English

Instructions for Use

HeartStart Intrepid

Monitor/Defibrillator

867172

PHILIPS

Notice

About This Edition

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CE 0123

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REACH requires Philips Healthcare to provide chemical content information for Substances of Very High Concern (SVHC) if they are present above 0.1% of the product weight. Components of/within electric and electronic equipment may contain phthalates above the threshold (e.g. bis(2-ethyl(hexyl)phthalate), CAS nr.: 117-81-7). The REACH SVHC list is updated on a regular basis. Therefore, please refer to the following Philips REACH website for the most up-to-date information on products containing SVHC above the threshold:
http://www.philips.com/about/sustainability/reach.page

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

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

Conventions Used in This Manual

This book contains the following conventions:

WARNING: Warning statements display or sound an alert 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 display or sound an alert 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 or **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

Electronic viewing only:

See "Introduction" on page 1	represents hypertext links; click on the blue link to go to that destination

Click for quick access

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Introduction

Thank you for choosing the HeartStart Intrepid monitor/defibrillator in the Philips family of defibrillators. The HeartStart Intrepid has been developed and designed to meet the advanced requirements of hospital code teams, nurses, physicians and first-responders in the Emergency Medical Services (EMS) environment. The device is easy to use in all modes, and can be used to monitor ECG and optional pulse oximetry (SpO_2), noninvasive blood pressure (NBP), end-tidal carbon dioxide ($EtCO_2$), and temperature. Administer therapy using 1-2-3 defibrillation in Manual Mode, 2-step AED Mode, synchronized cardioversion, and optional pacing and Q-CPR Modes.

These *Instructions for Use* provide guidance for the safe and proper operation of the device, as well as set-up, configuration, and maintenance information. Be sure to become familiar with the features and operation of the HeartStart Intrepid prior to using it.

This chapter is divided into the following major sections:

Overview

The HeartStart Intrepid is a lightweight, portable monitor/defibrillator with a large (21.3 cm or 8.4" diagonal) 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, the display shows four different ECG waveforms at one time. Using a 3-, 5-, or 10-lead ECG cable, view leads from I, II, III, aVR, aVL, aVF, and V (or V1 through V6). Optional monitoring of SpO_2 (numeric and pleth wave), $EtCO_2$ (numeric and capnogram), NBP, and Temperature are available. Measurements and waves are presented on the display and alarms are available to alert a change in the patient's condition. 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. 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. Perform synchronized cardioversion in Manual Defibrillation Mode.

In the optional AED Mode, the HeartStart Intrepid analyzes the patient's ECG and determines whether a shock is advised. Voice prompts guide the 2-step defibrillation process, while easy-to-follow instructions and patient information (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 Manual Defibrillation and AED modes incorporate Philips' low energy SMART Biphasic waveform for defibrillation. Both modes also offer the Q-CPR® meter 2 option. Q-CPR offers real-time measurement and corrective feedback on the rate, depth/complete release of compressions (and lack of CPR activity), and ventilation rate. The HeartStart Intrepid displays a CPR Timer and compression counter to assist with protocol management.

The device automatically stores critical event data such as Event Summaries and Vital Signs Trending. In clinical modes, the HeartStart Intrepid continually records data about the patient in an Event Summary record. The recorded data includes vital signs (such as SpO_2, and heart rate), ECG wave data, and therapy events (such as shock delivered). The Event Summary can be printed or exported after the patient event is completed.

Transfer the data through the Wi-Fi or cellular network or copy to a USB drive and download it to a compatible version of Philips' data management solution.

The HeartStart Intrepid 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 or DC 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 HeartStart Intrepid 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 HeartStart Intrepid is functioning properly.

The HeartStart Intrepid is highly configurable to better meet the needs of diverse users, particularly the EMS environment. Be sure to become familiar with the device's configuration before using the HeartStart Intrepid. See "Configuration" on page 161 for more details.

Intended Use

The HeartStart Intrepid is intended for use in an EMS or hospital setting by qualified medical personnel trained in the operation of the device and qualified by certified training in basic life support or advanced life support. This HeartStart Intrepid is intended for use in emergency resuscitation as follows:

- In AED Mode, to detect a shockable rhythm and deliver a shock
- In Manual Mode, to deliver synchronized and asychronized defibrillation.
- The optional Q-CPR meter 2 to provide the user feedback in performing chest compression during CPR
- In Pacing Mode to deliver external cardiac pacing
- In Monitor Mode, the Intrepid is intended to
  - measure heart rate and heart rhythm via ECG
  - measure blood oxygen saturation via SpO_2
  - measure exhaled CO_2 via $EtCO_2$
  - measure systolic, diastolic, and mean blood pressure via NBP
  - measure temperature

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 Intrepid. 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 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 Intrepid in the following modes and indications of use.

AED

When in AED mode, the Intrepid 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. Intrepid 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 using the defibrillator to analyze the patient's ECG.

Contraindications: Intrepid is contraindicated for asynchronous defibrillation in AED mode for patients that are conscious, have a pulse, and are breathing.

Manual Defibrillation Therapy

A direct current defibrillator applies a brief intense pule of electricity to the cardiac muscle. Intrepid 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 AHA and ERC has 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 Intrepid 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 which is 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. Intrepid 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: Intrepid is contraindicated for asynchronous defibrillation in manual mode for patients that are conscious, have a pulse, and are breathing or don't have a pulse and are in a non-shockable rhythm, such as asystole or pulseless electrical activity. Intrepid 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

Noninvasive pacing in Intrepid delivers an electrical impulse to the heart causing cardiac depolarization and myocardial contraction. The energy is delivered through electrode pads placed on the chest. It is recognized by the AHA and ERC that successful pacing of a patient is related to the length of time between the onset of a brady-dysrhythmia 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. Intrepid in Pacing mode requires user interaction to set the mA, rate, and start pacing the patient.

- Indications of use: Noninvasive transcutaneous pacing is indicated for hemodynamically unstable bradycardia in patients with a pulse that are unresponsive to atropine.
- Contraindications: Intrepid is contraindicated for prolonged brady-asystolic cardiac arrest.

Q-CPR Feedback

Good CPR involves early intervention that provides feedback that chest compressions are at the correct depth and rate, with complete release and minimal interruption, and ventilation is performed at the correct rate.

Indications for Use: Q-CPR™ is indicated to provide feedback to encourage rescuers to perform resuscitation in accordance with AHA/ERC guidelines for chest compression rate, depth, and duty cycle and ventilation rate, volume and flow rate (inflation time).

Contraindications: The Q-CPR option is contraindicated for use on neonatal and pediatric patients (under 8 years of age or weighing less than 25 kg) and is not for use when CPR is contraindicated.

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 Intrepid is obtained by placing electrodes or pads/paddles on the patient and allows the heart's electrical activity to be monitored and recorded. Intrepid in Monitoring mode requires user interaction to assess the patient's ECG.

Indications for Use: Intrepid is indicated for monitoring and recording 3-5 and 12 lead ECG waveforms and heart rate in patients with and without cardiac dysfunction.

Contraindications: There are no known contraindications for ECG monitoring.

Pulse Oximetry (SPO_2) Monitoring

Pulse oximetry is a noninvasive method that checks the saturation of oxygen in the arterial blood. The pulse oximetry functionality in Intrepid 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 a SpO2 reading. Intrepid 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 for developing hypoxemia.

Contraindications: There are no known contraindications for SpO2 monitoring.

Noninvasive Blood Pressure Monitoring

Intrepid measures the blood pressure of patients by automatically inflation of an occluding cuff and, using oscillometer measurement technique determines systolic, diastolic, mean arterial pressures and pulse. The measurement can be initiated manually or set to recur at a predetermined interval. Intrepid in Monitoring mode requires user interaction to assess the patient's NBP.

Indications for Use: Noninvasive 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, and titration of vasoactive and cardiotonic medications, and post-defibrillation recovery.

Contraindications for Use: There are no known contraindications for NBP monitoring.

End-tidal CO_2 ($EtCO_2$) Monitoring

The EtCO2 functionality in Intrepid 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 side stream method and can be used with intubated and non-intubated patients. Respiration rate is also measured and displayed in breaths per minute. The Intrepid 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 such as to determine the adequacy of chest compressions during CPR, to detect endotracheal tube placement, and endotracheal tube misplacement.

Contraindications for Use: There are no known contraindications for EtCO2 monitoring.

Temperature Monitoring

Body temperature monitoring is a noninvasive method to measure and record a patient's temperature. Temperature monitoring on Intrepid requires a probe be placed on the skin, inserted rectally, or through the esophagus as users should be acutely aware of patients' temperature because it serves as a useful indicator of change in their clinical condition

Indications for Use: Temperature is indicated to obtain a baseline temperature to enable comparisons to be made with future recordings to enable close observation in resolving hypothermia/hyperthermia; to observe and monitor patients for changes indicating an infection; to monitor the effect of treatment for antimicrobial therapy for infection.

Contraindications: There are no contraindications for temperature monitoring.

Use Environment

The HeartStart Intrepid monitor/defibrillator is used primarily by ALS-trained EMS providers, such as EMTs, paramedics, and emergency physicians in the pre-hospital environment. This is a challenging environment where providers must provide assessment and treatment to a wide range of patient demographics, disease states and acuities in a highly stressful emergent situation. EMS users

need tools to support standards of care that are influenced by the latest clinical evidence, accepted guidelines and local protocols. As such, clinicians need a device which provides a wide range of capabilities to help insure accurate diagnosis and continuous assessment of a patient's condition.

EMS users must also be assured their equipment will perform reliably and effectively in all weather conditions and in all locations where an emergency may occur. The equipment must be designed to withstand the environment not only during clinical use but also during long-term storage and transportation in a variety of vehicles including ambulances, fire apparatus, police vehicles, marine vessels and military vehicles.

The secondary use environment for Intrepid will be in the hospital, primarily for high acuity areas and patient transport. Key requirements for this use model include small size and weight, flexibility to configure the device to adjust to a wide range of patient acuity levels, and interoperability with other data systems.

Intended Users

The primary clinical users for the Intrepid will be qualified medical personnel in a prehospital setting who are trained in the operation of the device and qualified by training in advanced life support (ALS). Prehospital caregivers with Basic Life Support (BLS) training may use the device in AED mode. The Intrepid may also be used by qualified medical personnel in a hospital setting who are also trained in the operation of the device and qualified by training in advanced life support (ALS).

Medical Directors are physicians who provide medical oversight, guidance, leadership and quality assurance to an EMS service. They are responsible for the creation of protocols for patient treatment for paramedics/EMTs and assurance that protocols are followed. Medical Directors are key decision makers in the purchase of clinical equipment with a focus on improving patient outcomes through reliable, quality care.

Non-clinical users include EMS Operations or hospital personnel such as IT support, technicians, biomedical engineers, and service personnel. These users may be responsible for device implementation issues such as integration with IT infrastructure, clinical configuration settings, performance testing and verification, calibration, repairs and routine product maintenance on the monitor/defibrillator device. Other potential responsibilities may include Quality Assurance/Quality Improvement (QA/QI) activities and reporting to the appropriate county, state or federal agencies.

Safety Considerations

General warnings and cautions that apply to the use of the HeartStart Intrepid are provided in "Safety Considerations" on page 48. Additional warnings and cautions specific to a particular feature are provided in the appropriate sections of these instructions.

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

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

Use only supplies and accessories approved for use with the HeartStart Intrepid. Use of non-approved supplies and accessories could affect performance and results. Non-approved supplies can affect performance, results, or protection of the device of a defibrillator discharge. Do not service this device while in use with a patient.

Use the HeartStart Intrepid on one patient at a time.

Use single-use supplies and accessories only once.

Getting Started

The HeartStart Intrepid comes from the factory ready to use. However, before putting the device into clinical use for the first time, it is recommended to

- Read these *Instructions for Use* in their entirety.
- Fully charge the battery. See "Power" on page 31.
- Run an Operational Check. See "Operational Check" on page 201.
- Perform a Shift Check. See "Shift Check" on page 199.
- Perform an Alarm test. See "Alarm Test" on page 210.

NOTES

2

Device Basics

Overview

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

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

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

See "Operating the Device" on page 27 for instructions on how to operate the device.

If the HeartStart Intrepid includes additional features for the EMS environment, review the section related to "Additional Features" on page 23 as well as the rest of the chapter.

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

Pictures of the HeartStart Intrepid display throughout this manual are for illustration purposes only. The content of these areas varies with the display view, the options on the device, and the function performed.

This chapter is divided into the following major sections:

Basic Orientation

This section provides an overview of the HeartStart Intrepid, options and accessories.

Front of the Device

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

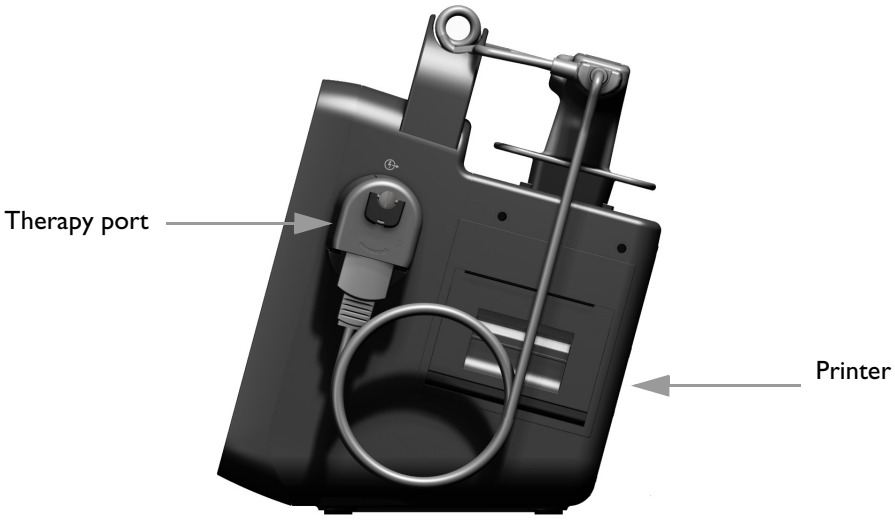
Figure 1 **HeartStart Intrepid Front View**

Additional controls and indicators are located on the external paddles (see "External Paddles" on page 17) and the Lithium Ion battery (see "Battery Fuel Gauge" on page 20).

Right Side

The right side of the HeartStart Intrepid 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 and, optionally, a Q-CPR meter 2 cable. It also contains the printer.

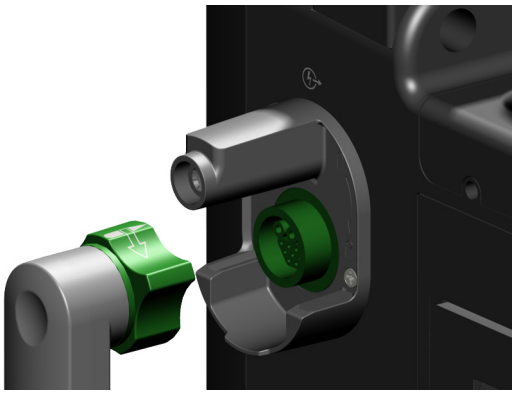
Figure 2 **Therapy Port and Printer**



To connect the Therapy Cable:

1. Align the white pointer on the cable with the white arrow on the green Therapy port as shown in Figure 3.
2. Insert the cable into the green Therapy port and push until it clicks 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**



3. Attach and lock the collar lid, see "Therapy Cable Collar" on page 22.

To detach the Therapy Cable:

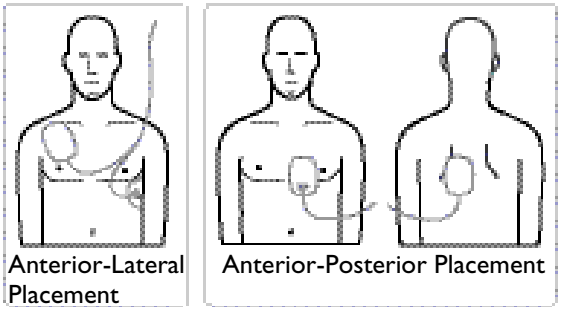
1. Unlock and detach the collar lid, see "Therapy Cable Collar" on page 22.
2. Rotate the green knob in a clockwise direction as indicated by the unlock symbol  next to the Therapy port.

3 Pull the cable away from the device.

Multifunction Electrode Pads

Use multifunction electrode pads to monitor and administer therapy to patients with the HeartStart Intrepid.

Figure 4 **Multifunctional Pads**



Connecting Multifunction Electrode Pads

To connect multifunction electrode pads:

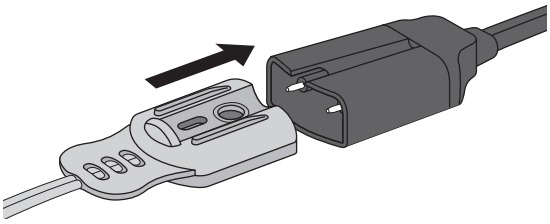
1 Check the expiration date on the pads package and inspect the package for any damage. Discard expired or damaged pads.

2 Connect the Therapy cable to the HeartStart Intrepid (see "Connecting the Therapy Cable" on page 11).

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

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

Figure 5 **Connecting Multifunctional Pads**



Installing Printer Paper

The HeartStart Intrepid uses 75 mm paper for printing.

To install printer paper:

1 Open the printer door by pulling up on the door latch. Allow the door to fall open (see Figure 6).

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.

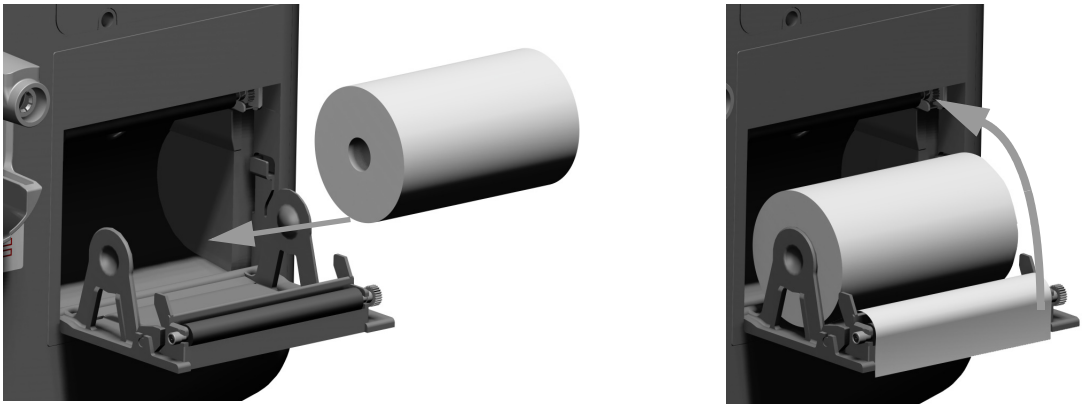
4 Place the new roll of paper in the paper well, positioning the roll so that the loose end of the roll is on the bottom.

5 Pull the end of the paper out past the roller.

6 Close the printer door. Make sure it clicks in place.

7 Test the printer before putting the defibrillator back into service. See "Operational and Shift Checks" on page 199.

Figure 6 **Installing Printer Paper**



Paper not installed according to the above procedure is prone to paper jams during printing functions.

To avoid printer paper jams:

1 Remove the used paper roll.

2 Clean the printer roller with alcohol.

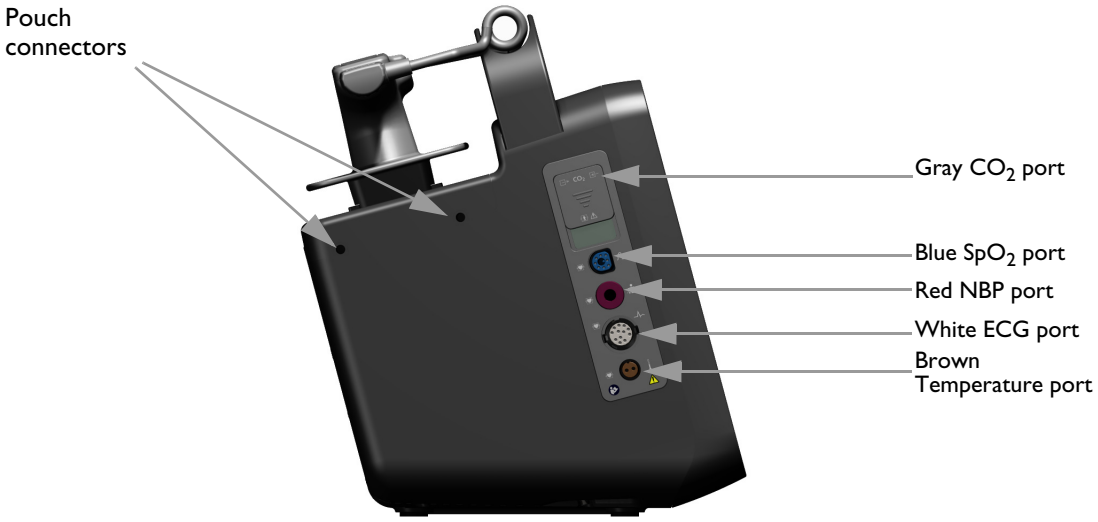
3 Use pressurized air to remove paper dust.

4 Insert the new paper roll.

Left (Monitor) Side.

The left side of the HeartStart Intrepid is dedicated to monitoring key vital signs (see Figure 7). It has ports for ECG, SpO_2, CO_2, NBP, and temperature.

Figure 7 **Monitoring Side**



Connecting the CO_2 Tubing

NOTE: Depending on user needs and available accessories set, the CO_2 airway assembly may contain cannulas, adapters, dehumidification tubes, and extension lines listed in Table 96 "$EtCO_2$ Monitoring Accessories" on page 226. See "Preparing to Measure $EtCO_2$" on page 131.

To connect the CO_2 tubing:

1. Slide the CO_2 compartment door down with a finger as shown in Figure 8.
2. Insert the fitting into the CO_2 Inlet port closest to the front of the device.
3. Turn the fitting clockwise until it is tightly and firmly in place.

Figure 8 **Connecting the CO_2 Filter Line**

NOTE: Confirm the Filter Line is properly connected to the device. A loose connection may result in inaccurate readings.

Connecting the SpO_2 Cable

To connect the SpO_2 cable:

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

Figure 9 **Connecting the SpO_2 Cable**

Connecting the NBP Cable

To connect the NBP cable:

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

Figure 10 **Connecting the NBP Cable**

Connecting the ECG cable

To connect a 3-, 5-, or 10-Lead cable:

1. Align the ECG cable with the white ECG port (see Figure 11). 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 11 **Connecting the ECG cable**

Connecting the Temperature Cable

To connect the temperature cable:

1. Insert the Temperature cable into the brown Temperature port (see Figure 12).
2. Push the cable completely in.
3. Insert the appropriate probe into the end of the cable.

Figure 12 **Connecting the Temperature Cable**

Top Panel

The top of the HeartStart Intrepid 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 13).

Figure 13 **Top Panel**

External Paddles

The HeartStart Intrepid has two options for external paddles: part numbers 989803196431 and M3543A as shown in Figure 14 and Figure 15. While the paddle sets look slightly different, they function the same in a clinical environment.

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

Figure 14 **989803196431 External Paddles**

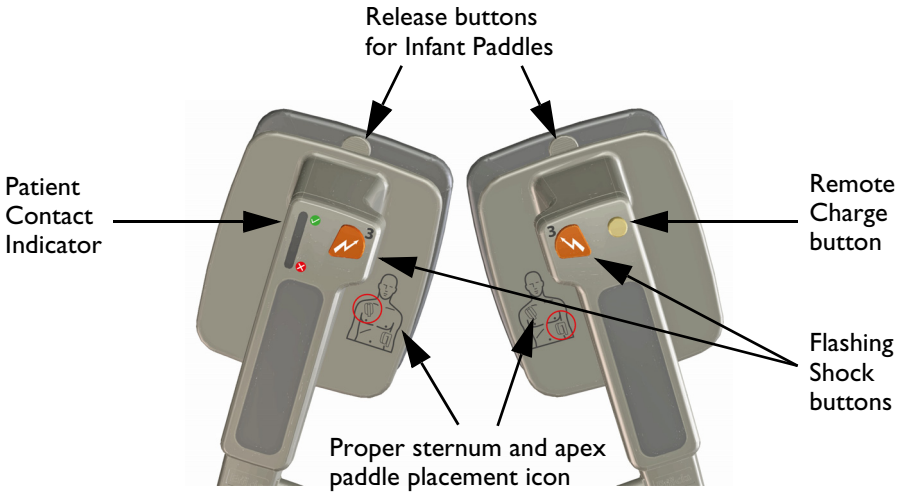
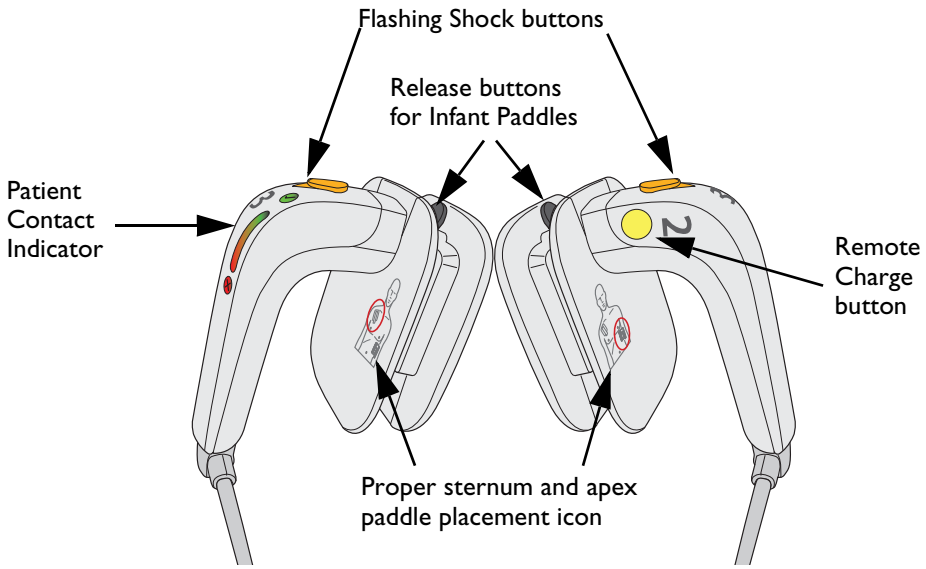


Figure 15 **M3543A External Paddles**



Accessing Infant Paddles

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

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

To access the infant paddles:

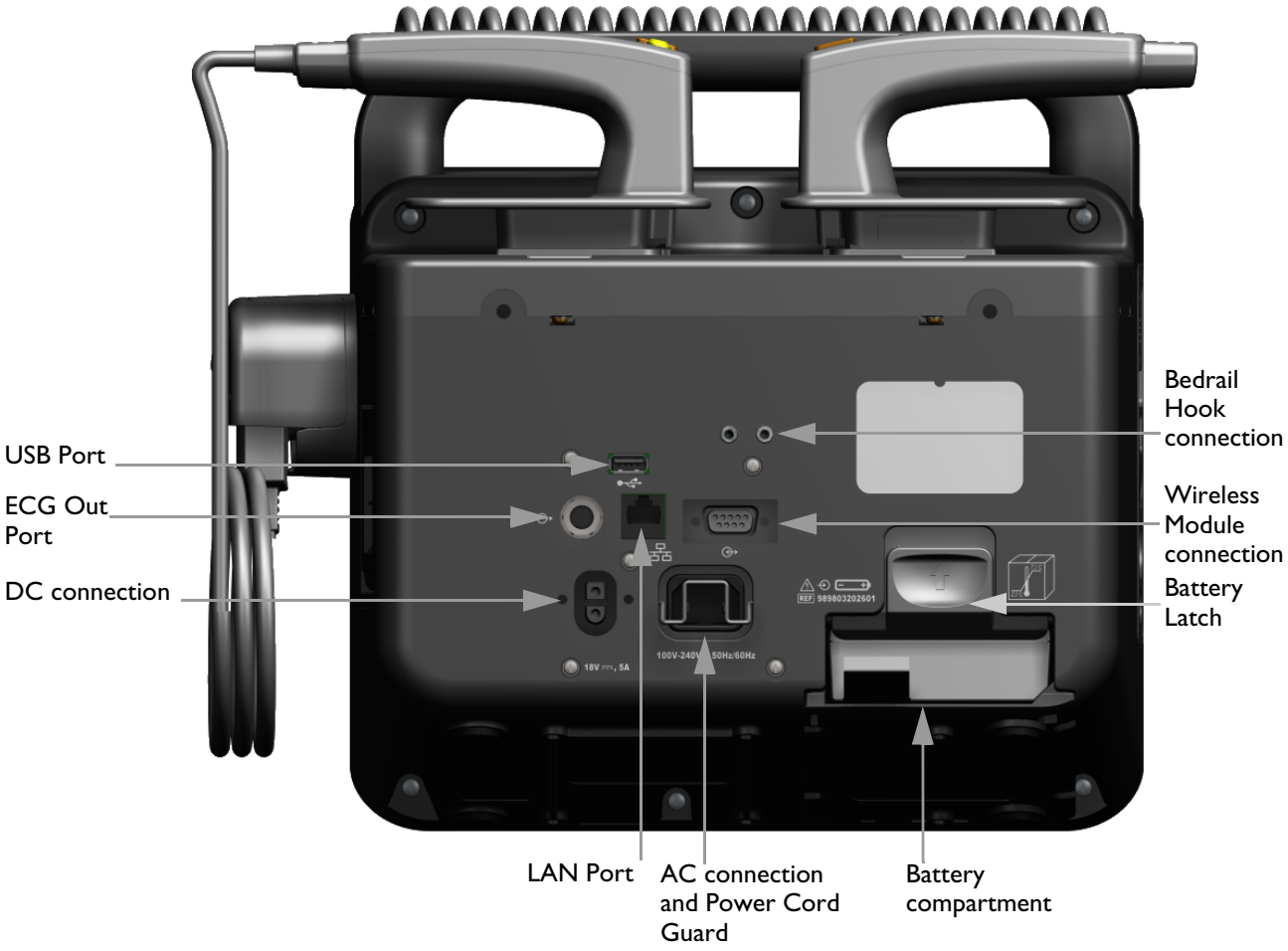
1. Press down on the release buttons located on the front of the external paddles, ❶.
2. Slide the adult electrode clip off and away from the paddle exposing the infant-sized surface underneath, ❷. See Figure 16.

Figure 16 **Infant Paddles**

Back Panel

The back panel of the HeartStart Intrepid has a compartment for the lithium ion battery. It also contains the AC and DC power connections, Wireless Communication Module connector, ECG Out port, and the USB port; see Figure 17. The USB can only be used in Data Management, Service, or Configuration modes but not in Clinical Mode. The LAN port is for factory use only.

Figure 17 **Back Panel**



WARNING: Do not connect a LAN cable to the HeartStart Intrepid. The LAN port is for factory use only.

Battery and AC Power

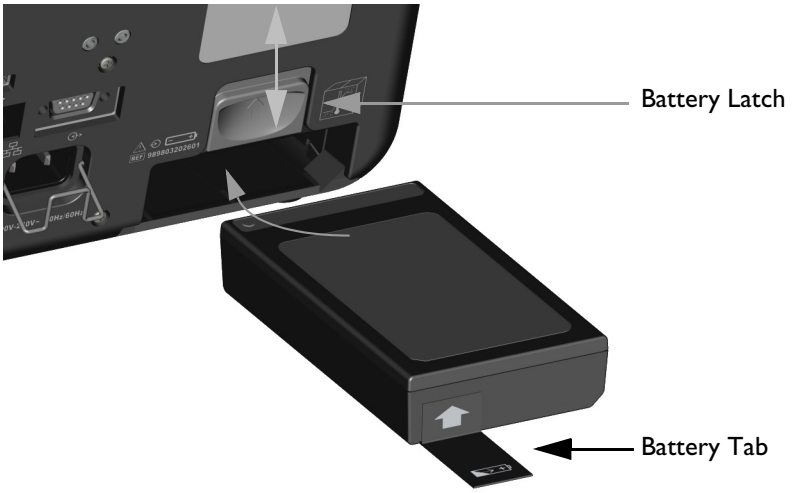
This section describes basics of power supply. See "Power" on page 31 for a detailed discussion.

Installing the Battery

To install the HeartStart Intrepid lithium ion battery:

1. Align the battery in the battery compartment. Confirm the arrow on the Battery Tab is positioned at the bottom, see Figure 18.
2. Push the battery into the battery compartment until the battery latch is locked into place.

Figure 18 **Installing the Battery**



NOTE: 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

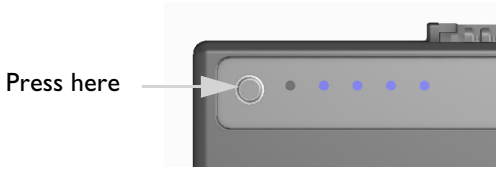
To remove the HeartStart Intrepid lithium ion battery:

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

Battery Fuel Gauge

To check the power remaining in the lithium ion battery when it is not installed in the HeartStart Intrepid, press the Battery Power Gauge (see Figure 19) 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 from the button indicates the battery is too weak and must be recharged before use.

Figure 19 **Battery Gauge**



To check the battery power remaining when the battery is inserted in the device, look at the battery gauge on the display (see "Battery Charge Level" on page 33).

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

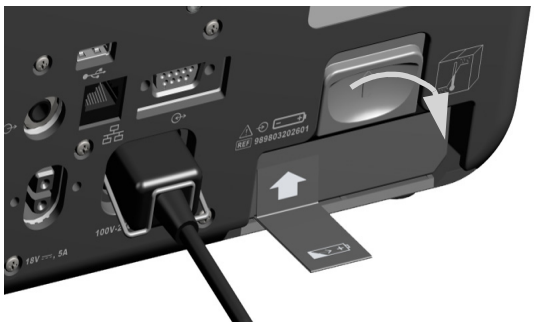
AC Power Cord Guard

The HeartStart Intrepid is equipped with an AC Power Cord Guard.

To put the power cord guard in proper position:

1. Plug the AC power cord into the AC Connection on the back of the device. Push it firmly into place.
2. Lower the Power Cord Guard into place, confirming it catches on the back of the AC power cord (see Figure 20).
3. Confirm a secure fit by lightly tugging on the cord.

Figure 20 **AC Power Cord Guard**

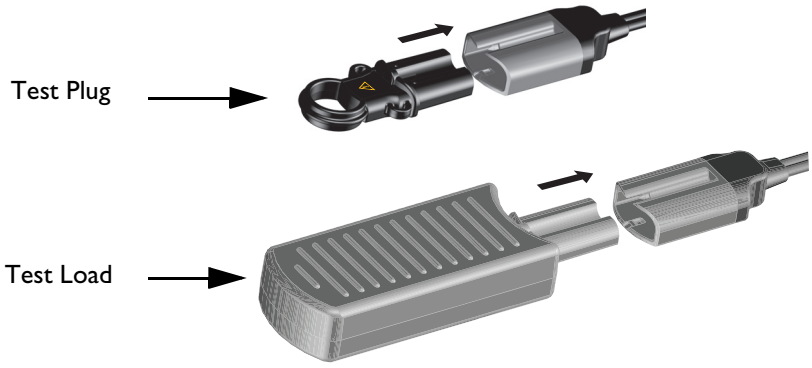


Test Plug and Test Load

The HeartStart Intrepid comes with a defibrillator test plug to assist in performing a weekly shock test and operational check. Alternatively, use the M3725A or M1781A Test Load, ordered separately, to perform a weekly shock test and operational check.

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

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



The Test Plug and Test Load behave differently during the Weekly Shock Test. Similar successful Weekly Shock Test results appear differently on the device:

- The Test Plug creates an electrical “short” so the device does not deliver a shock into it. Listen for a **Shock Cancelled** audio message, see a **Shock Aborted** alarm on the display, and the printed strip indicates **Test Passed**.

- The Test Load applies an impedance at the end of the Therapy cable such that the device delivers a shock. Listen for a **Shock Delivered** audio message, and the printed strip indicates **Test Passed**.

For more on the Weekly Shock Test, see "Weekly Shock Test" on page 199.

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

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

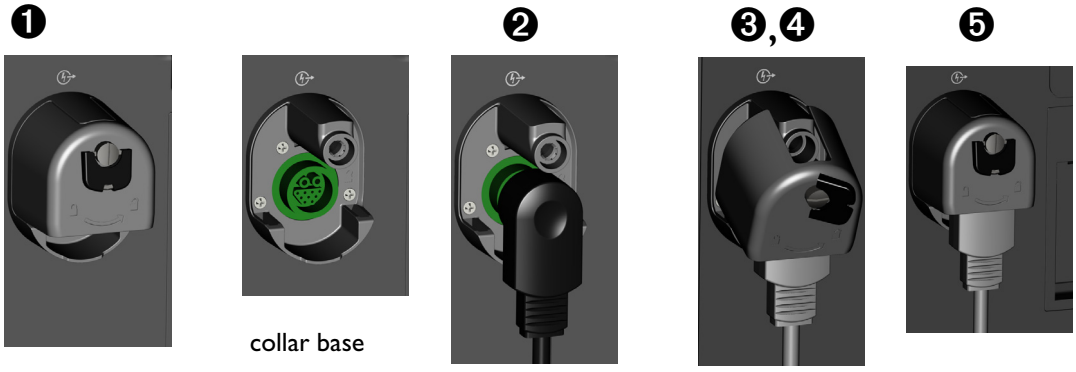
Therapy Cable Collar

Philips strongly suggests the HeartStart Intrepid be fitted with the Therapy Cable Collar before being placed into service. The collar adds an extra level of security to prevent excessive wear and vibration with the Therapy port. The collar base comes installed from the factory.

To connect the Therapy Cable and install the Collar Lid:

1. Remove the Collar Lid if attached. See Figure 22.
2. Plug the Therapy Cable into the green connector port.
3. Slide the feet of the Collar Lid into the grooves on the Collar base and push the top of the Lid into place.
4. Grasp the Locking Key and push in while turning clockwise until the Key locks into place.
5. To remove the cover, lift up on the lid latch and turn counter clockwise. After the Key unlocks, lift the lid out of place. Use a flat-head screwdriver to engage and disengage the cover.

Figure 22 **Locking the Collar Lid**



WARNINGS: If using the HeartStart Intrepid in a transport or high-vibration environment without the Therapy Cable fully installed, the 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.

Additional Features

The additional features of the HeartStart Intrepid may include Cable Straps and Carry Bags.

Cable Straps

To aid with cable management, straps can be snapped on to the side of the HeartStart Intrepid instead of carry bags.

Figure 23 **Cable straps right and rear view**

Figure 24 **Cable straps left and front view**

Carry Bags

To install the HeartStart Intrepid carry bags, use a Phillips-head screwdriver.

To install the carry bags

1. Place the device in the pouch assembly.
2. Feed the long strap from the right side through the loop on the left side.

Figure 25 **Step 2**

3 Pull the long strap tight and fold it down, pressing the hook-and-loop fasteners together.

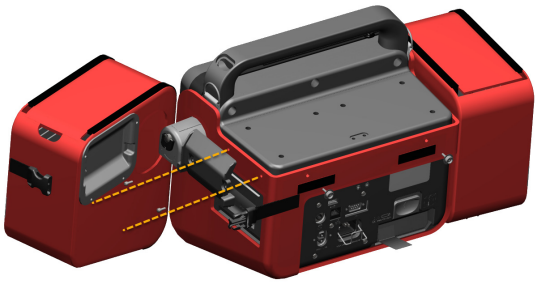
Figure 26 **Step 3**

4 Screw two snap studs through the holes in the rear of the pouch and into the holes in the side of the device.

Figure 27 **Step 4**

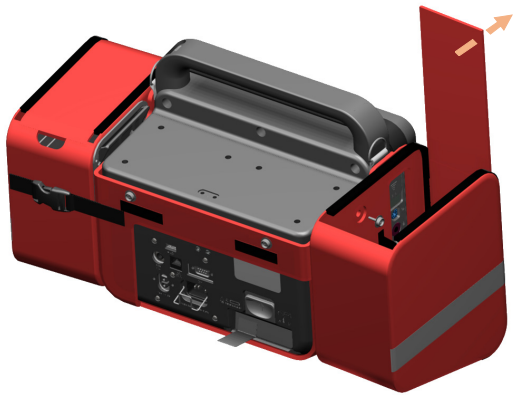
5 Unsnap the rear buckle and swing out the right side pouch. Install 2 screws through the plastic paper guide and into the holes in the right side of the device. Re-snap the rear buckle. The plastic guide must match the plastic on the right side of the pouch.

Figure 28 **Step 5**



6 Open the left side pouch. Using a short screwdriver, screw a snap stud through the hole in the inside wall of the pouch, into the hole in the left side of the device. Close the left side pouch.

Figure 29 **Step 6**



7 Push the rear pouch onto the snap studs and hook-and-loop fasteners on the back of the device.

Figure 30 **Steps 7**

8 Connect the shoulder strap to the loops at each end of the handle.

NOTE: 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.

EMS Environment

Using the HeartStart Intrepid in the EMS environment can put stresses on the device and its accessories that could potentially affect essential performance. Be aware of the following:

- Philips recommends the use of the HeartStart Intrepid carry bag to protect the device from drops and bumps.
- Direct sunlight and other sources of excessive illumination can affect SpO_2 readings. For more information see "Understanding Pulse Oximetry" on page 102.
- The device has been built to withstand lint and dust. Thoroughly clean the HeartStart Intrepid after an event where it was exposed to lint and dust. See "Cleaning Instructions" on page 219 for more information.
- Make sure the ambient temperature is within the acceptable range. See "Temperature:" on page 257.
- Cellular telephones, 2-way radios and other radio frequency-emitting devices could cause interference problems and potentially affect the behavior of the device.

- Check all accessories frequently. Confirm that all sensors, electrodes, ports and the Therapy cable are in working order. Replace all that are not in good working order.
- Make sure that the Therapy Cable Collar is installed on devices in high-vibration environments. See "Therapy Cable Collar" on page 22.

3

Operating the Device

This chapter is divided into the following major sections:

Operating Modes

The HeartStart Intrepid has four clinical modes and three non-clinical modes of operation, each with a customized display (see Table 1 and Table 2).

The HeartStart Intrepid is used by trained clinicians in clinical modes (Monitor, Manual Defibrillation/Synchronized Cardioversion, AED, and Pacing) to monitor and provide therapy to patients, and in Data Management Mode to print, export or transmit the stored Event Summary records.

Configuration Mode is used by the organization biomedical department to configure the settings and parameters used by the device, such as high and low alarm limits.

Service Mode is used by authorized service personnel to service and maintain the device, including managing passwords and upgrading device options and software.

NOTE: It is recommended to write down the Configuration Mode and Service Mode passwords and store them in a secure location. Refer to the insert that shipped with the HeartStart Intrepid. The insert contains the Data Management password and the Configuration Mode password.

Table 1 **Clinical operating modes**

Mode	Description	For more information see
Monitor	Use to monitor ECG, optional SpO_2, NBP, Temperature, and $EtCO_2$ parameters and for viewing Vital Signs Trending data.	"ECG Monitoring" on page 51; "Monitoring SpO_2" on page 101; "Monitoring Noninvasive Blood Pressure and Temperature" on page 109, "Monitoring Carbon Dioxide" on page 129, "Trending" on page 181, "Traumatic Brain Injury Advisory" on page 141, and "12-Lead ECG" on page 119
AED	Use to analyze ECG and, if necessary, administer semi-automated external defibrillation, or monitor HR, $EtCO_2$, and SpO_2.	"AED Mode Option" on page 67
Manual Defibrillation	Use to perform asynchronous cardioversion (defibrillation).	"Manual Defibrillation and Cardioversion" on page 81
Pacer	Use to perform demand or fixed pacing.	"Pacing" on page 93

Table 2 **Non-Clinical Operating Modes**

Mode	Description	For more information see
Data Management	Use to review or transmit Event Summaries and other device data after clinical use.	"Data Management" on page 181.
Configuration	Use to display and change the HeartStart Intrepid's configuration options.	"Configuration" on page 161.
Service	Used by qualified service personnel to service the device, including software upgrades. Service Mode is used to initialize and reset a password.	The HeartStart Intrepid *Service Manual*

Controls

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

Therapy Knob and Controls

The HeartStart Intrepid Therapy knob is customized for the options included in the device. Devices with the Pacing and/or the AED functionality, include those options 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 HeartStart Intrepid device on: Turn the Therapy knob clockwise for Monitor Mode, Manual Defibrillation, or Pacer; turn counterclockwise for AED Mode.

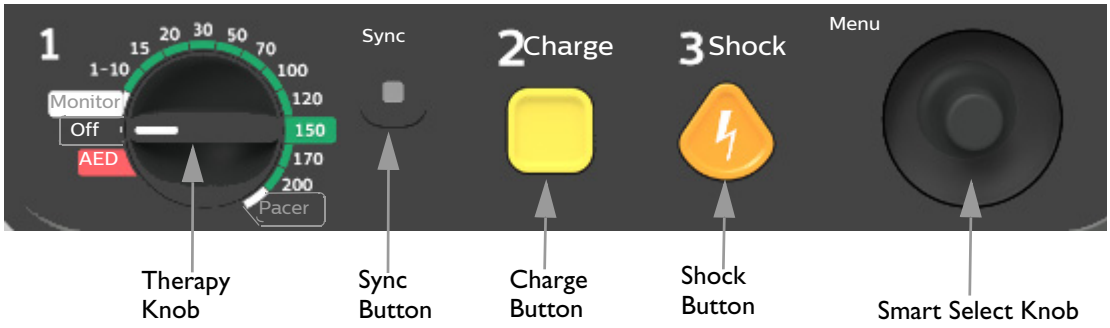
Charge button: Charges the defibrillator to the selected Manual Defibrillation energy setting. It is used only in Manual Defibrillation Mode. The defibrillator charges automatically in AED Mode.

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, pre-configure the energy to be 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 using external paddles, or switched internal paddles that have Shock buttons, the HeartStart Intrepid delivers a shock by pressing the Shock button(s) located on the paddles.When using switchless internal paddles, the shock is delivered by pressing the Shock button on the device.

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 31 **Therapy Controls**



Smart Select Knob

The Smart Select knob is the HeartStart Intrepid's steering wheel, and has the following functionality:

Press the knob: If there is not a menu on the display, the Main Menu is displayed. If there is a menu on the screen, then the highlighted entry is selected.

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

General Function Buttons

The General Function buttons control monitoring or non-critical resuscitation activity. See Figure 1 "HeartStart Intrepid Front View" on page 10 for the location of the buttons and below for their definitions.

Table 3 **General Function Buttons**

Function	Button	Description
Patient Category		Quickly changes the patient category from adult (≥ 25 kg or ≥ 8 years old) to infant/child (< 25 kg or < 8 years old) and back again.
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 the device configuration, including pads, if the corresponding cable is connected. See "Lead Selection" on page 56.
ECG Gain (height)		Pressing the button increases the ECG waveform vertical scale of the primary lead by one setting. If the ECG size is 4-x when the button is pressed, the ECG waveform vertical scale of the primary lead is set to ¼-x.
Mark Events		Inserts 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 47.
Print		Begins a continuous printout of the primary ECG and other selected waveforms either in real time or with a 10-second delay, depending upon the configuration. Pressing the Print button while printing is in progress stops the printing. See "Printing Data" on page 197.
Alarms		When pressed, 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. In AED Mode, this button is used for "Alarms Off". See "Adjusting Volumes" on page 39.

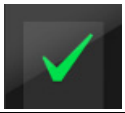
Soft Keys

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**

Appearance		Description
Blinking green check mark		Indicates the shock, pacing, and ECG functions of the device are ready for use. Sufficient battery power is available for device operation.
Blinking red X with periodic audio chirp		Indicates either: • A low battery condition exists, and the battery is not charging. • There is no battery installed and the device is running on AC/DC power only.
Blinking red X 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 X with periodic audio chirp		Indicates a critical failure has been detected that may prevent the delivery of defibrillation therapy, pacing or ECG acquisition.
Solid red X with no audio chirp		Indicates no power available or the device cannot power on. If, after power is returned, the indicator reverts to the blinking green check mark, the device is ready for use.

Power

The HeartStart Intrepid is powered by a lithium ion battery or AC/DC power. The battery should always be installed so the device is ready for use whether or not AC/DC power is available at the point of care. A **Switched to Battery** message is displayed when AC/DC power is removed and a battery is installed. When pacing, AC/DC power should be connected if possible to prevent the battery from eventually becoming depleted and interrupting the pacing operation.

Keep the battery charged at all times. For more information on the battery see "Display" on page 34, and "Battery Maintenance" on page 216.

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

If AC/DC 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 HeartStart Intrepid may take longer to charge to the desired energy level, and, in the event of power loss longer than 30 seconds, all settings reset to configured settings and a new event is created when power is returned. However, all saved data remains intact (up to the device's memory capacity) and can be found by retrieving the previous event. Keep the battery installed and charged.

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

To completely disconnect the power supply, unplug the AC and DC power cord, remove the battery.

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

For information on power-related alarms see "Power-Related Alarms" on page 218.

Lithium Ion Battery

The HeartStart Intrepid uses a lithium ion battery for power.

Battery Capacity

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

- 100 full-energy charge/shock cycles.

  or

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

  or

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

Low Battery Conditions

The HeartStart Intrepid 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 pacing or monitoring.
- The HeartStart Intrepid cannot determine the battery's charge level.

To optimize performance, a battery that is in the Low Battery condition (less than 20% remaining) should be charged as soon as possible.

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

Battery Charging

With the ambient temperature at 25°C (77°F), AC/DC power connected, and the device turned off, the HeartStart Intrepid recharges its battery to 80% capacity in less than two hours and to 100% after one additional hour. Charge time can be substantially longer if the device is turned on or the ambient temperature is significantly lower or higher.

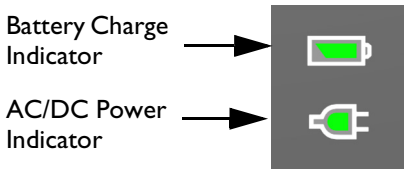
Battery Maintenance

For information on battery maintenance, see "Battery Maintenance" on page 216.

Power Indicators

The Power Indicators are located in the upper right corner of the HeartStart Intrepid's front panel (see Figure 32). The green AC/DC Power Indicator is lit whenever AC/DC power is connected to the HeartStart Intrepid, even if the device is turned off.

Figure 32 **Power Indicators**



The green Battery Charge Indicator flashes when the battery is charging. The indicator is solid green when the battery is fully charged and AC/DC 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/DC power present.

Battery Icons

The Battery Icon is located in the upper right corner of the screen next to the Power Indicators and indicates the battery status and level of charge remaining.

Figure 33 **Battery Charge Level**

* See "Low Battery Conditions" on page 32.

Powering the Device On and Off

To power on the HeartStart Intrepid, turn the Therapy knob to the desired mode of operation.

To power off the HeartStart Intrepid, turn the Therapy knob to the Off position. If the device is powered off while in a clinical mode, the HeartStart Intrepid enters the Continued Use period (see "Continued Use" on page 46). The screen displays a 10-second countdown before turning off.

NOTE: Leave the device plugged in to keep the battery charged and allow automated diagnostic tests to run periodically. There is no harm in leaving the device plugged in indefinitely.

Device Shutdown

When no AC/DC power is connected, and the battery charge level drops to a critically low level, the correct operation of the HeartStart Intrepid can no longer be guaranteed. The device generates an **Imminent Shutdown** alarm. There is approximately one minute to connect the device to AC/DC power or insert a new battery 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 HeartStart Intrepid automatically turns back on, user settings are restored to their values prior to the shutdown, the HeartStart Intrepid 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 HeartStart Intrepid recovers from a power loss. Pacing must be restarted manually.

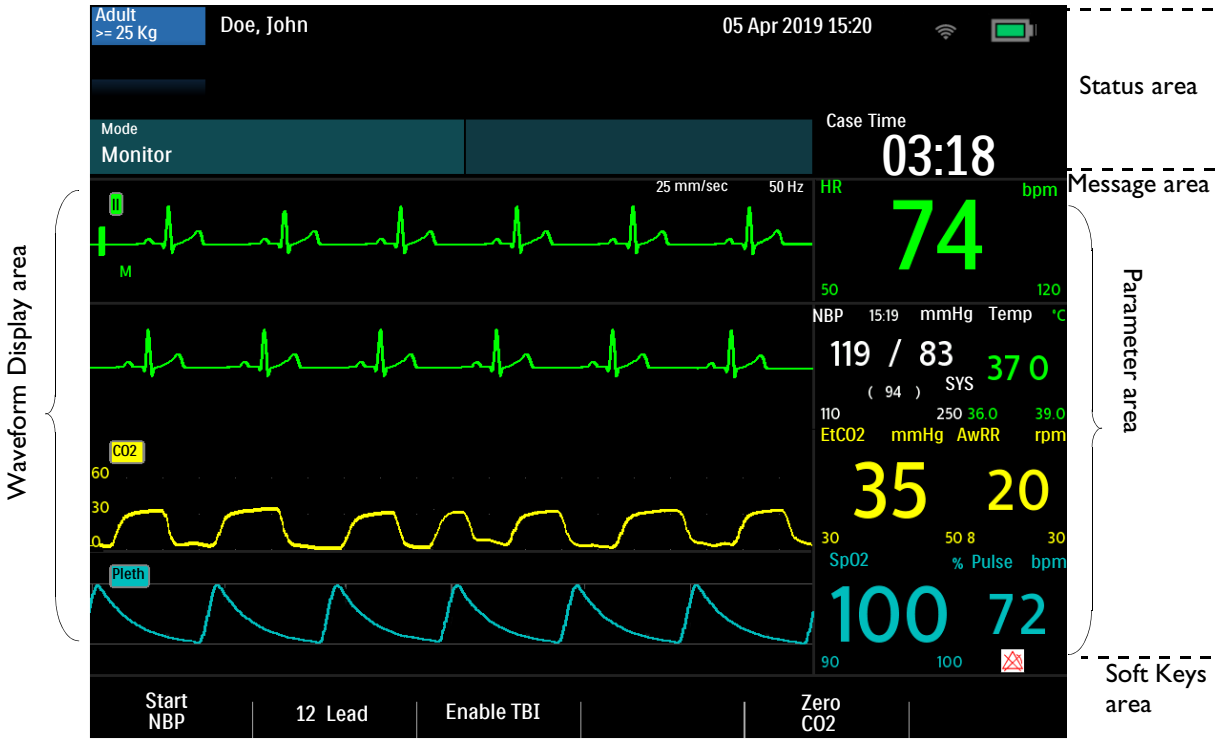
If the HeartStart Intrepid restarts after 30 seconds and the Therapy knob is not in the Off position, all settings are returned to their configured values, a new Event Summary starts and notifies that the previous Event Summary was closed.

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.

Display

The HeartStart Intrepid's display layout is easily configurable. There are five basic segments of the display. See Figure 34.

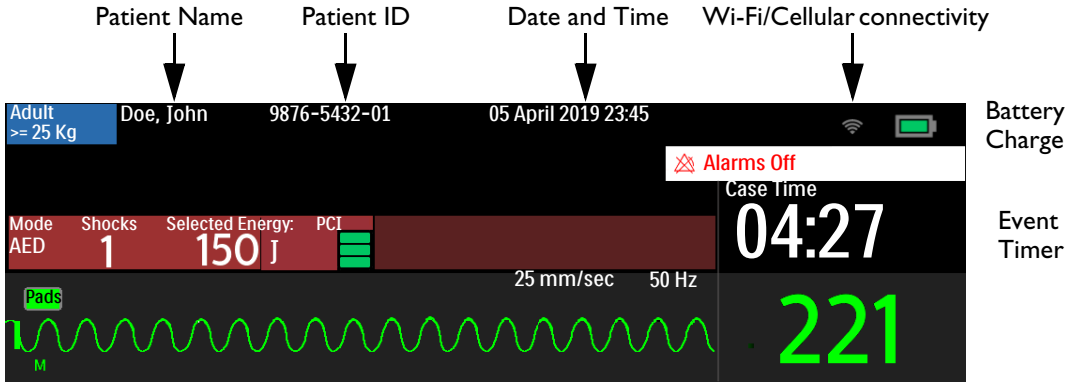
Figure 34 **General Display Layout**



Status Area

The Status Area contains key device and patient information as shown in Figure 35. For the Alarms displayed in the status area, see "Alarms" on page 40.

