



Instructions for Use

Efficia DFM100

Defibrillator/Monitor

REF 866199

PHILIPS

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Medical Device Directive

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

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 represents hypertext links; click on the blue link to go to that destination

“Introduction” (Computer screen viewing only)

on page 1”

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NOTES

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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 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 SpO₂ (numeric and pleth wave), EtCO₂ (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 noninvasive 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 SpO₂, 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 131 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 asynchronized 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 SpO₂, measure exhaled CO₂ via EtCO₂, 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 bradysystolic 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 (SpO₂) 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 SpO₂ reading. The Efficia DFM100 in Monitoring mode requires user interaction to assess the patient's SpO₂.

- **Indications for Use:** Pulse oximetry is indicated for any patient who is at risk of developing hypoxemia.
- **Contraindications:** There are no known contraindications for SpO₂ 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 CO₂ Monitoring

The EtCO₂ functionality in the Efficia DFM100 is a capnometric device that uses non-dispersive infrared spectroscopy to continuously measure the amount of carbon dioxide (CO₂) 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 EtCO₂.

- **Indications for Use:** EtCO₂ monitoring is indicated for the detection of trends in the level of expired CO₂. 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 EtCO₂ monitoring.

Safety Considerations

General warnings and cautions that apply to the use of the Efficia DFM100 are provided in “[Safety Considerations](#)” on page 37. Additional warnings and cautions specific to a particular function are provided in the appropriate sections of these instructions.

Getting Started

Before putting the Efficia DFM100 into clinical use for the first time, do the following:

- Read these *Instructions for Use* in their entirety.
- Initialize and fully charge the battery. For more information, see “[Initializing Batteries](#)” on page 156.
- Perform an operational check and shift check. For more information, see “[Operational and Shift Check](#)” on page 143.

WARNING: Ensure that you understand the use of the device, including functions, terminology, and abbreviations described in these *Instructions for Use* before using on a patient. Failure to do so may cause patient harm or death.

NOTES

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Device Basics

This chapter provides information about the Efficia DFM100 exterior and associated connections.

Overview

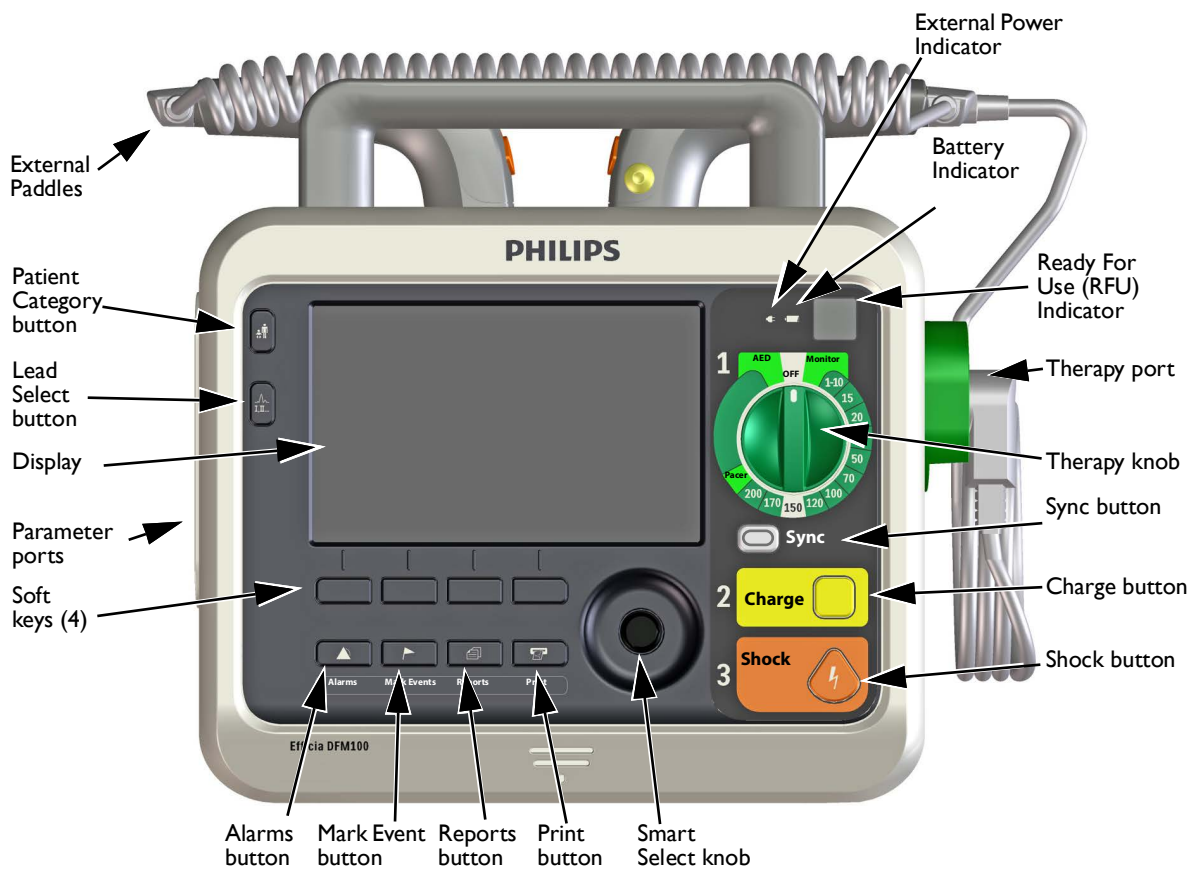
Philips pioneered 1-2-3 defibrillation for you to defibrillate a patient and save a life quickly and easily. Efficia DFM100 controls, indicators, menus and icons were carefully designed and organized to facilitate ease of use. Display information is designed to present key information for the current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

Some information in this chapter and the instructions for use may not be applicable to your device, depending on your device options, configurations, and the functions being performed. Images of the Efficia DFM100 and its display are for example purposes only.

Front of the Device

The front of the device contains operational controls and indicators as shown in [Figure 1](#).

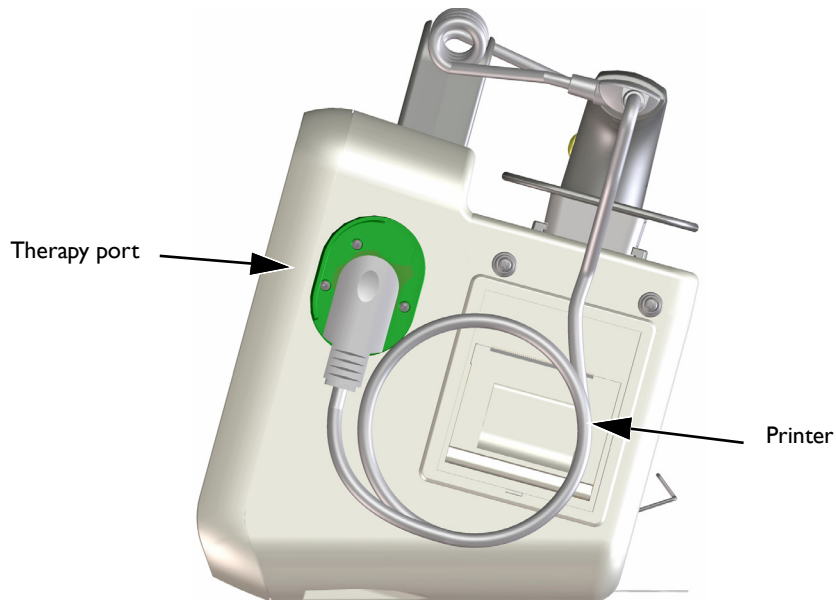
Figure 1 **Front of the Efficia DFM100**



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. See [Figure 2](#).

Figure 2 **Right Side - Therapy Port and Printer**



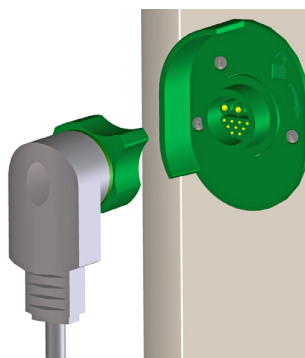
Connecting and Detaching the Therapy Cable

If your device also has the Therapy Cable Collar, see [“Connecting the Therapy Cable Collar”](#) on page 17.

© **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**



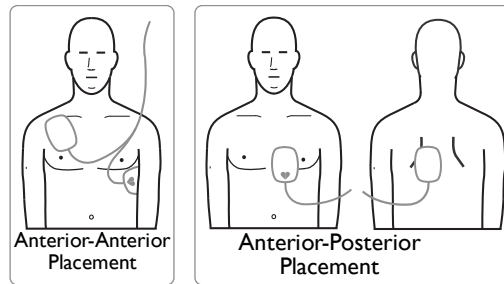
© **To detach the Therapy Cable:**

- 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 **Placement of Multifunction Electrode Pads on an Adult**

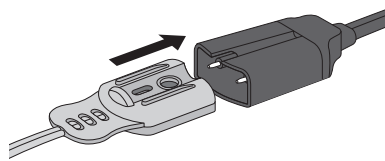


Connecting Multifunction Electrode Pads

© **To connect multifunction electrode pads:**

- 1 Ensure that the Therapy cable is connected to the Efficia DFM100. See [“Connecting the Therapy Cable”](#) on page 8.
- 2 Ensure that the multifunction electrode pads are not expired and that the package is not damaged. Discard expired or damaged multifunction electrode pads.
- 3 Remove the multifunction electrode pads from their packaging.
- 4 Insert the multifunction electrode pads connector into the end of the Therapy cable. See [Figure 5](#).

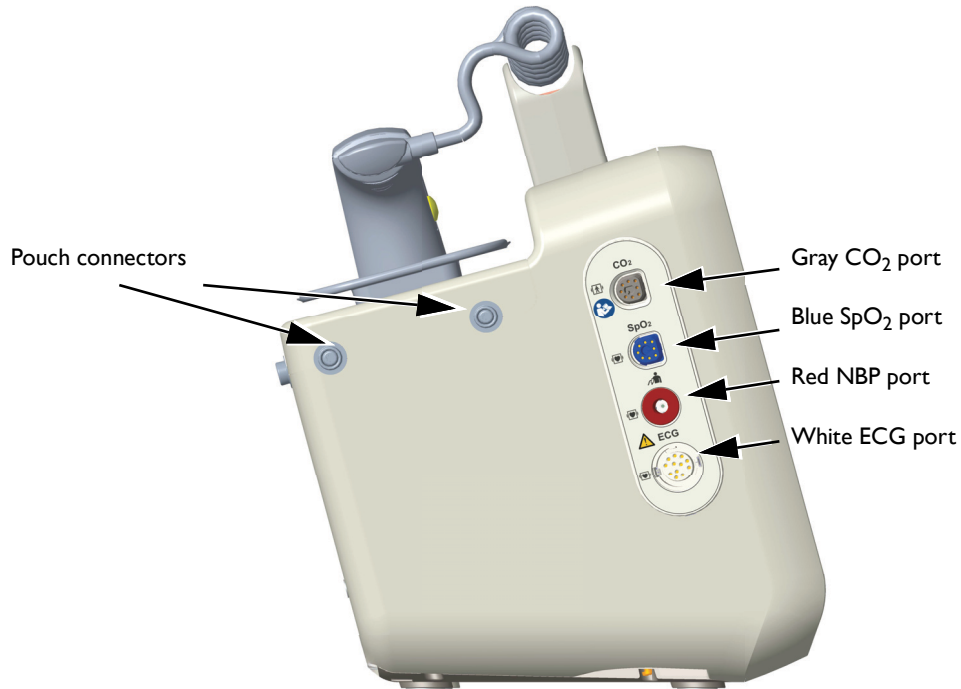
Figure 5 **Inserting the Multifunction Electrode Pads Connector**



Left (Monitor) Side

The left side of the Efficia DFM100 is dedicated to monitoring key vital signs. It has ports for ECG, SpO₂, CO₂, 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 CO₂ Cable and Sample Line

© To connect the CO₂ cable:

- 1 Hold the cable connector with the flat side facing the front of the Efficia DFM100, insert the cable into the gray CO₂ 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 EtCO₂](#)” on page 92.

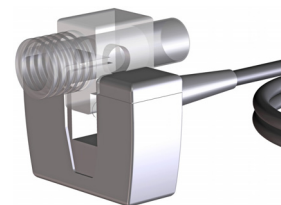
Figure 8 **Connecting the CO₂ Cable**



Connecting a Sidestream Module



Connecting a Mainstream Module

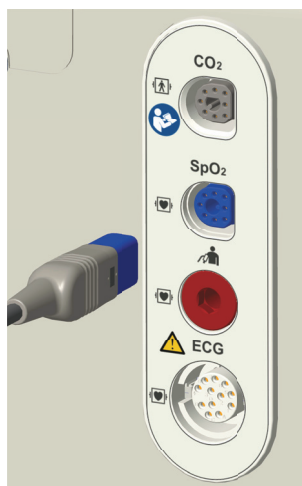


Connecting the SpO₂ Cable

© To connect the SpO₂ 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 SpO₂ port and push the blue portion of the connector into the device until it is no longer visible.

Figure 9 **Connecting the SpO₂ 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.

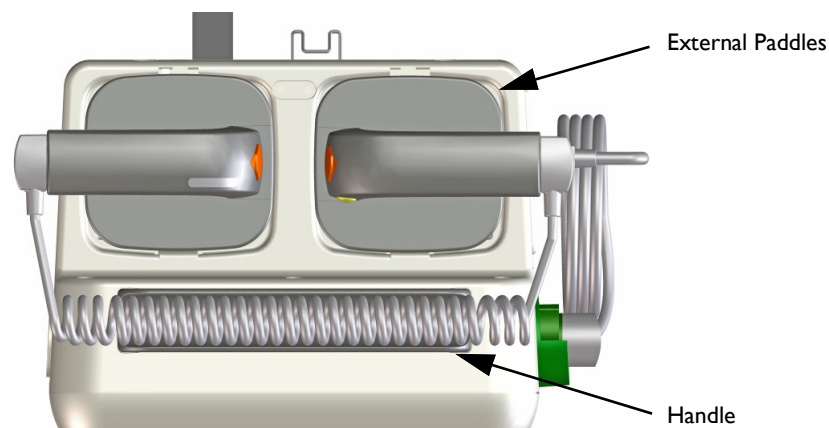
Figure 10 **Connecting the NBP Cable**



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 and infant/child 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**

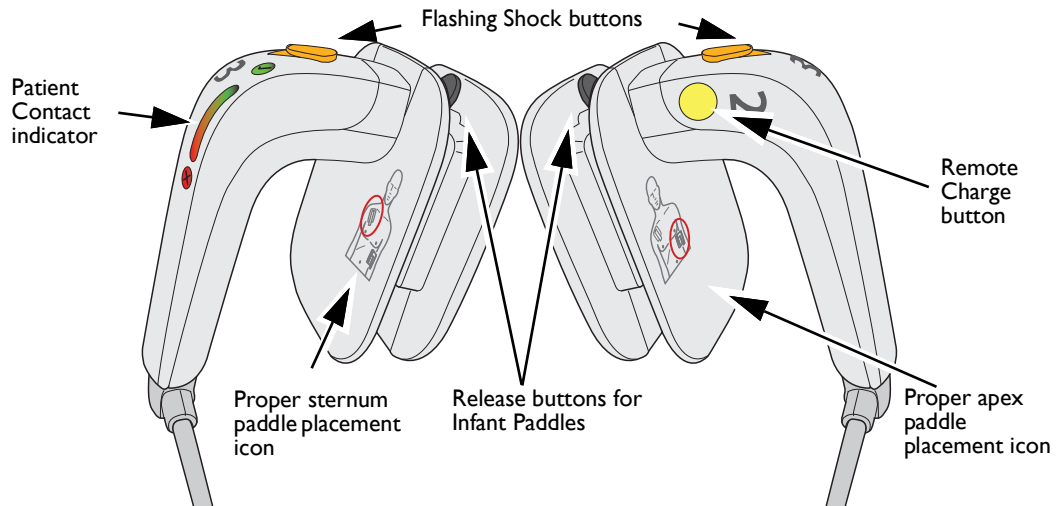
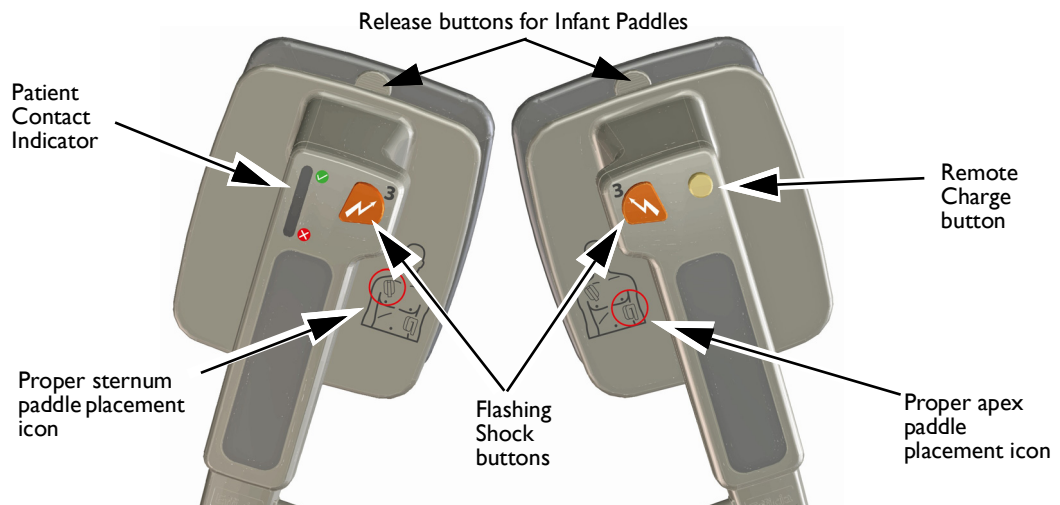


Figure 13 **External Paddle Features - 989803196431**



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**

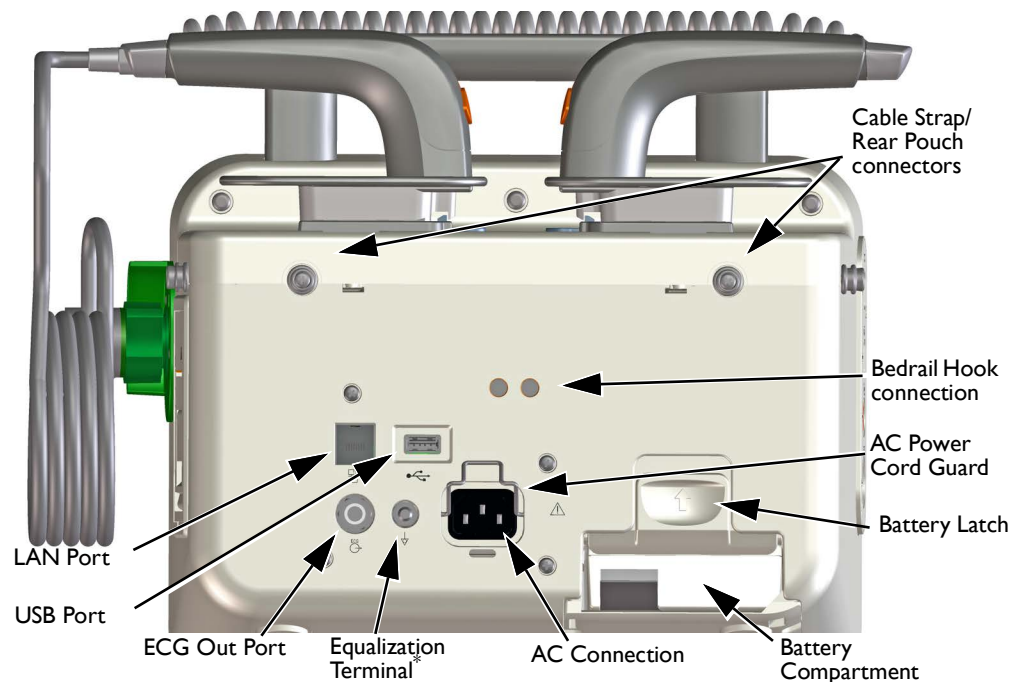


WARNING: Make sure the defibrillator is not charged before accessing the infant paddles.

Back Panel

The back panel of the Efficia DFM100 has a compartment for the Lithium Ion battery. It also contains the AC power connection, ECG Out port, USB port, and LAN port.

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

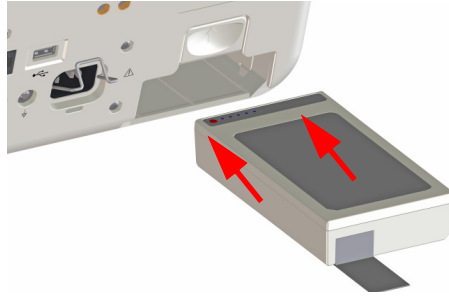
WARNING: Only trained personnel should install the battery. An improperly inserted battery could create hazards, such as excessive battery temperature, fire, or explosion.

© **To install the battery:**

- 1 Align the battery in the battery compartment. Confirm the arrow on the battery tab is pointed up. See [Figure 16](#).

- 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 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.

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

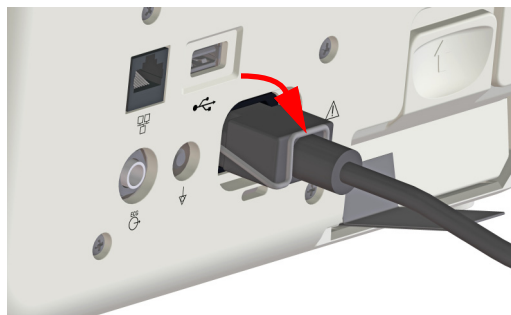
Inserting the AC Power Cord Guard

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

☉ **To insert the power cord guard:**

- 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 17](#)).
- 3 Confirm a snug fit by lightly tugging on the cord.

Figure 17 **AC Power Cord Guard**



Installing Paper

The Efficia DFM100 uses 50 mm paper for printing.

CAUTIONS: Printer paper may jam if the paper is wet.

The printer may be damaged if wet paper is allowed to dry while in contact with printer elements.

☉ **To install printer paper:**

- 1 Open the printer door by pulling up on the door latch. Allow the door to fall open (see [Figure 18](#)).
- 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 143.

Figure 18 **Installing Printer Paper**



Tying the Defibrillator Test Plug to the Therapy Cable

The Efficia DFM100 includes a defibrillator test plug to assist in performing a weekly shock test.

To help prevent losing the test plug:

- Using the included tie, attach the test plug about 50 cm (18 inches) from the end of the therapy cable, tight enough to prevent the test plug from sliding along the cable.
- Position the test plug so that it can be inserted easily into the therapy cable when the therapy cable is stowed.

CAUTION: The defibrillator test plug (part number 989803171271) is not for use with the HeartStart MRx or HeartStart XL.

Connecting the Therapy Cable Collar

When the Efficia DFM100 is used in transport or high-vibration environments, Philips strongly recommends connecting the Therapy Cable Collar before placing the Efficia DFM100 into service. The Therapy Cable Collar adds an extra level of security to prevent excessive wear and vibration with the Therapy port. For Emergency Medical Services (EMS) configurations of the Efficia DFM100, the Therapy Cable Collar base comes installed from the factory.

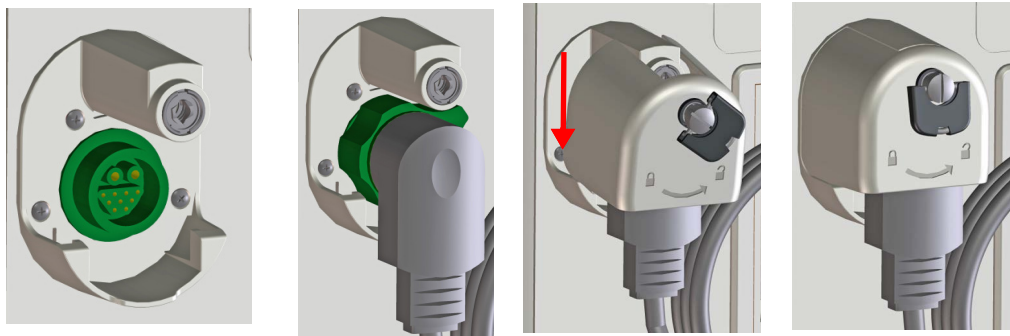
WARNINGS: If you use the Efficia DFM100 in a transport or high-vibration environment without the Therapy Cable fully installed, your device is susceptible to premature Therapy port and cable wear and potential failure which may result in a delay in therapy.

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.

© 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 19](#).
- 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 19 Locking the Collar Lid into Place



Connecting the 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.

Installing the Efficia DFM100 Cradle and Carry Bags

To install the optional Efficia DFM100 cradle and carry bags, a Phillips-head screwdriver is required.

© To install the cradle and carry bags:

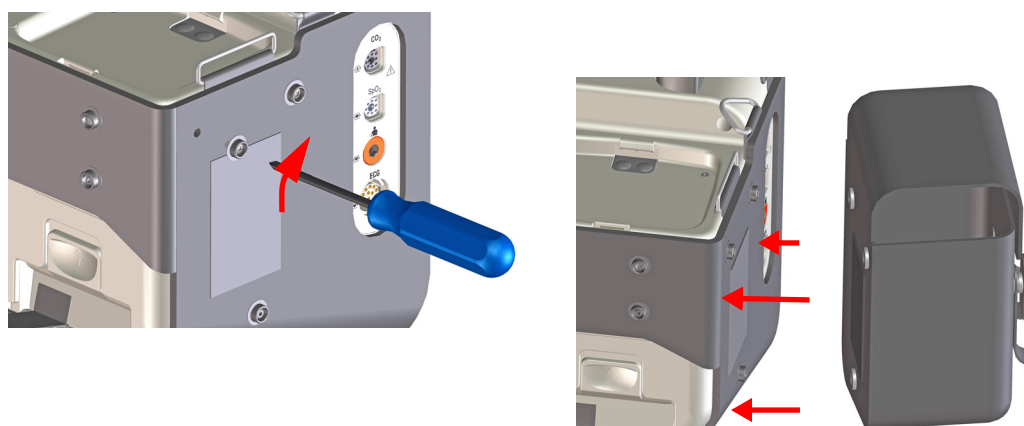
- 1 Open the cradle and set the Efficia DFM100 down snugly inside.
- 2 Taking one cradle edge at a time, lift the edge into place.

