

# PHILIPS

M3535A/M3536A  
User Training Workbook



## HeartStart MRx

**HEARTSTART**  
DEFIBRILLATORS



# Notice

## About This Edition

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## Edition History

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## Warning

Radio frequency (RF) interference from nearby transmitting devices may degrade the performance of the HeartStart MRx. Electromagnetic compatibility with surrounding devices should be assessed prior to using the monitor/defibrillator.

This workbook should be used primarily for HeartStart MRx instructor-based end-user training, along with the 453564045041 Instructor Guide. The workbook contains the following conventions:

<i>Voice</i>	represents voice prompt messages
<i>Text</i>	represents messages that appear on the HeartStart MRx display
<b>Text</b>	represents options that appear on HeartStart MRx menus
<b>[Soft key]</b>	represents soft key labels that appear on the display above the button to which they correspond

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# Getting Acquainted

## Lesson Introduction

This lesson provides an overview of the HeartStart MRx controls, indicators, operational modes, and display views. It also provides general information on use of the device.

## Objectives

Upon completion of this lesson, you should be able to:

1. Identify the physical features, controls, and indicators of the MRx.
2. Identify the purpose of various controls and indicators.
3. Identify the display view characteristics associated with MRx's operating modes.

## Notes:

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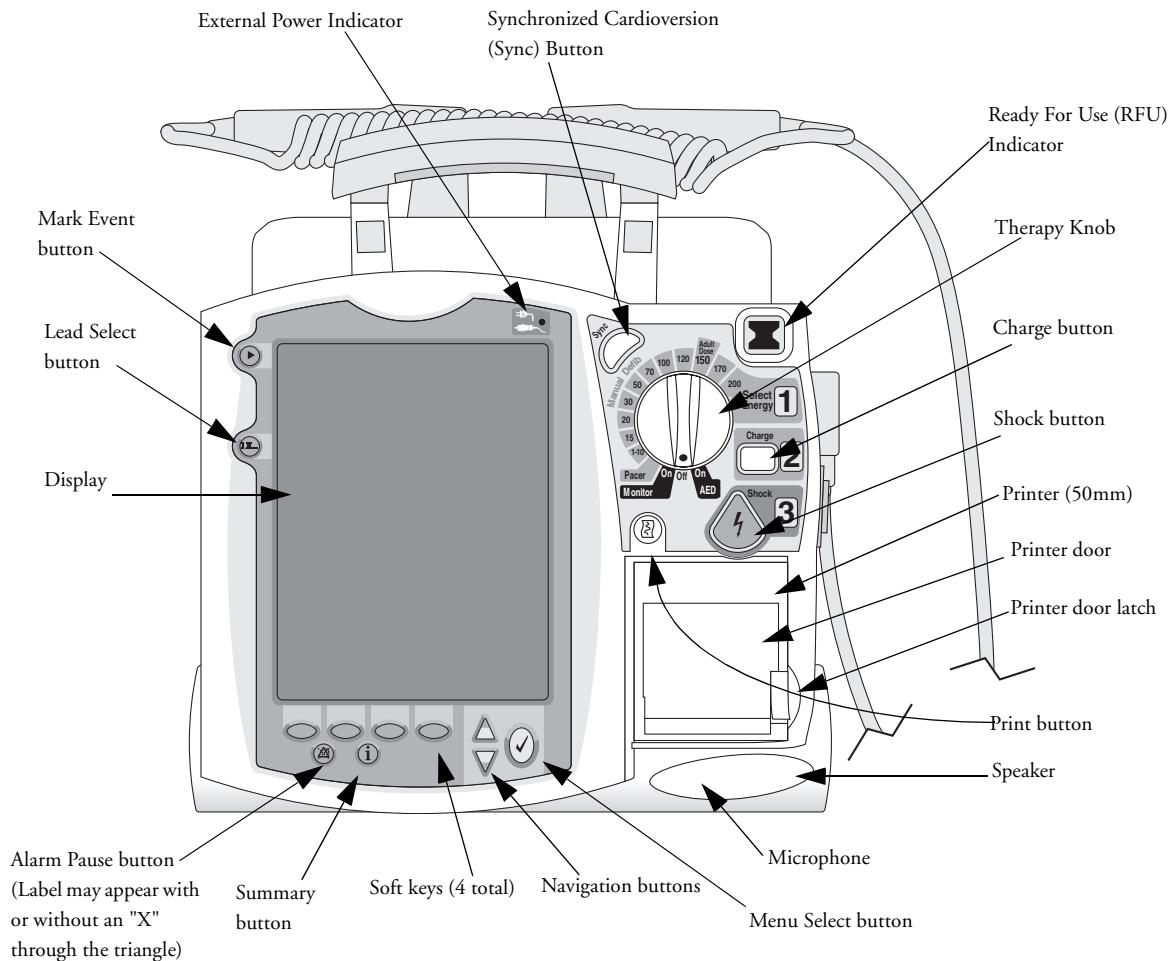
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# Lesson Presentation

## Basic Orientation

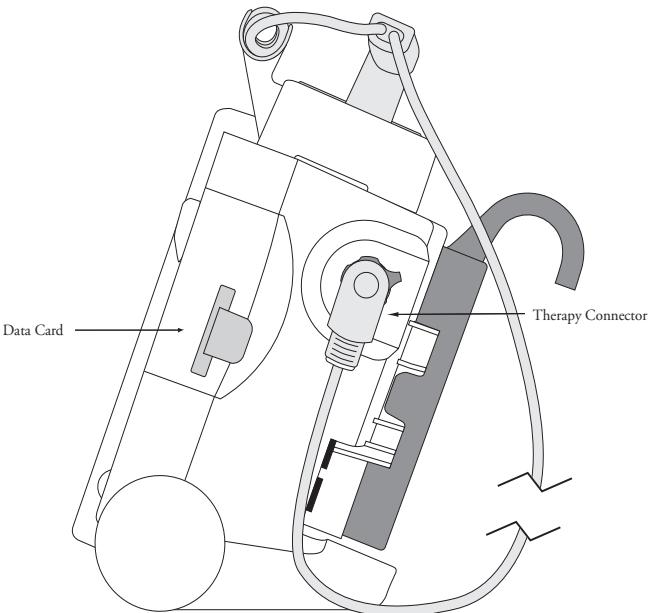
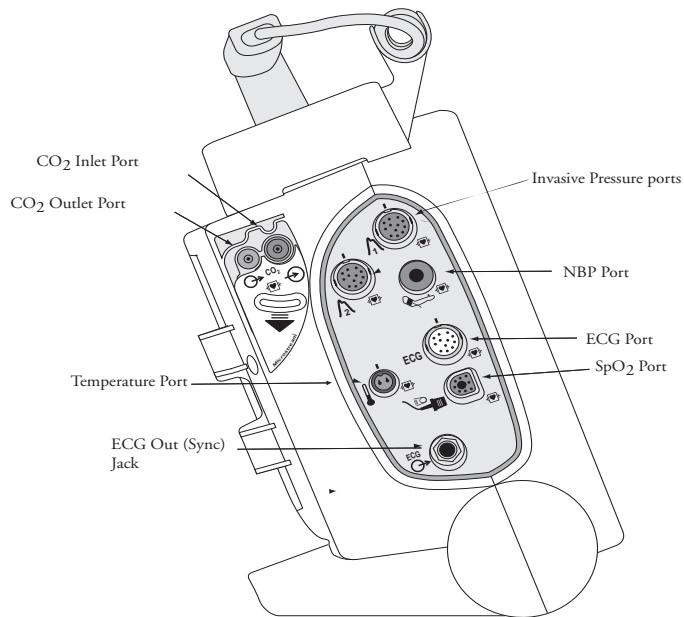
The MRx controls are organized to facilitate ease of use.

### Front Panel



## Notes:

## Side Panels



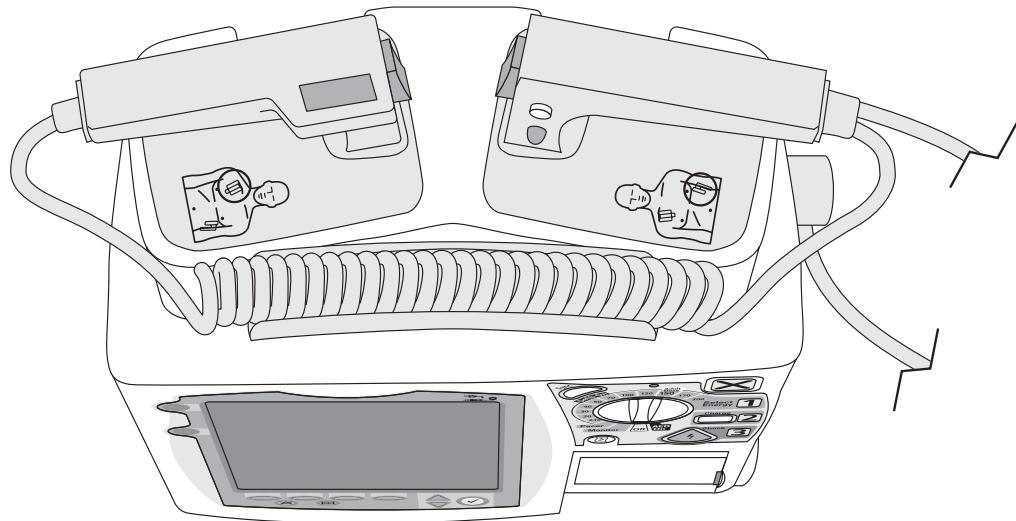
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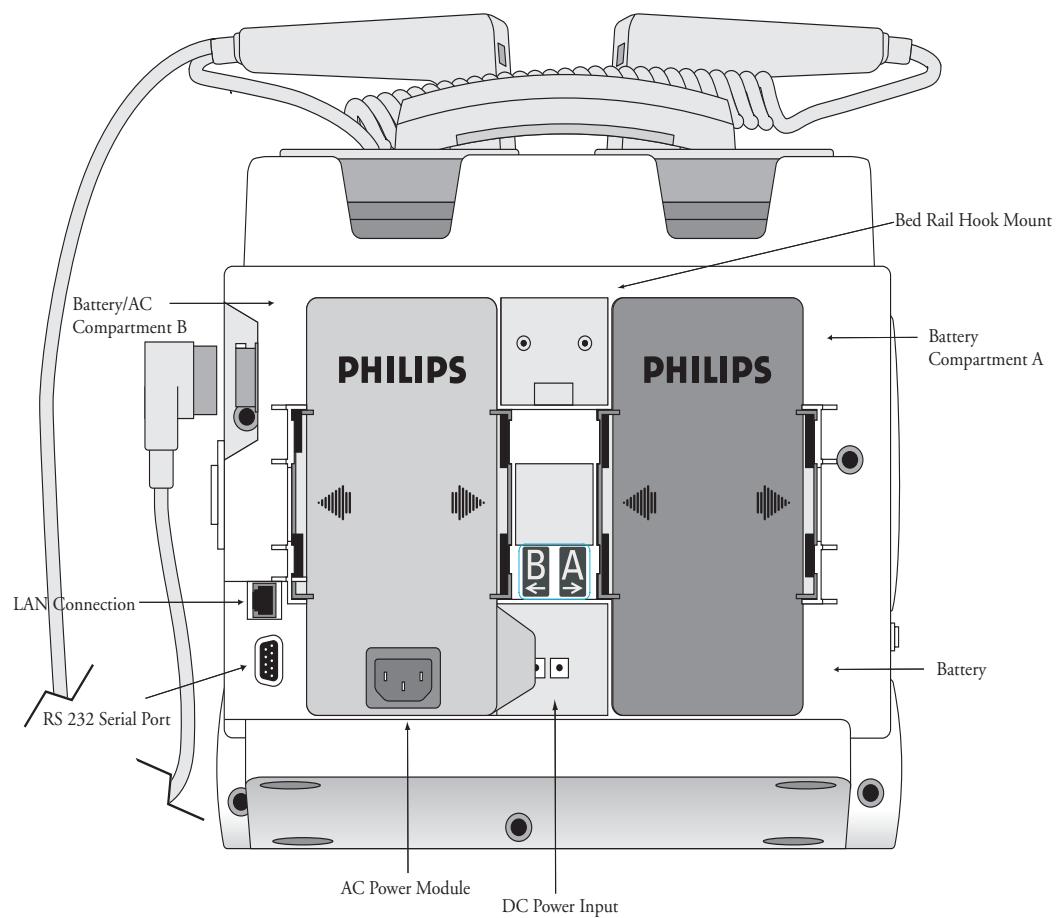
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## Top Panel



## Notes:

**Back Panel****Notes:**

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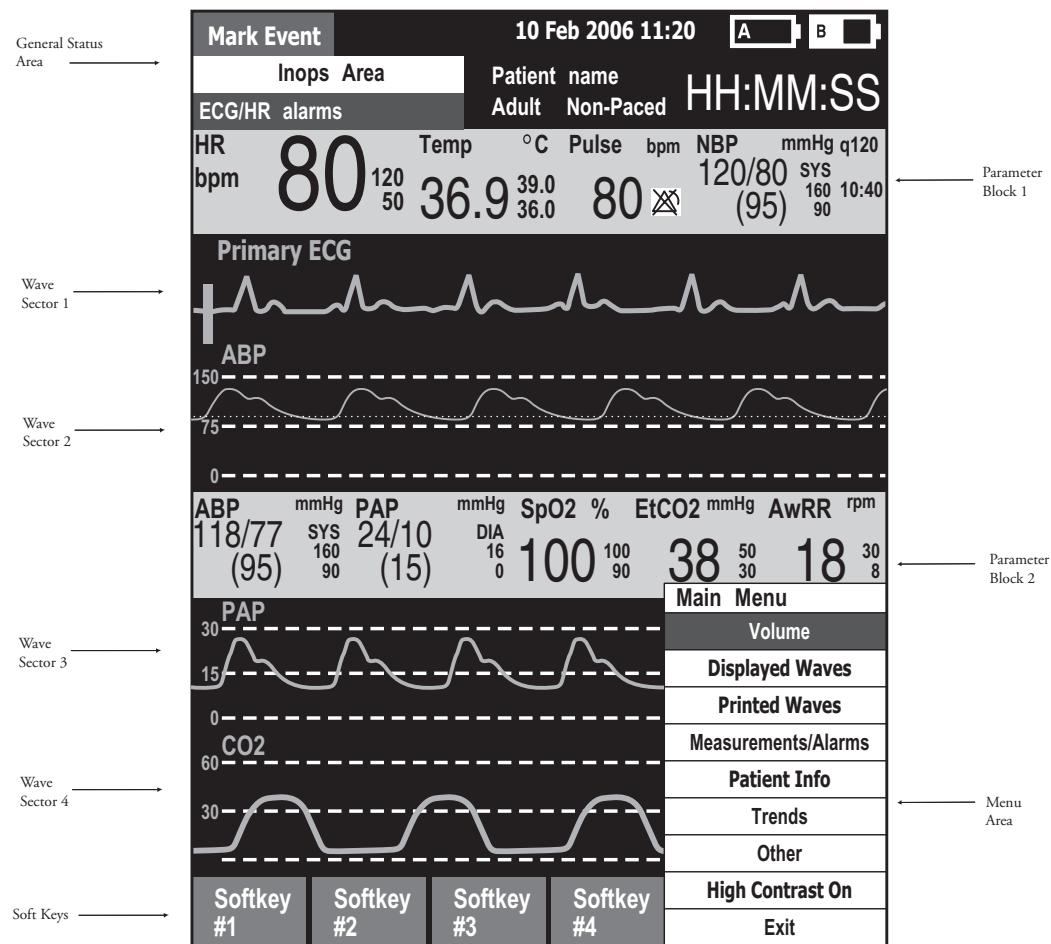
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## Display View

The MRx layout is as follows.