Figure 35 **Status Area**



Patient information includes:

- **Patient Name/ID** – If entered, displays the patient's name, patient's ID or nothing depending on the current configuration. See "General Settings" on page 166.
- **Date and Time** – The current date and time
- **Paced Status** – Internally paced or not internally 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** – Adult (defined as ≥ 25kg) or Infant/Child (defined as < 25kg). The background color changes with the selected patient category for Adult (blue) and Infant/Child (pink).

Device information includes:

- **Clinical Alarm Indicator** – Indicates the overall state of alarms. If alarms are active and audio is not paused, the indicator is blank. If the alarms are not active, the indicator displays **Alarm Audio Off** indicator **Alarm Audio Paused xx min**. In AED Mode, the indicator displays **Alarms Off**.
- **Technical Alarms** – Technical alarms not related to the battery or pacing are displayed in the cyan Technical Alarms area at the top of the display. An arrow indicates there are multiple alarms present, alternating on the display.
- **Battery Icon** – as discussed in "Battery Icons" on page 33.
- **Wi-Fi Connectivity Icon**– Indicates whether Wi-Fi connectivity is enabled .
- **Cellular Connectivity Icon**– Indicates whether cellular connectivity is enabled .

Message Area

The message area displays key messages during an event. The messages help with technical alarms and provide clinical suggestions. The type of message shown varies according to the current mode.

Figure 36 **Message Area**.

Waveform Display and Soft Key Areas

The HeartStart Intrepid is configured to populate each of its four wave sectors with a preconfigured waveform when powered on in Monitor, Manual Defibrillation, Pacing, and AED modes. A dashed line in an ECG wave sector indicates that the waveform source is invalid. Wave sectors may contain a variety of information as appropriate to the parameter, view and task currently being performed.

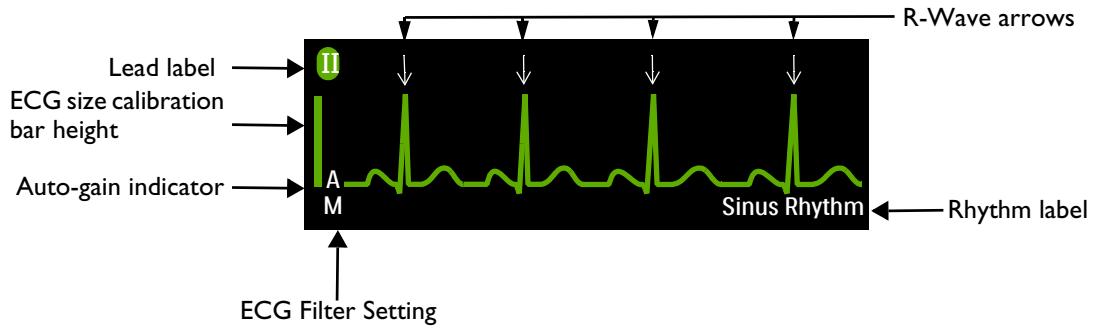
It is possible to display up to four waveforms at one time on the display depending on which mode the HeartStart Intrepid is currently in, and how the device is configured.

Wave Sector 1

Wave Sector 1 can only contain an ECG waveform. No other vital sign parameters can be displayed in Wave Sector 1. This waveform is used by the arrhythmia, heart rate derivation and AED analysis algorithms. Available waveforms include: Paddles (unavailable in AED Mode), Pads, I, II, III, aVR, aVL, aVF, and V or V1 – V6.

Wave Sector 1 also contains the ECG size Calibration Bar, the Auto Gain Indicator, Rhythm Label, ECG filter setting, and R-Wave arrows. The Calibration Bar is used as a reference point to compare the actual ECG wave displayed to the selected size. The Auto Gain Indicator is displayed as an "A" when auto-scaling is active. R-Wave arrows appear when the device is in Sync Mode, Monitor Mode or Demand Mode Pacing.

Figure 37 **Wave Sector 1 Markings**



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

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

If the Rhythm Label is configured off, the device only displays Learning ECG and Learning Rhythm labels. For more on configuring the label, see "Monitoring Settings" on page 167.

The ECG filter settings for the display are:

E – EMS Monitor Bandwidth—2.0 Hz - 20.0 Hz

M – Monitor Bandwidth—0.15 Hz - 40 Hz

S – ST Monitor Bandwidth—0.05 Hz - 40 Hz

ECG filter settings can be changed in Configuration Mode. See "Monitoring Settings" on page 167.

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

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

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

Wave Sectors 2, 3, and 4

Wave Sectors 3 and 4 are automatically populated when the parameter source's cable is connected to the HeartStart Intrepid. 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 (or V1 – V6), Pleth, Capnogram, and a Cascade Wave from Wave Sector 1. If an ECG wave for sectors 2, 3, or 4 is selected, the ECG filter setting is also displayed (except in cascade and annotated ECGs).

An annotated ECG for Wave Sector 2 can also be selected. See "Displaying an Annotated ECG" on page 60.

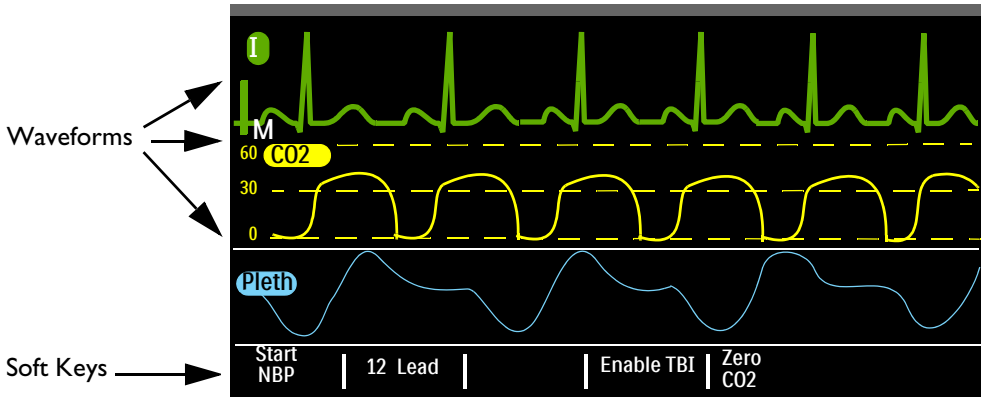
Changing Displayed Waveforms

Wave Sector 1 has a dedicated Lead Select button  (see "General Function Buttons" on page 29) to change the displayed lead/source. Waveforms displayed in the other sectors are changed for the current event using the Smart Select knob. See "Menus" on page 37.

Soft Key Labels

The five soft key labels correspond to the soft key buttons located immediately below them. See Figure 38. These labels change, according to the current display view and function.

Figure 38 **Waveform and Display Soft Keys Area**



Menus

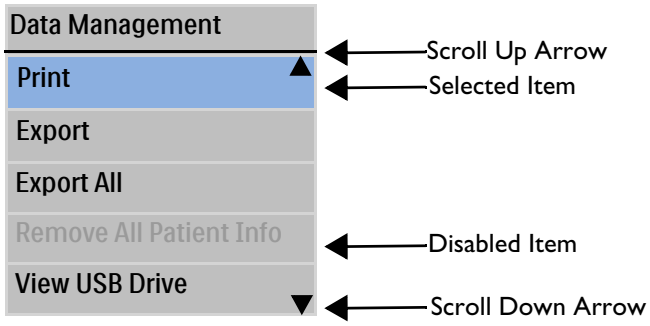
Menus with controls and options specific to each HeartStart Intrepid function are easily accessible using the Smart Select knob on the front panel. Menus are used to adjust volume, select waveforms, select waves for printing, set alarms, enter patient information, generate reports and complete a variety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

To display a menu, press the Smart Select knob to bring up the Main Menu, then turn the Smart Select knob to scroll up or down through the available choices until the desired selection is highlighted. The menus have a wrap-around scrolling feature – once the top or bottom of a menu is reached, the next menu item automatically displays.

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

Depending upon a given situation, there are times when some options are unavailable for use. Menu choices are grayed out when they are unavailable. They cannot be highlighted or selected. See Figure 39.

Figure 39 **Sample Menu**

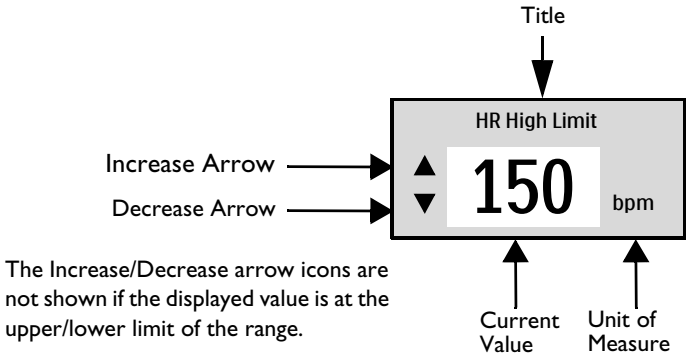


NOTE: Menus are removed from the display when the Charge button is pressed.

Adjusting Numeric Values

Using the HeartStart Intrepid Smart Select knob, you can enter numeric values for several parameters, including high and low alarm limits. See Figure 40. The value initially displayed is the default value. Some values are adjustable in increments greater than 1. To exit, press the Smart Select knob.

Figure 40 **Setting Numeric Values**



Adjusting Volumes

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

To adjust the volume for the current event:

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

The new volume level remains in place for the duration of the current event. Use Configuration Mode to adjust the default volume levels. See "Configurable Parameters" on page 165.

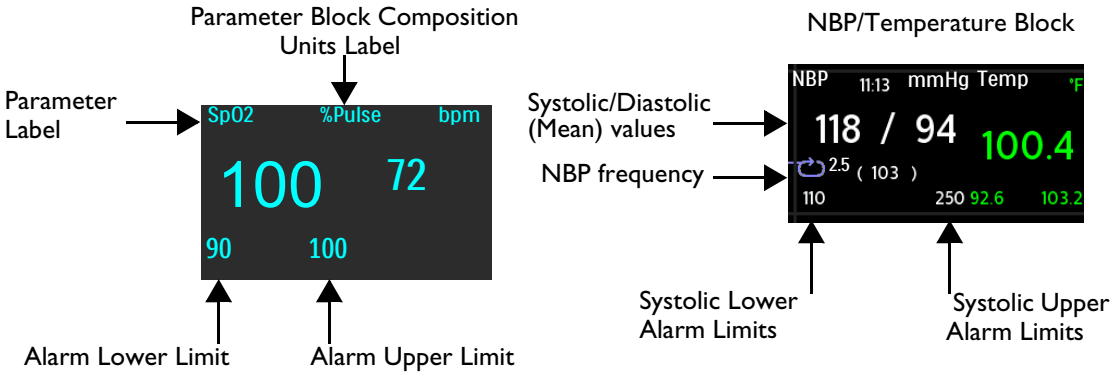
NOTE: Adjusting one volume type does not affect the other volume types. For example, adjusting the QRS volume does not affect the volumes for alarms and voice.

Parameter Area

The Parameter Area displays the key physiological numerical values currently being monitored; see Figure 41. Displayed values for each parameter include:

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

Figure 41 **Parameter Area**



Alarms

The HeartStart Intrepid provides various types of alarms indicating changes in patient condition or device/cable conditions that may require attention. Alarms conditions are based on comparisons against preset limits and algorithm results. The HeartStart Intrepid breaks alarms into different categories. See Table 5.

Physiological Alarm: An alarm, detected while in a clinical mode, resulting from a patient-related parameter being monitored. SpO2 Low is an example of a physiological alarm. These alarms are not detected in non-clinical modes.

Technical Alarm: An alarm resulting from an equipment-related issue.

Alarms are either latching or non-latching:

Latching: The alarm remains active regardless if the alarm condition continues to exist or not. A latching alarm is not removed until the condition no longer exists and it is acknowledged.

Non-Latching: The HeartStart Intrepid automatically removes the alarm when the alarm condition no longer exists.

Table 5 **Alarm Types**

Alarm Type	Alarm Sample	Condition
High Priority	V-Fib/Tach	An immediate response is required. A life-threatening alarm condition is present. A red alarm message is displayed and an alarm tone sounds. High priority red alarms are latching.
Medium Priority	SpO2 Low	Prompt response is required. A non-life-threatening alarm condition exists. A yellow alarm message is displayed and an alarm tone sounds. Medium priority alarms are latching or non-latching depending on the device's configuration. See Table 42 "Configuration – General" on page 166.
Low Priority	Printer Door Open	Awareness is required. A non-life-threatening alarm condition exists. A cyan alarm message is displayed and an alarm tone sounds. Low priority cyan alarms are non-latching.

NOTES: The presence of multiple alarm conditions at the same time is quite possible. To avoid confusion and to make sure a less serious condition does not hide a more serious condition, the HeartStart Intrepid prioritizes and categorizes alarms so the highest priority alarm condition is announced. If multiple same-parameter, same-priority alarms occur, all alarms are displayed one at a time.

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

Clinical Mode Alarm Notification

When in a Clinical Mode, the HeartStart Intrepid can be configured to react differently when an alarm condition occurs. See Table 6.

Table 6 **Alarm Notification Types**

Type	Alarm	Location *	Alarm Status	Comments
Alarms On	None	None	Both visual and audio indications are on.	All alarms are on.
Alarm Audio Pause 	**Alarm Audio Paused min** (message includes duration of the pause)	Upper right corner of the display underneath the Date / Time.	Only visual indications are on for the configured Audio Pause timeframe. Audio returns when the pause timeframe is complete.	Appears when the Alarms button is pressed, and the configured alarm pause is set to something other than indefinite.
Alarm Audio Pause 	**Audio Pause**	In the Menu area above the Smart Select knob.	Only visual indications are on for the configured Audio Pause timeframe. Audio returns when the pause timeframe is complete.	When displayed, press the Smart Select knob to pause Audio.
Alarm Audio Off 	**Alarm Audio Off**	Upper right corner of the display underneath the Date / Time.	Only visual indications are on.	Appears when Alarms button is pressed and the configured alarm pause is indefinite.
	Audio Off	In the Menu area above the Smart Select knob.		When displayed, press the Smart Select knob to turn Audio off.
Alarms Off 	**Alarms Off**	• When in AED Mode, upper right corner beneath Date/Time. • Under individual out-of-limit values.	Both audio and visual alarm indications are off.	Press the Alarms button to activate alarms in AED mode.

* See "Alarm Notification Display Locations".

All alarm conditions are cleared when the HeartStart Intrepid is switched from a clinical mode to a non-clinical mode.

If a sensor is intentionally disconnected, an alarm sounds. Press the Smart Select knob to stop the alarm. The HeartStart Intrepid prompts the user to confirm the selection. Press the Smart Select knob again.

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

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

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

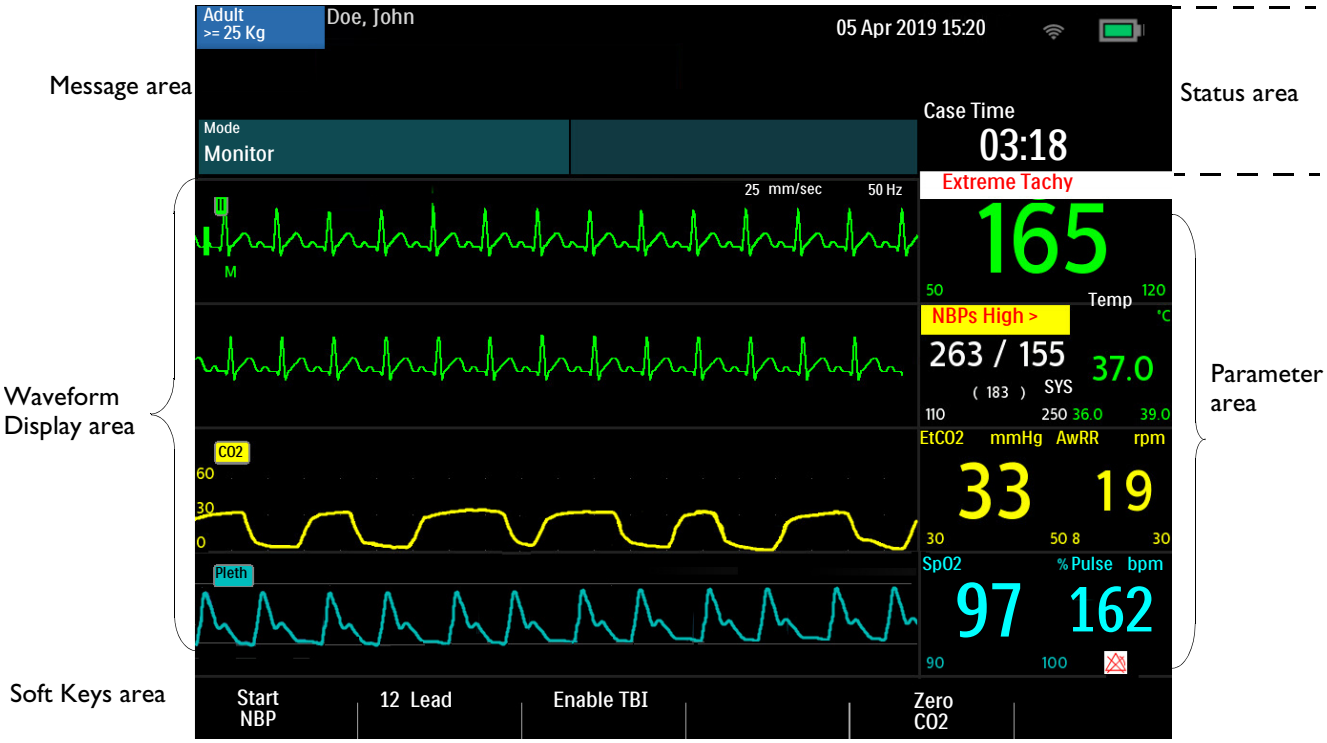
A potential hazard exists if different alarm limits are used for the same or similar equipment in any single area.

Alarm Notification Display Locations

Depending on the alarm type, the HeartStart Intrepid displays notifications in various locations. See Figure 42.

NOTE: Pacing alarms appear in the Pacing Bar. See "Pacing Alarms" on page 99.

Figure 42 **Alarm Notification Locations**



Adjusting Alarm Limits

Alarm limits are preset on the HeartStart Intrepid based on its configuration and the patient type. When alarms are on, alarm limits are visible next to the parameter's numeric value. It is possible to adjust an alarm limit for the current event. Adjust the alarm limits and configurations according to the actual situation of patient.

Adjust alarms according to these alarm limit resolutions:

Heart Rate	SpO_2	NBP	Temperature	CO_2
1 bpm	1 bpm	1 mmHg or 0.1 kPa	0.1°C	1 mmHG /0.13 kPa

To adjust an alarm limit:

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

Alarm Management and Configuration

The HeartStart Intrepid allows for adjusting alarm notifications when first powering the device on. In Configuration Mode, configure the alarms for HR/Arrhythmia, $EtCO_2$, AwRR, SpO_2, NBP, and Temperature to be on or off when the device first powers on.

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

See the parameter configuration sections on alarms: Table 43 "Configuration – HR/ECG" on page 168, Table 44 "Configuration – NBP" on page 169, Table 45 "Configuration – SpO2" on page 169, Table 46 "Configuration – EtCO2 / AwRR" on page 170, and Table 48 "Configuration – Temperature" on page 171.

Audio Tones and Alarm Indications

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

Table 7 Tones and Alarms

Tone/Indication	Description	Tone level
Single beep and Alarm Audio Reminder tone	Message. Accompanies a new message on the display; generally informational.	2000 Hz
Continuous tone	Charged. Generated when the selected defibrillation energy is reached and continues until the Shock button is pressed or the device is disarmed.	2042 Hz
Continuous tone; lower pitch than Charged tone	Charging. Generated when the Charge button is pressed and continues until the device is fully charged.	1333 Hz
Periodic chirp	Attention. Generated in instances such as low battery and device failure.	1000 Hz

Table 7 **Tones and Alarms *(Continued)***

Tone/Indication	Description	Tone level
Tone synchronized with each heart beat	QRS. Single beeps aligned with the QRS. The volume of this tone can be set in Configuration, see Table 42 “Configuration – General” on page 166.	667 Hz
Continuous tone with alternating pitch	Imminent shutdown. The device will shut down in one minute.	Alternating between 1000 and 2100 Hz
Philips tone lasting 0.5 second, repeated every second	High priority alarm condition.	960 Hz
IEC high priority alarm		Meets IEC 60601-1-8/YY 0709
Philips tone lasting 1 second, repeated every 2 seconds	Medium priority alarm condition.	480 Hz
IEC medium priority alarm		Meets IEC 60601-1-8/YY 0709
Philips tone lasting 0.25 second, repeated every 2 seconds	Low priority alarm condition	480 Hz
IEC low priority alarm		Meets IEC 60601-1-8/YY 0709

Responding to Alarms

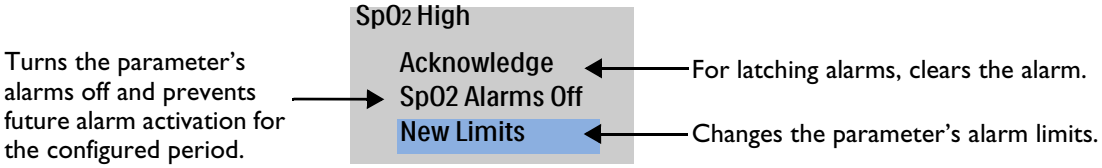
Alarm limits are displayed with each parameter, if alarms for the parameter are on. When an alarm condition occurs there are several ways to respond. Initially:

1. Attend to the patient.
2. Identify the alarm(s) indicated.
3. Silence (pause) the alarm(s). Press the Smart Select knob on the front panel of the HeartStart Intrepid to pause/silence the alarm and then press the knob again to acknowledge the alarm. The alarm is paused for the configured pause period while the patient is attended to. If the alarming condition continues to exist, it re-alarms after the configured pause period ends.

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

   If the Alarms button  is pressed, all parameter alarms are silenced for the configured pause period. No new alarms sound.
4. Address the alarm condition on the HeartStart Intrepid by using the Alarm Response Menu, see Figure 43.

Figure 43 **Sample Alarm Response Menu**



NOTE: Alarm history can be accessed in the patient's Event Summary. This information is maintained after powering the device down and in the unlikely event of a power loss. To access this information, see "Event Summary" on page 183.

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

- Heart rate and arrhythmia alarms – see "Heart Rate and Arrhythmia Alarms" on page 62.
- AED alarms – see "AED Alarms" on page 78.
- Defibrillation alarms – see "Manual Defibrillation and Cardioversion" on page 81.
- Cardioversion alarms – see "Manual Defibrillation and Cardioversion Alarms" on page 91.
- Pacing alarms – see "Pacing Alarms" on page 99.
- SpO_2 alarms – see "SpO_2 and Pulse Rate Alarms" on page 105.
- Pulse alarms – see "Temperature Alarms" on page 115.
- NBP and Temperature alarms – see "Temperature Alarms" on page 115.
- $EtCO_2$ and AwRR alarms – see "$EtCO_2$ and AwRR Alarms" on page 134.
- Power alarms – see "Power-Related Alarms" on page 218.

Entering Patient Information

Patient information can be entered (except when in AED Mode) for the following categories:

Name **Age** **Sex** **ID** **Paced Status**

NOTE: HeartStart Intrepid users are responsible for protecting use, disclosure, and exchange of electronic Protected Health Information in accordance with local laws and healthcare institution policies.

To enter patient information on the HeartStart Intrepid:

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 desired category to enter information and press the Smart Select knob.
4. For entering the patient's name, the **Last Name** screen appears with a menu of letters to enter the patient's last name. See Figure 44. Using the Smart Select knob, select the first letter of the patient's last name.
   a. Press the Smart Select knob to select the letter.
   b. Repeat the process with the remaining letters of the last name.
   c. When finished spelling the patient's last name, select **Done**. The HeartStart Intrepid stores the last name and prompts for a first name to be entered.
5. Repeat Step 4 to insert the patient's first name. Selecting **Done** saves the first name and prompts for a Patient ID.

NOTES: If the last name, first name, or patient ID has been previously entered, the HeartStart Intrepid remembers the information and populates the screen.

There are 18-letter limits for a first name and a last name; 16-character limit for Patient ID.

6 Turn the Smart Select knob to **ID** screen to enter the patient's ID using the menu of letters and numbers.

7 Turn the Smart Select knob to either **Male** or **Female** to enter the patient's gender.

8 Select knob to the **Paced** screen and choose either the **Yes** or **No** option. Select **Paced Yes** if the patient has an internal pacemaker and **No** if they do not.

NOTE: It is important to set the patient's correct paced status in order to optimize ECG analysis. Paced status does not appear in AED Mode.

Advanced Features

This section presents what is needed to take full advantage of the HeartStart Intrepid features.

Continued Use

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

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

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

Pacing stops when Pacer Mode is exited. It must be restarted manually. Patient settings are retained upon return to Pacer Mode.

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

Mark Events

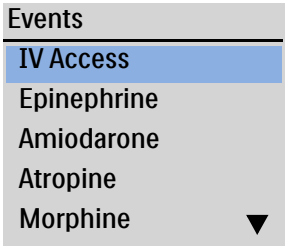
The Mark Events button allows annotation in the Event Summary and ECG strip when the button is pressed. If configured, pressing the Mark Events button prints a 10-second ECG strip leading up to the event, the event itself, and the 5 seconds after the event.

To mark an event:

1. Press the Mark Event button. The Events Menu (see Figure 44) is displayed.
2. Turn the Smart Select knob to select the desired event.
3. Press the Smart Select knob to mark the event. If configured, an ECG strip prints including the mark event symbol and the selected event label.

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

Figure 44 **Events Menu**



Passwords

The HeartStart Intrepid requires passwords to enter Service Mode and to make certain changes in Configuration Mode. Passwords can be changed from their originally set values.

Keep the passwords confidential.

Service Password

The Service main menu has an option to change or reset Service Mode passwords.In Service Mode, to initially set a password, enter a new password to set it, then enter it again to confirm it.

1. In the **New Password** field, enter a new password.
2. In the **Confirm Password** field, re-enter the new password from step 1.
   If the fields don't match, the message **New password and confirmation password do not match** is displayed. If the length of the new password is fewer than required, the message **Password must be at least 8 characters** is displayed.
3. If the new and confirmed fields match, select the **[Save]** soft key to save the password.

It is recommended to set up a Service password when first accessing Service Mode. See the HeartStart Intrepid *Service Manual* for instructions to initialize and reset the Service Mode password.

NOTE: Saving the password is immediate, and does not require saving.

Configuration Password

The Configuration password can be changed from Service Mode. As an extra security measure, the Service password is needed to change the Configuration password

To enter a new password:

1. In the **New Password** field, enter a new password.
2. In the **Confirm Password** field, re-enter the new password from step 1.

   If the fields don't match, the message **New password and confirmation password do not match** is displayed. If the length of the new password is fewer than required, the message **Password must be at least 8 characters** is displayed.
3. Enter the Service password in the **Service Password** field.
4. If the new and confirmed fields match, select the **[Save]** soft key to save the password.

Data Management Password

The Data Management mode has an optional password that can be configured **On** or **Off** in the Configuration Mode **General** menu. The Data Management password can be changed in Configuration Mode. As an extra security measure, the Configuration password is needed to change the Data Management password.

To set a password:

1 In the New Password field, enter a new password.

2 In the Confirm Password field, re-enter the new password from step 1.

3 If the fields don't match, the message **New password and confirmation password do not match** is displayed. If the length of the new password is fewer than required, the message **Password must be at least 8 characters** is displayed.

4 Enter the configuration password in the Configuration Password field.

5 If the new and confirmed fields match, select the **[Save]** soft key to save the password.

Safety Considerations

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

WARNINGS: The HeartStart Intrepid 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. This device and its accessories are not intended for home use.

Use of the HeartStart Intrepid is restricted to a single patient at a time.

Algorithms used during rhythm analysis use the internal paced status that is selected by the user. Confirm that the patient's paced status is correct.

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

Do not touch or move patient during analysis.

Never operate the HeartStart Intrepid in standing water. Do not immerse or pour fluids on any portion of the HeartStart Intrepid. If the device does get wet, dry it with a towel. Using wet device is hazardous to the operator and bystanders.

Do not use the HeartStart Intrepid in the presence of a flammable anesthetic mixture or oxygen concentrations greater than 25% (or partial pressures greater than 27.5 kPa / 206 mmHg). This can cause an explosion hazard.

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

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

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

Do not touch the communication ports and a patient simultaneously.

When several items are interconnected, current leakage may occur.

Defibrillator protection requires use of manufacturer-specified accessories.

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

Accessory equipment connected to the HeartStart Intrepid'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 the institution's local Customer Care Center or representative.

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

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

NOTES: If internal sterilizable paddles are used, check their continuity and confirm that they have not reached the end of their sterility before using in an event. See the *Sterilizable Defibrillator Paddles Instructions for Use.*

Keep the HeartStart Intrepid Lithium Ion battery charged and a spare battery nearby.

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

Clinical usage of the HeartStart Intrepid does not require any special ElectroStatic Discharge (ESD) precautionary procedures.

4

ECG Monitoring

This chapter is divided into the following major sections:

Overview

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

Use the HeartStart Intrepid to monitor the patient's ECG through:

- multifunction electrode pads,
- 3-, 5-, or 10-lead ECG monitoring electrode sets,
- external paddles (for quick assessment only, not continuous monitoring).

If both pads and monitoring electrodes are connected, the HeartStart Intrepid allows for selecting a lead to monitor from either source.

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

Use the HeartStart Intrepid to monitor both adult and infant/child ECGs. Use the Patient Category button to switch categories.

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

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

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

ECG waveforms can be acquired through the Therapy port for pads/paddles or the ECG Monitoring port for 3-, 5-, or 10-lead sets. When 3-lead ECG monitoring is used, only one ECG lead vector is available. If using 5- or 12-lead ECG monitoring, up to four ECG lead vectors are available at the same time for display.

Use the ECG Gain Select button to adjust the ECG size of the primary lead. See "ECG Gain" on page 59 for details.

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

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

Do not use an external monitor as an ECG source.

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 certain arrhythmias.

NOTES: If the ECG Out cable is used to send an ECG signal from the HeartStart Intrepid to a bedside monitor, the ECG signal and alarms on the HeartStart Intrepid should be considered primary. The bedside monitor ECG is ancillary/secondary.

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

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

Do not use a Philips SureSigns monitor® connected to the HeartStart Intrepid. The devices are not compatible.

Preparing to Monitor ECG

Monitor ECG through multifunction electrode pads or ECG electrodes and do a quick look with external paddles. See the *Improving ECG Quality* Application Note.

NOTE: Use multifunction electrode pads prior to their expiration date. Discard pads after use. Do not reuse pads. Do not use for more than eight hours of continuous pacing. If monitoring for an extended period of time, monitoring electrodes and multifunction electrode pads may need to be changed periodically. Check the expiration date on the pads package and inspect the package for any damage. Discard expired or damaged pads.'Refer to the manufacturer's documentation for how often to replace the monitoring electrodes or pads.

Skin Preparation

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

◎ **To prepare the skin:**

1. Identify the appropriate locations:
   For pads – see the pads package.
   For electrodes – see "Electrode Placement" on page 54.
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.

CAUTIONS: To reduce the risk of burns:

1. Choose a flat or relatively flat muscular area that will not bear the patient's weight during surgery for dispersive electrode placement.
2. Before placing the electrode, thoroughly clean and dry the site. It is safer to assume that the site should be shaved than not shaved.
3. Place the electrode in a location where it is not likely to come into contact with fluids.
4. Before placing the electrode, check it for defects such as dried-out or insufficient amounts of conductive gel or adhesive.
5. After applying the electrode, run a hand over the dispersive pad to confirm uniform placement. While smoothing, move only from the outside to the inside of the pad so that no gel is forced out from underneath the pad.

Monitoring ECG with Pads

◎ **To monitor ECG through multifunction electrode pads:**

1 If not preconnected, connect the Therapy cable to the HeartStart Intrepid as described in " Device Basics" on page 9.

2 Connect the pads to the Therapy cable as described in "Connecting Multifunction Electrode Pads" on page 12.

3 Prepare the skin as directed above.

4 Apply the pads to the patient as described on the pads package.

Monitoring ECG with Electrodes

◎ **To monitor ECG through electrodes:**

1 Prepare the skin. See "Skin Preparation" on page 52.

2 Attach the snaps or grabbers to the electrodes before placing them on the patient.

3 Apply electrodes by peeling them, one at a time, from the protective backing and sticking them firmly to the patient's skin. Press around the entire edge of each electrode to ensure they are secure. Make sure the lead wires do not pull on the electrodes. See "Electrode Placement" for proper electrode locations.

4 If not preconnected, connect the ECG cable as described in "Connecting the ECG cable" on page 15.

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

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

Electrode Placement

Figure 45 shows the typical electrode placement for a 3-lead ECG set.

Figure 45 **3-Lead Placement**

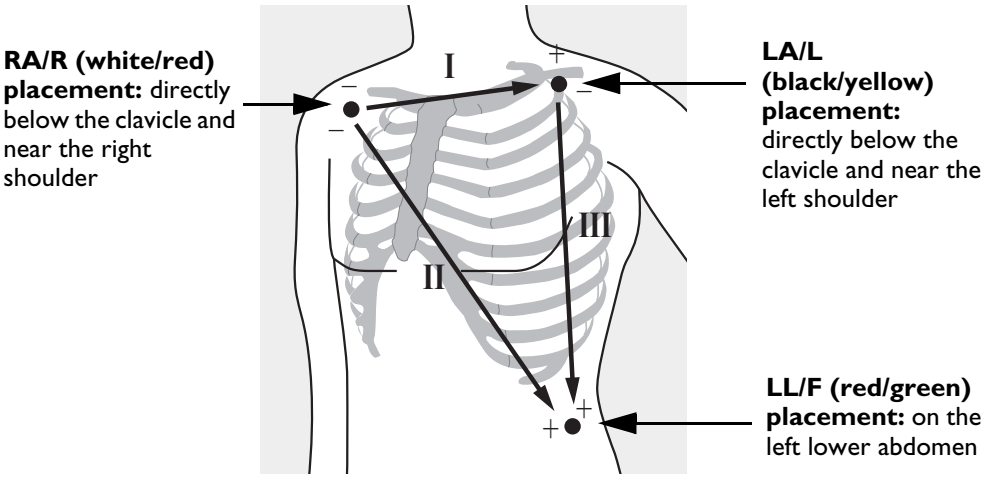
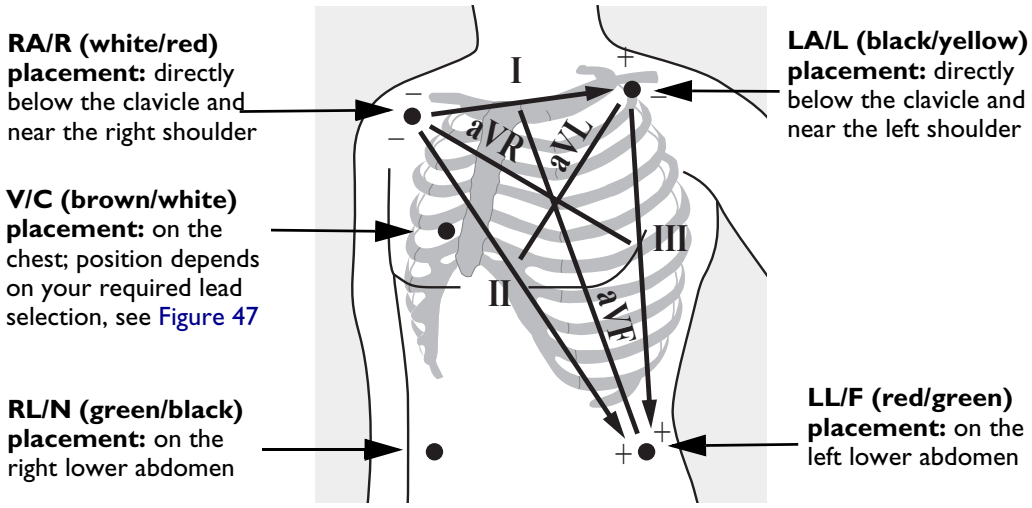


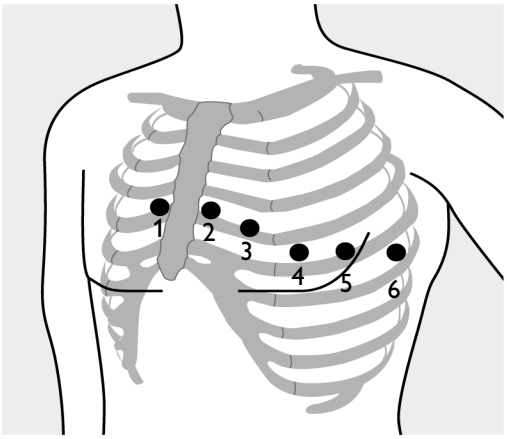
Figure 46 shows the typical electrode placement for a 5-lead ECG set.

Figure 46 **5-Lead Placement**



The single V/C lead of a 5-lead cable may be placed in any of the precordial electrode positions as shown in Figure 47 (V1/C1 through V6/C6).

Figure 47 **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

NOTE: No matter which V/C electrode of a 5-lead cable placement selected, it appears as V on the HeartStart Intrepid. If a V electrode is used, it can act as a reference electrode if the RL electrode is unavailable.

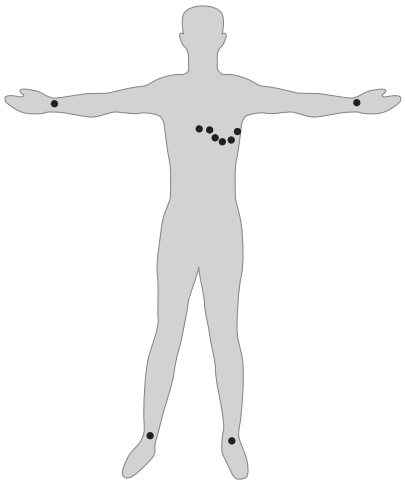
For accurate V/C lead placement and measurement, it is important to locate the fourth intercostal space.

To locate the fourth intercostal space:

1. Locate the second intercostal space by first palpitating the Angle of Louis (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 the fourth intercostal space is located.

When performing a 12-Lead ECG, attach the limb leads to the patient's extremities. Figure 48 shows electrode placement for a 12-Lead ECG set.

Figure 48 **12-Lead Placement**



12-Lead ECG: In a 12-Lead ECG using 10 electrodes, an electrode is placed on the right arm, left arm, right leg, and left leg. Six V/C electrodes are placed on the chest as shown in Figure 48. The right leg electrode is the reference electrode.

Lead Selection

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

For non-paced patients:

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

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

All isoelectric segments including I and K waves are excluded from the Q, R, S, R' and S' waves.

For paced patients with internal/transvenous pacemakers:

- Confirm **Paced Status** is set correctly on the HeartStart Intrepid, see "Entering Patient Information" on page 45.
- All four criteria for non-paced patients listed above.
- Large enough to be detected (half the height of the QRS complex), with no re-polarization artifact. Some unipolar pacemakers display pace pulses with re-polarization tails which may be counted as QRSs in the event of cardiac arrest or other arrhythmias. Choose a lead to minimize the size of re-polarization tails.

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

Lead Choices

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

Table 8 **Lead Choices**

If using	...these leads are available
a 3-Lead ECG set	I, II, III
a 5-Lead ECG set	I, II, III, aVR, aVL, aVF, V
a 12-Lead ECG set	I, II, III, aVR, aVL, aVF, V1-V6

To select leads to display on the HeartStart Intrepid, see "Selecting the Waveform" on page 58.

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

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

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

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

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

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

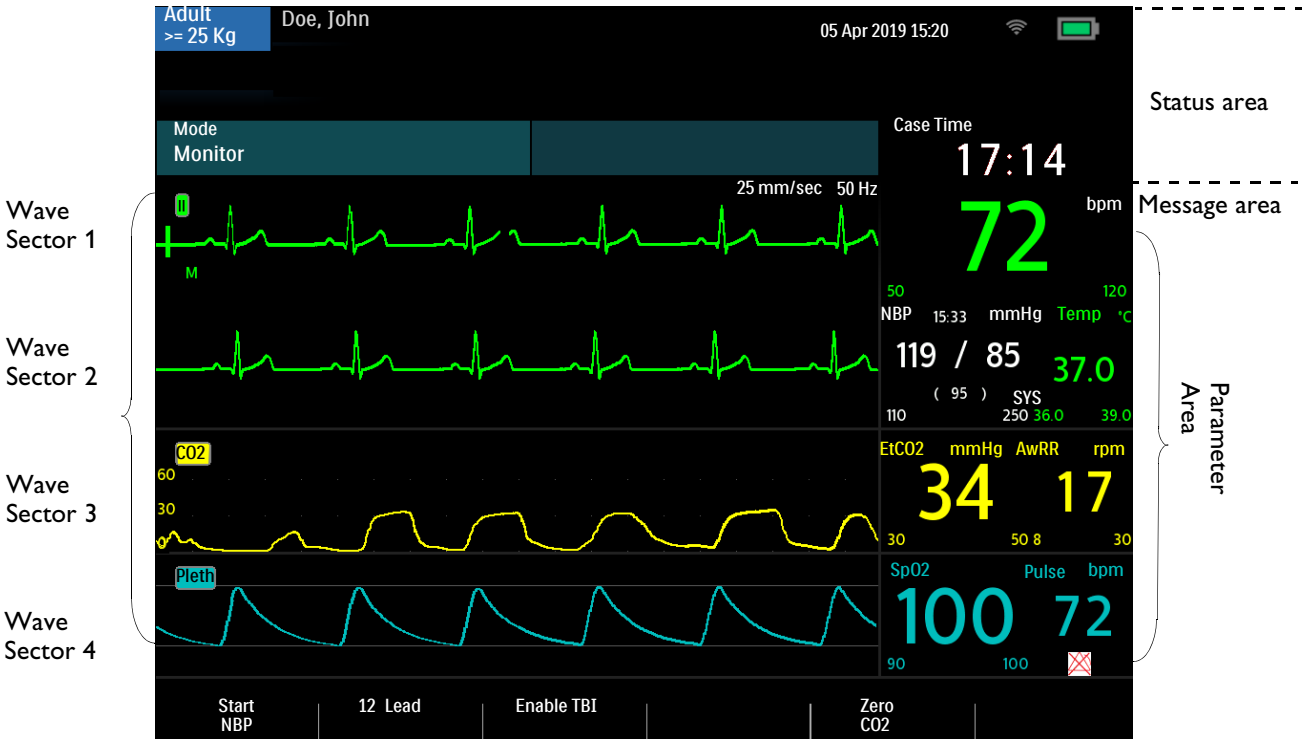
When the ECG Analog Output is used, detected internal pacemaker pulses are inserted into the output as pulses of less than 3.5 ms in width when measured at 50% of the peak of the pulse. The amplitude of the inserted pulse is >40% and <70% of the detected pacemaker pulse amplitude for pulses widths of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

Monitor View

To primarily monitor the patient's ECG waveform in Monitor View, turn the Therapy knob to Monitor.

In Monitor View, four waves can be reviewed simultaneously while monitoring all current vital sign parameters. See Figure 49.

Figure 49 **Monitor View Layout**



Selecting the Waveform

The HeartStart Intrepid allows configuration of the lead displayed as the primary ECG lead in Wave Sector 1 when the device is turned on. The factory default is Lead II. See Table 53 “Configuration – Waves Settings” on page 173.

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

Waveforms can be changed for each sector during a patient event.

Monitor, Manual Defibrillation, and Pacing Modes

The ECG wave for Wave Sector 1 is selected through the Lead Select button  (see “General Function Buttons” on page 29) or through the Displayed Waves menu. The waves for Wave Sectors 2, 3, and 4 are selected through the Displayed Waves menu only.

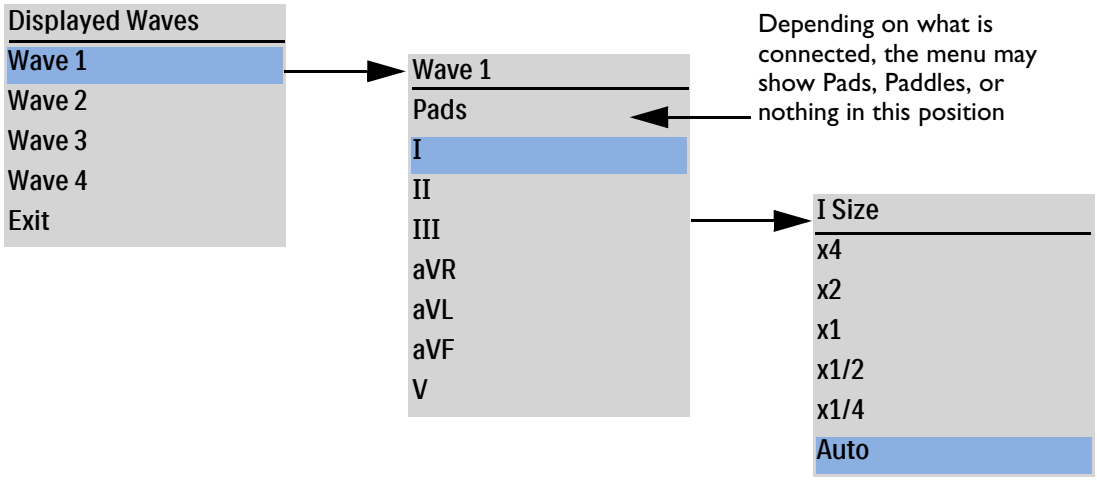
Use the ECG Gain Select  button on the front panel to adjust the ECG gain of primary lead. For other wave sectors use this procedure:

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 50).
3. Select the wave sector to modify and press the Smart Select knob.
4. Select the new wave type and press the Smart Select knob.

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

Figure 50 **Wave Menus**



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

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

NOTE: The Pads ECG wave is automatically populated in Wave Sector 1 in AED Mode.

ECG Gain

Use the ECG Gain Select button on the front panel to adjust the ECG gain of primary lead.

Unless viewing all 12 leads, pressing the ECG Gain Select button increases the vertical scale of the primary lead waveform by one setting. If the ECG size is **x4** when the button is pressed, the vertical scale of the primary lead reverts to **x1/4**.

If viewing all 12 leads, or if the primary lead is set to **Auto**, then pressing the ECG Gain Select Button has no effect.

Dashed Lines

A dashed line on the ECG display indicates that there is no ECG signal received from the patient in the wave sector. Either troubleshoot the currently selected lead to solve the problem (see Table 103 “ECG Problems” on page 234) or select a different lead.

To replace a dashed line with a different lead:

- In Wave Sector 1, use the Lead Select button to cycle through available leads and select an appropriate lead, or
- Use the **Displayed Waves** menu to select an appropriate lead.

NOTE: Dashed lines may briefly occur with a change of the selected lead.

Displaying an Annotated ECG

The HeartStart Intrepid 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. See Table 9 for beat label classifications.

Table 9 **Arrhythmia Beat Labels**

Label	Description	Where Displayed
N	Normal	Above QRS
V	Ventricular Ectopic	
P	Paced	
L	Learning Patient's ECG	
?	Insufficient information to classify beats	
'	Pacer Spike	Above waveform, where pacer spike was detected (If the patient is both atrially and ventricularly paced, the display shows two marks above the waveform aligned with the atrial and ventricular pacing.)
"	Biventricular Pace Pulse	Above waveform where the biventricular pace pulse was detected
A	Artifact (noisy episode)	Above waveform where noise was detected
I	Inoperative condition (e.g. there is a lead 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 detected

To display an annotated ECG:

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

Arrhythmia Monitoring

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

During arrhythmia analysis, the monitoring function continuously:

- Optimizes ECG signal quality to facilitate arrhythmia analysis. The ECG signal is continuously filtered to remove baseline wander, muscle artifact and signal irregularities. Also, if the patient's internal paced status is set to yes, pace pulses are filtered out to avoid processing them as QRS beats.
- Measures signal features such as R-Wave height, width and timing.

- Creates beat templates and classifies beats to aid in rhythm analysis and alarm detection.
- Examines the ECG signal for ventricular arrhythmias and asystole.

NOTE: Because the Philips ST/AR Algorithm is the HeartStart Intrepid's cardiotach source and is needed to generate heart rate and heart rate alarms, the algorithm can never be disabled. However, if desired, arrhythmia and heart rate alarms can be turned off. See "Setting Alarms" on page 64.

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

Aberrantly-Conducted Beats

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

Arrhythmia Learning/Relearning

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

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

Arrhythmia learning/relearning automatically occurs when:

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

Initiate manual relearning if the beat detection is not occurring or if beat classification is incorrect and results in a false alarm. Remember if the same signal condition which caused the algorithm to perform poorly still exists, relearning does not correct the problem. The problem can only be corrected by improving the signal quality (e.g., selecting a different lead).

To initiate relearning manually:

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

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

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

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

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

Some pace pulses can be difficult to reject. When this happens, the pulses are counted as a QRS complex, and could result in incorrect HR and failure to detect cardiac arrest or some arrhythmias. Keep pacemaker patients under close observation. See "Specifications and Safety" on page 245 for details on Pacemaker Pulse Rejection Capability.

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

Heart Rate and Arrhythmia Alarms

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

HR/Arrhythmia alarms can be generated for the conditions shown in Table 10 "HR/Arrhythmia Physiological Alarms" below and Table 11 "HR/Arrhythmia Technical Alarms" on page 63. Once generated, they appear as alarm messages in the HR alarm status area above the HR numeric. When ECG alarms are off an ECG Alarms Off message appears above the HR numeric. There are both audio and visual alerts. For more information on alarms, see "Alarms" on page 40.

TIP: Alarm notification is configurable. See "Alarm Management and Configuration" on page 43.

Table 10 **HR/Arrhythmia Physiological Alarms**

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

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

Table 11 **HR/Arrhythmia Technical Alarms**

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

Figures 51 and 52 illustrate the precedence of alarms based on their priorities.

Figure 51 **Basic Mode Arrhythmia Alarm Priority Chain**

For Monitor, Manual Defibrillation, and Pacing

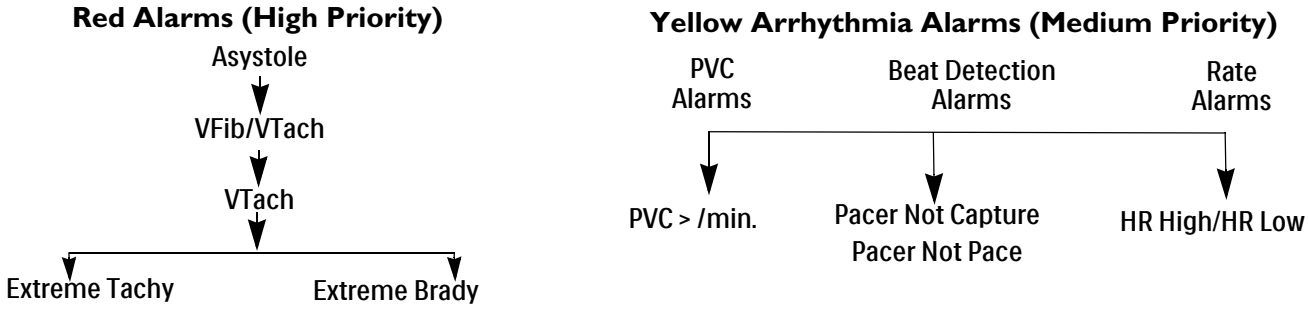


Figure 52 **Cardiotach Mode Arrhythmia Alarm Priority Chain**

For AED Mode Only

Setting Alarms

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

Changing Alarm Limits

◎ **To change HR, VTach or PVC Rate Limits:**

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

Enabling/Disabling Alarms

◎ **To enable/disable the HR and Arrhythmia alarms:**

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

3 Select **HR/Arrhythmia** and press the Smart Select knob.

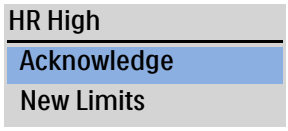
4 Select **Alarms On** (**Alarms Off**) and press the Smart Select knob.

Responding to Alarms

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

After pausing the audio on the HeartStart Intrepid, attend to the patient and press the Smart Select knob to acknowledge the alarm condition. If required, adjust the alarm limits using the Smart Select knob. Certain lethal arrhythmias have only **Acknowledge** as a menu option.

Figure 53 **Sample Alarm Response Menu**



HR/Arrhythmia Alarms in AED Mode

If alarms are turned on in AED Mode, all Technical Alarms listed in Table 11 on page 63 and the following Physiological Alarms from Table 10 on page 63 are generated when the condition exists:

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

For more information on AED Mode, see "AED Mode Option" on page 67. For more information on Alarms see "Alarms" on page 40.

Troubleshooting

If the HeartStart Intrepid does not operate as expected during ECG and Arrhythmia monitoring, see "ECG Problems" on page 234.

NOTES

5

AED Mode Option

Defibrillation therapy is the definitive method for termination of lethal arrhythmias. The HeartStart Intrepid's optional semi-Automated External Defibrillation (AED) Mode is designed for standard treatment algorithms for cardiac arrest. The HeartStart Intrepid with this option provides therapy through the application of a brief biphasic pulse of current to the heart. This energy is transferred through disposable multifunctional pads applied to the patient's bare chest.

This chapter is divided into the following major sections:

Overview

This chapter describes how to use AED Mode. It explains the voice and visual prompts used in the defibrillation process, and describes how prompts vary depending upon the condition of the patient and the device configuration. Use the configuration choices to customize AED Mode to better meet the unique needs of each institution or resuscitation team.

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

In AED Mode the patient's ECG, SpO_2, pulse, $EtCO_2$ and AwRR can be monitored. Certain ECG alarms can also be displayed in AED Mode. Even though ECG alarms, which are obtained through the Philips ST/AR Algorithm, can be viewed in AED Mode, the SMART Analysis algorithm is used as the only basis for determining a shock. See "Other Alarms in AED Mode" on page 79.

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

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

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

WARNING: Make sure to properly select patient category. If the age is not known, use your judgment of the patient's weight.

For information on annotating, storing, exporting and printing event information acquired in AED Mode, see "Data Management" on page 181.

For guidance on setting AED configuration choices, see "Configuration – AED" on page 172.

Optional SpO_2 and Pulse, CO_2 and AwRR, and Q-CPR meter 2 monitoring are also available in AED Mode. For more information, see:

- Chapter 8 "Monitoring SpO_2" on page 101
- Chapter 11 "Monitoring Carbon Dioxide" on page 129
- Chapter 13 "Q-CPR" on page 145.

Precautions for AED Therapy

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

Use only pads that are approved for use with the HeartStart Intrepid. Use of non-approved pads could affect performance and results. See "ECG and Defibrillation Accessories" on page 221 for a list of supported pads.

For adults in AED Mode, the preferred position of the multifunction electrode pads are the anterior-lateral position shown on the packaging. For Infant/Child patients, the pads can be in the anterior-posterior position.

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

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

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

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

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

NOTES: Successful resuscitation depends on many variables specific to the patient's physiological state and the circumstances surrounding the patient event. Failure to have a successful patient outcome is not a reliable indicator of monitor/defibrillator 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 and 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 a **Shock Aborted** message is displayed, 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 HeartStart Intrepid's 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 Operational Check and according to organizational protocol.

AED View

When the Therapy knob is moved to AED, AED View is displayed (see Figure 54). AED Mode-related information includes:

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

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

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. Green light on the PCI indicates good contact is established. The PCI is displayed when pads are attached and the device is charging or is charged.

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.

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

Wave Sector 2: Displays the ECG (annotated or cascaded) or the compression feedback (if using Q-CPR meter 2) depending upon which combinations of options are configured (see Table 50 on page 172).