- 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 20](#).
- 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 20](#).
- 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 20 **Attaching the Cradle and Side Carry Bags**



Usage in the Emergency Medical Services Environment

The Emergency Medical Services (EMS) environment can place additional stress on the Efficia DFM100 and its accessories. Check all accessories frequently. Confirm that all sensors, electrodes, ports and the Therapy cable are in working order. Replace accessories that are not in good working order.

Although the Efficia DFM100 is designed for use in the EMS environment, the following conditions may affect essential performance:

- Make sure that the Therapy Cable Collar is installed on devices in high-vibration environments. For more information, see [“Connecting the Therapy Cable Collar”](#) on page 17.
- Direct sunlight and other sources of excessive illumination can affect SpO₂ readings. For more information, see [“Understanding Pulse Oximetry”](#) on page 100.
- If the DFM100 was exposed to lint and dust, you should thoroughly clean it. For more information, see [“About Cleaning and Disinfecting the Device and Accessories”](#) on page 158.

- Cellular telephones, 2-way radios, and other radio frequency-emitting devices could cause interference problems and potentially affect the behavior of the device. For information about separation distances, see “[Recommended Separation Distances](#)” on page 210.
- Devices in the EMS environment may require a power converter to convert vehicle DC power to AC power for the Efficia DFM100.

WARNING: Use of the Efficia DFM100 in conditions that are inconsistent with the Efficia DFM100 environmental specifications (such as excessive vibration or after mechanical shock to the device) may cause harm or death to the patient or harm to the user.

Ambulance Docking Station

The Efficia DFM100 with the X01 option is designed for use in the Emergency Medical Services (EMS) environment and includes the carry case and the ambulance docking station.

CAUTION: All installation and maintenance activities involving the ambulance docking station, including attaching and detaching the Efficia DFM100, is to be performed by qualified service personnel using special tools. See the Efficia DFM100 *Service Manual* for installation, maintenance, and service instructions.

NOTES

[illegible]

Operating the Device

This chapter describes Efficia DFM100 operating modes, how to use the general device controls and features (such as alarms and passwords), and enter basic information (such as patient information).

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	Additional 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 39; “Monitoring EtCO₂” on page 89; “Monitoring SpO₂” on page 99; “Monitoring NBP” on page 107; “Trending” on page 115.
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” on page 53.
Manual Defibrillation	This mode is used to perform asynchronous and synchronous cardioversion (defibrillation).	“Manual Defibrillation” on page 67.
Pacer	This optional mode is used to perform demand or fixed pacing.	“Pacing” on page 81.

Table 2 **Non-Clinical Modes**

Mode	Description	Additional 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 143.
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 119.
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 131.
Service	This mode is used by service personnel to service the device and install software upgrades. This mode requires a password.	The Efficia DFM100 <i>Service Manual</i>

Continued Use Feature

In clinical modes, the Continued Use feature is active. This feature retains the current settings and patient record when you change clinical modes or if the Efficia DFM100 is turned off for less than 10 seconds. The most recent data for the following information is retained:

- Alarm settings and conditions
- Wave sector settings
- Event timing
- Volume settings
- Trends data for vital signs
- Pacing settings
- Synchronized cardioversion settings
- SpO₂ value
- EtCO₂ value
- AwRR value
- NBP value and measurement frequency
- Event summary

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

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. To reach the controls and operate the device, stand within one meter (3 feet) of the device.

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.

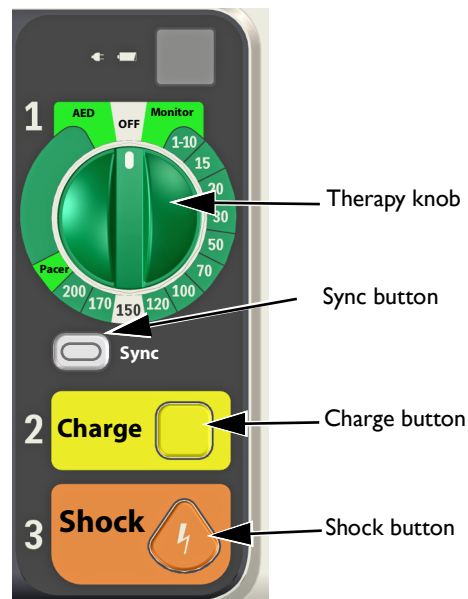
Charge button – Charges the defibrillator to the selected Manual Defibrillation energy setting. It is used only in Manual Defibrillation mode. The defibrillator charges automatically in AED mode.

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 150 J. If the patient category is Infant/Child, 50 J 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 21 Therapy Controls



Smart Select Knob

Use the Smart Select knob 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.

Turn 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, turn the Smart Select knob clockwise to increase the numerical value and counter clockwise to decreases the value.

General Function Buttons

The general function buttons control monitoring or non-critical resuscitation activity.

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 Criteria” on page 43.
Patient Category		Changes the patient category: - Adult patient category. Patients over 25 kg (55 lbs) or greater than 8 years old. - Infant/Child patient category. Patients under 25 kg (55 lbs) or 0-8 years old.
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 32.
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 32.
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.
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.

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 RFU Indicator

Indicator Appearance	Device Status
 Blinking hourglass	Indicates that shock, pacing, and ECG functions of the device are ready for use. Sufficient battery power is available for device operation.
 Blinking red 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/DC power only.
 Blinking red with no 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 with periodic audio chirp	Indicates that a critical failure has been detected and may prevent the delivery of defibrillation therapy, pacing, or ECG acquisition.
 Solid red with no audio chirp	Indicates no power available or the device cannot power on.

Power

The Efficia DFM100 is powered by a lithium ion battery or AC power:

- When pacing, to prevent the battery from eventually becoming depleted and interrupting the pacing operation, AC power should be connected if possible.
- A **Switched to Battery** message is displayed when AC power is removed and a battery is installed.

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 and a spare battery nearby.

WARNINGS: Use only a Philips-approved 3-wire AC power cord with ground protection.

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.

The battery should always be installed so the device is ready for use whether or not AC power is available at the point of care.

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.

If power is lost for 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 the battery installed and charged.

Do not position the device in such a way that it becomes difficult to remove the power cord.

If you suspect that the AC power cord is malfunctioning, disconnect it from the device and operate on battery power. Replace the AC power cord before connecting the device to AC power.

Lithium Ion Battery

The Efficia DFM100 uses a lithium ion battery for power:

- For information on battery charging and maintenance, see [“Battery Maintenance”](#) on page 155.
- For information on battery specifications, see [“Battery”](#) on page 191.

Power Indicators

The Power Indicators are located in the upper right corner of the front panel. The green AC Power Indicator is lit when 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 22 Power Indicators



Battery Icon

The battery icon is in the upper right corner of the Efficia DFM100 display, next to the power indicators. The icon indicates the battery status.

Table 5 Battery Icons

Icon	Battery Status
	Incompatible battery.
	Battery not installed.
	Less than 20% charge remaining (low battery condition).
	Less than 40% charge remaining.
	40% to 65% charge remaining.
	65% to 90% charge remaining.
	90% or more charge remaining.

Turning the Efficia DFM100 On

To turn the Efficia DFM100 on, turn the Therapy knob to the intended 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. 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.

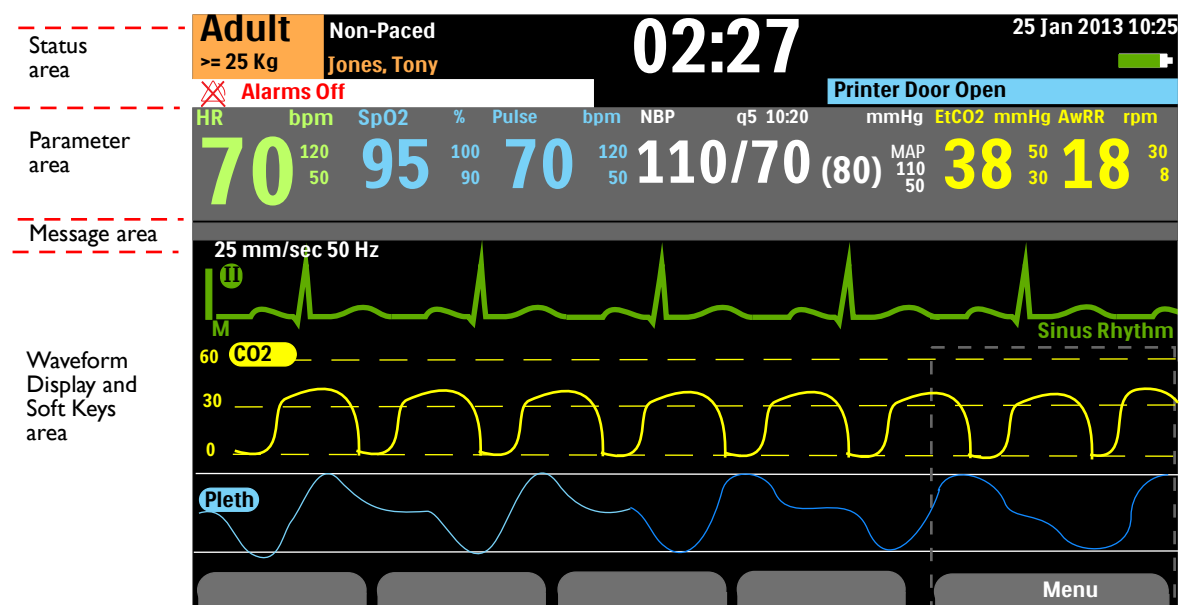
If the Efficia DFM100 restarts after 30 seconds and the Therapy knob is not in the OFF position, all settings are returned to their configured values, a new event summary starts and you are notified that the previous event summary was closed.

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 device display layout is configurable. There are four basic areas of the display. See [Figure 23](#).

Figure 23 General Display Layout

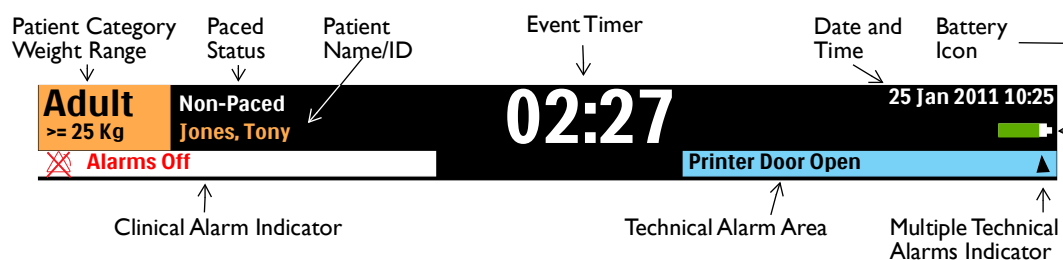


Dotted box indicates location of menu when displayed.

Status Area

The Status Area contains device and patient information.

Figure 24 **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 41 “General Settings”](#) on page 135.
- 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 $\geq 25\text{kg}$) or Infant/Child (defined as $< 25\text{kg}$). The background color changes with the selected patient category for Adult (orange) and Infant/Child (blue).

Device information includes:

- Clinical Alarm Indicator- Identifies the overall alarm setting.
- 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 Icon– If a battery is installed, the battery icon indicates the level of charge remaining.

Parameter Area

The Parameter Area displays the physiological parameters currently being monitored. 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
 - If alarm limits are turned off, the alarms off symbol ☒ is displayed.

For an example, see [Figure 23 “General Display Layout”](#) on page 27.

Message Area

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

Waveform Display

You can display up to three waveforms at one time, depending on the mode being used and your device configuration. Wave sectors populate with a preconfigured waveform in Monitor, Manual Defibrillation (two wave sectors only), Pacing mode (two wave sectors only), and AED mode (one wave sector).

Wave Sector 1

Wave sector 1 displays an ECG waveform. Available waveforms include: Paddles (unavailable in AED mode), Pads, I, II, III, aVR, aVL, aVF and V. The waveform is used in arrhythmia, heart rate derivation, and AED analysis.

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

Figure 25 Wave Sector 1 Labels

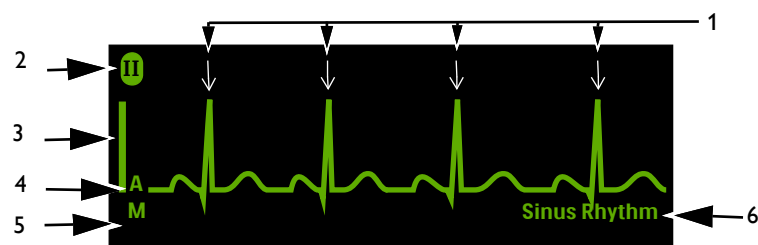


Table 6 Wave Sector 1 Label Descriptions

Number	Label Title	Label Description
1	R-Wave arrows	R-Wave arrows appear when the device is in Sync mode, Monitor mode, or Demand mode pacing.
2	Lead label	Identifies the lead waveform used for the wave sector.
3	Calibration bar	Reference to compare the actual ECG wave displayed to the selected size.
4	Auto-gain indicator	Indicates whether auto-scaling is active.

Table 6 **Wave Sector 1 Label Descriptions (Continued)**

Number	Label Title	Label Description
5	ECG bandwidth filter	Identifies the ECG bandwidth filter used for the display, based on the ECG Bandwidth for Display configuration. Values: • M – ECG bandwidth for diagnostic monitoring in a motionless and low-noise environment. • E – ECG bandwidth for diagnostic monitoring in environments that may cause ECG noise, such as EMS environments. • S – ECG bandwidth for ST segment monitoring.
6	Rhythm label	For clinical modes except AED mode, identifies the waveform based on the ECG analysis algorithm. Values: Asystole , Cannot Analyze ECG , Learning ECG , Learning Rhythm , Paced Rhythm , Sinus Brady , Sinus Rhythm , Sinus Tachy , SV Brady , SV Rhythm , SV Tachy , Unknown ECG Rhythm , V-Fib/Tach , VTach . If the Display Rhythm Status configuration is off, only the Learning ECG and Learning Rhythm values are used.

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 wave sectors 2 or 3, the ECG bandwidth filter is displayed (except in cascade and annotated ECGs). You can also select an annotated ECG for wave sector 2.

Menus

Menus with controls and options specific to each Efficia DFM100 function are 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.

Depending on the use scenario, menu options may be grayed out when unavailable or not applicable for use. They cannot be highlighted or selected.

NOTE: If the Charge button is pressed, any open menus are removed from the display.

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 first and last name is limited to 18 characters each. The patient ID is limited to 16 characters. 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 field you want, and press the Smart Select knob.
- 4 If you select **Name**, the **Last Name** field and menu appears:
 - a Turn and press the Smart Select knob to highlight and enter each character of the last name. When finished, select **Done**. The last name is saved, and you are prompted to enter the first name.
 - b Turn and press the Smart Select knob to highlight and enter each letter of the first name. When finished, select **Done**. The first name is saved, and you are prompted to enter the patient ID.
- 5 To enter the patient ID, turn and press the Smart Select knob to highlight and enter each character of the ID.
- 6 To enter the patient's sex, turn and press the Smart Select knob to highlight and select **Male** or **Female**.
- 7 To enter the patient's paced status, turn and press the Smart Select knob to highlight and select the value as follows:
 - If the patient has an internal pacemaker, select **Yes**.
 - if the patient does not have an internal pacemaker, select **No**.

Event Volume and Annotation

Changing Volume Levels for the Current Event

You can change the volume levels for alarms, voice instructions, and the QRS indicator for the current event. The new volume level remains in place for the duration of the current event. Adjusting one volume type does not affect the other volume types. For example, adjusting the QRS volume does not affect the volumes for alarms and voice instructions.

⦿ **To change 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**) and press the Smart Select knob.
- 4 Select the new volume level and press the Smart Select knob.

Mark Events

The Mark Events button  allows annotation in the event summary and ECG strip:

- If the Mark Event button is pressed and no event is selected from the Events Menu within five seconds, the Events menu closes and a generic event is logged.
- If the Mark Event button is pressed a second time within five seconds of the first press, a generic event is logged and the Events menu remains open for five seconds.
- If configured, pressing the Mark Event button prints a ten-second ECG strip leading up to the event, the event itself, and five seconds after the event.

☉ To mark an event:

- 1 Press the Mark Event button. The **Events** menu appears.
- 2 Turn the Smart Select knob to select the event you want.
- 3 Press the Smart Select knob to mark the event.

Alarms

Alarms indicate changes in the patient, device, and cable conditions that may require attention. Alarms conditions are based on comparisons against preset limits and algorithm results:

- Physiological alarms are associated with the patient-related parameter being monitored in a clinical mode. Physiological alarms are not detected or shown in non-clinical modes.
- Technical alarms are associated with an equipment-related issue.
- Latching alarms remain active until the condition that triggered the alarm no longer exists and the alarm is acknowledged.
- Non-latching alarms are automatically removed when the alarm condition no longer exists.

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, alarms are prioritized and categorized. The highest priority alarm condition is announced. If multiple alarms occur for the same parameter at the same priority, the alarms are displayed one at a time.

Table 7 Alarm Priority

Alarm Priority	Condition
High priority	• An immediate response is required. A life-threatening alarm condition exists. • The alarm background is red, accompanied by a high-priority alarm tone. • An example of a high-priority alarm is V-Fib/Tach.
Medium priority	• Prompt response is required. A non-life-threatening alarm condition exists. • The alarm background is yellow, accompanied by a medium-priority alarm tone. • An example of medium-priority alarm is SpO2 Low.
Low priority	• Awareness is required. A non-life-threatening alarm condition exists. • The alarm background is cyan, accompanied by a low-priority alarm tone. • An example of a low-priority alarm is Printer Door Open.

Alarm Management and Configuration

You can configure general and function-specific alarms, including whether alarms are on at start up and whether you are reminded when alarms are off. For information about function-specific alarms and messages, see the applicable alarm section in the Efficia DFM100 *Instructions for Use*. For configuration information, see [Chapter 14 “Configuration”](#) on page 131.

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.

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

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

For patients who are not continuously attended by a clinician, configure the alarm system and settings based on the patient's physiological condition.

During a technical alarm condition, a physiological alarm condition may not be accurately detected.

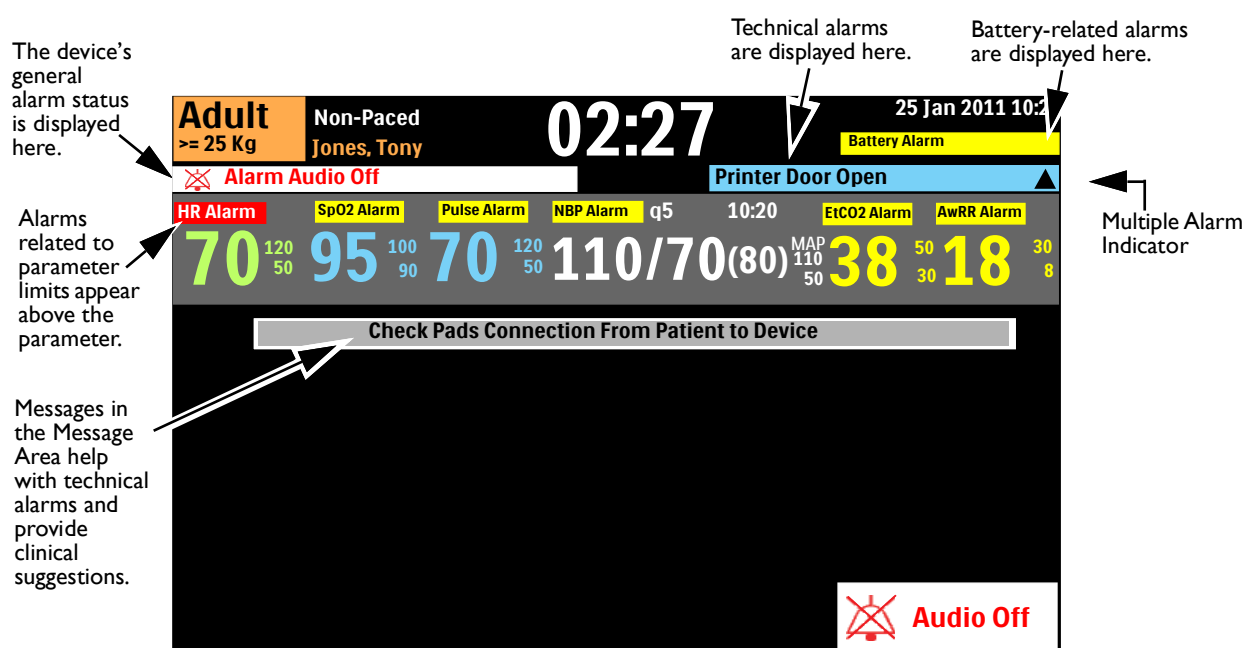
Do not set alarm limits to such extreme values that render the alarm system useless.

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

Alarm Display Locations

If alarms for the parameter are on, alarm limits are displayed with each parameter. For an example of alarm display locations, see [Figure 26 “Alarm Display Locations”](#).

Figure 26 Alarm Display Locations



NOTE: Pacing alarms appear in the Pacing Bar.

Clinical Alarm Notification

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.

The alarm symbol and message identifies your general alarm status.

Table 8 Alarm Symbols and Messages

Alarm Symbol and Message	Alarm Status	Display Location	Criteria for Appearance
 Alarm Audio Paused min (message includes duration of the pause)	- Only visual indications are on for the configured audio pause timeframe. - Audio returns when the pause timeframe is complete.	Upper left corner of the display, under the patient category.	The message appears when you press the Alarms button and the configured alarm pause is set to something other than indefinite.
 Alarm Audio Off	Only visual indications are on.	Upper left corner of the display, under the patient category.	The message appears when you press the Alarms button and the configured alarm pause is indefinite.
 Alarms Off	Both audio and visual alarm indications are off.	In AED mode, upper left corner of the display, under the patient category.	The message appears in AED mode when you press the Alarms button to activate alarms.
 Audio Off	Only visual indications are on.	Lower right corner, above the Smart Select knob.	The message appears as an option for you to press the Smart Select knob to turn audio off.
 Audio Pause	- Only visual indications are on for the configured Audio Pause timeframe. - Audio returns when the pause timeframe is complete.	Lower right corner, above the Smart Select knob.	The message appears as an option for you to press the Smart Select knob to pause audio.

Tone and Alarm Indications

The Efficia DFM100 uses a mixture of audio tones and alarm indications to communicate device and patient status.

Table 9 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

Table 9 Tones and Alarms (Continued)

Tone/Indication	Description	Tone level
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 135.	667 Hz
Continuous tone with alternating pitch	Imminent shutdown. The device will shut down in one minute.	Alternating between 1000 and 2100 Hz
• Audio. Philips tone lasting 0.5 second, repeated every second. • Visual. Flashing at 2 Hz with 50% duty cycle (0.25 second flash twice every second).	High priority alarm condition.	960 Hz
IEC high priority alarm		Meets IEC 60601-1-8/YY 0709
• Audio. Philips tone lasting 1 second, repeated every 2 seconds. • Visual. Flashing at 0.5 Hz with 50% duty cycle (a 1 second flash every other second).	Medium priority alarm condition.	480 Hz
IEC medium priority alarm		Meets IEC 60601-1-8/YY 0709
• Audio. Philips tone lasting 0.25 second, repeated every 2 seconds. • Visual. Continuously on.	Low priority alarm condition	480 Hz
IEC low priority alarm		Meets IEC 60601-1-8/YY 0709

NOTE: Tone and alarm volumes range from 45 dB(A) to 85 dB(A).

Changing Alarm Limits

Alarm limits are based on their configuration and the patient category. When alarms are on, alarm limits are visible next to the parameter’s numeric value.

© To change 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 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 limit. Press the Smart Select knob to finish.

Responding to Alarms

When an alarm condition occurs, **Audio Pause** appears in the lower right corner of the screen. After tending to the patient, you can respond to the alarm in the following ways:

- Pause the individual alarm audio and acknowledge the alarm condition.
- Reset all alarms (**Alarm Reset** in Monitor mode only).

Pausing and Acknowledging an Alarm

If you pause the alarm audio and acknowledge the alarm condition, the alarm audio is paused for two minutes. If the same alarm condition occurs again or the alarm condition is still present after two minutes, the alarm audio sounds again.

Ⓢ To pause alarm audio and acknowledge an alarm:

- 1 When the **Audio Pause** appears in the lower right corner of the screen, press the Smart Select knob to pause the alarm audio and view the alarm response menu.
- 2 In the menu, use the Smart Select knob to acknowledge the alarm or you can adjust the alarm limits.

Resetting Alarms (Alarm Reset)

In Monitor mode, the **Alarm Reset** function affects alarms in the following ways:

- For all alarms where the alarm condition is still present, the **Alarm Reset** function removes audio indication of all active alarm conditions, but the visual indications of all active alarm conditions remain.
- For all alarms where the alarm condition is no longer present, the **Alarm Reset** function removes audio and visual indications of the alarms.
- If a new instance of an alarm condition occurs, the audio and visual indications of the alarm occur again, which you can reset or acknowledge as appropriate.

You can access the **Alarm Reset** function in the following ways (remember that this affects all active alarm conditions):

- When an alarm condition occurs and **Audio Pause** appears in the lower right corner of the screen, turn the Smart Select knob to **Alarm Reset** and press the Smart Select knob to confirm.
- Press the Smart Select to view the main menu and use the Smart Select knob to navigate to and select **Alarm Reset**.

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 132. 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.

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 that are inconsistent with their mechanical condition (environmental specifications and electromagnetic compatibility) may cause device malfunction, harm to the user, or harm or death to the patient.

Do not use the Efficia DFM100 in the presence of flammable anesthetics (such as a flammable anesthetic mixture with air, oxygen, or nitrous oxide), flammable agents (such as gasoline), or in an oxygen-rich environment. Use of the device in these environments may cause an explosion hazard.

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 expose the Efficia DFM100 or its accessories to x-ray or strong magnetic fields (MRI).

Allow for settling time if the device has been in extreme temperatures. The time required for the device to warm from -20°C before use is 80 minutes. The time required for the device to cool from 70°C before use is 80 minutes.