### Notes:

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## Responding to Alarms

Follow the steps below to respond to an alarm condition.

1. Attend to the patient.
2. Identify the alarm(s) indicated.
3. Silence the alarm(s) using the Navigation and Menu Select buttons.
4. Address the alarm condition.

### Notes:

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## Password Security

Access to Manual Defib and Pacer Modes may be password protected if enabled in Configuration. Failure to enter the correct Manual Therapy Security password prevents manual defibrillation/ synchronized cardioversion delivery or pacing therapy. AED Mode is always available without a password.

## Printing Waveforms

To change wave forms for the second wave printed with a 50mm printer:

1. Press the Menu Select button.
2. Using the Navigation buttons, select the **Printed Waves** option and press Menu Select.
3. Using the Navigation buttons, select the wave form you want to print in Wave 2 and press Menu Select.

To change wave forms for the second or third wave printed with a 75mm printer:

1. Press the Menu Select button.
2. Using the Navigation buttons, select the **Printed Waves** option and press Menu Select.
3. Using the Navigation buttons, select **Wave 2** or **Wave 3** and press Menu Select.
4. Using the Navigation buttons, select the wave form you want printed and press Menu Select.
5. Repeat Steps 2 through 4 for the other printed wave.

## Continued Use

MRx's Continued Use feature facilitates continued treatment of the same patient by retaining current settings and the patient record when the MRx is turned off for less than 10 seconds or switching between modes (e.g., Monitor, AED, and Manual Defib).

## Return to Owner

To enable the Return to Owner feature:

1. Press the Menu Select button.
2. Select **Other** and press Menu Select.
3. Select **Return To Owner** and press Menu Select.
4. Press the **[Activate]** soft key.
5. Enter the number of days in the loan period and press Menu Select.
6. Press the **[Exit Return-To]** soft key.

To disable the Return to Owner feature:

1. Press the Menu Select button.
2. Select **Other** and press Menu Select.
3. Select **Return To Owner** and press Menu Select.
4. Press the **[Deactivate]** soft key.
5. Enter the password and press Menu Select.
6. Press the **[Exit Return-To]** soft key.

### Notes:

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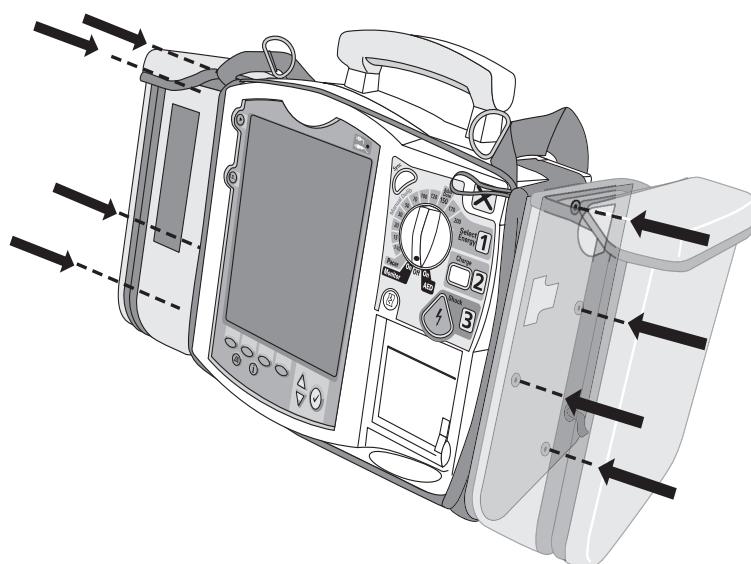
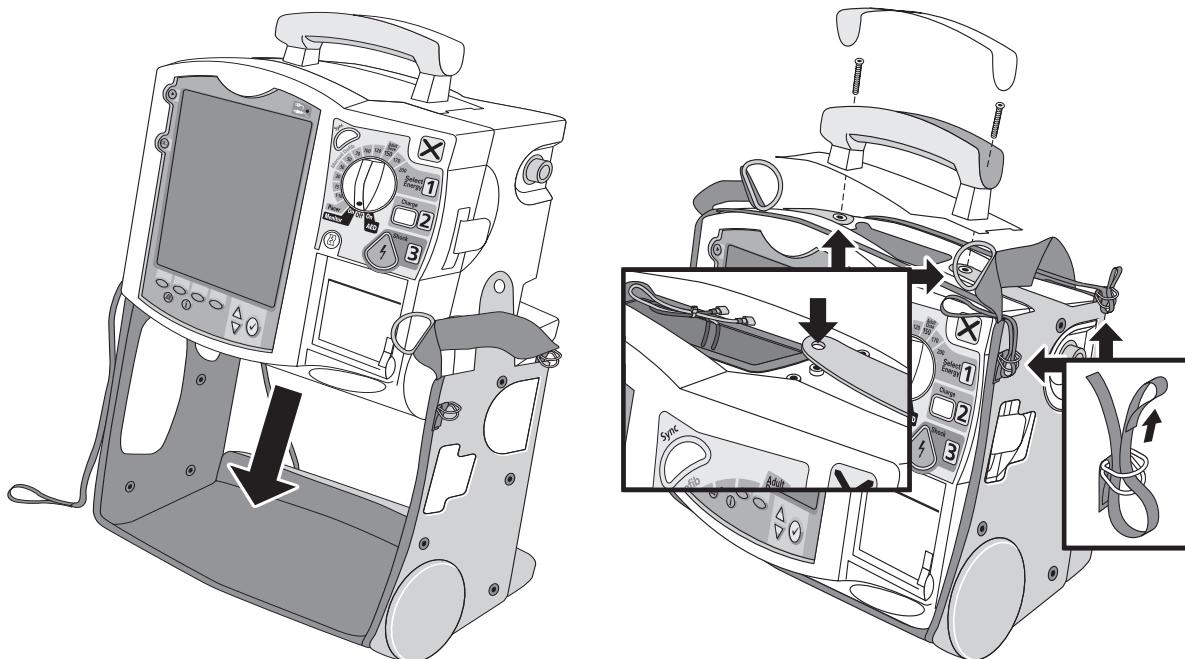
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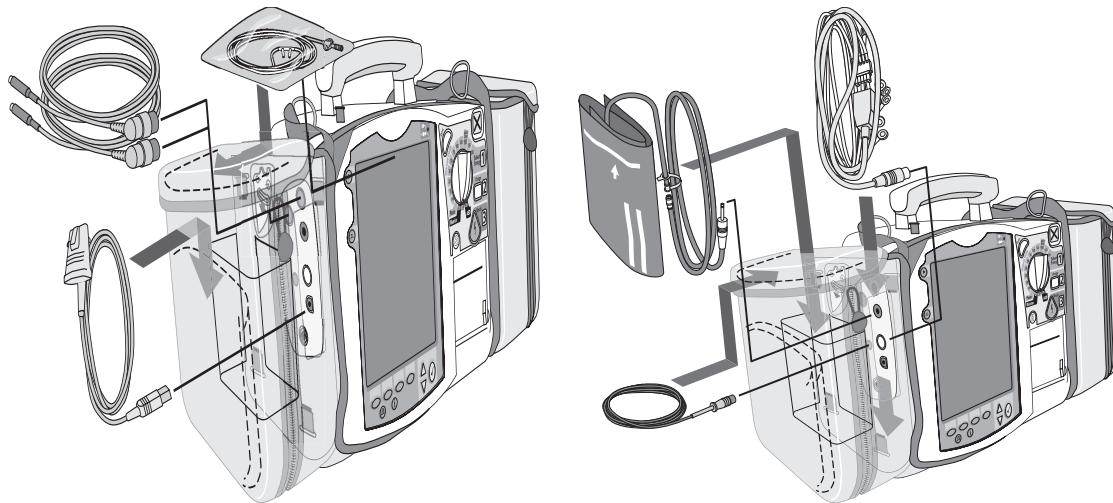
## Carrying Case and Accessory Pouch Assembly

The following topics are for only customers who have carrying cases and accessory pouches, and require assembly procedures and recommended accessory placement and storage. The following illustrations show carrying case and accessory pouch assembly. Detailed directions can be found in the Setting Up chapter of the *MRx Instructions For Use*.

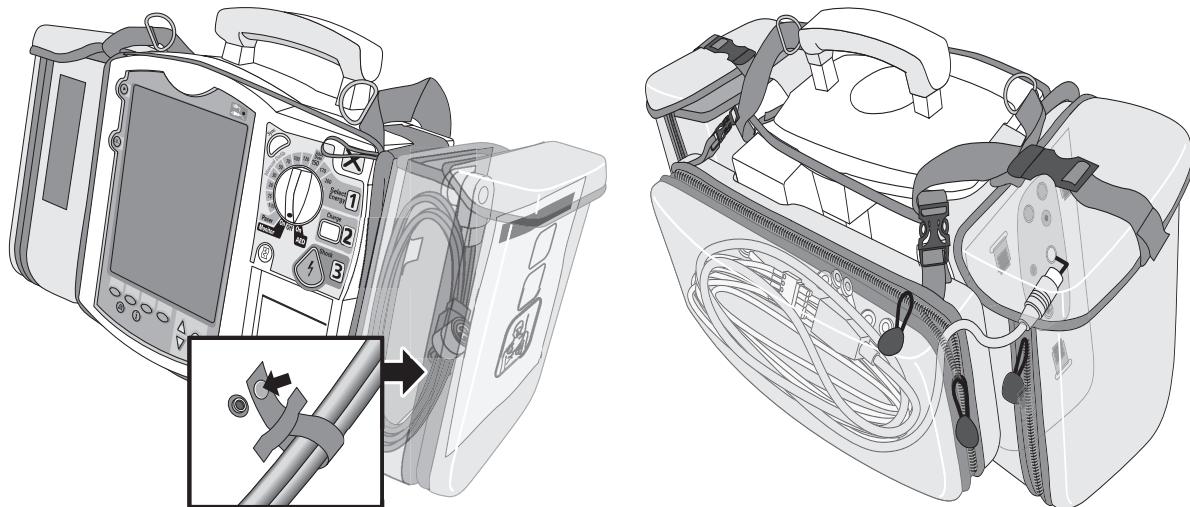


## Storing Accessories

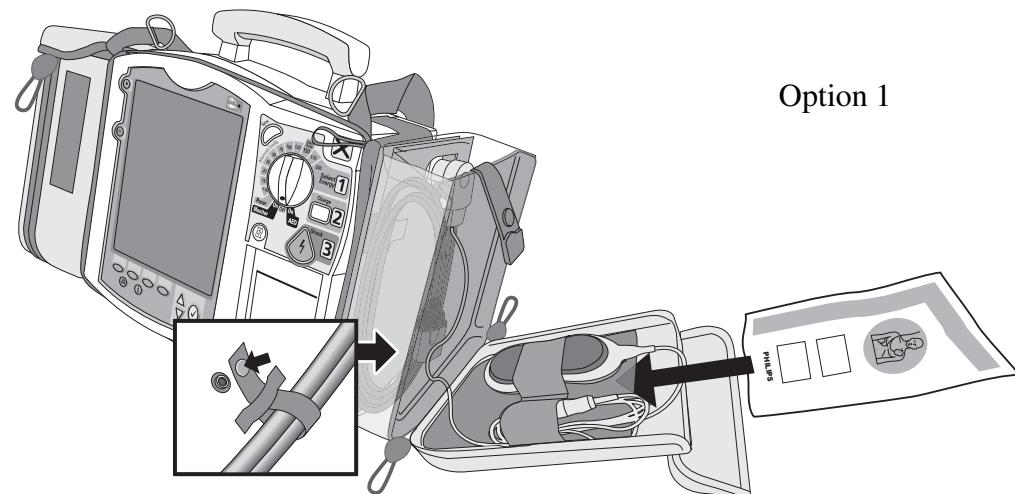
The following illustrations show parameter cabling and accessory storage in the left pouch.



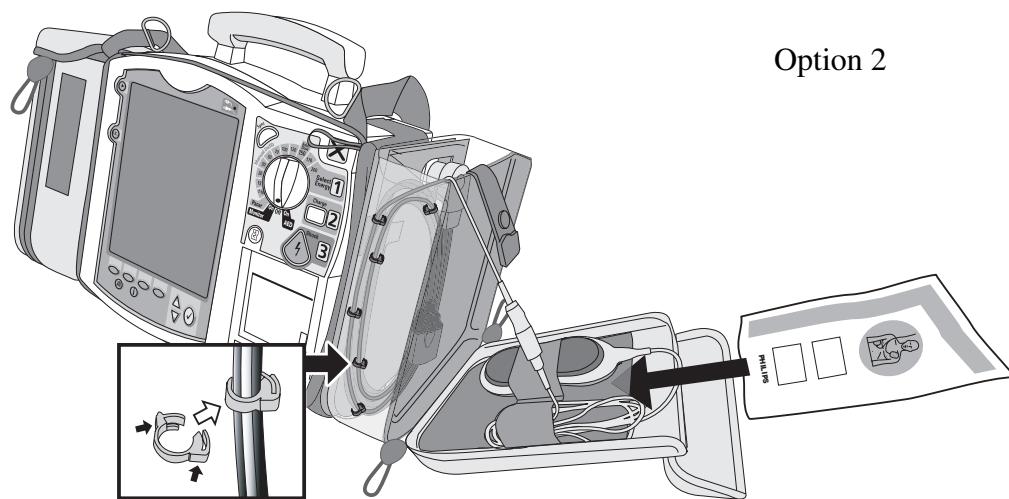
Below is right pouch storage for the Therapy cable (on the left) and back pouch storage for ECG electrodes (on the right).



Here are recommended carry bag storage instructions for Q-CPR accessories.



Option 1



Option 2

**Notes:**

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## Review

Please answer the following questions related to MRx features, controls, and display view.

1. Identify at least three controls or buttons on the MRx involved with defibrillation.
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_
  - c. \_\_\_\_\_
2. What does a solid red "X" and periodic audio chirp indicate on the RFU?
  - a. No battery is present
  - b. No power is available
  - c. A low battery condition
  - d. Defibrillation therapy may not be available
3. The arrhythmia algorithm uses the ECG in which Wave Sector for analysis?
  - a. 1
  - b. 2
  - c. 3
  - d. all of the above
4. You can select the ECG lead for Wave Sector 2 using either the Lead Select button or **Displayed Waves** menu. T or F
5. You should respond to alarms primarily by pressing the Alarm Pause button. T or F

# ECG and Arrhythmia Monitoring

## Lesson Introduction

This lesson describes the basic ECG and arrhythmia monitoring functions of the HeartStart MRx. It briefly examines Monitor View, monitoring preparation, alarms, annotated ECGs, and arrhythmia learning/relearning.