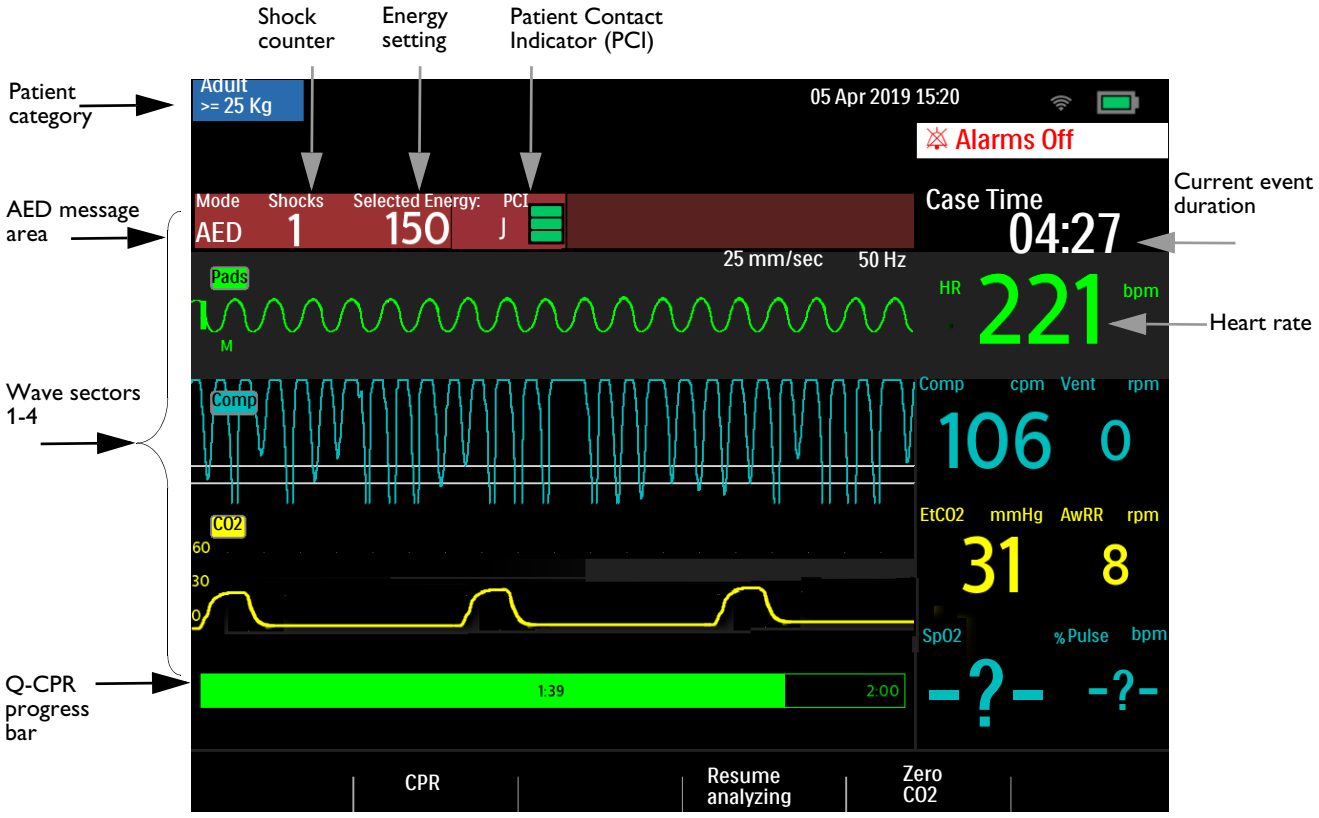
Wave Sector 3: Displays the Capnogram.

Wave Sector 4: Displays the SpO_2 waveform if enabled and available, or the AED Pause/CPR Progress Bar.

AED Pause/CPR Progress Bar: When in use, replaces the wave in Wave Sector 4 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 (blue) and Infant/Child (pink).

Figure 54 **AED View Layout**



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

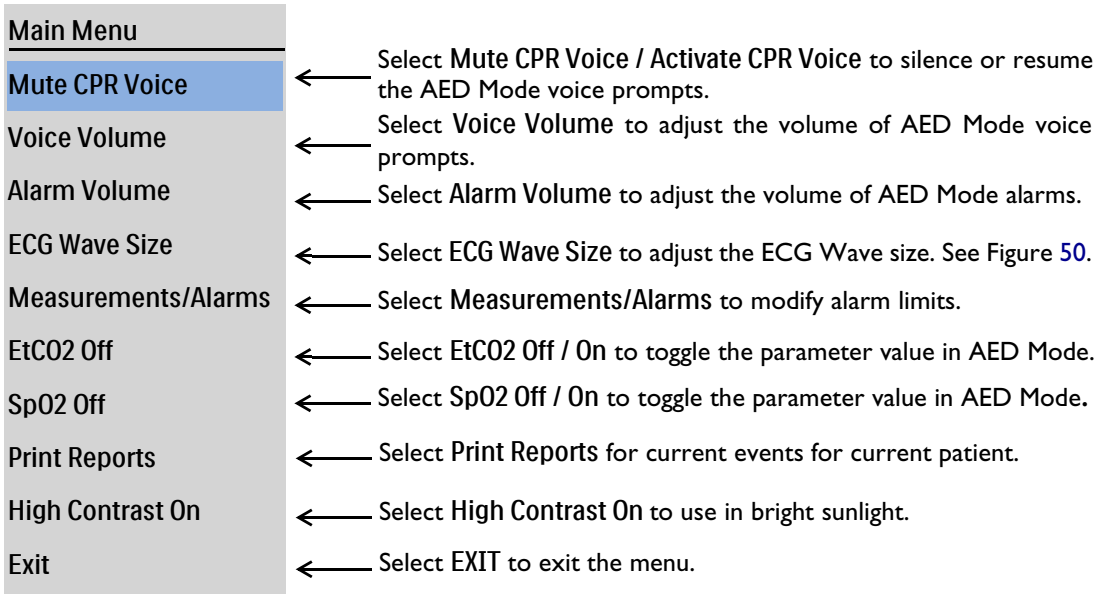
AED Soft Keys

AED Mode has the following soft keys available for use (see Figure 54):

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

Pressing the Smart Select knob brings up the main menu for AED Mode. See Figure 55.

Figure 55 **AED Main Menu**



For more information on menus, see "Menus" on page 37.

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

Using AED Mode to Defibrillate

Preparation

To prepare for defibrillation in AED Mode:

1. Confirm the patient is:
   - Unresponsive
   - Not breathing normally
   - Pulseless
2. Expose patient's bare chest. Wipe moisture from the patient's chest and, if necessary, clip or shave excessive chest hair.
3. Check the expiration date on the pads package and inspect the package for any damage.
4. Connect the Therapy cable to the HeartStart Intrepid (see "Attach and lock the collar lid, see "Therapy Cable Collar" on page 22." on page 11).
5. If the pads are not expired and package is undamaged, open the package and connect the pads connector to the end of the Therapy cable (see "Connecting Multifunction Electrode Pads" on page 12).
6. Apply the pads to the patient as directed on the pads packaging or according to organizational protocol.

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

Operation

To operate the HeartStart Intrepid in AED Mode:

1. Turn the Therapy knob to AED. The HeartStart Intrepid announces and displays the current patient category.

   If not correct, use the Patient Category button to select the appropriate patient category.
   - For patients that are ≥ 25 kg or ≥ 8 years old, use Adult patient category.
   - For patients < 25 kg or < 8 years old, use Infant/Child patient category.
2. Follow the voice and screen prompts.
3. Press the orange Shock button if prompted.

See the following sections for more information.

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

Step 1 – Turn the Therapy Knob to AED

When the HeartStart Intrepid is turned to AED, it announces and displays the patient category.

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

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

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

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, there is no need to abort the analysis in progress and restart a new one. The algorithm is not sensitive to patient category.

Step 2 – Follow Screen and Voice Prompts

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

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

WARNING: Handling or transporting the patient during ECG rhythm analysis can cause an incorrect or delayed diagnosis. Under these circumstances, if the HeartStart Intrepid 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 HeartStart Intrepid automatically charges to the preconfigured Joule setting (default is 150 J) if the Adult patient category is selected (see "Configuration – AED" on page 172) or 50 J if in the Infant/Child category. Charging is accompanied by voice and screen prompts. When the device is fully charged, a steady high-pitched tone sounds, and the orange Shock button flashes.

Heart rhythm analysis continues while the HeartStart Intrepid 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, 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 HeartStart Intrepid audibly advises **No shock advised**. Follow the institution's protocol for a No Shock Advised alert. The device's next steps are determined by the **NSA Action** configuration choice, see Table 50 "Configuration – AED" on page 172. If the configuration is set to:

  – **NSA Monitor** – The HeartStart Intrepid monitors the ECG and automatically resumes analysis if a potentially shockable rhythm is detected. Periodically prompts indicate to press **[CPR]** soft key and to begin CPR if indicated. The frequency of these prompts is defined in the **NSA Monitor Prompt Interval** configuration choice. Press **[CPR]** to suspend monitoring and administer CPR any time.

  – **NSA CPR** – Analysis is suspended for the specific period which is defined by the **NSA Action** configuration choice. Attend to the patient and administer CPR if indicated. The Pause Status Bar is displayed (see "AED View Layout" on page 70). At the end of the pause period, the HeartStart Intrepid resumes analyzing.

- **ECG cannot be analyzed** – If artifact interferes with analysis, the HeartStart Intrepid provides an alert to attempt to continue analyzing. If artifact persists and device announces that the ECG cannot 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 pressing the **[Resume Analyzing]** soft key. Always use the analyze function to determine if a rhythm is shockable.

For more information on AED messages, see "AED Mode User Messages" on page 74.

Step 3 – Press Shock Button if Prompted

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

WARNINGS: The Shock button must be pressed to deliver a shock. The HeartStart Intrepid 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 pressing the **[Resume Analyzing]** soft key. If switching to Manual Defibrillation during the CPR Pause period, the device continues the CPR period. If switching to Monitor or Pacer modes, the CPR Pause period exits.

NOTE: Once prompted to administer the shock, if not done so within the configured Auto Disarm time interval, the HeartStart Intrepid disarms itself and enters a pause period for CPR. The device resumes analyzing at the end of the pause period or when pressing the **[Resume Analyzing]** soft key. Rhythm monitoring is intended to provide a backup or secondary measure of potentially shockable rhythms in various environments but is not a substitute for being attentive to the patient's state.

AED Mode User Messages

AED Mode provides guidance through the defibrillation process. Depending upon the given situation, voice prompts and display messages are presented to assist in using AED. The AED Mode Informational Messages may appear during normal AED Mode operation.

Table 12 **AED Mode Informational Messages**

Audio Message	Display Text	Condition	User Action
Adult Mode	**Patient Type: Adult**	The current AED Mode patient category is Adult.	None
Infant/Child Mode	**Patient Type: Infant/Child**	The current patient category is Infant/Child.	
Low battery	None. See battery icon in upper right of the display.	The battery charge level is low.	Charge or replace the battery.

The AED Mode Pad Connection Messages may appear when the Therapy or Pads/Q-CPR meter 2 cable is not connected properly to the device or the pads are not applied properly to the patient.

Table 13 **AED Mode Pad Connection Messages**

Audio Message	Display Text	Condition	User Action
"Plug In Connector"	Connect Pads Cable Connect Pads/CPR Cable	The cable is not connected to the device.	Securely connect the Therapy cable or Pads/Q-CPR meter 2 cable to the device.
None	Disconnect Paddles Cable	A paddles cable is connected to the device.	Disconnect the paddles and attach the Pads/Q-CPR meter 2 or Therapy cable to the device.
• "Apply Pads" • "Apply pads to patient's bare chest" • "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" • "Insert connector firmly	Insert Connector, Apply Pads	The pads are not applied or applied incorrectly.	Observe the graphics and follow the voice prompts.
• "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 pads impedance is too high or too low.	
• "Poor Pads Contact" • "Replace Pads"	Poor Pads Contact		

The AED Mode Analysis-Related Messages may appear during AED analysis.

Table 14 **AED Mode Analysis-Related Messages**

Audio Message	Display Text	Condition	User Action
"Stay clear of patient" pause "Analyzing" pause "Stay clear"	Stay Clear of Patient, Analyzing	AED Analysis in progress.	None. Wait for further guidance.
"Shock advised" pause "Stay clear"	Stay Clear of Patient, Shock Advised	Shockable rhythm detected.	
"Analyzing interrupted" pause "Stay clear of patient" pause "Stop all motion"	Stay Clear of Patient, Analyzing Interrupted	Artifact detected, analyzing interrupted.	Stop moving or touching the patient.
"Cannot Analyze"	Cannot Analyze	Artifact detected. 45 seconds without determination.	Attend to the patient
"No shock advised"	Attend to Patient, No Shock Advised	No shockable rhythm detected.	
"Begin CPR"	Press the CPR Button and Begin CPR	Pads off or impedance too high or low.	Begin CPR
	Begin CPR	Shock delivered.	
	Attend to Patient	No shock advised.	
Stop CPR"	None	CPR pause period exit	Pause CPR

The AED Mode Shock-Related Messages may appear during normal AED therapy delivery.

Table 15 **AED Mode Shock-Related Messages**

Audio Message	Display Text	Condition	User Action
"Deliver shock now"	Deliver Shock Now	Shock advised	Call out "Stay Clear," ensure no one is touching the patient, and press the flashing orange **Shock** button.
"Press the flashing orange button now"	Press Orange Button		
None	Shock Delivered Attend to Patient, Shock Delivered	Shock or shock series delivery completed.	Attend to patient.
	Stay Clear of Patient, Shock Delivered	Shock series delivery not completed.	Stay clear.

Table 15 **AED Mode Shock-Related Messages *(Continued)***

Audio Message	Display Text	Condition	User Action
"Shock cancelled" "No Shock Advised"	Shock Cancelled	Shock reversal	Attend to patient.
"Shock cancelled" "Press pads firmly to patient's bare skin"		Shock aborted due to high impedance	Check the pads.
"Shock cancelled" "Pads must not be touching clothing or each other"		Shock aborted due to low impedance	
"Shock button not pressed"	Charge Cancelled	Charge timeout	Press **[Resume Analyzing]** and attend to patient.
"Press pads firmly to patient's bare skin"	None	Poor pads contact	Check the pads.

Using AED Mode to Monitor

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

To monitor ECG in AED Mode and activate alarms:

1. Turn the Therapy knob to AED. The HeartStart Intrepid announces the patient category currently set.

   If not correct, use the Patient Category button to select the appropriate patient category.
   - For patients that are ≥ 25 kg or ≥ 8 years old, use Adult patient category.
   - For patients <25 kg or < 8 years old, use Infant/Child patient category.
2. After performing an initial ECG rhythm analysis, if the rhythm is not shockable, the HeartStart Intrepid begins to monitor the patient.
3. To activate ECG alarms in AED Mode, press the Alarms button on the front of the device.

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

1. Once in AED Mode, attach an SpO_2 line to the device and patient (see "Applying the Sensor" on page 103).
2. If the device is configured to monitor SpO_2 in AED Mode, SpO_2 monitoring begins once a pulsatile reading is obtained. For more information on SpO_2, see Chapter 8 "Monitoring SpO_2" on page 101.
3. To activate the SpO_2 alarms in AED mode, press the Alarms button on the front of the device.

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

1. Once in AED Mode, attach a CO_2 line to the device and the patient (see "Connecting the CO_2 Tubing" on page 14).

2 If the device is configured to monitor CO_2 in AED Mode, CO_2 monitoring begins once a reading is obtained. For more information on CO_2, see Chapter 10 “Monitoring Carbon Dioxide” on page 109.

3 To activate the $EtCO_2$ alarms in AED mode, press the Alarms button on the front of the device.

Configurable Resuscitation Protocols

AED Mode has the flexibility to configure the HeartStart Intrepid to match institutional resuscitation protocols as follows:

- Customize the device for the number of shocks (1-4) in a series.
- Select the energy setting within a given shock series (Adult patient category only).
- Set the CPR Pause interval from 1-3 minutes.
- Select the level of detail for the voice prompts in the AED Mode.
- Select what the device does after a No Shock Advised decision.
- Enable and disable the SpO_2 and $EtCO_2$ monitoring during AED.

For more information, see Table 50 “Configuration – AED” on page 172.

AED Alarms

The Philips SMART Analysis algorithm generates AED Defibrillation alarms for the conditions shown in Table 16. There are both audio and visual alerts, when turned on.

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

For more information on alarms, see “Alarms” on page 40.

The following AED Defibrillation Alarms may appear during AED analysis:

Table 16 **AED Defibrillation Alarms**

Display Text	Condition	Type of Alarm
Abnormal Shock Dose Delivered	Abnormal shock dose due to marginal patient impedance.	High priority latching
Pads/Paddle Type Unknown	The device detected a change in paddles or pads type, or the therapy cable identification is invalid.	
Shock Aborted	Shock aborted due to abnormal impedance.	
Therapy Disabled: Run OpCheck	Equipment failure.	
Pads Off	Pads connection problem.	High priority non-latching

Other Alarms in AED Mode

ECG

If ECG alarms are turned on in AED Mode, all Technical Alarms listed in "HR/Arrhythmia Technical Alarms" on page 63 and the following Physiological Alarms from "HR/Arrhythmia Physiological Alarms" on page 63 are generated when the condition exists:

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

Once generated, all alarms appear as messages in the HR alarm status area above the HR numeric. There are both audio and visual alerts. For more information on ECG alarms, see "Arrhythmia Monitoring" on page 60.

SpO_2 and Pulse

If SpO_2 and Pulse alarms are turned on, once generated, the alarm messages appear in the SpO_2 or Pulse status area above their respective numeric. For more information on these alarms see "Enabling/Disabling SpO_2 and Pulse Alarms" on page 107.

CO_2 and AwRR

If $EtCO_2$ or AwRR alarms are turned on, once generated, the alarm messages appear in their respective status areas above the numeric. For more information on these alarms see "$EtCO_2$ and AwRR Alarms" on page 134.

Troubleshooting

If your HeartStart Intrepid does not operate as expected during AED Mode, see "Defibrillation and Pacing Problems" on page 236.

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

NOTES

6

Manual Defibrillation and Cardioversion

This chapter explains how to prepare for and perform asynchronous and synchronous (cardioversion) defibrillation using multifunction electrode pads, external paddles, and internal paddles.

WARNING: Do not use the Manual Mode if not trained in Advanced Life Support.

This chapter is divided into the following major sections:

Overview

Defibrillation therapy is the definitive method for termination of lethal arrhythmias. The HeartStart Intrepid 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 user control: Assess the ECG, decide if defibrillation or cardioversion is indicated, select the appropriate energy, charge the HeartStart Intrepid and deliver the shock. Text messages on the display provide relevant information throughout the process. Be attentive to these messages when displayed.

The ECG strip and Event Summary are easily annotated with information using the Mark Events button. See "Mark Events" on page 47.

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.

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

Precautions

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. Using thumbs, press the shock buttons on the paddle handles.

Use only pads that are approved for use with the HeartStart Intrepid. Use of non-approved pads could affect performance and results. See "ECG and Defibrillation Accessories" on page 221 for a list of supported pads.

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

Make sure to properly select patient category. If the age is not known, use judgment of the patient's weight. 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.

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.

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

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.

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 monitor/defibrillator 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 it is possible to monitor the ECG using an alternate ECG source (3-, 5-, or 10-lead monitoring electrodes). If an alternate ECG source is connected, any available lead may be displayed.

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

Code View

In Manual Defibrillation Mode, when an energy is selected, Code View is displayed. Code View is optimized to clearly communicate data associated with a resuscitation event (see Figure 56). Code-related information in Code View includes:

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 (blue) and Infant/Child (pink).

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

Selected Energy: Displays the currently selected energy.

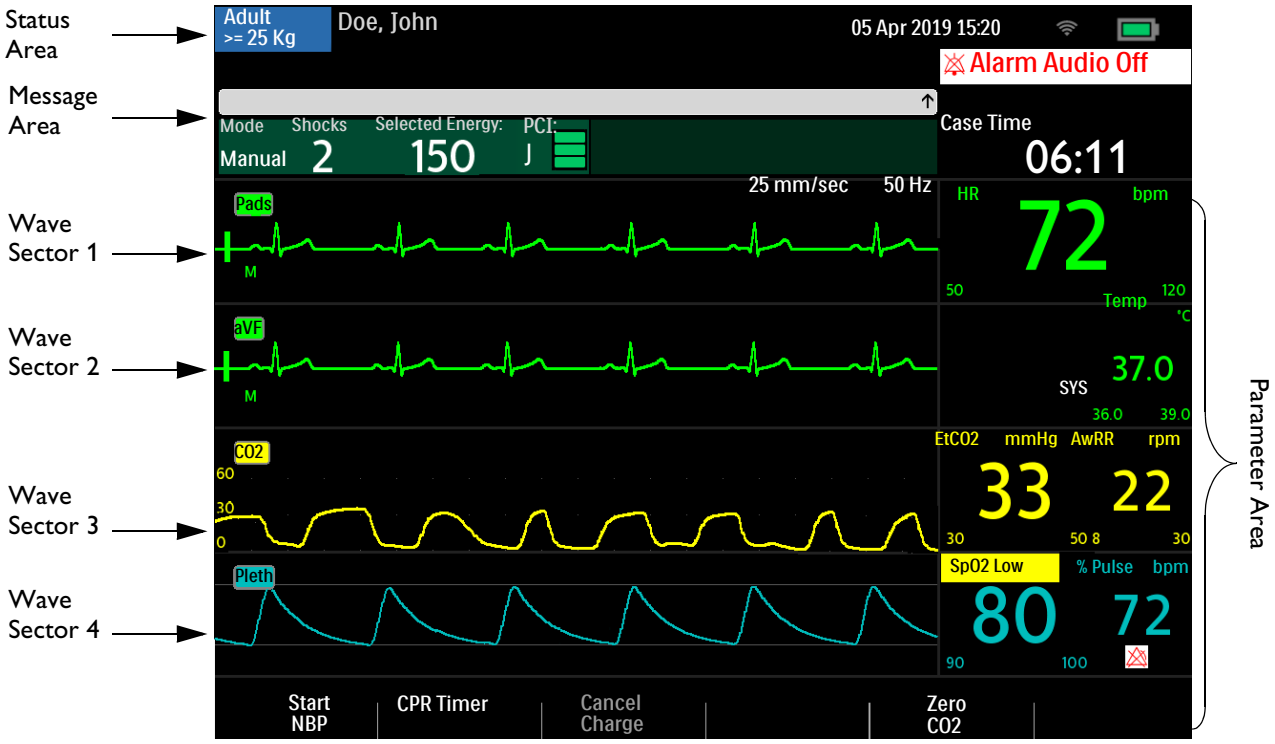
Patient Contact Indicator: Graphical representation of the contact quality between the patient and the multifunction electrode pads. Orange or red lights on the PCI indicate poor patient contact. Adjust pads to optimize patient contact. Green light on the PCI indicates good contact is established. The 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.

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, 3, 4: 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.

CPR Progress Bar: When the **[CPR Timer]** soft key is pressed, the wave in Wave Sector 4 is replaced with the CPR Progress bar. This tracks the progress of the CPR pause period.

Figure 56 **Manual Mode 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 52.
2. Connect the appropriate therapy cable. See "Attach and lock the collar lid, see "Therapy Cable Collar" on page 22." on page 11.
3. Apply paddles or pads as described in the following sections.

Using Multifunction Electrode Pads

To set up for defibrillating using multifunction electrode pads:

1. Check the expiration date on the pads package and inspect the package for any damage.
2. If not preconnected, connect the Therapy cable to the HeartStart Intrepid (see " Device Basics" on page 9).
3. If the pads are not expired and package is undamaged, open the package and connect the pads connector to the end of the Therapy cable (see "Connecting Multifunction Electrode Pads" on page 12).
4. Apply the pads to the patient as directed on the pads packaging or according to institutional protocol.
5. Follow the defibrillation steps in "Defibrillation" on page 86.

Using External Paddles

◎ **To set up for defibrillation using external paddles:**

1. After connecting the paddles cable to the HeartStart Intrepid, remove the paddle set from the paddle tray by pulling the paddles straight up and out of the paddle tray. Confirm 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 organizational protocol.

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

3. Apply the paddles to the patient's bare chest using the anterior-lateral placement (or in accordance with organizational protocol).
4. Use the Patient Contact Indicator (PCI) lights on the sternum paddle handle to adjust paddle pressure and placement to optimize patient contact. Once proper contact is made, the PCI turns green. See "External Paddles" on page 17.

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 86.

Quick Look

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

◎ **To view a patient's ECG using external paddles:**

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

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

Using Infant Paddles

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

◎ **To set up for defibrillating using infant paddles:**

1. Expose the infant paddle surfaces, see "Accessing Infant Paddles" on page 18.
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 85.
4. Follow the defibrillation steps in "Defibrillation" on page 86.

Using Internal Paddles

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

1. Select the appropriate paddle electrode size.
2. If using switchless internal paddles, connect the paddles to the M4740A Internal Paddle Adapter Cable.
3. Connect the paddles cable (or the paddle adapter cable) to the HeartStart Intrepid. See "Attach and lock the collar lid, see "Therapy Cable Collar" on page 22." on page 11.
4. Follow the defibrillation steps in "Defibrillation" on page 86.

NOTE: The HeartStart Intrepid has a built-in limit of 50 J when using internal paddles.

Defibrillation

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

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

See the following sections for more information.

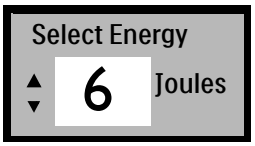
Step 1 – Select Energy

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

Energy choices range from 1 to 200 J with 150 J highlighted as the recommended level for defibrillating adult patients. If selecting the 1-10 energy setting, use the Smart Select knob to increase or decrease the desired setting.

◎ **To re-adjust a low energy setting:**

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



WARNINGS: For manual defibrillation of infant/child patients follow institutional policy.

Do not leave patients unattended when the HeartStart Intrepid is in Manual Defibrillation Mode with pads applied to the patient.

Step 2 – Charge

Press the **Charge** button on the front panel. See "Therapy Knob and Controls" on page 28. If using external paddles, the charge button on the side of the apex paddle may be used instead. As the defibrillator charges, the energy selection shown on the display changes to show the current charge state. A continuous low-pitch charging tone sounds until the desired energy level is reached at which point a continuous high-pitch charged tone sounds.

It is acceptable to increase or decrease the selected energy at any time during or after charging. Move the Therapy knob to the desired energy level. The HeartStart Intrepid charges to the selected energy level automatically.

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

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

Step 3 – Shock

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

If using:

- **Pad** – Press the flashing **Shock** button on the front of the HeartStart Intrepid 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 HeartStart Intrepid to deliver a shock.

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

WARNINGS: The Shock button must be pressed to deliver a shock. The HeartStart Intrepid 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.

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**.

Synchronized Cardioversion

The HeartStart Intrepid provides synchronized cardioversion therapy by delivering a brief biphasic pulse of electricity to the cardiac muscle immediately following an R-wave detected in the ECG measurement. The SMART Biphasic waveform utilized in the HeartStart Intrepid has undergone clinical testing demonstrating its effectiveness for cardioversion of certain atrial and ventricular arrhythmias. Cardioversion should only be delivered by trained healthcare professionals.

Perform synchronized cardioversion in either of the following ways:

- Multifunction electrode pads or external paddles and 3, 5, or 12-lead set monitoring electrodes directly connected to the HeartStart Intrepid. This is the best quality source for cardioversion.
- Only the multifunction electrode pads directly connected to the HeartStart Intrepid.

Preparation

To prepare for synchronized cardioversion:

1. Perform tasks as described in "Preparing for Defibrillation" on page 84.
2. If monitoring through a 3-, 5-, or 12-Lead ECG cable, plug the ECG cable into the ECG port on the HeartStart Intrepid and apply monitoring electrodes to the patient (see "Lead Selection" on page 56).
3. Use the Lead Select button to select the desired waveform 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 "Synchronized Shock with External Paddles" on page 90.

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

Do not use a Philips SureSigns® monitor connected to the HeartStart Intrepid. The devices are not compatible.

Do not use an external monitor as an ECG source.

NOTES: When a patient is already connected to Philips bedside monitoring equipment, the ECG cable must be removed and connected to the HeartStart Intrepid. An external ECG output cable can plugged into the HeartStart Intrepid's ECG port and then connected to the bedside monitor's ECG port. This allows the ECG signal from the HeartStart Intrepid to display onto the bedside monitor.

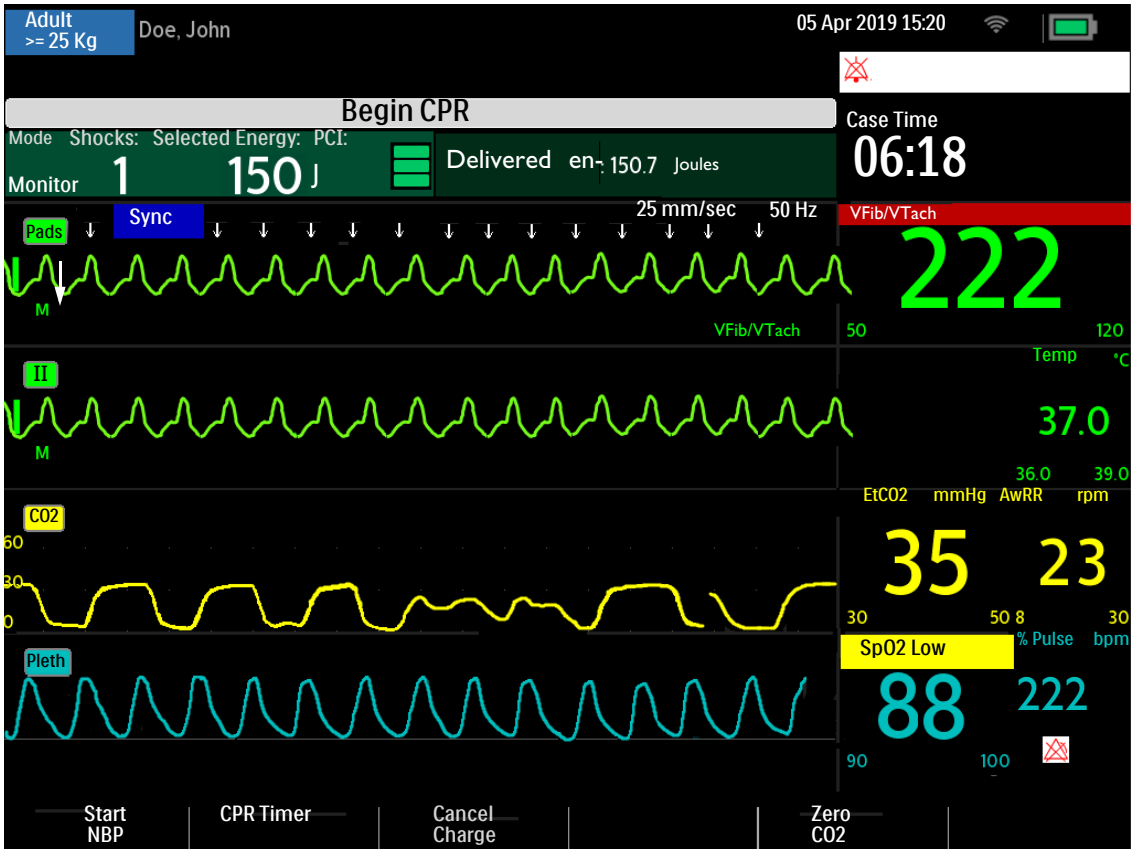
The ECG signal from the bedside monitor should never be routed to the HeartStart Intrepid.

Code View and Cardioversion

When Synchronized Cardioversion is active, Code View adds R-Wave arrows and a Sync notification to the display. The Sync button is also backlit. See Figure 57.

Delivering a Synchronized Shock

Figure 57 **Cardioversion View Layout**



◎ **To perform synchronized cardioversion using pads:**

1. Turn the Therapy Knob to the desired energy setting.
2. Press the **Sync** button (see Figure 1 on page 10).
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.
4. Press the yellow **Charge** button on the HeartStart Intrepid, or if using paddles, the yellow charge button located on the apex paddle.

   Increase or decrease the selected energy at any time during charging or after charging. Move the Therapy knob to the desired energy level. The HeartStart Intrepid charges to the selected energy level automatically. Wait until the charge reaches the selected energy level before proceeding. Do not change the energy level while holding the **Shock** button down.

   To disarm the defibrillator, press the **[Cancel Charge]** soft key. 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 the ECG and then re-confirm the energy dose and waveform.

7 Press and hold the **Shock** button on the HeartStart Intrepid 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.

WARNING: The Shock button must be pressed to deliver a shock. The HeartStart Intrepid 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.

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

If the HeartStart Intrepid does not detect an ECG lead when **Charge** is pressed, a **Check ECG Lead** message is displayed. Fix the lead problem before pressing **Charge** again.

Synchronized Shock with External Paddles

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

Carefully review the waveform immediately prior to administering synchronized cardioversion and confirm there is a non-paddles wave label.

To perform synchronized cardioversion using external paddles:

1 Prepare the patient for synchronized cardioversion as directed in "Preparing for Defibrillation" on page 84.

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

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

a 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 desired waveform.
- Confirm a non-paddles monitoring lead appears in Wave Sector 1. Check for R-Wave arrows.
- Proceed with the normal protocol for synchronized cardioversion.

b 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 4–7 under "Delivering a Synchronized Shock" on page 89.

NOTE: The HeartStart Intrepid's Sync function can be configured to either remain enabled or be disabled after each synchronized shock is delivered. See Table 49 "Configuration – Defib/Sync" on page 171.

Turning Sync Off

To turn the Sync function off, press the **Sync** button again. The button light turns off and Sync indicator is removed from the display.

Manual Defibrillation and Cardioversion Alarms

Defibrillation and cardioversion alarms can be generated for the conditions shown in Table 17. There are both audio and visual alerts when activated by the **Alarms** button. When the patient category is switched, all parameter alarm limits change to the new patient category. These changes are retained when modes are switched.

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

For more information on alarms, see "Alarms" on page 40.

Table 17 **Manual Defibrillation and Cardioversion 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
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

Troubleshooting

If the HeartStart Intrepid does not operate as expected during manual defibrillation or cardioversion, see "Defibrillation and Pacing Problems" on page 236.

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

NOTES

7

Pacing

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

This chapter is divided into the following major sections:

Overview

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

While in Pacing Mode, the ECG strip and Event Summary are easily annotated using the **Mark Event** button. See "Mark Events" on page 47.

The HeartStart Intrepid Pacing Mode can be used on both adult and infant/child patients.

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

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

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

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

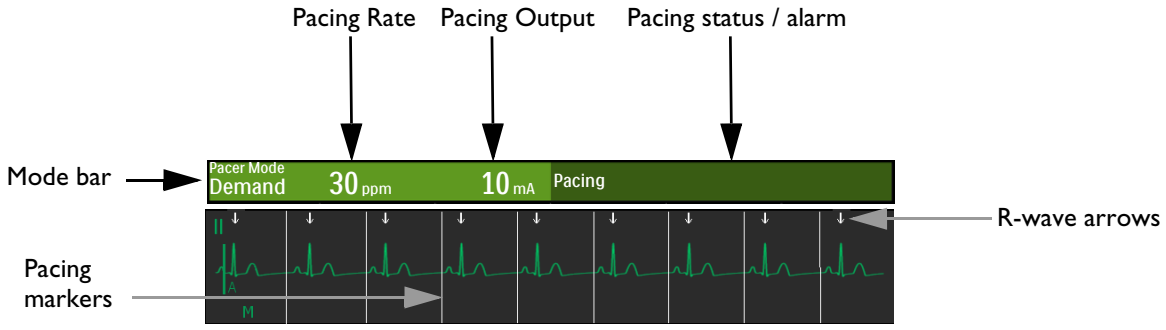
Waveforms, ECG monitoring, measurements and most alarms remain active and retain their settings when transitioning from Monitor or Manual Defibrillation Mode to Pacing Mode.

Pacing View

Pacing View appears when the Therapy knob is turned to the **Pacer** position (see Figure 58). 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/DC 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 99.
- **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 58 **Pacing View Layout**



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

Demand Mode Versus Fixed Mode

The HeartStart Intrepid can deliver paced pulses in either **Demand** Mode or **Fixed** Mode.

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

WARNING: Philips recommends to use Demand Mode pacing whenever possible. Fixed Mode pacing may be used when artifact or other ECG noise makes R-Wave detection unreliable, when monitoring electrodes are not available, or at your clinical discretion.

The HeartStart Intrepid requires a 3-, 5-, or 10-lead ECG cable and monitoring electrodes as the source of the ECG during Demand Mode pacing. Pace pulses are delivered through multifunction electrode pads. However, during Demand Mode pacing, the pads cannot be used to monitor ECG and deliver paced pulses simultaneously.

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

When using the HeartStart Intrepid for pacing in the Operating Room in the presence of cautery tools, use Fixed Mode only.

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

Preparing for Pacing

To prepare for pacing:

1. If not already connected, connect the Therapy cable to the HeartStart Intrepid. See "Attach and lock the collar lid, see "Therapy Cable Collar" on page 22." on page 11.
2. Prepare the patient's skin to achieve good contact. See "Skin Preparation" on page 52.
3. Connect the multifunction electrode pads. See "Connecting Multifunction Electrode Pads" on page 12.
4. If pacing in Demand Mode, apply monitoring electrodes (see "Electrode Placement" on page 54) and connect the ECG cable to the HeartStart Intrepid (see "Connecting the ECG cable" on page 16).

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/DC power with a battery installed for backup so that pacing will not be interrupted in the event of either an AC/DC power failure or the battery losing its charge.

In Pacing Mode, Sync settings are turned off.

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

If **Paddles** is selected for display in Wave Sector 2 and the device enters Pacer Mode, the corresponding Wave Sector waveform automatically switches to Cascade.

If **Paddles/Pads** is selected for display in Wave Sector 3, the device enters Pacer Mode, and CO_2 is available, the corresponding Wave Sector waveform automatically switches to CO_2, otherwise is None.

If **Paddles/Pads** is selected for display in Wave Sector 4, the device enters Pacer Mode, and SpO_2 is available, the corresponding Wave Sector waveform automatically switches to SpO_2, otherwise is None.

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 Cascade.

If monitoring for an extended period of time, monitoring electrodes and multifunction electrode pads may need to be changed periodically. Refer to the electrode 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

Pace pulse duration can be selected in Configuration Mode to either 20 or 40 msec. Confirm organizational clinical needs. If 20 msec is selected, available settings range from 10–200 mA. If 40 msec is selected, available settings range from 10–140 mA. See "Configuration – Pacer" on page 172.

Demand Mode Pacing

To pace in Demand Mode:

1. Turn the Therapy knob to the **Pacer** position.

   The message **Pacing Paused** appears in the Pacing Bar indicating 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.

NOTES: If the configured lead is Pads, then Lead II or the first available monitoring lead is displayed automatically.

While in Demand Mode pacing, if the lead is changed in Wave Sector 1, the HeartStart Intrepid waits a second before notifying you with a Cannot Analyze ECG alarm.

2. Press the Lead Select button  to select the best lead with an easily detectable R-Wave. (See "Lead Selection" on page 56).
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.

NOTE: If anterior-lateral pad placement is used while pacing and it is difficult to get a reading with Lead II, select another lead.

4 Press the **[Pacer Rate]** soft key to adjust the rate value.

5 Turn the Smart Select knob to adjust the rate.

6 Press the Smart Select knob to confirm the desired rate.

7 Press the **[Start Pacing]** soft key. **Pacing** appears in the Pacing Bar.

8 Verify white pacing markers or white R-Wave arrows appear on the ECG waveform.

9 Press the **[Pacer Output]** soft key to adjust the output value.

10 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.

11 Decrease the output to the lowest level that still maintains capture.

12 Assess the patient for a peripheral pulse. (Pulse alarms are automatically turned on.)

To stop pacing:

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

  or

- Move the Therapy knob away from the **Pacer** position.

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

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

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

When pacing in Demand Mode, the ECG cable from the patient must be directly connected to the HeartStart Intrepid.

If 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

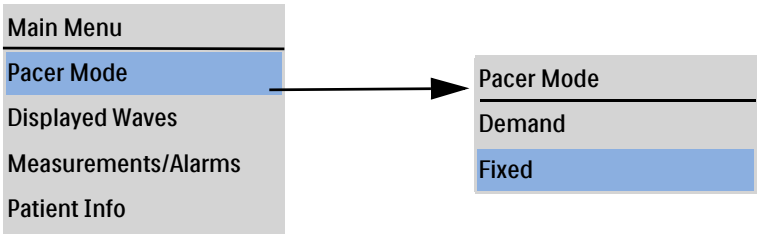
To pace in Fixed Mode:

1 Turn the Therapy knob to the **Pacer** position.

The message **Pacing Paused** appears in the Pacing Bar and indicates 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.
   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. (See Figure 59.)

Figure 59 **Changing Pacing Modes**



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

3 Press the Lead Select button to select the desired lead for viewing, if one is available.
4 Press the **[Pacer Rate]** soft key to adjust the rate value.
5 Turn the Smart Select knob to adjust the rate.
6 Press the Smart Select knob to confirm the desired rate.
7 Press **[Start Pacing]** soft key. **Pacing** appears in the Pacing Bar.
8 Verify white pacing markers or white R-Wave arrows appear on the ECG waveform.
9 Press the **[Pacer Output]** soft key to adjust the output value.
10 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.
11 Decrease the output to the lowest level that still maintains capture.
12 Assess the patient for a peripheral pulse. (Pulse alarms are automatically turned on.)

To stop pacing:

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

  or

- Move the Therapy knob away from the Pacer position.

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

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

If pacing is interrupted for any reason, 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. See "Low Battery Conditions" on page 32.

Defibrillating During Pacing

If there is a need to defibrillate the patient during pacing, refer to the procedure for defibrillation in Manual Defibrillation Mode (see Chapter 6 "Manual Defibrillation and Cardioversion" on page 81) or AED Mode (Chapter 5 "AED Mode Option" on page 67). 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 96 or "Fixed Mode Pacing" on page 97. 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 HeartStart Intrepid.

Pacing Alarms

Pacing messages and alarms can be generated for the conditions shown in Tables 18 and 19. Once generated, they appear as alarm messages in the Pacer Bar. There are both audio and visual alerts. When you switch patient categories, all parameter alarm limits change to the new patient category. These changes are retained when you switch modes.

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

For more information on alarms, see "Alarms" on page 40.

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.

Table 18 **Pacing Messages**

Message	Condition	Indication
Press Start Pacing To Start	Knob is set at **Pacer**, pads are connected to the device and patient, but pacing has not started.	Medium, non-latching
Connect ECG Cable. Attach Leads	No leads or pads detected	
Connect Pads Cable		
Insert Connector, Apply Pads		

Table 19 **Pacing Alarms**

Alarm Message	Condition	Indication
Pacer Output Low	The actual delivered pace pulse current is less than the selected output.	Physiological alarm in the HR area
Pacing on Low Battery	The battery charge level is low.	
Pacing Stopped	Pacer Mode exited or device turned off.	High priority alarm tone even if alarm audio is disabled. If the condition is resolved, the displayed text becomes **Pacing Stopped**. Remains latched until the **[Start Pacing]** soft key is pressed.
Pacing Stopped. Device Error.	An error detected which prevents delivery of pacing therapy.	
Pacing Stopped. Leads Off.	Primary ECG lead has become invalid in Demand Mode pacing.	
Pacing Stopped. Pads Cable Off.	Therapy cable is disconnected from the device.	
Pacing Stopped. Pads Off.	Pads Off condition has been detected during pacing.	
Pacing Stopped. Power Interrupted.	Power failure during pacing.	

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 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 HeartStart Intrepid does not operate as expected during pacing, see "Defibrillation and Pacing Problems" on page 236.

8

Monitoring SpO_2

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

This chapter is divided into the following major sections:

Overview

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

SpO_2 can be monitored in all HeartStart Intrepid clinical modes and on both adult and infant/child patients. Use the Patient Category button to switch categories.

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

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

  The neonatal patient category is not supported.

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

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

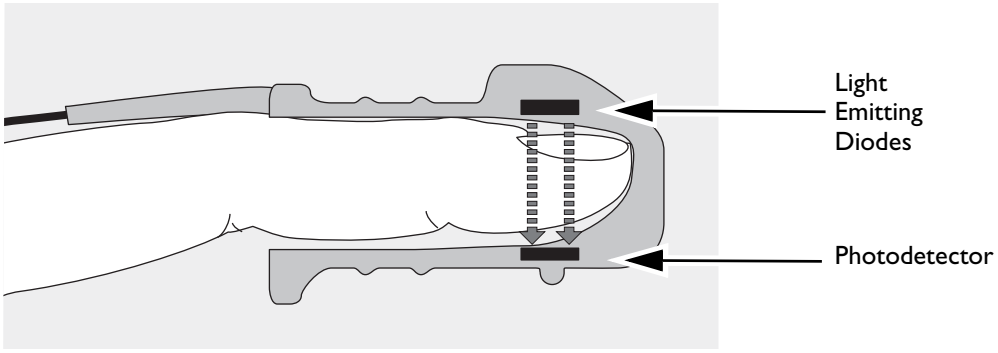
Do not rely solely on SpO_2 readings; assess the patient at all times. Inaccurate measurements may be caused by:

- Incorrect sensor application or use
- Significant levels of intravascular dyshemoglobins such as carboxyhemoglobin or methemoglobin in patient and other disorders of hemoglobin
- Restricted blood flow to the extremities (such as patients that have poor circulation or are in severe shock or hypothermia)
- Constrictor medications
- Photosensitive drugs or acidosis
- Injected dyes such as methylene blue
- Exposure to excessive illumination such as surgical lamps (especially those with a xenon light source), bilirubin lamps, fluorescent lights, infrared heating lamps or direct sunlight.

Understanding Pulse Oximetry

A pulse oximetry sensor sends light through patient tissue to a receiver on the other side of the sensor. Light-emitting diodes transmit red and infrared light through the peripheral areas of the body such as a finger. See Figure 60.

Figure 60 **Pulse Oximetry Sensor**



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

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

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

Selecting a Sensor

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

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

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

See "Monitoring Supplies and Accessories" on page 225 for a list of SpO_2 sensors and accessories that can be used with the HeartStart Intrepid.

CAUTIONS: Do not use more than one extension cable.

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

Applying the Sensor

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

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

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

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

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

Monitoring SpO_2

To monitor SpO_2:

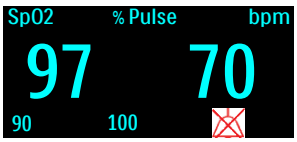
1. Connect the appropriate sensor cable to the HeartStart Intrepid (see "Connecting the SpO_2 Cable" on page 15).
2. Apply the sensor to the patient.
3. If the HeartStart Intrepid is not turned on, turn the Therapy knob to a clinical mode.
   - SpO_2 needs to be configured to appear in AED Mode and does not display unless it is pulsatile.
4. Check that the patient category is appropriate for the patient. If necessary, change the Patient Category to select the appropriate category. See "General Function Buttons" on page 29.

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

Pulse Rate: The patient's pulse rate, as derived from pulse oximetry, is displayed in the Parameter Area. See Figure 61.

Figure 61 **SpO_2 Value**

Alarm Limits: If SpO_2 or pulse rate alarms are turned on, the alarm limits are displayed. If alarm limits are turned off, the Alarms Off symbol is displayed.

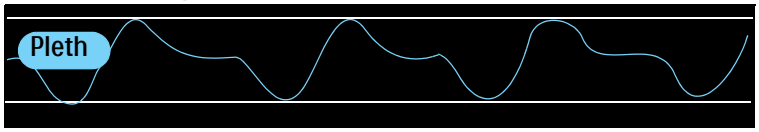


Pleth Wave

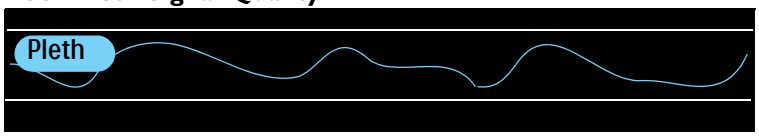
When the sensor is connected to the HeartStart Intrepid, the pleth wave is displayed in Wave Sector 4. Grid lines are displayed to indicate signal quality. When the signal quality is good, the pleth wave is auto-scaled to the grid lines. When the signal is poor, the size of the wave is proportionally decreased and appears not to reach the grid lines. The pleth wave in Figure 62 has not been normalized; it shows good and poor quality.

Figure 62 **Pleth Waves**

Good Pleth Signal Quality



Poor Pleth Signal Quality



SpO_2 and Pulse Rate Alarms

SpO_2 alarm settings are controlled by configuration, the factory default is On. See Table 45 "Configuration – SpO2" on page 169. Pulse Rate alarms can be turned on or off in all clinical modes when SpO_2 is available.

Alarms activate if measurements fall outside the configured limits for high or low SpO_2, or if the measurement falls below the configured SpO_2 Desat Limit. SpO_2 alarms, except Desat, are non-latching alarms, meaning they are automatically removed when their alarm condition no longer exists. Desat alarms are latching, meaning they remain present even if the alarm condition no longer exists.

SpO_2 alarms can be generated for the conditions shown in Tables 20 and 21. Once generated, they appear as alarm messages in the SpO_2 alarm status area above the SpO_2 numeric. There are both audio and visual alarms. For more information on alarms, see "Alarms" on page 40.

NOTE: Alarm notification is configurable. See "Alarm Management and Configuration" on page 43.

Table 20 **SpO_2 and Pulse Rate Physiological Alarms**

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

Table 21 **SpO_2 Technical Alarms**

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

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

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

SpO_2 Desat Alarm

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

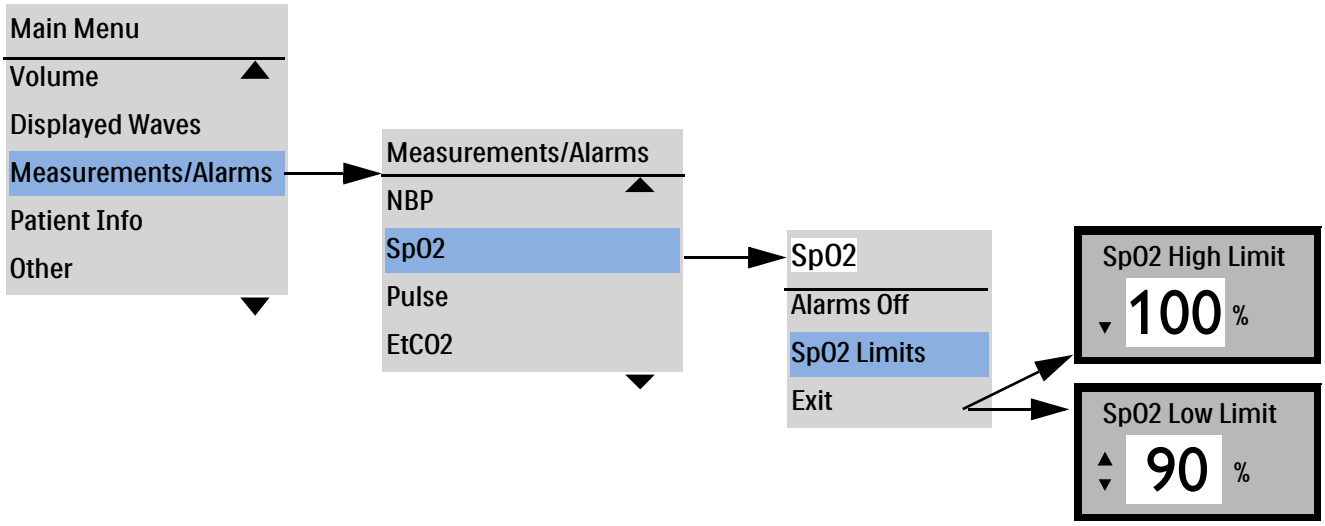
NOTE: If the SpO_2 **Low Limit** alarm value is set below the configured SpO_2 **Desat Limit**, the Desat Limit is automatically adjusted to the SpO_2 **Low Limit** value. Should the SpO_2 reading fall below this value, the **Desat** physiological alarm is announced.

Changing SpO_2 and Pulse Alarm Limits

To change the SpO_2 or 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 **SpO2** or **Pulse** and press the Smart Select knob.
4. Select **SpO2 Limits** or **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, see Figure 63.

Figure 63 **Adjusting SpO_2 Alarms**



Enabling/Disabling SpO_2 and Pulse Alarms

To enable/disable SpO_2 or 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 **SpO2** and press the Smart Select knob.
4. Select **Alarms On (Alarms Off)** and press the Smart Select knob.

WARNING: Turning alarms off prevents all alarms associated with the SpO_2 measurement from being annunciated. If an alarm condition occurs, no alarm indication is announced.

Disabling SpO_2 Monitoring

To disable SpO_2 monitoring:

1. Disconnect the sensor cable from the SpO_2 port. The message **SpO2 Unplugged - Turn Off SpO2?** appears.

2 Select **Yes** and press the Smart Select knob.

NOTE: If the sensor cable is disconnected accidentally, select **No** and press the Smart Select knob. Secure the sensor connection to begin SpO_2 monitoring again.

Caring for Sensors

Refer to the manufacturer's instructions for care and cleaning of sensors. To get the best results from 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 the HeartStart Intrepid does not operate as expected during SpO_2 Monitoring, see Table 105 "SpO_2 Problems" on page 238.

9

Monitoring Noninvasive Blood Pressure and Temperature

This chapter explains how to monitor noninvasive blood pressure (NBP) and temperature using the HeartStart Intrepid.

This chapter is divided into the following major sections:

Overview

The HeartStart Intrepid 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 of changes in the patient's condition.

The HeartStart Intrepid offers one channel of real-time continuous temperature monitoring. The device can monitor nasopharyngeal, esophageal, rectal, skin, and urinary bladder temperatures. Measurements, which can be displayed in either Fahrenheit or Celsius degrees, may be taken while in Monitor, Pacer or Manual Defibrillation modes.

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 HeartStart Intrepid uses a mechanical manometer to measure at which pressure blood flow is starting, and at which pressure it is unimpeded.

NBP measurements can be taken in Monitor, Manual Defibrillation, and Pacing modes. NBP and temperature are not available in AED Mode. NBP measurements can be taken automatically on a pre-set schedule or manually on demand.

Use the Patient Category  button to switch between patient categories.

When pressing the Patient Category button, all parameter alarm limits and initial inflation pressures change to the new patient category. These changes are retained when modes are switched.

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

  NBP may be used on pregnant and pre-eclampsia patients.

NOTES: Infant/Child Mode limits:

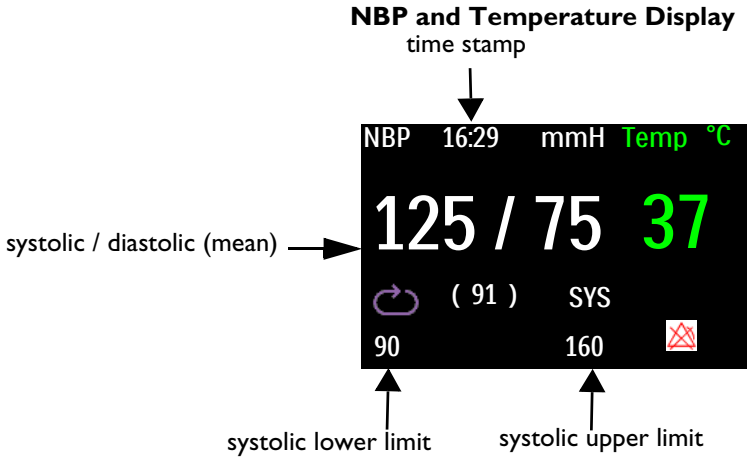
The approximate age range for a newborn (neonate) is from birth to 1 month.

The approximate age range for an infant is from 1 month to two years. For the purpose of this standard, up to three years of age are considered infants (see ISO 81060-2, 6.1.3).

The maximum pressure is 150 mmHg and uses a different algorithm than the Adult mode.

While an NBP measurement is in progress, the current cuff pressure is displayed in the Parameter area. Once the measurement is complete, the values for systolic, diastolic, and mean pressure are displayed along with the measurement schedule (manual or automatic intervals) and a time stamp (see Figure 64.)

Figure 64 **NBP and Temperature Values Display**



WARNING: Do not perform NBP monitoring on patients whose upper arm circumference is less than 13cm. Doing so may result in inaccurate measurements.