Allow the Efficia DFM100 to stabilize within the operating temperature range for 30 minutes prior to operation.

Remove all moisture from the device before use, especially condensation that may occur on or near the electrical ports of the device during storage. Failure to do so may affect device performance or damage the device.

When transporting a patient or carrying the Efficia DFM100, 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 intended positions.

Ensure all device connections that use small-bore connectors (especially those for noninvasive blood pressure) are connected correctly, consistent with ISO 80369 requirements. Misuse or misconnection of small-bore connectors with the device and accessories may cause patient injury from inappropriate delivery of gases or air.

Do not use the USB port to connect to any non-approved USB data drive or other devices, especially near a patient. Failure to do so may result in electric shock.

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.

Do not touch the communication ports and a patient simultaneously.

Defibrillator protection requires use of manufacturer-specified accessories.

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

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

CPR Safety Considerations

WARNINGS: If the Efficia DFM100 is unavailable or inoperable for defibrillation during a cardiac event, perform CPR on the patient immediately.

CPR may cause discomfort, bruising, or tenderness even when performed properly. In rare cases, skin laceration or soft tissue injuries may also occur.

CAUTION: Perform CPR as recommended by the American Heart Association (AHA) and the European Resuscitation Council (ERC) guidelines, in conjunction with your organization's protocol.

ECG Monitoring

This chapter describes the ECG and arrhythmia monitoring functions.

Overview

You can monitor your patient's ECG using the following methods:

- Multifunction electrode pads. If both pads and monitoring electrodes are connected, you can select a lead to monitor from either source.
- 3- or 5-lead ECG monitoring electrode 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.
- External paddles (for quick assessment only, not continuous monitoring).

The Efficia DFM100 uses the Philips ST/AR Algorithm for ECG analysis. The paced status defined for the patient is used as part of the rhythm analysis. If the paced status is not defined, the algorithm uses Paced.

Configurable heart rate and arrhythmia alarms notify you of the patient status.

In Monitor mode, up to three waveforms are shown at one time, depending on your device configuration. For information about the waveform display, see [“Waveform Display”](#) on page 29.

Intended Use Population

ECG monitoring is intended for use on:

- Patients 25 kg (55 lb) or over or those 8 years old or over by using the Adult patient category.
- Patients less than 25 kg (55 lb) or under 8 years old by using the Infant/Child patient category.

Safety Considerations

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.

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

Do not allow conductive parts of the electrodes or associated connectors of applied parts to contact other conductive material, including earth.

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

Do not use external monitoring as an ECG source.

For accurate rhythm analysis, ensure that the patient's paced status is correctly defined.

To prevent misdiagnosis, ensure the appropriate ECG bandwidth filter is used for the patient condition and environment.

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.

CAUTION: Keep electrode wires and cables away from power cords. Line isolation monitor equipment may produce power line transients that may resemble actual cardiac waveforms that inhibit heart rate alarms.

Electrosurgery Considerations

The Efficia DFM100 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.

To help reduce burn hazards associated with a defect in electrosurgical equipment:

- Ensure the electrodes of the ECG lead are properly placed. For information on proper ECG lead placement, see “[ECG Electrode Placement](#)” on page 41.
- Refer to the electrosurgery device’s Instructions for Use.

CAUTIONS: Measurement accuracy may be temporarily decreased while performing electrosurgery or defibrillation. This does not affect patient or equipment safety.

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

Preparing to Monitor ECG

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

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 “[ECG Electrode Placement](#)” on page 41.
- 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 Using Multifunction Electrode Pads

- © To monitor ECG using multifunction electrode pads:
- 1 Prepare the skin. See “[Skin Preparation](#)” on page 40.
 - 2 Ensure that the Therapy cable is connected to the Efficia DFM100. See “[Connecting and Detaching the Therapy Cable](#)” on page 8.
 - 3 Connect the multifunction electrode pads to the Therapy cable. See “[Connecting Multifunction Electrode Pads](#)” on page 9.
 - 4 Apply the multifunction electrode pads to the patient as described on their package or according to your organization’s protocol.

Monitoring ECG Using Electrodes

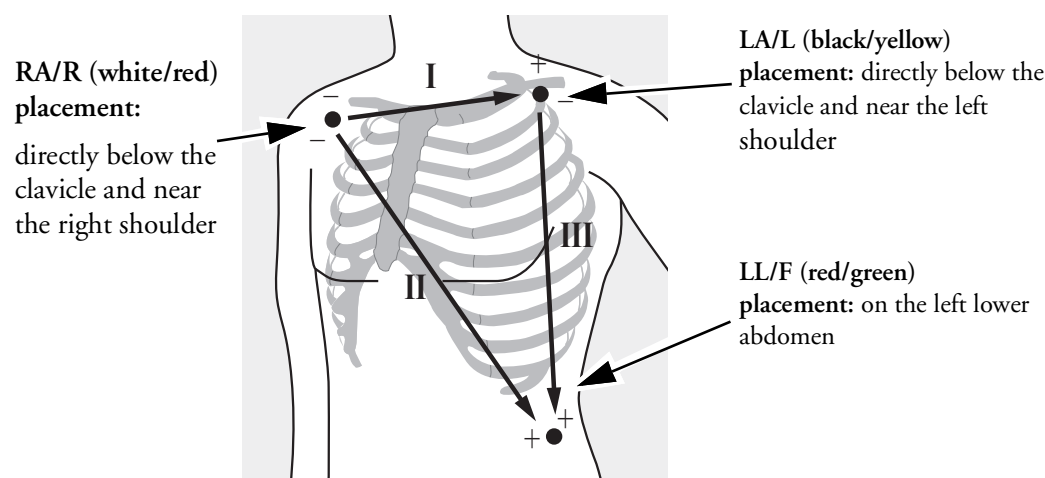
- © To monitor ECG using electrodes:
- 1 Prepare the skin. See “[Skin Preparation](#)” on page 40.
 - 2 Attach the snaps or grabbers to the electrodes before placing the electrodes on the patient.
 - 3 Apply electrodes by peeling them, one at a time, from the protective backing and sticking them firmly 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 “[ECG Electrode Placement](#)” for proper electrode locations.
 - 4 Connect the ECG cable. See “[Connecting the ECG Cable](#)” on page 10.

ECG Electrode Placement

3-Lead ECG Electrode Placement

Figure 27 shows the typical electrode placement for a 3-lead ECG set.

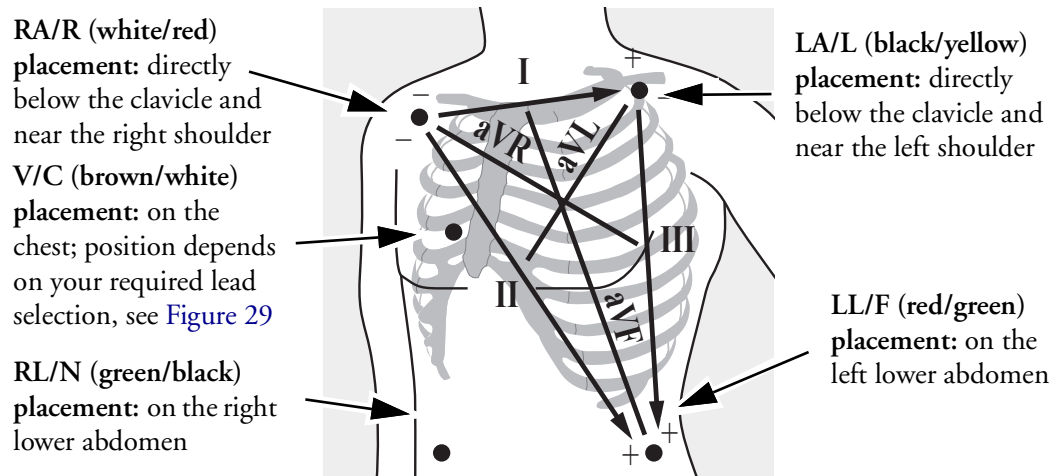
Figure 27 3-Lead ECG Electrode Placement



5-Lead ECG Electrode Placement

Figure 28 shows the typical electrode placement for a 5-lead ECG set.

Figure 28 5-Lead ECG Electrode Placement

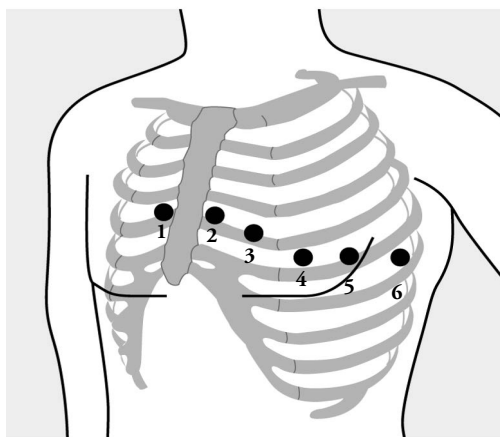


V/C Electrode Placement

The single V/C lead may be placed in any of the precordial electrode positions as shown in Figure 29 (V1/C1 through V6/C6).

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.

Figure 29 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

Locating the Fourth Intercostal Space

For accurate V/C lead placement and measurement, you must properly locate the fourth intercostal space.

☉ To locate the fourth intercostal space:

- 1 Locate the second intercostal space by first palpating 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 Criteria

For a QRS complex to be accurately detected, a suitable lead must be used for monitoring the patient. The following table lists criteria to help you identify a suitable lead for non-paced and paced patients.

For patients with pacemakers, ensure the paced status is set correctly on the Efficia DFM100.

Table 10 Lead Selection Criteria for Non-Paced and Paced Patients

Criteria for Non-Paced Patients	Criteria for 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.	• Ensure the criteria for non-paced patients are met. • Pace pulses must be 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: 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 IEC 60601-2-27 specifications. If the ECG signal is too weak, you may get false alarms for asystole.

Available Lead Choices

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

- For a 3-lead ECG set, the following leads are available: I, II, III.
- For a 5-lead ECG set, the following leads are available: I, II, III, aVR, aVL, aVF, V.

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.

Selecting the Waveform

When you first turn on the device, Wave Sector 1 shows the primary ECG lead:

- For non-AED modes, the primary ECG lead depends on your waves settings.
- For AED mode, Pads is the primary ECG lead. The Lead Select button is inactive.

For information on wave settings, see “[Waves Settings](#)” on page 139. You can change the waveform for each sector during a patient event. For steps to change the waveform in non-AED modes or AED mode, see the following sections.

NOTE: When you first turn on the device, if the default lead is not available or is of poor quality, the device automatically searches for the ECG source and lead with the best quality and displays that new lead in Wave Sector 1 in non-AED modes. The device searches for an active ECG source and lead in the following order: default lead, II, Pads (or Paddles), I, III.

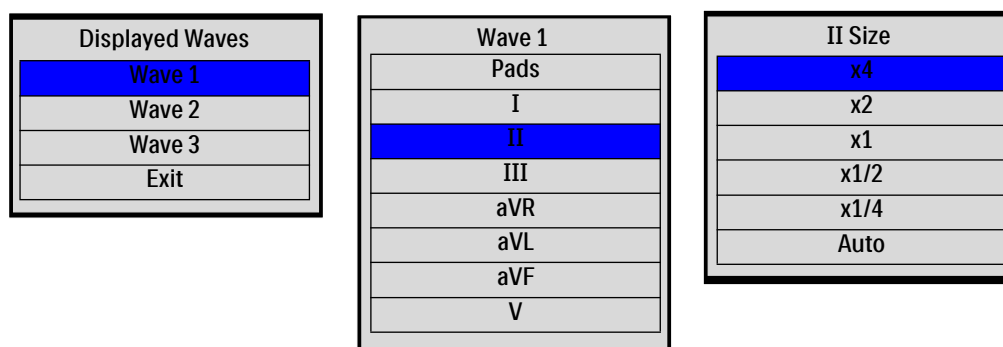
Selecting the Waveform in Non-AED Modes

The ECG wave for Wave Sector 1 is selected through the Lead Select button  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 30](#)).
- 3 Select the wave sector and press the Smart Select knob.
- 4 Select the wave type and press the Smart Select knob.
- 5 If needed, select the appropriate ECG wave size and press the Smart Select knob:
 - 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.

- Selecting the **Auto** size automatically adjusts the ECG size to the maximum size allowed without clipping the wave sector.

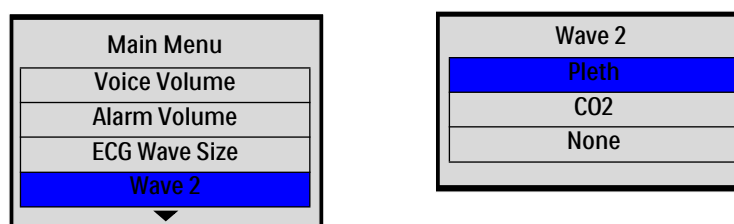
Figure 30 **Wave Menus**

NOTE: 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.

Selecting the Waveform 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 CO₂ and/or SpO₂ 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 31 **Wave 2 Menu in AED mode**

Dashed Line in ECG Display

A dashed line on your ECG display indicates that you have an invalid ECG signal in the wave sector. You can select a different lead using the Lead Select button or Displayed Waves menu. For ECG troubleshooting information, see “ECG Problems” on page 167.

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

Displaying an Annotated ECG

You can 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.

☉ 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

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. Adjusting the ECG wave size on the display does not affect the ECG signal used for 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.

WARNING: 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.

Arrhythmia Beat Labels

Table 11 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.

Table 11 **Arrhythmia Beat Labels (Continued)**

Label	Description	Where Displayed
"	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

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.

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.
- Display an annotated wave to ensure the beat labels are correct.

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. For pacemaker pulse rejection capability, see [Chapter 19 “Specifications”](#) on page 187.

Initiating Arrhythmia Relearning Manually

If the beat detection is not occurring or if beat classification is incorrect and results in a false alarm, initiate manual relearning. If the same signal condition that 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, such as 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.

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.

Alarm messages appear in the HR alarm status area above the HR value. When ECG alarms are off, an **ECG Alarms Off** message appears above the HR value. If you change the patient category, all parameter alarm limits change to the new patient category. These changes are retained when you switch modes.

Table 12 Heart Rate and Arrhythmia Physiological Alarms

Alarm Message	Condition	Type of Alarm
Asystole	No detectable beats for four seconds in the absence of V-Fib.	High priority latching alarm (indicated by a 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 (indicated by a 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 (indicated by a yellow alarm message with alarm tone)
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 13 **Heart Rate and Arrhythmia Technical Alarms**

Alarm Message	Condition	Type of Alarm
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 while the device is charged or charging.	High priority non-latching alarm (indicated by a 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 32 **Basic Mode Arrhythmia Alarm Priority Chain**

For Monitor, Manual Defibrillation, Synchronized Cardioversion and Pacing

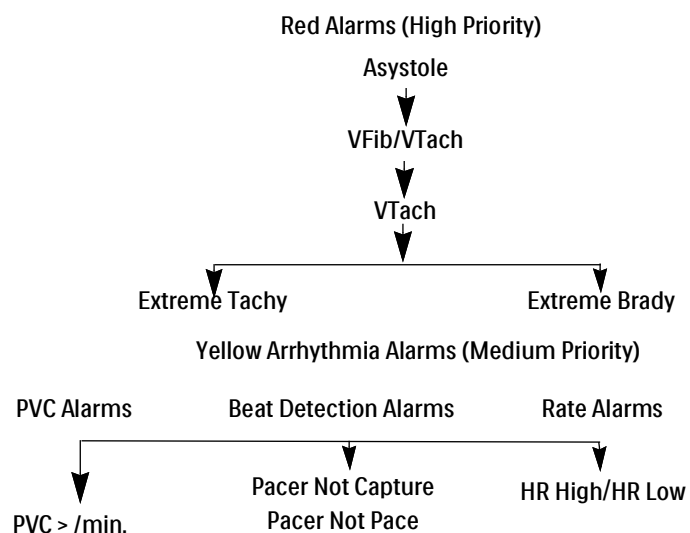
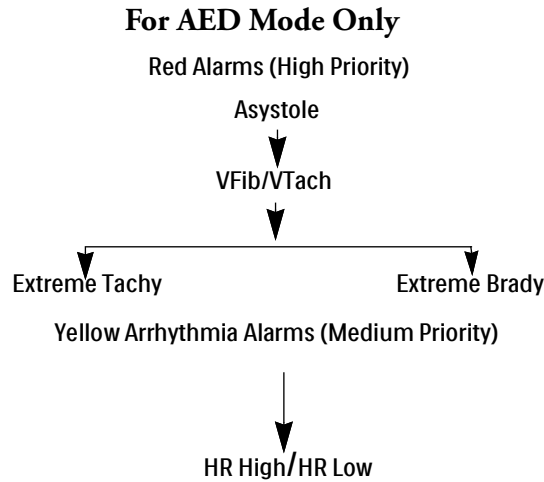


Figure 33 **Cardiotach Mode Arrhythmia Alarm Priority Chain**

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 cannot 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 and Disabling Alarms

- © To enable or 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.

Heart Rate and Arrhythmia Alarms in AED Mode

If alarms are turned on in AED mode, all technical alarms listed in [Table 13 “Heart Rate and Arrhythmia Technical Alarms”](#) on page 50 and the following physiological alarms are generated when the condition exists:

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

Troubleshooting

If your Efficia DFM100 does not operate as expected during ECG and arrhythmia monitoring, see [“ECG Problems”](#) on page 167.

AED Mode

This chapter describes how to use the optional Semi-Automated External Defibrillation (AED) mode of the Efficia DFM100.

Overview

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.

In AED mode, you can also monitor the patient's ECG, SpO₂, pulse, EtCO₂ and AwRR. Certain ECG alarms can also be displayed in AED mode.

Smart Analysis Algorithm

The Efficia DFM100 uses the 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.

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%.
- **Normal Sinus Rhythm:** 99% with LCL of 97%.
- **Asystole:** 95% with LCL of 92%.
- **Other Non-shockable Rhythms:** 95% with LCL of 88%.

Intended Use Population

AED mode and functions are intended for use on:

- Patients 25 kg (55 lb) or over or those 8 years old or over by using the Adult patient category.
- Patients less than 25 kg (55 lb) or under 8 years old by using the Infant/Child patient category.

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

Safety Considerations

WARNING: In patients with cardiac pacemakers that may have erratic spiking problems, 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.

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.

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

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 Mode Display

AED mode displays the following information:

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.

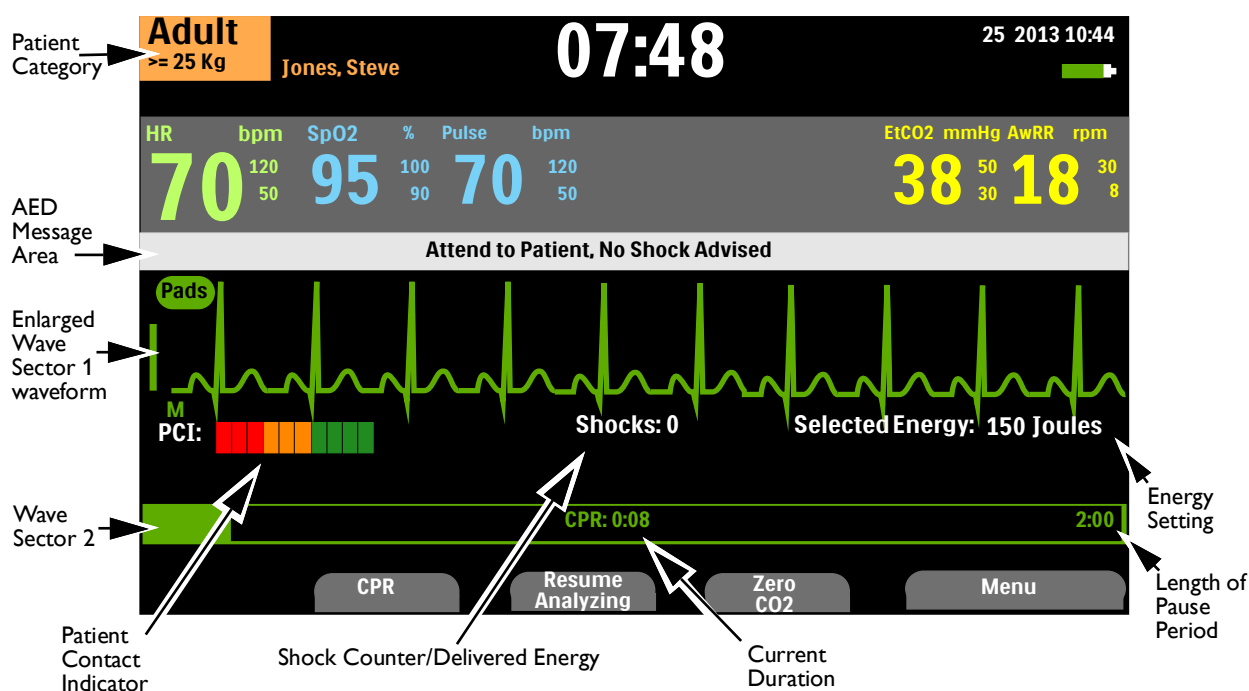
Wave Sector 2: Displays the Capnogram or the SpO₂ waveform depending upon which combinations of options you have configured (see Table 48 on page 140) or the AED Pause/CPR Progress Bar.

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 34 AED Mode Display



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

Using the AED Soft Keys

You can access the following functions by pressing the associated soft key. For an example of the soft key layout in AED mode, see [Figure 34](#).

Table 14 AED Mode Soft Key Functions

AED Mode Soft Key	Description
CPR	Begins the configured pause period to perform CPR.
Resume Analyzing	Resumes the patient analysis for AED use.
Zero CO ₂	Zeros the value of the CO ₂ sensor. Available only if AED CO ₂ monitoring is enabled.
Background Analysis	Begins No Shock Advised (NSA) monitoring. Available only if AED mode is configured for NSA monitoring and you have activated NSA pause.

Accessing the AED Main Menu

Press the Smart Select knob to view the AED main menu.

Table 15 AED Main Menu Options

Menu Option	Description
Voice Volume	Enables you to change the volume of the AED mode voice prompts.
Alarm Volume	Enables you to change the volume of the AED mode alarms.
ECG Wave Size	Enables you to change the ECG wave size. See Figure 30 on page 45.
Wave 2	Enables you to change the wave form shown in wave sector 2.
Measurements/Alarms	Enables you to change measurement alarm limits.
SpO ₂ Off	Enables you to turn off the SpO ₂ parameter. Available only if the SpO ₂ function is configured for AED mode.
EtCO ₂ Off	Enables you to turn off the EtCO ₂ parameter. Available only if the EtCO ₂ function is configured for AED mode.

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

Preparing for AED Use

WARNING: Before using AED mode, ensure the patient is unresponsive and not breathing.

⊙ To prepare for defibrillation in AED mode:

- 1 Expose patient's bare chest. Wipe moisture from the patient's chest and, if necessary, clip or shave excessive chest hair.
- 2 Connect the Therapy cable to the Efficia DFM100 (see ["Connecting and Detaching the Therapy Cable"](#) on page 8).
- 3 Ensure that the multifunction electrode pads are not expired and that the package is not damaged. Discard expired or damaged multifunction electrode pads.

- 4 Remove the multifunction electrode pads from their packaging.
- 5 Insert the multifunction electrode pads connector into the end of the Therapy cable.
- 6 Apply the multifunction electrode pads to the patient as directed on the their packaging or according to your organization's protocol.

Using the AED Function

Ensure the patient is prepared for AED use before using the AED function.

The following table summarizes the steps to use the AED function on a patient.

Table 16 Using the AED Function

Step	Description
1 Enter AED mode and confirm the patient category.	Turn the Therpay knob to AED mode. If necessary, use the Patient Category button to select the appropriate patient category. For more information, see “ Step 1 - Enter AED Mode and Confirm Patient Category ” on page 57.
2 Follow the voice and screen prompts.	For more information, see “ Step 2 - Follow Screen and Voice Prompts ” on page 58.
3 If prompted, press the orange Shock button.	For more information, see “ Step 3 - If Prompted, Press the Shock Button ” on page 59.

NOTES: While 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 CO₂ and/or SpO₂ 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.

Sync is disabled when AED mode is activated and must be turned back on upon returning to Manual Defibrillation mode.

Step 1 - Enter AED Mode and Confirm Patient Category

Turn the Therapy knob to AED. The Efficia DFM100 announces and displays the current patient category.

If necessary, press the Patient Category button  to change the patient category.

WARNING: Ensure you select the correct patient category. If unsure of the patient's age, use your judgment of the patient's weight to select the patient 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.
- If the 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 end the analysis in progress and start 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. 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 (150 J for the adult patient category and 50 J for the infant/child patient 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 140.
 - **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. 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.

Step 3 - If Prompted, Press the Shock Button

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.

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.

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.

NOTE: 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

General Messages

The following general messages can appear in AED mode.

Table 17 **AED Mode Messages**

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.

Connect Pads Messages

The following messages can appear when the Therapy cable is not connected properly to the Efficia DFM100.

Table 18 **Connect Pads Messages**

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.

AED Analysis Messages

The following messages can appear during AED analysis.

Table 19 **AED Mode Analysis Related Messages**

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.

Pads Off Messages

The following messages can appear when the multifunction electrode pads are not secured to the patient.

Table 20 **AED Mode Pads Off Messages**

Audio Message	Display Text	Condition	User Action
“Insert connector firmly. Apply pads to patient’s bare chest.” (long prompt version) “Insert connector firmly. Apply pads.” (short prompt version) “Apply Pads” is repeated four times or until the connection is made.	Insert Connector, Apply Pads	For the Adult patient category, there is no connection between the pads and the Therapy cable.	Securely connect the Therapy cable and the pads connector.
“Insert connector firmly. Look carefully at the screen for Infant/Child pad placement.” “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.”	Insert Connector, Apply Pads	For the Infant/Child patient category, there is no connection between the pads and the Therapy cable. For the Infant/Child patient category, if pads remain disconnected, more audio prompts follow.	Securely connect the Therapy cable and the pads connector.
“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.” “Be sure pads connector is completely inserted.”	Press Pads Firmly	The Therapy cable is connected. A pads off condition still exists.	Securely connect the Therapy cable and the pads connector. Confirm there is a good pads contact with the skin.
“Poor pads contact, Replace pads.”	Poor Pads Contact		Replace the pads.
“Begin CPR.”	Press The CPR Button And Begin CPR		Begin CPR, if indicated.

