirm that you hear a "**Shock Cancelled**" audio message, see a **Shock Aborted** alarm on the display and the printed strip indicates **Test Passed**. If not, confirm you did the test properly before taking the device out of use and calling for service. **NOTE:** It is normal behavior that a shock is not delivered in this instance.	
7	Detach test load/plug from the Therapy cable so your device is ready for use when needed. Do not leave the test load/plug attached to the Therapy cable. Test complete.		Test complete.

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NOTES

On the web
www.philips.com

By e-mail
healthcare@philips.com

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