Monitoring NBP

The first time an NBP measurement is taken, the cuff's initial inflation pressure is 165 mmHg (22 kPa) for adults and 130 mmHg (17.3 kPa) for infant/child. The device aborts a measurement, deflates the cuff and generates an alarm before the inflation pressure exceeds 300 mmHg (40.0 kPa) for adults and 150mmHg (20.0 kPa) for children.

NOTES: For pediatric and adult patient populations, blood pressure measurements made with the HeartStart Intrepid NBP Module are equivalent to those obtained by trained observers using the cuff/stethoscope auscultatory method within limits prescribed by ANSI/AAMI SP10: 1992 & 2002/YY 0670-2008 (mean error difference of ±5 mmHg or less, standard deviation of 8 mmHg or less).

When the Patient category selected is Infant/Child, the NBP overpressure limit is set to 150 mmHg. If the patient's systolic blood pressure is above 150 mmHg, the device will not be able to get a reading and displays an error message. If this occurs, the patient's blood pressure should be taken manually. When the error message **NBP Cuff Overpressure** is displayed, the patient's blood pressure should be taken manually.

To measure NBP:

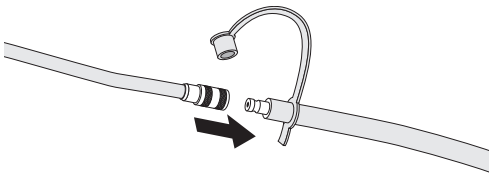
1 Select the appropriately sized cuff for the patient. The cuff width should be either 40% of the limb circumference or 2/3 of the upper arm length. The inflatable part of the cuff should be long enough to encircle 50-80% of the limb.

NOTES: Selecting the right cuff size for the patient is important. The wrong cuff size may give false and misleading results.

Pressurization of the cuff can temporarily cause loss of function of simultaneously used monitoring medical equipment on the same limb.

2 Attach the cuff to the NBP tubing, making sure that air can pass through the tubing and the tubing is not squeezed or kinked. See Figure 65.

Figure 65 **Connecting the NBP Cuff/Tubing**



NOTE: Securely attach the cuff and tubing to prevent accidental disconnections.

3 Insert the NBP tubing into the NBP port as described in "Connecting the NBP Cable" on page 15.

4 Apply the blood pressure cuff to the patient's arm as follows:

a Ensure that the cuff is completely deflated.

b Wrap the cuff around the arm, making sure that the artery marker is aligned over the brachial artery. Ensure that:

- The cuff is not placed on the same extremity as an SpO_2 sensor.
- The cuff is not wrapped too tightly around the limb. Excessive tightness may cause discoloration and eventual ischemia of the extremities.
- The NBP tubing from the defibrillator to the cuff is not compressed, crimped or damaged.
- The edge of the cuff falls within the range identified by the <——> markings.

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.

7 When the measurement is complete, the NBP values are displayed.

To stop an NBP measurement in progress, press the **[Stop NBP]** soft key.

WARNINGS: Do not perform noninvasive blood pressure measurements on patients with sickle-cell disease or any condition where skin damage has occurred or is expected.

Do not use in a hyperbaric chamber.

Care should be taken when using an oscillometric NBP device on patients with decreased consciousness, neuropathy, irregular cardiac rhythm, labile high blood pressure, increased arm activity, or arterial insufficiency especially if the unit is utilized for a prolonged period. A safeguard of the NBP system is that the device incorporates a **Stop NBP** 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 anyone if 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 cause tissue damage around the catheter when the infusion is slowed or blocked during cuff inflation.

Use only approved cuffs and tubing in order to prevent inaccurate data, injury or damage. All specified cuffs are protected against the effects of the discharge of a defibrillator.

Prolonged series of NBP measurements in automatic mode may be associated with purpura, ischemia and neuropathy in the limb wearing the cuff. When monitoring a patient, examine the extremities of the limb frequently for normal color, warmth and sensitivity. If any abnormality is observed, stop the blood pressure measurements immediately.

Blood pressure readings may be affected by the position of the patient, their physiologic condition, the presence of arrhythmia and other factors.

Kinked or otherwise restricted tubing can lead to a continuous cuff pressure, causing blood flow interference and potentially resulting in injury to the patient.

Do not apply the cuff over a wound as this can cause further injury.

Avoid applying the cuff on the same side as a mastectomy as the pressure increases the risk of lymphedema. For patients with a bilateral mastectomy, use clinical judgment to decide whether the benefit of the measurement outweighs the risk.

To obtain accurate blood pressure readings, the cuff must be the correct size and also be correctly fitted to the patient. Incorrect size or incorrect fitting may result in incorrect readings.

CAUTIONS: Do not compress or restrict pressure tubes during an NBP measurement.

If liquid appears inside the tubing, contact a service personnel.

NOTE: When utilizing NBP, use clinical judgment on appropriate application for patient's clinical status.

NBP Frequency

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 – One measurement is taken each time the **[Start NBP]** soft key is pressed. Take additional measurements by pressing the **[Start NBP]** soft key again.

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

NOTE: All criteria must be met in order for an automatic NBP to be taken. For example, if the automatic measurement is set to every 1 minute, the device attempts to take an NBP every 60 seconds. However, for the measurement to successfully begin, the previous measurement must have ended, cuff must be deflated and 30 seconds must have elapsed after cuff deflation. If these criteria are not met, the device waits the 60 seconds to attempt another measurement.

Additional manual measurements can be taken without affecting the automatic measurement schedule by pressing the **[Start NBP]** soft key.

The configured NBP measurements schedule may be changed during an event.

To change the NBP schedule and/or the interval of automatic measurements for the current patient:

1. Press the Smart Select knob.
2. Turn the Smart Select knob to highlight **Measurements/Alarms** and press the Smart Select knob.
3. Select **NBP** and press the Smart Select knob.
4. Select **NBP Frequency** and press the Smart Select knob.
5. Select the desired interval and press the Smart Select knob.

NOTES: Interval choices are indicated with qXX, where XX represents the time in minutes from the time the **[Start NBP]** soft key is pressed.

When cuff measurements are set to be taken at an automatic interval, there is a forced 30-second minimum period in between measurements, even if a measurement is due to be taken. The HeartStart Intrepid display shows the last NBP (if obtained in the last 60 minutes), time obtained and frequency.

If no subsequent measurements are taken, NBP values are removed from the display after 60 minutes but can still be obtained through Vital Signs Trending and the Event Summary.

NBP Alarms

NBP alarms can be generated for the conditions shown in Table 22 “NBP Physiological Alarms” and Table 23 “NBP Technical Alarms”. Once generated, they appear as alarm messages in the Message Area of the screen.

There are audio and visual alerts a when a measurement for the configured source (systolic or diastolic mean) falls outside the configured high or low limits. NBP alarms are non-latching, meaning they are automatically removed when their alarm condition no longer exists. Both the source of the alarm and the limits may be changed during an ongoing patient event. For more information on alarms, see “Alarms” on page 40.

Alarms are on unless turned off during use. Once turned off, alarms remain off until they are turned back on.

WARNING: Turning alarms off prevents all alarms from being annunciated. If an alarm condition occurs, no alarm indication is announced.

NOTE: Alarm notification is configurable. See "Alarm Management and Configuration" on page 43. If alarms are enabled, alarm limits appear next to the value. If alarms are off, the Alarms Off symbol replaces the limits.

Table 22 **NBP Physiological Alarms**

Alarm Message	Condition	Type of Alarm	Indicator
NBPs High NBPs Low	The NBP systolic value exceeds the high alarm limit or falls below the low alarm limit.	Medium priority latching configurable alarm	Yellow alarm message with audio tone
NBPd High NBPd Low	The NBP diastolic value exceeds the high alarm limit or falls below the low alarm limit.		
NBPm High NBPm Low	The NBP mean value exceeds the high alarm limit or falls below the low alarm limit.		

Table 23 **NBP Technical Alarms**

Alarm Message	Condition	Type of Alarm	Indicator
NBP Cuff Overpressure	The cuff pressure exceeds 300 mmHg (40 kPa).	Low priority non-latching alarm	Cyan alarm message with audio tone
NBP Cuff Not Deflated	The cuff fails to deflate.		
NBP Measurement Failed	The device is unable to complete a measurement.		
NBP Calibration Overdue	NBP module calibration is due.		
NBP Equipment Malfunction	A problem with the NBP module has been detected.		
NBP Error	A non-critical failure has been detected.		

Changing NBP Alarm and Source Limits

To change the NBP alarm source and/or limits:

1. Press the Smart Select knob.
2. Turn the Smart Select knob to highlight **Measurements/Alarms** and press the Smart Select knob.
3. Select **NBP** and press the Smart Select knob.
4. Select **NBP Limits** and press the Smart Select knob.
5. Select the desired source for the alarm **(Systolic**, **Diastolic,** or **Mean)** and press the Smart Select knob.
6. Turn the Smart Select knob to select the new high limit value then press the Smart Select knob.
7. Select the new low limit and press the Smart Select knob.

Enabling/Disabling NBP Alarms

To enable/disable NBP alarms:

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

NOTE: NBP alarms are on unless specifically turned off or alarms for the entire device are off. Once disabled, alarms remain off until they are turned back on. The HeartStart Intrepid allows for adjusting alarm notifications.

NBP Calibration

NBP should be calibrated yearly. To calibrate the NBP module, call for service or refer to the HeartStart Intrepid *Service Manual*.

Monitoring Temperature

To monitor temperature:

1. Connect the temperature cable to the HeartStart Intrepid.
2. Check that the current device settings (including alarm settings) are appropriate for the patient.
3. Connect the temperature probe to the cable.
4. Apply the temperature probe to the patient.

Temperature Alarms

Alarms are annunciated when a measurement for the configured source falls outside the configured high or low limits. Temperature alarms are non-latching alarms, meaning they are automatically removed when their alarm condition no longer exists. Both the source of the alarm and the limits may be changed during an ongoing patient event. There are both audio and visual alerts. For more information on alarms, see "Alarms" on page 40.

Alarms are on unless turned off during use. Once turned off, alarms remain off until they are turned back on.

WARNING: Turning alarms off prevents all alarms from being annunciated. If an alarm condition occurs, no alarm indication is announced.

NOTE: Alarm notification is configurable. See "Alarm Management and Configuration" on page 43. If alarms are enabled, alarm limits appear next to the value. If alarms are off, the Alarms Off symbol replaces the limits.

Table 24 **Temperature Alarms**

Alarm Message	Condition	Type of Alarm	Indicator
Temp High	The temperature value exceeds the high alarm limit.	Medium priority latching configurable alarm	Yellow alarm message with audio tone
Temp Low	The temperature value has fallen below the low alarm limit.		
Temp out of range	Temperature out of range	Low priority	Cyan alarm message with audio tone
Temp Equipment Malfunction	Temperature Monitoring Malfunction	Low priority	
Temp Calibration Failed	Temperature Calibration Failure	Low priority	
Temp Unplugged	Temperature probe has become disconnected.	Low priority	
Temp Error	Temperature Source Malfunction	Low priority	

Changing Temperature Alarm Limits

To change the temperature alarm limits for the current incident:

1. Press the Smart Select knob.
2. Turn the Smart Select knob to highlight Measurements/Alarms and press the Smart Select knob.
3. Select Temp and press the Smart Select knob.
4. Select Temp Limits and press the Smart Select knob.
5. Turn the Smart Select knob to change the high limit and press the Smart Select knob.
6. Turn the Smart Select knob to change the low limit and press the Smart Select knob.

Enabling/Disabling Temperature Alarms

To disable temperature alarms (the alarms are on by default):

1. Press the Smart Select knob.
2. Turn the Smart Select knob to highlight Measurements/Alarms and press the Smart Select knob.
3. Select Temp.
4. Select Alarms On or Alarms Off and press the Smart Select knob.

Changing Units of Measurement

The HeartStart Intrepid can display temperature in either Fahrenheit or Celsius. The default is Celsius and can only be changed through Configuration Mode. See Chapter 14 “Configuration” on page 161 for more information.

Disabling the Temperature Function

To turn off the Temperature function, disconnect the temperature cable from the HeartStart Intrepid port. The message **Temp unplugged-Turn off Temp?** appears. Select **Yes** and press the Smart Select knob.

If the temperature cable get disconnected accidentally, or if the probe and cable separate, the message **Temp unplugged-Turn off Temp?** appears. To continue monitoring temperature, select **No** and press the Smart Select knob. Reconnect the temperature cable to restart the temperature monitoring function.

Caring for NBP Cuffs and Temperature Cables

Refer to the manufacturer’s instructions for care and cleaning of the NBP cuffs temperature accessories and on disposal of temperature probes. To get the best results from your cuffs, handle them with care and protect them from sharp objects. Inappropriate treatment of the cuffs will reduce their lifetime.

Troubleshooting

If the HeartStart Intrepid does not operate as expected during NBP or temperature monitoring, see Table 107 “NBP Problems” on page 241 and Table 108 “Temperature Monitoring Problems” on page 242.

NOTES

10

12-Lead ECG

This chapter describes how to use the diagnostic 12-Lead ECG function of the HeartStart Intrepid. This chapter is divided into the following major sections:

Overview

The optional 12-Lead ECG function for both adult and infant/child patients, using Philips' DXL 12-Lead algorithm, is available in Monitor Mode to preview, acquire, print, copy, and store a 12-Lead ECG. In addition, the 12-Lead function provides computerized ECG analysis using one of two configuration options of the DXL Algorithm. A report with measurements and interpretive statements from the analysis is displayed, stored and printed, as configured. Certain interpretive results generate Critical Value statements which alerts for an interpretation, which may mean the patient needs immediate attention.

WARNING: Computerized ECG interpretation is not intended to be a substitute for interpretation by a qualified physician.

NOTE: Refer to the *Philips DXL ECG Algorithm* application note for more information on the algorithm's functionality. The DXL Algorithm is capable of interpreting up to 16 leads, however the HeartStart Intrepid uses the 12-Lead functionality only.

The Philips DXL 12-Lead Algorithm provides an analysis of the amplitudes, durations, and morphologies of the ECG waveforms and the associated rhythm. Patient age and gender are used to define normal limits for heart rate, axis deviation, time intervals, and voltage values, for interpretation accuracy in tachycardia, bradycardia, prolongation or shortening of PR and QT intervals, hypertrophy, early repolarization, myocardial infarction and culprit artery detection. DXL Algorithm adult criteria apply if the patient age is 16 years old or older. Pediatric criteria apply if the patient age is less than 16. The DXL Algorithm also identifies internally paced patients automatically. The patient's age and gender are necessary for the algorithm to make accurate determinations; other patient information (name, ID, paced status) is optional.

WARNING: The 12-Lead patient's age is different from the age defined by the Patient Category button. The patient's age is discussed below in the "Acquiring a 12-Lead ECG" section.

Preparation

Proper skin preparation and electrode placement are the most important elements in producing a high quality 12-Lead ECG. See *Improving ECG Quality* Application Note. The patient should be supine and relaxed when an ECG is acquired.

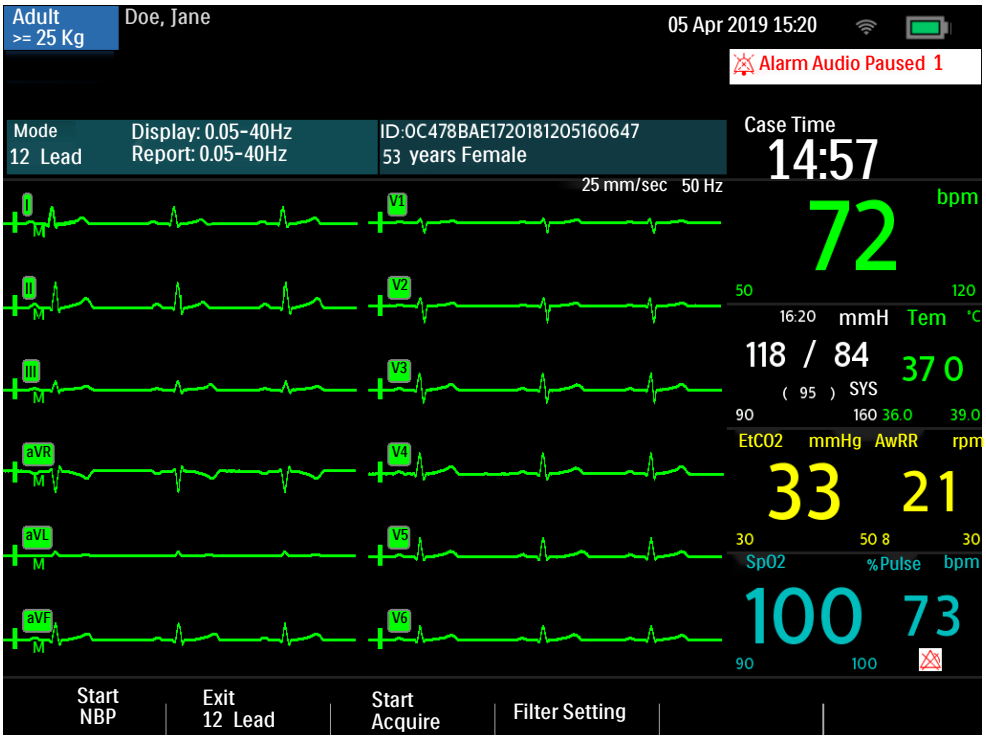
To prepare for acquiring the ECG:

1. Connect the 10-Lead cable to the device, as described in "Connecting the ECG cable" on page 15.
2. Prepare the skin and apply electrodes, as described in "Electrode Placement" on page 54.
3. Turn the Therapy knob to Monitor.
4. Press the **[12-Lead]** soft key.

Preview Screen

The 12-Lead function's Preview Screen displays real-time 12-Lead ECG data and verify signal quality before acquiring the ECG. As shown in Figure 66, it displays patient information and approximately 2.5 seconds of each of the 12 leads acquired. Waveforms are presented at a rate of 25 mm/sec and the configured wave size. A dashed line is displayed if a lead cannot be derived. The **Leads Off** message is displayed if an electrode is not making adequate contact with the patient.

Figure 66 **12-Lead ECG Preview Screen** </>



The Preview Screen's patient information includes ID, age, and sex if entered. The Event ID is displayed until the patient's ID is entered. Age and sex are displayed once entered (see "Entering Patient Information" on page 45).

The 12-Lead ECG Preview presents information as shown in Table 25. Press the **Lead Select** button to navigate through the preview sets.

Table 25 **12-Lead ECG Preview Sets** </>

Wave Set	Waves displayed in sector	
	1	2
1	I	V1
2	II	V2
3	III	V3
4	aVR	V4
5	aVL	V5
6	aVF	V6

Although waveforms for monitored parameters such as ECG, SpO_2, and CO_2 are not visible on the Preview Screen, related alarms, measurements, and Technical Alarms remain active and are reported in the Parameter and Status areas.

Acquiring a 12-Lead ECG

Once preparation is complete, to acquire a 12-Lead ECG in Monitor Mode:

1. Press the **[12-Lead]** soft key.
2. The Preview Screen is displayed, as shown in Figure 66 on page 120.
3. Check the signal quality on each lead and, if necessary, make adjustments as described in "Improving Signal Quality" on page 126.
4. Check filter settings.
5. Press the **[Start Acquire]** soft key. If patient age and sex were not previously entered, prompts appear to enter the information.
6. Use the Smart Select knob to select and adjust the patient's sex and age. The message **Acquiring 12-Lead** is then displayed while the HeartStart Intrepid acquires ten seconds of ECG data.
7. Keep the patient still while the message **Acquiring 12-Lead** is displayed.

Once ECG acquisition is complete, ECG analysis begins automatically and is accompanied by the message **Analyzing 12-Lead**. The patient does not need to be still during this time.

Following analysis, the 12-Lead Report is displayed, printed, and stored internally.

To acquire another 12-Lead ECG, press **[New 12-Lead]**. To exit the 12-Lead function, press **[Exit 12-Lead]**.

WARNING: An incorrect patient age and gender can result in erroneous diagnosis.

NOTES: A minimum of one chest lead and all limb leads are required to get a partial interpretation from the 12-Lead algorithm. All six chest leads are required to get a full interpretation. Also, wet gel electrodes take less time to settle than hydrogel electrodes, thereby varying the amount of time to wait before acquiring a 12-Lead ECG. Pressing the **[Start Acquire]** soft key too soon may result in a dashed line. If age and sex were not entered, the HeartStart Intrepid does not provide an interpretation.

The Lead Select button is disabled when the 12-Lead function is active. The HeartStart Intrepid does not provide an interpretation unless age and gender are entered.

12-Lead Report

The 12-Lead Report View is in a format similar to Monitor View, so that it is possible to monitor the patient while viewing the report. In this view, the 12-Lead Report replaces Monitoring View's Wave Sectors 3 and 4, as shown in Figure 67, and includes the following information, if configured:

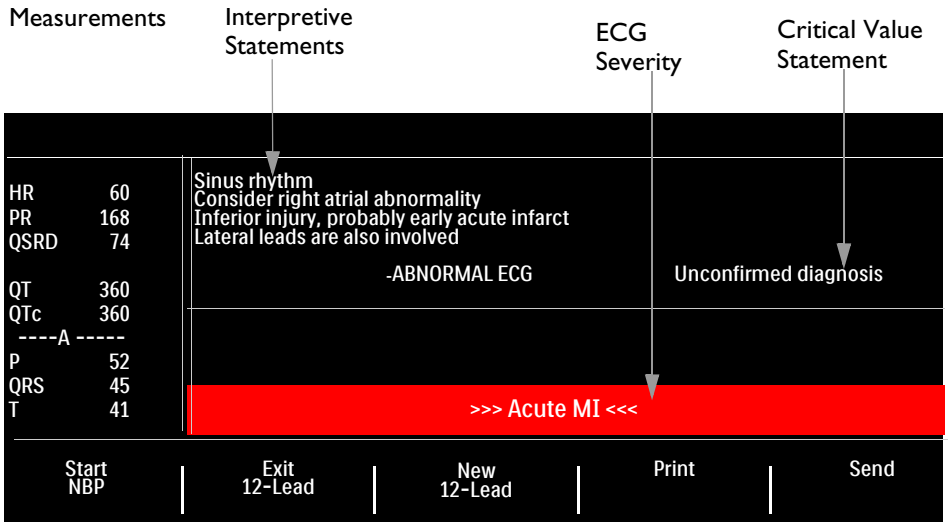
Measurements: The measurements component of the algorithm generates standard interval and duration measurements, in milliseconds, limb lead axis measurements, in degrees, and heart rate, in beats per minute.

Interpretive statements: Measurements and patient information are used by the Philips DXL 12-Lead Algorithm to generate statements describing the patient's cardiac rhythm and waveform morphology. There is also culprit artery detection which locates the probable anatomical site of a coronary artery occlusion responsible for ischemia. Statements regarding signal quality problems encountered during ECG acquisition are also included in this section.

Critical Values Statements: The HeartStart Intrepid displays Critical Value statements to aid in quickly identifying an interpretation that may mean the patient needs immediate attention. Statements identify any of four life-threatening conditions: acute myocardial infarction, acute ischemia, complete heart block and extreme tachycardia. The values appear as white text on a red background.

ECG severity: Each interpretive statement on the report has an associated severity. The severities of all selected interpretive statements are assessed to determine an overall severity for the ECG. The categories of severity are: Normal ECG, Otherwise Normal ECG, Borderline Normal ECG, Abnormal ECG and Defective ECG.

Figure 67 **Displayed 12-Lead Report**



NOTES: Full interpretive statements appear on the printed strip but may be shortened on the display.

Should an alarm condition occur while a 12-Lead Report is printing, the alarm strip is not printed, however, the corresponding ECG waveform is stored and available in the Event Summary.

A 12-Lead report must finish printing before acquiring a new 12-Lead. To see the report before it finishes printing, cancel the printing before acquiring the new 12-Lead.

Stored and printed 12-Lead Reports can be configured to include all 12 leads, measurements, and interpretive analysis statements.

The printed 12-Lead Report header contains DXL Algorithm's Acute MI detection configuration setting (**Standard** or **EMS**). One or two copies of the 12-Lead Report are printed at the completion of acquisition and/or analysis, as configured. Press the **[Print]** soft key to print another copy. In addition to the information on the displayed 12-Lead Report, the printed report includes a rhythm strip with up to three ECG leads.

WARNING: Do not pull on the paper while a report is being printed. This can cause distortion of the waveform and lead to potential mis-diagnosis.

Critical Values

Certain interpretive results generate Critical Value statements which alert you to a condition which may need immediate attention. The Critical Value statements appear on the bottom of the HeartStart Intrepid 12-Lead display in white text on a red background with directional arrows (>>> <<<) on each side of the statement text.

Acute Myocardial Infarct

If the interpretive statement listed in Table 26 result from measurements generated by an ECG, the Critical Value statement **Acute MI** appears on the 12-Lead Report.

Table 26 **Acute MI Statements**

Interpretive Statement	Criteria
Probable anterolateral infarct, acute	ST >0.15 mV, V2-V6, aVL
Anterolateral infarct, possibly acute	Q >35 mS, ST >0.15 mV, V2-V6, I, aVL
Anterolateral infarct, acute	ST >0.20 mV, V2-V6, I, aVL
Anterolateral infarct, acute (LAD)	ST >0.20 mV, V2-V6, I, aVL
Probable anteroseptal infarct, acute	ST>0.15 mV, T UPRIGHT, V1-V2
Anteroseptal infarct, possibly acute	Q>35 mS, ST>0.15mV, V1-V2
Anteroseptal infarct, acute	ST >0.20 mV, V1-V2
Anteroseptal infarct, acute (LAD)	ST >0.25 mV, V1-V2
Probable anterior infarct, acute	ST >0.15 mV, UPRIGHT T, V2-V5
Anterior infarct, acute	ST >0.25 mV, V2-V5
Anterior infarct, acute (LAD)	ST >0.25 mV, V2-V5
Anterior infarct, possibly acute	ST >0.15 mV, UPRIGHT T, V2-V5
Extensive anterior infarct, acute	ST >0.20 mV, V1-V6

Table 26 **Acute MI Statements *(Continued)***

Interpretive Statement	Criteria
Extensive anterior infarct, acute (LAD)	ST >0.20 mV, V1-V6
Extensive anterior infarct, possibly acute	Q>35 mS, ST >0.15 mV, V1-V6
Probable inferior infarct, acute	ST>0.10 mV, II III aVF
Inferior infarct, possibly acute	Q >30 mS, ST >0.10 mV, II III aVF
Inferior infarct, acute	ST >0.10 mV T UPRIGHT, II III aVF
Inferior infarct, acute (RCA)	ST >0.10 mV IN III > II
Inferior infarct, acute (LCX)	ST >0.10 mV II III aVF, STD V1-V3
Inferoposterior infarct, acute	ST >.1 INF, <-.1 V1-3 OR >.05 V7-9
Inferoposterior infarct, acute (RCA)	ST >.1 INF, <-.1 ANT
Inferoposterior infarct, acute (LCX)	ST >.1 INF, <-.1 V1-3 OR >.05 V7-9
Inferolateral infarct, acute	ST >.10 mV, INF-LAT LEADS
Inferolateral infarct, acute (LCX)	ST >.10 mV, INF-LAT LEADS
Inferolateral infarct, acute (RCA)	ST >.10 mV, INF-LAT LEADS
Probable lateral infarct, acute	Q >28 mS, ST>0.10 mV, V5 V6 I aVL
Lateral infarct, possibly acute	Q >28 mS, ST > 0.10 mV, V5 V6 I aVL
Lateral infarct, acute	ST >.10 mV, V5 V6 I aVL
Lateral infarct, acute (LAD)	ST >.10 mV, V5 V6 I aVL
Posterior infarct, acute	ST<-.01 V1-V3 or ST>.05 V7-V9
Probable posterior infarct, acute	ST<-.05 V1-V3 or >.05 V7-V9
Posterior infarct, acute (LCX)	ST<-.01 V1-V3 or ST>.05 V7-V9

Acute Ischemia

If the interpretive statement listed in Table 27 result from measurements generated by an ECG, the Critical Value statement **Acute Ischemia** appears on the 12-Lead Report.

Table 27 **Acute Ischemia Statements**

Interpretive Statement	Criteria
Repol abnrm, severe global ischemia (LM/MVD)	STe aVR, STd & Tneg, ant/lat/inf

Extreme Tachycardia

If the interpretive statements listed in Table 28 result from measurements generated by an ECG, the Critical Value statement **Very High Heart Rate** appears on the 12-Lead Report.

Table 28 **Extreme Tachycardia Statements**

Interpretive Statements
Extreme tachycardia v-rate > (220-age)
Wide-QRS tachycardia vs-rate > ***, QRSD > ***
Extreme tachycardia with wide complex, no further rhythm analysis attempted

Complete Heart Block

If the interpretive statements listed in Table 29 result from measurements generated by an ECG, the Critical Value statement **Complete Heart Block** appears on the 12-Lead Report.

Table 29 **Complete Heart Block Statements**

Interpretive Statements
AV block, complete (third degree) v-rate < ***, AV dissociation
Complete AV block with wide QRS complex v-rate < ***, QRSD >***, AV dissoc
Atrial flutter/fibrillation with complete AV block

Accessing Stored Reports

Access stored reports to print additional copies from internal storage. It is also possible to copy the report to a USB drive or transmit wirelessly. The list of stored reports for the current patient event may be accessed while a report is displayed or from either the 12-Lead Acquire screen or the 12-Lead Preview screen.

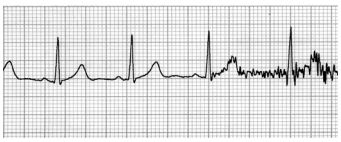
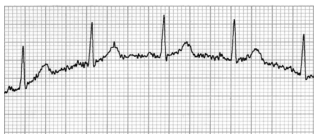
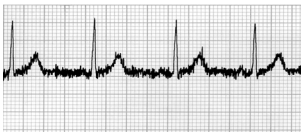
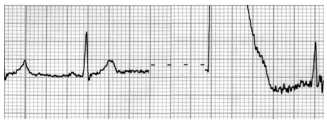
To access a stored report:

1. While in 12-Lead, press the Smart Select knob.
2. Rotate the Smart Select knob to select **Reports**.
   Reports for the current patient event are listed by date, time and sequence number.
3. Use the Navigation buttons to select a report and press the Smart Select knob.
4. Select **Print** or **Send** and press the Smart Select knob.
5. To select another report, repeat Step 1 through Step 3.
6. Press **Exit** to close the menu.

Improving Signal Quality

Signal quality can impact ECG analysis. See *Improving ECG Quality* Application Note or refer to Table 30 for possible solutions to common ECG quality problems.

Table 30 **ECG Signal Problems** </>

Problem	Possible Causes	Possible Solutions
Tremor or muscle artifact 	• Poor electrode placement. • A cold patient. • Tense, uncomfortable patient. • Patient tremors.	• Clean the site and reapply electrodes. Be sure the electrodes are placed on flat, non-muscular areas of the body. • Warm the patient. • Reassure and relax the patient. • Attach electrodes high on the extremities, near the trunk.
Baseline wander 	• Patient movement. • Electrode movement. Poor electrode contact and skin preparation. • Respiratory interference.	• Reassure and relax the patient. • Be sure lead wires are not pulling on the electrodes. • Move electrodes away from areas with the greatest respiratory motion, if possible.
Power line AC Interference 	• Poor electrode contact. Dry or dirty electrodes. • Interference from poorly grounded instrument near patient.	• Apply new electrodes. • Route electrode wires along the limbs and away from other electrical equipment.
Intermittent or jittery waveform 	• Poor electrode contact. • Dry electrodes. • Faulty lead wires	• Clean the site and reapply electrodes. • Apply new electrodes. • Repair or replace faulty leads.

12-Lead Filters

ECG bandwidth filters of 0.15 - 40 Hz, 0.05 - 40 Hz, or 0.05 - 150 Hz may be selected in Configuration to apply to 12-Lead ECG waveforms shown on the display. Additionally, the 12-Lead Report may be configured to apply either the same filter choice used for the display, or a 0.05 - 150 Hz filter. The filter setting for the 12-Lead Report is applied to both printed and stored 12-Lead Reports.

Regardless of filter settings for display or printing, the DXL algorithm uses the full 0.05 -150 Hz bandwidth for its analysis. The full bandwidth is also transmitted.

A filter soft key is available to switch between filter settings during use. When changing the filter during use, the filter setting is applied to both the display and the 12-Lead Report. The display and 12-Lead Report filter settings are returned to their configured settings when the Therapy knob is moved from the Monitor position.

Configuring the DXL Algorithm

Configure the 12-Lead DXL Algorithm to one of two Acute Myocardial Infarction (AMI) detection settings:

- **Standard** – provides the standard Philips DXL algorithm AMI sensitivity setting, found in Philips' patient monitors and cardiographs. (This is the HeartStart Intrepid's factory default setting.)
- **EMS** – decreases AMI sensitivity in the presence of other possible causes of ST elevation that can mimic AMI, such as Bundle Branch Blocks.

See Table 56 "Configuration – 12-Lead" on page 175 for more configuration information.

WARNING: Before changing the configuration, carefully consider clinical implications of this algorithm configuration choice. Selecting EMS results in a slight decrease in sensitivity compared to the AMI detection sensitivity reported in the latest edition of the *Philips' DXL 12-Lead Algorithm Application Note*.

NOTE: See the *Philips 12-Lead Algorithm Application Note* for theoretical and practical aspects of ST Elevation Myocardial Infarction (STEMI) detection.

Troubleshooting

If the HeartStart Intrepid does not operate as expected during 12-Lead ECG operation, see Chapter 19 "Troubleshooting" on page 229.

NOTES

11

Monitoring Carbon Dioxide

This chapter describes how to monitor carbon dioxide (CO_2) and measure end-tidal carbon dioxide ($EtCO_2$) and Airway Respiration Rate (AwRR) with the Respironics CapnoTrak® technology provided by Philips.

This chapter is divided into the following major sections:

Overview

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

The HeartStart Intrepid used the CapnoTrak module to provide CO_2 monitoring of adult, pediatric, infant, or neonatal patients when indicated by clinicians.

For patients prone to mouth breathing, use an oral-nasal cannula. Place the cannula onto the patient. Verify the position of the oral sampling tip. Patient accessories are available in a variety of sizes for use on intubated and non-intubated patients

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

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

The CO_2 monitoring function of the HeartStart Intrepid provides an $EtCO_2$ value, a CO_2 waveform (Capnograph), and an Airway respiratory rate (AwRR). The AwRR relies on CO_2 functionality to identify valid breaths for numeric display and alarm conditions such as no breath detected.

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

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

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

Precautions for Measuring $EtCO_2$

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

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

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

Do not use on patients that cannot tolerate the withdrawal of 50 ml/minute ±10 ml/minute from the airway or patients that cannot tolerate the added dead space to the airway.

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

CO_2 measurements may be inaccurate when measured in the presence of aerosolized pharmaceuticals or anesthetic gases. EtCO2 accuracy has a maximum error of 5% and 10% using an I:E ratio of 1:2.

EtCO2 and Respiration Rate accuracy is verified by using a solenoid test setup to deliver a square wave of known CO2 concentration to the device. 5% and 10% CO2 concentrations were used and respiration rate was varied over the range of the device. Pass/fail criteria was a comparison of the respiratory rate output from the sensor to the frequency of the square wave. EtCO2 measurements at those rates were compared to the CO2 readings under static flow conditions. The respiration rate range is 0,2 to 100 br/m ± 1br/m, 8-breath averaging. The EtCO2 is calculated by the peak of the expired CO2 waveform over the selected time period. A minimum of 5 mmHg between peak and valley of waveform is required.

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

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

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

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

Nitrous oxide, elevated levels of oxygen, helium, halogenated hydrocarbons can influence the CO2 measurement. Levels are supplied by host device to the CapnoTrak Module through the communications interface.

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

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

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

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

CAUTIONS: Automatic correction on the CO_2 values is performed using internal barometric pressure and sample cell pressure measurements. CO_2 values are normalized to barometric pressure.

Calibration gases must be disposed of in accordance with local regulations.

The Water Filter Assembly lasts up to the following lengths of time:

- 12 hours when used without the Dehumidification Tubing in a non-humidified environment.
- 120 hours when used with the Dehumidification Tubing under conditions based on a sample gas temperature of 37°C, a room temperature of 23°C, and sample relative humidity of 100%, as defined in ISO 80601-2-55 §201.7.9.2.9.101b.

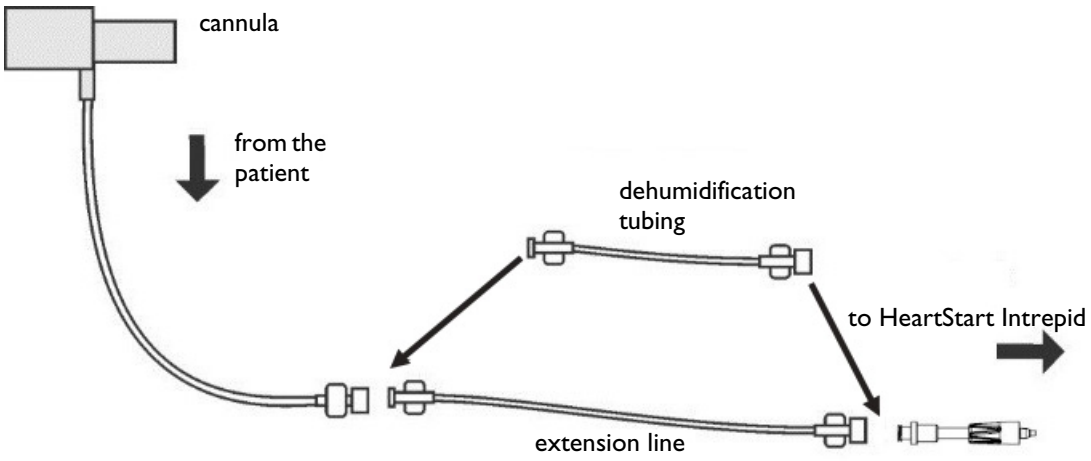
Any fluids accumulated in the patient accessory or water filter assembly should be treated as a hazard when full of fluid.

Perform the Cell Pressure Accuracy Check to set the EtCO2 module atmospheric pressure automatically. See the HeartStart Intrepid *Service Manual* for more information on setting the atmospheric pressure.

Preparing to Measure $EtCO_2$

The $EtCO_2$ airway assembly is configurable for patients' needs and institution guidelines, see Figure 68. The compatible dehumidification tubes and extension lines are listed in Table 96 "$EtCO_2$ Monitoring Accessories" on page 226.

Figure 68 **CO_2 Airway Assembly**



Selecting the Accessories

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

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

WARNINGS: Use only accessories listed in the supplies chapter to ensure correct functioning of the CO_2 measurement. See Table 96 "$EtCO_2$ Monitoring Accessories" on page 226 for a listing of approved CO_2 accessories.

Do not position patient accessories in any manner that may cause entanglement or strangulation.

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

Using the Cannula

To set up $EtCO_2$ measurements using the nasal or oral cannula:

1. Attach the cannula tubing to the CO_2 Inlet port as described in "Connecting the CO_2 Tubing" on page 14.
2. If using a nasal cannula, then check that both nostrils are clear
3. Position the cannula on the face by inserting the tips into the nostrils or mouth.
4. Pass the tubing over the ears, then slide the sleeve up the tubing towards the neck to a comfortable fit under the chin. If using dual purpose tubing, connect the green tubing to the oxygen source. Check the positioning of the tubes regularly to ensure proper monitoring function.
5. If a CO_2 Check Line technical alarm appears, check the cannula tubing and the water filter assembly. Replace one or both components if they appear occluded.

Using the Cannula with Airway Adapter

To set up $EtCO_2$ measurements using the cannula and airway adapter:

1. Attach the tubing to the CO_2 Inlet port as described in "Connecting the CO_2 Tubing" on page 14.
2. Connect the inlet of the airway adapter to the endotracheal tube and connect the narrow end of the airway adapter to the ventilator tubing or manual resuscitator.
3. Support the airway adapter to prevent stress on the tube.
4. If the CO2 Occlusion technical alarm appears, check the cannula tubing and the water filter assembly. Replace one or both components if they appear contaminated.

Disconnect the adapter during suctioning and nebulizing therapies. For best results for non-humidified use, change the adapter after 24 hours of continuous use.

NOTES: Should the blockage occur during CO_2 monitoring, the CO_2 waveform appears as a flat line, and if alarms are on, an apnea alarm is annunciated.

Do not connect more than one extension line. One extension line and one dehumidification tube provide the longest sampling line.

To maintain the dehumidifying function, replace the dehumidification tube as directed by the tube instructions.

Monitoring $EtCO_2$

To monitor $EtCO_2$:

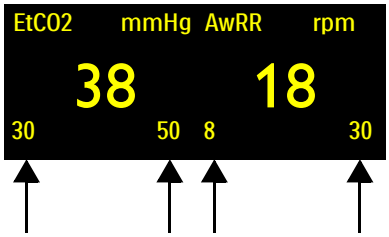
1. Connect the sampling line to the HeartStart Intrepid (see "Using the Cannula" and "Using the Cannula with Airway Adapter" above).
2. Apply the sampling line to the patient.
3. If the HeartStart Intrepid is not turned on, turn the Therapy knob to Monitor.
4. Check that the patient category is appropriate for the patient. If necessary change the Patient Category to select the appropriate category. See "General Function Buttons" on page 29.

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

Question marks:

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

Figure 69 **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 or sampling system may cause the displayed $EtCO_2$ values to be significantly low. Always connect all components securely and check for leaks according to standard clinical procedures. Displacement of the nasal or combined nasal oral cannulas can cause lower than actual $EtCO_2$ readings. Even with combined nasal / oral cannulas, the $EtCO_2$ readings may be slightly lower than actual in patients breathing through the mouth only.

Inspiratory/Expiratory (I:E) ratios <2:1 have no effect on stated $EtCO_2$ levels stated in the above warnings. For I:E ratios >2:1,the $EtCO_2$ accuracy specification is as follows:

IE2:1	-7% + -4% for every 10BPM over 40
IE3:1	-7% + -5% for every 10BPM over 30
IE4:1	-12% + -6% for every 10BPM over 30

$EtCO_2$ and AwRR Alarms

Alarms sound if measurements fall outside the configured limits for high or low $EtCO_2$, high or low AwRR and Apnea time. All $EtCO_2$ alarms except Apnea are categorized as "non-latching" alarms, meaning they are automatically removed when their alarm condition no longer exists. Apnea alarms are latching, meaning they remain present even if the alarm condition no longer exists.

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

$EtCO_2$ alarms can be generated for the conditions shown in Table 31 and Table 32 below. Once generated, they appear as alarm messages in the $EtCO_2$ alarm status area above the numerics. There are both audio and visual alerts. For more information on alarms, see "Alarms" on page 40.

NOTE: Alarm notification is configurable. See "Alarm Management and Configuration" on page 43.

Table 31 **$EtCO_2$ Physiological Alarms**

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

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

Table 32 **$EtCO_2$ Technical Alarms**

Alarm Message	Condition	Type of Alarm	Indication
CO2 Sensor Over Temp	CO_2 sensor is reporting an over temperature condition.	High Priority Non-Latching Alarm	Red alarm message with audio tone.
CO2 Service Required	CO_2 sensor requires service.		
CO2 Communication Failure	CO_2 sensor is connected but the HeartStart Intrepid cannot communicate with it.		
CO2 Zero Required	CO_2 sensor needs to be zeroed.	Low Priority Non-Latching Alarm	Cyan alarm message with audio tone.
CO2 Sensor Warming Up	CO_2 sensor has not warmed up to operating temperature range.		
CO2 Check Line	The sampling line is kinked or blocked.		
CO2 Error	A non-critical failure has been detected.		
CO2 Out of Range	CO_2 is out of range.		
CO2 Tube Unplugged	Sampling line is disconnected.		
CO2 Power Overload	CO_2 sensor has a power problem.		

Changing the $EtCO_2$ Alarm Limits

◎ **To change the $EtCO_2$ alarm limits:**

1. Press the Smart Select knob.
2. Turn the Smart Select knob to highlight the **Measurements/Alarms** menu and press the Smart Select knob.
3. Select **EtCO2** and press the Smart Select knob.
4. Select **EtCO2 Limits** and press the Smart Select knob.
5. Turn the Smart Select knob to select the new high limit value then press the Smart Select knob.
6. Set the new low limit value and press the Smart Select knob.

Enabling/Disabling the $EtCO_2$ Alarms

◎ **To enable or disable the $EtCO_2$ alarms:**

1. Press the Smart Select knob.
2. Turn the Smart Select knob to highlight the **Measurements/Alarms** menu and press the Smart Select knob.
3. Select **EtCO2** and press the Smart Select knob.
4. Select **Alarms On (Alarms Off)** and press the Smart Select knob.

Changing the AwRR Alarm Limits

◎ **To change the AwRR alarm limits:**

1. Press the Smart Select knob.

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

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

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

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

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

Changing the Apnea Time Alarm Limit

To change the apnea time alarm limit:

1 Press the Smart Select knob.

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

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

4 Select **Apnea Time** and press the Smart Select knob.

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

Enabling/Disabling AwRR Alarms

1 Press the Smart Select knob.

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

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

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

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

Zeroing the CO_2 Module

To avoid inaccurate readings, the CO_2 module needs to be reset and requires a valid zero to be performed when:

- attaching a new sample line
- accuracy of the reading is questionable
- requested by the HeartStart Intrepid
- there has been a significant change in environmental conditions.

For best results, allow the CO_2 module to warm up for three minutes or when “CO2 Sensor warming up message” is no longer displayed before performing the Zero procedure.

NOTES: Do not zero the CO_2 module without a sampling line installed.

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

Keep the sampling line away from all sources of CO_2, including exhaled breaths and ventilator exhaust.

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

Zeroing Using the Soft Key

To zero the CO_2 module using the soft key:

1. Confirm the HeartStart Intrepid is in a clinical mode.
2. Confirm that the sampling line has been removed from the patient.
3. Press the **[Zero CO2]** soft key.
4. The **CO2 Zero in Progress** message appears on the display. The message disappears when zeroing is finished.

Zeroing Using the Smart Select Knob

To zero the CO_2 sensor using the Smart Select knob:

1. Confirm the HeartStart Intrepid is in a clinical mode.
2. Confirm that the sampling line has been removed from the patient, or that the airway adapter is out of the patient circuit.
3. Press the Smart Select knob.
4. Turn the Smart Select knob to highlight **Measurements/Alarms** menu and press the Smart Select knob.
5. Select **EtCO2** and press the Smart Select knob.
6. Select **Zero** and press the Smart Select knob.
7. The **CO2 Zero in Progress** message appears on the display. The message disappears when zeroing is finished.

See Table 33 for messages that might appear during zeroing.

Table 33 **Zeroing Messages**

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

NOTE: The **[Zero CO2]** soft key is grayed out when the HeartStart Intrepid is in the process of zeroing the sensor. [The **Zero CO2]** soft key does not appear while the Trends table is displayed.

Cleaning

Use the CapnoTrak-provided procedures to clean the water filter and humidification tubing. Special materials are required for each procedure.

CapnoTrak Tubing

To clean tubing, use a needle-less 10 ml syringe with a male Luer tip and 50 ml of 3% hydrogen peroxide (H_2O_2).

NOTE: Cleaner/disinfectant must have a CE mark (as applicable in your region).

1. Fill the syringe with 10 ml of hydrogen peroxide.
2. Insert the syringe into the female Luer end of the tubing.

3. Flow hydrogen peroxide through the tubing.
4. Repeat steps 1 through 3 five times, using fresh hydrogen peroxide each time.
   DO NOT reuse the hydrogen peroxide.
5. Fill the syringe with 10 ml of room air.
6. Insert the syringe into the Luer end of the tubing and quickly force the air through the tubing.
7. Repeat steps 5 and 6 four times.

Before re-use, inspect for cracking, crazing, and intact glue joints.

WARNING: Failure to use the recommended volume of cleaner/disinfectant may not sufficiently clean the item.

CAUTIONS: Do not sterilize or immerse.

Do not blow high-pressure air through the item

NOTE: Dehumidification tubing may be cleaned and disinfect a maximum of **90** times with no drying time needed. Store disinfected parts separately from new parts.

CapnoTrak Water Filter Assembly

To clean tubing, use a needle-less 10 ml syringe with a male Luer tip and 50 ml of 70% Isopropyl alcohol.

NOTE: Cleaner/disinfectant must have a CE mark (as applicable in your region).

1. Fill the syringe with 10 ml of Isopropyl alcohol.

2 Insert the syringe into the clear end of the water filter.

3 Flow alcohol through the filter.

4 Repeat steps 1 through 3 five times total, using fresh alcohol each time.
DO NOT reuse the alcohol.

5 Fill the syringe with 10 ml of room air.

6 Insert the syringe into the clear end of the water filter and quickly force the air through the filter.

7 Repeat steps 5 and 6 four more times.

8 Allow the filter to dry for a minimum of 12 hours.

Before re-use, inspect for cracking, crazing, and intact glue joints

WARNING: Failure to use the recommended volume of cleaner/disinfectant may not sufficiently clean the item.

CAUTIONS: Do not sterilize or immerse.

Do not blow high-pressure air through the item

NOTE: The water filter may be cleaned and disinfect a maximum of **three** times. Store disinfected parts separately from new parts.

Disabling the $EtCO_2$ Monitoring Function

To disable the $EtCO_2$ monitoring function, disconnect the tube from the HeartStart Intrepid. The message **CO2 Tube Unplugged - Turn Off EtCO2?** appears. Select **Yes** and press the Smart Select knob.

If the airway is disconnected accidentally, the message **CO2 Tube Unplugged - Turn Off EtCO2?** appears to indicate the disconnection. Select **No** and press the Smart Select knob. Secure the airway connection. The CO_2 monitoring function is enabled again.

Troubleshooting

If the HeartStart Intrepid does not operate as expected during CO_2 Monitoring, see Table 106 "$EtCO_2$ Problems" on page 240.

NOTES

12

Traumatic Brain Injury Advisory

This chapter describes the use of the HeartStart Intrepid's Traumatic Brain Injury (TBI) advisory feature.

This chapter is divided into the following major sections:

Overview

TBI occurs when an external mechanical force inflicts sudden trauma to the head, causing a disruption in the normal function of the brain. In the absence of obvious head injury, TBI can be difficult to diagnose. Oxygenation and blood pressure are significant parameters associated with outcomes for patients with severe traumatic brain injuries (http://www.epic.arizona.edu/).

The TBI advisory feature on the HeartStart Intrepid assists in the monitoring of patients who are determined at high risk of having suffered a traumatic brain injury. The TBI advisory provides visual guidance to help prevent the following conditions:

- hypoxia—low blood oxygen saturation (as measured by SpO_2)
- hypotension—low systolic blood pressure
- hyperventilation-induced hypocapnea—decreased carbon dioxide in the blood (as measured by $EtCO_2$).

Even short episodes of these conditions in the early stages of a TBI can quickly lead to vasoconstriction of cerebral arteries, further reducing blood and oxygen flow to damaged brain cells, and to a lower probability of a good cognitive outcome.

The TBI Advisory is available for both adult and infant/child patients on devices in Monitor Mode configured with SpO_2, NBP, and $EtCO_2$. The TBI Advisory display reflects the appropriate target limits for each TBI Care parameter.

NOTE: These limits must be pre-established and pre-configured prior to using this feature (see Table 47 "Configuration – TBI Advisory" on page 170).

Enabling the TBI Advisory

To Enable TBI:

1 Ensure an SpO_2 sensor, NBP cuff, and $EtCO_2$ tubing are connected to the patient.

2 Press the **[Enable TBI]** soft key.
If no patient age has been entered, the **Patient Age** number selector appears.

3 If prompted, enter the patient age.
The patient age is displayed in the status area next to patient name/ID.
When age is entered, mode text changes from **Monitor** to **Monitor TBI**.

NOTES:
- The TBI Advisory is only available in Monitor Mode and is not available during acquisition of a 12-lead ECG.
- Devices must be configured with SpO_2, NBP, and $EtCO_2$ measurement parameters and all three parameter must be in use.
- TBI Advisory can only be enabled when TBI limits are pre-configured on the device.
- The neonatal patient category is not supported.

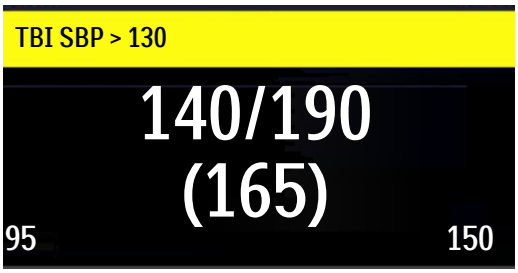
Displaying the TBI Advisory

The TBI Advisory display appears in the numeric parameter area. A TBI limit bar is displayed at the top of the corresponding measure box for NBP, $EtCO_2$, and SpO_2.

TBI for Systolic Blood Pressure (SBP)

Systolic blood pressure that falls outside the established TBI limits is indicated by a yellow bar, and **TBI SBP > High Limit** or **TBI SBP < Low Limit** is displayed, as shown in Figure 70.

Figure 70



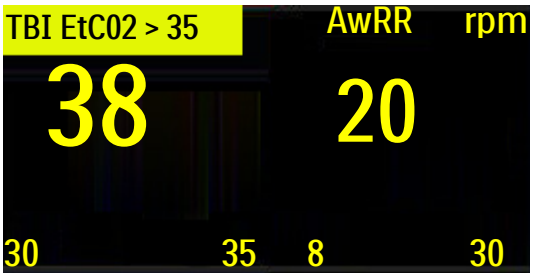
Systolic blood pressure within the limits setting for the TBI configuration is indicated by **TBI SBP** on a green bar as shown in Figure 71.

Figure 71

TBI for $EtCO_2$

If the $EtCO_2$ value falls outside the established TBI limits, **TBI** $EtCO_2$ **> High Limit** or **TBI** $EtCO_2$ **< Low Limit** is displayed in a yellow TBI bar as shown in Figure 72.

Figure 72 **TBI outside limits**



If the $EtCO_2$ value is within the limits setting for the TBI configuration, **TBI EtC02** is displayed in a green bar as shown in as shown in Figure 73.

Figure 73 **TBI within limits**

TBI for SpO_2

For SpO_2, there is no upper limit, only a lower limit threshold if SpO_2 is set. If the SpO_2 value falls below the established TBI limit, **TBI** SpO_2 **< Low Limit** is displayed on a yellow TBI bar as shown in Figure 74.

Figure 74 **SPO_2 below TBI limit**

If the SpO_2 value is above the limit set for the TBI configuration, the TBI bar is green, and the text **TBI** SpO_2 is displayed on a green bar as shown in Figure 75.

Figure 75 **SPO_2 above TBI limit**

NOTE: If a physiological alarm condition occurs, it will have a higher priority than the TBI Advisory and will obscure the TBI Indicators.

Disabling TBI Advisory

To Disable TBI:

- Press the **[Disable TBI]** soft key.
  The display returns to Monitor Mode.

Troubleshooting

If your HeartStart Intrepid does not operate as expected when the TBI Advisory is enabled, see "TBI Advisory Problems" on page 242.

13

Q-CPR

This chapter is divided into the following major sections:

Overview

Cardiopulmonary Resuscitation (CPR) is a combination of chest compressions and ventilations delivered to victims in cardiac arrest. The Q-CPR® option offers real-time measurement and corrective feedback on the rate, depth, and complete release of compressions, ventilation rate, and lack of CPR activity in accordance with current CPR guidelines. The feedback can appear on the HeartStart Intrepid display and on the Q-CPR meter 2 display (compression feedback only).

Compressions are measured by the Q-CPR meter 2 connected to the HeartStart Intrepid using a Pads/Q-CPR meter 2 cable. Ventilation data is acquired through Philips multifunction defibrillation electrode pads applied to the patient and connected to the HeartStart Intrepid using the same Pads/CPR cable.

Q-CPR is available in Manual Mode, AED Mode, and Pacer Mode (Fixed only). Easy-to-follow visual indicators and audio prompts provide feedback to the rescuer when CPR performance deviates outside of target ranges.