Marginal Impedance Messages

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

Table 21 **AED Mode Marginal Impedance Messages**

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, 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.

Low Impedance Messages

The following messages can 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.

Table 22 **Low Impedance Messages**

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.

Shock-Related Messages

The following messages can appear when a shock is advised or immediately after a shock is delivered.

Table 23 Shock-Related Messages

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.
"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.

Forced Pause-Related Messages

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

Table 24 **Forced Pause-Related Messages**

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.

Monitoring in AED Mode

You can use AED mode to monitor your patient's ECG, SpO₂, pulse, EtCO₂ 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. If necessary, use the Patient Category button to change the 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 SpO₂ and pulse in AED mode and activate alarms:

- 1 Once in AED mode, attach an SpO₂ sensor to the device and patient.
- 2 If you have the device configured to monitor SpO₂ in AED mode, SpO₂ monitoring begins once a pulsatile reading is obtained.
- 3 To activate SpO₂ and Pulse alarms in AED mode, press the Alarms button on the front of the Efficia DFM100.

© **To monitor optional EtCO₂ and AwRR in AED mode and activate alarms:**

- 1 Once in AED mode, attach an CO₂ sensor to the device and the patient.
- 2 If you have the device configured to monitor CO₂ in AED mode, CO₂ monitoring begins once a reading is obtained.
- 3 To activate CO₂ and AwRR alarms in AED mode, press the Alarms button on the front of the Efficia DFM100.

Configurable AED and CPR Settings

You can configure AED and CPR settings to align with your organization's resuscitation protocols. For more information, see [Table 48 "AED Settings"](#) on page 140 and [Table 49 "CPR Settings"](#) on page 140.

Alarms in AED Mode

AED mode provides AED defibrillation alarms, and, if configured, some ECG, SpO₂, pulse, EtCO₂, and AwRR alarms.

If you change the patient category, all parameter alarm limits change to the new patient category. These changes are retained when you switch modes.

WARNING: To prevent the negligence of alarm conditions that may lead to patient harm or death, ensure that you are aware of all active alarms when changing from a clinical mode to AED mode:

- Some alarms that were active in the prior clinical mode may not be shown in AED mode, even though the alarm condition is still active.
- When changing from AED mode back to a clinical mode, alarms are restored for active alarm conditions.

Defibrillation Alarms in AED Mode

Table 25 **AED Defibrillation Alarms**

Alarm Message	Condition	Type of Alarm
Pads Off	With pads in use, the connection between the device and patient has been lost.	High priority non-latching alarm (indicated by a red alarm message with alarm tone)
Shock Aborted	A shock has been automatically aborted.	High priority latching alarm (indicated by a red alarm message with alarm tone)
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.	

ECG Alarms in AED Mode

If ECG alarms are turned on in AED mode, all technical alarms listed in [Table 13 “Heart Rate and Arrhythmia Technical Alarms”](#) on page 50 and the following physiological alarms 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 value. There are both audio and visual alerts. For more information on ECG alarms, see [“Arrhythmia Monitoring”](#) on page 46.

SpO₂ and Pulse Alarms in AED Mode

If SpO₂ and pulse alarms are turned on, the alarm messages appear in the SpO₂ or pulse status area above their respective values. For more information, see [“SpO₂ Alarms”](#) on page 103 and [“Pulse Rate Alarms”](#) on page 105.

CO₂ and AwRR Alarms in AED Mode

If EtCO₂ or AwRR alarms are turned on, the alarm messages appear in their respective status areas above the value. For more information, see [“EtCO₂ and AwRR Alarms”](#) on page 93.

Troubleshooting

If your Efficia DFM100 does not operate as expected in AED mode, see [“Defibrillation and Pacing Problems”](#) on page 170.

Manual Defibrillation

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

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.

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.

Intended Use Population

Manual defibrillation is intended for use on:

- Patients 25 kg (55 lb) or over or those 8 years old or over by using the Adult patient category.
- Patients less than 25 kg (55 lb) or under 8 years old by using the Infant/Child patient category.

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

Use only pads that are approved for use with the Efficia DFM100. Use of non-approved pads could affect performance and results.

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

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.

Leads Off Sensing and PCI Sensing for Pads/Paddles: Apply 500 nA rms (571 Hz); 200uA rms (32 kHz).

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 35](#)). 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.

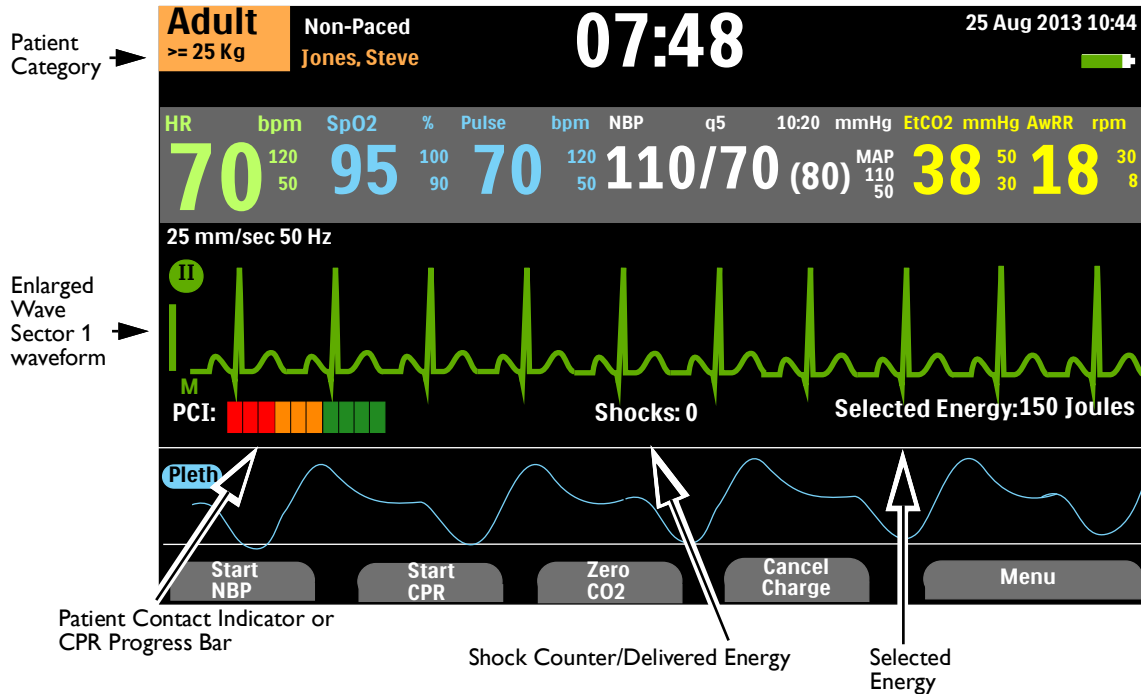
Wave Sector 2: Displays the currently configured waveform. If Cascade is selected, depending on the ECG size, parts of the wave may be clipped due to the smaller sector size.

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 35 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 40.
- 2 Connect the appropriate therapy cable. See ["Connecting and Detaching the Therapy Cable"](#) on page 8.
- 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 Ensure that the Therapy cable is connected to the Efficia DFM100. See ["Connecting and Detaching the Therapy Cable"](#) on page 8.
- 2 Connect the multifunction electrode pads to the Therapy cable. See ["Connecting Multifunction Electrode Pads"](#) on page 9.
- 3 Apply the multifunction electrode pads to the patient as described on their package or according to your organization's protocol.

WARNING: Ensure adhesive pads on the patient are at least 8 cm (3 inches) away from an implantable cardiac device. If necessary, use an alternative position, such as anterior-later or posterior-anterior. Failure to do so may damage the implantable cardiac device during defibrillation.

- 4 Follow the defibrillation steps in ["Defibrillation"](#) on page 71.

Using External Paddles

WARNING: Ensure you select the correct patient category. If unsure of the patient's age, use your judgment of the patient's weight to select the patient category.

⊙ **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).

WARNING: Do not apply external paddles to an open wound or recent incision site.

- 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.

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 71.

Viewing an ECG and Heart Rate with External Paddles (Quick Look)

You can use external paddles for a quick look to assess the adult or infant/child patient's ECG rhythm and heart rate. If necessary, you can then deliver therapy. Use this method only when multifunction pads and monitoring electrodes are not immediately available.

⊙ **To view a patient's ECG and heart rate 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 and heart rate on the display.

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

Using Infant Paddles

The Efficia DFM100 external paddles include infant paddles. American Heart Association (AHA) 2010 guidelines recommend using 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 Access the infant paddles. See [“Accessing Infant Paddles”](#) on page 13.

- 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 70.
- 4 Follow the defibrillation steps in [“Defibrillation”](#) on page 71.

Using Internal Paddles

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

© **To set up for defibrillating using internal paddles:**

- 1 Select the appropriate paddle electrode size.
- 2 Connect the paddles cable to the Efficia DFM100. See [“Connecting and Detaching the Therapy Cable”](#) on page 8.
- 3 Follow the defibrillation steps in [“Defibrillation”](#) on page 71.

Defibrillation

Defibrillation has three basic steps: select the defibrillation energy, charge the defibrillator, and shock the patient.

WARNINGS: For manual defibrillation of infant/child patients, follow your organization's policy. Guidelines are 2 to 4 J/kg for the first shock and 4 J/kg for each subsequent shock.

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

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.

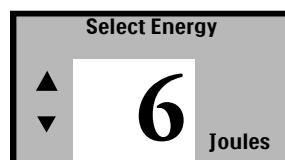
Select the Defibrillation Energy

Turn the Therapy knob to the appropriate energy level for the patient. The recommended energy dose for adult patients is 150 J. Follow your organization's guidelines for infant/child patients. The selected energy is also shown on the screen.

If you turn the Therapy knob to 1-10, the **Select Energy** menu appears on the screen:

- To change the individual joule setting in the **Select Energy** menu, turn and press Smart Select knob.
- To access the **Select Energy** menu from the main menu while the Therapy knob is on 1-10, press the Smart Select knob, select **Energy 1-10 Joules**, and press the Smart Select knob again.

Figure 36 **Select Energy Menu**



WARNINGS: Defibrillation may cause myocardial injury to the patient.

The energy from cumulative shocks may harm the patient. Follow your organization's protocol for selecting defibrillation energy and delivering shocks.

Defibrillation therapy may affect the performance of a patient's implantable cardiac device. Refer to the manufacturer's guidelines for the implantable cardiac device.

Charge the Defibrillator

Press the **Charge** button on the front panel. 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. The device emits a continuous low-pitch charging tone until the selected energy level is reached and then changes to a continuous high-pitch charged tone.

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

If you need to cancel the charge, press the **[Cancel Charge]** soft key. If the **Shock** button has not been pressed within the time period specified in the **Time to Auto Disarm** configuration setting, the device automatically cancels the charge.

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

Shock the Patient

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

After a successfully delivered shock, **Begin CPR** is announced and shown on the screen.

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

NOTES: Defibrillation therapy may cause minor skin burns on the patient underneath the applied paddles or multifunction electrode pads.

Electrodes, multifunction electrode pads, and external paddles may cause skin irritation on the patient. If this occurs, contact medical staff.

Defibrillation therapy may cause patient discomfort or muscle contractions.

Defibrillation therapy with external paddles may cause patient discomfort, bruising, or tenderness.

Manual Defibrillation Alarms

Defibrillation alarms can be generated for the conditions shown in [Table 26](#). There are both audio and visual alerts when activated by the Alarms button. If you change patient categories, all parameter alarm limits change to the new patient category. These changes are retained when you switch modes.

Table 26 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 170.

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

NOTES

[illegible]

Synchronized Cardioversion

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

For information about asynchronized cardioversion, see [Chapter 6 “Manual Defibrillation”](#) on page 67.

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.
 - The best quality source for cardioversion is a 3 or 5-Lead set connected to the Efficia DFM100. Use only approved lead sets with the Efficia DFM100. Failure to do so may introduce noise and result in intermittent **Cannot Analyze ECG** messages.
- 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.

Cardioversion is delivered through pads or paddles, regardless of your monitoring source.

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.

Intended Use Population

Synchronized cardioversion is intended for use on:

- Patients 25 kg (55 lb) or over or those 8 years old or over by using the Adult patient category.
- Patients less than 25 kg (55 lb) or under 8 years old by using the Infant/Child patient category.

Safety Considerations for Cardioversion

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

Ensure the Sync function is off when not intending to perform synchronized cardioversion. Incorrect use of the Sync function may cause patient harm or death.

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.

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.

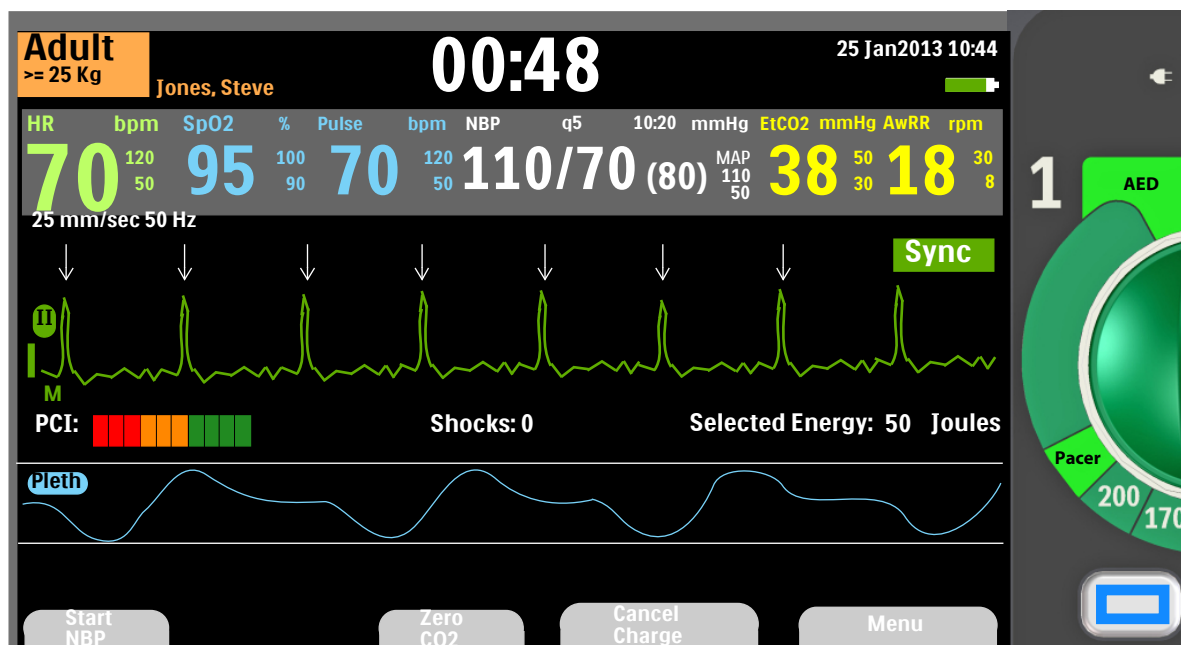
Medical electrical equipment which does not incorporate defibrillator protection should be disconnected during defibrillation.

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

The R-Wave arrows indicate which R-Wave a shock would be triggered on if the Shock button is pressed.

Figure 37 Code View With Sync Layout



Preparing for Synchronized Cardioversion

◎ To prepare for synchronized cardioversion:

- 1 Perform tasks as described in “Preparing for Defibrillation” on page 69.

- 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 Criteria” on page 43).
- 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 78.

Delivering a Synchronized Shock

WARNING: Ensure you select the correct patient category. If unsure of the patient’s age, use your judgment of the patient’s weight to select the patient category.

© **To perform synchronized cardioversion:**

- 1 Turn the Therapy knob to the appropriate energy setting.
- 2 Press the Sync button.
- 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: You should not use external paddles as your monitoring lead in Wave Sector 1. Artifacts 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.

WARNING: Do not apply external paddles to an open wound or recent incision site.

- 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 77.

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 27](#). 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.

Table 27 **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 170.

NOTES

[illegible]

Pacing

This chapter describes the noninvasive transcutaneous pacing function.

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 annotated using the Mark Event button.

Intended Use Population

The noninvasive transcutaneous pacing function is intended for use on:

- Patients 25 kg (55 lb) or over or those 8 years old or over by using the Adult patient category.
- Patients less than 25 kg (55 lb) or under 8 years old by using the Infant/Child patient category.

Safety Considerations

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

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

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

NOTES: Pacing therapy may cause minor skin burns on the patient underneath the applied multifunction electrode pads.

Pacing therapy may cause patient discomfort or muscle contractions.

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.

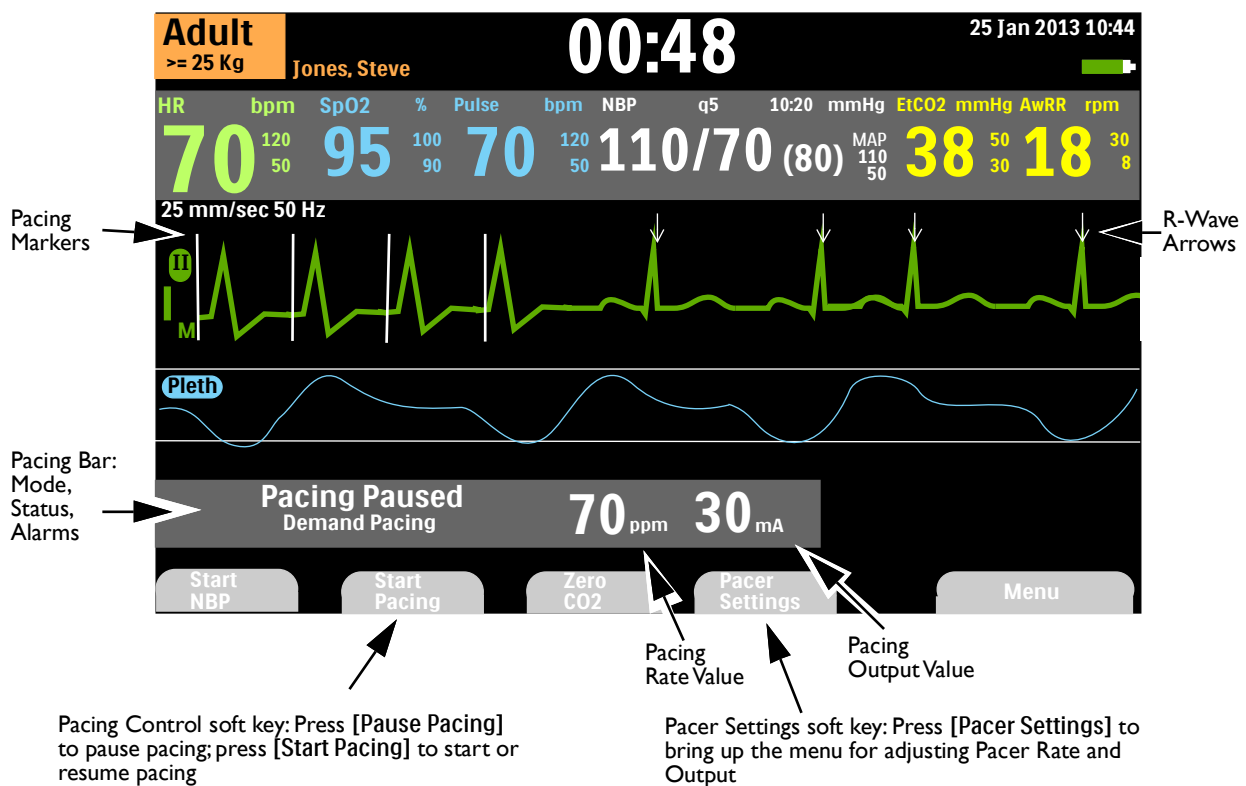
Pacing stops if you leave Pacer mode. It must be restarted manually.

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 38](#)). 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 87.
- **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 38 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.

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.

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.

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 Ensure that the Therapy cable is connected to the Efficia DFM100. See [“Connecting and Detaching the Therapy Cable”](#) on page 8.
- 2 Prepare the patient's skin to improve skin contact. See [“Skin Preparation”](#) on page 40.
- 3 Connect the multifunction electrode pads to Therapy cable. See [“Connecting Multifunction Electrode Pads”](#) on page 9.
- 4 If pacing in Demand mode, apply monitoring electrodes (see [“ECG Electrode Placement”](#) on page 41) and connect the ECG cable to the Efficia DFM100 (see [“Connecting the ECG Cable”](#) on page 10).

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 141.

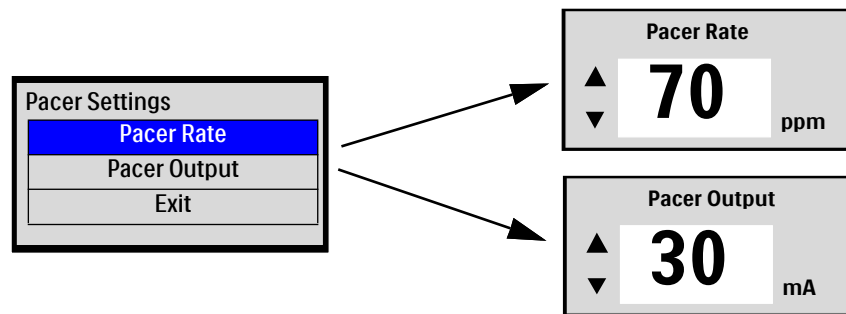
Demand Mode Pacing

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.

🎯 To pace in Demand mode:

- 1 Turn the Therapy knob to the Pacer position. Note the following:
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. Note the following:
 - If the configured lead is Pads, Lead II or the first available monitoring lead is displayed automatically.
 - If you change the lead in Wave Sector 1, a Cannot Analyze ECG alarm is generated shortly after your change.
- 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.
 - If you are using anterior-anterior pad placement while pacing and are experiencing difficulty for Lead II, select another lead.
- 4 Press the [Pacer Settings] soft key and then select **Pacer Rate** from the menu.
- 5 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.

Figure 39 Adjusting Pacer Rate and Output



NOTE: If you want to cancel a selected action, press the [Cancel] soft key.

- 6 Press [Start Pacing]. Pacing appears in the Pacing Bar.
- 7 Verify white pacing markers or white R-Wave arrows appear on the ECG waveform.
- 8 Press the [Pacer Settings] soft key, and then select **Pacer Output**.
- 9 Turn 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.
- 10 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.
- 11 Assess the patient for a peripheral pulse.
- 12 To stop pacing, do one of the following:
 - 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.
 - 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.

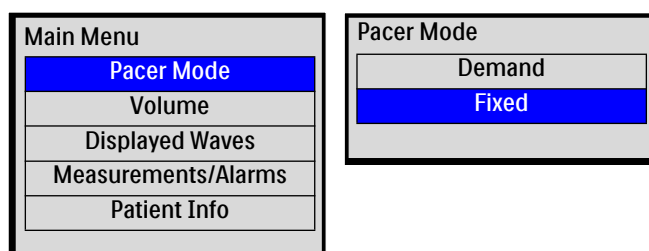
The [Start Pacing] soft key is grayed out for Demand mode pacing until a leads-on condition is detected for the ECG lead used for R-Wave detection and the pads-on condition is detected. In Fixed mode, the soft key is grayed out until pads are detected.

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 40.
 - 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 40 **Fixed Pacer Mode**



- 3 Press the Lead Select button to select the desired lead for viewing:

NOTE: If you want to view the ECG waveform and related parameters while pacing, you must have ECG electrodes on the patient with pads. Viewing Pads in Wave Sector 1 while pacing may give you an incorrect heart rate and inappropriate alarms.

- 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.
- 10 To stop pacing, do one of the following:
 - 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.
 - 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 or AED mode. 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 84 or “[Fixed Mode Pacing](#)” on page 86. 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 28](#). Once generated, they appear as alarm messages in the Pacer Bar. There are both audio and visual alerts. If you switch patient categories, all parameter alarm limits change to the new patient category. These changes are retained when you switch modes.

Table 28 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 170.

Monitoring EtCO₂

This chapter describes how to monitor carbon dioxide (CO₂), end-tidal carbon dioxide (EtCO₂) and Airway Respiration Rate (AwRR).

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 (EtCO₂) is derived.

EtCO₂ is the peak CO₂ value measured during expiration. It is used to monitor the patient's respiratory status. The EtCO₂ measurement uses a technique based on the absorption of infrared radiation by some gases. It indicates the change in:

- The elimination of CO₂.
- The delivery of O₂ to the lungs.

The CO₂ monitoring function of the Efficia DFM100 provides an EtCO₂ value, a CO₂ waveform (Capnogram), and an airway respiration rate (AwRR). The AwRR relies on CO₂ functionality to identify valid breaths for numeric display and alarm conditions such as Apnea.

CO₂ monitoring is available in AED, Monitor, Pacer and Manual Defib modes.

Intended Use Population

The end-tidal carbon dioxide (EtCO₂) function is intended for use on:

- Patients 25 kg (55 lb) or over or those 8 years old or over by using the Adult patient category.
- Patients less than 25 kg (55 lb) or under 8 years old by using the Infant/Child patient category.

The neonate (a child within 4 weeks of birth) patient category is not supported.

Safety Considerations for Measuring EtCO₂

WARNINGS: The EtCO₂ readings do not always correlate closely with blood gas values, especially in patients with pulmonary disease, a pulmonary embolism or inappropriate ventilation.

EtCO₂ and AwRR measurements may be inaccurate when the CO₂ 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 EtCO₂.

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.

CO₂ measurements may be inaccurate when measured in the presence of aerosolized pharmaceuticals or anesthetic gases.

The Sidestream CO₂ 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 EtCO₂ values may be significantly low.

When using the Sidestream CO₂ measurement on patients who are receiving or have recently received anesthetics, connect exhaust tubing from the CO₂ 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 CO₂ 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.

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.

Do not allow the patient accessory or water filter assembly to become fully filled with fluid; it can be a hazard. Follow your organization's policy for regular and proper disposal of accumulated fluids.