## Objectives

Upon completion of this lesson, you should be able to:

1. Locate pertinent information in Monitor View.
2. Prepare a patient for ECG and arrhythmia monitoring.
3. Set heart rate and arrhythmia alarms.
4. Display an annotated ECG.
5. Initiate manual relearning.

## Notes:

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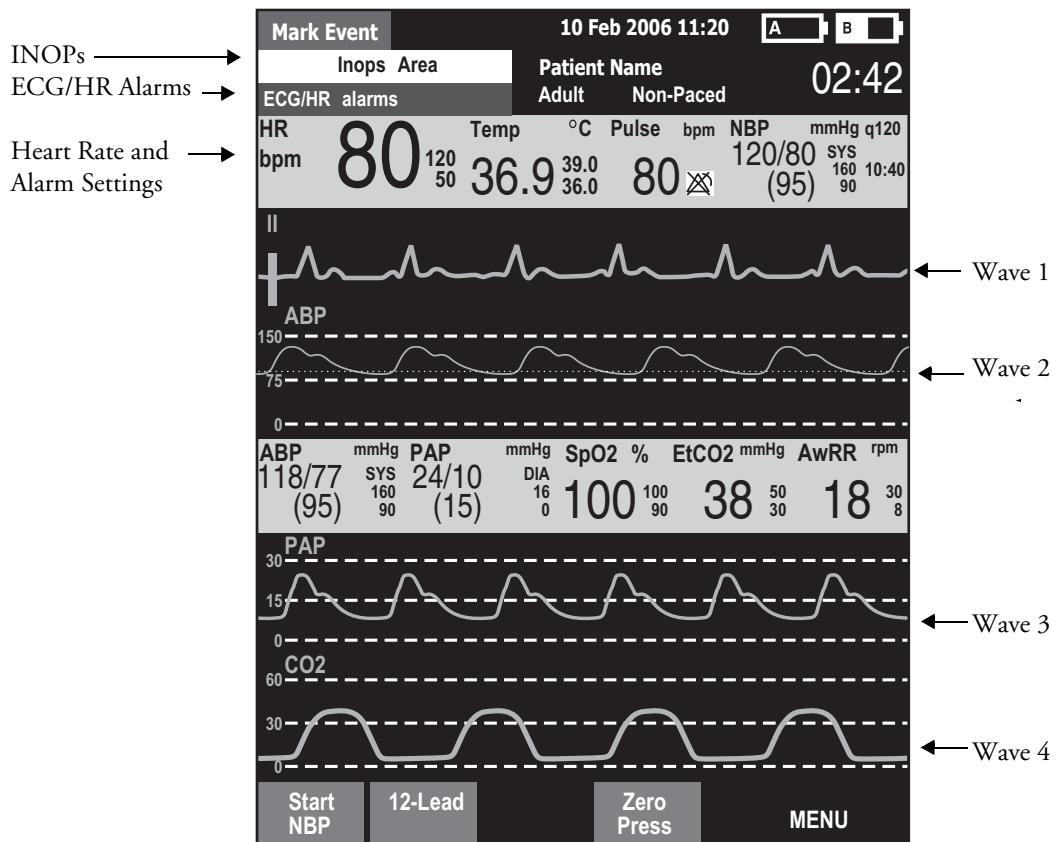
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# Lesson Presentation

## Monitor View

Monitor View is displayed when you turn the Therapy Knob to Monitor.



### Notes:

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## Preparation

Follow the steps below to prepare for monitoring using multifunction electrode pads or electrodes.

### Multifunction electrode pads

1. Prepare the patient's chest (i.e., remove clothing, remove moisture from chest, and remove excessive hair).
2. Apply multifunction electrode pads to the patient according to the pads package directions or your organization's protocol.
3. If not pre-connected, insert the pads cable into MRx's green Therapy port.
4. Connect the pads to the pads cable.

### Electrodes

1. Prepare the patient's skin at appropriate electrode sites.
  - If necessary, clip hair at the electrode sites (or shave sites if needed).
  - Clean and abrade the skin at each electrode site.
  - Dry the electrode sites briskly to increase capillary blood flow in the tissues and to remove oil and skin cells.
2. Attach the snaps to the electrodes.
3. Apply the electrodes.
4. If not pre-connected, connect the ECG patient cable to the MRx.

### Lead Selection

Use the Lead Select button to select the ECG lead for Wave Sector 1. To select a lead for Wave Sectors 2-4:

1. Press the Menu Select button.
2. Select **Displayed Waves** and press Menu Select.
3. Select the appropriate Wave Sector and press Menu Select.
4. Select the desired lead (with the clearest signal) and press Menu Select.

**Practice Exercise 1**

Attach a simulator and 3-, 5-, and 10-Lead ECG set to the MRx (5- or 10-Lead set preferred), set the simulator to a normal sinus rhythm, and complete a variety of lead selections for Wave Sectors 2, 3, and 4, as appropriate.

**Questions**

1. How do Wave 2, 3, and/or 4 menus differ from each other in terms of available leads? From the Wave 1 menu?
2. What wave size(s) provide the clearest wave form?
3. What happens if you add a parameter?

**Notes:**

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## Heart Rate and Arrhythmia Alarms

### Introduction

The ST/AR Basic Arrhythmia Algorithm generates heart rate and heart rate alarms, and can never be disabled. Here are the various alerts MRx generates:

- Red alarms
- Yellow alarms
- INOP messages

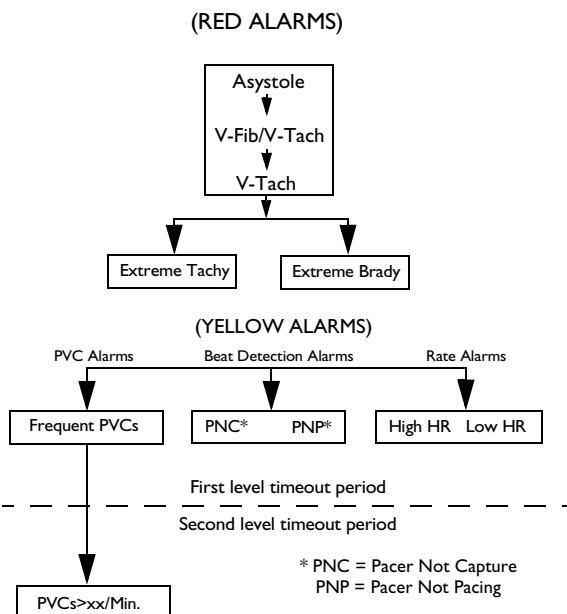
HR/Arrhythmia Red Alarms

Alarm Message	Condition	Indicator	Latching/ Non-Latching
Asystole	No detectable beats for four seconds in the absence of Vfib	Red alarm message, alarm tone	Latching
VFIB/VTACH	A fibrillatory wave detected for four seconds	Red alarm message, alarm tone	Latching
VTACH	Consecutive PVCs and HR exceed defined limits	Red alarm message, alarm tone	Latching
Extreme Brady	10 bpm below HR Low limit, capped at 30 bpm	Red alarm message, alarm tone	Latching
Extreme Tachy	20 bpm above HR High limit capped at 200 bpm (adult) or 240 bpm (pedi)	Red alarm message, alarm tone	Latching

HR/Arrhythmia Yellow Alarms

Alarm Message	Condition	Indication	Latching/ Non-Latching
HR High	The HR exceeds the configured HR high limit	Yellow alarm message, alarm tone	Non-Latching
HR Low	The HR is below the configured HR low limit	Yellow alarm message, alarm tone	Non-Latching
PVC/min. High (value > limit)	The number of detected PVCs in a minute exceeds the limit of 15 (adult/pedi)	Yellow alarm message, alarm tone	Non-Latching
Pacer Not Capture	No QRS following a pacer pulse	Yellow alarm message, alarm tone	Latching
Pacer Not Pacing	No QRS or pacer pulse detected	Yellow alarm message, alarm tone	Latching

## Alarm Chain for Basic Arrhythmia Monitoring

**Practice Exercise 2**

Set the simulator and MRx to produce a variety of latching, non-latching, and INOP conditions, as directed.

**Questions**

1. What do you see and hear when a red alarm goes off? A yellow alarm? An INOP message?

**Notes:**


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## Setting Alarms

- Alarms are automatically enabled in Monitor and Pacer Modes.
- In Manual Defib Mode, alarms are automatically enabled if the Sync function is enabled. If the Sync function is not enabled, alarms are enabled using the Alarm Pause button.
- Alarms alert you when values exceed or fall below defined limits.
- Heart rate (HR) and VTACH alarm settings are as configured but may be changed during operation for the current patient.
- The PVC rate limit setting may only be changed in response to a PVC rate alarm condition.
- Other HR and arrhythmia alarms may not be changed.

## Changing Heart Rate or VTACH Alarm Limits

To change HR or VTACH limits:

1. Press the Menu Select button.
2. Select **Measurements/Alarms** and press Menu Select.
3. Select **HR/Arrhythmia** and press Menu Select.
4. Select **HR Limits** and press Menu Select.
5. Select new values and press Menu Select.
6. Select **VTACH Limits** and press Menu Select.
7. Select new values and press Menu Select.

## Enabling/Disabling Heart Rate and Arrhythmia Alarms

To enable or disable HR and arrhythmia alarms:

1. Press Menu Select.
2. Select **Measurements/Alarms** and press Menu Select.
3. Select **HR/Arrhythmia** and press Menu Select.
4. Select **Alarms On/Off** and press Menu Select.

Note: Disabling alarms prevent all alarms associated with HR measurements from being annunciated. If an alarm condition occurs, no alarm indication will be given.

## Responding to HR and Arrhythmia Alarms

To respond to the Audio Pause label, press the Menu Select or Navigation buttons.

To respond to alarms:

1. **Acknowledge** the alarm condition.
2. Adjust the limits using the **New Limits** menu.

**Practice Exercise 3**

Change HR or VTACH limits, enable or disable alarms, and respond to HR and arrhythmia alarms.

**Questions**

1. What happens when you change a limit? Disable an alarm? Respond to the Audio Pause label or an alarm?

**Notes:**

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**Displaying an Annotated ECG**

An annotated wave displays how the ST/AR Algorithm labels beats. To display an annotated ECG:

1. Press Menu Select.
2. Select **Displayed Waves** and press Menu Select.
3. Select **Wave 2** and press Menu Select.
4. Select **Annotated ECG** and press Menu Select.

**Practice Exercise 4**

Complete the steps to display an annotated ECG.

**Question**

Where does the annotation first appear?

**Notes:**

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## Arrhythmia Learning/Relearning

MRx automatically performs arrhythmia learning/relearning when the lead or mode of operation is changed so the ST/AR Algorithm can properly analyze the patient's normal and/or paced complexes.

Initiate *manual* relearning if beat detection is not occurring or if beat classification is incorrect and results in a false alarm. To initiate relearning manually:

1. Press Menu Select.
2. Select Measurements/Alarms and press Menu Select.
3. Select HR/Arrhythmia and press Menu Select.
4. Select Relearn Rhythm and press Menu Select.

### Practice Exercise 5

Complete the steps to initiate manual relearning.

#### Notes:

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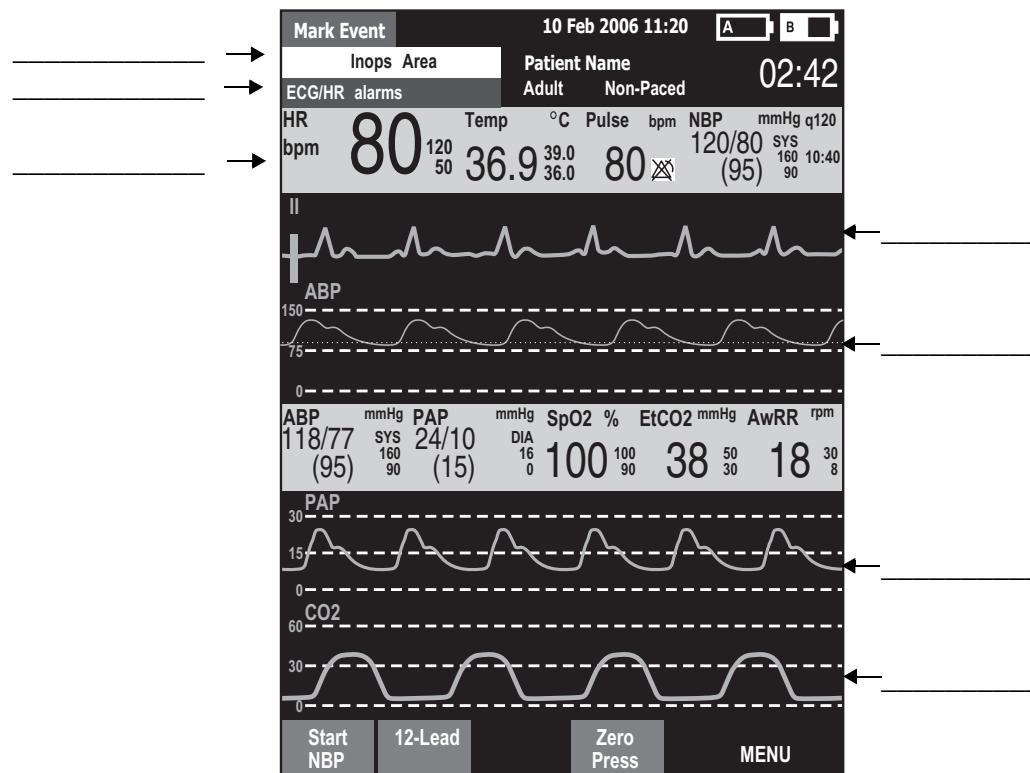
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## Review

Please answer the following questions related to ECG and arrhythmia monitoring.

- Identify the Monitoring View elements.



- You can select the ECG lead for Wave Sectors 1-4 using the Lead Select button. T or F
- Which of the following alarms can ONLY be changed while IN RESPONSE TO AN ALARM CONDITION?
  - HR
  - PVC
  - VTACH
- Which of the following statement(s) are TRUE?
  - All arrhythmia alarms are classified as "latching" alarms.
  - Yellow alarms can communicate equipment failures.
  - Alarms are enabled as soon as you enter Monitor Mode if the Sync function is enabled.
  - Menu Select AND Navigation buttons can acknowledge alarms.
- The MRx automatically performs arrhythmia learning/relearning when there is a lead selection change for Wave Sector 1 or 2. T or F

# Semi-Automated External Defibrillation

## Lesson Introduction

This lesson describes how to use AED Mode. It highlights the AED display view and explains the steps and associated prompts that guide users through the defibrillation process.