When using Q-CPR, SpO_2 monitoring functionality is not available.

NOTE: Q-CPR is deactivated when Sync is activated when entering Monitor, Sync, or Demand Pacing modes.

Precautions for Q-CPR

The Q-CPR option is contraindicated as follows:

- The Q-CPR option is contraindicated for use on neonatal and pediatric patients (under 8 years of age or weighing less than 25 kg).
- The Q-CPR option is not for use when CPR is contraindicated.

WARNINGS: The Q-CPR option is not intended for use in a moving environment, such as an ambulance. Additional movement introduced during patient transport may reduce the accuracy of the compression and ventilation measurements. If Q-CPR must be used in a moving environment, do not rely on the Q-CPR feedback during such conditions. It is not necessary to remove the Q-CPR meter 2 from the patient.

Q-CPR is not to be used on patients under 8 years of age or less than 25 kg (55 lb). Q-CPR is not enabled when the Patient Category is set to Infant/Child.

Properly performed CPR can result in the fracturing of a patient's ribs or other chest injuries, including external chest wall bruising or abrasion.[1] If patient rib or chest integrity has been compromised, continue to provide CPR according to local protocol.

If the Q-CPR meter 2 stops working, is not working as expected or there is uncertainty about the patient's age or the device fitting properly on the patient, remove the CPR meter from the patient and continue CPR according to your organization's protocol.

The Q-CPR option with the Q-CPR meter 2 provides feedback on the performance of CPR. The device does not provide guidance in the decision whether to perform CPR on a suspected cardiac arrest victim. The decision to perform CPR on a suspected cardiac arrest victim must be made independent of whether the CPR meter is used.

If CPR is performed when the patient is lying on a surface that yields, such as a mattress, compression depth feedback from the CPR meter may be misleading, especially if a backboard is not placed under the patient. When a backboard is in place, compensate for mattress compliance by ensuring that each compression exceeds the compression depth on CPR meter or the generated waveform hits the appropriate line on the HeartStart Intrepid display.

Do not use the Q-CPR option to verify placement of airway adjuncts, such as endotracheal tubes and laryngeal masks. Ventilation feedback accuracy may be decreased when the patient is handled or moved, or when the Q-CPR option is used on patients with certain conditions such as trauma, seizures, reduced lung volume, or high cardiac ejections.

Do not practice with the Q-CPR meter 2 on a person. The CPR meter can be used with a training manikin or on a compliant surface for practice.

CAUTION: The Q-CPR option is not intended for use with any other CPR compression devices.

NOTES: If not familiar with the CPR meter (or suspect a problem with the Q-CPR meter 2), disregard feedback from the Q-CPR meter 2 and continue with CPR. At an appropriate time after use, inspect the device for soiling or damage, apply a new adhesive pad and have a trained user perform chest compressions with the meter on a CPR manikin. If the meter does not function as expected, remove it from use and contact a Philips representative.

Shut down the HeartStart Intrepid before disconnecting the Q-CPR meter 2. Failure to do so may delay the appearance of the meter's Customer Service indicator.

To ensure the Q-CPR meter 2 performs its internal self-checks properly, it is recommended the meter remains stationary for at least one second when first powered on.

1. Black C.J., Busittil A., Robertson C. Chest wall injuries following cardiopulmonary resuscitation. *Resuscitation*. 2004; 63:339-343.

Preparing to Use Q-CPR

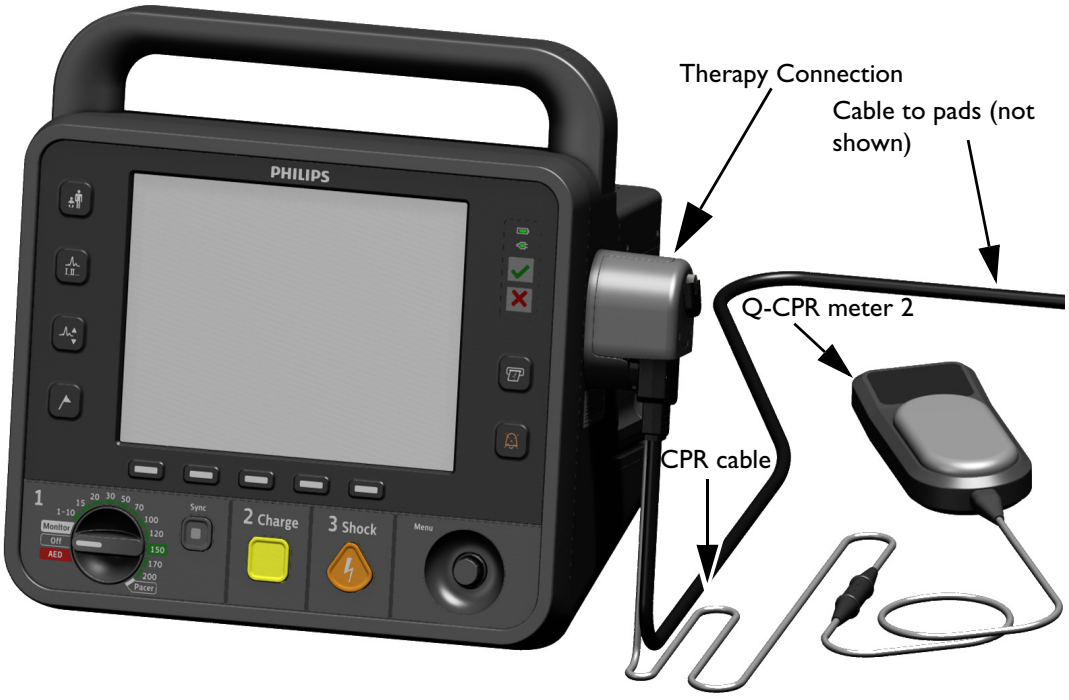
A Pads/CPR cable connects the Q-CPR meter 2 to the HeartStart Intrepid. To set up the Q-CPR option on the HeartStart Intrepid and prepare the patient for use, follow the steps described on the following pages.

Connecting the Pads/CPR Therapy Cable

To connect the Pads/CPR therapy cable:

1. Align the white pointer on the cable with the white arrow on the green Therapy port as shown in Figure 76.
2. Insert the cable into the green Therapy port. Push until it clicks into place. As a time saving measure, it is possible to choose to always keep the Pads/CPR cable pre-connected to the HeartStart Intrepid.

Figure 76 **Connecting the Pads/CPR Therapy Cable**



NOTE: The Q-CPR option is operational only when the Pads/CPR cable is connected to the HeartStart Intrepid. CPR feedback is not available if the standard pads or paddles cable is connected.

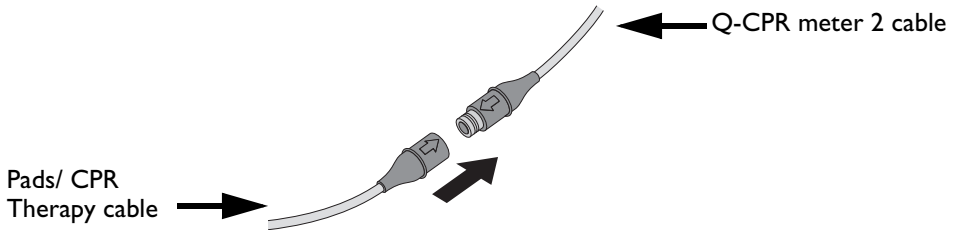
Connecting the CPR Meter to the Pads/CPR Therapy Cable

To connect the CPR meter to the Pads/CPR Therapy cable

1. Align the arrow on the Q-CPR meter 2 cable with the arrow on the receptacle end of the Pads/CPR cable as shown in Figure 77. As a time saving measure, always keep the Q-CPR meter 2 cable preconnected to the Pads/CPR therapy cable.

Push until it snaps into place. There should be no gap between the two connectors.

Figure 77 **Pads/CPR Therapy Cable connection**



Applying Multifunction Electrode Pads

Philips multifunction defibrillation electrode pads are required to measure ventilation activity as well as acquire an ECG signal and deliver a shock, as appropriate.

To apply pads to the patient:

1. Check the expiration date that appears on the pads package.
2. Inspect the packaging for any damage, then open.
3. Connect the pads connector to the Pads/CPR Therapy cable. See Figure 78.
4. Apply the pads to the patient in the anterior/apex position as shown on the pads package.

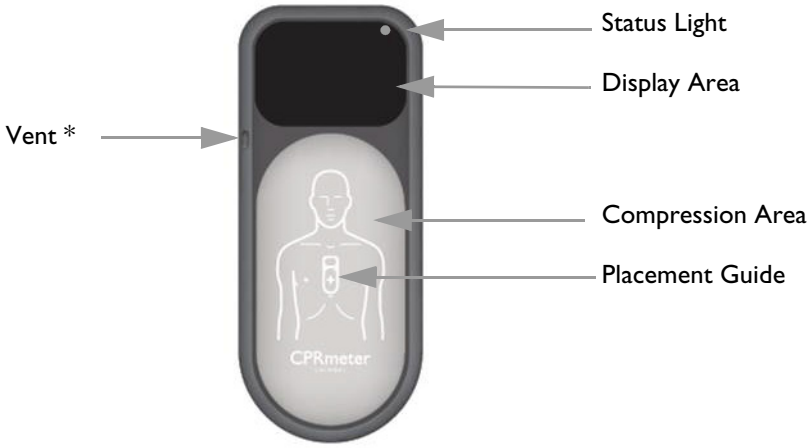
Figure 78 **Pads Connections**

WARNING: Anterior-posterior pad placement should not be used with the Q-CPR option.

CPR Meter

The CPR meter is a small, lightweight device that provides CPR feedback in a display area in the line of sight of the caregiver performing compressions. See Figure 79.

Figure 79 **CPR Meter**



* The vent allows internal and external pressures to equalize. Do not block the vent.

NOTE: Remove the protective film from the CPR meter's display screen before first use. To prolong the life of the display, avoid storing the CPR meter where it is exposed to direct sunlight when not in use.

Status Light

The CPR meter's status light is off when the HeartStart Intrepid to which the meter is attached is turned off. When the HeartStart Intrepid is turned on, the CPR meter's status light turns green to indicate that it has passed its self test. If the status light is orange or does not light during start-up, take the meter out of service. The status light turns off once the CPR meter display turns on. The status light turns on and remains on for 10 seconds after the HeartStart Intrepid is turned off.

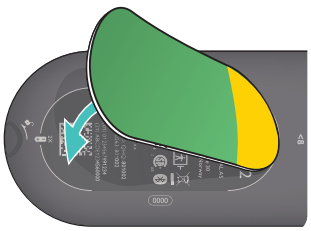
Attaching the CPR Meter Adhesive Pad

An adhesive pad must be attached to the back of the CPR meter before using.

To attach the Q-CPR meter 2 adhesive pad:

1. Confirm that the Q-CPR meter 2 pads are within their expiration date, and open the package of adhesive pads.
2. Peel one pad off the strip, exposing the adhesive surface on the underside. Apply the pad to the back of the Q-CPR meter 2, covering the entire flat oval surface. See Figure 80.
3. Do not peel off the green and yellow liner from the front of the pad until ready to apply the device to a patient.

Figure 80 **CPR Meter Adhesive Pad**



WARNING: The Q-CPR meter 2 adhesive pad is intended for single-patient use only. Replace after each use. Check the label on the outside packing to confirm the adhesive pads are within their expiration date. Do not use pads beyond their expiration date.

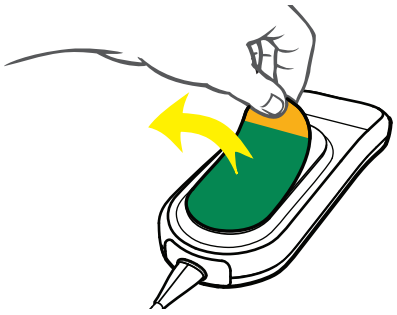
CAUTION: The CPR meter should always be stored with the Q-CPR meter 2 adhesive pad in place as described above. As directed in the instructions, the Q-CPR meter 2 must be used with the adhesive pad in place.

Placing the CPR Meter on the Patient

To place the Q-CPR meter 2 on the patient:

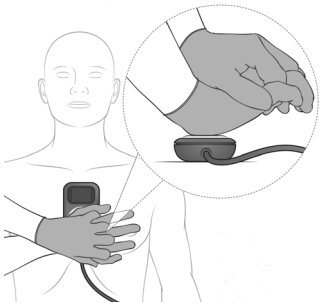
1. Ensure the patient's skin is clean and dry. If necessary, clip or shave the hair from the sternum area.
2. Peel off the green liner from the Q-CPR meter 2 adhesive pad to expose the adhesive surface. See Figure 81.

Figure 81 **Exposing the Adhesive Surface**



3. Position the Q-CPR meter 2 so the compression area is placed on the lower half of the sternum, on the centerline of the bare chest as illustrated on the front of the Q-CPR meter 2 and in Figure 82. It is acceptable if the Q-CPR meter 2 overlaps the defibrillator pad.

Figure 82 **CPR Meter Placement**



If it is difficult to apply the CPR meter, do not delay CPR. Remove the Q-CPR meter 2 and begin compressions. If the CPR meter moves during use, reposition it correctly in the center of the chest.

WARNINGS: Do not apply the Q-CPR meter 2 to an open wound or recent incision site.

Do not use the Q-CPR meter 2 in conjunction with any mechanical or automated compression device.

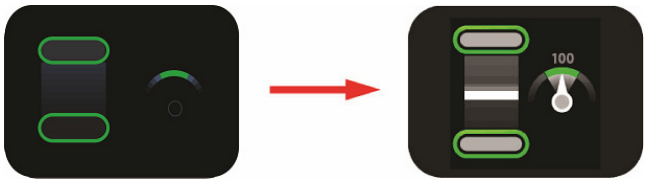
If the Q-CPR meter 2 stops working, isn't working as expected or there is uncertainty about the patient's age or the device fitting properly on the patient, remove the CPR meter from the patient and continue CPR according to organizational protocol.

Starting CPR with the CPR Meter

Using standard CPR technique, place the heel of one hand directly over the compression area of the attached Q-CPR meter 2. Place the other hand on top of the first, interlocking fingers. Make sure the display area of the Q-CPR meter 2 is visible to look for feedback (see Figure 82). Provide chest compressions according to organizational CPR protocol.

When the Q-CPR meter 2 first detects compressions, the display activates targets for compression release and depth, and a compression rate indicator. See Figure 83. For a list of all feedback displays, see "Feedback Prompts" on page 156.

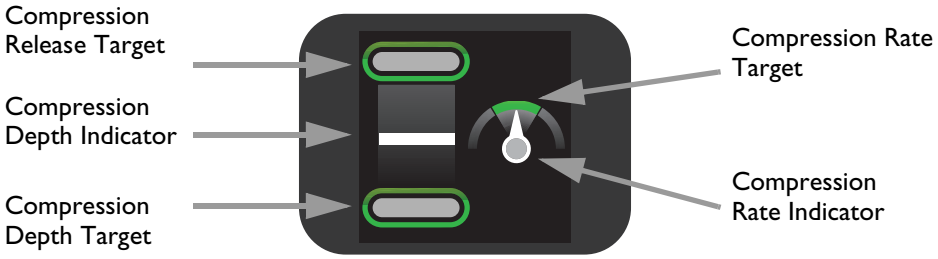
Figure 83 **Beginning Compressions on CPR Meter**



CPR Meter Display

The Q-CPR meter 2 provides real-time graphical feedback as a coaching tool once CPR compressions begin. See Figure 84.

Figure 84 **CPR Meter Indicators**

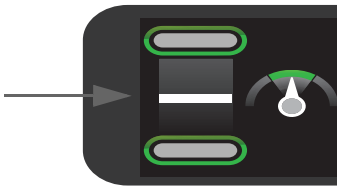


Compression Depth

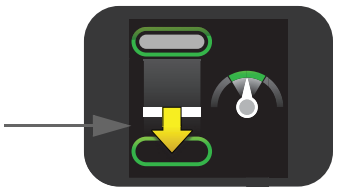
When CPR is administered, the Q-CPR meter 2 display indicates the compression depth, and whether pressure is not completely released after a compression. Use the Compression depth Indicator as an indication of proper compression depth. See Figure 85.

Figure 85 **Compression Depth Indicators**

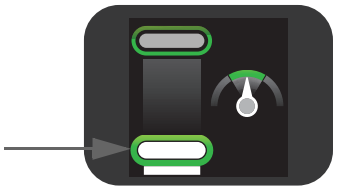
Each compression performed is represented on the Q-CPR meter 2 display by a moving white compression depth indicator bar. When the correct compression depth is achieved, the bottom target lights up. When the pressure is completely released, the top target lights up.



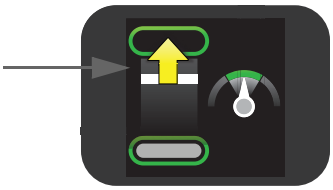
If compression fails to meet the target depth (50-60 mm for a patient on a hard surface), the compression depth target zone does not light up. If four consecutive compressions fail to meet the depth target, a yellow arrow appears on the display, pointing to the depth target zone. If the compression depth is not corrected the HeartStart Intrepid provides corrective voice prompts (if configured).



If the Q-CPR meter 2 detects a compression that reaches 70 mm, the area below the compression depth target area lights up.



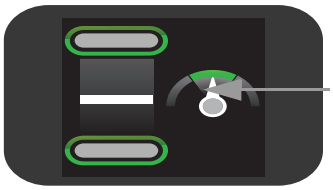
If pressure is not fully released between four consecutive compressions, the Q-CPR meter 2 display shows a yellow arrow pointing up to the compression release target zone. Allow the chest to completely recoil between compressions.



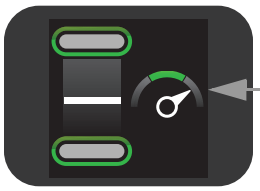
Compression Rate

The Q-CPR meter 2 also provides feedback on the rate of compressions and uses a speedometer to indicate whether to speed up or slow down the compression rate. See Figure 86.

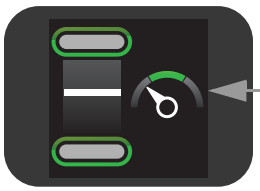
Figure 86



If the Q-CPR meter 2 detects the compression rate is within the target area, the speedometer needle on the compression rate indicator points to the green target zone, which lights up.



If the Q-CPR meter 2 detects the compression rate is faster than the target rate (120 compressions per minute), the needle on the compression rate indicator points to the right of the green target zone. If the compression rate is not corrected the HeartStart Intrepid provides corrective voice prompts (if configured).



If the Q-CPR meter 2 detects the compression rate is slower than the target rate (100 cpm), the needle on the compression rate indicator points to the left of the green target zone. If the compression rate is not corrected the HeartStart Intrepid provides corrective voice prompts (if configured).

Table 34 describes other icons appearing on the Q-CPR meter 2 display:

Table 34 **Other Q-CPR meter 2 Display Icons**

Icon on Display	Definition
	The Q-CPR meter 2 displays the *Do Not Touch The Patient* icon when the HeartStart Intrepid provides prompts to stop CPR to analyze the patient's heart rhythm, the device is charging or advises a shock is required. Stay clear of the patient when the icon is displayed. **NOTE:** Do not remove the Q-CPR meter 2 during rhythm analysis or shock delivery. Leave the Q-CPR meter 2 on the patient's chest.
	If compressions are stopped for 10 seconds, the Q-CPR meter 2 display changes to a flashing white image to indicate that CPR should be resumed. If compressions are not resumed, the HeartStart Intrepid provides voice prompts (if configured) that no compressions are detected.
	The Customer Service indicator appears only at shutdown when the number of compressions performed on the Q-CPR meter 2 reaches the device's service limit (500,000 compression cycles). Take the Q-CPR meter 2 out of service and contact a local response center for more information. **NOTE:** Shut down the HeartStart Intrepid before disconnecting the Q-CPR meter 2. Failure to do so may delay the appearance of the meter's Customer Service Indicator.

Using Q-CPR on the HeartStart Intrepid

Q-CPR feedback is displayed on the Q-CPR meter 2 and on the HeartStart Intrepid device screen. The HeartStart Intrepid can display the following parameters, depending upon configuration. See Figure 88:

- Compression rate
- Compression wave showing compression depth
- No flow time (shown as **No CPR sec** on the display)
- Ventilation rate
- CPR Timer
- Compression counter

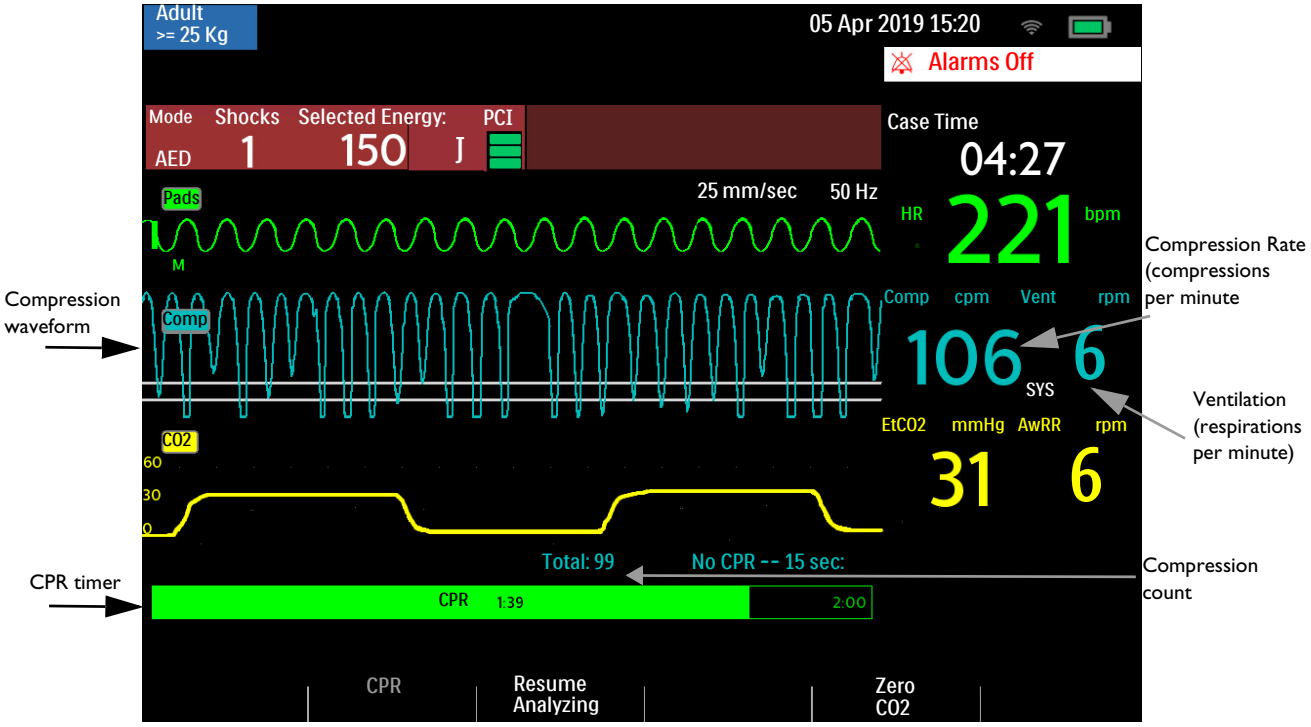
If the HeartStart Intrepid is equipped with the $EtCO_2$ option, the display also provides:

- $EtCO_2$ numeric (if available)
- CO_2 wave (if available)

Using Q-CPR in AED Mode

In AED Mode, CPR feedback is provided automatically during the CPR Pause period of the AED protocol or manually when the CPR Pause soft key is pressed. If the No Shock Advised (NSA) Action configuration item is set to provide a CPR Pause interval, Q-CPR can be activated by delivering a compression with the Q-CPR meter 2. Voice prompts are issued as guidance.

Figure 87 **Q-CPR Display in AED Mode**



AED Soft Keys

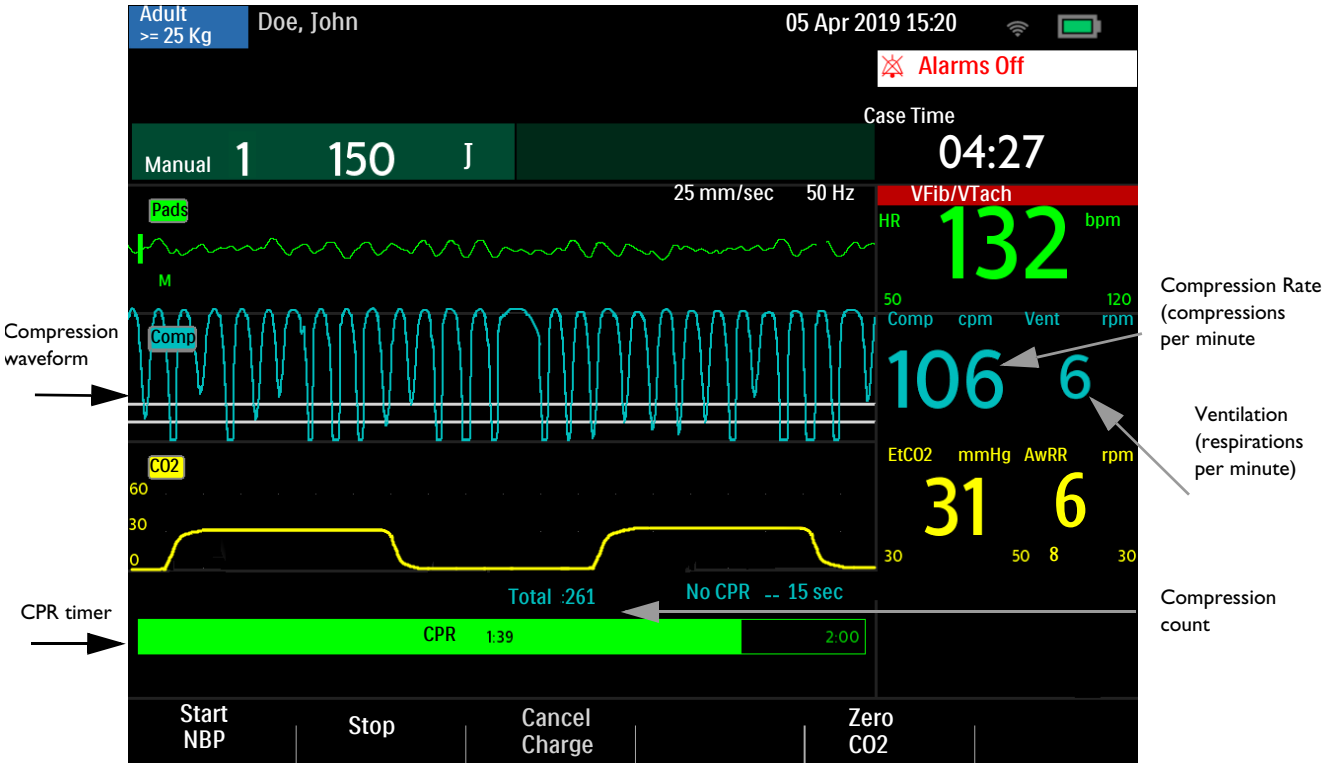
AED Mode has two soft keys available.

- CPR - Pressing the CPR soft key initiates the configured pause period to perform CPR.
- Resume Analyzing - Pressing the Resume Analyzing soft key initiates the AED analysis algorithm to resume or restart analysis.

Using Q-CPR in Manual Defibrillation Mode

In Monitor Mode, when the Therapy knob is moved to a Manual Defibrillation setting, the CPR View is automatically displayed only if the patient category is Adult and compressions are detected. If CPR voice prompts are not enabled, **CPR Voice Muted** displays beneath the progress bar.

Figure 88 **Q-CPR View**



Soft Keys

To stop CPR, press the **[Stop CPR]** soft key. To start CPR, press the **[CPR Timer]** soft key.

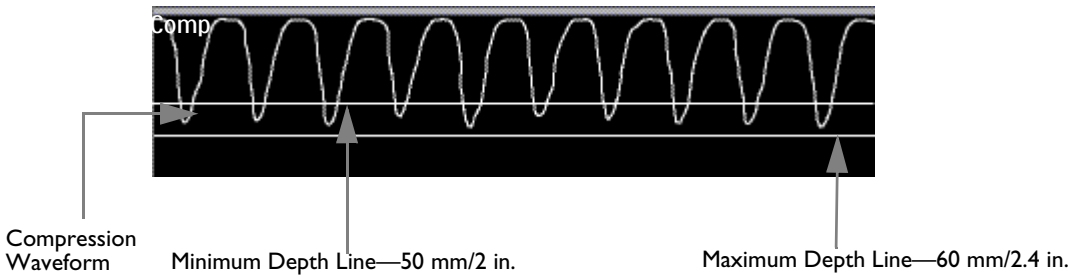
CPR Compression Depth Guidelines

WARNING: When doing CPR on a patient lying on a surface that yields, do not use the CPR meter if a backboard is not in place.

The HeartStart Intrepid Q-CPR Views display two guidelines on the screen:

- 50 mm—solid line indicates the minimum depth when the patient is on a firm surface. CPR compression waves should at a minimum drop below this line.
- 60 mm—solid line indicates the maximum depth when the patient is on a firm surface. CPR compression waves should stay on or above this line.

Figure 89 **HeartStart Intrepid Compression Depth Guidelines**



Good compression depth is achieved when the peak, or minimum value, of the waveform appears between the lines. When pressure is not released between compressions, an asterisk (*) will annotate the baseline segment between compressions. This is also referred to as "leaning." If the signal from the CPR meter becomes invalid (e.g., the meter is disconnected), the waveform appears as a dashed line.

NOTES: If the Pads/CPR cable is not connected when you turn the Therapy knob to AED Mode, the message **Connect Pads Cable** is displayed.

Compression measurement value is printed in the annotation area of the ECG printed strip.

User Messages

Table 35 lists the user messages that may be issued during the use of Q-CPR.

Table 35 **CPR User Messages**

Condition	Displayed Text	HeartStart Intrepid Voice Prompt
Poor pads contact	Press pads firmly	"Press pads firmly to patient's bare skin."
Q-CPR meter not connected properly or pads not applied	Insert Connector, Apply Pads	"Insert connector firmly Apply Pads."

Feedback Prompts

Table 36 lists the feedback prompts that may be issued during the use of Q-CPR.

Table 36 **CPR Feedback Prompts**

CPR Component	Problem	HeartStart Intrepid Voice Prompt
Compression Depth	Compression rate too shallow	"Compress deeper"
Compression Rate	Compression rate too low	"Compress faster"
	Compression rate too fast	"Slow down compressions"
Residual Pressure on the Patient's Chest	Incomplete release of compression	"Release fully between compressions"
No Compression Activity	Compression inactivity or not detected	"No compressions detected"
Ventilation Rate	Too many ventilations	"Ventilate less often"

Adjusting CPR Feedback Volume

To adjust the volume of CPR feedback voice prompts in Manual or Pacer Mode:

1 Press the Smart Select knob.

2 Use the Smart Select knob to select **Volume**.

3 Use the Smart Select knob to select **Voice**.

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

A sample voice prompt is annunciated to confirm the selection.

NOTE: Not applicable unless Q-CPR is active.

To adjust the volume of CPR feedback voice prompts in AED Mode:

1 Press the Smart Select knob.

2 Select **Voice Volume**.

3 Select the desired voice value.

4 Choose the volume.

5 Press the Smart Select knob to confirm the selection.

If desired, CPR feedback voice prompts may also be muted. When muted, a **CPR Voice Muted** text message displays below the CPR progress bar. CPR inactivity time is indicated by an audible tone.

To mute the CPR feedback voice prompts:

1 Press the Smart Select knob.

2 Use the Smart Select knob to select **Mute CPR voice**.

To resume voice prompts set at the previously selected volume:

1 Press the Smart Select to confirm the prompt.

2 Press the Smart Select knob again to select **Activate CPR Voice**.

NOTE: Mute is only available when Q-CPR is active.

After Each Use

The Q-CPR meter 2 and vent membrane should be inspected after each use and cleaned if necessary. Remove the Q-CPR meter 2 Adhesive Pad from the Q-CPR meter 2 and follow the cleaning directions listed in the Maintenance chapter.

Data and Events Recorded

The HeartStart Intrepid records CPR data in Manual defibrillation and AED modes. It will start recording when a Q-CPR meter 2 is detected and stop when the meter is removed from the HeartStart Intrepid, or the HeartStart Intrepid leaves that mode (see Table 37). CPR-related data and events that are logged in the Event Data Record are shown in Table 31. These Q-CPR related data/events are not included in the Event Summary report printed by the HeartStart Intrepid.

Table 37 **Q-CPR Captured Data in Event Data Record**

Captured Data	Description
Compression Waveform	Waveform showing compression depth versus time.
Ventilation Waveform	Waveform showing change in chest impedance over time.
Compression event	Compression occurs
Ventilation event	Ventilation occurs
Compression rate	Rate of compressions
Compression depth	Depth of compression
Ventilation rate	Rate of ventilation
Level 2 feedback	Visual feedback (arrow) on the Q-CPR meter 2 is displayed if some aspect of the CPR performed does not conform to CPR guidelines.
Level 3 feedback	Verbal feedback announced if some aspect of the CPR performed continues to fall outside CPR guidelines after Level 2 feedback is given.

Research Storage Setting

When Research Storage is enabled, in addition to the data and events listed in Table 37 the following data is captured:

Table 38 **Q-CPR Research Storage Captured Data**

Captured Data	Description
Acceleration waveform	Q-CPR meter 2 acceleration data
Chest force waveform	Q-CPR meter 2 force data
PCI waveform	Patient Contact Impedance (PCI) from multifunction electrode pads

Q-CPR Alarms

Table 39 shows alarms associated with Q-CPR.

Table 39 **Q-CPR Alarms**

Alarm Message	Condition	Type of Alarm	Indication
CPR Meter Malfunction	Corrupt CPR meter	Low Priority Non-Latching Alarm	Alarm message with audio tone or prompt.
	CPR meter failure		
	CPR Meter Self-test failure		
CPR Meter Disconnected	The CPR meter is unplugged or the device cannot communicate with the CPR meter.		
CPR Meter Power Overload	A CPR meter power overload is detected.		
Noisy Vent Signal	Excessive noise on the impedance signal		
Incompatible CPR Meter	The CPR meter attached is not compatible with the current version of the device software.		
Pads Off	Pads are not making proper contact with the patient	Medium Priority prompt with audio	
Poor Pads Contact	Thoracic impedance measured is out of hte 25-200 Ohms. Therefore, the signal is not valid for ventialtion detection.		

Reviewing Q-CPR Data

To review Q-CPR data:

Copy the event data from the HeartStart Intrepid internal memory to a USB drive or transmit to a data management application.

Troubleshooting

If the HeartStart Intrepid does not operate as expected during Q-CPR, see "Troubleshooting" on page 229.

NOTES

14

Configuration

This chapter describes the configurable parameters of the HeartStart Intrepid and procedures for modifying configuration.

This chapter is divided into the following major sections:

Overview

Configuration settings allow you to customize the HeartStart Intrepid to meet your needs. Configuration is viewed and changed through the Configuration Menu. A password is required to change and save your device's configuration. See the insert that is shipped with your device to access the Configuration password.

NOTE: As you are making configuration choices, consider all the clinical environments the HeartStart Intrepid may be used in. Choices for one department might not be suitable for another department.

Entering Configuration Mode

Use Configuration Mode, to view, print, export/import configuration settings, change the date and time, and change and save configuration settings. New configuration settings are saved by pressing the **[Save]** soft key. Entering the Configuration password is required to save all changes except the date and time.

WARNING: Do not perform configuration activities while the HeartStart Intrepid is connected to a patient.

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. The prompt **Exit Clinical Mode** appears.

5 Select **Yes** to exit Clinical Mode and enter the Configuration screen.

6 Press the Smart Select knob to access the Configuration menu.

7 To confirm the selection, select **Yes** and press the Smart Select knob. If **No** is selected, the device returns to the original mode.

Once in Configuration Mode, press the **[Exit Config]** soft key to return to clinical operation.

Working in Configuration Mode

WARNING: Configuration affects the device behavior. It is your responsibility to keep the device configuration in accordance with your institution guidelines.

Setting Date and Time

Date and Time are the only configuration parameters you can change without entering the configuration password.

To modify Date and Time:

1 Once in Configuration Mode, press the Smart Select knob.

2 Select **Date/Time** and press the Smart Select knob. The Configuration Date/Time screen appears. See Figure 90.

Figure 90 **Date and Time Settings**

Configuration - Date/Time	
Time Zone	UTC-5 (82.5°W – 67.5°W)
Date/Time Format	Standard
Year	2019
Month	Jan
Day	12
Hour	23
Minute	34

3 Use the Smart Select knob to select the entry you want to change and press the Smart Select knob.

4 Adjust the value (see "Adjusting Numeric Values" on page 39). Press the Smart Select knob to accept your change.

5 Select another value for modification or press the **[Main Config]** soft key to save changes and return to the main Configuration screen.

NOTE: To adjust and save the format of the date and time, enter the Configuration Mode password. See "Date/Time Format Settings" on page 165.

Changing Settings

To change default settings in Configuration Mode:

1. Press the Smart Select knob and use it to select the menu item to be changed, then press the Smart Select knob.
2. Select the sub-menu item to be changed, then press the Smart Select knob.
3. Select a new value and press the Smart Select knob to select the highlighted choice.
4. Use the **[Next Screen]** and **[Previous Screen]** soft key to advance to other configuration menus and repeat steps 1 – 3 to make additional changes.

   Once the desired changes have been made, press the **[Main Config]** soft key to return to the Configuration Main screen.
5. Press the **[Save/Discard]** soft key to save the new configuration. The **Save/Discard All Changes?** dialog appears.
   - Press **Save** to save the changes.
   - Press **Discard** to discard the changes.
   - Press **Exit** to return to the Configuration Main screen.
6. If **Save** is selected, follow the prompt to enter the configuration password:
   a. Use the Smart Select knob to select the first digit and press the Smart Select knob.
   b. Use the Smart Select knob to enter the remaining digits of the password.
   c. When finished, select **OK** and press the Smart Select knob.
7. Press the **[Exit Config]** soft key to return to normal operating mode. If you made changes and press **[Exit Config]** before saving changes, then the **Configuration Not Saved - Exit Anyway?** dialog appears.
   - If you want to save the changes, select **No**, press the Smart Select knob, and return to Step 5 to save the configuration.
   - If you do not want to save the configuration, select **Yes** and press the Smart Select knob to exit Configuration Mode.

If you accidentally saved a wrong configuration, see "Restoring Default Settings" on page 165.

Change Password for Data Management

Reset the Data Management password from the **Change DataMgmnt Password** screen.

To reset the Data Management password:

1. In the New Password field: enter a new password.
2. In the Confirm Password field, re-enter the new password.

   If the fields don't match, the message "New password and confirmation password do not match" is displayed. If the length of the new password is fewer than required, the message "Password must be at least 8 characters" is displayed.
3. Enter the configuration password.
4. If the new and confirmed fields match, select the **[Save]** soft key to save the password.

NOTE: It is recommended to write down the Configuration Mode and Service Mode passwords and store them in a secure location. Refer to the insert that shipped with your device for default password information for Configuration and Data Management modes.

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. If you made any changes in configuration, make sure to either save or discard the changes.
3. Press the **[Export]** soft key.
   The HeartStart Intrepid copies the 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.

If you accidentally imported a wrong configuration, see "Restoring Default Settings" on page 165.

Importing Settings

To import configuration settings from a USB drive:

1. Enter the Configuration Mode, see "Entering Configuration Mode" on page 161.
2. Save the existing configuration to a USB drive as a back up.
3. Insert the USB drive with the saved settings to be imported.
4. Press the **[Import]** soft key. The HeartStart Intrepid copies the current configuration from the USB drive. The imported configuration does not become effective until saved.
5. Make any device-specific configuration changes.
6. Review the changed configuration before saving.
7. Press the **[Save/Discard]** soft key. The **Save/Discard All Changes?** dialog appears.
   - Press **Save** to save the changes.
   - Press **Discard** to discard the changes.
8. Press **Exit** to return to the Configuration Main screen.

NOTE: If your device attempts to import a configuration parameter not supported in your version or options set, you may see a ***xxx*** **Setting Not Supported** technical alarm.

Printing Configuration Settings

Make sure you have enough printer paper. Configuration printing takes paper and time.

To print the 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.

NOTE: To stop printing, press the Print button  .

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 165.

Restoring Default Settings

To return all configuration settings to those originally set during manufacturing:

1 Once in Configuration Mode, press the **[Factory Defaults]** soft key.

2 The **Reset Configuration to Factory Defaults?** dialog appears.

- If you want to reset the configuration, select **Yes** and press the Smart Select knob. You are prompted to enter the configuration password, see Changing Settings, Step 6 on page 163.
- If you do not want to reset the configuration, select **No** and press the Smart Select knob to return to Configuration main screen.

Configurable Parameters

The following tables list configurable parameters for the HeartStart Intrepid. Default settings are in bold type. Values are adjusted in increments of 1 unless otherwise stated. Use the User Setting column to record your choice.

Date and Time Settings

You can change these settings without entering the configuration password.

Table 40 **Configuration – Date/Time**

Parameter	Description	Setting Choices	User Setting
Time Zone	Defines the time zone.	**UTC (7.5°W – 7.5°E)** through **UTC 12(172.5°E – 172.5°W)** and **UTC-1 (22.5°W – 7.5°W)** through **UTC-11 (172.5°W – 157.5°W)**	
Date/Time Format	Defines whether Daylight Saving Time is used.	**Standard**, DST	
Default values are the current date, time, and time format.			

Date/Time Format Settings

Saving changes to date and time settings requires the Configuration password.

Daylight Saving Time (DST) 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.

Use the ◀ and ▶ soft keys to navigate between: **DST Start Setting** and **DST End Setting**.

Table 41 **Configuration – Date/Time Format**

Parameter	Description	Setting Choices	User Setting
Time Format	Defines the time format.	12-Hour, **24-Hour**	
Date Format	Defines the date format.	**DD Mon YYYY**, YYYY-MM-DD (D = Day, Mon or M =Month, Y=Year)	
Auto Daylight Saving Time (DST)	Defines whether or not your device auto corrects for DST.	Yes, **No**	

Table 41 **Configuration – Date/Time Format** ***(Continued)***

Parameter	Description	Setting Choices		User Setting
DST Offset	Defines the hour and minute time shift during DST.	±2 hours, **+1 hour** adjusted in 30 minutes increments		
		DST Start Setting	**DST End Setting**	
Month	The month DST begins/ends.	Any of the 12 months, **Mar**	Any of the 12 months, **Nov**	
Week of Month	The week DST begins/ends.	**First**, **Second**, Third, Fourth, Last	**First**, Second, Third, Fourth, Last	
Day of Week	The day DST begins/ends.	**Sun**, Mon, Tues, Wed, Thu, Fri, Sat		
Hour	The hour DST begins/end.	00-23 (if 24-hour format); 01-12 (if 12-hour format), **02**		
Minute	The minute DST begins/end.	00-59, **00**		
am/pm	Shown if the 12-hour format is chosen.	**am**, pm		

General Settings

Your General configuration settings customize your HeartStart Intrepid to your healthcare institution environment.

Table 42 **Configuration – General**

Parameter	Description	Setting Choices	User Setting
Institution Name	Enters your organization's name in the 12-Lead ECG Report.	up to 32 characters, **blank**	
Facility ID	Enters the Facility ID in the 12-Lead ECG Report.	up to 5 alpha-numeric characters including period, slash, hyphen and space, **blank**	
Department ID	Enters the Department ID in the 12-Lead ECG Report.	up to 10 alpha-numeric characters including period, slash, hyphen and space, **blank**	
Device ID	Enters a device identification number.	up to 4 digits, **blank**	
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 *	

Table 42 **Configuration – General *(Continued)***

Parameter	Description	Setting Choices	User Setting
Minimum Alarm Volume	Defines the minimum audible alarm level available within use.	**Very Soft**, Soft, Medium, Loud, Very Loud	
Voice Volume	Defines voice prompt levels.	Very Soft, Soft, **Medium**, Loud, Very Loud	
QRS Volume	Defines the volume level of audible beeps with each QRS complex detected.	Off, **Very Soft**, Soft, Medium, Loud, Very Loud	
Units Display	Defines if parameter values are displayed with or without the corresponding measurement units.	**On**, Off	
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**	
Data Management Password Required	When on, requires a password to print, export, export all, transmit event, or remove all patient data	On, **Off**	
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.	**No**, Yes	
Alarm Audio Off Reminder	Reminder every three minutes to turn the alarm audio off when alarms are suspended indefinitely.	On, **Off**	

*The list of available alarm volumes is limited so that no choice less than the current setting for Minimum Alarm Volume.

Monitoring Settings

The monitoring settings customize your HeartStart Intrepid to your institution's clinical monitoring guidelines. Use the ◀ and ▶ soft keys to navigate between: **Adult,** and **Infant/Child**. Table 43 lists the Heart Rate and ECG monitoring settings.

Table 43 **Configuration – HR/ECG**

Parameter	Description		Setting Choices		User Setting
Color	Selects the HR/ECG color.		Red, Yellow, Blue, **Green,** Cyan, Magenta, White		
Auto-Gain	Determines whether ECG size is automatically adjusted to the maximum wave size without clipping the wave sector*. If auto-gain is off, the gain is set to x1 (10 mm/mV).		On, Off		
AC Line Filter	Selects the setting used to filter out AC line noise from ECG data. Adjust setting to the power frequency of your country.		50 Hz, 60 Hz		
ECG Bandwidth For Display	Selects the display filter frequency for 3/5/10-Lead ECG cable.		**0.15-40** Hz, 0.05-40 Hz, 2-20 Hz		
ECG Bandwidth For Printer	Selects the display filter frequency for the attached therapy cable or 3/5/10-Lead ECG cable.		**0.05-150** Hz Diagnostic, 0.05-40 Hz, 0.15-40 Hz, 2-20 Hz		
ECG Electrode Labels	Selects the electrode label format. AAMI: RA, LA, LL, RL, V (V1-V6); IEC: R, L, F, N, C (C1-C6).		AAMI, IEC		
HR/Arrhythmia Alarms	Selects if HR/Arrhythmia alarms are on or off at start up.		**On**, Off		
Display Rhythm Status	Determines if the rhythm status is seen on the display with the primary ECG wave in all clinical modes (except AED).		**On**, Off		
			Adult	Infant/Child	
HR/Pulse High Limit	Selects the default High / Low alarm limit for the HR derived from the ECG and the pulse derived from SpO_2.	adjusted in increments of 5	35-300, **120** bpm	35-300, **160** bpm	
HR/Pulse Low Limit			30-295, **50** bpm	30-295, **80** bpm	
VTACH HR Limit	Selects the VTach heart rate limit.		95-150, **100** bpm	95-150, **120** bpm	
VTACH Run Limit	Selects the VTach run limit.		3-20, **5**		
PVC Rate Limit	Selects the PVC limit.		1-99, **10**	1-99, **5**	

*Adjusting the ECG wave size on the display does not affect the ECG signal that is used for arrhythmia analysis.

Table 44 lists the Noninvasive Blood Pressure (NBP) monitoring settings.

Table 44 **Configuration – NBP**

Parameter	Description	Setting Choices		User Setting
Color	Selects the NBP color.	Red, Yellow, Blue, Green, Cyan, Magenta, **White**		
Unit	Selects the measurements units.	**mmHg**, kPa		
NBP 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		
NBP Alarms	Selects if NBP alarms are on or off at start up.	**On**, Off		
		Adult	Infant/Child	
Systolic High Limit	Selects the High / Low limit alarm value when systolic / diastolic / mean is the selected alarm source. Adjusted in increments of **5 mmHg / 0.5 kPa**	35 – 270, **160 mmHg**; 4.5 – 36.0, **21.0 kPa**	35 – 130, **120 mmHg**; 4.5 – 17, **16.0 kPa**	
Systolic Low Limit		30 – 265, **90 mmHg**; 4.0 – 35.0, **12.0 kPa**	30 – 125, **70 mmHg**; 4.0 – 16.5, **9.0 kPa**	
Diastolic High Limit		15 – 245, **90 mmHg**; 2.0 – 32.5, **12.0 kPa**	15 – 100, **70 mmHg**; 2.0 – 13.0, **9.0 kPa**	
Diastolic Low Limit		10 – 240, **50 mmHg**; 1.5 – 32.0, **7.0 kPa**	10 – 95, **40 mmHg**; 1.5 – 12.5, **5.0 kPa**	
Mean High Limit		25 – 255, **110 mmHg**; 3.5 – 34, **15.0 kPa**	25 – 120, **90 mmHg**; 3.5 – 16.0, **12.0 kPa**	
Mean Low Limit		20 – 250, **60 mmHg**; 3.0 – 33.0, **8.0 kPa**	20 – 115, **50 mmHg**; 3.0 – 15.0, **7.0 kPa**	

Table 45 lists the Pulse Oximetry (SpO_2) monitoring settings.

Table 45 **Configuration – SpO_2**

Parameter	Description	Setting Choices		User Setting
Color	Selects the SpO_2 color.	Red, Yellow, Blue, Green, **Cyan**, Magenta, White		
SpO2 Alarms	Selects if SpO_2 alarms are on or off at start up.	**On**, Off		
		Adult	Infant/Child	
SpO2 High Limit	Selects the High alarm limit value.	51 – 100, **100%**	51 – 100, **100%**	
SpO2 Low Limit	Selects the Low alarm limit value.	50 – 99, **90%**	50 – 99, **90%**	
SpO2 Desat Limit	Selects the extreme low limit alarm value.	50 – (SpO2 Low Limit), **80%**	30 – (SpO2 Low Limit), **80%**	

Table 46 lists the End-tidal Carbon Dioxide ($EtCO_2$) monitoring settings.

Table 46 **Configuration – EtCO2 / AwRR**

Parameter	Description	Setting Choices		User Setting
Color	Selects the $EtCO_2$ color.	Red, **Yellow**, Blue, Green, Cyan, Magenta, White		
Unit	Selects the measurements units.	**mmHg**, kPa		
EtCO2 Alarms	Selects if $EtCO_2$ alarms are on or off at startup.	**On**, Off		
AwRR Alarms	Selects if AwRR alarms are on or off at startup.	**On**, Off		
		Adult	Infant/Child	
EtCO2 High Limit	Selects the $EtCO_2$ High alarm limit value.	20 – 99, **50** mmHg 2.7 – 13.2 **kPa**, **6.7** kPa	20 – 99, **50** mmHg 2.7 – 13.2 **kPa**, **6.7** kPa	
EtCO2 Low Limit	Selects the $EtCO_2$ Low alarm limit value.	10 – 95, **30** mmHg 1.3 – 12.7 **kPa**, **4.0** kPa	10 – 95, **30** mmHg 1.3 – 12.7 **kPa**, **4.0** kPa	
AwRR High Limit	Selects the AwRR High alarm limit value.	10 – 100, **30** rpm	10 – 100, **60** rpm	
AwRR Low Limit	Selects the AwRR Low alarm limit value.	0 – 99, **8** rpm	0 – 99, **12** rpm	
Apnea Time	The length of time without respiration required to trigger an apnea alarm.	10 – 40, **20** sec	10 – 40, **20** sec	

If the HeartStart Intrepid has the SpO_2, $EtCO_2$, and NBP options installed, TBI settings shown in Table 47 "Configuration – TBI Advisory" are available in the Configuration menu. These settings are blank by default, and must be configured to enable the TBI function.

Table 47 **Configuration – TBI Advisory**

Parameter	SPO_2 Lower Limit	SBP Lower Limit	SBP Upper Limit	$EtCO_2$ Lower Limit	$EtCO_2$ Upper Limit
Infant (<1 year)	50-99	30-125mmHg	30-130 mmHg	10-95 mmHg	20-99 mmHg
Child>1 year to puberty [15 years])	50-99	30-125mmHg	30-130 mmHg	10-95 mmHg	20-99 mmHg
Adult (>15 years)	50-99	30-265mmHg	35-270mmHg	10-95 mmHg	20-99 mmHg

Table 48 lists the Temperature monitoring settings.

Table 48 **Configuration – Temperature**

Parameter	Description	Setting Choices		User Setting
Color	Selects the Temperature color.	Red, Yellow, Blue, **Green**, Cyan, Magenta, White		
Unit	Selects the measurements units.	**°C,** °F		
Temperature Alarms	Selects if Temperature alarms are on or off at start up.	**On**, Off		
		Adult	Infant/Child	
Temp High Limit	Selects the Temperature High alarm limit value.	0.1 – 45.0°C, **39.0°C** 32.2 – 113°F, **102.2°F**	0.1 – 45.0°C, **39.0°C** 32.2 – 113°F, **102.2°F**	
Temp Low Limit	Selects the Temperature Low alarm limit value.	0.0 – 44.9°C, **36.0°C** 32.0 – 112.8°F, **96.8°F**	0.0 – 44.9°C, **36.0°C** 32.0 – 112.8°F, **96.8°F**	

Therapy Delivery Settings

The therapy delivery settings customize the way your HeartStart Intrepid delivers therapy. Table 49 lists the Manual Defibrillation and Sync mode settings.

Table 49 **Configuration – Defib/Sync**

Parameter	Description	Setting Choices	User Setting
1-10 Joules Default	Defines the device's low-energy setting.	1, 2, 3, 4, 5, **6,** 7, 8, 9, 10 Joules	
Remain In Sync Mode After Shock	Defines if the device remains in Sync Mode after a delivered shock.	**Yes**, No	
Time To Auto Disarm	Defines the amount of time the device remains charged if a shock has not been delivered. Applies to Manual Defibrillation and Sync modes only.	**30,** 60, 90 sec	
Shock Series	Defines the number of shocks in a shock series.	1, 2, 3, 4	
Shock Protocol Timeout	Defines the time interval used to determine if a shock should be counted as part of a shock series.	**1 min,** 2 min, Infinite	

Table 50 lists the AED mode settings.

Table 50 **Configuration – AED**

Parameter	Description	Setting Choices	User Setting
Voice Prompts	Defines the level of detail in AED Mode voice prompts.	Long, **Short**	
NSA Action	Defines what the device does after a **No Shock Advised** (NSA) decision. **NSA Monitor** allows you to initiate background shock advisory analysis; **NSA CPR** prompts you to initiate a CPR Pause period, if needed.	NSA Monitor, **NSA CPR**	
NSA Monitor Prompt Interval	Defines the interval for patient care prompts in **NSA Monitor** following an NSA decision.	**1,** 2, 3, **Infinite** (no prompts at all) **min**	
SpO2 Monitoring	Defines whether SpO_2 monitoring is available in AED Mode.	Enabled, **Disabled**	
EtCO2 Monitoring	Defines whether $EtCO_2$ monitoring is available in AED Mode.	Enabled, **Disabled**	
Adult 1st Shock Energy Dose	Defines the energy dose for the first shock in a series in AED Mode.	**150,** 170, 200	
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 200 J, **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 200 J, **150**	
Alarms Off	Neither visual nor audio indications are enabled. **I**n clinical modes, all alarm condition events that generate alarm signals shall be stored in the current Event record.	**Enabled**, Disabled	

Table 51 lists the Pacer settings.

Table 51 **Configuration – Pacer**

Parameter	Description	Setting Choices	User Setting
Default Pacer Rate	Defines the delivery rate of paced pulses. Adjusted in increments of 10.	30-180, **70** ppm	
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 **Pace Pulse Duration** is 20 msec: 10-200, **30 mA** If **Pace Pulse Duration** is 40 msec: 10-140, **30 mA**	

Table 52 lists the CPR settings. When the Q-CPR option is not enabled, then the only configurable item is **CPR Time**.