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 EtCO₂. 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 EtCO₂

Sensors

There are two sensors that can be used with the Efficia DFM100 to measure EtCO₂:

- Mainstream
- Sidestream

Figure 41 EtCO₂ 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:

- Type of patient: adult or infant/child (neonate is not supported).
- Airway status of the patient: ventilated or not ventilated.
- For a ventilated patient: humidified or non-humidified ventilation.

WARNING: Use only accessories listed in the supplies chapter to ensure correct functioning of the CO₂ measurement.

CAUTIONS: Do not reuse, clean, or sterilize single-use CO₂ accessories. Reuse may cause a risk of contamination and affect measurement accuracy.

Clean reusable accessories according to the manufacturer's recommendations.

Monitoring EtCO₂

☉ To monitor EtCO₂:

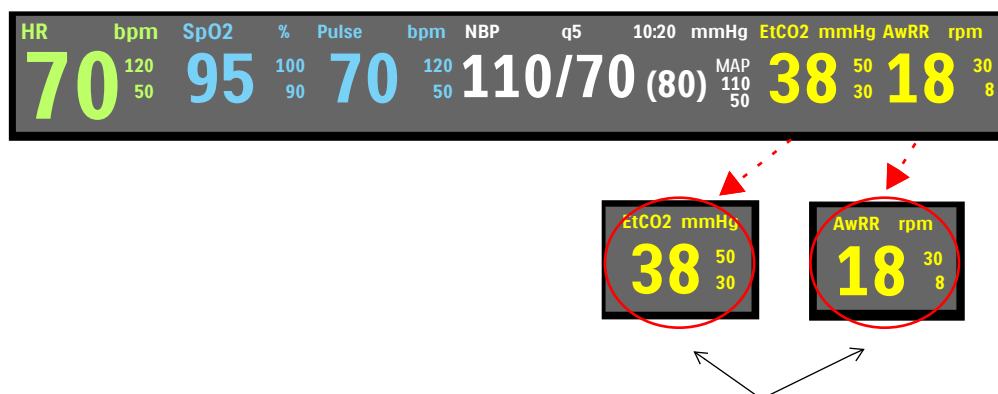
- 1 Connect the sensor to the Efficia DFM100 and the sampling line to the sensor (see “Connecting the CO₂ Cable and Sample Line” on page 11).
- 2 Apply the sampling line to the patient.
- 3 If the Efficia DFM100 is not turned on, turn the Therapy knob to a clinical mode.
 - EtCO₂ needs to be configured to appear in AED mode.
- 4 Check that the patient category is appropriate for the patient. If necessary, press the Patient Category button to change the patient category. See “General Function Buttons” on page 24.

The EtCO₂ measurement automatically turns on when you connect a sensor to the CO₂ port. The Capnogram is displayed in the configured Wave Sector if available. The measurement values for EtCO₂ 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 42 EtCO₂ 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 EtCO₂ 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 EtCO₂ readings. Even with combined nasal oral cannulas, the EtCO₂ 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 EtCO₂ measurement in the parameter bar.

EtCO₂ and AwRR Alarms

EtCO₂ alarms can be generated for the conditions shown in Table 29 and Table 30. Alarms behave the same regardless of which sensor is attached to the Efficia DFM100. Alarms are configurable.

Alarm messages appear in the EtCO₂ alarm status area above the numerics. There are both audio and visual alarms:

- EtCO₂ and AwRR alarms are on (except in 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.
- If you change the patient category, all parameter alarm limits change to the new patient category. These changes are retained when you switch modes.

WARNING: Turning off alarms prevents all alarms associated with EtCO₂ or AwRR measurements from annunciating. If an alarm condition occurs, no alarm indication will be given.

Table 29 **EtCO₂ 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
EtCO ₂ High	The EtCO ₂ value exceeds the high alarm limit.	Medium Priority, Latching Configurable Alarm	Yellow alarm message with audio tone
EtCO ₂ 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 30 **EtCO₂ Technical Alarms**

Alarm Message	Condition	Type of Alarm	Indication
CO ₂ Replace Sensor	CO ₂ sensor has reached its end of service life.	High Priority Non-Latching Alarm	Red alarm message with audio tone.
CO ₂ Sensor Over Temp	CO ₂ sensor is reporting an over temperature condition.		
CO ₂ Service Required	CO ₂ sensor requires service.		
CO ₂ Communication Failure	CO ₂ sensor is connected but the Efficia DFM100 cannot communicate with it.		

Table 30 **EtCO₂ Technical Alarms (Continued)**

Alarm Message	Condition	Type of Alarm	Indication
CO ₂ Zero Required	CO ₂ sensor needs to be zeroed.	Low Priority Non-Latching Alarm	Cyan alarm message with audio tone.
CO ₂ Sensor Warming Up	CO ₂ sensor has not warmed up to operating temperature range.		
CO ₂ Check Line	The sampling line is kinked or blocked. For Sidestream only.		
CO ₂ Check Airway Adapter	The airway adapter is blocked. For Mainstream only.		
CO ₂ Error	A non-critical failure has been detected.		
CO ₂ Out of Range	CO ₂ is out of range. A Zero Required prompt appears after one minute.		
CO ₂ Tube Unplugged	Sampling line is disconnected.		
CO ₂ Sensor Unplugged	CO ₂ sensor is unplugged.		
EtCO ₂ Power Overload	CO ₂ sensor has a power problem.		

Changing the EtCO₂ Alarm Limits

⊙ To change the EtCO₂ 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 and Disabling the EtCO₂ Alarms

⊙ To enable or disable the EtCO₂ 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 and 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 CO₂ Sensors

To avoid inaccurate readings, Sidestream and Mainstream CO₂ Sensors need to be reset and require a valid zero be performed when:

- For Sidestream CO₂ Sensors, attaching a new sample line
- There has been a significant change in environmental conditions
- The accuracy of the reading is questionable
- Requested by the Efficia DFM100

NOTES: Do not zero a Sidestream CO₂ Sensor without a sample line attached.

Wait 20 seconds after removing the sample line from the patient's airway before zeroing the CO₂ sensor, so any lingering CO₂ in the line can dissipate.

Keep the sample line away from all sources of CO₂, including exhaled breaths (yours and the patient's) and ventilator exhaust.

During zeroing, EtCO₂ 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 CO₂ sensor using the soft key:

- 1 Confirm the Efficia DFM100 is in a clinical mode.
- 2 Press the [Zero CO₂] soft key.
- 3 The C02 Zero in Progress message appears on the display. The message disappears when zeroing is finished.

Zeroing Using the Smart Select knob

☉ To zero the CO₂ 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 C02 Zero in Progress message appears on the display. The message disappears when zeroing is finished.

See [Table 31](#) for messages which might appear during zeroing.

Table 31 **Zeroing Messages**

Message	Situation	Possible Solution
C02 Zero in Progress	The CO ₂ sensor is being zeroed.	No action required.
Unable to zero: C02 in the Tube	There is CO ₂ in the sample line.	If patient is not breathing into the tube, zero again.
Unable to zero: C02 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 EtCO₂ Monitoring Function

To disable the EtCO₂ monitoring function, disconnect the sensor's cable from the Efficia DFM100. The message **C02 Sensor Unplugged - Turn Off EtC02?** appears. Select **Yes** and press the Smart Select knob.

Should the sensor and cable be disconnected accidentally, the message **C02 Sensor Unplugged - Turn Off EtC02?** appears to notify you of the disconnection. Select **No** and press the Smart Select knob. Secure the connection. The CO₂ monitoring function is enabled again.

Troubleshooting

If your Efficia DFM100 does not operate as expected during CO₂ Monitoring, see [Table 63 "EtCO2 Problems"](#) on page 174.

NOTES

[illegible]

Monitoring SpO₂

This chapter describes how to monitor pulse oximetry SpO₂.

Overview

Pulse oximetry is a noninvasive method of continuously measuring functional oxygen saturation (SpO₂) in arterial blood. SpO₂ readings indicate the percentage of hemoglobin molecules in arterial blood which are saturated with oxygen.

You can monitor SpO₂ in all Efficia DFM100 clinical modes.

Intended Use Population

Pulse Oximetry (SpO₂) functions are intended for use on:

- Patients 25 kg (55 lb) or over or those 8 years old or over by using the Adult patient category.
- Patients less than 25 kg (55 lb) or under 8 years old by using the Infant/Child patient category.

The neonate (a child within 4 weeks of birth) patient category is not supported.

Safety Considerations

The following safety considerations apply when using SpO₂ functions of the Efficia DFM100:

WARNINGS: Verify the compatibility of the monitor, sensor, and cable before use. Otherwise, patient injury may result.

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

Do not leave an SpO₂ sensor on a patient undergoing an MRI.

Ensure the SpO₂ probe is properly applied without excessive pressure. A probe that is misapplied with excessive pressure or for prolonged time may cause skin irritation, such as reddening, blistering, or burns.

SpO₂ Measurement Accuracy

The following considerations apply to SpO₂ measurement accuracy:

CAUTIONS: For accurate SpO₂ measurements, ensure the following conditions are met:

- 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, including when the patient is being transported in a moving vehicle.
- The sensor cable and connector should be positioned away from power cables to avoid electrical interference.

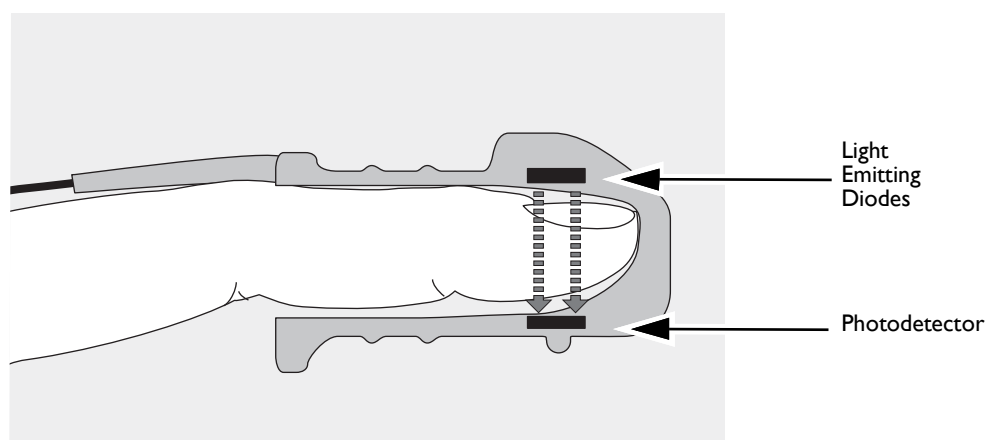
Do not rely solely on SpO₂ readings; assess the patient at all times. SpO₂ measurements may be unable to occur or inaccurate when the patient has any of the following:

- Significant levels of intravascular dyshemoglobins, such as carboxyhemoglobin or methemoglobin in patient.
- Other disorders of hemoglobin.
- Poor circulation or restricted blood flow to the extremities (such as patients with 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.
- Are receiving a photosensitive drug or vasoconstrictor medications.
- Incorrectly used or applied sensor.

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 43](#).

Figure 43 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 SpO₂ value and wave are displayed.

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.

SpO₂ 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.

CAUTION: Do not use more than one extension cable.

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: 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 SpO₂

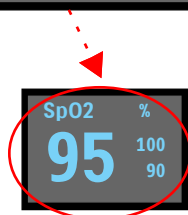
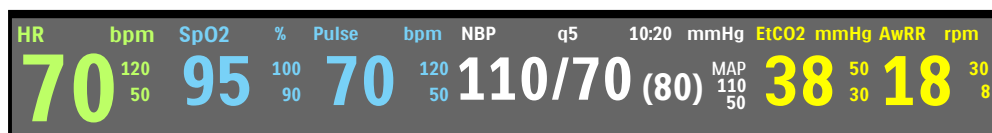
© To monitor SpO₂:

- 1 Connect the appropriate sensor cable to the Efficia DFM100 (see [“Connecting the SpO₂ Cable”](#) on page 11).
- 2 Apply the sensor to the patient.

- 3 If the Efficia DFM100 is not turned on, turn the Therapy knob to a clinical mode.
SpO₂ 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 24.

Once the sensor cable is connected and the device is turned on, an SpO₂ measurement begins. A -?- is displayed for the SpO₂ 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 44.

Figure 44 SpO₂ Value

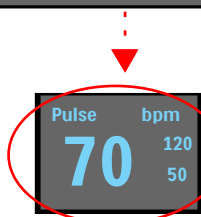
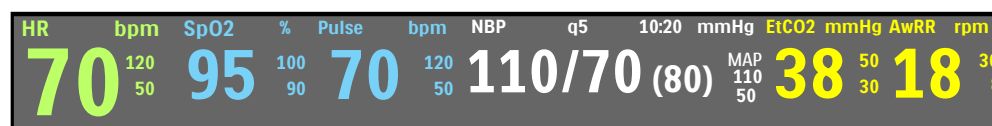


Alarm Limits - If SpO₂ alarms are turned on, the alarm limits are displayed. If alarm limits are turned off, the alarms off symbol ✕ is displayed.

Pulse Rate

The patient's pulse rate, as derived from pulse oximetry, is displayed in the Parameter Area. See Figure 45.

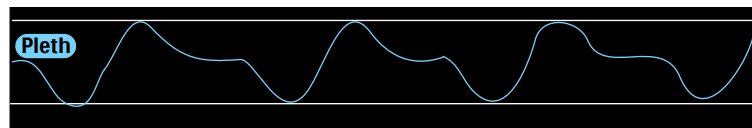
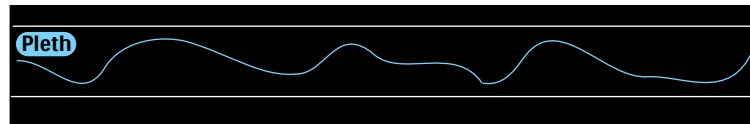
Figure 45 Pulse Rate Value



Alarm Limits - If pulse rate alarms are turned on, the alarm limits are displayed. If alarm limits are turned off, the alarms off symbol ✕ is displayed. Pulse alarms are off by default.

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. The pleth wave is non-normalized.

Figure 46 **Pleth Waves****Good Pleth Signal Quality****Poor Pleth Signal Quality**

SpO₂ Alarms

SpO₂ alarms can be generated for the conditions shown in Tables 32 and 33. Once generated, they appear as alarm messages in the SpO₂ alarm status area above the SpO₂ value. There are both audio and visual alarms. If you change the patient category, all parameter alarm limits change to the new patient category. These changes are retained when you switch modes.

SpO₂ 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. Alarms are configurable.

While an NBP measurement is in progress, SpO₂ alarms are suppressed.

Table 32 **SpO₂ 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 33 SpO₂ 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.		

SpO₂ Desat Alarm

The SpO₂ 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.

If the SpO₂ Low Limit alarm value is set below the configured SpO₂ Desat Limit, the Desat Limit is automatically adjusted to the SpO₂ Low Limit value. Should the SpO₂ reading fall below this value, the SpO₂ Desat Limit Alarm is announced.

Changing SpO₂ Alarm Limits

© To change the SpO₂ 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 and Disabling SpO₂ Alarms

☉ To enable or disable SpO₂ 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 SpO₂ 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 SpO₂ 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 34](#). 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 32.

Table 34 **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 and Disabling Pulse Rate Alarms

☉ To enable or 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 SpO₂ Monitoring

© To disable SpO₂ monitoring:

- 1 Disconnect the sensor cable from the SpO₂ 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 SpO₂ 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 SpO₂ Monitoring, see [Table 62 “SpO2 Problems”](#) on page 172.

Monitoring NBP

This chapter describes how to monitor noninvasive blood pressure (NBP).

Overview

Noninvasive blood pressure (NBP) is measured with a NBP meter, also known as a blood pressure monitor, a sphygmomanometer, or blood pressure gauge. The meter uses an inflatable cuff to collapse the artery and then release it under the cuff. This measures the pressure at which blood flow is starting and at which pressure blood flow is unimpeded. The DFM100 uses a mechanical manometer to measure at which pressure blood flow is starting and at which pressure it is unimpeded.

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.

Intended Use Population

The noninvasive blood pressure (NBP) function is intended for use on:

- Patients 25 kg (55 lb) or over or those 8 years old or over by using the Adult patient category.
- Patients less than 25 kg (55 lb) or under 8 years old by using the Infant/Child patient category.

The neonate (a child within 4 weeks of birth) patient category is not supported.

Safety Considerations for NBP

The following safety considerations apply when using the noninvasive blood pressure (NBP) functions of the Efficia DFM100. When using NBP functions, use your clinical judgment on appropriate application for the patient's clinical status.

-
- WARNINGS:**
- Do not perform NBP monitoring on patients whose upper arm circumference is less than 13 cm. Doing so may result in inaccurate measurements.
 - 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 soft key 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 judgment 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 injure the patient if 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 judgment to decide whether the benefit of the measurement outweighs the risk.

-
- CAUTIONS:**
- Noninvasive blood pressure measurements may be unable to occur or be inaccurate in the following patient circumstances:
 - Regular arterial pressure pulse is hard to detect.
 - Rapid blood pressure changes.
 - Cardiac arrhythmias.
 - Severe shock or hypothermia that reduces blood flow.
 - Excessive and continuous movement, such as shivering or convulsions.
 - Layers of fat on the limb from obesity dampens the oscillations coming from the artery.
 - Excessive motion or vibration is present, such as when the patient is being transported in a moving vehicle.
 - The cuff is the incorrect size or improperly fitted for the patient.
 - Pressure tubes are compressed or restricted.
 - Pressurization of the cuff can temporarily cause loss of function of simultaneously used monitoring medical equipment on the same limb.
 - Usage of a blood pressure cuff for noninvasive blood pressure (NBP) monitoring may cause minor skin irritation or bruising.
 - The effectiveness of this sphygmomanometer has not been established in pregnant (including pre-eclamptic) patients.
 - If a spill occurs and liquid appears inside the tubing, contact your service personnel.
-

Measuring NBP

Review the “[Safety Considerations for NBP](#)” on page 107 before measuring noninvasive blood pressure.

The cuff's initial inflation pressure and NBP overpressure safety limit are different based on the patient category:

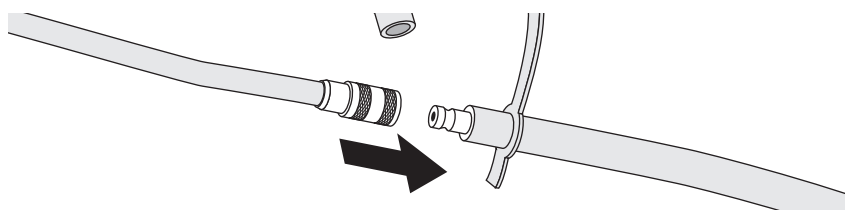
- For an adult, the cuff's initial inflation pressure is 160 mmHg $\pm$ 10 mmHg (21.3 kPa $\pm$ 1.3 kPa). The NBP overpressure safety limit is 290 mmHg $\pm$ 10 mmHg (38.7 kPa $\pm$ 1.3 kPa). If the cuff pressure exceeds the NBP overpressure safety limit, the device aborts the measurement, deflates the cuff, and generates the NBP Cuff Overpressure alarm. If you receive the NBP Cuff Overpressure alarm, measure the patient's blood pressure manually.
- For an infant/child, the cuff's initial inflation pressure is 120 mmHg $\pm$ 10 mmHg (16 kPa $\pm$ 1.3 kPa). The NBP overpressure safety limit is 145 mmHg $\pm$ 5 mmHg (19.3 kPa $\pm$ 0.7 kPa). If the cuff pressure exceeds the NBP overpressure safety limit, the device aborts the measurement, deflates the cuff, and generates the NBP Cuff Overpressure alarm. If you receive the NBP Cuff Overpressure alarm, measure the patient's blood pressure manually.
- The NBP function is not intended for use on neonates (a child within four weeks of birth).

NOTE: For infant/child 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 IEC 80601-2-30 (mean error difference of ± 5 mmHg or less, standard deviation of 8 mmHg or less).

© To measure NBP:

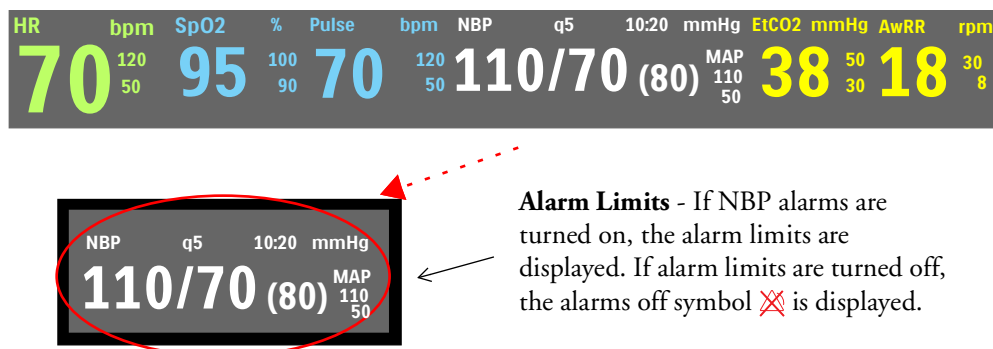
- 1 Select the appropriately sized cuff for the patient. The cuff width should be either 40% of the limb circumference or 2/3 of the upper arm length. The inflatable part of the cuff should be long enough to encircle 50-80% of the limb.
- 2 Securely attach the cuff to the NBP tubing to prevent accidental disconnection:
 - Ensure that air can pass through the tubing.
 - Ensure the tubing is not squeezed or kinked.

Figure 47 **Connecting the NBP Cuff and Tubing**



- 3 Insert the NBP tubing into the NBP port as described in “[Connecting the NBP Cable](#)” on page 12.
- 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 SpO₂ 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 current cuff pressure is displayed. If you need to stop an NBP measurement in progress, press the [Stop NBP] soft key.
 - When 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. For an example, see Figure 48 "NBP Values" on page 110.
 - NBP values are removed from the display after 60 minutes but can be obtained later through Vital Signs Trending and the event summary.
 - 7 If the NBP values are unexpected, use alternate means to determine the patient's vital signs, and then verify that the equipment is working correctly.

Figure 48 **NBP Values**

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 that 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.

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. Additional manual measurements can be taken without affecting the automatic measurement schedule.

Automatic - A measurement is attempted at configured intervals - every 1, 2.5, 5, 10, 15, 30, 60, or 120 minutes.

- Automatic measurements have a 30-second minimum period in between measurements, even if a measurement is due to occur.
- For the measurement to begin, the previous measurement must have ended, the cuff must have deflated, and 30 seconds must have elapsed after cuff deflation. All criteria must be met in order for the next automatic NBP measurement to begin. If the criteria are not met, the device waits for the configured interval (for example, one minute) before attempting the next automatic measurement.
- You can change the measurement schedule during an event.

© **To change the NBP schedule 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. 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.

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 35 and 36. 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 32.

Table 35 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 36 **NBP Technical Alarms**

Alarm Message	Condition	Type of Alarm	Indication
NBP Cuff Not Deflated	The cuff failed to deflate.	High priority non-latching alarm	Red alarm message with audio tone
NBP Cuff Overpressure	- For an adult, the cuff pressure exceeded 290 mmHg $\pm$ 10 mmHg (38.7 kPa $\pm$ 1.3 kPa). - For an infant/child, the cuff pressure exceeded 145 mmHg $\pm$ 5 mmHg (19.3 kPa $\pm$ 0.7 kPa).	- For an adult, low priority non-latching alarm - For an infant/child, high priority non-latching alarm	- For an adult, cyan alarm message with audio tone - For an infant/child, red alarm message with audio tone
NBP Measurement Failed	The device is unable to complete a measurement because excessive pump-up time has been detected, the connecting tube is disconnected, or the determined blood pressure is outside the rated range for cuff pressure.	Low priority non-latching alarm	Cyan alarm message with audio tone
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 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 and Disabling NBP Alarms

⊙ To enable and 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.

NBP Calibration

The noninvasive blood pressure (NBP) module should be calibrated yearly. To calibrate the NBP module, call for service or refer to the Efficia DFM100 *Service Manual*.

Troubleshooting

If your Efficia DFM100 does not operate as expected during NBP monitoring, see [Table 64 “NBP Problems”](#) on page 175.

NOTES

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Trending

This chapter describes how to review trend data.

Overview

In Monitor mode, you can view and print numeric vital signs trending data for the current incident. Trending data is 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, SpO₂, EtCO₂ and pulse) are the average of multiple measurements over the trend time period. Trending data for NBP appear with the timestamp of the measurement.

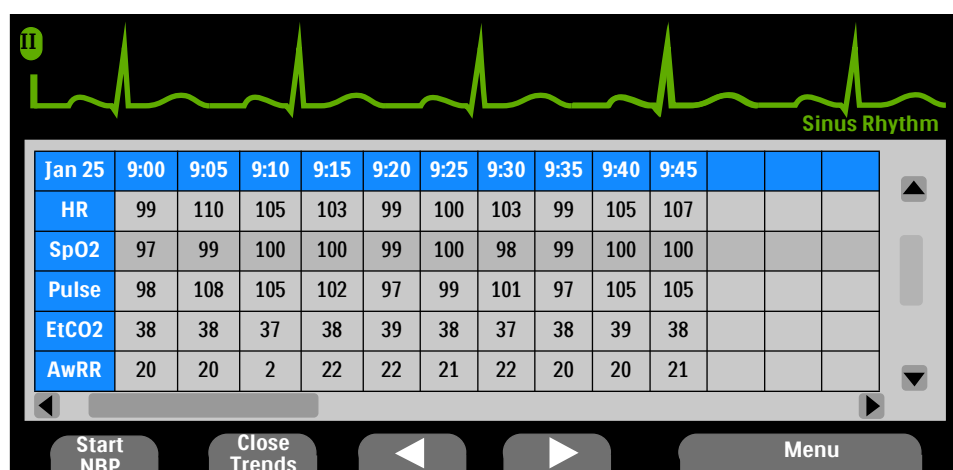
Viewing Trend Data

☉ 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 49](#).

To close the Trends report, press the [Close Trends] soft key.

Figure 49 Trends Report



About the Trends Report Data

- When trending is initially displayed, the most recent trending data appears 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 SpO₂ Option and values for SpO₂ and Pulse are available, they are listed second and third in the Trends report. If your device has the EtCO₂ option and values are available, the EtCO₂ 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, EtCO₂, SpO₂, 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 50](#).