### Objectives

Upon completion of this lesson, you should be able to:

1. Locate pertinent information in AED View.
2. Prepare a patient for AED defibrillation.
3. Defibrillate in AED Mode.

### Notes:

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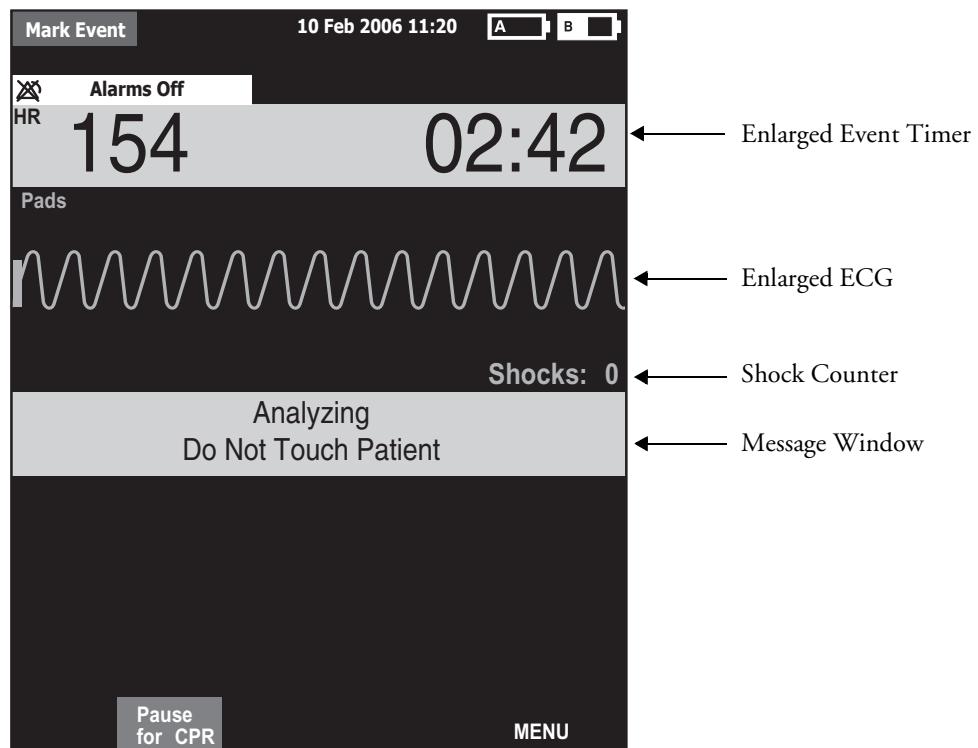
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# Lesson Presentation

## AED View

Turn the Therapy Knob to AED to display the AED View.



### Notes:

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## Preparation

To prepare for AED defibrillation:

1. Confirm the patient's condition (i.e., unresponsive, not breathing, and/or pulseless).
2. Prepare the patient's chest.
3. Apply multifunction electrode pads using the **anterior-anterior** electrode placement.
4. If not pre-connected, insert the pads cable into the green Therapy port.
5. Connect the pads to the pads cable.

## Notes:

## AED Mode

To defibrillate in AED Mode:

1. Turn the Therapy Knob to AED.
2. Follow the voice and screen prompts.
3. Press the orange Shock button, if prompted.

## **Practice Exercise 1**

Turn the Therapy Knob to **AED** and to see what happens when your pads cable and/or pads are not connected.

## Notes:

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## Shock Advised

## Practice Exercise 2

Attach an ECG simulator to the MRx via a hands-free (pads) cable, set the simulator to a shockable rhythm (e.g., VF), and follow the steps to defibrillate. Complete one shock.

## Questions

1. What screen prompts do you see and voice prompts do you hear initially?
2. How do you know the device is ready to deliver a charge?
3. What do you see and hear after delivering a shock?
4. What happens when you press the **[Resume Analyzing]** soft key?

## Notes:

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## No Shock Advised

### **Practice Exercise 3**

Set the simulator to a normal sinus rhythm and see what happens.

## Questions

1. What screen prompts do you see and voice prompts do you hear?
2. What happens when you press the **[Pause for CPR]** soft key?

## Notes:

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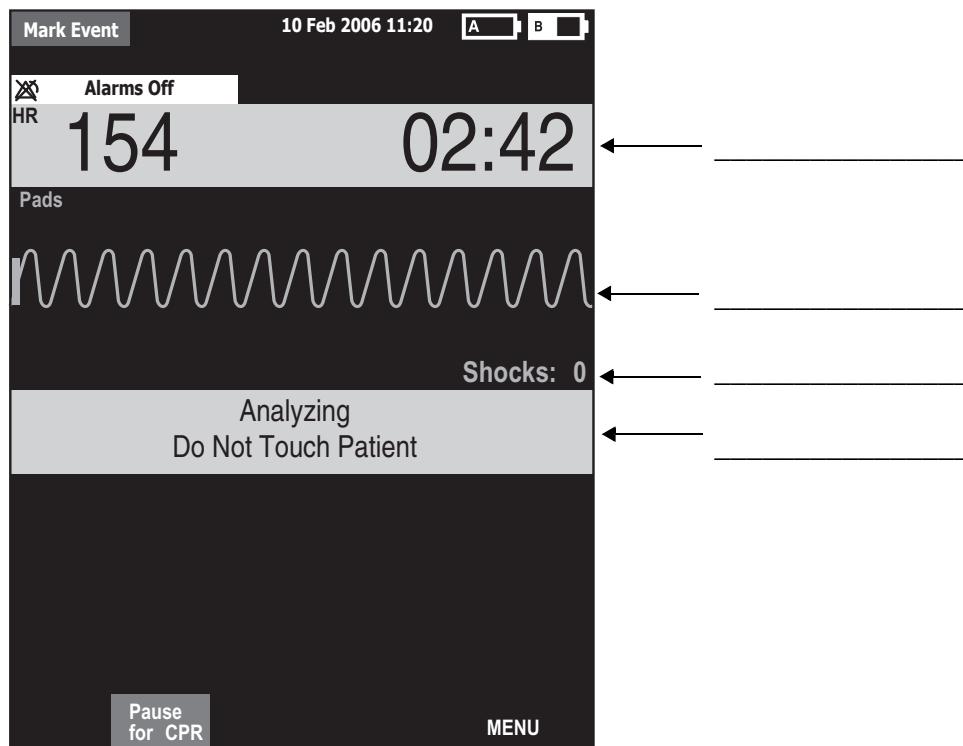
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## Review

Please answer the following questions related to AED.

1. Identify the AED View elements.



2. Apply multifunction electrode pads using anterior-posterior placement for AED. T or F
3. What are the three basic steps for AED using the MRx?
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_
  - c. \_\_\_\_\_
4. Which of the following statement(s) about AED Mode are TRUE?
  - a. The MRx automatically checks for proper pads cable and pads connection.
  - b. If artifact interferes with ECG analysis and persists, analysis will suspend but resume automatically after 60 seconds.
  - c. The MRx automatically disarms if a shock becomes unnecessary.
  - d. The MRx automatically analyzes the patient's heart rhythm after a shock is delivered.



# Manual Defibrillation and Cardioversion

## Lesson Introduction

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

### Objectives

Upon completion of this lesson, you should be able to:

1. Locate pertinent information in Code View.
2. Prepare a patient for asynchronous and synchronous defibrillation.
3. Perform asynchronous and synchronous defibrillation.

### Notes:

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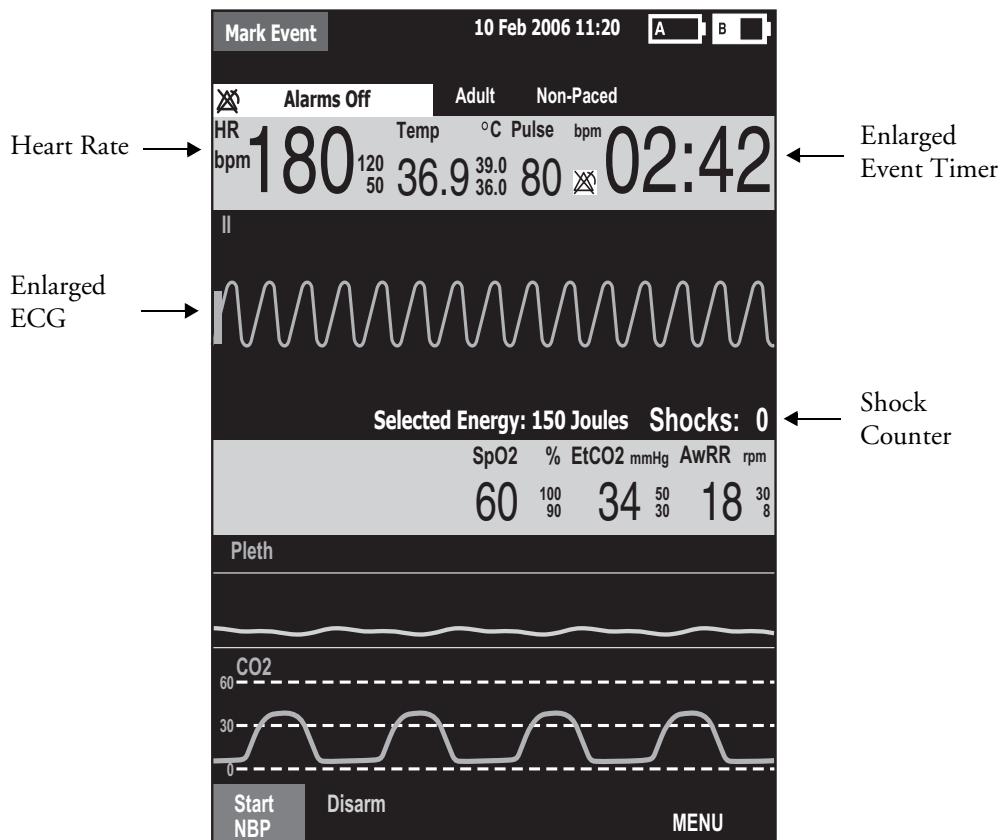
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# Lesson Presentation

## Code View

Turn the Therapy Knob to Manual Defib to display the Code View.



### Notes:

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## Manual Defibrillation Preparation

Follow the steps below to prepare for manual defibrillation using multifunction electrode pads or external paddles.

## Multifunction Electrode Pads

1. Confirm the patient's condition (i.e., unresponsive, not breathing, and/or pulseless).
2. Prepare the patient's chest.
3. Apply multifunction electrode pads to the patient according to pads package directions or your organization's protocol.
4. If not pre-connected, insert the pads cable into MRx's green Therapy port.
5. Connect the pads to the pads cable.

## External Paddles

1. Confirm the patient's condition (i.e., unresponsive, not breathing, and/or pulseless).
2. If not pre-connected, insert the paddles cable into the green Therapy port.
3. Remove the paddles from paddle tray.
4. Apply the paddles to patient's bare chest, using the anterior-anterior placement or your organization's protocol.

## Internal Paddles

1. Select the appropriate switched or switchless paddle electrode size.
2. If using switchless paddles, connect the paddles to the M4740A Paddle Adapter Cable.
3. Connect the paddles cable (or the paddle adapter cable) to the MRx.

## Notes:

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## Manual Defibrillation

To defibrillate in Manual Mode:

1. Turn the Therapy Knob to **Manual Defib** and select an energy setting.
2. Press the Charge button on the MRx (or external paddle).
3. Make sure no one is touching the patient or anything connected to the patient before shock; call out loudly and clearly "Stay Clear!"
4. Press the orange Shock button on the MRx (or the shock buttons on the external or switched internal paddles).

### Practice Exercise 1

Attach a simulator and parameter accessories (if available and appropriate) to the MRx, set the simulator to a shockable rhythm (e.g., VF), and complete the manual defibrillation steps (with three shocks).

#### Questions

1. What do you see and hear during a charge?
2. How do you know the device is ready to deliver a charge?
3. What do you see and hear after delivering a shock?
4. What happens when you press the [Disarm] soft key?

#### Notes:

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## Synchronized Cardioversion Preparation

Follow the steps below to prepare for synchronized cardioversion.

1. Perform the steps as described in the previous *Manual Defibrillation Preparation* topic.
2. If monitoring through a 3-, 5-, or 10-Lead ECG cable, plug the cable into MRx's ECG port and apply monitoring electrodes to the patient.
3. Press the Lead Select button to select Pads, Paddles, or a lead from attached monitoring electrodes.

### Notes:

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## Synchronized Shock Delivery

To deliver a synchronized shock:

1. Turn the Therapy Knob to **Monitor** position and press the Sync button.
2. Confirm that the Sync marker appears with each R-wave.
3. Turn the Therapy Knob to **Manual Defib** and select an energy setting.
4. Press the Charge button on the MRx (or external paddle).
5. Make sure no one is touching the patient or anything connected to the patient before shock; call out loudly and clearly "Stay Clear!"
6. Press and hold the orange Shock button on the MRx (or the orange shock buttons on both paddles) until the shock is delivered.

### Practice Exercise 2

Attach a simulator and pads to the MRx, set the simulator to a shockable rhythm (e.g., VF), and complete synchronized cardioversion.

#### Questions

1. What do you see when you press the Sync button?
2. Once in Sync mode, what happens when you turn the Therapy Knob to a position other than Manual Defib?
3. What happens when you press the Sync button again?

#### **Notes:**

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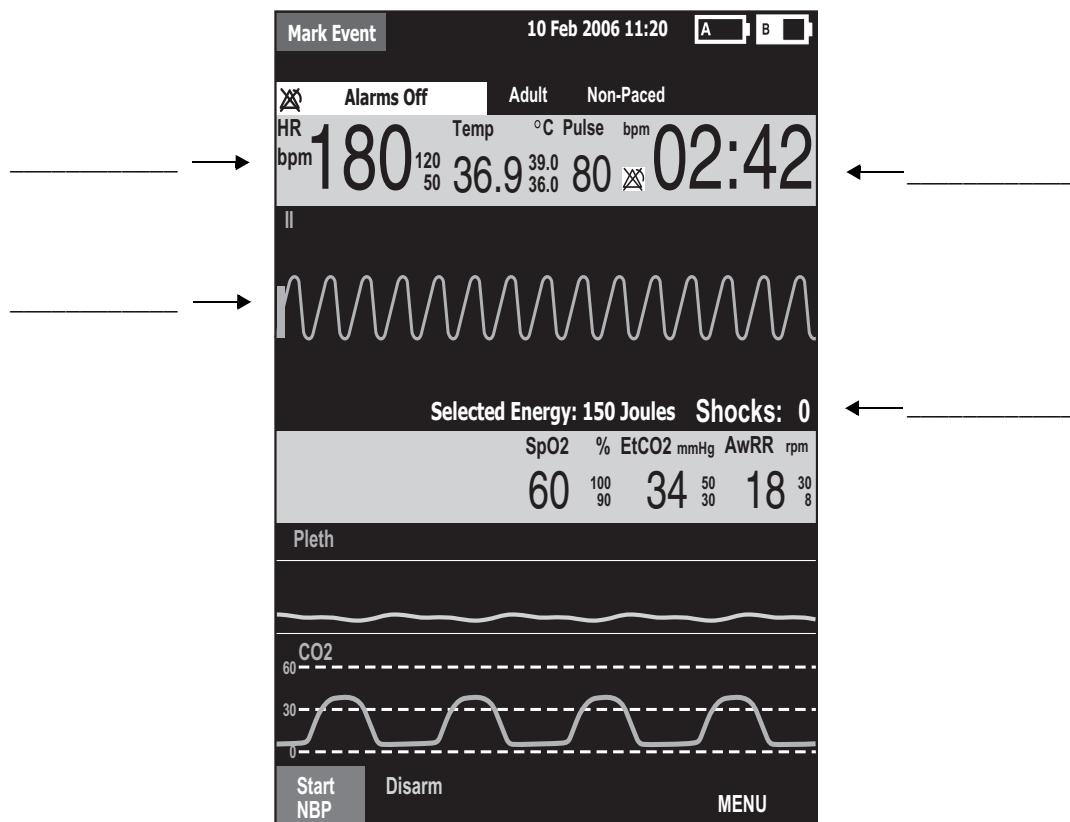
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## Review

Please answer the following questions related to manual defibrillation and synchronized cardioversion.