Table 52 **Configuration – CPR**

Parameter	Description	Setting Choices	User Setting
Q-CPR	Turns the Q-CPR option On or Off.	**On**, Off	
Q-CPR Feedback	Turns the Q-CPR feedback On or Off.	**On**, Off	
Q-CPR Voice	Turns the Q-CPR voice prompts.	**Audible**, Muted	
Compression-Only CPR	When enabled, turns off prompts for ventilation.	Enabled, **Disabled**	
Compression Color	Defines the color of the Compression Counter.	Red, Yellow, Blue, Green, **Cyan**, Magenta, White	
Ventilation Color	Defines the color of the Ventilation Counter.	Red, Yellow, Blue, Green, **Cyan**, Magenta, White	
Research Storage	Defines whether the device stores the force, acceleration, and PCI wave data.	On, **Off**	
CPR Time	Defines the length of the CPR administration interval.	1, 1.5, **2**, 2.5, 3 min	

Display Settings

The display settings customize the data that is displayed on the HeartStart Intrepid screen.

Table 53 **Configuration – Waves Settings**

Parameter	Description	Setting Choices	User Setting
Wave 1	Selects the waveform displayed in the corresponding Wave Sector. NOTE: The default for Wave Sector 1 cannot be set to **Paddles**.	Pads, I, **II,** III, aVR, aVL, aVF, V	
Wave 2		Pads/Paddles, I, II, III, aVR, aVL, aVF, V, **Cascade,** Annotated ECG, None	
Wave 3		Pads/Paddles, I, II, III, aVR, aVL, aVF, V, **CO2** (if the $EtCO_2$ option is installed), None	
Wave 4		Pads/Paddles, I, II, III, aVR, aVL, aVF, V, **Pleth** (if the SpO_2 option is installed), None	

Table 54 lists the Mark Events settings used to annotate the ECG strip and Event Summary. There is a 32-character limit when defining events.

Table 54 **Configuration – Mark Events**

Parameter	Description	Default Settings	User Setting
Mark Event 1:	Defines the corresponding event menu choice.	IV Access	
Mark Event 2:		Epinephrine	
Mark Event 3:		Amiodarone	
Mark Event 4:		Atropine	
Mark Event 5:		Morphine	
Mark Event 6:		Nitroglycerin	
Mark Event 7:		Aspirin	
Mark Event 8:		Other	

Table 55 lists the Printing settings used to define the information printed at certain moments and events.

Table 55 **Configuration – Printing**

Parameter	Description	Setting Choices	User Setting
Print On Alarm	Defines the type of alarms that automatically print a strip.	High/Medium, **High**, None	
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 Events button is pressed.	**Yes**, No	
Printer Delay	Defines whether printed strips include an additional 10 seconds of information which occurred just prior to initiating the print.	0 sec, **10 sec**	
Event Summary Report	Defines the information contained in an Event Summary. Short includes a log of events and vitals; Long adds waveforms.	Short, **Long**	
Auto Print OpCheck Report	Defines if an OpCheck report is automatically printed upon the completion of an OpCheck.	**Yes**, No	
Weekly Tests in AutoTest Summary	Provides a numerical value indicating the number of weekly tests in the AutoTest summary.	1-53, **53**	
Waveform Print Speed	The time scale at which the printer produces waveform printouts +/- 5%. Once configured, the print speed is applicable for any print mode.	**25 mm/sec**, 50 mm/sec	

Data Management Settings

The data management settings customize the way your HeartStart Intrepid communicates with other healthcare devices and networks.

Table 56 lists the 12-Lead settings used to control the 12-Lead reports transmission and display.

Table 56 **Configuration – 12-Lead**

Parameter	Description	Setting Choices	User Setting
Analysis	Defines the analysis information included on the 12-Lead Report. None: prints waveforms, Event/patient ID, date and time. Measurements Only: adds HR, interval and axis measurements Standard adds severity, interpretive statements and reasons. Standard: prints waveform, ID, basic measurements and standard diagnostic statements.	None, Measurements Only, **Standard**	
Critical Value Statements	Enables or disables the printing and exporting of Critical Value Statements.	**Yes**, No	
ECG Bandwidth for 12-Lead Display	Defines the default ECG bandwidth for the 12-Lead display.	0.15-40 Hz, **0.05-40 Hz,** 0.05-150 Hz	
ECG Bandwidth for 12-Lead Report	Defines the default ECG bandwidth for printed and stored 12-Lead Reports.	**Same as Display**, 0.05-150 Hz	
ECG Report	Specifies how the 12-Lead ECG segments are displayed for the 12-Lead Report. The segments are displayed in three rows, four columns for each row. Sequential reports: Each column represents a sequential 2.5-second period of time for a total of 10 seconds. Simultaneous reports: Each column represents the same 2.5-seconds of time.	**Sequential, Simultaneous**	
Number of Automatic Printouts	Selects the number of 12-Lead ECG Reports printed at the end of analysis.	0, **1**, 2	
Printer Format	Selects the number of rhythm strips to be printed with the 12-Lead Report.	3x4, **3x4 1R**, 3x4 3R	
Rhythm Strip #1	Selects the first rhythm strip printed in the 3x4 1R or 3x4 3R format.	I, **II**, III, aVR, aVL, aVF, Vk1, V2, V3, V4, V5, V6	

Table 56 **Configuration – 12-Lead *(Continued)***

Parameter	Description	Setting Choices	User Setting
Rhythm Strip #2	Selects the second rhythm strip printed for reports in the 3x4 3R format.	I, II, III, aVR, aVL, **aVF**, V1, V2, V3, V4, V5, V6	
Rhythm Strip #3	Selects the third rhythm strip printed for reports in the 3x4 3R format.	I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, **V5**, V6	
DXL Sensitivity	**Standard**: standard DXL algorithm AMI sensitivity setting. **EMS**: decreases AMI sensitivity in the presence of other possible causes of ST elevation See "Configuring the DXL Algorithm" on page 127.	**Standard**, **EMS**	

Wi-Fi Configuration

Table 57 lists Wi-Fi parameters. Security can be one of two groups: personal (used in small businesses and homes) or enterprise (used in large businesses). Available parameters depend on the security type selected. Not all settings in Table 57 are required. Check with your Wi-Fi network administrator.

Table 57 **Configuration – Wi-Fi**

Parameter	Description	Setting Choices	User Settings
SSID	Network name (example: WLAN-ABC)	32 characters, **blank**	
Security	Defines the method of security to protect the wireless connection to the Wi-Fi access point.	**blank** Personal (see Note 1 for available parameters): Off, WEP, WPA_TKIP_PSK, WPA_AES_PSK, WPA2_TKIP_PSK, WPA2_AES_PSK. Enterprise (see Note 2 for available parameters): WPA_TKIP_ENT, WPA_AES_ENT, WPA2_TKIP_ENT, WPA2_AES_ENT	
Key Index	Key index available in WEP	**1**, 2, 3, 4	
EAP Type	Extensible Authentication Protocol type. Available in enterprise security.	PEAP-MSCHAP,EAP-TTLS,EAP-TLS	
Key	Pre-Shared key. Available in personal security.	64 characters	

Table 57 **Configuration – Wi-Fi**

Parameter	Description	Setting Choices	User Settings
UserName	User name for authentication. Available with EAP types PEAP-MSCHAP, EAP-TTLS, EAP-TLS	64 characters	
Password	Password for authentication. Available with EAP types PEAP-MSCHAP, EAP-TTLS	64 characters	
Client Certificate	User certificate to authenticate client in server side. Available with EAP type EAP-TLS	Imported in certificate management page	
Client Certificate Password	The password for the user certificate file. Available with EAP type EAP-TLS	64 characters	
CA Certificate	Authenticates radius server in client side. Available with EAP types PEAP-MSCHAP, EAP-TTLS, EAP-TLS	Imported in certificate management page	
Domain	Reserved		

NOTE 1: Personal Security types available parameters:

OFF: None

WEP: Key Index, Key

WPA_TKIP_PSK: Key

WPA_AES_PSK: Key

WPA2_ TKIP_PSK: Key

NOTE 2: Enterprise Security types available parameters:

All four security types—WPA_TKIP_ENT, WPA_AES_ENT, WPA2_ TKIP_ ENT, WPA2_AES_ ENT—require the choice of an EAP type (PEAP-MSCHAP, EAP-TTLS, EAP-TLS).

The EAP types available are

- PEAP-MSCHAP: UserName, Password, CA Certificate
- EAP-TTLS (): UserName, Password, CA Certificate
- EAP-TTLS: UserName, Client Certificate, Client Certificate Password, CA Certificate

Contact your mobile network provider to obtain the correct Access Point Name (APN) for the APN field in Table 58.

Cellular Configuration

Contact your cellular mobile network provider to obtain the correct Access Point Name (APN) for the APN field in Table 58.

Table 58 **Configuration – Cellular**

Parameter	Description	Setting Choices	User Settings
Connection name	User-defined string to identify the mobile network operator (e.g., T-Mobile, Vodafone, Orange)	blank	
Login Username	User name for the authentication phase.	32 characters	
Login Password	Password for the authentication phase.	64 characters	
APN string	Access Point Name, such as apn.provider.com	32 characters	

Certificate Management Configuration

Wi-Fi Client and Wi-Fi CA certificates are used with the Wi-Fi Enterprise Security settings in Table 59. The certificates can be obtained from the Wi-Fi network administrator and can be imported using a USB drive.

The Import Server CA Certificate field is used to import a certificate used to authenticate the connection to the Philips IntelliSpace Connect server. This field is pre-configured at the factory. If required, it can be imported to the Intrepid device from a USB drive. For details on this, contact your Philips representative. Certificates that have been imported are displayed in Table 59 "Configuration – Certificate Management".

When importing a certificate, the HeartStart Intrepid displays the available certificates on the USB drive in the bottom right of the display. Select a certificate with the Smart Select knob and then use the Import soft key to import to the HeartStart Intrepid internal memory. Certificates can be deleted by selecting the certificate name and selecting the **[Delete]** soft key.

Table 59 **Configuration – Certificate Management**

Parameter	Description	Setting Choices	User Settings
Available Wi-Fi CA Certificate	Current available CA certificate list.	Installed Wi-Fi modules.	
Available Wi-Fi Client Certificate	Current available Client certificate list.	Installed Wi-Fi modules.	
Import Wi-Fi CA Certificate	Import a CA certificate to Wi-Fi module.	File with a suffix ".cer" from an installed USB drive's root directory.	
Import Wi-Fi Client Certificate	Import a Client certificate to Wi-Fi module.	File with a suffix ".pfx" from an installed USB drive's root directory.	
Import Server CA Certificate	Import a Server CA certificate to device.	USB drive with the fixed name IntrepidRootCA.pem or IntrepidRootCA.cer	

Communication Configuration

Table 60 lists the communication destinations for the 12-Lead reports transmissions that are sent to the Philips IntelliSpace Connect server.

Table 60 **Configuration – Communication**

Parameter	Description	Setting Choices	User Setting
Reference ID	Free field that can be used to identify the HeartStart Intrepid device that is sending the information.	up to 32 characters, **blank**	
Cloud URL	Contains the URL of the Philips IntelliSpace Connect server. The URL varies depending on your country and location. Obtain the correct URL from your Philips representative.	up to 32 characters, **blank**	
Account ID	Contains the six-character Philips IntelliSpace Connect account ID.		
Destination 1–32	Contains the name of the hospital or medical facility that has access to the data that is sent from the HeartStart Intrepid. The destination must be enabled in order for the HeartStart Intrepid to send data to that location. The Destination field is not required. If no destination is specified, the data is available in Philips IntelliSpace Connect to only the HeartStart Intrepid device owner.	10 alpha-numeric characters including period, slash, hyphen and space, Enabled, Disabled	

Table 61 **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 configuration password, required to set the data management password	at least eight characters, **blank**

NOTE: It is recommended to write down the Data Management password and store it in a secure location. Refer to the insert that shipped with your device for default password information for Configuration and Service modes.

NOTES

15

Data Management

This chapter describes the data management features of the HeartStart Intrepid, including transmitting and printing data, Trends Reports (available in Monitor Mode), Event Summary, and printing functionality.

WARNING: Do not enter Data Management Mode while monitoring a patient.

This chapter is divided into the following sections:

Overview

The HeartStart Intrepid automatically generates an Event Summary for each patient event. Each Event Summary is assigned a unique event identification number, is date/time stamped and stored in the device's internal memory. Data related to the current event is available for viewing, reporting, transmitting, and printing. Vital sign parameters are part of the Event Summary but are also available in the Trends Report (see "Trending").

When the internal memory is full, each additional summary causes one or more of the oldest event summaries to be overwritten.

Event Summaries stored in internal memory can be:

- Printed
- Transmitted
- Exported to a USB flash drive in Data Management Mode for transfer to a data management application.

Trending

In Monitor Mode the HeartStart Intrepid provides the ability to view and print numeric vital signs trending data for the current event. Trending data are automatically acquired if parameters are on.

When viewing trending data, the Trending Report is displayed in the HeartStart Intrepid's lower two wave sectors. Trend data can be displayed at selected intervals for up to 8 hours of monitoring. The trend interval can be set to 1, 5, 10, 15, 30 or 60 minutes.

Trending data displayed for parameters continuously measured (heart rate, SpO_2, $EtCO_2$, pulse, and Temperature) 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 the HeartStart Intrepid 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 Trending Report takes over the bottom two wave sectors. See Figure 91.

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

Figure 91 **Trending Report**

Jan 25	11:55	11:50	11:45	11:40	11:35	11:30	11:25	11:20	11:15	11:10	11:05
HR	99	111	118	103	109	98	99	111	118	103	109
SpO2	97	98	99	100	97	98	99	100	97	98	99
Pulse	94	106	113	98	104	93	94	106	113	98	104
EtCO2	-?-	-?-	-?-	-?-	-?-	-?-	-?-	-?-	-?-	-?-	-?-
AwRR	15	16	17	18	15	16	17	18	15	16	17
NBPs	123			132			128			124	
NBPd	80			84			83			79	
NBPm	96			98			97			96	
	11:53			11:38^			11:22			11:07	
Temp	98.7	98.6	98.7	98.6	98.4	98.7	98.5	98.4	98.5	98.2	98.3

Displayed Data

- When trending is initially displayed, the most recent trending data appear in the far right column.
- The display automatically updates as new data become available, with the newest data appearing in the far right column of the display and older data moving over to the left. If the display is full, the oldest displayed data is removed.
- If scrolling horizontally to view older data, the HeartStart Intrepid 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 the device has the SpO_2 Option and values for SpO_2 and Pulse are available, they are listed second and third in the Trend Report.
  - If the device has the $EtCO_2$ option and values are available, the $EtCO_2$ and AwRR values are listed next.
  - If the device has the NBP option and values for NBP are available, they are listed after AwRR in the Trends Report.
  - If the device has the Temperature option and Temperature values are available, they are listed at the bottom of the Trends Report.

- If there is more than one valid NBP measurement during the interval, then the systolic, diastolic, mean, and time stamp of the latest valid measurement is displayed with a "^".
- For continuous trend data (HR, $EtCO_2$, SpO_2, Temperature, and pulse) the displayed value 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 Trend table and report.

Setting Trend Intervals

Trending data can be shown at selected intervals for up to the last 8 hours of monitoring. Adjust the display's time interval for the current incident to 1, 5, 10, 15, 30 or 60 minutes. The default is the previously selected interval or, if this is the first time, 5 minutes.

To adjust the Trend Interval:

1. Confirm there is a Trends Report on the HeartStart Intrepid 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 the Trending Report

Use the horizontal scroll soft keys to scroll left and right (backward and forward in time) in the Trending 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: If there is an active menu on the device screen, exit the menu before trying to scroll up or down in the Trends Report.

Event Summary

A new Event Summary is initiated the first time one of the following occurs after the device is powered on:

- The arrival of a valid ECG signal either through electrodes or pads/paddles.
- The arrival of valid SpO_2 data.
- The arrival of valid CO_2 data
- The arrival of valid NBP data.
- The arrival of a valid CPR compression.
- The Charge button is pressed.
- The Mark Events button is pressed.

An Event Summary ends when the device is turned off or enters a non-clinical mode.

NOTE: There is an 8-hour data limit per incident for an Event Summary. When the 8-hour limit is reached, the HeartStart Intrepid stops recording and a message is displayed on the HeartStart Intrepid. The number of Event Summaries that can be stored is related to the duration of each individual Event Summary. For example, the HeartStart Intrepid can store approximately 50 Event Summaries of approximately 30 minutes in length or 5 Event Summaries of approximately 8 hours in length.

Event Summary Data Collected

Patient data collected, if available, includes:

- Two ECG waveforms with beat labels
- One pleth waveform
- One CO_2 waveform
- Patient event information including:
  - Patient name, sex, category, ID
  - Parameter information / Trends data
  - Physiological alarms and alarm limits
  - Defibrillation and pacing events
  - Mark events
- Technical/device event information including:
  - Power on/off
  - Technical alarms
  - Initial mode and mode changes
  - Initial battery status and subsequent changes
  - Print Strip
- Research data, including waves (AED Mode only) and shock / no shock decisions

The HeartStart Intrepid can be configured to save short or long Event Summaries. Short Event Summaries include all the above information except waveforms. Long Event Summaries contain all the above information.

Printing an Event Summary

Print an Event Summary Report during a patient event or from Data Management Mode after the event has concluded. See "Printing While in Data Management Mode" on page 197f.

NOTE: If an Event Summary stops printing because the paper runs out, the summary resumes printing if a new roll of paper is installed within 3.5 minutes.

Three waves can be included when printing an Event Summary:

- First printed wave is always the primary ECG
- Second and third printed waves are whatever the parameter is being displayed in Wave 2 and Wave 3 on the device screen.

Events Stored in an Event Summary

Events and wave segments can be stored in an Event Summary. Tables 62 – 75 below list events and related information stored in an Event Summary. Not all events listed might be possible, based on the device's configuration. Text in parentheses is replaced by an appropriate value that includes the parameter's unit of measurement.

To have waves stored in the Event Summary the HeartStart Intrepid must be configured for long Event Summaries. See Table 55 on page 174. Segments include a header, waveform and events.

NOTE: 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.

To send Event Summaries from Data Management Mode, post-event:

1. Press the Smart Select knob
2. From the menu, choose **Other**, then choose **Data Management**.
3. Choose **Yes** to exit Clinical Mode.
   The Data Management—Internal Memory screen displays with a list of events stored in Data Management internal memory.

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

4. From the Data Management—Internal Memory screen use the Smart Select knob to scroll to the event to be sent. Then press the Smart Select knob.
5. From the pop-up menu, select **Transmit Event**. Then press the Smart Select knob to begin transmission.
   When sending is finished, the message **Transmit Succeeded** is displayed.
6. If data fails to send, an alert message **Transmit Failed** is displayed.
7. Press **OK** to close the window.

Power-Related Events

Table 62 **Power-Related Event Information**

Logged Event	Logged when …
Device On	… device first turns on.
Continued Use	… device is turned on after being turned off for less than 10 seconds.
Device Off	… the Therapy Knob is turned to the Off position.
Autotest Failure	… a critical device failure has been reported.
!!!Equipment Disabled: System Failure	… any out-of-range voltages are detected.
!!System Failure. Service Required	… the device determines that one or more subsystems is not functioning properly.
!!!Autotest Error. Run Op Check	… the device cannot determine when the last Autotest was run.
Autotest Overdue: Run OpCheck	… power was not available (for a week or longer) to run a scheduled Autotest.
Power Test Failure	… during RFU testing if the battery cannot sufficiently charge the device.

Patient and Mode Change Events

Table 63 **Patient, Mode and Energy Position Information**

Logged Event	Logged when …
Adult or Infant/Child	… patient category is set or changed.
Paced, Non-Paced, Pacing Status Unknown	… internal paced status is set or changed.

Table 63 **Patient, Mode and Energy Position Information *(Continued)***

Logged Event	Logged when …
AED Mode	… at the start of an event and when mode or selected energy changes.
Monitor Mode	
Pacer Mode	
Defib Mode	
Sync activated	
Defib energy in joules J)	
Exit Clinical Mode	… exiting a clinical mode.

Battery Status Change Events

Table 64 **Battery Status Information**

Logged Event	Logged when …
Low Battery	… battery is low.
Pacing on Low Battery	… you are pacing and the battery is low.
Shutting Down in 1 min	… imminent shutdown warning is issued.
Shutting Down Now	… shutdown warning is issued.
Battery Charge Good	… the battery charge level is good.
Battery Not Present	… the battery is not present.
Battery Communication Failure	… communication with the battery has failed.
Replace Battery	… the battery has reached its end of life.

Pads / Paddles / Leads Events

Table 65 **Pads / Paddles / Leads and Vitals Information**

Logged Event	Logged when …
Pads On	… pads are applied to the patient.
Pads Off	… after a Pads On event if the multifunction electrode pads are removed from the patient or the Therapy cable is disconnected.
Pads Shorted	… a pad impedance is low.
Pads Marginal	… poor pads contact, high pad impedance.
External Paddles On	… external paddles make contact with the patient.
External Paddles Off	… after External Paddles On if paddles lose contact with the patient.
Internal Paddles On	… internal paddles make contact with the patient.
Internal Paddles Off	… after Internal Paddles On if paddles lose contact with the patient.

Table 65 **Pads / Paddles / Leads and Vitals Information *(Continued)***

Logged Event	Logged when …
Leads On	… monitoring electrodes for primary ECG are attached to the patient.
Leads Off	… after Leads On if a monitoring electrode for the primary wave loses contact with the patient.
HR (value), SpO2 (value), EtCO2 (value), AwRR (value), Pulse (value), NBP (value)	… a measurement is recorded.

HR / ECG and Pacing Events

Table 66 **HR / ECG Event Information**

Logged Event	Logged when …
***Asystole	… a high priority latching physiological alarm is generated.
***V-Fib/Tach	
***V-Tach	
Extreme Brady (value) < (limit)	
Extreme Tachy (value) > (limit)	
**Pacer Not Capture	… In Pacer Mode, a medium priority latching physiological alarm is generated.
**Pacer Not Pace	
**PVC (value) > (limit)/min	… a medium priority non-latching physiological alarm is generated.
HR High (value) > (limit)	
HR Low (value) < (limit)	
Cannot Analyze ECG	… there is ECG data that cannot be analyzed.
ECG Equipment Malfunction	… there has been an ECG equipment malfunction.
Pads ECG Equipment Malfunction	… there has been a ECG pads (or paddles) equipment malfunction.
ECG Alarms On / ECG Alarms Off	… ECG alarms are turned off or on and any subsequent change.
HR Limits (low) (high)	… HR alarms are turned on and when there is a change in alarm limits.
VTACH Limits HR (limit) bpm Run (limit)	… VTACH alarms are turned on and when there is a change in alarm limits.
PVC/min Limit (limit)	… PVC rate alarms are turned on and when there is a change in alarm limits.
Learning ECG	… the HeartStart Intrepid is evaluating the ECG signal.
Learning Rhythm	… the HeartStart Intrepid 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	… the device detects a therapy equipment failure.

Oximetry and Pulse Events

Table 67 SpO_2 and Pulse Event Information

Logged Event	Logged when …
SpO2 On / SpO2 Off	… SpO_2 monitoring is connected and any subsequent disconnect/connect.
**SpO2 High (value) > (limit)	… the patient's SpO_2 value is higher than the configured limit.
**SpO2 Low (value) < (limit)	… the patient's SpO_2 value is lower than the configured limit.
***Desat (value) < (limit)	… the patient's Desat value is lower than the configured limit.
SpO2 Sensor Malfunction	… the device is on and unable to acquire a Pleth waveform.
SpO2 Unplugged	… SpO_2 monitoring is on and the sensor is disconnected.
SpO2 Noisy Signal	… SpO_2 is on and a noisy signal is detected.
SpO2 Interference	… SpO_2 is on and light interference is detected at the SpO_2 sensor.
SpO2 Non-Pulsatile	… SpO_2 is on and a non-pulsatile SpO_2 sensor signal is detected.
SpO2 Equipment Malfunction	… SpO_2 is on and an SpO_2 equipment malfunction is detected.
SpO2 Erratic	… SpO_2 is on and an erratic measurement condition occurs.
SpO2 Extended Update	… SpO_2 is on and the measurement update period exceeds 30 seconds.
SpO2 Low Perfusion	… SpO_2 is on and low perfusion occurs.
SpO2 Error	… a non-critical SpO_2 error is detected.
SpO2 Alarms On/SpO2 Alarms Off	… SpO_2 alarms are turned on or off and any subsequent change.
SpO2 Limits (low) (high) Desat (limit)	… SpO_2 alarms are turned on and when there is a change in alarm limits.
**Pulse High (value) > (limit)	… the patient's pulse is higher than the configured limit.
**Pulse Low (value) < (limit)	… the patient's pulse is lower than the configured limit.
Pulse Alarms On / Pulse Alarms Off	… pulse alarms are turned on or off and any subsequent change.
Pulse Limits (low limit) (high limit)	… pulse alarms are turned on and when there is a change in alarm limits.

Capnography and Respiration Events

Table 68 $EtCO_2$ and AwRR Event Information

Logged Event	Logged when …
EtCO2 On / EtCO2 Off	… $EtCO_2$ monitoring is connected and any subsequent disconnect/connect.
**EtCO2 High (value) > (limit)	… the patient's $EtCO_2$ value is higher than the configured limit.
**EtCO2 Low (value) < (limit)	… the patient's $EtCO_2$ value is lower than the configured limit.
CO2 Sensor Warming Up	… the CO_2 sensor has not warmed up to operating temperature range.
CO2 Tube Unplugged	… the CO_2 sensor is unplugged or the filter line is disconnected.
CO2 Sensor Unplugged	… the CO_2 sensor is unplugged.
EtCO2 Alarms On / EtCO2 Alarms Off	… CO_2 alarms are turned on or off and any subsequent change.
EtCO2 Limits (low value) (high value)	… CO_2 alarms are turned on and when there is a change in alarm limits.

Table 68 $EtCO_2$ and AwRR Event Information

Logged Event	Logged when …
CO2 Zero In Progress	… the sensor is zeroing.
CO2 Zero Required	… the sensor needs to be zeroed.
CO2 Zero Complete	… the sensor zeroing is complete.
CO2 Zero Failed - (reason)	… the sensor zeroing failed.
CO2 Service Required	… the CO_2 sensor needs servicing.
CO2 Check Line	… the CO_2 sensor detects a kinked or blocked filter line.
CO2 Sensor Over Temp	… the CO_2 sensor detects that it is overheated.
CO2 Out of Range	… the CO_2 sensor detects its result is out of range.
CO2 Error	… a non-critical $EtCO_2$ error is detected.
CO2 Communication Failure	… the HeartStart Intrepid cannot communicate with the CO_2 sensor.
AwRR Alarms On / AwRR Alarms Off	… AwRR alarms are turned on or off and any subsequent change.
AwRR Limits (low value) (high value)	… AwRR alarms are turned on and when there is a change in alarm limits.
**AwRR High (value) > (limit)	… the patient's AwRR value is higher than the configured limit.
**AwRR Low (value) < (limit)	… the patient's AwRR value is lower than the configured limit.
***Apnea > (limit)	… the Apnea alarm is displayed.
Apnea Time (time)	… there is a change to the Apnea alarm Limit setting.

Blood Pressure and Temperature Measurement Events

Table 69 NBP and Temperature Event Information

Logged Event	Logged when …
NBP On Manual	… a manual NBP measurement is requested.
NBP On (frequency value)	… an automatic NBP measurement is requested (including frequency value).
NBP Frequency Manual	… an automatic NBP measurement is changed to manual (including frequency value).
NBP Frequency (frequency)	… the NBP frequency is changed.
NBP Alarms On / NBP Alarms Off	… NBP alarms are turned on or off and any subsequent change.
NBP Limits Systolic (low, high value)	… the Systolic NBP alarm limit is changed.
NBP Limits Diastolic (low, high value)	… the Diastolic NBP alarm limit is changed.
NBP Limits Mean (low, high value)	… the Mean NBP alarm limit is changed.
**NBPs High (value) > (limit)	… the patient's Systolic NBP is higher than the configured limit.
**NBPs Low (value) < (limit)	… the patient's Systolic NBP is lower than the configured limit.
**NBPd High (value) > (limit)	… the patient's Diastolic NBP is higher than the configured limit.
**NBPd Low (value) < (limit)	… the patient's Diastolic NBP is lower than the configured limit.
**NBPm High (value) > (limit)	… the patient's Mean NBP is higher than the configured limit.

Table 69 **NBP and Temperature Event Information** ***(Continued)***

Logged Event	Logged when …
**NBPm Low (value) < (limit)	… the patient's Mean NBP is lower than the configured limit.
NBP Cuff Not Deflated	… the NBP cuff fails to deflate after 3 minutes.
NBP Cuff Overpressure	… the NBP cuff pressure reaches 270 mmHg/40 kPa.
NBP Measurement Failed	… an NBP measurement fails to complete.
NBP Error	… the device detects a non-critical NBP failure.
NBP Equipment Malfunction	… the NBP module detects a malfunction.
**Temp High (value) > (limit)	…the patient's temperature is higher than the configured limits
**Temp Low (value) < (limit)	…the patient's temperature is lower than the configured limits
Temperature On / Off	… device is turned On and the probe is connected, and On / Off when the probe is connected/disconnected.
Temperature Limits (low, high value)	… on event if Temperature alarms are on, when settings are changed, or when the Temperature alarms are turned on.
Temp Alarms Off	… the Temperature alarms are turned off.

Defibrillation Events

Table 70 **Defibrillation Event Information**

Logged Event	Logged when …
Charging to (value) J	… charging is initiated.
Disarm Manual	… the device is disarmed manually.
Disarm Auto - (reason)	… 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	… a shock is delivered.
Shock Aborted (impedance)	… a shock is initiated but aborted before a full shock dose is delivered.

Table 70 **Defibrillation Event Information *(Continued)***

Logged Event	Logged when …
Sync On / Sync Off	… Sync is turned on or off and any subsequent change.
Abnormal Shock Dose Delivered	… a shock is initiated and completed but the full dose is not delivered.
Therapy Malfunction	… a critical failure has occurred, preventing therapy delivery.

AED Events

Table 71 **AED Mode Event Information**

Logged Event	Logged when …
Analyzing	… the algorithm begins analysis.
Artifact Detected	… artifact has been detected.
Shock Advised	… the algorithm detects a shockable rhythm.
No Shock Advised	… the algorithm detects a non-shockable rhythm.
Cannot Analyze ECG	… the algorithm is unable to make a shock/no shock decision.
Forced Pause	… the device enters or exits a forced pause.
NSA Pause	… the device enters or exits a NSA pause.
NSA Monitoring	… the device enters or exits NSA monitoring.
CPR Pause	… the device enters or exits CPR pause.

Pacing Events

Table 72 **Pacing Event Information**

Logged Event	Logged when …
Pacer Mode Demand / Pacer Mode Fixed	… pacing starts and when the mode is changed.
Pacer Rate (value)	… the Pacer Rate is changed.
Pacer Output (value)	… the Pacer Output is changed.
Pacing Paused	… pacing is paused.
Pacer Started (rate) (current) (width)	… pacing starts.

Table 72 **Pacing Event Information *(Continued)***

Logged Event	Logged when …
Pacing Stopped. Power Interrupted.	… 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) < setting (value)	… the Pacer Output is less than the selected setting by 20 percent or 10 mA (whichever is greater).
Pacing stopped with reason	… 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.

12-Lead Events

Table 73 **12-Lead Event Information**

Logged Event	Logged when …
12-Lead Acquired	… the action occurs.

Printing and Marking Events

Table 74 **Printing and Mark Events Information**

Logged Event	Logged when …
Printer Test Failure	… there is a printer failure during an Op Check.
Mark Event	… the Mark Events button is pressed.
(Configured Event Text)	… select an entry from the Mark Events menu.

Alarm Events

Table 75 **Alarms Event Information**

Logged Event	Logged when …
Alarms On / Alarms Off	… alarms are enabled/disabled.
All Alarms Audio Paused	… alarm audio is paused.
All Alarms Audio Off	… alarm audio is turned off.
Active Alarms Audio Paused	… an active alarm's audio is paused.
Active Alarms Audio Off	… an active alarm's audio is turned off.

Data Management Mode

Data Management Mode is a non-clinical mode used to manage event data records. Print or export an individual Event Summary or export all Event Summaries. Configure the HeartStart Intrepid to remove patient information from Event Summaries prior to exporting them. It is possible to manage Event Summary data on the external USB drive.

WARNING: Do not enter Data Management Mode while monitoring a patient.

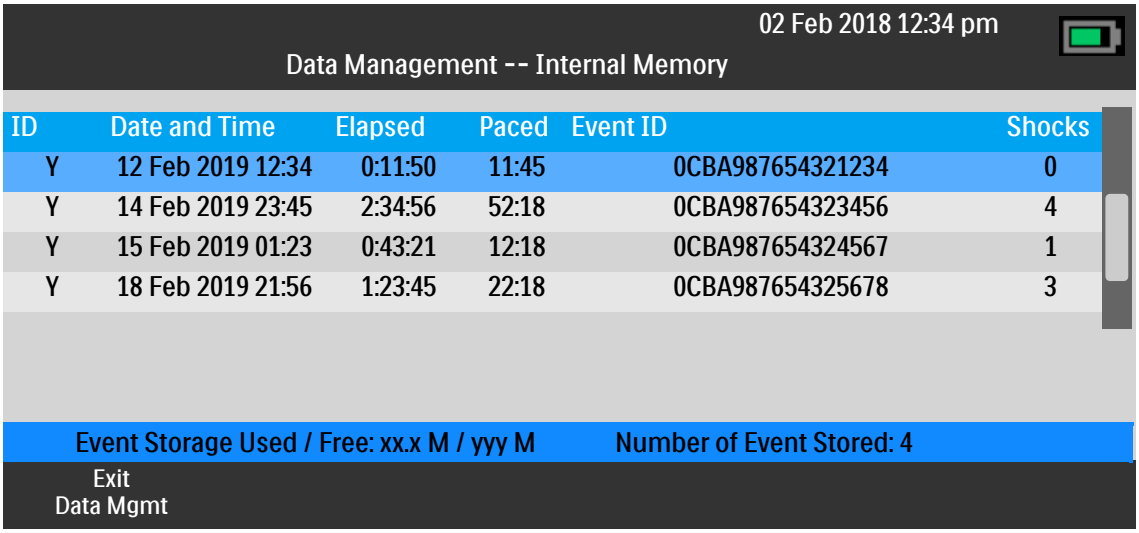
To enter Data Management Mode:

1. Turn the Therapy knob to either Monitor, Pacer, or Manual Defib.
2. Press the Smart Select knob.
3. Turn the Smart Select knob to highlight **Other** and press the Smart Select knob.
4. Select **Data Management** and press the Smart Select knob.
5. Confirm the selection to leave Clinical Mode. Use the Smart Select knob to select **Yes** and press the Smart Select knob. By selecting elect **No**, the mode reverts to the starting mode.

Internal Memory

When first entering Data Management Mode, the Internal Memory Screen is displayed. See Figure 92.

Figure 92 **Data Management Internal Memory Screen**



The following information is listed on the display:

- **ID** – Indicates if the event data record contains any patient information which could uniquely identify the individual. **Y** indicates there is; **N** indicates there isn't.
- **Date and Time** – Date and time the event began.
- **Elapsed** – Duration of the event.
- **Paced** – Total paced time for the event.
- **Event ID** – The unique ID for the event.
- **Shocks** – Total number of shocks delivered during the event.

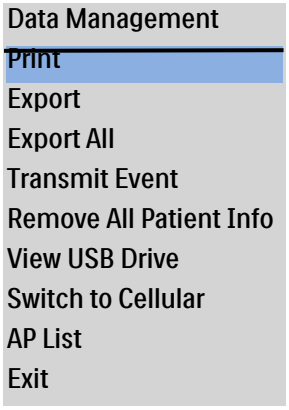
- **Event Storage Used/ Free** – The amount of space used/available in internal memory.
- **Number of Events Stored** – The number of events that are currently stored in internal memory.

Internal Memory Menu

From the Internal Memory Menu it is possible to print, export, remove all patient identification data, and view data on a USB drive.

To use the Internal Memory Menu:

1. Confirm you are in Data Management.
2. Press the Smart Select knob.
3. Using the Smart Select knob, select the desired operation:
   - Select **Print** to print the currently selected Event Summary.
   - Select **Export** to export the currently selected Event Summary to the USB drive.
   - Select **Export All** to export all Event Summaries currently in Internal Memory to the USB drive.
   - Select **Transmit Data** to transmit data to the USB drive.
   - Select **Remove All Patient Info** to de-identify all Event Summaries in Internal Memory. See "Removing All Identifying Patient Data" on page 195.
   - Select **View USB Drive** to view all Event Summaries on an external USB drive. See "Accessing Data on the USB Drive" on page 196.
   - Select **Exit** to exit the menu.
   - Select **Switch to Cellular** to switch from Wi-Fi mode to Cellular mode.
   - Select **AP list** to show a list of applications.



4. Press the Smart Select knob to perform the task.

NOTES: Select **Cancel Export** from the Data Management Menu to cancel an export once it begins. The option appears in the menu after printing/exporting has begun. To cancel printing, press the Print button.

If changing from Data Management Mode to a clinical mode while data is exporting, an alert appears indicating that data export is in process and asked to **Stop Exporting?** Select **Yes** to stop data export and continue to the new mode. Select **No** to continue exporting data.

If turning the device off while exporting data, the export is stopped and the exported data might be incomplete.

A USB drive must be inserted to the Export, Export All, and View USB Drive selections.

Removing All Identifying Patient Data

All HeartStart Intrepid users are responsible for protecting the use, disclosure and exchange of electronic Protected Health Information (ePHI). Patient-related data include name, medical record number, dates related to the individual, patient age if over 89 and any other information that could uniquely identify an individual. In Data Management Mode, de-identify patient Event Summaries two ways:

- When exporting Event Summaries, the HeartStart Intrepid can be configured to prompt whether to remove all patient-related data prior to exporting. If this function is enabled, the HeartStart Intrepid prompts whether to **Export Without Patient Info**. Select **Yes** to remove the patient-identifying related data prior to exporting and **No** to export with patient-identifying related data in the Event Summary.
- When the Internal Memory Menu is displayed (Figure 92 on page 193), selecting **Remove All Patient Info** prompts the HeartStart Intrepid to asks whether to **Remove Patient Info from All Internal Event Data?** Select **Yes** to remove the patient-identifying related data and **No** to keep the patient-identifying related data in the Event Summary.

NOTE: This will remove patient-identifying data from *all* records in the memory.

Sending Data with Wi-Fi or the Communication Module

Use Wi-Fi or the Communications Module to send data during patient care or post-event. During an event, send 12-Lead ECGs or vitals data. Post-event transmissions include Event Summaries. For more information on sending data, see "Event Summary Data Collected" in "Data Management".

Successful transmission is dependent on the availability of public or private telecommunication Wi-Fi or telecommunications networks and other influencing factors, particularly for cellular communications. These factors include but are not limited to weather, geography, transmitting location, cellular service availability, the number of cellular service users in the area, and authorization/subscription from the cellular service provider. Make sure there is a contingency plan for interrupted or unsuccessful data transmissions.

The steps to send data from the HeartStart Intrepid are the same regardless whether data is sent via Wi-Fi or cellular broadband communication.

To send the current 12-Lead data from 12-Lead Mode during an event

1. In 12-Lead Mode press the **[Start Acquire]** soft key.When the 12-lead acquisition is complete, press the **[Send]** soft key.
   If the device has been configured with a destination list, the list is displayed.
2. Choose the destination for the 12-lead report, then press the Smart Select knob to begin sending.
3. If multiple 12-lead reports have been taken during the event, choose a report to send.
   When sending is finished, the message **Transmit Succeeded** is displayed.
   If data fails to send, an alert message **Transmit Failed** is displayed.
4. Press **OK** to close the window.

To send vitals data from Clinical Mode during an event

1. Verify that the HeartStart Intrepid is in Monitor mode (not 12-lead mode)
2. Press the Smart Select knob.
3. From the menu, select **Transmit Vitals**.

4 Press the Smart Select knob to begin transmission.
If the device has been configured with a destination list, the list is displayed.

5 Choose the destination, then press the Smart Select knob to begin sending.
When sending is finished, the message **Transmit Succeeded** is displayed.
If data fails to send, an alert message **Transmit Failed** is displayed.

6 Press **OK** to close the window.

Accessing Data on the USB Drive

When selecting the **View USB Drive** option from the Internal Memory Menu, the HeartStart Intrepid first checks that there is a compatible USB drive inserted into the USB port on the back of the device (see Figure 17 on page 19). If a compatible USB drive is not found, the Internal Memory Screen remains on the display. If a compatible drive is found, then the USB Drive Screen is displayed.

The USB Drive screen layout is similar to the Internal Memory screen (see "Internal Memory Menu" on page 194), except "**Data Management - Internal Memory**" is replaced with "**Data Management- USB Drive**" in the screen title.

Using the HeartStart Intrepid, save Event Summaries to the USB drive, and view and delete them from the USB drive. Data on the USB drive can be downloaded to a computer and viewed with a data management software application.

Saving Data to the USB Drive

Data can be saved to a USB drive from Data Management Mode, Configuration Mode, and after an Operational Check.

To save data to a USB Drive:

1 Confirm that a USB drive is inserted into the USB port.

2 Press Smart Select knob and select **Export** from the menu. The HeartStart Intrepid copies data to the USB drive. Be sure to wait until downloading is complete and "Do Not Remove USB Flash Drive" is no longer displayed.

CAUTION: Use only the USB drive recommended by the manufacturer, see Table 90 "Data Management Accessories" on page 224. Using other brands of USB drives may cause damage or be incompatible with the HeartStart Intrepid.

NOTE: If data exporting is in process and the device changes from a non-clinical mode to a clinical mode or vice versa, the HeartStart Intrepid asks if the user wants to continue exporting. Select **Yes** to stop; **No** to continue with the export.

Deleting Event Summaries from the USB Drive

To delete Event Summaries from the USB drive:

1 Confirm the device is in Data Management Mode.

2 Press the Smart Select knob.

3 Turn the Smart Select knob to highlight **View USB Drive** and press the Smart Select knob.

4 Once in the USB Drive Screen, press the Smart Select knob.

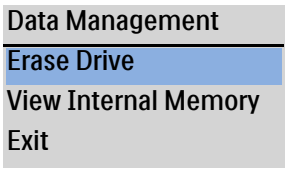
5 The **Data Management** Menu appears. See Figure 93.

6 Turn the Smart Select knob to select **Erase Drive**.

7 Press the Smart Select knob to erase all event summaries from the USB drive.

8 HeartStart Intrepid prompts to confirm your selection. Select **Yes** to erase all data on the drive. Select **No** to leave all data on the drive.

Figure 93 **Data Management Menu Screen**



- Select **Erase Drive** to erase all data on the USB drive.
- Select **View Internal Memory** to view all Event Summaries in the device's internal memory.
- Select **Exit** to exit the menu.

Printing Data

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

Printing During a Patient Event

The HeartStart Intrepid allows you to print various data reports in a clinical mode during a patient event.

To print a strip during an event:

1 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. See Table 76.

Table 76 **Event Markers**

Event	Symbol
Mark Events	▶
Physiological Alarm	
Shock Delivered	

The HeartStart Intrepid can also be configured to print a strip when an alarm, charge, shock or mark event occurs. See Table 55 "Configuration – Printing" on page 174.

Printing While in Data Management Mode

To print an Event Summary contained in Internal Memory:

1 Use the Smart Select knob to select the Event Summary you wish to print.

2 Press the Smart Select knob, select **Print**.

3 Press the Smart Select knob again to begin printing.

To print a Trends Report related to an Event Summary contained in Internal Memory:

1. Select the Event Summary that contains the Trends Report you wish to print.
2. Use the Smart Select knob to select the Trend Interval you want.
3. Press the Smart Select knob to begin printing.

NOTES: To see how to install printer paper rolls, see "Installing Printer Paper" on page 13.

If you change from a clinical to non-clinical mode during printing, the HeartStart Intrepid asks if you want to stop printing. Select **Yes** to stop printing and **No** to continue printing.

If you have manually started printing a strip, and the HeartStart Intrepid tries to automatically initiate a strip, the automated print strip is ignored.

If the HeartStart Intrepid 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 a request to print a data report is made while the printer is currently printing another report, the HeartStart Intrepid prompts you with questions. Your answers determine which report takes precedence for printing.

Troubleshooting

If your HeartStart Intrepid does not operate as expected during data management, see "Troubleshooting" on page 229.

16

Operational and Shift Checks

The HeartStart Intrepid performs several automated tests to make sure it is ready for use (see "Automated Tests" on page 213). Two important checks to perform to supplement the automated tests are Operational Check and Shift Check. This chapter details both of these important tasks.

This chapter is divided into the following major sections:

Shift Check

In order to ensure defibrillators are ready when needed, Philips Healthcare 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 the facility's biomedical or clinical engineering team. The activities on this checklist include verifying that the appropriate supplies and accessories are present, the device is plugged in and has sufficient battery power, and the device is ready for use, see "HeartStart Intrepid Shift Checklist" on page 211.

As part of the Shift Check, it is required to 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:

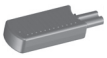
- Weekly Shock Test (see "Weekly Shock Test" on page 199)
- Operational Check (see "Operational Check" on page 201)

WARNING: When performing an Operational Check or Weekly Shock Test, confirm the HeartStart Intrepid is not connected to a patient.

Weekly Shock Test

A Weekly Shock Test is performed using either a test plug, a test load or paddles. The Weekly Shock Test process and results differ depending which way the test is performed. See the following chart.

◎ To perform the Weekly Shock Test:

	If using pads with a test load: 	If using pads with a test plug: 	If using paddles:
1	Verify that the device is not connected to a patient.		
2	Turn the device on by turning the Therapy knob to 150 J.		
3	Connect the Therapy cable to the defibrillator and test load to the end of the Therapy cable.	Connect the Therapy cable to the defibrillator and test plug to the end of the Therapy cable.	Make sure the paddles and the paddle tray are thoroughly clean and there is no debris or residue (including all conductive material) on the electrode surfaces of the paddles and tray. Secure paddles in tray and confirm Patient Contact Indicator (PCI) LEDs are not lit. If the LEDs are lit, adjust paddles in tray. If the LEDs continue to light, clean both the adult and infant paddle electrode surfaces.
4	Press the Charge button on the front panel. Confirm that the charging tone is heard. If it becomes necessary to disarm the defibrillator, press **[Cancel Charge]**.		Press the Charge button on the paddles sitting in the tray. Confirm the charging tone is heard. If it becomes necessary to disarm the defibrillator, press **[Cancel Charge]**.
5	Press the Shock button on the HeartStart Intrepid.		Simultaneously press the Shock buttons located on the paddles.
6	A strip prints, if configured to do so. If the strip does not print immediately, press the Print button.		A strip prints, if configured to do so. If the strip does not print immediately, press the Print button.
7	Detach test load/plug from the cable so your device is ready for use when needed. Do not leave the test load/plug 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. **NOTE:** It is normal behavior that a shock is not delivered in this instance.
8	Detach test load/plug from the Therapy cable so the device is ready for use when needed. Do not leave the test load/plug attached to the Therapy cable. Test complete.		Test complete.

NOTES: For more information on the differences between a test load and test plug, see "Test Plug and Test Load" on page 21.

If a Weekly Shock Testis performed with internal paddles and corresponding test equipment, the HeartStart Intrepid must be set to 50 J. Refer to the test equipment manufacturer's instructions for information on interpreting results of the test.

Operational Check

Operational Checks (Op Checks) supplement automated tests by verifying therapy cables, the ECG cable, paddles, audio, charge and shock buttons, and the ability to deliver defibrillation and pacing therapy. Op Check also checks the SpO_2, NBP, Temperature, and $EtCO_2$ modules, and CPR meter and printer.

Perform Op Checks weekly to supplement the hourly, daily and weekly tests the HeartStart Intrepid performs automatically.

From Op Check it is possible to print Automated Test and performed results.

WARNING: When performing a Weekly Shock Test, confirm the HeartStart Intrepid is not connected to a patient.

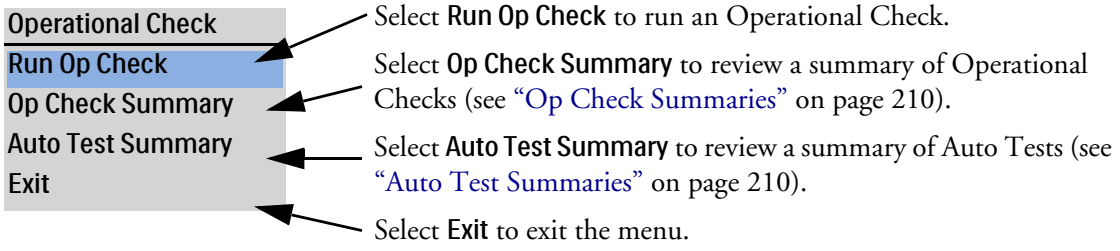
NOTES: Do not run performed with internal paddles attached. Perform a Weekly Shock Test to test internal paddles.

To confirm the ECG cable used during an event is functioning properly, use that same cable during performed.

To enter Op Check:

1. Turn the Therapy knob to Monitor.
2. Press the Smart Select knob.
3. Turn the Smart Select knob to highlight **Other** and press the Smart Select knob.
4. Select **Operational Check** and press the Smart Select knob. See Figure 94 for Op Check menu options.

Figure 94 **Operational Check Menu**



5. Confirm exit from a clinical mode. Select **Yes** and press the Smart Select knob.

The following tests are performed during an Op Check (see "Op Check Tests and Results" on page 206):

- General System
- Therapy Knob
- Charge button
- Shock button
- Sync button
- Therapy delivery
- Pads/Paddles ECG
- Leads ECG
- Leads ECG rerun (if necessary)
- SpO_2
- $EtCO_2$
- NBP
- Temperature
- CPR meter
- Audio
- Printer
- Battery
- Wi-Fi
- Cellular

Performing an Operational Check

Prior to performing an Op Check:

If using external paddles: Make sure the paddles are connected to the device, paddles and the paddle tray are thoroughly clean and there is no debris or residue (including all conductive material) on the electrode surfaces of the paddles and tray. Secure the paddles in the tray and confirm the Patient Contact Indicator (PCI) LEDs are not lit. If the LEDs are lit, adjust the paddles in the tray. If the LEDs remain lit, clean both the adult and infant/child paddle electrode surfaces.

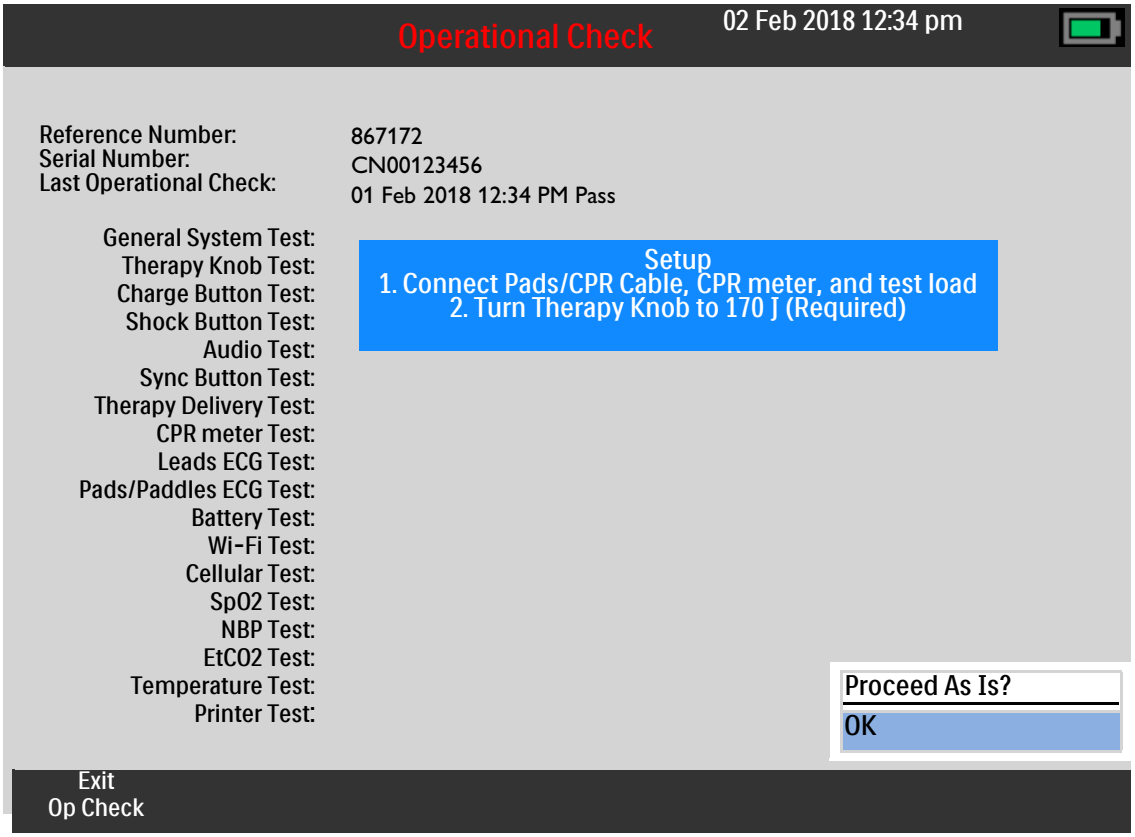
If using multifunction electrode pads: Make sure the pads therapy cable is plugged into the defibrillator test plug or test load.

To begin an Op 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** to continue with an Op Check. Select **No** to return to Monitor Mode. Press the Smart Select knob to confirm your choice.
9. If **Yes** is selected, the HeartStart Intrepid displays the Op Check Screen and starts the Op Check automatically.

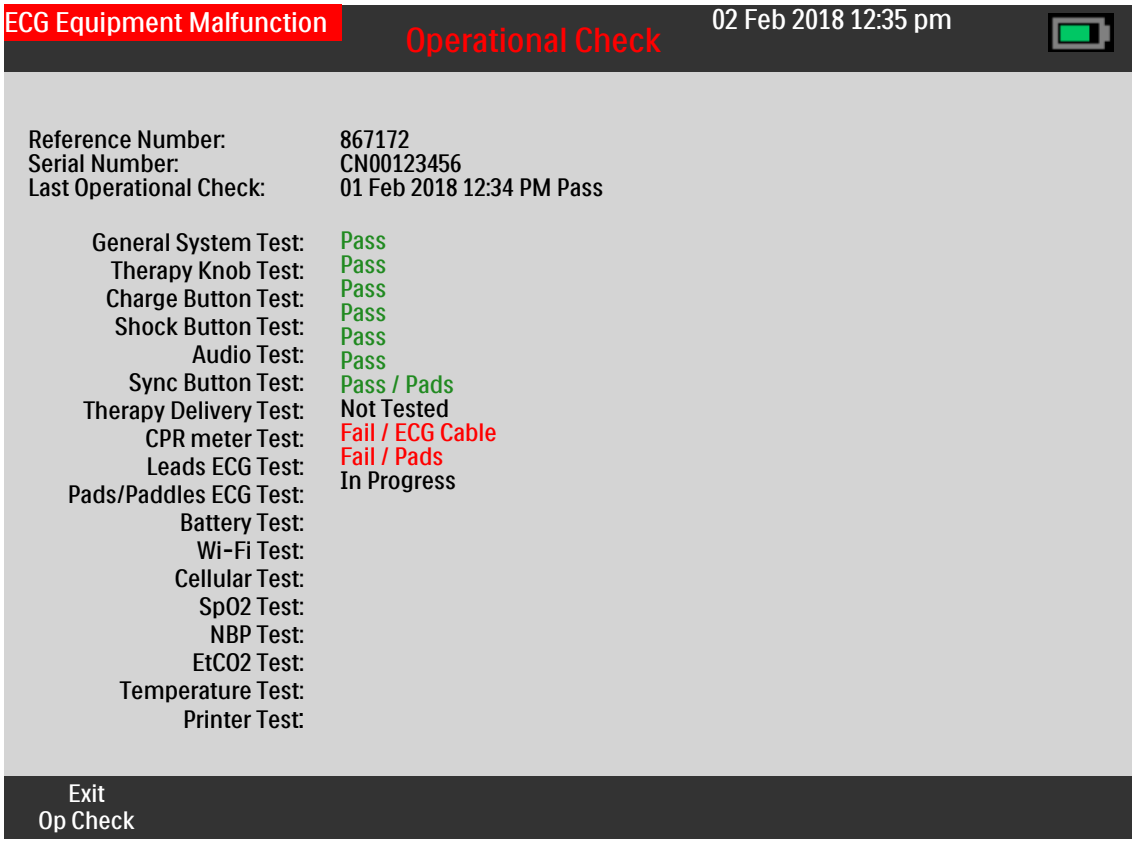
NOTE: If the HeartStart Intrepid is not set up correctly, the display prompts to make the required changes for a successful Op Check (see Figure 95). The Therapy knob must be set to 170 J to begin Op Check. Once the check begins, set the knob back to 150 J when prompted to do so. Op Check runs automatically. If you choose to proceed without setting up properly, the Op Check may fail.