Figure 50 **Sample Trends Printed Report**

Trends Header Page:	Trends Data Page:										
Trend Report	25	9:00	9:05	9:10	9:15	9:20	9:25	9:30	9:35	9:40	9:45
Event ID: 123456	HR bpm	107	105	99	103	100	99	103	105	110	99
SMITH, FRED	SpO2 %	100	100	99	98	100	99	100	100	99	97
Patient ID: 65432	Pulse bpm	107	105	99	103	100	99	103	105	110	99
Patient Sex: M	EtCO2 mmHg	39	39	38	36	35	39	39	38	39	39
(25 Jan2014 9:45)	AwRR rpm	12	12	12	12	12	12	12	12	12	12
	NBPs mmHg		120		120		117		120		118
Efficia DFM100 866199	NBPd mmHg		70		60		64		70		65
S/N: CN01235	NBPm mmHg		82		80		81		82		81
SW Rev: 1.0			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 119.

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 163.

NOTES

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Data Management

This chapter describes Data Management mode, event summaries, and printing functions.

Overview

Data Management mode is a non-clinical mode used to perform the following functions:

- View and manage event summaries, including printing and exporting to a USB.
- Remove patient-identifying information from event summaries.
- Manage event summaries on a connected USB drive.

Event Summaries

The Efficia DFM100 automatically generates an event summary for each patient event. Each event summary is assigned a unique event identification number, date and 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 and also available in the Trends report.

An event summary is initiated when one of the following occurs:

- A valid ECG signal is acquired.
- Valid SpO₂ data is acquired.
- Valid CO₂ data is acquired.
- Valid NBP data is acquired.
- The Charge button is pressed.
- The Mark Event button is pressed.

An event summary ends when the device is powered off or enters a non-clinical mode.

Data Collected During an Event Summary

The Efficia DFM100 can be configured to save short or long event summaries. Long event summaries contain all of the following information. Short event summaries exclude waveform information.

Patient data that is collected, if available, includes the following information:

- Two ECG waveforms with beat labels
- One pleth waveform
- One CO₂ 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

Event Summary Retention

The Efficia DFM100 has an 8-hour data limit per incident for an event summary. 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:

- If the 8-hour limit is reached, the Efficia DFM100 stops recording and a message is displayed on the Efficia DFM100.
- When the internal memory is full, the oldest event summary is automatically deleted to store the new event summary.

Accessing Data Management Functions

When you first access Data Management mode, the **Data Management - Internal Memory** screen appears and provides the following event information:

- **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.

WARNING: Do not access Data Management mode while monitoring a patient.

☉ To access Data Management mode:

- 1 Turn the Therapy knob to Monitor, Pacer, or Manual Defib.
- 2 Press the Smart Select knob. The **Main Menu** appears.
- 3 In the **Main Menu**, select **Other** and press the Smart Select knob. The **Other** menu appears.
- 4 In the **Other** menu, select **Data Management** and press the Smart Select knob.
- 5 When prompted to exit clinical mode, select **Yes** and press the Smart Select knob. The **Data Management - Internal Memory** screen appears.

NOTE: The more data in memory, the longer the list takes to populate.

- 6 Press the Smart Select knob. The **Data Management** menu appears.

- 7** In the **Data Management** menu, turn and press the Smart Select knob to highlight and select the function you want:
- **Print** to print the currently selected event summary. See “[Printing Data](#)” on page 122.
 - **Export** to export the currently selected event summary to a USB drive. See “[Exporting Data to the USB Drive](#)” on page 121.
 - **Export All** to export all event summaries currently in Internal Memory to a USB drive. See “[Exporting Data to the USB Drive](#)” on page 121.
 - **Remove All Patient Info** to de-identify all event summaries in Internal Memory. See “[Removing All Identifying Patient Information](#)” on page 122.
 - **View USB Drive** to view all event summaries on a USB drive. See “[Viewing Event Summary Data on the USB Drive](#)” on page 121.

Viewing Event Summary Data on the USB Drive

When you select **View USB Drive** from the internal memory menu, the Efficia DFM100 first checks that there is a compatible USB drive inserted. If a compatible USB drive is not found, the Internal Memory screen remains on the display. If a compatible USB drive is found, then the USB Drive screen is displayed.

Using the Efficia DFM100, you can only export event summaries to and delete from the USB drive. Additional USB drive operations can be performed with a USB-compatible computer.

CAUTION: Use only approved USB drives with the Efficia DFM100. Using other brands of USB drive may cause damage or be incompatible with the Efficia DFM100.

Exporting Data to the USB Drive

You can export (save) data to a USB drive from Data Management mode, Configuration mode, and after an operational check. You can export a single event summary or all event summaries from the Efficia DFM100 to the inserted USB drive.

Note the following:

- If you change from Data Management mode to a clinical mode while data is exporting, an alert appears indicating that data export is in process and includes the prompt **Stop Exporting?**. Select **Yes** to stop the export and continue to the new mode. Select **No** to continue exporting data.
- If you power off the Efficia DFM100 while exporting data, the export is stopped and the exported data may be incomplete.

⦿ To export data from a single event summary to an approved USB drive:

- 1** Access the **Data Management - Internal Memory** screen.
- 2** Select the event summary you want to export and press the Smart Select knob. The **Data Management** menu appears.
- 3** In the **Data Management** menu, select **Export** and press the Smart Select knob:
 - Depending on your device configuration, you may be prompted to remove all patient-related data prior to exporting.
 - A message appears warning you to not remove the USB drive and disappears when the export is complete.

⦿ To export all event summaries to an approved USB drive:

- 1** Access the **Data Management - Internal Memory** screen.
- 2** Press the Smart Select knob. The **Data Management** menu appears.

- 3 In the **Data Management** menu, select **Export All** and press the Smart Select knob. A message appears warning you to not remove the USB drive and disappears when the export is complete.
- 4 To cancel an export in progress, select **Cancel Export**.

Managing Event Summaries from the USB Drive

You can view event summaries stored on the USB drive. You can also delete all event summaries from the USB drive.

- ⊙ **To manage event summaries on the USB drive:**
- 1 Access the **Data Management - Internal Memory** screen.
 - 2 Press the Smart Select knob. The **Data Management** menu appears.
 - 3 In the **Data Management** menu, select **View USB Drive** and press the Smart Select knob. The **Data Management - USB Drive** screen appears.
 - 4 If you want to delete all event summaries from the USB drive:
 - a Press the Smart Select knob. The **Data Management** menu appears.
 - b In the **Data Management** menu, select **Erase Drive** and press the Smart Select knob to erase all event summaries from the USB drive.
 - c In the confirmation prompt, select **Yes** to erase all data on the USB drive.
 - 5 To return to the **Data Management - Internal Memory** screen:
 - a Press the Smart Select knob. The **Data Management** menu appears.
 - b In the **Data Management** menu, select **View Internal Memory** and press the Smart Select knob.

Removing All Identifying Patient Information

All Efficia DFM100 users are responsible for protecting the use, disclosure, and exchange of electronic Protected Health Information (ePHI). Patient-related data includes name, medical record number, age, and other information that could uniquely identify an individual. In **Data Management** mode, you can de-identify patient event summaries in two ways:

- When exporting event summaries, the Efficia DFM100 can be configured to prompt whether to remove all patient-related data prior to exporting. If this function is enabled, you are prompted to export without patient information before the data is exported.
- When the Internal Memory Menu is displayed, selecting **Remove All Patient Info** prompts you to confirm whether to remove patient information from all internal event data.

NOTE: This removes patient-identifying data from all records in the memory.

Printing Data

The Efficia DFM100 can print multiple pieces of information in both clinical and non-clinical modes. The Efficia DFM100 can be configured to print automatically when certain events occur or you can initiate a print request at any time during an event.

Note the following printer behavior:

- 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 report while the printer is printing another report, the Efficia DFM100 prompts you with questions. Your answers determine which report takes precedence for printing.
- 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.

Printing During a Patient Event

You can print reports in a clinical mode during a patient event:

- To print a strip during an event, press the Print button . The printed strip contains the header information, configured waveforms, wave markings (R-Wave Arrows, Pacing Markers), and events, including event markers.
- To print an event summary for the current event, press the Report button , select **Event Summary** from the list, and press the Smart Select knob to print.

Table 37 **Event Markers**

Event	Symbol
Mark Event	
Physiological Alarm	
Shock Delivered	

Printing While in Data Management Mode

If your organization requires a Data Management mode password, you are prompted to enter the password before printing begins.

Printing an Event Summary

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 EtCO₂
 - A pleth wave if you are measuring SpO₂ and not EtCO₂
 - A second ECG if you are not measuring either EtCO₂ or SpO₂ and there is a valid second ECG wave available
 - Empty if a valid EtCO₂, SpO₂, or second ECG wave are not available

Values listed on a printed event summary also include the parameter's unit of measurement. High priority physiological alarms are preceded by ***. Medium priority physiological alarms are preceded by **. High priority technical alarms are preceded by !!! . Medium priority alarms are preceded by !!. Low priority alarms are not preceded by any marks.

© To print an event summary contained in Internal Memory:

- 1 Access the **Data Management - Internal Memory** screen.
- 2 Select the event summary you want to print and press the Smart Select knob. The **Data Management** menu appears.
- 3 In the **Data Management** menu, select **Print**. The **Print** menu appears.

- 4 In the **Print** menu, select **Event Summary** and press the Smart Select knob to begin printing.

Events Stored in an Event Summary

Events and wave segments can be stored in an event summary. Table 38 lists events and related information that can be stored in an event summary. Depending on your device configuration, not all events are applicable. Text in parenthesis is replaced by an appropriate value.

Segments include a header, waveform, and events.

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.

Table 38 **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.
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.

Table 38 Event Information (Continued)

Logged Event	Frequency
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.
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.

Table 38 Event Information (*Continued*)

Logged Event	Frequency
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.
SpO₂	
SpO ₂ On/SpO ₂ Off	Logged when SpO ₂ monitoring is connected and any subsequent disconnect/connect.
**SpO ₂ High > (value, limit)	Logged when the patient's SpO ₂ value is higher than the configured limit.
**SpO ₂ 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.
SpO ₂ Sensor Malfunction	Logged when the device is on and unable to acquire a Pleth waveform.
SpO ₂ Unplugged	Logged when SpO ₂ monitoring is on and the sensor is disconnected.
SpO ₂ Noisy Signal	Logged when SpO ₂ is on and a noisy signal is detected.
SpO ₂ Interference	Logged when SpO ₂ is on and light interference is detected at the SpO ₂ sensor.
SpO ₂ Non-Pulsatile	Logged when SpO ₂ is on and a non-pulsatile SpO ₂ sensor signal is detected.
SpO ₂ Equipment Malfunction	Logged when SpO ₂ is on and an SpO ₂ equipment malfunction is detected.
SpO ₂ Erratic	Logged when SpO ₂ is on and an erratic measurement condition occurs.
SpO ₂ Extended Update	Logged when SpO ₂ is on and the SpO ₂ measurement update period exceeds 30 seconds.
SpO ₂ Low Perfusion	Logged when SpO ₂ is on and low perfusion occurs.
SpO ₂ Error	Logged when a non-critical SpO ₂ error is detected.
SpO ₂ Alarms On/SpO ₂ Alarms Off	Logged when SpO ₂ alarms are turned on or off and any subsequent change.
SpO ₂ 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.

Table 38 Event Information (Continued)

Logged Event	Frequency
Pulse Limits (low limit) (high limit)	Logged when pulse alarms are turned on and when there is a change in alarm limits.
EtCO₂	
EtCO ₂ On/EtCO ₂ Off	Logged when EtCO ₂ monitoring is connected and any subsequent disconnect/connect.
**EtCO ₂ High > (value, limit)	Logged when the patient's EtCO ₂ value is higher than the configured limit.
**EtCO ₂ Low < (value, limit)	Logged when the patient's EtCO ₂ value is lower than the configured limit.
CO ₂ Sensor Plugged In -(type)	Logged when a CO ₂ sensor is connected to the Efficia DFM100.
CO ₂ Sensor Warming Up	Logged when the CO ₂ sensor has not warmed up to operating temperature range.
CO ₂ Tube Unplugged	Logged when the CO ₂ sensor is unplugged or the filter line is disconnected.
CO ₂ Sensor Unplugged	Logged when the CO ₂ sensor is unplugged.
EtCO ₂ Alarms On/EtCO ₂ Alarms Off	Logged when CO ₂ alarms are turned on or off and any subsequent change.
EtCO ₂ Limits (low value) (high value)	Logged when CO ₂ alarms are turned on and when there is a change in alarm limits.
CO ₂ Zero In Progress	If using the Mainstream or Sidestream sensor, logged when the sensor is zeroing.
CO ₂ Zero Required	If using the Mainstream or Sidestream sensor, logged when the sensor needs to be zeroed.
CO ₂ Zero Complete	If using the Mainstream or Sidestream sensor, logged when the sensor zeroing is complete.
CO ₂ Zero Failed -(reason)	If using the Mainstream or Sidestream sensor, logged when the sensor zeroing failed.
CO ₂ Replace Sensor	Logged when the CO ₂ sensor has reached its end of life.
CO ₂ Service Required	Logged when the CO ₂ sensor needs servicing.
CO ₂ Check Line	Logged when the CO ₂ sensor detects a kinked or blocked filter line.
CO ₂ Check Airway Adapter	Logged when the CO ₂ sensor detects the airway adapter is blocked.
CO ₂ Sensor Over Temp	Logged when the CO ₂ sensor detects that it is over temperature.
CO ₂ Out of Range	Logged when the CO ₂ sensor detects its result is out of range.
CO ₂ Error	Logged when a non-critical EtCO ₂ error is detected.
CO ₂ 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.

Table 38 Event Information (*Continued*)

Logged Event	Frequency
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	- For an adult, logged when the cuff pressure exceeded 290 mmHg $\pm$ 10 mmHg (38.7 kPa $\pm$ 1.3 kPa). - For an infant/child, logged when the cuff pressure exceeded 145 mmHg $\pm$ 5 mmHg (19.3 kPa $\pm$ 0.7 kPa).
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.

Table 38 Event Information (*Continued*)

Logged Event	Frequency
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 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	
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.

Table 38 Event Information (*Continued*)

Logged Event	Frequency
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.

Configuration

This chapter describes the configurable parameters of the Efficia DFM100 and how to change them.

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. 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 adjust the format of the date and time, you need to enter the Configuration mode password.

© 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.
- 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 apply your change.
- 5 Select another value for modification, or press the **[Main Config]** soft key to return to the Main Configuration screen.

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 press the [Save Changes] soft key to save the new 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 DataMgmt 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 39 Configuration - Change DataMgmt 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 51](#).

NOTE: To stop printing, press the Print button.

Figure 51 **Sample Configuration Report**

Configuration Report			
	Options	Date/Time Format Settings	General Settings
23Dec2014 11:06		Date Format: (xx)	Patient Category: (xx)
Efficia DFM100 866199		Time Format: (xx)	Voice Volume: (xx)
S/N: CN32600030		Auto Correct For Daylight Savings Time(DST): (xx)	QRS Volume: (xx)
SW Rev: 1.0		DST Start: (xx)	Units Display: (xx)
		DST End: (xx)	Export Without Patient Info: (xx)
		DST Offset: (xx)	Patient Information To Display: (xx)

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 134.

NOTE: Configuration settings in parenthesis with “xx” in [Figure 51](#) 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.

Table 40 **Date and Time Format Settings**

Parameter	Description	Setting Choices	
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	
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 41 **General Settings**

Parameter	Description	Setting Choices
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

Table 41 General Settings (*Continued*)

Parameter	Description	Setting Choices
Units Display	Defines if parameter values are displayed with or without the corresponding measurement units.	On, Off
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 than 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 42 Heart Rate and ECG Settings

Parameter	Description	Setting Choices
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 ECG bandwidth used for the Efficia DFM100 display. Note: If the ECG source is pads or paddles, Monitor is used, regardless of the configuration setting.	0.15-40 Hz (Monitor), 0.05-40 Hz (ST Monitor), 2.0-20 Hz (EMS)
ECG Bandwidth For Printer	Selects the ECG bandwidth used for printing.	0.05-150 Hz (Diagnostic), 0.05-40 Hz (ST Monitor), 0.15-40 Hz (Monitor), 2.0-20 Hz (EMS)
ECG Electrode Labels	Selects the electrode label format. AAMI: RA, LA, LL, RL, V; IEC: R, L, F, N, C.	AAMI, IEC
HR/Arrhythmia Alarms	Selects if HR/Arrhythmia alarms are on or off at start up.	On, Off

Table 42 Heart Rate and ECG Settings (Continued)

Parameter	Description	Setting Choices
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 43 NBP Settings

Parameter	Description	Setting Choices
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
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

Table 43 **NBP Settings (Continued)**

Parameter	Description	Setting Choices
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 44 **SpO₂ Settings**

Parameter	Description	Setting Choices
SpO ₂ 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
SpO ₂ High Limit	Selects the high alarm limit value.	Adult: 51-100, 100% Infant/Child: 51-100, 100%
SpO ₂ Low Limit	Selects the low alarm limit value.	Adult: 50-99, 90% Infant/Child: 50-99, 90%
SpO ₂ 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 45 **EtCO₂ Settings**

Parameter	Description	Setting Choices
Color	Selects the EtCO ₂ color.	Red, Yellow , Blue, Green, Cyan, Magenta, White
Unit	Selects the measurements units.	mmHg, kPa
EtCO ₂ 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
EtCO ₂ 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

Table 45 **EtCO₂ Settings (Continued)**

Parameter	Description	Setting Choices
EtCO ₂ 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: 10-60, 20 sec Infant/Child: 10-60, 20 sec adjusted in increments of 5

Table 46 **Waves Settings**

Parameter	Description	Setting Choices
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, CO ₂ , None
Wave 3	Selects the waveform displayed in Wave Sector 3.	Pads/Paddles, I, II, III, aVR, aVL, aVF, V, Pleth, CO ₂ , None. Default: CO ₂ 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 47 **Defib Sync Settings**

Parameter	Description	Setting Choices
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

Table 48 **AED Settings**

Parameter	Description	Setting Choices
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 min, 2 min, 3 min, Infinite (no prompts)
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
Shock Series	Defines the number of shocks in a shock series. Shock series is the configured number of shocks (1-4) before the CPR pause period. After the CPR pause period or shock protocol time out, the shock series begins again.	1, 2, 3, 4
Shock Protocol Timeout	Defines the time interval that determines whether a shock is included as part of the shock series. The value Infinite means that a shock is included in the shock series per the Shock Series configured shocks, regardless of the time between shocks.	1 min, 2 min, Infinite

NOTE: In AED mode, the time to auto disarm is 30 seconds and not configurable.

Table 49 **CPR Settings**

Parameter	Description	Setting Choices
CPR Time	Defines the length of the CPR administration interval.	1, 1.5, 2, 2.5, 3 min

Table 50 **Pacer Settings**

Parameter	Description	Setting Choices
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 51 **Mark Events Settings**

Parameter	Description	Setting Choices
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.		

Table 52 **Printing Settings**

Parameter	Description	Setting Choices
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
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

Table 52 **Printing Settings (Continued)**

Parameter	Description	Setting Choices
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

Operational and Shift Check

This chapter describes activities associated with shift checks, operational checks, and weekly shock tests.

Shift Check

Per the European Resuscitation Council (ERC), hospitals should ensure that clinical areas have immediate access to resuscitation equipment and drugs to facilitate rapid resuscitation of the patient in cardiac arrest. Missing or malfunctioning equipment contributes to treatment delays. Equipment should be standardized throughout the hospital and equipment checked regularly.

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.

Shift check activities 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. 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. Complete this important requirement by performing one of the following:

- Operational check
- Weekly shock test

Shift Checklist

Inspect your Efficia DFM100, accessories, and supplies at the change of every shift. Ensure that your organization performs and tracks operational and shift checks according to your organization's policies and requirements.

The following is a list of items to be inspected during a shift check:

- **RFU Indicator:** A blinking hourglass indicates that the device is ready for use. If a red X appears, attention is needed. For more information, see [“Ready For Use Indicator”](#) on page 25.
- **Case:** clean, free from spills and objects.
- **Cables/connectors:** present and inspected.
- **Paddles/Therapy cable:** present, inspected and paddles release from tray, ensure package seal is intact.
- **Multifunction pads:** present, sufficient supply, expiration date checked.
- **Monitoring electrodes:** present, sufficient supply, expiration date checked.
- **Charged batteries:** one in device, spares. Battery gauge checked.
- **AC power cord:** plugged in, green light on.
- **Printer paper:** present, sufficient supply.
- **USB drive:** present.

- SpO₂ sensors (if installed): present, sufficient supply.
- NBP cuffs/tubing (if installed): present, sufficient supply.
- CO₂ cannulas, extension lines, and dehumidification tubes (if installed): present, sufficient supply.

Accessing the Operational Check Menu

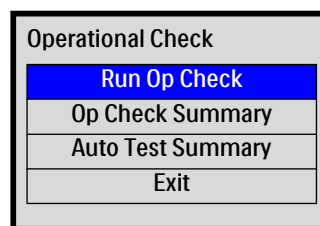
You can access the following items from Operational Check menu:

- **Run Op Check.** For more information, see “Performing an Operational Check” on page 144.
- **Op Check Summary.** Displays a summary of the last 60 operational checks stored in the device. You can use the Smart Select knob to print or export the summary.
- **Auto Test Summary.** Displays a summary of automated test results currently stored in the device. For more information, see “Automated Tests” on page 153.

© 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.
- 5 In the Operational Check menu, turn the Smart Select knob to select the item you want and press the Smart Select knob.

Figure 52 **Operational Check Menu**



Operational Check

An operational check (Op Check) includes the following tests:

- | | | | |
|------------------|----------------------------------|---------------------|------------|
| • General System | • Therapy delivery | • EtCO ₂ | • Printer |
| • Therapy Knob | • Pads/Paddles ECG | • NBP | • Battery |
| • Charge button | • Leads ECG | • Temperature | • Wi-Fi |
| • Shock button | • Leads ECG rerun (if necessary) | • CPR meter | • Cellular |
| • Sync button | • SpO ₂ | • Audio | |

Performing an Operational Check

Perform an operational check weekly to supplement automated tests:

- Do not run an operational check with internal paddles attached. Perform a weekly shock test to test internal paddles.
- To confirm that the ECG cable used during an event is functioning properly, use that same cable during the operational check.

Before performing an operational check:

- **If using external paddles:**
 - Ensure the external paddles are connected to the device, that the external paddles and paddle tray are thoroughly clean, and that no debris or residue (including all conductive material) is on the electrode surfaces of the external paddles and tray.
 - Secure the external paddles in the tray and confirm that 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 using multifunction electrode pads:** Ensure the pads therapy cable is plugged into the defibrillator test plug or test load.

WARNING: When performing the operational check, ensure that the device is not connected to a patient.

☉ **To perform an operational check:**

- 1** Confirm that the device has a charged battery and an ECG cable connected (but not connected to a patient or lead sets).
- 2** Confirm that a test load or a test plug is connected to the Therapy Cable.
- 3** Turn the Therapy knob to 170 J.
- 4** Press the Smart Select knob.
- 5** Turn the Smart Select knob to highlight **Other** and press the Smart Select knob.
- 6** Select **Operational Check** and press the Smart Select knob.
- 7** Select **Run Op Check** and press the Smart Select knob. The message **Leaving clinical mode. Patient monitoring will be turned off.** appears.
- 8** Select **Yes**, and press the Smart Select knob to start the operational check. The Operational Check Screen appears.
 - If the Efficia DFM100 is not set up correctly, a message with the required changes and a **Proceed As Is?** prompt appear. If you proceed without proper setup, the operational check may fail.
- 9** During the operational check, when a response is required, use the Smart Select knob to select your answer and press the Smart Select knob to confirm your choice. As each test runs, the name of the test is highlighted on the display with the message **In Progress**.
 - Once the **Sync** button is pressed, leave the Efficia DFM100 unattended as the operational check completes. If you exit or cancel the operational check before it completes all tasks, it is not saved as part of the Operational Check Summary.
- 10** When the operational check completes, on the Operational Check screen, review the summary note.
- 11** As needed, perform the recommended actions from the summary note and use the soft keys to perform additional tasks:
 - Exit OpCheck
 - Hide and show messages
 - Rerun Op Check
 - Review Op Check Summary
 - Review Autotest Summary

12 If you want, print the operational check report:

- a** Press the Smart Select knob. An additional Operational Check menu appears and includes a Print option.
- b** Select the Print option and press the Smart Select knob to print the operational check report.

NOTE: If configured, the operational check report will print automatically.

13 After a successful operational check, complete the user checks listed on the operational check report. For more information, see “[User Checks](#)” on page 149.

Upon completing the operational check and returning to a clinical mode, all settings return to the device’s configured values.

Operational Check Results and Failures

For a list of operational check tests and results, see [Table 53](#).

Note the following considerations related to operational check failures:

- An improperly performed operational check may cause a failure. To clear the failed operational check, successfully perform a proper operational check. If the device continues to fail the operational check, remove the device from use and call for service.
- If an operational check fails for a therapy-related problem (such as a failed Therapy knob or button), therapy is disabled. Messages appear on the display, and the RFU indicator is a solid red **X**. After exiting the operational check, the Efficia DFM100 restarts with therapy disabled.
- When exiting the operational check, if the failure is related to the Therapy knob, 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.
- If the Leads ECG test fails, the Efficia DFM100 may provide the message **Leads ECG Test Failed With Cable. Disconnect ECG Cable to Rerun Test Without Cable**. When the ECG cable is removed, the device reruns the operational check. Press the Smart Select knob to proceed without rerunning the Leads ECG test.

Table 53 Operational Check Tests and Results

Test	Device Prompts	User Actions	Results	What to do for test failure
General System - tests internal clock battery, power supply and internal memory	None	None	Pass - All tested systems are functioning properly. Fail - One or more of the tested systems is not functioning properly.	Take the device out of use and call for service.
Therapy Knob - tests if the Therapy knob is set to 170J and functioning properly	None	Confirm the Therapy knob is at 170 J.	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.	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.