1. Identify the Code View elements.



2. What are the three basic steps for manual defibrillation using the MRx?

- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_

3. Which of the following indicate that the MRx is ready to deliver a shock via pads?

- a. The device sounds a continuous high-pitched tone. Y or N
- b. The Charged value on the display matches the Therapy Knob setting. Y or N
- c. The disarm soft key is disabled. Y or N
- d. The Shock button flashes. Y or N

4. What are the four basic steps for synchronized cardioversion using the MRx?

- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_
- d. \_\_\_\_\_



# Q-CPR™

## Lesson Introduction

This lesson describes how to set-up and use the Q-CPR™ option available on the HeartStart MRx.

Note: Q-CPR™ is a trademark of Laerdal Medical.

### Objectives

Upon completion of this lesson, you should be able to:

1. Identify intended use and preparation for use related to Q-CPR.
2. Identify characteristics related to Q-CPR in Manual Defib and AED Modes.

### Notes:

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# Lesson Presentation

## Overview

### Q-CPR:

- Offers measurement and corrective feedback on:
  - compression rate, depth, and duration time,
  - ventilation rate, volume, and flow rate (inflation time)
  - CPR inactivity
- Measures compressions through a Compression Sensor and ventilations through multifunction defib electrode pads
- Is used with only the HeartStart MRx
- Is contraindicated:
  - on neonatal and pediatric patients (under 8 years of age or weighing less than 25 kg)
  - when CPR is contraindicated
  - in a moving environment
  - with any other CPR compression devices (aside from the Q-CPR Compression Sensor)
- Events related to Q-CPR are not stored in the HeartStart MRx Event Summary.

### Notes:

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## Q-CPR Preparation

Follow the steps below to prepare for Q-CPR use.

1. Connect the Pads/CPR cable to the MRx, aligning the white pointer on the cable with the white arrow on the green Therapy port, inserting the cable into the port, and pushing until you hear it click into place. Compression Sensor to the Pads/CPR Cable
2. Connect the Compression Sensor to the Pads/CPR cable, aligning the key marker on the Compression Sensor cable with the key marker on the receptacle end of the Pads/CPR cable, and pushing until you hear it click into place.
3. Attach the Compression Sensor Adhesive Pad to the Compression Sensor, peeling the white liner from the bottom of the Compression Sensor Adhesive Pad, aligning the Sensor Adhesive Pad with the yellow area of the sensor, and pressing into place.  
Note: Complete steps 1-3 before a rescue or resuscitation event to save time on set-up.
4. Prepare the patient's chest and apply the multifunction electrode pads to the patient as directed on the pads package, using the anterior-anterior placement.
5. Connect the pads to the Pads/CPR cable.
6. Place the Compression Sensor on the lower half of the patient's sternum, which is at the normal CPR hand location.

### Notes:

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**Practice Exercise 1**

Make all cable attachments and then detach a cable to see what inop is produced. Loosen a multifunction pad to see what inop is produced.

**Notes:**

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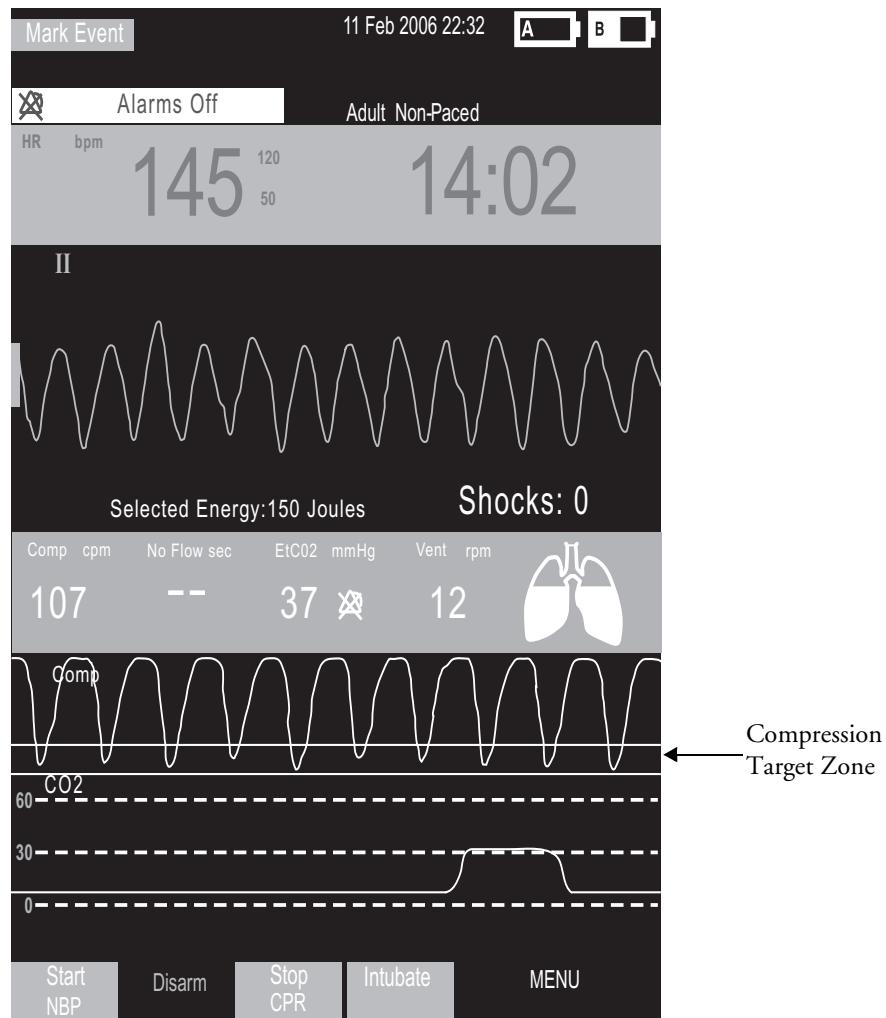
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## Q-CPR in Manual Defib Mode

Turn the MRx Therapy Knob to **Manual Defib** and select the 150J energy setting.



### Practice Exercise 2

Turn to the 150J adult manual defibrillation setting and practice performing CPR alone and with another student on a manikin (to experience 1- and 2-rescue person situations) according to AHA guidelines for compression-to-ventilation ratio. Also, press the Sync and/or Alarm Pause button to see what happens to Q-CPR.

#### Questions

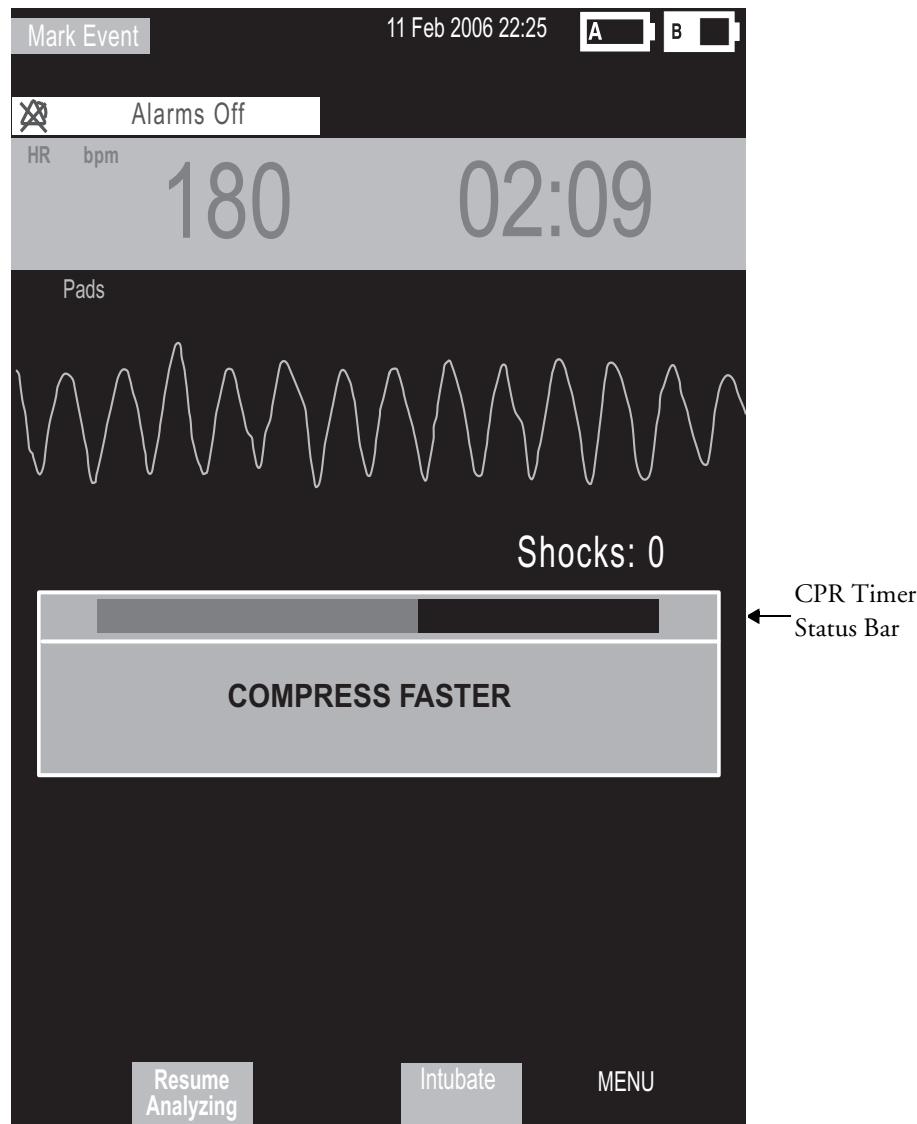
1. What voice prompts do you hear when performing CPR? What is the most frequently heard prompt?
2. How long can you perform CPR without getting a voice prompt? How long could you perform CPR before getting totally fatigued?
3. What range of compression and ventilation rates do you achieve?
4. How full does the ventilation (lungs) icon get when you do ventilations?
5. How often do you get 'No Flow' times and how long are those times?

6. What happens to Q-CPR when you press the Sync and/or Alarm Pause button?

## Notes:

## Q-CPR in AED Mode

Turn the Therapy Knob to AED and press the **Pause for CPR** soft key.



### Practice Exercise 3

Turn to AED, press the **Pause for CPR** soft key, and practice performing CPR alone and with another student on a manikin (to experience a 1- and 2-rescue person situation) according to AHA guidelines for compression-to-ventilation ratio.

#### Questions

1. What voice and text prompts do you get when performing CPR? What is the most frequent voice or text prompt produced?
2. How long can you perform CPR without getting a voice or text prompt? How long could you perform CPR before getting totally fatigued?

## Notes:

## CPR Feedback Volume Adjustment

To mute the CPR feedback voice prompts (once you start CPR):

1. Press Menu Select.
2. Select **Mute CPR Voice** and press Menu Select.

To resume voice prompts set at the previously selected volume:

1. Press Menu Select.
2. Select **Resume CPR Voice** and press Menu Select.

To adjust the volume of CPR feedback voice prompts:

1. Press the Menu Select button.
2. Select **Volume** and press Menu Select.
3. Select **Voice** and press Menu Select.
4. Select the desired volume level and press Menu Select.

## Review

Please answer the following questions related to Q-CPR.

1. Q-CPR can be used on patients 8 years and older. T or F
2. The multifunction pads should be placed in an anterior/posterior position to ensure the ventilation algorithm interprets ventilations properly. T or F
3. The compression sensor should be positioned on the upper half of the patient's sternum to perform compressions. T or F
4. In Manual Defib Mode, good compression depth is indicated by the downward "peak" of the waveform appearing between the horizontal lines representing the target zone. T or F
5. The ventilation volume icon indicates ventilation has been detected but not the actual filling of both lungs. T or F
6. Only AED Mode provides voice and text prompts associated with compression and ventilation activity. T or F



# Noninvasive Pacing

## Lesson Introduction

This lesson describes the noninvasive transcutaneous pacing option available with the HeartStart MRx and how to perform pacing.

### Objectives

Upon completion of this lesson, you should be able to:

1. Identify pertinent information in Pacing View.
2. Prepare a patient for pacing.
3. Perform demand or fixed mode pacing.

### Notes:

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# Lesson Presentation

## Pacer Mode

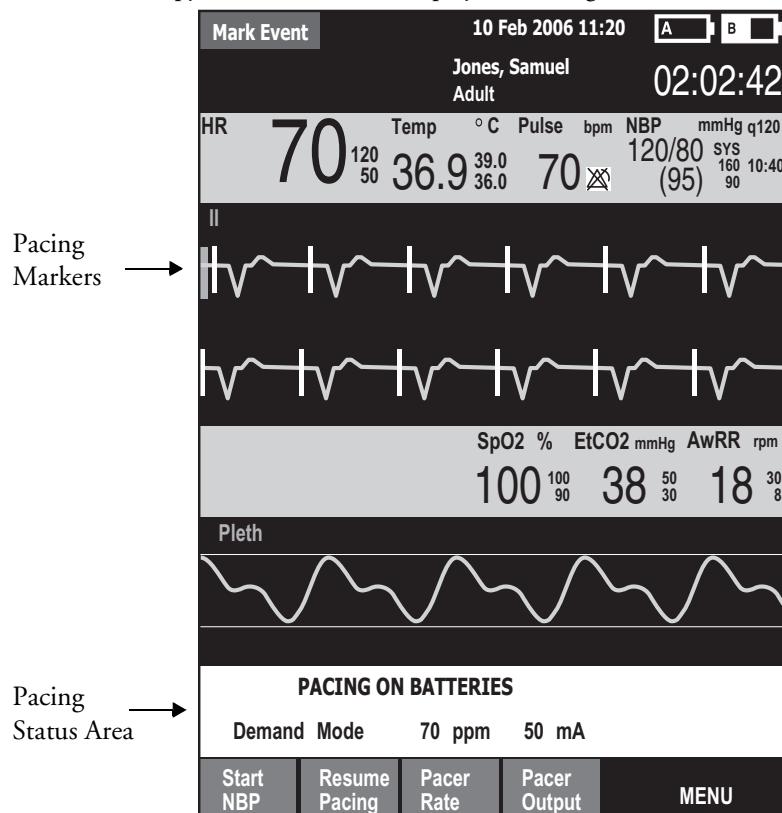
In this mode:

- Pace pulses are delivered through multifunction electrode pads.
- Waveforms, ECG monitoring, measurements, and most alarms\* (from Monitor or Manual Defib Mode) remain active if enabled and retain settings.