Figure 95 **Op Check Setup Screen**



10 During the Op Check, when a response is required, use the Smart Select knob to select your answer and then confirm your choice. As each test runs, the name of the test appears highlighted on the display with the message **In Progress**. See Figure 96.

Figure 96 **Operational Check In Process Screen**



NOTE: Once the **Sync** button is pressed, leave the HeartStart Intrepid unattended as Op Check completes its process. If the Op Check is cancelled before it completes all tasks, there is no record of the check in the Op Check Summary.

After the automated part of Op Check concludes, an Op Check Report is printed (see "Printing Op Check Results" on page 209).

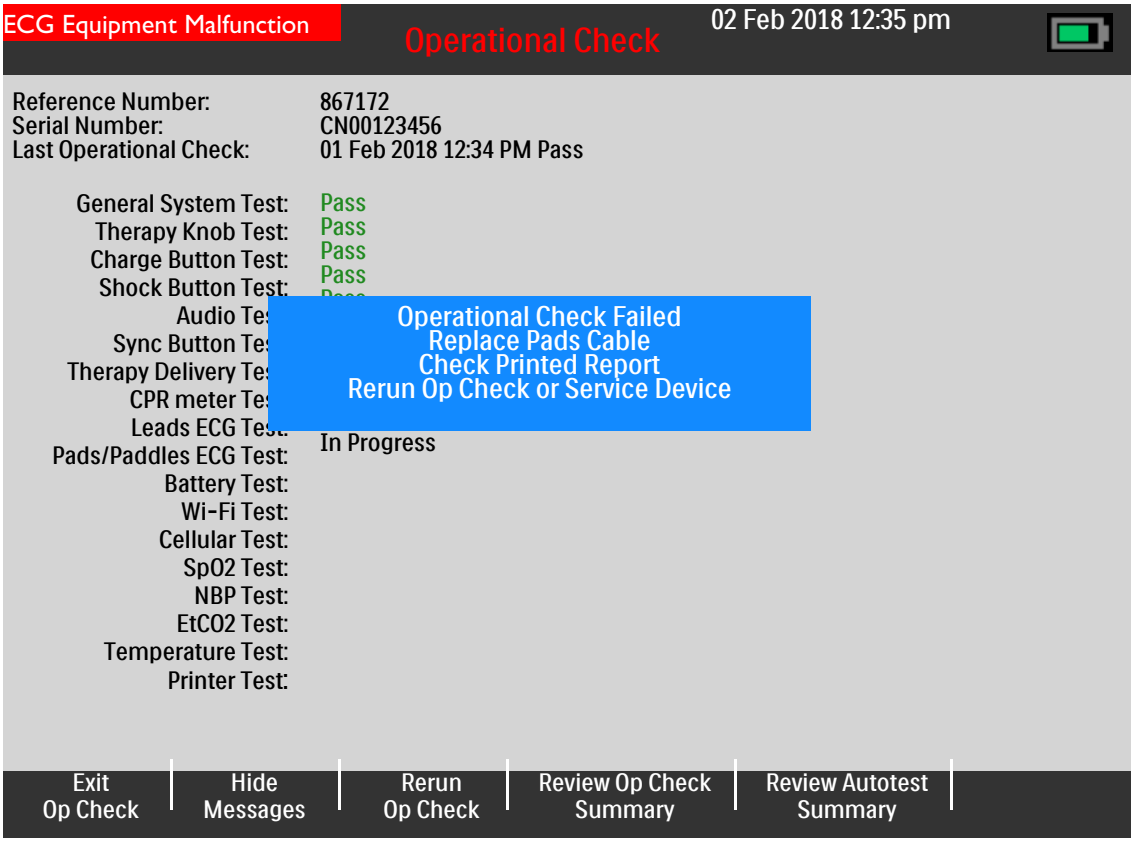
NOTE: It is important to complete all instructions listed on the Setup screen in order to successfully complete an Op Check. Approximately 10 seconds after entering Op Check, a **Proceed As Is?** prompt appears in the lower right corner of the display. This prompt allows for continuing with the Op Check if the device is not responding to actions taken during Setup. Selecting **Proceed As Is?** while there are still required items listed in the setup instructions causes Op Check failures.

Op Check Results

Each test that makes up the Op Check either passes or fails (see Figure 96 for an example)

Once the Op Check is completed, a summary note appears in the middle of the display. To remove the message from the screen press the **[Hide Messages]** soft key. To bring the messages back, press the **[Show Messages]** soft key.

Figure 97 **Operational Check Results Screen**



If an Op Check fails for a therapy-related problem (for example 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 Op Check, the HeartStart Intrepid restarts with therapy disabled.

NOTE: When exiting Op 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.

The failure may have been caused by an improperly performed Op Check. To clear the failed Op Check, successfully perform a proper Op Check. If the device continues to fail the Op Check after confirming the Op Check was performed properly, take the device out of use and call for service.

Leads ECG Test Rerun

If the Leads ECG test fails, upon the completion of Op Check, the HeartStart Intrepid may prompt with the message **Leads ECG Test Failed With Cable. Disconnect ECG Cable to Rerun Test Without Cable.** As soon as the ECG cable is removed, the device reruns Op Check to check if the problem is in the device itself. Press the Smart Select knob to proceed without rerunning the Op Check test.

Re-Running Op Check

Once Op Check is completed, it is possible to re-run Op Check by pressing the **[Rerun Op Check]** soft key.

Table 77 **Op Check Tests and Results**

Test	Device Prompts	User Actions	Results	What to do if fails
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 170 J 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.	Confirm that the Therapy knob is set to 170 J and repeat Op Check. If the test continues to fail, take the device out of use and call for service.
			NOTE: When the Therapy knob fails, the device restarts and remains in Monitor Mode regardless of the knob's position on the dial.	
Charge button: tests the Charge button's functionality with a Therapy Cable	**Turn the Knob to 150J Verify Test Load Is Attached Press the Charge Button**	Move Therapy knob to 150. Confirm test load or test plug is attached and press the Charge button.	**Pass:** Charge button passed. **Fail:** Charge button is not functioning. **Fail:** The Smart Select knob was used to charge.	Repeat the test and make sure you press the Charge button. If continues to fail, take the device out of use and call for service.
Charge button: tests the Charge button's functionality with External Paddles	**Turn the Knob to 150J** **Verify Paddles are in Holders** **Press the Charge Button**	Move Therapy knob to 150. Confirm the paddles are seated in their pockets and press the Charge button.	**NOTE:** If the device does not detect a pressed Charge button within 10 seconds, you are prompted to use the Smart Select knob to charge.	
Shock button: tests the Shock button's functionality	**Press Shock Button** or **Press Both Shock Buttons on Paddles.**	Press the Shock button on the device or paddles.	**Pass:** Shock button passed. **Fail:** • Shock button is not functioning. • You used the Smart Select knob to shock. • Device disarmed automatically.	Repeat Op Check and make sure you press the Shock button before the defibrillator disarms. If Op Check continues to fail, take the device out of use and call for service.
	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 after the time specified in Configuration (see Table 49 on page 171). A **Defib Disarmed** message is displayed.			

Table 77 **Op Check Tests and Results** ***(Continued)***

Test	Device Prompts	User Actions	Results	What to do if fails
Audio: tests the speaker system	The device announces: **Shock Delivered**	Did you hear the announcement? 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 Op 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.** Press and release the 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.		**Pass:** Sync button passed. **Fail:** Sync button is not functioning.	Repeat Op 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:** test passed with the specified cable type connected. **Fail:** test failed with the specified cable type connected.	Repeat Op Check using a different cable. If passes, replace the defective cable. If continues to fail, take the device out of use and call for service.
CPR meter: tests the CPR meter functionality	None	None	**Pass:** CPR meter functions as specified. **Fail:** CPR meter does not functions as specified. **No Meter:** Pads/CPR cable connected, no meter connected. **Not Tested:** Pads/CPR cable not connected.	• Make sure the CPR meter does not move during the test. • Replace the meter if persists. • Check Pads/CPR cable or meter as applicable
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 Op Check. If it continues to fail, take the device out of use and call for service.

Table 77 **Op Check Tests and Results *(Continued)***

Test	Device Prompts	User Actions	Results	What to do if fails
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 Op 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	Op Check does not start if there is no battery in the slot.	Insert a charged battery.
			Pass: battery is functioning properly and charged.	
			Fail: Battery has reached end of its life.	Replace the battery.
			None: Battery is not inserted:	Insert a charged battery.
			Low: low battery.	Charge the battery.
Wi-Fi: tests whether Wi-Fi hardware is working properly	None	None	**Pass:** Wi-Fi passed test. **Fail:** Wi-Fi failed test.	Call for service.
Cellular: tests whether cellular module hardware is working properly	None	None	**Pass:** Cellular hardware passed test. **Fail:** Cellular hardware failed test. **Not tested:** Cellular hardware not connected.	Call for service.
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.

Table 77 **Op Check Tests and Results** ***(Continued)***

Test	Device Prompts	User Actions	Results	What to do if fails
$EtCO_2$: 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.	Call for service to repair the CO_2 module. If CO_2 monitoring is essential to patient care, take the device out of use.
Temperature: tests whether the temperature hardware is working properly.	None	None	**Pass:** temperature hardware passed its self-test. **Fail:** temperature hardware failed its self-test.	Call for service.
Printer: runs a printer self test	None	None	**Pass:** Printer passed its self-test. **Fail:** Printer failed its self-test.	Call for service.

Printing Op Check Results

If configured to do so (see "Configuration – Printing" on page 174), the Operational Check Report automatically prints out after an Op Check is completed. To print manually, press the Smart Select knob and select Print.

The first part of printed Op Check lists test results. The second part lists checks to be performed by the user.

User Checks

Once the Op Check Report prints, perform the following manual checks to complete the Op Check.

- **Defibrillator Inspection** – Make sure the HeartStart Intrepid is clean (including the surfaces of the paddles and paddle trays), clear of objects and has no visible signs of damage.
- **ECG Cables / Connectors / Paddles / Pads / Monitoring Electrodes** – Make sure there are no visible cracks, broken wires or other visible signs of damage. Make sure all the connections are secure. Check expiration date and quantity of pads and monitoring electrodes.
- **Charged Battery** – Make sure a charged battery is installed in the HeartStart Intrepid. Another charged battery should be available or charging. Confirm the battery has no visible signs of damage.
- **AC and DC power cords** – Check the AC/DC power source by connecting the AC/DC power cord to the HeartStart Intrepid and plug it into a power outlet. Then verify that the external power indicator on the front panel is lit.
- **Printer Paper** – Make sure the printer has sufficient paper and is printing properly.
- SpO_2 **Sensor** – Inspect the sensor and cable for visible signs of damage.
- $EtCO_2$ **accessories** – Inspect the cannulas, adapters, dehumidification tubes, and extension lines for blockages and visible signs of damage.
- $EtCO_2$ **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.
- **Temperature Sensor** – Presents sufficient supply.

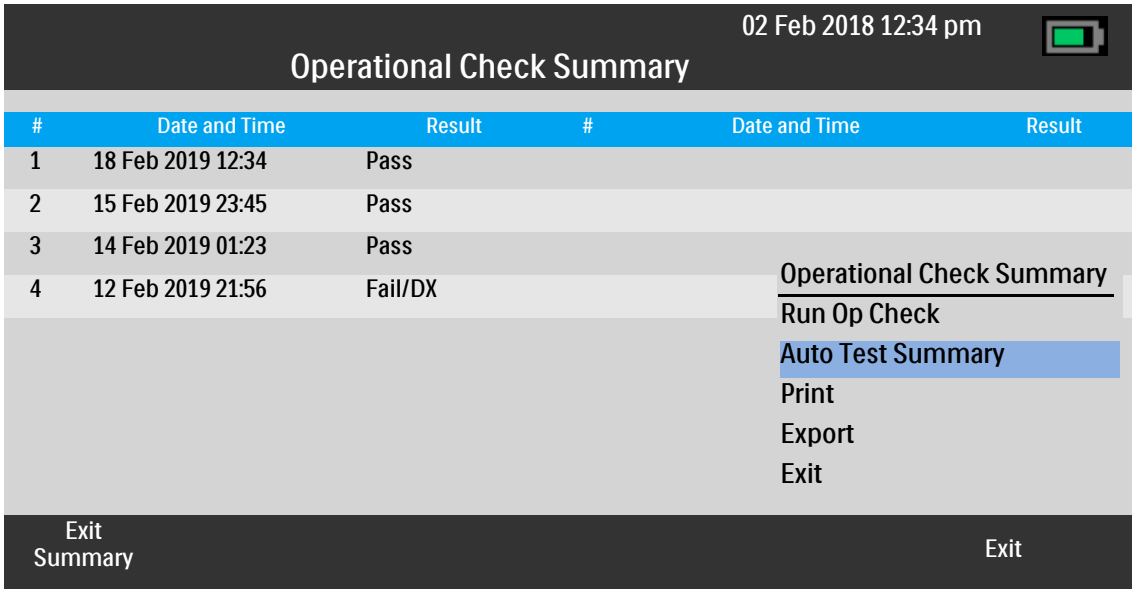
- **CPR meter and adhesive pads** – Inspect for visible signs of damage. Check expiration date and quantity of pads.
- **USB Connector** – Inspect the connector for visible signs of debris or damage.

NOTE: Upon completing the Op Check and returning to a clinical mode, all settings are reset to the device's configured values.

Op Check Summaries

Selecting **Op Check Summary** from the Op Check menu (see Figure 94 on page 201) displays a summary of the last 60 Op Checks stored in the HeartStart Intrepid (see Figure 98). Use the Smart Select knob to print or export the summary.

Figure 98 **Op Check Summary**



Auto Test Summaries

Selecting **Auto Test Summary** from the Op Check or Op Check Summary menu displays a summary of automated test results currently stored in the HeartStart Intrepid.

For more information, see "Automated Tests" on page 213.

NOTE: If you try to print a summary or report while the printer is printing another report or summary, the HeartStart Intrepid asks you if you want to stop the current printing and begin the second one. Use the Smart Select knob to select your answer and then press the Smart Select knob.

Alarm Test

If your institution's protocol requires periodic alarm verification and you wish to perform an alarm verification test (in a non-clinical environment) outside of Op Check testing, connect the HeartStart Intrepid to a simulator, then manually change the alarm limits to a setting which should cause the device to alarm. Look at the display and listen for the alarm. Be sure to reset the alarm limits to the appropriate settings before returning the device to a clinical environment.

HeartStart Intrepid Shift Checklist

Inspect your HeartStart Intrepid, accessories, and supplies at the change of every shift. Place a check mark in the box as you check each item in the list below or place a dash or N/A if not applicable. Then, initial the list to indicate the check was performed for that shift.

Device Name or Serial Number:_____ Unit or Department:_____

Date:															
Shift:	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**
RFU Indicator: Green check mark **If blinking red X:** Plug into AC/DC power or insert charged battery **If solid red X:** Insert charged battery or plug into AC/DC power. If persists, call for service															
Case: clean, free from spills and objects															
Cables/connectors: present and inspected															
Paddles/Therapy cable: present, inspected and paddles release from tray, 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															
SpO_2 **Sensors:** present, sufficient supply *															
NBP cuffs/tubing: present, sufficient supply *															
Temperature Sensors: present, sufficient supply *															
CO_2 **cannulas, extension lines, and dehumidification tubes:** present, sufficient supply *															
Initials															

* if the option is installed

Shift Checklist: Weekly Shock Test

Do one of the following checks at least once a week to verify the ability to deliver defibrillation therapy:

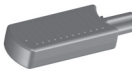
- ☐ Operational Check, see "Operational Check" on page 201 for details.
- ☐ Deliver a 150 J shock into a test plug or test load (if using multifunction electrode pads) or the paddle tray (if using paddles.) See "Weekly Shock Test" on page 199 for details.
- ☐ Weekly Shock test is not applicable for this Shift Check.

Check off which option you selected and sign/date below.

Signature:	Date:

NOTE: Test reusable sterilizable paddles (internal or external) prior to each use. See the *Sterilizable Defibrillator Paddles Instructions for Use*.

To perform the Weekly Shock Test:

	If using pads with a test load: 	**If using pads with a test plug:** 	**If you are using paddles:**
1	Turn the device on by turning the Therapy knob to 150 J.		
2	Connect the Therapy cable to the defibrillator and test load to the end of the Therapy cable.	Connect the Therapy cable to the defibrillator and test plug to the end of the Therapy cable.	Make sure the paddles and the paddle tray are clean and there is no debris or residue (including all conductive material) on the electrode surfaces of the paddles and tray. Secure paddles in tray and confirm PCI LEDs are not lit. If the LEDs are lit, adjust paddles in tray. If the LEDs continue to light, clean both the adult and infant paddle electrode surfaces.
3	Press the Charge button on the front panel. Confirm you hear the charging tone. If it becomes necessary to disarm the defibrillator, press **[Cancel Charge]**.		Press the Charge button on the paddles sitting in the tray. Confirm you hear the charging tone. If it becomes necessary to disarm the defibrillator, press **[Cancel Charge]**.
4	Press the Shock button on the HeartStart Intrepid.		Simultaneously press the Shock buttons located on the 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/plug from the Therapy cable so your device is ready for use when needed. Do not leave the test load/plug attached to the Therapy cable. Test complete.	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. **NOTE:** It is normal behavior that a shock is not delivered in this instance.

17

Maintenance

This chapter describes how to care for your HeartStart Intrepid and its accessories.

Overview

Proper maintenance of the HeartStart Intrepid is a simple, yet important factor in dependability. Attending to routine maintenance is vital to keeping the HeartStart Intrepid ready to respond in an emergency.

Routine maintenance involves:

- Providing power so automated tests can run (see "Automated Tests" on page 213).
- Observing the Ready For Use (RFU) indicator to confirm the device's readiness (see "Ready For Use Indicator" on page 31).
- Performing Operational Checks and Shift Checks (see "Operational and Shift Checks" on page 199).
- Caring for batteries (see "Battery Maintenance" on page 216).
- Cleaning the device and accessories (see "Cleaning Instructions" on page 219).
- Checking expiration dates on supplies and accessories, and ordering replacements (see Chapter 18 "Supplies and Accessories" on page 221).

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

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

Electric shock hazards exist internally. Do not open device.

Automated Tests

The HeartStart Intrepid 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 HeartStart Intrepid's display when the device is turned on. Table 78 provides a brief explanation of the tests and lists each test's frequency.

Table 78 **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.
Yearly	Every 12 months	The CapnoTrak Module flow rate accuracy should be verified every 12 months by direct measurement using a calibrated flow meter.

NOTE: If the HeartStart Intrepid is turned on in the middle of an automated test, the test stops and the device starts in normal operating mode.

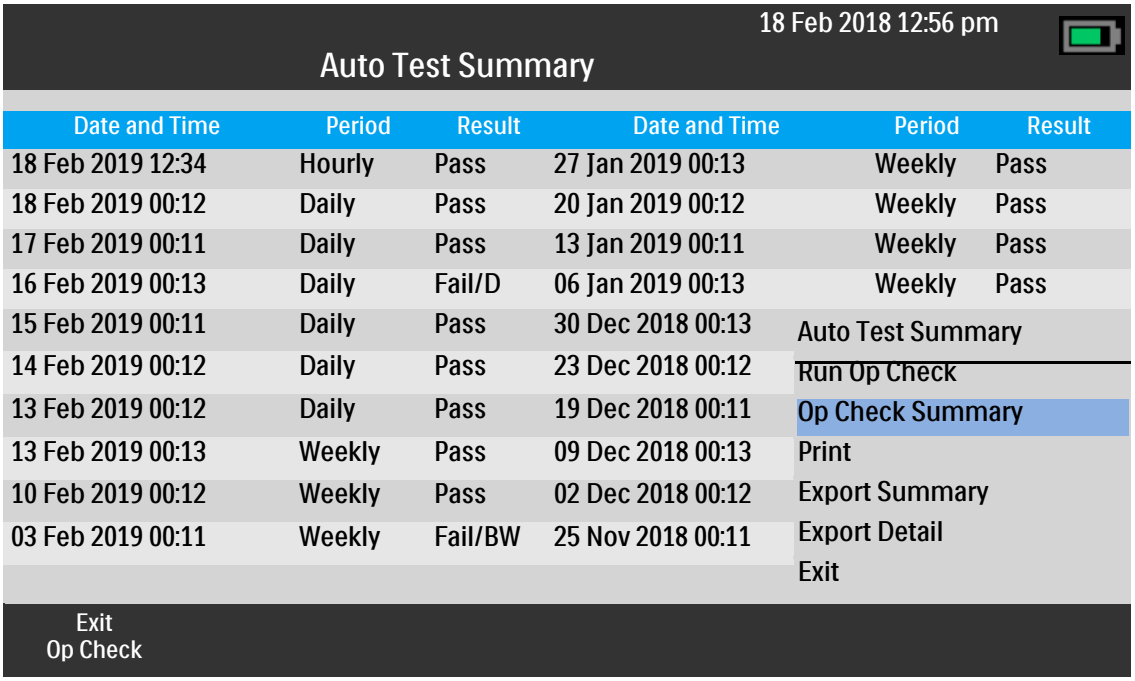
Auto Test Summaries

You can review, print and export all Auto Test Summaries the HeartStart Intrepid performs.

To view a summary of Automated Tests:

1. Turn the Therapy knob to Monitor.
2. Press the Smart Select knob.
3. Turn the Smart Select knob to highlight **Other** and press the Smart Select knob.
4. Select **Operational Check** and press the Smart Select knob.
5. Select **Auto Test Summary** and press the Smart Select knob. The message **Leaving clinical mode. Patient monitoring will be turned off.** appears.
6. Select **Yes** if you wish to exit clinical mode. Select **No** to return to Monitor mode. Press the Smart Select knob to confirm your choice.
7. If you selected **Yes** the HeartStart Intrepid displays the Automated Test Summary screen (see Figure 99).

Figure 99 **Automated Test Summary**



Auto Test Summary Results

The Automated Test Summary reports results for the hourly, daily and weekly tests that have been performed. (See Table 79.) The AutoTest Summary lists the result of the most recent hourly test, the six most recent daily tests and the configured amount (1-53) of weekly tests. The table below describes each result and the corresponding RFU Indicator display. For more on the RFU Indicator see “Ready For Use Indicator” on page 31.

Table 79 **Auto Test Summary Results**

Result	RFU Indicator	Definition	Required Action
Pass	Green check	All tests passed.	None.
Fail/DX	Solid red X, chirp	Service required. A critical device failure has been detected.	Turn the Therapy knob to Monitor. A message indicating the problem is displayed. Refer to Chapter 19 “Troubleshooting” on page 229 for further action.
Fail/BW	Blinking red X	Service is not required but the battery is low or malfunctioning.	Charge the battery as soon as possible or replace it with a charged battery. You can charge the battery in the HeartStart Intrepid by connecting the device to AC/DC power.
Fail/CX	Solid red X, chirp	An ECG cable failure has been detected.	Replace the ECG cable and rerun Operational Check.
Fail/D	Green check	A non-critical failure has been detected.	Turn the Therapy knob to Monitor. A message indicating the problem is displayed. Refer to Chapter 19 “Troubleshooting” on page 229 for further action.

Printing and Exporting Auto Test Summaries

You can print the Auto Test Summaries or export to a USB drive using the menu options, see Figure 99 on page 215. **Export Detail** if requested by your support or service personnel.

Battery Maintenance

HeartStart Intrepid Lithium Ion battery maintenance is essential to ensure that the battery's charge state is accurately reported, there is sufficient charge and capacity to operate your HeartStart Intrepid, and battery life is optimized. Remove faulty batteries from service immediately. Battery maintenance begins when you first receive your device and continues throughout the life of the battery. To optimize performance, a battery that is in the low battery condition (less than 40%) should be charged as soon as possible. Table 80 lists battery maintenance activities and when they should be performed.

Table 80 **Battery Maintenance Activities**

Activity	When to perform
Visual inspection	As part of a standard Operational Check.
Charge the battery	Upon receipt; after use; if the **Low Battery** message is displayed.
Store the battery	When not in use for an extended period of time, store the battery at a 20-40% charge.
Discard the battery	When there are visual signs of damage or you receive a message to replace the battery.

When properly cared for and used in its intended environment, the battery has an approximate useful service life of three years in low use environments (5-10 hours per week) and 1.5 years in high use environments (25-30 hours per week). Use outside intended conditions could reduce battery life. To optimize performance, charge a low battery as soon as possible.

NOTE: The HeartStart Intrepid battery automatically calibrates itself.

Initializing Batteries

When opening a new battery for the first time, it needs to first be charged before the fuel gauge lights activate.

Charging Batteries

The battery needs to be charged in the HeartStart Intrepid or in a Philips stand-alone battery charger. Insert the battery to be charged in the battery compartment and then plug the device into an AC/DC power outlet.

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

Once AC/DC power is supplied, the Battery Charging Indicator flashes green to indicate the battery is charging and the battery is ≤ 90% charged. The indicator turns solid green when the battery charge is > 90% of capacity and AC/DC power is present. If no battery is installed or the installed battery is not functioning properly, the light remains off. Charging the battery at temperatures above 40°C (104°F) may reduce battery life.

Charge Status

You can check the current charge status of a battery by:

- Pushing the fuel gauge button on the battery to illuminate the fuel gauge (see "Battery Fuel Gauge" on page 20).
- Turning the Therapy knob to any position and observing the battery power indicators displayed in the Status Area (see "Status Area" on page 34).

Storing Batteries

Batteries should be rotated regularly to ensure even usage. When storing batteries, make sure the battery terminals do not come in contact with metallic objects.

If storing batteries for an extended period of time, it is recommended they are stored between -20°C to +35°C (≤ 3 months) or -20°C to +20°C (≤1 year). Storing batteries at a higher temperature significantly reduces the battery's life expectancy. Stored batteries should be charged every 2 months to 20-40% of their full capacity. They should be charged to full capacity before being put into use.

CAUTION: Storing batteries in the HeartStart Intrepid, 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 HeartStart Intrepid 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 HeartStart Intrepid and charge only in the specified battery charger. Do not charge near a heater or in hot sunlight.

Do not connect the battery to any plug socket or to any other equipment.

CAUTIONS: Use caution when handling, using and testing batteries. Do not touch a leaking battery. Do not short circuit, crush, drop, mutilate, puncture, apply reverse polarity, expose to high temperatures or disassemble. Misuse or abuse could cause physical injury.

Do not drop or subject to strong physical shock.

Do not store your device for prolonged periods with the battery in.

Do not expose batteries to temperatures below -20°C (-4°F) or greater than 50°C (122°F). Excess temperatures may result in battery damage.

Wash skin with large amounts of water in the event of electrolyte leakage to prevent skin irritation and inflammation.

Power-Related Alarms

Power-related alarms are generated for the conditions shown in Table 81. Once generated, they appear as alarm messages on the HeartStart Intrepid display. There are both audio and visual alerts. For more information on alarms, see "Alarms" on page 40.

Table 81 **Power-Related Alarms**

Alarm Message	Condition	Type of Alarm	Indication and Location
Low Battery	Battery power is low.	High Priority if pacing otherwise, low priority non-latching alarm	Red alarm message if pacing, cyan if not with audio tone in Battery Status area.
Shutting Down in 1 min	Battery power is critically low. The device will shut down in 1 minute.	High Priority if pacing otherwise, medium priority non-latching alarm	Red alarm message if pacing, yellow if not with audio tone in Message 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 Message area.
Equipment Disabled: System Failure	A low voltage has been detected.		
Battery Communication Failure	Communications between the device and the battery have failed.	Medium Priority Non-Latching	Yellow alarm message with audio tone in Battery Status area.
Replace Battery	The battery has reached its end of life.	Low Priority Non-Latching	Cyan alarm message with audio tone in Message area.

Cleaning Instructions

Listed below are the recommended cleaning instructions for the HeartStart Intrepid and its associated accessories.

CAUTIONS: The HeartStart Intrepid, along with its accessories and supplies, may not be autoclaved, steam sterilized, ultrasonically cleaned or immersed unless otherwise indicated in the *Instructions for Use* that accompany the accessory or supply.

Do not use abrasive cleaners or strong solvents such as acetone or acetone-based compounds.

Do not clean electrical contacts or connectors with bleach.

A soft cloth is recommended for cleaning the display window to prevent scratching.

Quaternary ammonium compounds such as Steris Coverage Plus NPD are not recommended for routine cleaning.

Disinfect the HeartStart Intrepid as determined by your institution's policy to avoid damage to the device.

Monitor/Defibrillator, Paddles, Cables, and Battery

You can clean the exterior of the HeartStart Intrepid, external paddles, therapy cables, ECG cables and battery by hand wiping with a clean cloth. Remove all soil (tissue, fluid, etc.) and wipe thoroughly with a water-dampened cloth before applying one of the following cleaning products:

- Isopropyl alcohol (70% solution in water)
- Mild detergent and water
- Chlorine bleach (containing 6% sodium hypochlorite), 3% solution in water
- Cleaning solutions/wipes with milder Isopropyl alcohol and chlorine bleach concentrations

CAUTIONS: When cleaning, do not immerse. Wring any excess moisture from the cloth before cleaning and be sure to avoid pouring fluids on the device. Do not allow fluids to penetrate the exterior surfaces of the device.

No parts of the device (except sterilizable internal paddles) may be ultrasonically cleaned, immersed, autoclaved or ETO sterilized.

The ECG cables may not be ultrasonically cleaned, immersed, autoclaved or steam sterilized.

NOTE: For information about cleaning and sterilizing internal sterilizable paddles, see the *Sterilizable Defibrillator Paddles Instructions For Use*.

Printer Printhead

If the printout has light or varying print density, clean the print head to remove any buildup of paper residue.

To clean the print head:

1. Open the printer door.
2. Move the paper out of the way.

3 Clean the print head surface (top, front of the compartment) with a cotton swap dipped in Isopropyl alcohol.

4 Replace roll of paper and close door.

Carry Bags

After removing from the device, the carry bags and pouches may be cleaned by hand with mild soap and water and air dried. Do not wash or dry by machine.

SpO_2 Sensor and Cable

Follow the manufacturer's instructions to clean the SpO_2 sensor and cable.

NBP Cuff

Follow the manufacturer's instructions to clean the cuff.

Service and Care of the Cables and Paddles

Life expectancies for the HeartStart Intrepid 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 the cable and paddles 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 HeartStart Intrepid in transport and EMS environments that place additional stress on the cable connection and increase the chance for wear, impacting its useful life.

HeartStart Intrepid Disposal

Dealing with electronic waste is a concern for industry and society. Electronic waste is one of the fastest growing waste streams. Please visit https://www.philips.com/content/corporate/en_AA/about/sustainability/sustainable-planet/circular-economy/product-recycling-services.html/ to request a Philips recycling passport to have your HeartStart Intrepid refurbished or recycled as it ends its life.

Make sure the patient data are sanitized before disposal, see "Removing All Identifying Patient Data" on page 195.

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

WARNINGS: Disposing 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.

CPR Meter and Adhesive Pads Disposal

The CPR meter contains electronic components. Dispose of it at an appropriate recycling facility in accordance with local regulations. A used patient adhesive pad may be contaminated with body tissue, fluid or blood. Dispose of it as infectious waste.

18

Supplies and Accessories

Overview

This chapter provides information on the various supplies and accessories for the HeartStart Intrepid. Use of supplies or accessories other than those recommended by Philips Healthcare may compromise product performance.

Ordering Supplies and Accessories

If you have any questions or would like to order accessories and supplies, contact your local Philips Healthcare Sales Office or your authorized Philips Healthcare Dealer or Distributor.

Approved Supplies and Accessories

Not all accessories and supplies are available in all countries. The list of accessories is subject to change without notice.

WARNINGS: Use only multifunction electrode pads, battery and accessories listed in these *Instructions for Use*. Substitutions may cause the HeartStart Intrepid to function improperly and cause patient injury. For example, some electrodes may be subject to large offset potentials due to polarization.

Use single-use supplies and accessories only once.

NOTE: ECG electrodes, SpO_2 sensors, NBP cuffs, temperature probes, CO2 sampling tube, paddles/pads and CPR meters are considered applied parts.

ECG and Defibrillation Accessories

Some of the accessories are available in two standards:

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

Use the standards followed by your healthcare institution.

Table 82 **ECG Monitoring Electrodes**

Part Number	Description
M2202A	Adult radiolucent solid gel foam monitoring ECG electrodes, 300/case
989803148821	Small adult radiolucent solid gel foam monitoring ECG electrodes, 600/case

3-Lead ECG Cable Sets

Table 83 **3-Lead ECG Cable Sets**

Part Number	Description
M1669A	3-lead trunk cable, AAMI / IEC, 2.7 m
M1671A	3-lead ICU, grabber, AAMI, 1.0 m
M1672A	3-lead ICU, grabber, IEC, 1.0 m
M1673A	3-lead ICU, snap, AAMI, 1.0 m
M1674A	3-lead ICU, snap, IEC, 1.0 m
M1675A	3-lead OR, grabber, AAMI, 1.0 m
M1678A	3-lead OR, grabber, IEC, 1.0 m
989803173121	3-lead disposable, bedside AAMI, 1.0 m
989803174201	3-lead disposable, bedside IEC, 1.0 m

5-Lead ECG Cable Sets

Table 84 **5-Lead ECG Cable Sets**

Part Number	Description
M1644A	5-lead ICU snap, limb, AAMI, 1.6 m
M1645A	5-lead ICU snap, limb, IEC, 1.6 m
M1602A	5-lead ICU, snap, chest AAMI, 1.0 m
M1604A	5-lead ICU, snap, chest IEC, 1.0 m
M1668A	5-lead ECG trunk cable, AAMI / IEC, 2.7 m
M1971A	5-lead ICU grabber, limb, IEC, 1.6 m
M1973A	5-lead OR grabber, limb, AAMI, 1.6 m
M1974A	5-lead OR grabber, limb, IEC, 1.6 m
M1968A	5-lead ICU ECG set, grabber, limb AAMI, 1.6 m
989803173131	5-lead, disposable, bedside, AAMI, 1.0 m
989803174211	5-lead, disposable, bedside, IEC, 1.0 m

12-Lead ECG Cable Sets

Table 85 **12-Lead ECG Cable and Lead Sets**

Part Number	Description
M1663A	10-lead (5+5) ECG trunk cable, AAMI / IEC, 2.0 m
M1949A	10-lead (5+5) ECG trunk cable, AAMI / IEC, 2.7 m
M1976A	5-lead ICU, grabber, chest, AAMI, 1.6 m
M1978A	5-lead ICU, grabber, chest, IEC, 1.6 m
M1979A	5-lead OR, grabber, chest, AAMI, 1.6 m
M1984A	5-lead OR, grabber, chest, IEC, 1.6 m
M3526A	3-wire lead set plug, snap, AAMI, 1.6 m
M3527A	7-lead, snap, chest, AAMI, 1.6 m
M3528A	3-wire lead set plug, snap, IEC, 1.6 m
M3529A	7-lead, snap, chest, IEC, 1.6 m
989803176161	5-lead ruggedized ECG cable, snap, limb, AAMI, 1.6 m
989803176171	5-lead ruggedized ECG cable, snap, chest, AAMI, 1.0 m
989803176181	5-lead ruggedized ECG cable, snap, limb, IEC, 1.6 m

Table 86 **Pads Cables and Adapters**

Part Number	Description
M3507A	Hands-free pads cable, barrel style, 2.2 m
M3508A	Hands-free pads cable, plug style, 2.2 m (7 ft)
989803197111	Pads adapter cable, 2.1 m
989803158661	Hands-free pads cable, Q-CPR, HeartStart connector only (plug-style), 2.2 m
05-10200	Pads adapter, converts barrel connector to plug-style

WARNING: 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.

Table 87 **Multifunction Electrode Pads**

Part Number	Description
M3501A	Adult / child defib multifunction pads, AAMI, 0.6 m, 10 sets/case
M3504A	Infant defib multifunction pads, AAMI, 0.6 m, 5 sets/case
M3713A	Adult / child plus multifunction pads, 1.2 m 10 sets/case
M3716A	Adult / child radiolucent multifunction pads, 1.2 m, 10 sets/case
M3717A	Infant plus multifunction pads, 0.6 m, 5 sets/case
M3718A	Adult / child radiotransparent/reduced skin irritation multifunction pads, 1.2 m. 10 sets/case
M3719A	Infant radiotransparent/reduced skin irritation multifunction pads, 0.6 m, 5 sets/case

Table 87 **Multifunction Electrode Pads *(Continued)***

Part Number	Description
989803139261	SMART Pads II for adults, children, and infants, 1.2 m
989803149981	SMART Pads III for adults, children, and infants (1 set), 1.2 m
989803149991	SMART Pads III for adults, children, and infants (5 sets), 1.2 m
989803158211	HeartStart adult multifunction electrode pads (1 set), 1.2 m
989803158221	HeartStart adult multifunction electrode pads (5 sets), 1.2 m
989803166021	HeartStart adult / child preconnect pads, 1.2 m, 10 sets/case

WARNING: Use ECG electrodes prior to their expiration date. Discard electrodes after use, do not reuse.

Table 88 **Defibrillation Paddles**

Part Number	Description
External Paddles	
M3543A	External paddles with PCI, water resistant, 4.8 m
M4759A	Electrode replacement for M3543A
989803196431	Efficia external paddles with PCI, water resistant, 4.8 m
989803197591	Electrode replacement for 989803196431
Internal Paddles	
M1741A	7.5 cm switchless internal paddles, 3.9 m
M1742A	6.0 cm switchless internal paddles, 3.9 m
M1743A	4.5 cm switchless internal paddles, 3.9 m
M4740A	Internal paddles adapter cable, 0.3 m
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

Power Supply Accessories

Table 89 **Power Supply**

Part Number	Description
989803202601	Lithium Ion battery
989803202931	DC power module

Data Management Accessories

Table 90 **Data Management Accessories**

Part Number	Description
989803202611	USB data drive
989803202921	Wireless communication module

Paper

Table 91 **Paper Supplies**

Part Number	Description
989803138171	75 mm chemical thermal paper, 10 rolls

Test Loads

Table 92 **Test loads and Shorted Plugs**

Part Number	Description
M1781A	Test load for use with M3507A pads cable, 50 Ohm, barrel-style
M3725A	Test load for use with M3508A pads cable, 50 Ohm, plug-style
989803171271	Test Plug, shorted

Monitoring Supplies and Accessories

SpO_2 Sensors and Cables

Table 93 **SpO_2 Sensors and Cables**

Part Number	Description
Disposable	
M1131A	Single-patient SpO_2 sensor, Pediatric / Adult finger, 0.5 m
M1132A	Single-patient SpO_2 sensor, Infant finger, 0.9 m
M1133A	Single-patient SpO_2 sensor, Infant thumb/toe / Adult finger, 0.9 m
M1134A	Single-patient SpO_2 sensor, Neo / Infant / Adult, adhesive-free, Neonatal foot/hand, Infant thumb/toe / Adult finger, 0.9 m
M1140A	Single-patient Adult / child SpO_2 sensor, nasal Alar, 0.9 m
Reusable	
M1191B	Reusable SpO_2 sensor, Adult finger, 2 m
M1191BL	Reusable SpO_2 sensor, Adult finger, 3 m
M1192A	Reusable SpO_2 sensor, Pediatric / Small Adult, glove, 1.5 m
M1194A	Reusable SpO_2 sensor, Pediatric / Adult, ear clip, 1.5 m
M1196A	Reusable SpO_2 sensor, Adult finger, 3 m
M1196S	Reusable SpO_2 sensor, Adult clip, 2 m
Cables	
M1941A	SpO_2 extension cable, 2 m
M1943A	SpO_2 adapter cable, 1.1 m
M1943AL	SpO_2 adapter cable, 3 m

Blood Pressure Cuffs and Hoses

Table 94 Reusable Blood Pressure Cuffs and Hoses

Part Number	Description
Air Hoses	
M1598B	NIBP Air hose, Pediatric / Adult, 1.5 m
M1599B	NIBP Air hose, Pediatric / Adult, 3 m
Comfort Care Cuffs	
M1572A	Comfort cuff, Pediatric
M1573A	Comfort cuff, Small Adult
M1574A	Comfort cuff, Adult
M1574XL	Comfort cuff, Adult XL
M1575A	Comfort cuff, Large Adult
Easy Care Cuffs, Antimicrobial	
M4552B	Easy Care care cuff, Infant
M4553B	Easy Care care cuff, Pediatric
M4554B	Easy Care care cuff, Small Adult
M4555B	Easy Care care cuff, Adult
M4556B	Easy Care care cuff, Adult Long
M4557B	Easy Care care cuff, Large Adult
M4558B	Easy Care care cuff, Large Adult X-Long

Table 95 Single-Care Disposable Cuffs

Part Number	Description
Single Care Disposable Cuffs	
989803182281	Single Care cuff, Pediatric, 20 pack
989803182291	Single Care cuff, Small Adult, 20 pack
989803182301	Single Care cuff, Adult, 20 pack
989803182311	Single Care cuff, Adult XL, 20 pack
989803182321	Single Care cuff, Adult Large, 20 pack

$EtCO_2$ Monitoring

Table 96 $EtCO_2$ Monitoring Accessories

Part Number	Description
989803198891	CO_2 Nasal Cannula, Large
989803198901	CO_2 nasal cannula, Medium
989803198911	CO_2 nasal cannula, Small
989803198921	CO_2 / O_2 nasal cannula, Large
989803198931	CO_2 / O_2 nasal cannula, Medium
989803198941	CO_2 / O_2 nasal cannula, Small
989803198951	CO_2 oral / nasal cannula, Large

Table 96 **$EtCO_2$ Monitoring Accessories *(Continued)***

Part Number	Description
989803198961	CO_2 oral / nasal cannula, Medium
989803198971	CO_2 / O_2 oral nasal cannula, Large
989803198981	CO_2 / O_2 oral nasal cannula, Medium
989803198991	Airway Adapter Set; endotracheal diameter ET > 4.0 mm
989803199001	Airway Adapter Set; ET ≤ 4.0 mm
989803199011	Water filter assembly
989803199021	CapnoTrak CO_2 sampling extension line, 1.5 m
989803199031	CapnoTrak O_2 delivery extension line, 1.5 m
989803199041	CapnoTrak dehumidification tubing

Temperature Monitoring

Table 97 **Temperature Monitoring Probes**

Part Number	Description
Reusable Probes	
21075A	Esophageal/rectal temperature probe, Adult, 3.0 m
21076A	Esophageal/rectal probe, Pediatric, 3.0 m
21078A	Skin surface probe, Adult, 3.0 m
Disposable Probes	
21082A	Extension cable, 3.0 m
21082B	Extension cable,1.5 m
M1837A	Esophageal/rectal temperature probe, 9 FR, 20 pack,1.0 m
21090A	Esophageal/rectal probe, 12 FR, 20 pack 1.0 m
21091A	Sterile skin surface probe, 20 pack 0.8 m
21093A	Esophageal/stethoscope probe, 12 FR, 20 pack 0.8 m
21094A	Esophageal/stethoscope probe, 18 FR, 20 pack 0.8 m
21095A	Esophageal/stethoscope probe, 24 FR, 20 pack 0.8 m
21096A	Foley catheter probe, 16 FR, 10 pack 0.8 m
21097A	Foley catheter probe, 18 FR, 10 pack 0.8 m
M2255A	Foley catheter probe, 14 FR, 10 pack 0.8 m

Other Accessories

Q-CPR Accessories

Table 98 **Q-CPR Accessories**

Part Number	Description
989803204811	Q-CPR meter 2
989803163291	Q-CPR adhesive pads, 10 pack

Miscellaneous

Table 99 **Cable Management/Accessory Storage**

Part Number	Description
989803202941	Intrepid accessory storage system
989803202971	Intrepid rear accessory pouch
989803202981	Intrepid carry case shoulder strap
989803190351	Cable management straps
989803194281	Therapy Cable Collar

Table 100 **Mounting Solutions**

Part Number	Description
989803190361	Bedrail hook
989803203001	Intrepid docking station

19

Troubleshooting

This chapter is divided into the following major sections:

Overview

If the HeartStart Intrepid detects an error or potential problem during use, it displays a Technical Alarm or a message window with text to guide you. Alarms and messages are often accompanied by a voice prompt or an audible beeping tone. This chapter describes the Technical Alarms and messages that you may see, along with other symptoms, and provides suggestions for what to do. In addition, this chapter provides an explanation of audible tones and information on contacting your service representative.

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 HeartStart Intrepid out of service.
- If the malfunction is related to SpO_2, $EtCO_2$, NBP, or Temperature, 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 RFU indicator and the Automated Test Summary report (see "Automated Tests" on page 213).

To respond to errors reported through Op Check, see "Op Check Tests and Results" on page 206).

For further technical and repair information, refer to the HeartStart Intrepid *Service Manual*.

WARNING: Product servicing and repair should only be performed by qualified service personnel.

Device Information

While troubleshooting, it is often beneficial to know what versions of software and hardware your HeartStart Intrepid contains. The Device Info Report provides that information.

To view the Device Info on the screen:

1. Press the Smart Select knob.
2. Turn the Smart Select knob to highlight **Other** and press the Smart Select knob.

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

4 To confirm your selection, select **Yes** and press the Smart Select knob.

The Device Info is displayed. View and print the Device Info or run Op Check. Enter the valid service password for other Service Mode activities.

To print a Device Info Report:

1 Press the Smart Select knob.

2 Turn the Smart Select knob to highlight **Other** and press the Smart Select knob.

3 Select **Print Device Info** and press the Smart Select knob to print the report.

The Device Info Report contains information on:

- Serial Number
- Software Revision
- Installed Options
- Main Processor PCA
- Processor Module
- Therapy Board
- SpO_2, CO_2, NBP, and Temp modules, as installed
- CPR meter, if present
- Printer Module
- Wi-Fi Module
- Cellular Module

If the HeartStart Intrepid does not have an option installed, then no information is printed.

If there is a device failure and the HeartStart Intrepid cannot determine a version number, a **-?-** is displayed in its place.

NOTE: When first turning the HeartStart Intrepid on, the CO_2 sensor 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 HeartStart Intrepid. The tables also provide possible causes and potential solutions. Symptoms are categorized by functionality.

Try the potential solutions in the order they are listed. The most likely and simple solutions are listed first; the solutions that require effort and less likely to help are listed last.

When troubleshooting issues related to connecting the patient to the HeartStart Intrepid, it is recommended that one single person follow the connection path from the patient to the device to assure a proper end-to-end connection.

Table 101 **Power Supply Problems**

Symptom	Possible Cause	Potential Solution
The HeartStart Intrepid does not turn on.	There is no power.	Check the battery pack. Insert a fully charged battery. Connect the device to AC/DC power.
Short battery life (battery appears to lose charge quickly).	Battery may be nearing its end of life.	Replace the battery.
Replace Battery message.	The battery has reached its end of life.	Replace the battery.

Table 101 **Power Supply Problems** ***(Continued)***

Symptom	Possible Cause	Potential Solution
Low Battery message.	The battery may not have enough remaining charge to provide six 200 J shocks and 10 minutes of pacing or monitoring.	• Connect to AC/DC power. • Insert a fully-charged battery.
Shutting Down in 1 min message.	Very low battery and the device is not charging.	
Shutting Down Now message.	Battery charge is depleted and the device is not charging.	Connect to AC/DC power to restart the device.
Battery Communication Failure technical alarm.	The device is unable to communicate with the battery.	• Connect to AC/DC power. • Insert a fully-charged battery. • If the problem persists, call for service. If battery power is essential to patient care, take the device out of use and call for service.
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 HeartStart Intrepid for about 1 minute to awaken it.
Power Test Failure technical alarm.	The installed battery is unable to charge the device for defibrillation.	• Insert a fully charged battery. • Run Op Check to diagnose the problem. If persists, take the device out of use and call for service.

Table 102 **General Problems**

Symptom	Possible Cause	Potential Solution
When turned on, the device displays **Therapy Not Available Due to Disabled Equipment**. If in AED or Manual Defibrillation Mode, **Begin CPR, If Needed**. is also displayed.	Therapy Mode is not available because of a device failure.	• Begin CPR if needed. • Run Op 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.
	Device's speaker failure	Run Op Check to confirm the speaker is operating.
All Settings Reset To Default Values message.	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.	An error has occurred which corrupted your configuration file.	Reset your Configuration settings to your customized settings.

Table 102 **General Problems** ***(Continued)***

Symptom	Possible Cause	Potential Solution
Critical Device Failure Detected. Service Required. message.	A critical device failure has been detected at startup or during RFU testing. Clinical modes are disabled.	Run Op Check. If it fails or the problem occurs repeatedly, take the device out of use and call for service.
Equipment Disabled: System Failure message.		
Therapy Disabled: Run Op Check message.	A device failure has been detected at startup or during RFU testing. The device is unable to deliver therapy.	
Non-critical Device Failure Detected. Service Required message.	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.	A faulty Therapy cable or the Therapy port.	• When prompted, pick the correct cable type from the menu and press the Smart Select knob. (If you select a wrong cable type in error, unplug and re-plug in the cable.) • Replace the Therapy cable. • If persists, take the device out of use and call for service.
One or more controls do not respond as expected (e.g. a button or soft keys does not work).	A faulty control or connection.	Remove the device from use and call for service.
Trending data is not appearing on the display.	Intrepid might not be in Monitor Mode.	Make sure your device is in Monitor Mode before attempting to display trending information.
Event Record Limit Reached technical alarm.	The eight hour duration limit for the current event has been reached.	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.
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.
USB Error technical alarm.		Restart device when it is appropriate to do so. If the alarm continues, call for service.
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 persists, remove the device from use and call for service.

Table 102 **General Problems** ***(Continued)***

Symptom	Possible Cause	Potential Solution
Device Restarted Due to Error technical alarm.	The previous shutdown was caused by an internal device error.	Run Op Check to diagnose the problem. If the problem persists, remove the device from use and call for service.
Power Equipment Malfunction technical alarm.	A power supply failure has occurred but no critical functions are affected.	
Autotest Failure technical alarm.	One of the Ready For Use tests failed to run to completion at its scheduled interval.	Run Op 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 Op Check to diagnose the problem. If the problem persists, remove the device from use and call for service.
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.
Display remains in Monitor Mode even when you switch to a different mode. Therapy is disabled.	The Therapy knob has failed Op Check.	Run a proper Operational Check to diagnose the problem. If the problem persists, take the device out of use and call for service.
System Failure. Service Required message.	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.	Autotest has not been run in over a week, possibly because the device was without power.	Run Op Check.
Autotest Error. Run Op Check. message.	The device cannot determine if all subsystems are operational.	Run Op Check.
Device doesn't administer a shock during Weekly Shock Test.	You are using a test plug or paddles during the Weekly Shock Test.	This is normal behavior. A shock is not delivered during a Weekly Shock test using a test plug or paddles.
	You are using a test load during the Weekly Shock test.	Confirm you did the test properly before taking the device out of use and calling for service.

Table 103 **ECG Problems**

Symptom	Possible Cause	Potential Solution
QRS beeper inaudible or beeps do not occur with each QRS complex.	The QRS volume is configured to **Off** or the setting is too low.	Configure the QRS beeper volume.
	The QRS volume was turned off or set too low through the Volume menu.	Adjust the volume through the Volume menu.
	The amplitude of the QRS complex is too small to detect.	Select a different lead.
Poor ECG signal quality (noisy trace, wandering baselines, etc.) from signal acquired through monitoring electrodes.	The monitoring electrodes are not making proper contact with the patient.	Check that the monitoring electrodes are properly applied. If necessary, prepare the patient's skin and apply new electrodes.
	The monitoring electrodes are out of date or dried out.	Check the date code on the electrodes. Do not open the electrode package until immediately prior to use.
	Radio frequency interference (RFI) is causing artifact.	Relocate or turn off equipment that may be causing RFI. Try repositioning the cables/leads.
	The ECG cable may be faulty.	Run Op Check with the ECG cable and check Leads ECG results. If fails, replace the ECG lead set 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. 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 Op Check with the Therapy cable and check pads ECG results. If the Op Check fails, replace the cable.
When monitoring with pads, there is a dashed line on the display instead of an ECG.	ECG data is not being acquired.	• Confirm that the desired lead is selected. • Check the pads, paddles or ECG cable connection. • Check that the pads, paddles, and monitoring electrodes are properly applied.

NOTE: Viewing a patient's ECG through paddles is not recommended for long-term monitoring. See "Quick Look" on page 85.

Table 103 **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 Op Check with the ECG cable. If fails, run it without the ECG cable. If passes, replace the cable. If persists, 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 Op 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.	Run Op 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, take the device out of 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 Op Check. If fails or the problem persists, take the device out of use and call for service.

Table 103 **ECG Problems** ***(Continued)***

Symptom	Possible Cause	Potential Solution
Press "I,II.." Button to Select Another ECG Lead message.	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.	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.	Two or more limb lead electrodes are off or not making proper contact with the patient.	Check that the limb lead electrodes are properly applied. This message does not display when V and RL are off because the device assumes a 3-Lead cable is attached.

Table 104 **Defibrillation and Pacing Problems**

Symptom	Possible Cause	Potential Solution
Check Pads Connection From Patient to Device message.	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	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	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		Check pads connection with the patient.
Connect Therapy Cable message	The pads or paddles Therapy cable is not connected to the device.	Confirm all cables are properly connected.
Insert Connector, Apply Pads message	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	An energy greater than 50 J was selected with internal paddles connected.	Re-set energy setting to 50 J or less.
Replace Pads message	A shock has been aborted due to high impedance - second notice.	Replace the pads and check connection with patient.

Table 104 **Defibrillation and Pacing Problems *(Continued)***

Symptom	Possible Cause	Potential Solution
Reapply Pads to Dry Chest message.	A shock has been aborted due to low impedance.	Confirm proper skin prep and reapply pads.
Paddles Must Not Be Touching Each Other message.		• 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.	A shock was delivered but there was marginal impedance.	Check pads connection with the patient.
Press Paddles Firmly For Next Shock message.		Check paddles connection with the patient.
Paddles Power Overload message.	The device has detected a power overload with the connected paddles.	Run Op Check to see if the message clears. If it does not, run Op Check with a different set of paddles. If persists, take the device out of use and call for service.
Select Therapy Cable Type message.	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	A device failure has occurred.	Run Op 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 HeartStart Intrepid has detected an error which prevents pacing therapy delivery.	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 104 **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 Op Check to clear the error.

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

Table 105 **SpO_2 Problems**

Symptom	Possible Cause	Potential Solution
The SpO_2 waveform is not displayed.	The sensor is not properly connected or the sensor cable is damaged.	• Check the sensor connection and cable. • Try another sensor.
	The SpO_2 waveform is not configured to be displayed and there is not an unused wave sector.	Use the Displayed Waves menu to select a wave sector to display the SpO_2 waveform.
	You are in AED Mode and SpO_2 waveform is not configured to be displayed or SpO_2 is non-pulsatile.	Configure AED Mode to use SpO_2.
SpO2 Non-Pulsatile technical alarm.	The patient's pulse is absent or too weak to be detected or the sensor has come off.	• Check perfusion at the measurement site. • Check that the sensor is applied properly. • Make sure the sensor site has a pulse. • If the message occurs during an NBP measurement on the same limb, wait until the NBP measurement is finished. • Relocate the sensor to another site with improved circulation. • Try another sensor.