Table 53 **Operational Check Tests and Results (Continued)**

Test	Device Prompts	User Actions	Results	What to do for test failure
Charge button - tests the Charge button's functionality	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 External Paddles: You are prompted to Turn the Knob to 150J Verify Paddles Are in Holders 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.	Move Therapy knob to 150. Confirm test load/defibrillator test plug is attached and press the Charge button. Move Therapy knob to 150. Confirm the external paddles are seated in their pockets and press the Charge button.	Pass - Charge button passed. Fail - Charge button is not functioning. Fail - You used the Smart Select knob to charge.	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.
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.

Table 53 Operational Check Tests and Results (Continued)

Test	Device Prompts	User Actions	Results	What to do for test failure
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.
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.

Table 53 **Operational Check Tests and Results (Continued)**

Test	Device Prompts	User Actions	Results	What to do for test failure
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.

User Checks

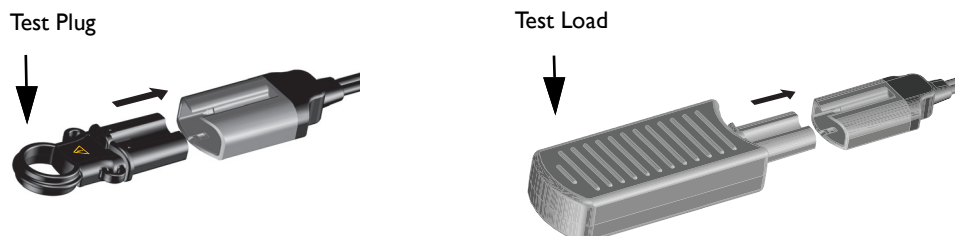
After completing a successful operational check, the following manual checks are recommended:

- **Defibrillator inspection.** Ensure that the Efficia DFM100 is clean (including the surfaces of the external paddles and paddle trays), clear of objects, and has no visible signs of damage.
- **ECG cables, connectors, paddles, pads, monitoring electrodes.** Ensure that there are no visible cracks, broken wires, or other visible signs of damage. Ensure all the connections are secure. Check expiration date and quantity of pads and monitoring electrodes.
- **Charged battery.** Ensure that a charged battery is installed in the Efficia DFM100. Another charged battery should be available or charging. Confirm that the battery has no visible signs of damage.
- **AC power cords.** Connect the AC power cord to the Efficia DFM100 and plug the cord into a power outlet. Verify that the external power indicator on the front panel is lit.
- **Printer paper.** Ensure that the printer has sufficient paper and prints properly.
- **EtCO₂ sensor.** Inspect the sensor and cable for visible signs of damage.
- **SpO₂ sensor.** Inspect the sensor and cable for visible signs of damage.
- **EtCO₂ accessories.** Inspect the cannulas, adapters, dehumidification tubes, and extension lines for blockages and visible signs of damage.
- **EtCO₂ port.** Inspect the port for visible signs of debris or damage.
- **NBP cuffs and tubing.** Inspect the pressure cuffs and tubing for visible signs of damage.
- **USB connector.** Inspect the connector for visible signs of debris or damage.

Weekly Shock Test

You can use the defibrillator test plug (included with the device), test load (ordered separately), or external paddles to perform a weekly shock test. The weekly shock test process differs depending on how the test is performed.

Figure 53 Connecting the Defibrillator Test Plug or Test Load



WARNING: When performing a weekly shock test, ensure that the Efficia DFM100 is not connected to a patient.

NOTE: Internal paddles are tested before each use; a weekly shock test for internal paddles is not necessary. For more information, see the internal paddles instructions for use.

☉ **To perform a weekly shock test:**

	If using pads with a test load:	If using pads with a test plug:	If using external 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. See Figure 53 on page 150.	Connect the Therapy cable to the defibrillator and test plug to the end of the Therapy cable. See Figure 53 on page 150.	WARNING: Ensure that the external paddles and paddle tray are clean and free of debris or residue (including all conductive material) on the electrode surfaces. If the external paddles or tray are dirty, sparking may occur during a weekly shock test. Secure external paddles in tray and confirm that the 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 external paddles sitting in the tray. Confirm you hear the charging tone. If it becomes necessary to disarm the defibrillator, press [Cancel Charge] .
4	Press the Shock button on the Efficia DFM100.		Simultaneously press the Shock buttons located on the external paddles.
5	A strip prints, if configured to do so. If the strip does not print immediately, press the Print button.		
6	Confirm 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.		

7	Detach test load from the Therapy cable so your device is ready for use when needed. Do not leave the test load attached to the Therapy cable. Test complete.	Confirm that the device issues a Shock Cancelled audio message, displays a Shock Aborted message, and that a printed strip indicates Test Passed. If not, confirm that the test was performed properly before taking it out of use and calling for service.	Confirm that the device issues a Shock Cancelled audio message, displays a Shock Aborted message, and that a printed strip indicates Test Passed. If not, confirm that the test was performed properly before taking it out of use and calling for service. It is normal for a shock to not be delivered in this instance.
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Alarm Test

If your institution's protocol requires periodic alarm verification and you want to perform an alarm verification test (in a non-clinical environment) outside of operational check testing, connect the Efficia DFM100 to a simulator, then manually change the alarm limits to a setting that 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.

NOTES

[illegible]

Maintenance

This chapter describes how to care for your Efficia DFM100 and its accessories.

Overview

Attending to routine maintenance is vital to keeping the Efficia DFM100 ready to respond in an emergency.

Routine maintenance involves:

- Providing power for automated tests.
- Observing the Ready For Use (RFU) Indicator to confirm the device's readiness.
- Performing operational checks and shift checks.
- Maintaining batteries.
- Cleaning the device and accessories.
- Checking expiration dates on supplies and accessories, and ordering replacements.

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

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

Do not service the device while in use with a patient.

Do not modify the device or its supported accessories.

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 54](#) provides a brief explanation of the tests and lists each test's frequency.

Table 54 **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 Efficia 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** and press the Smart Select knob. The Efficia DFM100 displays the **Automated Test Summary** screen.
- 7 To perform additional actions, such as printing or exporting, use the menu options.

Figure 54 **Automated Test Summary Screen**

Automated Test Summary					
Date and Time	Period	Result	Date and Time	Period	Result
16 Jan 2013 12:11	Hourly	Pass			
16 Jan 2013 01:11	Daily	Pass			
15 Jan 2013 01:11	Daily	Pass			
14 Jan 2013 01:11	Daily	Pass			
13 Jan 2013 01:11	Daily	Pass			
12 Jan 2013 01:11	Daily	Pass			
11 Jan 2013 01:11	Daily	Pass			
10 Jan 2013 12:11	Weekly	Pass			

Exit Summary ◀ ▶ Menu

Auto Test Summary Results

The Automated Test Summary lists results for the hourly, daily and weekly tests that have been performed. 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.

Table 55 **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. For more information, see Chapter 17 “Troubleshooting” on page 163.
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. For more information, see Chapter 17 “Troubleshooting” on page 163.

Battery Maintenance

Battery maintenance is essential to ensure sufficient charge and capacity for device operation, optimal battery life, and accurate charge state reporting:

- Battery maintenance begins when you first receive your device and continues throughout the life of the battery.
- Keep the lithium battery charged and a spare battery nearby.
- If you have a faulty battery, remove it from service immediately.

Table 56 **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.

Battery Useful Life

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). To optimize performance, charge a low battery as soon as possible. Use outside intended conditions could reduce battery life.

CAUTION: Do not store your device for prolonged periods with the battery installed.

Checking the Battery Charge

You can check the charge status of a Efficia DFM100 Lithium Ion battery in the following ways:

- When the battery is not installed in the Efficia DFM100, press the Battery Power Gauge 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 55 **Battery Power Gauge**



- When the battery is installed in the Efficia DFM100, turn the Therapy knob to any position and observe the battery power indicators in the Status Area.

Low Battery Conditions

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

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.

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.

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 the ambient temperature at 25°C (77°F), AC power connected, and the device turned off, the following charge times apply to the battery:

- Less than 3 hours to 100% capacity
- Less than 2.5 hours to 90% capacity
- Less than 2 hours to 80% capacity

Charge time can be substantially longer if the device is on.

When 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.

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, non-condensing.
- 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: Do not store your device for prolonged periods with the battery installed. 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 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 57](#). 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 32.

Table 57 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. Otherwise, cyan alarm message 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. Otherwise, yellow alarm message with audio tone in Battery Status 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 Battery Status area.
Equipment Disabled: System Failure	A low voltage has been detected.	High priority non-latching	Red alarm message with audio tone in Technical Alarm area.
Battery Communication Failure	Communications between the device and the battery have failed.	Medium priority non-latching	Yellow alarm message with audio tone in Technical Alarm 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.

About Cleaning and Disinfecting the Device and Accessories

Note the following considerations when maintaining the device and accessories:

- Internal paddles must be cleaned and sterilized (not disinfected). Before using internal paddles in an event, confirm that they have not exceeded their reprocessing cycles. For instructions, see the Internal Paddles *Instructions for Use*.
- If an accessory has cleaning and disinfecting instructions from the manufacturer or as part of your organization’s policy, use those instructions.

- For cleaning and disinfection frequency of the device and individual accessories, follow your organization's policy.

Supplies for Cleaning and Disinfecting

The following supplies are required to clean and disinfect the device and its accessories. Note the following:

- Ensure you have enough wipes and brushes to clean and disinfect the item. Do not reuse wipes and brushes. Reusing wipes and brushes can recontaminate the item.
- Follow your organization's process to dispose of contaminated wipes and brushes.

Table 58 **Supplies for Cleaning and Disinfecting**

Cleaning Supply	Description
Non-linting wipes that can be wetted	Used to remove contaminants from the device and its accessories
Dry non-linting wipes	Used to dry the device and accessories
Soft bristle brush	Recommended to clean difficult surfaces, such as buttons, seams, ridges, cavities, and so on
Cleaning and disinfecting solution	For cleaning and disinfecting, use 70% isopropyl alcohol

Safety Considerations

Review the following safety considerations to help prevent damage to the device or device accessory during cleaning and disinfecting.

-
- CAUTIONS:**
- Do not steam autoclave, steam sterilize, or ultrasonically clean the device or device accessory unless otherwise indicated by the manufacturer's instructions.
 - Do not use a detergent or solution other than what is indicated in the manufacturer's instructions or this *Instructions for Use* document.
 - Do not immerse, pour liquid on, or allow liquid to penetrate the device or device accessory.
 - Do not allow excess liquid to contact electrical parts or connectors during cleaning.
-

Cleaning the Device

Before cleaning the device, perform preparation steps to prevent damage and contamination.

- ☉ To prepare the device before cleaning:
 - 1 Disconnect the device from power.
 - 2 Remove all cables and accessories from the device, including the external paddles. For accessory connection information, see [Chapter 2 "Device Basics"](#).
 - 3 If the device or accessories are transported for cleaning, follow your organization's policies to ensure that all items are secured.
- ☉ To clean the device:
 - 1 For the exterior surfaces of the printer door and latch, use non-linting wipes wetted (but not dripping) with the cleaning agent to wipe the surfaces thoroughly for 30 seconds.

- 2 For the exterior surfaces, use non-linting wipes wetted (but not dripping) with the cleaning agent to wipe the surface for at least three minutes and until visibly clean. If necessary, use soft-bristled brushes to clean difficult surfaces. Difficult surface may include buttons, seams, ridges, cavities, and so on.
- 3 Use dry, non-linting wipes to dry all the cleaned surfaces of the device.
- 4 Inspect the device in a well-lit area to ensure that all surfaces are clean. If any surfaces remain contaminated, repeat the cleaning steps until all surfaces of the device are visibly clean.

Cleaning the Device Printhead

You may need to clean the device printhead if printouts from the device have light or varying print density. You do not need to clean the device printhead as part of the regular cleaning and disinfecting frequency of the device.

The printhead surface is in the top front of the printer compartment.

☉ To clean the device printhead:

- 1 Open the printer door.
- 2 Remove the printer paper.
- 3 Use a non-linting wipe or soft-bristle brush wetted (but not dripping) with the cleaning agent to wipe the printhead surface.
- 4 If necessary, allow the printhead surface to air-dry.
- 5 Reinsert the roll of paper and close the printer compartment door.
- 6 Perform a test print to check the print quality.

Cleaning Device Accessories

For device accessories that do not have cleaning instructions from the manufacturer or as part of your organization's policies, use the following steps to clean the accessory.

☉ To clean device accessories:

- 1 Use non-linting wipes wetted (but not dripping) with the cleaning agent to wipe the accessory for at least three minutes and until visibly clean. Note these additional considerations:
 - For cords and cables, wipe from the device connection outward.
 - If necessary, use soft-bristled brushes to clean difficult surfaces. Difficult surfaces may include buttons, seams, ridges, cavities, and so on.
 - If cleaning reusable noninvasive blood pressure cuffs, hoses, and related parts, detach parts that can collect liquid. Point the parts downward so that any liquid from cleaning can properly drain from the parts.
- 2 Use dry, non-linting wipes to dry all the cleaned surfaces of the device accessory.
- 3 Inspect the accessory in a well-lit area to ensure that all surfaces are clean. If any surfaces remain contaminated, repeat the cleaning steps until all surfaces of the accessory are visibly clean.

Disinfecting the Device and Accessories

Use the following steps to disinfect the device. For accessories, note the following:

- If an accessory has disinfecting instructions from the manufacturer or as part of your organization's policy, use those disinfecting instructions.
- If you are unsure whether an accessory must be disinfected, follow your organization's policy.

© To disinfect the device or device accessory:

- 1 For all exterior surfaces of the device or accessory, use non-linting wipes wetted (but not dripping) with 70% isopropyl alcohol until all surfaces are visibly wet.
- 2 Ensure that all surfaces remain visibly wet for at least 10 minutes. If a surface begins to dry early, repeat step 1.
- 3 After 10 minutes, use dry, non-linting wipes or clothes to dry the surfaces.

Service and Care of the Therapy Cable and External Paddles

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

Before disposing of the device, do the following:

- Remove patient data. For more information, refer to the Efficia DFM100 *Service Manual*.
- Remove the battery.
- Follow your country's regulations for disposing of equipment containing electronic parts.

To request a Philips recycling passport to have your device refurbished or recycled, see the following website:

www.philips.com/a-w/about/environmental-social-governance/environmental/circular-economy/recycle

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.

NOTES

[illegible]

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 SpO₂, EtCO₂ 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 153).

To respond to errors reported through operational check, see “Operational Check Tests and Results” on page 146).

For more 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 Information

The Device Info report provides software and hardware version information of the device, which can be helpful for troubleshooting.

☉ **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
- Installed Options
- Software Revision
- External Modules
- Main Processor PCA
- Therapy Board
- Processor Module
- 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 CO₂ sensor, the module is not connected to the device, no information is printed.

NOTE: When first turning the Efficia DFM100 on or plugging the CO₂ 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.

General Problems

Table 59 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.

Table 59 **General Problems (Continued)**

Symptom	Possible Cause	Potential Solution
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.
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.		
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.

Table 59 General Problems (Continued)

Symptom	Possible Cause	Potential Solution
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.
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.

Table 59 **General Problems (Continued)**

Symptom	Possible Cause	Potential Solution
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.
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 external 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 external 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.

ECG Problems

Table 60 **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.

Table 60 ECG Problems (*Continued*)

Symptom	Possible Cause	Potential Solution
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.
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. External 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.
Signal interference is detected on the secondary patient monitor when the multifunction electrodes of the Efficia DFM100 are attached to the patient while the Efficia DFM100 is connected to AC power.	Noisy power line frequency signal is conducted from the multifunction electrodes to the ECG leads of the secondary patient monitor.	Change the AC line filter setting on the secondary patient monitor to filter power line frequency noise. Select the 50 Hz or 60 Hz option according to the power line frequency of your country. If the signal interference persists, unplug the AC power cord from the Efficia DFM100 and run the Efficia DFM100 on battery power.
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, external paddles or ECG cable connection. Check that the pads, external paddles, or monitoring electrodes are properly applied.

NOTE: Viewing a patient's ECG using external paddles is not recommended for long-term monitoring. See [“Viewing an ECG and Heart Rate with External Paddles \(Quick Look\)”](#) on page 70.

Table 60 **ECG Problems (Continued)**

Symptom	Possible Cause	Potential Solution
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.
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.

Table 60 **ECG Problems (Continued)**

Symptom	Possible Cause	Potential Solution
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.

Defibrillation and Pacing Problems

Table 61 **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.
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.

Table 61 Defibrillation and Pacing Problems (Continued)

Symptom	Possible Cause	Potential Solution
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.
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.

Table 61 Defibrillation and Pacing Problems (*Continued*)

Symptom	Possible Cause	Potential Solution
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.

SpO₂ Problems

Table 62 SpO₂ 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 .

Table 62 SpO₂ Problems (Continued)

Symptom	Possible Cause	Potential Solution
SpO ₂ 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.
SpO ₂ 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.
SpO ₂ 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.
SpO ₂ 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.
SpO ₂ Unplugged technical alarm.	The sensor is not connected.	Check the SpO₂ connection. Try another sensor.
	There is too much interference.	
	The sensor is damaged.	
SpO ₂ Sensor Malfunction technical alarm.	The SpO ₂ sensor or cable is faulty.	Try another sensor. If the problem persists, call for service of the SpO₂ module. If SpO₂ monitoring is essential to patient care, take the device out of use.
SpO ₂ Equipment Malfunction technical alarm.	Faulty SpO ₂ hardware.	Call for service of the SpO₂ module. If SpO₂ monitoring is essential to patient care, take the device out of use.

Table 62 **SpO₂ Problems (Continued)**

Symptom	Possible Cause	Potential Solution
SpO ₂ 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.
SpO ₂ 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.
SpO ₂ 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.

EtCO₂ Problems

Table 63 **EtCO₂ 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: CO ₂ Sensor Not Ready or Unable to zero: CO ₂ in the Tube prompts.	See Table 31 “Zeroing Messages” on page 96 for possible causes and solutions.	
CO ₂ Replace Sensor technical alarm.	The CO ₂ sensor has reached its end of life.	Replace your sensor with a newer one.
CO ₂ 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.

Table 63 **EtCO₂ Problems (Continued)**

Symptom	Possible Cause	Potential Solution
EtCO ₂ Power Overload	The CO ₂ sensor is malfunctioning.	Replace the sensor.
CO ₂ 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.
CO ₂ 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 CO₂ Sensors” on page 95.
CO ₂ 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.
CO ₂ 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.
CO ₂ 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.
CO ₂ 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.
CO ₂ Tube Unplugged technical alarm.	The CO ₂ sampling line is disconnected.	Confirm the sampling line is firmly connected to the CO ₂ sensor.
CO ₂ 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.
CO ₂ 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.

NBP Problems

Table 64 **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.

Table 64 **NBP Problems (Continued)**

Symptom	Possible Cause	Potential Solution
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.	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.	

Printing Problems

Table 65 **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.
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.

Table 65 **Printing Problems (Continued)**

Symptom	Possible Cause	Potential Solution
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.

USB Problems

Table 66 **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.
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 66 **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 Efficia 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

Supplies and Accessories

This chapter provides information on the various supplies and accessories for the Efficia DFM100. If you have questions or need to order accessories and supplies, contact your local Philips sales office or your authorized Philips dealer or distributor.

WARNING: Use only supplies and accessories approved for use with the Efficia DFM100. Non-approved supplies can affect performance, results, or protection of the device of a defibrillator discharge.

Approved Supplies and Accessories

Not all accessories and supplies are available in all countries. The list of accessories is subject to change without notice. Supplies and accessories that may contact a person have been biologically evaluated and comply with ISO 10993-1.

Some of accessories are available in two standards:

- Association for the Advancement of Medical Instrumentation (AAMI)
- International Electrotechnical Commission (IEC)

Use the standards followed by your healthcare institution.

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

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

Use single-use supplies and accessories only once. Reuse may cause a risk of contamination and affect measurement accuracy.

CAUTION: 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.

NOTES: ECG electrodes, SpO₂ sensors, NBP cuffs, CO₂ sampling tube, and paddles/pads are considered applied parts.

Electromagnetic compatibility standards state that manufacturers of medical equipment must specify the maximum lengths of any associated cables that may affect the compliance of the device with emission and immunity tests.

Batteries

Table 67 **Batteries**

Part Number	Description
989803190371 (excluding India)	Rechargeable lithium ion battery pack
989803206781 (India only)	Rechargeable lithium ion battery pack

Cable Management and Accessory Storage

Table 68 **Cable Management and Accessory Storage**

Part Number	Description
989803190331	DFM100 Hospital Accessory Storage System
989803190341	DFM100 Prehospital Accessory Storage System
989803190351	Cable Management Straps
989803194281	Therapy Cable Collar
989803197571	Carry Case Shoulder Strap
989803197581	DFM100 Tray Cover Pouch
989803197671	DFM100 Tray Cover Pouch/Bag Shoulder Strap

Data Management Accessories

Table 69 **Data Management Accessories**

Part Number	Description
989803171261	USB data drive
989803202611	USB data drive

Device Mounting Accessories

Table 70 **Mounting Solutions**

Part Number	Description
989803190361	Bedrail Mount
989803199241	Docking station for DFM100 assembly
989803199251 (excluding Australia)	3-terminal power cord for DFM100 docking station
989803199601 (excluding Australia)	DFM100 docking station bundle

Table 70 **Mounting Solutions (Continued)**

Part Number	Description
989803199611 (Australia only)	3-terminal power cord for DFM100 docking station
989803199661 (Australia only)	DFM100 docking station bundle

ECG Monitoring Accessories

ECG Monitoring Electrodes

Table 71 **ECG Monitoring Electrodes**

Part Number	Description
M2202A	Radiotranslucent foam monitoring electrodes

3-Lead ECG Cable Sets

Table 72 **3-Lead ECG Cable Sets**

Part Number	Description	Maximum Cable Length
989803160641	Efficia 3/5 ECG trunk cable, AAMI/IEC	2.7 m
989803160651	Efficia 3-lead grabber, AAMI	1.0 m
989803160661	Efficia 3-lead grabber, IEC	1.0 m
989803170171	OR 3-lead ECG trunk cable, AAMI/IEC	2.7 m
M1669A	3-lead trunk cable, AAMI/IEC	2.7 m
M1671A	3-lead set, ICU grabber, AAMI	1.0 m
M1672A	3-lead set, ICU grabber, IEC	1.0 m
M1673A	3-lead set, ICU snap, AAMI	1.0 m
M1674A	3-lead set, ICU snap, IEC	1.0 m
M1678A	3-lead set, OR grabber, IEC	1.0 m

5-Lead ECG Cable and Lead Sets

Table 73 **5-Lead ECG Cable Sets**

Part Number	Description	Maximum Cable Length
989803160691	Efficia 5-lead grabber, limb, AAMI	1.6 m
989803160701	Efficia 5-lead grabber, limb, IEC	1.6 m
989803170181	OR 5-lead ECG trunk cable, AAMI/IEC	2.7 m
989803176161	5-lead snap limb, shielded, AAMI	1.6 m
989803176181	5-lead snap limb, shielded, IEC	1.6 m
M1644A	5-lead ICU ECG set, snap, limb, AAMI	1.6 m
M1645A	5-lead ICU ECG set, snap, limb, IEC	1.6 m

Table 73 **5-Lead ECG Cable Sets (Continued)**

Part Number	Description	Maximum Cable Length
M1668A	5-lead ECG trunk cable, AAMI/IEC	2.7 m
M1968A	5-lead ICU ECG set, grabber, limb, AAMI	1.6 m
M1971A	5-lead ICU ECG set, grabber, limb, IEC	1.6 m
M1974A	5-lead OR ECG set, grabber, limb, IEC	1.6 m

EtCO₂ Monitoring Accessories

Table 74 **EtCO₂ Mainstream Accessories**

Part Number	Description	Maximum Cable Length
M2501A	Mainstream CO ₂ sensor	2.9 m
M2533A	Single-patient use adult airway adapter, ET tube size > 4.0 mm	N/A
989803206591	Reusable adult/pediatric airway adapter, ET tube size > 4.0 mm	N/A

Table 75 **EtCO₂ Sidestream Accessories**

Part Number	Description	Maximum Cable Length
M2741A	Sidestream CO ₂ sensor	1.0 m
989803206611	CO ₂ LoFlo nasal cannula - adult	2.6 m
989803206621	CO ₂ LoFlo nasal cannula - pediatric	2.6 m
989803206631	CO ₂ LoFlo nasal cannula - infant	2.6 m
989803206641	CO ₂ /O ₂ LoFlo nasal cannula - adult	2.6 m
989803206651	CO ₂ /O ₂ LoFlo nasal cannula - pediatric	2.6 m
989803206661	CO ₂ /O ₂ LoFlo nasal cannula - infant	2.6 m
989803206671	CO ₂ LoFlo oral-nasal cannula - adult	2.6 m
989803206681	CO ₂ LoFlo oral-nasal cannula - pediatric	2.6 m
989803206691	CO ₂ /O ₂ LoFlo oral-nasal cannula - adult	2.6 m
989803206701	CO ₂ /O ₂ LoFlo oral-nasal cannula - pediatric	2.6 m
989803206711	Airway adapter set - adult/pediatric, endotracheal tube size > 4.0 mm	2.1 m
989803206721	Airway adapter set - adult/pediatric, endotracheal tube size ≤ 4.0 mm	2.1 m
989803206751	Sample line LoFlo with male luer	2.1 m

External Multifunction Electrode Pads

Cables and Adapters

Table 76 External Multifunction Pads Cables and Adapters

Part Number	Description	Maximum Cable Length
989803197111	Pads adapter cable	2.1 m
M3508A	Hands-free pads cable, plug style	2.2 m

Multifunction Electrode Pads

Table 77 Multifunction Electrode Pads

Part Number	Description	Maximum Cable Length
989803139261	SMART Pads II, 1 set	1.2 m
989803149981	SMART Pads III, 1 set	1.2 m
989803149991	SMART Pads III, 5 sets	1.2 m
989803158211	HS FR/FR2 Defib pads, 1 set	1.2 m
989803158221	HS FR/FR2 Defib Pads, 5 sets	1.2 m
989803166021	Adult/child Pre-Connect Defib Pads, 10 sets	1.2 m
M3713A	Adult/child plus multifunction electrode pads, 10 sets/case	1.2 m
M3716A	Adult/child radiolucent multifunction electrode pads, 10 sets/case	1.2 m
M3717A	Infant plus multifunction electrode pads, 5 sets/case	0.6 m
M3718A	Adult/child radiotransparent multifunction electrode pads, 10 sets/case	1.2 m
M3719A	Infant radiotransparent multifunction electrode pads, 5 sets/case	0.6 m

External Paddles

Table 78 External Paddles

Part Number	Description	Maximum Cable Length
989803196431	Efficia external paddles with PCI, water resistant	4.8 m
989803197591	Paddle electrode replacement for 989803196431	N/A
M3543A	External paddles with PCI, water resistant	4.8 m
M4759A	Paddle electrode replacement for M3543A	N/A

Internal Paddles

Table 79 Internal Paddles

Part Number	Description	Maximum Cable Length
M4741A	7.5 cm switched internal paddles	3.9 m
M4742A	6.0 cm switched internal paddles	3.9 m
M4743A	4.5 cm switched internal paddles	3.9 m

Noninvasive Blood Pressure Air Hoses and Cuffs

Table 80 Blood Pressure Air Hoses, Tubing, and Inlets

Part Number	Description	Maximum Cable Length
989803177471	Reusable blood pressure interconnect tubing	3.0 m
989803209761	Adult NBP air hose	1.5 m
989803209771	Adult NBP air hose	3.0 m

Table 81 Blood Pressure Cuffs, Reusable

Part Number	Description
989803177511	Blood pressure cuff - pediatric (GCF 1202)
989803177521	Blood pressure cuff - adult (GCF 1203)
989803177531	Blood pressure cuff - adult large (GCF 1204)

Paper

Table 82 Paper

Part Number	Description
989803190381	50 mm chemical thermal paper (no gridlines), 12 rolls
M4816A	Thermal array paper

SpO₂ Cables and Sensors

Table 83 SpO₂ Cables

Part Number	Description	Maximum Cable Length
M1941A	SpO ₂ extension cable	2.0 m
M1943A	Reusable SpO ₂ sensor adapter cable	1.1 m
M1943AL	Reusable SpO ₂ sensor adapter cable	3.0 m

Table 84 **SpO₂ Sensors**

Part Number	Description	Maximum Cable Length
M1191B	Reusable SpO ₂ sensor, adult finger	2.0 m
M1191BL	Reusable SpO ₂ sensor, adult finger	3.0 m
989803205871	Reusable SpO ₂ sensor, pediatric/small adult finger (M1192A)	1.5 m
989803205901	Reusable SpO ₂ clip sensor, adult (M1196A)	3.0 m
989803205831	Single-patient-use SpO ₂ ped-adult clip sensor (M1131A)	0.5 m
989803205841	Single-patient-use SpO ₂ infant wrap sensor (M1132A)	0.9 m
989803205851	Single-patient-use SpO ₂ neonatal/infant/adult wrap sensor (M1133A)	0.9 m
989803205861	Single-patient-use SpO ₂ adhesive-free wrap sensor (M1134A)	0.9 m

Test Loads and Shorted Plugs

Table 85 **Test Loads and Shorted Plugs**

Part Number	Description
989803171271	Test plug, shorted
M3725A	Test load, 50 Ohm, plug-style

NOTES

[illegible]

Specifications

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 (with battery and printing paper inside): Less than 7 kg (15.4 lbs)

Power: Rechargeable Lithium Ion battery; AC power

Device Service Life: Seven years

Mode of Operation: Continuous

AC Line Powered: 100-240 VAC, 50 or 60 Hz, 1 - 0.46 A, Class I Equipment

Battery Powered: Nominal 14.8 V, Rechargeable Lithium Ion

Defibrillator

Power On to Manual Defibrillation Mode: Less than 8 seconds from power on to Manual Defibrillation mode.