\*Arrhythmia alarms for Pacer Not Pacing and Pacer Not Capture (associated with non-transcutaneous pacing) are off. All other red and yellow alarms are active if enabled and their limits may be changed while in Pacer Mode. ECG INOPs are also annunciated.

## Pacing View

Turn the Therapy Knob to Pacer to display the Pacing View.



### Notes:

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## Demand vs. Fixed Mode

### Demand mode

- Pace pulses are delivered when the patient's heart rate is lower than the selected pacing rate.
- This mode uses monitoring electrodes AND pads for pacing.
- Demand mode is the suggested pacing mode.

### Fixed mode

- Pace pulses are delivered at a selected rate.
- Use when motion artifact or ECG noise makes R-wave detection unreliable or when monitoring electrodes are not available.

### **Notes:**

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## Preparation

Follow the steps below to prepare for pacing.

1. Prepare the patient's chest. Wipe moisture away and, if necessary, clip or shave excessive chest hair.
2. Apply multifunction electrode pads to the patient as directed on the pads packaging or according to your organization's protocol.
3. If not pre-connected, connect the pads cable to green Therapy port on the MRx.
4. Connect the pads connector to the pads cable.
5. If pacing in demand mode, apply monitoring electrodes and connect the ECG cable to the ECG port on the MRx.

### Notes:

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## Demand Mode Pacing

To pace in demand mode:

1. Turn the Therapy Knob to the **Pacer** position.
2. Press the Lead Select button to select the best lead with an easily detectable R-wave.
3. Verify white R-wave markers appear above or on the ECG waveform, with a single marker for each R-wave. If no R-wave markers appear or coincide with the R-wave, select another lead or increase wave size.
4. Press the [**Pacer Rate**] soft key and use the Navigation and Menu Select buttons to select the desired number of pace pulses per minute.
5. If needed, adjust the initial pacer output. Press [**Pacer Output**] and use the Navigation and Menu Select buttons to select the desired output.
6. Press [**Start Pacing**].
7. Verify white pacing markers appear above or on the ECG waveform.
8. Press [**Pacer Output**]. Then use the Navigation and Menu Select buttons to adjust the output to the lowest level that still maintains capture.
9. Verify the presence of a peripheral pulse.
10. Press [**Pause Pacing**] to stop pacing. Press [**Resume Pacing**] to resume delivery, as appropriate.

Note: You may also stop pacing by turning the Therapy Knob from **Pacer** to another position.

### Practice Exercise 1

Attach pads and electrodes to the MRx and a simulator, set the simulator to bradycardia, and complete the demand mode pacing steps.

#### Questions

1. What display changes do you see when completing each step (i.e., turn on pacing, set pacing status, adjust pacer rate and output, and stop pacing)?
2. How do you know when pace pulses are being delivered?

#### **Notes:**

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## Fixed Mode Pacing

To pace in fixed mode:

1. Turn the Therapy Knob to **Pacer**.
2. Change the pacer mode to **Fixed**.
3. Press the Lead Select button to select the desired lead.

Note: The remaining steps are similar to demand mode pacing.

4. Press [**Pacer Rate**] and use the Navigation and Menu Select buttons to select the desired number of pace pulses per minute.
5. If needed, adjust the initial pacer output by pressing [**Pacer Output**] and using the Navigation and Menu Select buttons to select the desired output.
6. Press [**Start Pacing**].
7. Verify the presence of a peripheral pulse.
8. Press [**Pacer Output**] and use the Navigation and Menu Select buttons to adjust the output, as needed.
9. Press [**Pause Pacing**] to stop pacing.

### Practice Exercise 2

Attach pads and electrodes to the MRx and a simulator, set the simulator to bradycardia, and complete the fixed mode pacing steps.

#### Questions

1. What display changes do you see when completing each step (i.e., turn on pacing, set pacing status, adjust pacer rate and output, and stop pacing)?
2. How do you know when pace pulses are being delivered?

#### **Notes:**

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## Defibrillating During Pacing

To defibrillate, turn the Therapy Knob to Manual Defib or AED. Note that:

- Pacing stops in either Manual Defib or AED Mode.
- Pacing settings selected prior to defibrillation are retained once pacing recommences.

### Notes:

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## Review

Please answer the following questions related to pacing.

1. Which of the following statement(s) are TRUE related to pacing with the MRx?
  - a. The device requires a 3-, 5- or 10-Lead ECG cable and monitoring electrodes during demand mode pacing.
  - b. The device always delivers pace pulses in demand mode.
  - c. The Pacing status area indicates pacing mode, status, rate, and output.
  - d. If you exit Pacing Mode to defibrillate and then return to pacing, the settings from the previous pacing session must be re-entered.
2. Which ONE of the following steps should be performed before pacing is initiated in demand mode?
  - a. Verify that a white pacing marker appears in front of each QRS complex.
  - b. Verify that white R-wave markers appear above or on the ECG waveform.
  - c. Increase pacer output until capture occurs.
  - d. Decrease pacer output to the lowest level that still maintains capture.

# Pulse Oximetry Monitoring

## Lesson Introduction

This lesson describes how to use the HeartStart MRx to monitor Pulse Oximetry (SpO<sub>2</sub>).

### Objectives

Upon completion of this lesson, you should be able to:

1. Monitor SpO<sub>2</sub>.
2. Set SpO<sub>2</sub> and pulse rate alarms.

### Notes:

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# Lesson Presentation

## Monitoring SpO<sub>2</sub>

To monitor SpO<sub>2</sub>:

1. Connect the appropriate sensor cable to the MRx.
2. Apply the sensor to the patient. If a finger sensor is used, the cable should come down the back of the hand.
3. Turn the Therapy Knob to **Monitor**.

### Notes:

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## Setting SpO<sub>2</sub> Alarms

### Changing Alarm Limits

To change the SpO<sub>2</sub> alarm limits:

1. Press the Menu Select button.
2. Using the Navigation buttons, select **Measurements/Alarms** and press Menu Select.
3. Select **SpO<sub>2</sub>** and press Menu Select.
4. Select **SpO<sub>2</sub> Limits** and press Menu Select.
5. Using the Navigation buttons, select the new high limit value and press Menu Select.
6. Select the new low limit value and press Menu Select.

### Enabling/Disabling Alarms

To enable the SpO<sub>2</sub> alarms:

1. Press the Menu Select button.
2. Select **Measurements/Alarms** and press Menu Select.
3. Select **SpO<sub>2</sub>** and press Menu Select.
4. Select **Alarms On/Off** and press Menu Select.

### Practice Exercise 1

Change the SpO<sub>2</sub> limits, and enable/disable and respond to related alarms.

#### Questions

What happens when you change a limit? Disable an alarm? Respond to an alarm?

#### **Notes:**

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## Setting Pulse Rate Alarms

### Changing Pulse Rate Alarm Limits

To change pulse rate alarm limits:

1. Press the Menu Select button.
2. Using the Navigation buttons, select **Measurements/Alarms** and press Menu Select.
3. Select **Pulse** and press Menu Select.
4. Select **Pulse Limits** and press Menu Select.
5. Using the Navigation buttons, select the new high limit value and press Menu Select.
6. Select the new low limit value and press Menu Select.

### Enabling/Disabling Pulse Rate Alarms

To enable pulse rate alarms:

1. Press the Menu Select button.
2. Select **Measurements/Alarms** and press Menu Select.
3. Select **Pulse** and press Menu Select.
4. Select **Alarms On/Off** and press Menu Select.

### Practice Exercise 2

Change the pulse rate limits, and enable/disable and respond to related alarms.

#### Question

What happens when you change a limit? Disable an alarm? Respond to an alarm?

#### **Notes:**

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## Disabling SpO<sub>2</sub> Monitoring

To disable SpO<sub>2</sub> monitoring:

- Disconnect the sensor cable from the SpO<sub>2</sub> port. The message *SpO<sub>2</sub> Unplugged. Turn off SpO<sub>2</sub>?* appears. Select **Yes** and press Menu Select.
- Should the sensor cable be disconnected accidentally, select **No** and press Menu Select. Then, secure the connection to re-enable the function.

### Notes:

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## Review

Answer the following questions related to SpO<sub>2</sub> monitoring.

1. You can monitor SpO<sub>2</sub> in all MRx modes (Monitor, Manual Defib, AED or Pacer). T or F
2. The pleth wave is auto scaled to grid lines when the signal quality is poor. T or F
3. SpO<sub>2</sub> alarms are off unless turned on during use while pulse rate alarms are on unless turned off during use. T or F
4. How many seconds are SpO<sub>2</sub> INOP messages suppressed during an NBP measurement?
  - a. 15
  - b. 30
  - c. 45
  - d. 60

# Noninvasive Blood Pressure Monitoring

## Lesson Introduction

This lesson describes how to monitor noninvasive blood pressure (NBP) with the HeartStart MRx.

### Objectives

Upon completion of this lesson, you should be able to:

1. Monitor NBP.
2. Set NBP alarms.

### Notes:

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# Lesson Presentation

## Preparing to Measure NBP

To prepare to measure NBP:

1. Select the appropriately sized cuff.
2. Attach the cuff to the NBP tubing.
3. Insert the NBP tubing into the NBP port on the MRx.
4. Apply the blood pressure cuff to the patient's arm.
5. Place the limb used for taking the measurement at the same level as the patient's heart.

### Notes:

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## Measuring NBP

To measure NBP:

1. Press the [**Start NBP**] soft key.
2. Press the [**Stop NBP**] soft key to stop a reading.

## Changing the NBP Schedule

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

1. Press the Menu Select button.
2. Using the Navigation buttons, select **Measurements/Alarms** and press Menu Select.
3. Select **NBP** and press Menu Select.
4. Select **NBP Schedule** and press Menu Select.
5. Using the Navigation buttons, select the desired interval and press Menu Select.

## Practice Exercise 1

Complete manual and automatic NBP measurements, including changing the NBP schedule.

### Questions

1. What displays when you start a measurement? Stop a measurement?
2. How does the display differ between a manual and automatic measurement?

### **Notes:**

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## Alarms

### Changing NBP Alarms

To change the NBP alarm source and/or limits:

1. Press the Menu Select button.
2. Using the Navigation buttons, select **Measurements/Alarms** and press Menu Select.
3. Select **NBP** and press Menu Select.
4. Select **NBP Limits** and press Menu Select.
5. Select the desired source for the alarm and press Menu Select.
6. Using the Navigation buttons, increase or decrease the high limit value and press Menu Select.
7. Set the new low limit value and press Menu Select.

### Enabling/Disabling NBP Alarms

To enable/disable NBP alarms:

1. Press the Menu Select button.
2. Using the Navigation buttons, select **Measurements/Alarms** and press Menu Select.
3. Select **NBP** and press Menu Select.
4. Select **Alarms On/Off** and press Menu Select.

### Practice Exercise 2

Change the alarm limits, and enable/disable and respond to related alarms.

#### Questions

1. What happens when you change a limit? Disable an alarm? Respond to an alarm?

#### **Notes:**

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## Review

Answer the following questions related to monitoring NBP.

1. Which of the following items can display when monitoring NBP?
  - a. Systolic and diastolic pressure
  - b. Alarm limits
  - c. Automatic measurement schedule
  - d. Time stamp
2. You can take manual measurements during an automatic measurement schedule. T or F
3. NBP alarms are “on” unless disabled. T or F



# Carbon Dioxide Monitoring

## Lesson Introduction

This lesson describes how to monitor carbon dioxide (CO<sub>2</sub>) and measure end-tidal carbon dioxide (EtCO<sub>2</sub>) and Airway Respiration Rate (AwRR) with the HeartStart MRx using the Microstream® (sidestream) method.

Note: Microstream® is a trademark of Oridion Medical Ltd.

## Objectives

Upon completion of this lesson, you should be able to:

1. Monitor CO<sub>2</sub>.
2. Set EtCO<sub>2</sub> and AwRR alarms.

## Notes:

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# Lesson Presentation

## Measuring EtCO<sub>2</sub>

To prepare and measure EtCO<sub>2</sub>:

1. Select the appropriate Microstream accessories based on the type and airway status of the patient.
2. Set up the Microstream accessories.

### Using the nasal FilterLine®

- a. Attach the FilterLine tubing to the CO<sub>2</sub> Inlet port.
- b. Position the nasal FilterLine on the patient. If using dual purpose FilterLine tubing, connect the green tubing to the oxygen source.

Note: FilterLine® is a trademark of Oridion Medical Ltd.

### Using the FilterLine and airway adapter

- a. Attach the FilterLine tubing to the CO<sub>2</sub> Inlet port.
- b. Connect the wide end of the airway adapter to the endotracheal tube.
- c. Connect the narrow end of the airway adapter to the ventilator tubing or manual resuscitator.

3. A measurement is automatically turned on when the FilterLine is connected to the CO<sub>2</sub> Inlet port.

Note: The Outlet port is used for removing anesthetic gases from MRx.

### Notes:

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## Setting Up the EtCO<sub>2</sub> and AwRR Alarms

### Changing EtCO<sub>2</sub> Alarm Limits

To change the EtCO<sub>2</sub> alarm limits:

1. Press the Menu Select button.
2. Using the Navigation buttons, select **Measurements/Alarms** and press Menu Select.
3. Select **EtCO<sub>2</sub>** and press Menu Select.
4. Select **EtCO<sub>2</sub> Limits** and press Menu Select.
5. Using the Navigation buttons, increase or decrease the high limit value and press Menu Select.
6. Set the new low limit value and press Menu Select.

### Enabling/Disabling EtCO<sub>2</sub> Alarms

To enable or disable the EtCO<sub>2</sub> alarms:

1. Press Menu Select. Using the Navigation buttons, select **Measurements/Alarms** and press Menu Select.
2. Select **EtCO<sub>2</sub>** and press Menu Select.
3. Select **Alarms On/Off** and press Menu Select.

### Changing AwRR Alarm Limits

To change the AwRR alarm limits:

1. Press Menu Select.
2. Using the Navigation buttons, select **Measurements/Alarms** and press Menu Select.
3. Select **AwRR** and press Menu Select.
4. Select **AwRR Limits** and press Menu Select.
5. Using the Navigation buttons, increase or decrease the high limit value and press Menu Select.
6. Set the new low limit value and press Menu Select.