Table 105 **SpO_2 Problems**

Symptom	Possible Cause	Potential Solution
SpO2 Erratic technical alarm. The numeric value is replaced with a **-?-**.	SpO_2 measurements are erratic.	• Check that the sensor is applied properly. • Make sure the sensor site has a pulse. • Relocate the sensor to another site with improved circulation. • Try another sensor.
SpO2 Noisy Signal technical alarm.	Excessive patient movement or electrical interference.	• Minimize patient movement. • Make sure the sensor cable is not positioned too close to power cables.
SpO2 Interference technical alarm.	Ambient light is too high.	• Cover the sensor with an opaque material to minimize ambient light. • Make sure the sensor cable is not positioned too close to power cables. • Make sure that the sensor cable is not damaged.
SpO2 Unplugged technical alarm.	The sensor is not connected.	• Check the SpO_2 connection. • Try another sensor.
	There is too much interference.	
	The sensor is damaged.	
SpO2 Sensor Malfunction technical alarm.	The SpO_2 sensor or cable is faulty.	• Try another sensor. • If the problem persists, call for service of the SpO_2 module. If SpO_2 monitoring is essential to patient care, take the device out of use.
SpO2 Equipment Malfunction technical alarm.	Faulty SpO_2 hardware.	Call for service of the SpO_2 module. If SpO_2 monitoring is essential to patient care, take the device out of use.
SpO2 Extended Update technical alarm. The numeric value is replaced with a **-?-**.	An NBP measurement or an excessively noisy signal is delaying display/update of the SpO_2 measurement for more than 30 seconds.	• Wait until the NBP measurement is complete. • Try another sensor site. • Move sensor to a different limb than the NBP cuff.
SpO2 Low Perfusion technical alarm. The numeric value is replaced with a **-?-**.	The SpO_2 signal is too low to give an accurate reading.	• Check that the sensor is applied properly. • Make sure the sensor site has a pulse. • Relocate the sensor to another site with improved circulation. • Try another sensor.
SpO2 Error technical alarm.	A non-critical device failure has occurred.	Restart device when it is appropriate to do so. If the problem persists, call for service of the SpO_2 module. If SpO_2 monitoring is essential to patient care, take the device out of use.

$EtCO_2$ Problems

When a solution mentions “airway”, it means the cannula, extension line, and dehumidification tubing, whichever are present in the assembly.

Table 106 **$EtCO_2$ Problems**

Symptom	Possible Cause	Potential Solution
The numeric value is replaced with a **-?-**.	The module is warming up.	No action required. As soon as the module 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 module is warming up.	No action required. As soon as the module has warmed up, the question mark is removed from the display.
The Capnogram does not appear on the display.	The Capnogram is not configured to be displayed.	Use the Displayed Waves menu to select a wave sector to display the Capnogram.
The Capnogram has a dashed line.	The sampling line is not properly connected	• Check all connections. • Check sampling line for knots, kinks or pinches.
Unable to zero: CO2 in the Tube message	There is CO_2 in the sample line.	Ensure the cannula or airway adapter is disconnected from the patient, then zero again.
CO2 Sensor Over Temp technical alarm.	The CO_2 module is overheated.	Ensure the HeartStart Intrepid is being used within the proper environmental temperature.
EtCO2 Power Overload technical alarm	The CO_2 module is malfunctioning.	Replace the module
CO2 Communication Failure technical alarm	The CO_2 module cannot communicate with the device.	• Run Op Check. • If persists, call for service.
CO2 Zero Required technical alarm.	The CO_2 module needs to be zeroed.	Zero the module, see “Zeroing the CO_2 Module” on page 136.
CO2 Out of Range technical alarm.	The CO_2 value is out of the measurement range.	
CO2 Sensor Warming Up technical alarm.	The module has not reached its proper operating temperature.	No action required. The technical alarm is removed when the module reaches its operating temperature.
CO2 Check Line technical alarm.	The sampling line or the water filter assembly is kinked or blocked.	• Check the sampling line for kinks or blockages. • Replace sampling line. • Check and replace water filter assembly if necessary.
CO2 Tube Unplugged technical alarm.	Patient interface connections are not properly tightened.	Tighten water filter connection to front panel.
CO2 Error technical alarm.	A non-critical error was detected.	Restart device when it is appropriate to do so.

Table 107 **NBP Problems**

Symptom	Possible Cause	Potential Solution
Measurement cycle doesn't automatically start.	NBP is not configured for automatic measurements.	Check/modify the configuration as needed.
	Automatic measurements are not scheduled for the current patient.	Use the Measurements/Alarms menu to define an automatic schedule of measurements for the current patient.
	The **[Start NBP]** soft key has not been pressed.	Press the **[Start NBP]** soft key.
The pump operates but the cuff does not inflate or fails to inflate fully.	Defective cuff.	Replace the cuff.
	Poor connection between the cuff and the HeartStart Intrepid.	Check connections and replace tubing if needed.
NBP measurements appear high/low.	The cuff size is too small/large for the patient.	Use the correct cuff size and take another measurement.
NBP Cuff Not Deflated technical alarm. The NBP numeric value is replaced with a **-?-**.	The cuff has not fully deflated after 3 minutes.	Remove the cuff from the patient. Release pressure in the cuff (disconnect cuff from tubing). Replace the cuff. If the problem persists, call for service.
NBP Cuff Overpressure technical alarm. The NBP numeric value is replaced with a **-?-**.	The NBP cuff pressure has exceeded the overpressure safety limit of 300 mmHg / 40 kPa.	The cuff should deflate automatically. If not, remove cuff from patient and deflate. Turn device off to reset the alarm and restart NBP.
NBP Measurement Failed technical alarm. The NBP numeric value is replaced with a **-?-**.	A measurement value could not be obtained.	Check cuff size and placement.
NBP Equipment Malfunction technical alarm.	Faulty NBP hardware.	Call for service. If NBP monitoring is essential to patient care, take the device out of use.
NBP Error technical alarm.	A non-critical device failure has occurred.	
NBP Calibration Overdue technical alarm	NBP module calibration is due.	Call for service.

Table 108 Temperature Monitoring Problems

Symptom	Possible Cause	Possible Solution
<Temperature Label> Equip Malfunction INOP	There has been a malfunction in the temperature hardware.	Contact Service.
<Temperature Label> Overrange INOP	The temperature value is outside the measurement range of the device (<0oC or > 45oC).	Check that the temperature probe is on the list of supported accessories. Try changing the application site.
<Temperature Label> Unplugged INOP	The temperature transducer is faulty or has been disconnected from the device.	Try unplugging and then replugging the temperature transducer. If the symptom does not go away, use a different transducer.
Temperature Label = one of the labels which can be applied to a temperature measurement.		

Table 109 TBI Advisory Problems

Symptom	Possible Cause	Potential Solution
The [Enable TBI] soft key does not appear.	The device is not in Monitor mode or is in 12-lead ECG mode.	Switch the device to Monitor mode or exit 12-lead ECG mode.
	The device is not equipped with either SpO2, NBP or EtCO2.	The TBI Advisory is only available on devices configured with SpO2, NBP and EtCO2 measurement parameters and all three parameters must be in use.
	TBI Limits have not been configured on the device.	In Configuration Mode, set the TBI limits for SpO2, SBP and EtCO2.
The TBI Advisory bar is blocked by another message.	If a physiological alarm condition occurs, it will have a higher priority than the TBI Advisory and will obscure the TBI Indicator.	Attend to the patient and address the alarm condition.

Table 110 Printing Problems

Symptom	Possible Cause	Potential Solution
Paper won't 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.
	Print head 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 110 **Printing Problems *(Continued)***

Symptom	Possible Cause	Potential Solution
Paper moves but print quality is poor or some dots are missing.	Dirty print head.	Clean the print head as directed in "Printer Printhead" on page 219.
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 HeartStart Intrepid off for 15 seconds and then turn it back on. If the problem persists, call for service. If printing is essential to patient care, take the device out of use.
Printer Error technical alarm.	A non-critical device failure has occurred.	Restart device. If the error continues and printing is essential to patient care, take the device out of use and call for service.

Table 111 **USB Problems**

Symptom	Possible Cause	Potential Solution
Insert Compatible USB Device message.	A non-compatible USB device has been inserted in the USB port.	Use only a compatible USB device to store data from the HeartStart Intrepid. See "USB Device" on page 258.
You can not 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 can not 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.	The USB flash drive was removed during data transfer.	Re-insert the USB flash drive and re-try.

Table 111 **USB Problems *(Continued)***

Symptom	Possible Cause	Potential Solution
Error Reading Configuration Data message.	The configuration file has become corrupted.	Save a new configuration file to the flash drive and re-try.
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 re-try.

Servicing the HeartStart Intrepid

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 the local Philips representative.

Before calling for service, note the following information:

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

20

Specifications and Safety

Overview

This chapter is divided into the following sections:

HeartStart Intrepid Specifications

General

Approximate Dimensions: 24.6 cm (H) x 29 cm (W) x 21 cm (D);
9.7 in (H) x 11.4 in (W) x 8.3 in (D)

Approximate Weight: (with pads cable, battery, and full roll of paper) ≤ 6.7 kg / 14.8 lb

Standard Operator Position: Within one meter (3 feet) of the device.

Power:
- Rechargeable Lithium Ion battery;
- AC power
- DC power, using the DC Power Module. See Table 89 “Power Supply” on page 224.

Alarms

The HeartStart Intrepid alarms comply with IEC 60601-1-8.

Alarm Tone and Voice Message Volume Range

- Maximum: 85 dB(A),
- Minimum: 45 dB(A).

Alarm Tones

Imminent Shutdown: Continuous tone alternating between 1000 and 2100 Hz.

High Priority: Tone of 960 Hz lasting 0.5 sec repeated every second.

Medium Priority: Tone of 480 Hz lasting 1 sec repeated every two seconds.

Low Priority: Tone of 480 Hz lasting 0.25 sec repeated every two seconds.

Visual Alarm Characteristics

High Priority: Flashing at 2 Hz with 50% duty cycle (a 0.25-sec flash twice every second).

Medium Priority: Flashing at 0.5 Hz with 50% duty cycle (a 1-sec flash every other second).

Low Priority: Constant on.

Defibrillator

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

Shock Delivery: Via multifunction electrode pads or paddles.

Shock Series: Configurable energy escalation in a series.

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

Table 112 **Delivered Energy Accuracy**

Nominal Delivered Energy vs. Load Impedance							
Selected Energy	**Load Impedance (ohm) ±2%**						
	25	**50**	**75**	**100**	**125**	**150**	**175**
1 J	1.2	1.3	1.3	1.2	1.1	1.0	0.9
2 J	1.7	2.0	2.1	2.0	1.9	1.7	1.6
3 J	2.6	3.0	3.1	3.2	3.2	3.1	2.9
4 J	3.5	4.0	4.2	4.3	4.4	4.5	4.3
5 J	4.3	5.0	5.2	5.4	5.5	5.6	5.4
6 J	5.2	6.0	6.3	6.5	6.6	6.7	6.5
7 J	6.1	7.0	7.3	7.6	7.8	7.8	7.6
8 J	6.9	8.0	8.4	8.6	8.9	8.9	8.7
9 J	7.8	9.0	9.4	9.7	10	10	9.8
10 J	8.7	10	10	11	11	11	11
15 J	13	15	16	16	17	17	16
20 J	17	20	21	22	22	22	22
30 J	26	30	31	32	33	33	33
50 J	43	50	52	54	55	56	54
70 J	61	70	73	76	78	78	76
100 J	87	100	105	108	111	111	108
120 J	104	120	126	130	133	134	130
150 J	130	150	157	162	166	167	163
170 J	147	170	178	184	188	189	184
200 J	173	200	209	216	222	223	217

The delivered energy accuracy is ±10% or ±1 J, whichever is greater, for all energy settings.

Charge Times

- Less than 5 seconds to the recommended adult energy level (150 J) with a new fully-charged battery installed.

- Less than 6 seconds to the selected energy level (up to 200 J) with a new fully-charged battery installed, even after the delivery of 15 discharges at maximum energy.
- Less than 10 seconds to the selected energy level while connected to AC/DC 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:

- 19 seconds with AC/DC 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:

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

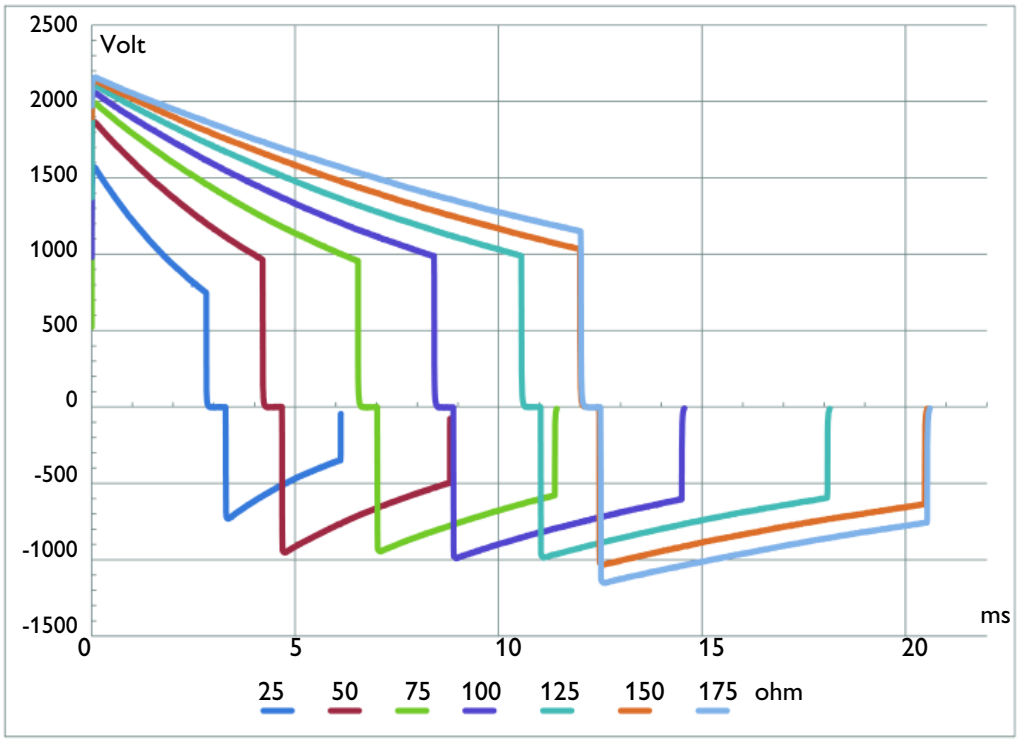
The device powers on in AED mode ready to deliver shock in less than:

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

Patient Impedance Range

- Minimum: 25 ohm (external defibrillation); 15 ohm (internal defibrillation);
- Maximum: 250 ohm. Actual functional range may exceed these values.

Figure 100 **SMART Biphasic Waveform**



Manual Defibrillation Mode

Manual Output Energy (Selected): 1-10, 15, 20, 30, 50, 70, 100, 120, 150, 170, 200 Joules; maximum energy limited to 50 J with internal paddles.

Controls: Therapy knob, Sync, Charge, Shock, Smart Select knob Patient Category, ECG Lead Select, ECG Gain Select, Mark Events, Print, Alarms.

Energy Selection: Front panel Therapy knob.

Charge Control: Front panel button; button on external paddles.

Shock Control: Front panel button; buttons on external or switched internal paddles.

Synchronized Control: Front panel Sync button.

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

Indicators: Text prompts, audio alerts, QRS beeper, battery status, Ready For Use (RFU), External Power, Sync Mode.

Armed Indicators: Charging/charged tones, flashing shock button on front of panel and on external paddles, energy level indicated on the display.

AED Mode

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

AED Controls: On/Off, shock.

Text and Voice Prompts: Extensive text/audible messages guide user through a user-configured protocol.

Indicators: Monitor display messages and prompts, voice prompts, battery status, RFU, external power.

Armed Indicators: Charging/charged tones, flashing shock button, energy level indicated on the display.

ECG analysis: Evaluates patient ECG and signal quality to determine if a shock is appropriate and evaluates connection impedance for proper defibrillation pad contact.

Shockable Rhythms: SMART Analysis is designed to shock ventricular fibrillation, ventricular flutter and polymorphic ventricular tachycardia. It is designed to avoid delivering a shock for rhythms that are commonly accompanied by a pulse or rhythms that would not benefit from an electrical shock.

Shock Advisory Algorithm Sensitivity: Meets AAMI DF39 requirements and AHA recommendations;

- **Adult:** Ventricular Fibrillation: 90% with lower confidence limit (LCL) of 87%, Polymorphic Ventricular Tachycardia and Ventricular Flutter: 75% with LCL of 67%;
- **Infant/Child:** Ventricular Fibrillation: 90% with LCL of 87%.

Shock Advisory Algorithm Specificity: Meets AAMI DF39 requirements and AHA recommendations;

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

ECG and Arrhythmia Monitoring

Inputs: Up to four ECG waves may be viewed on the display and up to three waves printed simultaneously. Lead I, II or III is obtained through the 3-wire ECG cable and separate monitoring electrodes. With a 5-lead ECG cable, leads aVR, aVL, aVF and V can also be obtained. With a 10-lead ECG cable, leads V1 – V6 can also be obtained. Pads ECG is obtained through two multifunction electrode pads.

Lead Fault: Messages and dashed lines appear on the display if an electrode or lead becomes disconnected.

Pad Fault: Dashed line appears on the display if a pad becomes disconnected.

Heart Rate Display: Digital readout on the display from 16 to 300 bpm (Adult Patient Category) or 16 to 350 bpm (Infant/Child), with an accuracy of ±10% or ±5 bpm whichever is greater.

Heart Rate/Arrhythmia Alarms: HR high, HR 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 10 mm/mV on the printed strip).

ECG waveforms: Displayed at a fixed timebase:

- Printer: 25 or 50 mm/sec ±5%,
- Display: 25 mm/sec ±10%.

ECG Leads Off Sensing: 3-, 5-, and 10-Lead wires apply a <35 nA DC current patient electrodes, <1.0 µA 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: 18 mm.

Frequency Response:

- ECG AC Line Filter: 50 Hz or 60 Hz.
- ECG for Display:
  - 0.15-40 Hz,
  - 0.05-40 Hz (IEC 60601-2-27:2011, 201.12.1.101.8 a, b),
  - 2.0-20.0 Hz
- ECG for Printer:
  - 0.05-150 Hz – Diagnostic,
  - 0.15-40 Hz – Monitor,
  - 0.05-40 Hz – ST Monitor (IEC 60601-2-27:2011, 201.12.1.101.8 a, b),
  - 2.0-20.0 Hz – EMS
- ECG sample rate: 1000 samples/sec, Channel skew: ≤100µs, Amplitude resolution: 2.12uV/LSB

Heart rate accuracy and response to irregular rhythm: Meets IEC standard for ventricular bigeminy (HR=80 bpm); slow alternating ventricular bigeminy (HR=60 bpm); rapid alternating ventricular bigeminy (HR=120 bpm); bidirectional systoles (HR=90 bpm) as measured after a 20 sec stabilization time.

Heart rate averaging: For heart rates ≥ 50 bpm, heart rate is determined by averaging the 12 most recent R-R intervals. Beats N, P, and V are included. When heart rate drops below 50 bpm, the four most recent R-R intervals are used in the average. Note: For ventricular tachycardia alarms, which have a user-definable PVC run length limit, the heart rate is based on the user-selected PVC length up to 9 PVCs maximum. Heart rate display update time is 1 second maximum.

Pace Pulse Detection Sensitivity: 1 mV for a width of 100 µs; 200 µV for a 500 µs width and 200 µV for widths of 500 µs to 2 ms.

ECG Analog Output Bandwidth: 0.5 to 70 Hz

ECG Analog Output Gain: 1 v output per 1 mV input ±10%

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

Pacemaker Pulse Rejection Capability: Amplitude from ± 2 mV to ± 700 mV, width from 0.1 ms to 2.0 ms as per IEC 60601-2-27:2011 201.12.1.101.13/YY1079 4.1.4.1, except the full overshoot range of IEC 60601-2-27 methods A and B.

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

Heart Rate Response Time: 7 sec for a High Heart Rate alarm when the rate changes from 80 to 120 bpm, with the alarm limit set at 100 bpm; 6 sec for a Low Heart Rate alarm when the rate changes from 80 to 40 bpm, with the alarm limit set at 60 bpm.

Time to Alarm for Tachycardia: 4 sec for 206 bpm (1 mV, halved amplitude and double amplitude) and 195 bpm (2 mV, halved amplitude and double amplitude) as measured following a normal 80 bpm rate with upper alarm limit set at 100 and lower alarm limit set at 60 bpm.

Patient Isolation (Defibrillation Proof):

- Lead ECG: Type CF
- SpO_2: Type CF
- CO_2: Type BF
- NBP: Type CF
- Pads/Paddles: Type BF
- Internal Paddles: Type CF
- Temperature: Type CF
- CPR meter: Type BF

Other consideration: The HeartStart Intrepid is suitable for use in the presence of electrosurgery. Burn hazard protection is provided via a 1K current-limiting resistor contained in each ECG lead wire. Proper lead placement (see "Electrode Placement" on page 54) is important to reduce burn hazards in the event of a defect in the electrosurgical equipment. Do not entangle the ECG cables with the electrosurgical equipment wires; do not place the ECG cabling near the electrosurgical equipment's grounding plate.

HeartStart Intrepid Leads ECG is not suitable for direct cardiac application.

Display

Size: Approximately 21.3 cm (8.4 in) diagonal viewing area.

Type: Color TFT LCD.

Resolution: 1024 x 768 pixels (VGA) with 32 brightness levels per color.

Sweep Speed: 25 mm/s ± 10% nominal (stationary trace; sweeping erase bar) for ECG and SpO_2; capnogram wave is 6.25 mm/s ± 10%.

Wave Viewing Time: 5.0 sec ± 10%.

Battery

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

Approximate Dimensions: 28.5 mm (H) x 80 mm (W) x 145.7 mm (L); 1.1 in (H) x 3.1 in (W) x 5.7 in (L)

Approximate Weight: Approximately 0.44kg (1 lb)

Capacity: With a new fully charged battery, at 20°C (68°F), one of the following:

- 100 full-energy charge/shock cycles.
- Five hours of monitoring (ECG, $EtCO_2$, SpO_2, and Temperature continuously monitored and NBP sampled every 15 minutes) followed by 20 full-energy charge/shock cycles.
- Three hours of pacing (180 ppm at 140 mA with 40 msec pulse) and monitoring (ECG, $EtCO_2$, SpO_2, and Temperature continuously monitored and NBP sampled every 15 minutes).

Charge Time with Device Turned Off and AC Power Connected: With temperature at 25°C (77° F), less than 3 hours to 100% capacity; less than 2 hours to 80% capacity.

Battery Indicators: Battery gauge on battery, capacity indicator on display, power indicators on front of device; flashing RFU indicator, audio beep and **Low Battery** messages on the display for low battery condition. When a low battery message first appears there is still enough energy for at least 10 minutes of pacing or monitoring and six maximum energy discharges.

Temperature

Measurement Range: 0°–45°C (32°–113°F)

Measurement Resolution: 0.1°C (0.2°F)

Measurement Accuracy (excluding any adapter cable):

- ±0.1°C from 25°C to 45°C;
- ±0.3°C from 0°C to 24.9°C
- temperature probe adds an additional ±0.1°C

NOTE: If operating under conditions according to the EMC standard IEC 60601-1-2 (Radiated Immunity 3 V/m or Conducted Immunity 3 VRMS), the additional temperature error is ≤ ±0.1°C.

Settling Time Constant: <10 seconds

Alarm Delay Time:

- High temperature alarm: 7 seconds;
- Low temperature alarm: 6.8 seconds

Averaging Time: 1 second

Minimum measurement time: See the probe's Instructions for Use to obtain minimum measurement times for accurate readings. The HeartStart Intrepid does not add any clinically significant time to obtain accurate readings.

Mode of Operation: Direct Mode

Transient response time from 25°C to 27°C: <60 seconds

Transient response time from 25°C to 23°C: <60 seconds

Thermal Array Printer

Continuous ECG Strip: The Print key starts and stops the strip. The printer can be configured to be run real time or with a 10-second delay. The strip prints the primary ECG lead and a second wave with event annotations and measurements. This strip prints a third wave from Wave Sector 3 or 4.

Auto Printing: The printer can be configured to automatically print on Mark Events, Charge, Shock and Alarm.

Reports: The following can be printed:

- Event Summary (Long or Short)
- Operational Check
- Status Log
- 12-lead
- Vital Signs Trends
- Configuration
- Device Information

Speed: 25 or 50 mm/s with an accuracy of ±5%

Amplitude Accuracy: 5% for offset voltages of ± 300 mV at 5 Hz

Paper Size: 75mm (W) x 30 m (L)

Noninvasive Pacing

Waveform: Monophasic

Current Pulse Amplitude: 10 mA to 200 mA if the pulse width is set to 20 ms (5 mA increments); accuracy ±10% or ±5 mA whichever is greater. For a 40 ms setting, the maximum pacing current is 140 mA.

Pulse Duration: 20 or 40 msec with ±10% accuracy

Rate: 30 ppm to 180 ppm (10 ppm increments); accuracy ±1.5%

Mode: Demand or Fixed

Refractory Period: 340 msec (30 to 80ppm); 240 msec (90 to 180 ppm) ±10%

Universal-function electrodes (Pads): After 60 minutes of pacing with approved defibrillators, the Multifunction Electrodes (Pads) exhibit a post-defibrillation DC Offset of less than ±800 mV at ≥4 seconds post-shock.

SpO_2 Pulse Oximetry

SpO_2 Measurement Range: 0-100%

SpO_2 Resolution: 1%

SpO_2 Update Period: 1-2 sec typical; maximum of ≤30 sec

SpO_2 Sensor Accuracy: Specified accuracy is the root-mean-square (RMS) difference between the measured values and reference values.

- Accuracy ±2%: M1132A, M1133A (Adult/Infant), M1134A (Adult/Infant), M1191B, M1191BL, M1192A
- Accuracy ±3%: M1131A, M1140A, M1194A, M1195A, M1196A, M1196S

NOTES: Accuracy outside the range specified for each sensor is not indicated. The above referenced sensors were validated for use with the HeartStart Intrepid using the Philips picoSAT II SpO_2 module with Fourier Artifact Suppression Technology (FAST).

While the SpO_2 module is able to report values below 70% and alarm limits can be set below 70%, the accuracy of measurements less than 70% has not been validated.

SpO_2 accuracy was validated in human studies against arterial blood sample references measured with a CO-oximeter. In a controlled desaturation study, healthy adult volunteers with saturation levels between 70-100% SpO_2 were studied. The population characteristics for those studies were approximately 50% male and 50% female, ranging in age from 19-39 with skin tone from light to dark.

Pulse oximetry equipment measurements are statistically distributed, therefore only two-thirds of pulse oximeter equipment measurements can be expected to fall within ±Arms of the value measured by a CO-oximeter.

Functional test equipment designed for SpO_2 testing cannot be used to assess the accuracy of the SpO_2 readings.

See the sensor's instructions for use for the maximum temperature possible at the sensor-skin interface and other information such as intended patient population, sensor application sites and use criteria.

The HeartStart Intrepid is calibrated to display functional oxygen saturation.

Ambient Light Sensitivity: Interference from fluorescent light is <2% SpO_2 under the following conditions: 0.3 and 1% perfusion, 50 nA/mA transmission, 10 to 1000 lx light intensity, 50/60±0.5 Hz power line frequency.

SpO_2 Alarm Range:

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

SpO_2 and Pulse High/Low Alarm Signal Generation Delay: 10 seconds

SpO_2 Response Time (90 to 80%): average 18.9 seconds, standard deviation 0.88 seconds

SpO_2 and Pulse Averaging Time: 10 sec

Emitted Light Energy: ≤15 mW

Wavelength Range: 500-1000 nm (Information about wavelength range can be useful to users, especially those performing photodynamic therapy.)

Desat Alarm Signal Generation Delay: 20 sec

Pulse Rate Measurement Range: 30-300 bpm

Pulse Rate Resolution: 1 bpm

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

Pulse Rate Reference Method: Electronic pulse simulator

Pulse Response Time (90 to 120 bpm): average 18.0 seconds, standard deviation 0.86 seconds

Pulse Alarm Range:

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

$EtCO_2$

The HeartStart Intrepid uses Respironics CapnoTrak® Sidestream CO_2 module.

Initialization Time: Capnogram available in less than 10 seconds.

Range: 0, 5 to 99 mmHg at sea level

Resolution: 1 mmHg (0.1 kPa)

Operating Atmospheric Pressure: 400 – 800 mmHg (533 – 1066 mbar)

Storage Atmospheric Pressure: 375 – 800 mmHg (467 – 1066 mbar)

Measurement Rate: 100 samples per second.

Total System Response Time: < 4 seconds, includes transport time and rise time with water filter assembly and airway adapter. Up to an additional 3 seconds for sidestream sampling cannulas with dehumidification and extension tubing.

Rise Time: < 340 ms. Up to an additional 70 ms for sidestream sampling cannulas with dehumidification and extension tubing.

Time to Zero: Maximum 30 seconds. Typical 15-20 seconds.

$EtCO_2$ Stability

Short Term Drift: Drift over 6 hours does not exceed 0.8 mmHg.

Long Term Drift: Accuracy specification maintained over a 120-hour period.

$EtCO_2$ Accuracy

- For values between 0 and 38 mmHg: ±2 mmHg of the actual value.
- For values between 39 and 99 mmHg: ±10% of the actual value.
- For breath rates above 80 bpm ±12% of the actual value.

Values read at the sea level.

Measurement Accuracy

For the gas reading range the measurement accuracy, and for a diverting respiratory gas monitors, the minimum sample flow rate is 50 ml/minute ± 10 ml/minute. The flow rate may exceed 60 ml/minute if the airway pressure range is greater than + 60 cmH2O (44.1mmHg).

Warm-up time

- 20 minutes before full specifications are met over the entire operation temperature range
- Three (3) minutes to fulfill accuracy specifications at an ambient temperature of 25°C

If the EtCO2 option is enabled, a low priority technical alarm is presented in clinical modes where EtCO2 monitoring is available, if the EtCO2 module has not warmed up to operating temperature range.

Sample Gas Humidity: Quantitative effects of humidity and condensation: Full accuracy specifications are maintained for all non-condensing humidity levels.

Airway Pressure Operational Range: +60 cmH_2O (44.1 mmHg) to -60 cmH2O (-44.1 mmHg). Exceeding the operational range may cause one or more error statuses.

Airway Pressure Maximum Allowable Range: +120 cmH_2O (88.27 mmHg) to -60 cmH2O (-44.1 mmHg). Exceeding the maximum allowable range may cause damage to the CO2 module. Airway pressures above 71.4 cmH_2O (52.5 mmHg) will cause an additional error. Example: at 100 cmH2O (73.6 mmHg) the additional error is 1 mmHg.

Maximum cross-sensitivity compensation error: Additional worst-case error is +/- 1mmHg over the range of 0 – 38 mmHg and an additional +1.3% of actual value when >38 mmHg.

Pressure Compensation: No additional error due to barometric pressure.

Automatic correction on the CO_2 values is performed using internal barometric pressure and sample cell pressure measurements. CO_2 values are normalized to barometric pressure.

Other Interference Sources: There are no known other sources of interference to the gas measurement.

Accuracy in the Presence of Interfering Gases

Nitrous oxide, elevated levels of oxygen, helium, halogenated hydrocarbons can influence the CO2 measurement.

Balance Gas Compensation: Room Air (N_2), Nitrous Oxide (N_2O), or Helium (He)

Balance Gas Compensation Default: Room Air

Anesthetic Agent Compensation Range: 0 to 20%

Anesthetic Agent Compensation Resolution: 0.1%

Anesthetic Agent Compensation Default: 0%

Agents include Halothane, Enflurane, Isoflurane, Sevoflurane, and Desflurane.

Anesthetic agent effects, Minimum Alveolar Concentration (MAC) levels	Uncompensated sensitivity	Accuracy specification maintained for halogenated anesthetic agents present at accepted MAC clinical levels, ISO 80601-2-55:2011 Table 201.107
	Compensated sensitivity	Testing at agent levels defined by accepted regulatory standards, ISO 80601-2-55:2011 Table 201.105

NOTE: The presence of Desflurane in the exhaled breath at concentrations greater than 5% positively biases CO_2 values by up to an additional 3 mmHg at 38 mmHg. Accuracy is not affected by the presence of 0.1% ethanol, 0.1% isopropanol, 0.1% acetone or 1% methane.

Alarm Range:

- Low Limit: 10 to 95 mmHg (1.3 - 12.7 kPa) (Adult/Infant-Child)
- High Limit: 20 to 99 mmHg (2.7 - 13.2 kPa) (Adult/Infant-Child)

AwRR

Range: 0, 2 –100 rpm

Resolution: 1 rpm

Accuracy: ±1 rpm

Alarm Range:

- Low Limit: 0 to 99 rpm (Adult, Infant/Child)
- High Limit: 10–100 rpm (Adult, Infant/Child)

Alarm Delay Time: (after alarm condition has been met): less than 8 sec

Measurement Method

AwRR: based on the average of the last 8 detected breaths

Apnea: based on the configured Apnea Time.

NBP

Pressure Range

Measurement	mmHg		kPa	
	Adult	Infant/Child	Adult	Infant/Child
Systolic	30–270	30–130	4.0–36	4.0–17.0
Diastolic	10–245	10–100	1.5–32.5	1.5–13.0
Mean	20–255	20–120	3.0–34	3.0–16.0

Initial Pressure: 165 mmHg/22 kPa (Adult); 130 mmHg/17.3 kPa (Infant/Child)

Overpressure Limit: 300 mmHg/40 kPa (Adult); 150 mmHg/20 kPa (Infant/Child)

Cuff Inflation Time: Typical for normal adult cuff (250 ml, 160 mmHg): Less than 10 seconds

Clinical Accuracy: Investigated according to the requirements of ISO 81060-2:2013.

Pressure Transducer Accuracy: (0 to 300 mmHg): ±3 mmHg.

Alarm Range

Measurement	mmHg		kPa	
	Adult	Infant/Child	Adult	Infant/Child
Systolic high limit	35-270	35-130	4.5-36	4.5-17
Systolic low limit	30-265	30-125	4.0-35	4-16.5
Diastolic high limit	15-245	15-100	2.0-32.5	2-13
Diastolic low limit	10-240	10-95	1.5-32	1.5-12.5
Mean high limit	25-255	25-120	3.5-34	3.5-16.0
Mean low limit	20-250	20-115	3-33	3-15

Auto Mode Repetition Time: 1., 2.5, 5, 10, 15, 30, 60, or 120 min

Maximum Measurement Time: 180 seconds for Adult, 90 seconds for Infant/Child

Alarm Delay Time from completion of measurement: < 2 sec

Interconnect Tube Length: Sampling extension line, 1.5 m or 3.0 m.

Patient Data Storage

Internal Event Summary : The HeartStart Intrepid can store up to 8 hours of 2 continuous ECG waves, 1 pleth wave, 1 capnogram wave, research waves (AED Mode only) events and trending data per Event Summary. There is a maximum capacity of approximately 80 Event summaries of approximately 30 minutes in length.

Environmental

Temperature:

- Operating temperature range for the device: 0 °C to 45°C (32°F to 113°F);
- Operating temperature range for $EtCO_2$ monitoring: 0 °C to 40°C (32°F to 104°F);
- Optimal temperature range for charging battery: 0 °C to 30°C (32°F to 86°F);
- Storage/transport range for the device without battery: -20°C to 70°C (-4°F to 158°F). Storing the battery for extended periods and charging at temperatures above 35°C (95°F) reduces battery capacity and degrades battery life.

Settling Time to 20°C: Time required for device to warm from -20°C before use is 80 minutes; time required for device to cool from 70°C before use is 80 minutes.

Humidity: 15% to 95% relative humidity

- Printer paper may jam if the paper is wet.
- Thermal printer may be damaged if wet paper is allowed to dry while in contact with printer elements.

Atmospheric Pressure Range/Operation and Storage: 1060 mbar to 572 mbar (-380 to 4550 m; -1250 to 15,000 ft).

Shock

Operating: Half-sine waveform, duration 11 ms, acceleration 30 g, 3 shocks per face.

Non-operating: Trapezoidal waveform, duration: < 25 ms, acceleration 30 g, velocity change 7.42 m/s ±10%, 1 shock per face.

Vibration:

<table>
<tr><th colspan="3">Operating / Non-Operating Random</th><th colspan="2">Non-Operating Swept Sine</th></tr>
<tr><th>Frequency (Hz)</th><th>Slope (dB/octave)</th><th>PSD (g^2/Hz)</th><th>Frequency (Hz)</th><th>Amplitude</th></tr>
<tr><td>10–100</td><td>—</td><td>0.052</td><td>10–57</td><td>± .15 mm</td></tr>
<tr><td>100–200</td><td>-7.0</td><td>—</td><td>57–150</td><td>2 g</td></tr>
<tr><td>200–2000</td><td>—</td><td>0.01</td><td colspan="2" rowspan="2">Test duration: 4 sweeps per axis x 3 axes; Each sweep: 10-150-10 Hz cycle at a sweep rate of 1 oct/min</td></tr>
<tr><td colspan="3">(Total RMS acceleration 5.1 g RMS)
Test duration: 30 min/axis x 3 axes = 90 minutes total.</td></tr>
</table>

MIL-STD 810G 514.6: Category 9, non-operating UH60 helicopter, general storage, random and sine. **Test duration:** 4 hours/axis (12 hours total)

Bump: Half-sine, 15 g peak, 6 ms, 1000 hits (vertical with the device in its normal mounting position)

Free Fall: IEC 60068-2-32 Free Fall. Total 6 faces (excluding bedrail hook).

- 40 cm (16 in.) without carry bags
- 75 cm (29.5 in.) with side and rear carry bags, one time on each face
- 50 cm (20 in.) with side and rear carry bags, two times on each face

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).

USB Device

Correct Drive: Use the Philips USB Drive that came with your device or is orderable under part number 989803202611.

CPR Meter

Maximum Dimensions: 160 mm x 65 mm x 30 mm with an integrated 0.91 m (3 feet) cable.

Maximum Weight including cable: 300 g (10.6 oz.).

Input voltage: 3.9-10.0VDC, max 170 mA. The CPR meter is electrically and galvanically isolated from the defibrillator power and communication sources.

Temperature: :

- Storage: -20°C to 60°C (-4°F to 140°F);
- Operating: 0°C to 50°C (32°F to 122°F)

Relative Humidity:

- Storage: 5% to 75%;
- Operating: 5% to 95%

Solids/Water Resistance: IP55. Meets ISO/IEC 60529

EMC: Meets IEC 60601-1-2

Security and Privacy

The HeartStart Intrepid is a lightweight, portable monitor/defibrillator. It provides four clinical modes of operation: Monitor, Manual Defibrillation/Synchronized Cardioversion, AED, and Pacing. It displays ECG waveforms and provides monitoring of SpO_2 (numeric and pleth wave), EtCO2 (numeric and capnogram), NBP, and Temperature. In clinical modes, the HeartStart Intrepid continually records data about the patient in an Event Summary record. The recorded data includes vital signs (such as SpO_2 and heart rate), ECG wave data, and therapy events (such as shock delivered). During a clinical event, any patient data that is entered by the operator (name, age, sex, ID number, paced status) is also captured in the Event Summary.

Modes of Operation and Roles

The HeartStart Intrepid is used by trained clinicians in Clinical modes (Monitor, Manual Defibrillation/Synchronized Cardioversion, AED, and Pacing) to monitor and provide therapy to patients, and in Data Management mode to print, export or transmit the stored Event Summary records.

The Configuration Mode is used by the organization biomedical department to configure the settings and parameters used by the device, such as high and low alarm limits.

Service Mode is used by authorized service personnel to service and maintain the device, including managing passwords and upgrading device options and software.

Security Controls and Access Controls

Role base security controls are used to control access to Clinical modes, Data Management mode, Configuration Mode and Service Mode.

Service Mode has the highest level of security and always requires a Service Mode password to enter. In Service Mode, the Service Mode password and the Configuration Mode password can be changed.

Configuration mode can be entered to view the configuration settings without a password. To make and save any changes to the configuration settings requires the entry of the Configuration Mode password. In Configuration Mode, the choice of **Data Management Password Required** can be set to **On** or **Off**.

Data Management mode access is controlled by an optional (as set in Configuration mode) Data Management mode password.

The HeartStart Intrepid is used to provide patient care in emergency situations where time to therapy delivery can be critical and therefore, access to Clinical modes is available to clinical users with no password required.

Event Summary Records at Rest and in Transit

All Event Summary records stored within the device are encrypted. The encryption method is AES-256.The Event Summary records are also encrypted when exported to an attached USB drive or when transmitted wirelessly via Wi-Fi or cellular communication. The encrypted event summary records stored within the device are automatically deleted after 30 days.

To avoid loss of data, Philips recommends that customers frequently backup the Event Summary records by exporting them to a USB memory in Data Management mode. The USB memory should be securely stored to prevent loss or unauthorized access to the data or damage to the USB memory device.

Access Logging

The HeartStart Intrepid maintains an Access Log file that is viewable in Service mode. This log records the date and time when configuration settings are changed and when device log files are cleared.

Physical Security Recommendations

To protect the device from any unauthorized operation or access, Philips recommends that the owning organization maintain the physical security of the device at all times such that it can only be accessed by authorized personnel.

Software Upgrades

Software upgrades for the HeartStart Intrepid are distributed through the Philips Service organization to provide feature upgrades and security patches. All software upgrade files produced by Philips are encrypted to ensure their integrity. A software upgrade can be performed in Service mode which requires the Service mode password for entry.

Philips recommends that customers always keep their HeartStart Intrepid updated with the most recent software release.

Device Disposal

When disposing the device, Philips recommends that the responsible organization remove all patient information from the device by entering Data Management mode, choosing “Remove All Patient Info” and selecting ‘yes’. This action will remove all patient identifiable data from all of the Event Summary records.

Connecting to Networks

The HeartStart Intrepid may be connected to a network, either a Wi-Fi or to a cellular, to allow the transmission of the Event Summary logs, 12-lead ECG analysis logs and patient vital signs logs. All information transmitted to a network is encrypted. The intended information flow through the network via an Internet or intranet is to reach a server which is authorized and configured to receive the encrypted logs from the HeartStart Intrepid.

For connecting to a Wi-Fi network or to a cellular network, the characteristics, technical parameters and configuration parameters must be obtained from the operator of the network. Failure to conform to the specifications of the network operator could result in the loss of or the inability to receive and analyze the Event Summary logs, 12-lead ECG analysis logs and patient vital signs logs.

Connecting the HeartStart Intrepid to any network that includes other connected equipment could result in previously unidentified risks to patients, operators or third parties. The owning organization is responsible to assess the risks that could result from changes to the network such as: network configurations, added or removed connections, updates or upgrades to connected equipment

Safety

Safety and EMC Meets IEC 60601:

- IEC 60601-1 ed. 3.1
- IEC 60601-1-8 ed. 2.1
- IEC 60601-2-27 ed. 3.0
- IEC 60601-1-2 ed. 4.0
- **IEC 60601-1-2 ed. 3.0**
- IEC 60601-2-25 ed. 2.0
- IEC 60601-1-12 ed. 1.0
- IEC 60601-2-4 ed. 3.0
- IEC 60601-2-49 ed. 2.0
- IEC 80601-2-30 ed. 1.1
- (EN) ISO 80601:
  - 80601-2-61 ed.1.0
  - 80601-2-56 ed. 2.0
  - 80601-2-55 ed. 1.0

Other considerations:

- The HeartStart Intrepid is not suitable for use in the presence of concentrated oxygen or a flammable anesthetic mixture with air, oxygen or nitrous oxide.
- Hazards arising from software errors were minimized by the product’s compliance with the software requirements contained in IEC 62304.

Mode of Operation: Continuous

AC Line Powered: 100 – 240 VAC, 50 or 60 Hz, 1.8 – 0.75 A, Class II equipment

DC Line Powered: With the DC Power Module (Input: 10-32 VDC, 11A maximum. Output: 18 VDC, 5A maximum.)

Battery Powered: Nominal voltage14.48 V, rechargeable Lithium Ion

Transient Operating Conditions: The HeartStart Intrepid meets all specifications for 20 minutes during transient operating conditions of a temperature range of –20°C to 50°C and a relative humidity range of 15% to 90%, non-condensing, but not requiring a water vapor partial pressure greater than 50 hPa.

Hazardous Waste:

Pb	Hg	Cd	Cr6+	PBB	PBDE
O	O	O	O	O	O

• = more than one of the device's raw material has this harmful substances and concentration over than standard concentration limit.

O = all the raw material concentrations of the device within allowed limits.

The Registration, Evaluation, Authorization, and Restriction of Chemicals (REACH) requires Philips Health Systems to provide chemical content information for Substances of Very High Concern (SVHC) if they are present above 0.1% of the article weight. Substances that are likely to be found in articles within our electronic products are listed in the List of Substances of the Standard IEC 62474 and on the Restricted and Declarable Substances List of BOM Check.

The following substances are found in articles in the HeartStart Intrepid:

- D4—Octamethylcyclotetrasiloxane, CAS nr: 556-67-2
- D5—Decamethylcyclopentasiloxane, CAS nr: 541-02-6
- D6—Dodecamethylcyclohexasiloxane, CAS nr: 540-97-6

More information can be found on the Philips REACH website, which also includes an up-to-date list of Philips products containing SVHCs above the threshold.

Symbol Definitions

Table 113 lists the meaning of symbols appearing on the HeartStart Intrepid, the Lithium Ion battery, and the shipping carton within the definition of IEC 60601-1.

Table 113 **Symbol Definitions**

Symbol	Definition	Symbol	Definition	Symbol	Definition
	Meets IEC type CF leakage current requirements and is defibrillator protected. (Patient Applied part is isolated and defib-proof suitable for direct patient contact, including the heart or major arteries).		Meets IEC type BF leakage current requirements and is defibrillator protected. (Patient Applied Part is isolated and defib-proof suitable for direct patient contact, except the heart or major arteries).		Device complies with the requirements of the Medical Device Directive 93/42/EEC
					RoHS exempt. Environmentally friendly for a use period of 50 years.
					Caution: See operating instructions in Instructions for Use.
	Manufacturer		Manufacture Date		Warning: dangerous voltage
	Recyclable	SN	Serial Number		Consult Instructions for Use.
	Class II Equipment	EC REP	Authorized Representative in the EC		Consult Service Manual.

Table 113 **Symbol Definitions** ***(Continued)***

Symbol	Definition	Symbol	Definition	Symbol	Definition
OPT	Options installed	REF	Reference order number		This end up
	RF Transmission Symbol, non-ionizing electromagnetic radiation	~	Alternating current		Rechargeable battery
	Output	⎓	Direct current		Dispose of in accordance to your local requirements.
	Input		SpO_2 Port	DANGER	A high level of risk exists.
	USB Port		ECG port		NBP port
	LAN Port		Atmospheric pressure range		Temperature Port
	Humidity limitation		Keep away from rain		Temperature range
	Fragile		Therapy Port		Insert battery
	Storage Temperature		Serial data communications module port		Refer to instruction manual/booklet

NOTE: For definitions of symbols which appear on the HeartStart Intrepid's front panel see "Basic Orientation" on page 9 and "General Function Buttons" on page 29. For definitions of symbols which appear on the external paddles see "External Paddles" on page 17.

Abbreviation Definitions

Table 114 lists various abbreviations used with the HeartStart Intrepid and in these Instructions for Use.

Table 114 **Abbreviations**

Abbreviation	Definition	Abbreviation	Definition
%	percent	µs	microseconds
°C	degrees Celsius	µV	microVolt
°F	degrees Fahrenheit	mA	milliAmpere
A	Amps	mV	milliVolt
AC	alternating current	min	minutes
bpm	beats per minute	mmHg	millimeters of mercury
cm	centimeter	ms	millisecond
dB	decibel	mW	milliwatt
dB(A)	A-weighted decibel	nA	nanoAmpere
DC	direct current	nM	nanometer
Hz	Hertz	NSA	No Shock Advised

Table 114 **Abbreviations** ***(Continued)***

Abbreviation	Definition	Abbreviation	Definition
in	inches	PSD	Power Spectral Density
J	Joules	RFU	Ready For Use
kg	kilograms	rpm	respirations per minute
kPa	kilo Pascal	sec	seconds
lb	Pounds	V	Volt
m	meter	VDC	Volts DC

Electromagnetic Compatibility

When using the HeartStart Intrepid, 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 HeartStart Intrepid. 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 HeartStart Intrepid.

When connected to a patient, symptoms of interference may include degraded performance of ECG signals from pads/paddles or ECG lead sets, 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 HeartStart Intrepid usage scenarios including powering on, monitoring and delivering therapy.

Fixed, portable, and mobile radio frequency communications equipment could affect the performance of medical equipment.

Reducing Electromagnetic Interference

The HeartStart Intrepid 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 whether 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 HeartStart Intrepid?
- 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

Essential performance of the HeartStart Intrepid monitor/defibrillator derived from the product's Safety Risk Assessments the ability to

- Deliver defibrillation therapy (manual, AED and Synchronized Cardioversion).
- Deliver pacing therapy (fixed and demand).
- Monitor the patient parameters (ECG monitoring, pulse oximetry, end-tidal CO_2, noninvasive blood pressure, temperature).
- Detect and generate physiological alarms.

All other functions are considered nonessential 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 HeartStart Intrepid is designed and tested to comply with the radiated and conducted emissions requirements of international and national standards. See Table 116 through Table 121 for detailed information regarding declaration and guidance.

WARNINGS: The use of accessories, transducers and cables other than those specified might result in increased emissions or decreased immunity of the HeartStart Intrepid.

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 HeartStart Intrepid.

The list of cables, transducers, and other accessories with which Philips claims compliance with the emissions and immunity requirements listed in "Supplies and Accessories" on page 221.

The EMC standards state that manufacturers of patient-coupled equipment must specify immunity levels for their systems. See Table 116 and Table 121 for this detailed immunity information.

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.

Caution should, therefore, 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.

Guidance and Manufacturer's Declaration

The HeartStart Intrepid is intended for use in the electromagnetic environment specified in the tables below. The customer or the user of the HeartStart Intrepid should assure that it is used in such an environment.

Table 115 Electromagnetic Emissions

Emissions Test	Compliance	Electromagnetic Environment - Guidance
RF emissions CISPR 11/GB4824	Group 1	
RF emissions CISPR 11/GB4824	Class B	• Emergency medical services environment • Professional healthcare facility environment.
Harmonic emissions IEC 61000-3-2/GB17625.1	Class A	
Voltage fluctuations/flicker emissions IEC 61000-3-3/GB17625.2	Complies	

Table 116 Enclosure Ports

Immunity Test	Immunity Test Level	Compliance Level	Electromagnetic Environment - Guidance
Electrostatic discharge (ESD) IEC 61000-4-2	±8 kV contact ±2, ±4, ±8, ±15 kV air	±8 kV contact ±2, ±4, ±8, ±15 kV air	Emergency medical services environment Professional healthcare facility environment
Radiated RF Electromagnetic Field IEC 61000-4-3	10 V/m 80 MHz - 2.7 GHz	10 V/m 80 MHz - 2.7 GHz	Emergency medical services environment Professional healthcare facility environment
Radiated RF Electromagnetic Field IEC 60601-2-4 (see Para. 202.6.2.3)	20 V/m (only defibrillation) 80 MHz to 2.7 GHz	20 V/m (only defibrillation) 80 MHz to 2.7 GHz	Emergency medical services environment Professional healthcare facility environment
Proximity fields from RF wireless communications equipment IEC 61000-4-3	Refer to table 117 below	Refer to table 117 below	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

The emission of the HeartStart Intrepid can meet Class I limit level of CISPR 25 when powered by a DC-DC power supply.

Table 117 **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

Table 118 **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
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 119 **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 120 **Input DC Power Ports**

Immunity Test	Immunity Test Level	Compliance Level	Electromagnetic Environment - Guidance
Electrical transient conduction along supply lines ISO 7637-2	Pulse 1, 2a, 2b, 3a, 3b, 4: Level III	Pulse 1, 2a, 2b, 3a, 3b, 4: Level III	Emergency medical services - environment Professional healthcare facility environment

Table 121 **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 122 **Wi-Fi Effective Radiated Power**

Networking Standard	Bands	Transmitter RF power Levels	Antenna Gain	EIRP
802.11a	UNII-1, UNII-2A, UNII-2C	17 dBm (50.1 mW)	3.9 dBi	21 dBm1
802.11a	UNII-3	15 dBm (31.6 mW)	4 dBi	19 dBm1
802.11b		17 dBm (50.1 mW)	2 dBi	19 dBm1
802.11g		17 dBm (50.1 mW)	2 dBi	19 dBm1
802.11n		17 dBm (50.1 mW)	2 dBi	19 dBm1
802.11n	UNII-1, UNII-2A, UNII-2C	17 dBm (50.1 mW)	3.9 dBi	21 dBm1
802.11n	UNII-3	15 dBm (31.6 mW)	4 dBi	19 dBm1

Table 123 **Wi-Fi Receiver Frequency and Bandwidth**

Networking Standard	Modulation type	TX/RX Frequency (GHz)*†	TX/RX Bandwidth
802.11a	OFDM	5*	20 MHz
802.11b	DSSS	2.4†	22 MHz
802.11g	OFDM	2.4†	20 MHz
802.11n	OFDM	2.4†	20 MHz (HT20)
			40 MHz (HT40)
		5*	20 MHz (HT20)
			40 MHz (HT40)

*See 5GHz channel to frequency map

†See 2.4GHz channel to frequency map

Table 124 **2.4 GHz Channel to Frequency Map**

Channel	Center Frequency (MHz)	Frequency Range (MHz)	Bandwidth (MHz)
1	2.412	2.401–2.423	22
2	2.417	2.406–2.428	22
3	2.422	2.411–2.433	22
4	2.427	2.416–2.438	22
5	2.432	2.421–2.443	22
6	2.437	2.426–2.448	22
7	2.442	2.431–2.453	22
8	2.447	2.436–2.458	22
9	2.452	2.441–2.463	22
10	2.457	2.446–2.468	22

Table 124 **2.4 GHz Channel to Frequency Map**

Channel	Center Frequency (MHz)	Frequency Range (MHz)	Bandwidth (MHz)
11	2.462	2.451–2.473	22
12	2.467	2.456–2.478	22
13	2.472	2.461–2.483	22
14	2.484	2.473–2.495	22

Table 125 **5 GHz Channel to Frequency Map**

Channel	Center Frequency (MHz)	Frequency Range (MHz)	Bandwidth (MHz)
32	5160	5150–5170	20
34	5170	5150–5190	40
36	5180	5170–5190	20
38	5190	5170–5210	40
40	5200	5190–5210	20
42	5210	5170–5250	80
44	5220	5210–5230	20
46	5230	5210–5250	40
48	5240	5230–5250	20
50	5250	5170–5330	160
52	5260	5250–5270	20
54	5270	5250–5290	40
56	5280	5270–5290	20
58	5290	5250–5330	80
60	5300	5290–5310	20
62	5310	5290–5330	40
64	5320	5310–5330	20
68	5340	5330–5350	20
96	5480	5470–5490	20
100	5500	5490–5510	20
102	5510	5490–5530	40
104	5520	5510–5530	20
106	5530	5490–5570	80
108	5540	5530–5550	20
110	5550	5530–5570	40
112	5560	5550–5570	20
114	5570	5490–5650	160
116	5580	5570–5590	20
118	5590	5570–5610	40
120	5600	5590–5610	20
122	5610	5570–5650	80
124	5620	5610–5630	20

Table 125 **5 GHz Channel to Frequency Map *(Continued)***

Channel	Center Frequency (MHz)	Frequency Range (MHz)	Bandwidth (MHz)
126	5630	5610–5650	40
128	5640	5630–5650	20
132	5660	5650–5670	20
134	5670	5650–5690	40
136	5680	5670–5690	20
138	5690	5650–5730	80
140	5700	5690–5710	20
142	5710	5690–5730	40
144	5720	5710–5730	20
149	5745	5735–5755	20
151	5755	5735–5775	40
153	5765	5755–5775	20
155	5775	5735–5815	80
157	5785	5775–5795	20
159	5795	5775–5815	40
161	5805	5795–5815	20
165	5825	5815–5835	20

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NOTES

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