Waveform: Biphasic Truncated Exponential. Waveform parameters adjusted as a function of patient impedance.

Table 86 **Delivered Energy Accuracy**

Nominal Delivered Energy vs. Load Impedance								
Selected Energy	Load Impedance (ohms) $\pm 2\%$							
	15	25	50	75	100	125	150	175
1 J	1.0	1.2	1.3	1.3	1.2	1.1	1.0	0.9
2 J	1.5	1.7	2.0	2.1	2.0	1.9	1.7	1.6
3 J	2.2	2.6	3.0	3.1	3.2	3.2	3.1	2.9
4 J	3.0	3.5	4.0	4.2	4.3	4.4	4.5	4.3
5 J	3.7	4.3	5.0	5.2	5.4	5.5	5.6	5.4
6 J	4.5	5.2	6.0	6.3	6.5	6.6	6.7	6.5
7 J	5.2	6.1	7.0	7.3	7.6	7.8	7.8	7.6
8 J	5.9	6.9	8.0	8.4	8.6	8.9	8.9	8.7
9 J	6.7	7.8	9.0	9.4	9.7	10	10	9.8
10 J	7.4	8.7	10	10	11	11	11	11
15 J	11	13	15	16	16	17	17	16

Table 86 **Delivered Energy Accuracy (Continued)**

Nominal Delivered Energy vs. Load Impedance								
Selected Energy	Load Impedance (ohms) $\pm 2\%$							
	15	25	50	75	100	125	150	175
20 J	15	17	20	21	22	22	22	22
30 J	22	26	30	31	32	33	33	33
50 J	37	43	50	52	54	55	56	54
70 J	N/A	61	70	73	76	78	78	76
100 J	N/A	87	100	105	108	111	111	108
120 J	N/A	104	120	126	130	133	134	130
150 J	N/A	130	150	157	162	166	167	163
170 J	N/A	147	170	178	184	188	189	184
200 J	N/A	173	200	209	216	222	223	217

The delivered energy accuracy is $\pm 10\%$ or $\pm 1\text{J}$ whichever is greater for all energy settings. Fifteen ohms load impedance is for internal paddles defibrillation only, therefore data is not available for nominal delivered energy over 50 J.

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:

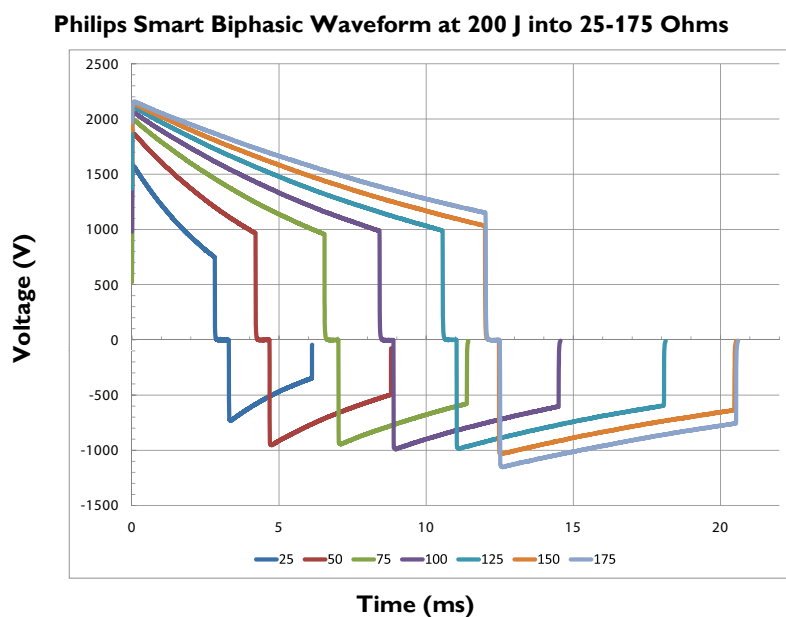
- 20 seconds with AC power only and at 90% of rated mains voltage.
- 20 seconds with a new, fully charged battery even after 15 discharges of maximum energy.

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: 175 ohm. Actual functional range may exceed these values.

Figure 56 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.

Synchronized Shock Timing: Maximum time from R-Wave detected to shock delivered is 25 ms, as measured with oscilloscope from peak of input QRS wave to leading edge of defibrillation discharge into a 50-ohm test load.

AED Mode

AED Energy Profile: 150 Joules (factory default) for Adult. 50 J for Infant/Child nominal into a 50-ohm test load.

ECG and Arrhythmia Monitoring

Inputs: Up to 3 ECG waves may be viewed on the display and up to 2 waves printed simultaneously.

Heart Rate Display: Digital readout on the display from 16 to 300 bpm (Adult) or 16 to 350 bpm (Infant/Child), with an accuracy of $\pm 10\%$ 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) $\pm 5\%$, 25 mm/sec (display) $\pm 10\%$.

ECG Waveform Recovery Time: Less than or equal to three seconds after defibrillation.

ECG Leads Off Sensing: 3- and 5-Lead wires apply a < 35 nA DC current patient electrodes, < 1.0 uA 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 bpm used: 1.8 mV.

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), 2.0-20.0 Hz
- ECG for Printer: 0.05-150 Hz - Diagnostic, 0.05-40 Hz - ST Monitor (IEC 60601-2-27), 0.15-40 Hz - Monitor, 2.0-20.0 Hz – EMS

Heart rate accuracy and response to irregular rhythm: Meets IEC 60601-2-27 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.

ECG Analog Output Bandwidth: 0.5 to 70 Hz

ECG Analog Output Gain: 1v output per 1 mV input $\pm 10\%$

ECG Analog Output Delay: Propagation delay time is <25 ms from ECG input to ECG analog output.

Pacemaker Pulse Rejection Capability: Rejects pacemaker pulses with amplitudes from ± 2 mV to ± 700 mV and pulse widths from 0.1 ms to 2.0 ms without overshoot as per IEC 60601-2-27.

Pacer Pulse Detector rejection of Fast ECG Signals: Slew Rate of 1.1 V/s.

Response Time to Heart Rate Change: Eight seconds for a high heart rate alarm when the rate changes from 80 to 120 bpm, with the alarm limit set at 100 bpm; six seconds 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
- SpO₂: Type CF
- CO₂: Type BF
- NBP: Type CF
- Pads/Paddles: Type BF
- Internal Paddles: Type CF

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 $\pm$ 10% nominal (stationary trace; sweeping erase bar) for ECG and SpO₂; capnogram wave is 6.25 mm/s $\pm$ 10%.

Wave Viewing Time: 6.5 sec $\pm$ 10%.

Battery

Type: Rechargeable, Lithium Ion; See battery label for capacity information.

Approximate Dimensions: 27.9 mm (H) x 81.2 mm (W) x 146.7 mm (L); 1.1 in (H) x 3.2 in (W) x 5.8 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 2.5 hours to 90% capacity
- Less than 2 hours to 80% capacity

Thermal Array Printer

Reports: The following can be printed:

- Event summary (long or short)
- Vital Signs Trends
- Operational check
- Configuration
- Error log
- Device information

Speed: 25 mm/s with an accuracy of $\pm$ 5%

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 $\pm$ 10% or $\pm$ 5 mA whichever is greater. For a 40 ms setting, the maximum pacing current is 140 mA.

Pulse Duration: 20 or 40 msec with $\pm$ 10% accuracy

Rate: 30 ppm to 180 ppm (10 ppm increments); accuracy $\pm$ 1.5%

Mode: Demand or Fixed

Refractory Period: 340 msec (30 to 80ppm); 240 msec (90 to 180 ppm) $\pm$ 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.

SpO₂ Pulse Oximetry

SpO₂ Measurement Range: 0-100%

SpO₂ Resolution: 1%

SpO₂ Update Period: 1-2 seconds typical; maximum of 30 seconds or less

SpO₂ Sensor Accuracy: Specified accuracy is the root-mean-square (RMS) difference between the measured values and reference values.

Table 87 SpO₂ Sensor Accuracy

Sensor Part Number	Accuracy
M1191B	$\pm 2\%$
M1191BL	$\pm 2\%$
989803205871 (M1192A)	$\pm 2\%$
989803205901 (M1196A)	$\pm 3\%$
989803205831 (M1131A)	$\pm 3\%$
989803205841 (M1132A)	$\pm 2\%$
989803205851 (M1133A)	$\pm 2\%$
989803205861 (M1134A)	$\pm 2\%$

NOTES: Accuracy outside the range specified for each sensor is not indicated. The sensors in Table 87 were validated for use with the Efficia DFM100 using the Philips picoSAT II SpO₂ module with Fourier Artifact Suppression Technology (FAST).

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.

While the SpO₂ 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.

SpO₂ 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% SaO₂ 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 ± 1 standard deviation of the value measured by a CO-oximeter.

Functional test equipment designed for SpO₂ testing cannot be used to assess the accuracy of the SpO₂ 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.

SpO₂ Alarm Range:

- Low Limit: 50-99% (Adult and Infant/Child)
- High Limit: 51-100% (Adult and Infant/Child)

SpO₂ and Pulse High/Low Alarm Signal Generation Delay (after alarm conditions has been met): 12 seconds

SpO₂ Response Time (90 to 80%): Less than 22 seconds

SpO₂ and Pulse Averaging Time: 10 seconds

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 Delay Time (after alarm conditions has been met): 21 seconds

Pulse Rate Measurement Range: 30-300 bpm

Pulse Rate Resolution: 1 bpm

Pulse Rate Accuracy: ±2% or 1 bpm, whichever is greater

Pulse Rate Reference Method: Electronic pulse simulator

Pulse Response Time (90 to 120 bpm): Less than 22 seconds

Pulse Alarm Range:

- Low Limit: 30-295 bpm (Adult and Infant/Child)
- High Limit: 35-300 bpm (Adult and Infant/Child)

EtCO₂

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 (0-20 kPa)

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 25°C

Accuracy Stability:

- Short Term Drift: Drift over four hours shall not exceed 0.8 mmHg

Warm-up Time:

- Mainstream sensor: 2 minutes at 25°C
- Sidestream sensor: 5 minutes at 25°C

System Response Time: Sidestream: 3.5 seconds typical

EtCO₂ High and Low Alarm Delay Time (after alarm condition has been met): Less than 3 seconds

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:**

- Mainstream sensor: 0-150 rpm
- Sidestream sensor: 0, 2-150 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 Signal Generation Delay Time (after alarm condition has been met): less than 2 seconds**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:

- Adult: 160 mmHg $\pm$ 10 mmHg (21.3 kPa $\pm$ 1.3 kPa)
- Infant/Child: 120 mmHg $\pm$ 10 mmHg (16 kPa $\pm$ 1.3 kPa)

Overpressure Safety Limit:

- Adult: 290 mmHg $\pm$ 10 mmHg (38.7 kPa $\pm$ 1.3 kPa)
- Infant/Child: 145 mmHg $\pm$ 5 mmHg (19.3 kPa $\pm$ 0.7 kPa)

Maximum Inflation Time:

- Adult: 180 seconds
- Infant/Child: 90 seconds

Clinical Accuracy: Meets the requirements of ISO 81060-2**Pressure Transducer Accuracy:** ± 3 mmHg (± 0.4 kPa) over the range 0-280 mmHg (0-37 kPa)**Cuff Rating:**

- Adult: 0-300 mmHg (0-40 kPa)
- Infant/Child: 0-150 mmHg (0-20 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

Environmental

Temperature: Operating temperature for the device: 0 °C to 45°C (32°F to 113°F); Operating temperature range for EtCO₂: 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).

Humidity: 15% to 95% relative humidity, non-condensing

- EtCO₂ measurements meet all specifications during and after exposure to non-condensing, relative humidity conditions from 15% to 90%

Atmospheric Pressure Range (Operation and Storage): 1060 mbar to 572 mbar (-382 m to 4568 m; -1250 ft to 15,000 ft).

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 60068-2-32 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/EN 60601-1-2.

Transient Operating Conditions: The Efficia DFM100 meets all specifications for a period not less than 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 IEC 60601-2-4, IEC 60601-1.

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 lead, which is known to the State of California to cause cancer. For more information, see www.P65Warnings.ca.gov.

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 event summaries of approximately 30 minutes in length or 5 event summaries of approximately 8 hours 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. Hazards arising from software errors are minimized by the product's compliance with the software requirements contained in IEC 62304.

All software upgrades are performed in Service mode. For more information, see the Efficia DFM100 *Service Manual*.

Symbol Definitions

The following table lists symbols that may be present on the Efficia DFM100, the lithium ion battery, or the shipping carton, per the definition of IEC 60601-1.

Table 88 **Symbol Glossary**

Symbol	Title	Description
	Alarm, general	Indicates an alarm on the control equipment.
	Alternating current	Indicates on the rating plate that the equipment is suitable for alternating current only. Identifies relevant terminals.
	Atmospheric pressure limit	Indicates the acceptable upper and lower limits of atmospheric pressure for transport and storage.
	Batch	Identifies the manufacturer's batch or lot code.
	Battery	Identifies the battery holder or the positioning of the battery itself.

Table 88 **Symbol Glossary (Continued)**

Symbol	Title	Description
	Cargo aircraft only	Indicates that the item is to be transported on cargo aircraft only, not on passenger aircraft.
	Caution	Indicates that caution is necessary when operating the device or control close to where the symbol is placed. Indicates that the current situation needs operator awareness or operator action in order to avoid undesirable consequences.
	Caution hot surface	Indicates that the marked item can be hot and should not be touched without taking care.
	Caution shock	Identifies equipment that has risk of electric shock.
	CE mark with notified body	Indicates European technical conformity.
	Class II equipment	Identifies equipment meeting the safety requirements specified for Class II equipment according to IEC 61140.
	Country of manufacture and date	Identifies the country of manufacture of products. In the application of this symbol: - The "CC" is replaced by the two-letter or three-letter country code defined in ISO 3166-1. - The date is adjacent to the symbol and in YYYY-MM-DD format.
	Dangerous voltage	Indicates hazards arising from dangerous voltages.
	Defibrillation-proof type BF applied part	Identifies a defibrillation-proof type body floating (BF) applied part complying with IEC 60601-1.
	Defibrillation-proof type CF applied part	Identifies a defibrillation-proof type cardial floating (CF) applied part complying with IEC 60601-1.
	Direct current	Indicates on the rating plate that the equipment is suitable for direct current only. Identifies relevant terminals.
	Do not deform or damage	Indicates that the equipment is to not be deformed or damaged.
	Do not dispose of in fire	Indicates that the equipment is to not be disposed of in fire.
	Do not open or dismantle	Indicates that the equipment is to not be opened or dismantled.
	Do not reuse	Indicates that the item is for single use only and must not be used more than once.
	Do not short circuit	Indicates that the equipment is not to be short circuited.

Table 88 **Symbol Glossary (Continued)**

Symbol	Title	Description
	EC rep	Identifies the authorized representative in the European community.
	ECG port	Identifies the connecting port for the ECG cable.
	Environmentally friendly use period (EFUP)	Identifies the environmentally friendly use period, up to 50 years.
	European Union	Indicates the European Union.
	Fragile	Indicates that the contents of the transport package are fragile, and the package shall be handled with care.
	Humidity limitation	Identifies the maximum and minimum limits of relative humidity at which the item shall be stored, transported, or used.
	Importer	Identifies the entity importing the medical device into the locale.
IP54	Ingress protection	Identifies the level of protection offered by an enclosure against solids and liquids.
	Input	Identifies an input terminal.
	Input (entrance)	Identifies an entrance.
	Input/output	Identifies a combined input/output connector.
	Keep away from rain	Indicates that the transport package shall be kept away from rain and in dry conditions.
	Keep away from sunlight	Indicate that the transport package shall not be exposed to sunlight.
	Korea certification	Indicates compliance with Korea's product safety requirements for electrical and electronic equipment.
	LAN port	Identifies the connecting port for the LAN cable. The LAN port is for factory use only.
	Lithium battery	Identifies the lithium battery classification: - UN 3480 indicates lithium ion battery. - UN 3481 indicates lithium ion battery packed with equipment.
	Malaysia MCMC	Indicates product compliance with Malaysian Communications and Multimedia Commission (MCMC). Unique certification number may be included with the symbol.

Table 88 **Symbol Glossary (Continued)**

Symbol	Title	Description
	Manufacturer	Identifies the manufacturer of a product.
	Mass, weight	Indicates mass or a function related to mass.
	Maximum altitude	Identifies that the product is intended to be usable up to the maximum altitude.
	Model number	Identifies the model number or type number of a product. In the application of this symbol, the model number or type number of the product should be accompanied with this symbol.
	MR Unsafe	Indicates that the product is unsafe to operate under magnetic resonance (MR) environments. Do not enter an MRI scanner room or an MR system.
	NBP port	Identifies the connecting port for the NBP cable.
	Nominal dimensions	Identifies the control to set or adjust the dimensions. Identifies the nominal dimensions.
	Non-ionizing electromagnetic radiation	Indicates generally elevated, potentially hazardous, levels of non-ionizing radiation. Indicates equipment or systems that include RF transmitters or intentionally apply RF electromagnetic energy for diagnosis or treatment.
	Operator's manual; operating instructions	Identifies the location where the operator's manual is stored. Identifies information that relates to the operating instructions. Indicates that the operating instructions should be considered when operating the device or control close to where the symbol is placed.
	Option key	Identifies the device option key.
	Options installed	Indicates that device options have been installed.
	Output	Identifies an output terminal.
	Output exit	Identifies an output exit.
	Part number	Identifies the product part number.
	Quantity	Identifies the number of pieces in the package.
	Rechargeable battery	Identifies equipment that shall only be used with rechargeable (secondary) cells or batteries. Identifies rechargeable cells or batteries.

Table 88 **Symbol Glossary (Continued)**

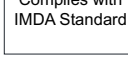
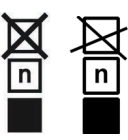
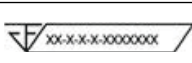
Symbol	Title	Description
 	Recyclable	Indicates that the marked item or its material is part of a recovery or recycling process.
	Refer to instruction manual	Signifies that the instruction manual must be read.
	Reference order number	Identifies the manufacturer's catalogue number.
	Rx only	Identifies the product as for use by prescription only.
	Serial number	Identifies the manufacturer's serial number.
	Singapore IMDA	Indicates product compliance with Infocomm Media Development Authority (IMDA) regulation. Unique certification number may be included with the symbol.
	SpO ₂ port	Identifies the connecting port for the SpO ₂ cable.
	Stacking limit by number	Indicates that the items shall not be vertically stacked beyond the specified number, either because of the nature of the transport packaging or because of the nature of the items themselves. N is to be replaced by the maximum number of items allowed, which does not include the bottom package in the stack.
	Swiss authorized representative	Indicates the authorized representative in Switzerland.
	Technical manual	Identifies the location where the manual is stored. Identifies information that relates to the servicing instructions for the equipment. Indicates that the service manual should be considered when servicing the device close to where the symbol is placed.
	Temperature limit	On the item, identifies the maximum and minimum temperature limits at which the item shall be used. On the package, identifies the maximum and minimum temperature limits at which the item with packaging shall be stored or transported.
	Temperature limit	Identifies the maximum and minimum temperature limits at which the item without packaging shall be stored or transported.
	Temperature port	Identifies the connecting port for the Temperature cable.
	Thai FDA import license	Identifies the medical device license number of Thailand.
	Therapy port	Identifies the connecting port for the Therapy cable.
	This way up	Identifies the correct upright position of the transport package.

Table 88 **Symbol Glossary (Continued)**

Symbol	Title	Description
	UNECE regulation	Indicates product compliance with United Nations Economic Commission for Europe. E24 is used for Ireland.
	Unique device identifier (UDI) non-harmonized	Identifies the device.
	Universal Serial Bus (USB)	Identifies a port or plug as meeting the generic requirements of the Universal Serial Bus (USB). Indicates that the device is plugged into a USB port or is compatible with a USB port.
	Use by date	Indicates that the device should not be used after the date accompanying the symbol.
	WEEE	Indicates that separate collection for waste electric and electronic equipment (WEEE) is required. The black line indicates that the item was put on market after August 2005.

NOTE: For definitions of symbols which appear on the Efficia DFM100's front panel see "[Front of the Device](#)" on page 7 and "[General Function Buttons](#)" on page 24. For definitions of symbols which appear on the external paddles see "[External Paddles](#)" on page 12.

Abbreviation Definitions

Table 89 lists various abbreviations used with the Efficia DFM100 and in these Instructions for Use.

Table 89 **Abbreviations**

Abbreviation	Definition
%	Percent
°C	Degrees Celsius
°F	Degrees Fahrenheit
A	Amps
AC	Alternating Current
AHA	American Heart Association
AwRR	Airway Respiration Rate
bpm	Beats per minute
cm	Centimeter
dB	Decibel
dB(A)	A-weighted decibel
DC	Direct Current
EMC	Electromagnetic Compatibility
ERC	European Resuscitation Council
Hz	Hertz
in	Inches

Table 89 Abbreviations (Continued)

Abbreviation	Definition
J	Joules
kg	Kilograms
kPa	Kilo Pascal
lb	Pounds
m	Meter
μs	Microseconds
μV	MicroVolt
mA	MilliAmpere
mV	MilliVolt
min	Minutes
mmHg	Millimeters of mercury
ms	Millisecond
mW	Milliwatt
nA	NanoAmpere
nm	Nanometer
NSA	No Shock Advised
PSD	Power Spectral Density
RFU	Ready For Use
rpm	Respirations Per Minute
sec	Seconds
V	Volt
VDC	Volts DC

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 97](#) 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 CO₂, noninvasive 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 90](#) through [Table 96](#) 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.

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 96](#) for this detailed immunity information. See [Table 97](#) 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 90 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 91 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	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 92	See Table 92	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 92 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
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 93 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
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 94 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 95 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

Table 96 Electromagnetic Immunity - Life Supporting Systems

Immunity Test	Test Level	Compliance Level	Electromagnetic Environment - Guidance
			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.
Conducted RF IEC 61000-4-6/GB/T17626.6	3 Vrms 150 kHz to 80 MHz outside ISM bands ^a	3 Vrms	Recommended Separation Distance: $d = 1.2\sqrt{P}$
	10 Vrms 150 kHz to 80 MHz in ISM bands	10 Vrms	
Radiated RF IEC 61000-4-3/GB/T17626.3	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	3 V/m* 10 V/m, 20 V/m** 80 MHz to 2.5 GHz	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: 

* 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 97 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.		

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