### Changing Apnea Time Alarm Limit

To change the Apnea Time alarm limit:

1. Press Menu Select.
2. Using the Navigation buttons, select **Measurements/Alarms** and press Menu Select.
3. Select **AwRR** and press Menu Select.
4. Select **Apnea Time** and press Menu Select.
5. Using the Navigation buttons, increase or decrease the limit and press Menu Select.

## Enabling/Disabling AwRR Alarms

To enable the AwRR alarms:

1. Press Menu Select.
2. Using the Navigation buttons, select **Measurements/Alarms** and press Menu Select.
3. Select **AwRR** and press Menu Select.
4. Select **Alarms On/Off** and press Menu Select.

### **Practice Exercise 1**

Change EtCO<sub>2</sub>, AwRR, and Apnea Time limits, and enable/disable and respond to related alarms.

## Questions

1. What happens when you change a limit? Disable an alarm? Respond to an alarm?

## Notes:

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## Disabling EtCO<sub>2</sub> Monitoring

To disable EtCO<sub>2</sub> monitoring:

- Disconnect the FilterLine from the CO<sub>2</sub> inlet port. The message *CO2 Unplugged - Turn Off EtCO2?* appears. Select Yes and press Menu Select.
- Should the FilterLine be disconnected accidentally, select No in response to the message and press Menu Select. Then, secure the connection to re-enable the function.

### Notes:

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## Review

Answer the following questions related to monitoring CO<sub>2</sub>.

1. EtCO<sub>2</sub> values may be significantly low if a patient is breathing through their mouth when using a nasal FilterLine. T or F
2. The CO<sub>2</sub> waveform only displays in Wave Sector 3. T or F
3. FilterLine or exhaust tubing blockage can generate an apnea alarm. T or F
4. AwRR alarms are disabled unless turned enabled during use. T or F

# Invasive Pressures Monitoring

## Lesson Introduction

This lesson describes how to monitor invasive pressures using the HeartStart MRx.

### Objectives

Upon completion of this lesson, you should be able to:

1. Set up a pressure measurement.
2. Select a pressure to monitor.
3. Zero the pressure transducer.
4. Set pressure alarms and view related settings.
5. Identify how pulse works with the Invasive Pressures option.

# Lesson Presentation

## Overview

- Two channels of real-time continuous invasive pressure measurements and waveforms are available in Monitor, Manual Defib and Pacer Modes.
- Systolic, diastolic and mean pressure values display for pulsatile pressure signals and mean value for non-pulsatile pressure signals.

## Pressure Measurement Set-up

To set up medical equipment to display a pressure measurement on the MRx:

1. Turn the HeartStart MRx to **Monitor**.
2. Connect the pressure cable to the MRx.
3. Connect the pressure cable to the transducer.
4. Prepare the flush solution.
5. Flush the system to expel air from the tubing. Make sure the stopcocks and transducer are also free of air bubbles.
6. Connect the pressure line to the patient catheter.
7. If you are using an infusion pressure cuff with the pressure line, attach the pressure cuff to the fluid to be infused. Inflate it according to your hospital's standard procedure and then begin the infusion. Position the transducer so that it is level with the heart, approximately at the level of the midaxillary line.

## Notes:

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## Selecting a Pressure to Monitor

To select a pressure label:

1. Press the Menu Select button.
2. Using the Navigation buttons, select **Measurements/Alarms** and press Menu Select.
3. Select **Press 1** (or **Press 2**) and press Menu Select.
4. Select **Label** and press Menu Select.
5. Select the appropriate label from the list provided and press Menu Select.

Label	Description	Label	Description
ABP	Arterial Blood Pressure	LAP	Left Atrial Pressure
ART	Arterial Blood Pressure	PAP	Pulmonary Artery Pressure
Ao	Aortic Pressure	RAP	Right Atrial Pressure
CVP	Central Venous Pressure	P1	Non-specific pressure label (Channel 1)
ICP	Intracranial Pressure	P2	Non-specific pressure label (Channel 2)

6. Verify and change the size of your scale, as appropriate.
7. Verify and change the alarm source type, as appropriate.
8. Set the high and low alarm limits.

## Pressure Waves

To select a pressure wave and the associated scale for the display or printed strip:

1. Press the Menu Select button.
2. Using the Navigation buttons, highlight **Displayed Waves** and press Menu Select.
3. Select **Wave Position (Wave 1, Wave 2, Wave 3 or Wave 4)** and press Menu Select.
4. Select the appropriate wave and press Menu Select.
5. Select the appropriate scale and press Menu Select.

### Practice Exercise 1

Attach a simulator (e.g., Dale14 multiparameter simulator) and pressure cable(s) to the MRx, select different pressure waves and associated scales, and display and print out the results, as appropriate.

#### Questions

1. How does the display (or printout) differ from one pressure wave to another? From Wave 1 menu?
2. What wave scale(s) provide the clearest wave form?
3. How would you assign a specific label to pressure channel 1 if it is already assigned to channel 2?

**Notes:**

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## Zeroing the Pressure Transducer

### Zeroing Using the Menu Select Button

To zero the transducer using the Menu Select button:

1. Place the transducer at the appropriate level for the measurement site.
2. Close the transducer stopcock to the patient and vent the transducer to atmospheric pressure.
3. Press the Menu Select button.
4. Using the Navigation buttons, select **Measurements/Alarms** and press Menu Select.
5. Select the pressure label you wish to zero.
6. Press **Zero** and press Menu Select. Zeroing begins.

### Zeroing in Monitor Mode

To zero the transducer in Monitor Mode:

1. Place the transducer at the appropriate level for the measurement site.
2. Close the transducer stopcock to the patient and vent the transducer to atmospheric pressure.
3. Press the soft key under the **[Zero Pressure]** label.
4. Using the Navigation buttons, select the pressure(s) you wish to zero from the **Zero** menu and press Menu Select. Zeroing begins.

### Last Zero

To view dates and times for a channel's last zero:

1. Press the Menu Select button.
2. Using the Navigation buttons, select **Measurements/Alarms** and press Menu Select.
3. Select the pressure label (**channel: label**) you want and press Menu Select.
4. The last zero dates and times are displayed.

### Notes:

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## Alarms

### Enabling/Disabling Alarms

To enable/disable alarms:

1. Press the Menu Select button.
2. Using the Navigation buttons, select **Measurements/Alarms** and press Menu Select.
3. Select the pressure label (channel: label) you wish to modify alarm status on and press Menu Select.
4. Select **Alarms On** (or **Alarms Off**) and press Menu Select.

### Viewing/Changing/Setting Source for Alarms

To view or change alarm settings for a given pressure label:

1. Press the Menu Select button.
2. Using the Navigation buttons, select **Measurements/Alarms** and press Menu Select.
3. Select the pressure label (channel: label) you wish to view/modify alarms on and press Menu Select.
4. Select pressure label **Limits** and press Menu Select.
5. If the pressure label is pulsatile, select the desired source of the alarm (Systolic, Diastolic or Mean) and press Menu Select.
6. Using the Navigation buttons, increase or decrease the high limit and press Menu Select.
7. Set the new low limit and press Menu Select.

### Practice Exercise 2

Change invasive pressure alarm limits, and enable/disable and respond to related alarms.

#### Questions

1. What happens when you change a limit? Disable an alarm? Respond to an alarm?

#### **Notes:**

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## Pulse

### Changing Pulse Source

To change pulse source for the current incident:

1. Press the Menu Select button.
2. Using the Navigation buttons, select **Measurements/Alarms** and press Menu Select.
3. Select **Pulse** and press Menu Select.
4. Select **Pulse Source** and press Menu Select. Pick a source with an arterial or pulmonary waveform.
5. Using the Navigation buttons, highlight the pulse source desired and press Menu Select.

### Enabling/Disabling the Pulse Alarm

To enable/disable the pulse alarm:

1. Press the Menu Select button.
2. Using the Navigation buttons, select **Measurements/Alarms** and press Menu Select.
3. Select **Pulse** and press Menu Select.
4. Select **Alarms On/Off** and press Menu Select.

### Changing Pulse Alarm Limits

To change pulse alarm limits:

1. Press the Menu Select button.
2. Using the Navigation buttons, select **Measurements/Alarms** and press Menu Select.
3. Select **Pulse** and press Menu Select.
4. Select **Pulse Limits** and press Menu Select.
5. Using the Navigation buttons, select the new high limit value and press Menu Select.
6. Select the new low limit and press Menu Select.

### Practice Exercise 3

Change pulse alarm limits, and enable/disable and respond to related alarms.

#### Questions

1. What happens when you change a limit? Disable an alarm? Respond to an alarm?

**Notes:**

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## Review

Answer the following questions related to monitoring invasive pressures.

1. You must flush the tubing system to remove air bubbles to prevent potential incorrect readings. T or F
2. Which of the following statement(s) are TRUE regarding pressure selection and related wave scale adjustment?
  - a. When selecting a label, you need to specify its color, alarm source and limits, and scale.
  - b. Controls for scale and alarm settings automatically appear after selecting a new label.
  - c. You can not select the same label for both pressure channels.
  - d. The available pressure wave scale spans from 300 to -20 in mmHg and from 38 to -2.5 in kPa.
3. Which of the following statement(s) are TRUE regarding zeroing a pressure?
  - a. You must zero a pressure every time you reconnect the transducer cable to the MRx.
  - b. Before zeroing a pressure, you must vent pressure transducers to atmospheric pressure and close the stopcock to the patient.
  - c. Invasive pressure alarms are active while the transducer is zeroing.
  - d. The message **Unable to zero** message displays if the zeroing process fails.
4. Which of the following statement(s) are TRUE regarding pressure alarms?
  - a. All invasive pressure alarms cease when their alarm condition no longer exists.
  - b. The **PAPd High** message means the pulmonary artery diastolic pressure has exceeded the high alarm limit.
  - c. If the pressure label is non-pulsatile, you select either Systolic, Diastolic or Mean as the desired alarm source.
  - d. When CPP and ICP are displayed together, only one of them can have related alarms enabled.
5. If SpO<sub>2</sub>, as the default pulse source, is not active but the ABP source is, the pulse value displays but it is invalid. T or F



# Temperature Monitoring

## Lesson Introduction

This lesson describes how to monitor temperature using the HeartStart MRx.

### Objectives

Upon completion of this lesson, you should be able to:

6. Select a temperature to monitor.
7. Set temperature alarms and related limits.

### Notes:

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# Lesson Presentation

## Overview

- MRx offers one channel of real-time continuous temperature monitoring (in Fahrenheit or Celsius) while in Monitor, Pacer or Manual Defib Modes.
- It can monitor nasopharyngeal, esophageal, rectal, skin, arterial, venous, core and urinary bladder (vesic) temperatures.

## Selecting a Temperature Label

Label	Type	Label	Type
Tesoph	esophageal temperature	Tnaso	nasopharyngeal temperature
Trect	rectal temperature	Tvesic	urinary bladder
Tskin	skin temperature	Tart	arterial temperature
Temp	non-specific temp label	Tven	venous temperature
Tcore	core temperature		

To select a temperature label:

1. Press the Menu Select button.
2. Using the Navigation buttons, select **Measurements/Alarms** and press Menu Select.
3. Select the temperature label option currently assigned to your measurement and press Menu Select.
4. Select **Label** and press Menu Select.
5. Select the appropriate label from the list provided and press Menu Select.

## Monitoring Temperature

To monitor a temperature:

1. Connect the temperature cable to the HeartStart MRx.
2. Select the correct temperature label for your measurement.
3. Check that the current device settings (including alarm settings) are appropriate for the patient.
4. Apply the temperature probe to the patient.

## Notes:

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## Setting Temperature Alarms

### Changing Alarm Limits

To change the temperature alarm limits for the current incident:

1. Press the Menu Select button.
2. Using the Navigation buttons, select **Measurements/Alarms** and press Menu Select.
3. Select the temperature label option currently assigned to your measurement and press Menu Select.
4. Select **Temperature Limits** and press Menu Select.
5. Using the Navigation buttons, change the high limit and press Menu Select.
6. Using the Navigation buttons, change the low limit and press Menu Select.

### Disabling/Enabling Alarms

To disable/enable temperature alarms:

1. Press the Menu Select button.
2. Using the Navigation buttons, select the **Measurements/Alarms** menu and press Menu Select.
3. Select the temperature label option currently assigned to your measurement and press Menu Select.
4. Select **Alarms Off/Alarms On** and press Menu Select.

## Disabling Temperature Monitoring

To disable the Temperature monitoring:

- Disconnect the temperature cable from the MRx Temperature port. The message *Temp* (or the label currently activated) *Unplugged. Turn Off Temp* (or the label currently activated)? appears. Select **Yes** and press the Menu Select button.
- Should the temperature cable get disconnected accidentally or if the probe and cable separate, and you want to continue monitoring temperature, select **No** and press Menu Select. Reconnect the temperature cable to restart the temperature monitoring function.

### Practice Exercise 1

Change temperature alarm limits, and disable/enable and respond to related alarms.

#### Questions

1. What happens when you change a limit? Disable an alarm? Respond to an alarm?

**Notes:**

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## Review

Answer the following questions related to monitoring temperature.

1. When you change a temperature label, you need to activate its related alarm limits. T or F
2. Which of the following statement(s) are TRUE regarding temperature alarms?
  - a. All temperature alarms cease when their alarm condition no longer exists.
  - b. The **Tesoph Low** message means the esophageal temperature has fallen below the low alarm limit.
  - c. Temperature alarms default to off.
  - d. Changing the label may change the alarm limits.



# 12-Lead ECG Monitoring

## Lesson Introduction

This lesson describes how to use the diagnostic 12-Lead ECG function of the HeartStart MRx.

### Objectives

Upon completion of this lesson, you should be able to:

1. Identify pertinent information in the 12-Lead Preview screen.
2. Perform 12-Lead ECG acquisition.
3. Identify important characteristics of the 12-Lead Report.

### Notes:

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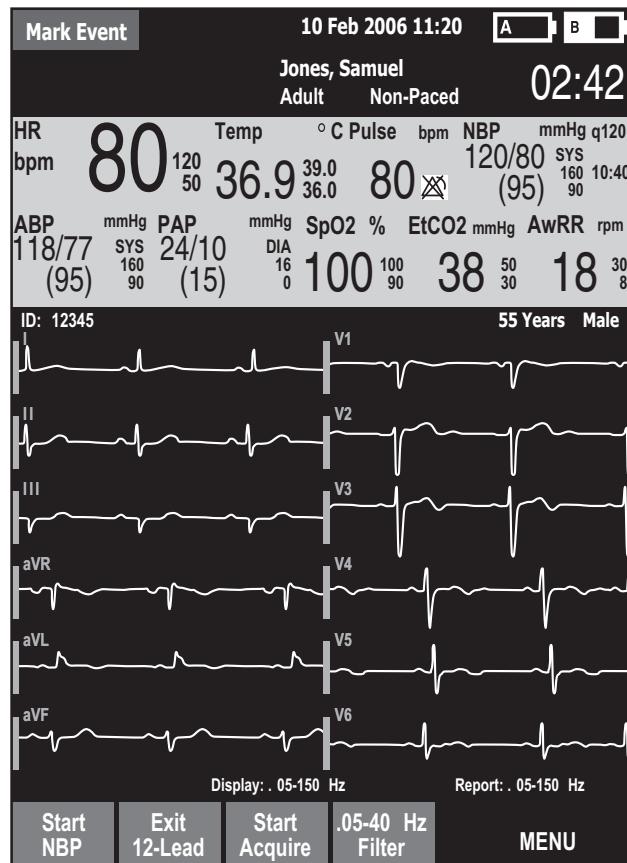
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# Lesson Presentation

## Preview Screen

The 12-Lead Preview Screen is displayed when you turn the Therapy Knob to **Monitor** and press the **[12-Lead]** soft key.



## Notes:

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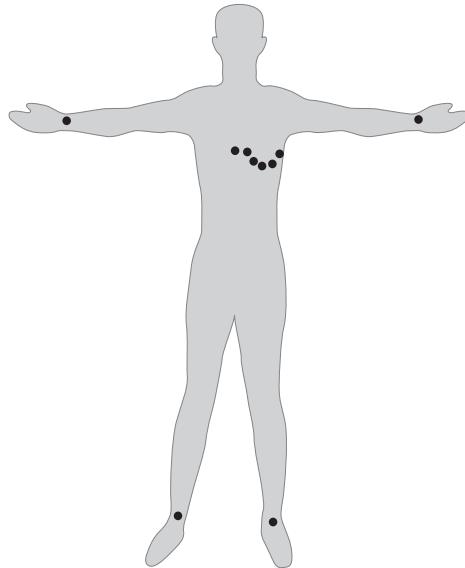


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## Preparation

To prepare for ECG acquisition:

1. Connect the 10-Lead cable to the MRx.
2. Prepare the patient's skin at appropriate electrode sites.
  - If necessary, clip hair at the electrode sites (or shave sites if needed).
  - Wash sites thoroughly with soap and water.
  - Dry the electrode sites briskly to increase capillary blood flow in the tissues and to remove oil and skin cells.
3. Attach the snaps to the electrodes.
4. Apply the electrodes to the patient. (See 10-Lead placement illustrated below.)
5. Turn the Therapy Knob to **Monitor**.
6. Enter the patient's ID, name, age, and sex.
7. Confirm the patient's pacing status is correct.



### Notes:

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## Acquiring the 12-Lead ECG

To acquire a 12-Lead ECG:

1. Press the **[12-Lead]** soft key.
2. Check the signal quality on each lead and, if necessary, make adjustments.
3. Press the **[Start Acquire]** soft key.
4. If the patient age and sex haven't been entered, input this information using the Navigation and Menu Select buttons.
5. Keep the patient still while the message *Acquiring 12-Lead* is displayed.
6. ECG analysis begins once acquisition is complete.
7. Following analysis, the 12-Lead Report is displayed, printed, and stored internally.
8. Press **[New 12-Lead]** to acquire another 12-Lead ECG.
9. Press **[Exit 12-Lead]** to exit the 12-Lead function.

### Practice Exercise 1

Attach a 10-Lead set to the MRx and a simulator, set the simulator to a normal sinus rhythm (NSR), and complete 12-Lead acquisition.

#### Questions

What display changes occur when you press the **[Start Acquire]** soft key? When acquisition is completed? When analysis is completed?

#### **Notes:**

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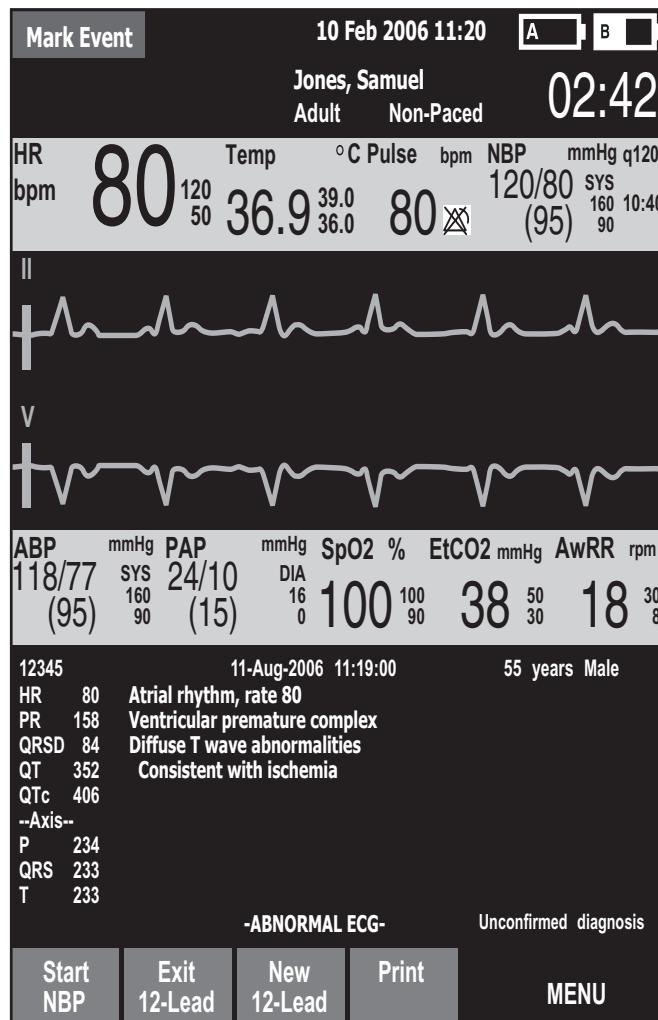
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## 12-Lead Report

The 12-Lead Report displays as follows.



### Notes:

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## Accessing Stored Reports

To access stored reports to print additional copies, copy them to a data card, or delete them from internal storage:

1. While in 12-Lead Mode, press the Menu Select button.
2. Use the Navigation buttons to select **Reports**.
3. Use the Navigation buttons to select a report and press Menu Select.
4. Select **Print, Copy, or Delete** and press Menu Select.
5. Press **Exit** to close the menu.

## Adjusting Wave Size

To adjust the ECG wave size:

1. While in 12-Lead Mode, press the Menu Select button.
2. Using the Navigation buttons, select **ECG Size** and press Menu Select.
3. Using the Navigation buttons, select the desired size value and press Menu Select.

### Notes:

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## Review

Answer the following questions related to 12-Lead ECG.

1. Which of the following statement(s) are FALSE? The 12-Lead Preview screen displays:
  - a. Patient ID, age, and sex.
  - b. Waveforms presented at a rate of 15mm/sec. for approximately 2.5 seconds.
  - c. A dotted line which indicates a lead can't be derived.
  - d. SpO<sub>2</sub>, CO<sub>2</sub>, and NBP measurements in Parameter Blocks 1 and 2, if configured.
2. Once ECG acquisition is complete, you press the Start Analysis soft key to start ECG analysis.  
T or F
3. The MRx acquires how many seconds of ECG data?
  - a. 5
  - b. 10
  - c. 12
  - d. 15
4. Which of the following statement(s) are TRUE regarding the 12-Lead Report?
  - a. It displays standard interval and duration measurements and waveform morphology.
  - b. It can be configured to include ALL 12 leads and related measurements.
  - c. Its printout can includes on-screen data and up to two rhythm strips.
  - d. An alarm strip is printed when an alarm condition occurs during printing.



# 12-Lead ECG via Bluetooth Transmission

## Lesson Introduction

This lesson describes how to transmit 12-Lead Reports from the HeartStart MRx using wireless Bluetooth® technology.

### Objectives

Upon completion of this lesson, you should be able to:

1. Identify characteristics of the 12-Lead report transmission process.
2. Set up for Bluetooth transmission.
3. Transmit a displayed or stored 12-Lead Report to a configured site or fax number.

### Notes:

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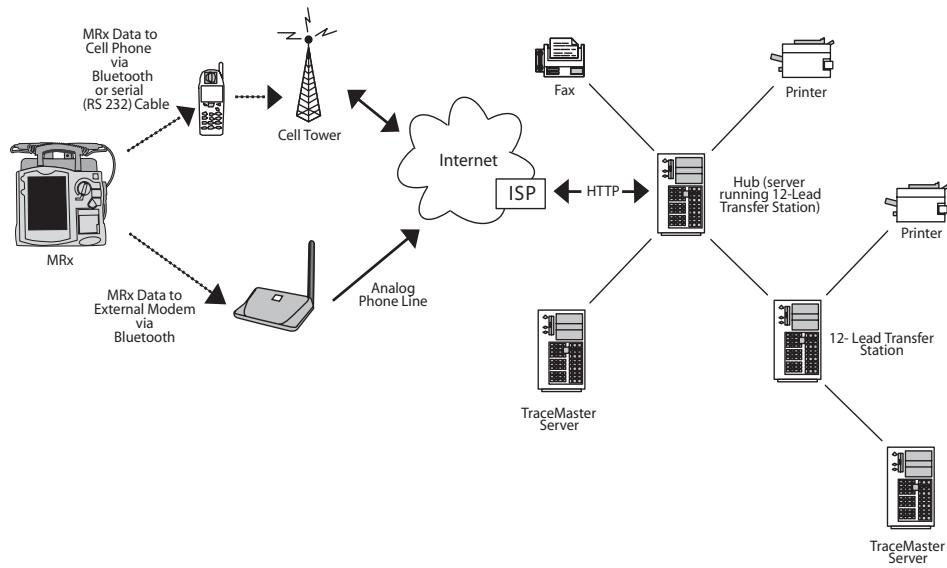
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# Lesson Presentation

## Overview

Transmit 12-Lead Reports from the MRx to a hub (a web server running Philips' 12-Lead Transfer Station software) to a printer, a fax machine, another server running 12-Lead Transfer Station software, or Philips' TraceMaster ECG Management System.



## Notes:

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## Setting Up for Bluetooth Transmission

### Adding a Bluetooth Device

To add a Bluetooth device to the list of transmission devices:

1. Press the Menu Select button.
2. From the 12-Lead Main Menu, select **Bluetooth Devices** and press Menu Select.
3. Select **Add Device** and press Menu Select. The message *Searching for Bluetooth Devices* is displayed.
4. From the Add Device menu, select the desired Bluetooth device and press Menu Select.

The selected device must now go through the “pairing” process described below.

### Pairing a Bluetooth Device and Selecting a Profile

1. Use the Navigation buttons to enter a passkey on the MRx and select **Done**.

Note: The passkey is like a PIN number or password you create for a personal account.

2. The Bluetooth device prompts you for a passkey. Enter the same passkey you just entered into the MRx. See the documentation that came with your Bluetooth device for instructions.
3. Select the designated profile from the Phone/Modem Profiles menu.

Note: The profile contains specific information about the cellular service provider (i.e., phone company) that enables the Bluetooth device to communicate with the 12-Lead Transfer Station. Your administrator can tell you which profile to choose.

4. Once the Bluetooth device is paired with the MRx and the profile selected, the MRx performs a transmission test. Press Menu Select to acknowledge a test completion message. See the “Troubleshooting” section in the *12-Lead Transmission Implementation Guide* or your administrator for support on failures.

### Changing a Bluetooth Profile

To change a Bluetooth device profile:

1. Press Menu Select.
2. From the 12-Lead Main Menu, select **Bluetooth Devices** and press Menu Select. A list of configured Bluetooth devices displays.
3. Use the Navigation buttons to select a device and press Menu Select.
4. Select **Change Profile** and press Menu Select. A menu of configured profiles for that device displays, with the current associated profile highlighted.
5. Select the profile you want to associate with the device.
6. Press Menu Select to acknowledge a test completion message.

**Practice Exercise 1**

Complete a Bluetooth transmission set-up.

**Questions**

1. What does it mean if you can't find a Bluetooth device when trying to add it to the transmission device list?
2. What other resources would you use to troubleshoot a problem?

**Notes:**

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**Transmitting to a Configured Site using Bluetooth**

To transmit a displayed 12-Lead Report to a configured site:

1. Press Menu Select.
2. Using the Navigation buttons if necessary, select **Send** from the 12-Lead Main Menu and press Menu Select.
3. Select the destination site from the configured list.
4. Press Menu Select to complete the selection.
5. Select the transmission device from the configured list.
6. Press Menu Select to complete the selection.

Note: If the Bluetooth device profile is configured as a landline, use the numeric menu to edit the configured dial prefix, if necessary. To confirm the prefix, select **Done** from the menu and press Menu Select.

## Transmitting to a Fax Number

To transmit a displayed 12-Lead Report to a manually entered fax number:

1. Press Menu Select.
2. Using the Navigation buttons if necessary, select **Send** from the 12-Lead Main Menu and press Menu Select.
3. Select **Fax Number** from the Send To menu.
4. Enter the fax number from the numeric list. Include any extra digits necessary (e.g., 9 for an outside line or 1 plus the area code for long distance).
5. Select **Done** and press Menu Select.

## Transmitting Stored 12-Lead Reports

To transmit a 12-Lead Report (for the current patient) stored in internal memory:

1. From the 12-Lead Preview or Report View, press Menu Select.
2. Use the Navigation buttons to select **Reports** from the 12-Lead Main Menu.
3. Scroll through the list of stored reports and highlight the desired report.
4. Press Menu Select to complete your selection.
5. Select **Send** from the 12-Lead Report Menu and press Menu Select.
6. Select the destination site or to manually enter a fax number.
7. Press Menu Select to complete the selection. For manual fax number entry, enter the fax number from the numeric list, select **Done** and press Menu Select.

### Practice Exercise 2

Complete transmission to a configured site, fax number, and/or for a stored report.

1. What display changes do you see when completing each transmission procedure?
2. What differences exist between each procedure?

## Cancelling Transmission

Demonstrate how to cancel a transmission once a connection has been initiated.

1. From the 12-Lead Preview or Report View, press Menu Select.
2. Select **Cancel Transmission** from the 12-Lead Main Menu and press Menu Select.

The transmission of any pending 12-Lead Reports is also canceled.

### Notes:

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## Review

Answer the following questions related to 12-Lead Report transmission using wireless Bluetooth technology.

1. Philips' 12-Lead Transfer Station software is required to complete 12-Lead Report transmission.  
T or F
2. Which one of the following statements is TRUE? To establish communication between a Bluetooth device and the MRx, a pass key is needed for:
  - a. only the Bluetooth device.
  - b. only the MRx
  - c. both the Bluetooth device and MRx.
3. Which one of the following statements is FALSE regarding 12-Lead Report transmission?
  - a. To complete transmission to a configured site, you need to select a transmission device from a configured list of devices.
  - b. If you are transmitting to a fax number, you may need to include a "9" for an outside line or "1" before the area code.
  - c. You must wait for one transmission to complete before initiating another one.
  - d. You can use MRx's Monitor Mode while transmission is in progress.



# Vital Signs Trending

## Lesson Introduction

This lesson describes the HeartStart MRx Vital Signs Trending and related report data.

### Objectives

Upon completion of this lesson, you should be able to:

1. Identify data and functionality of the Vital Signs Trending Report.

### Notes:

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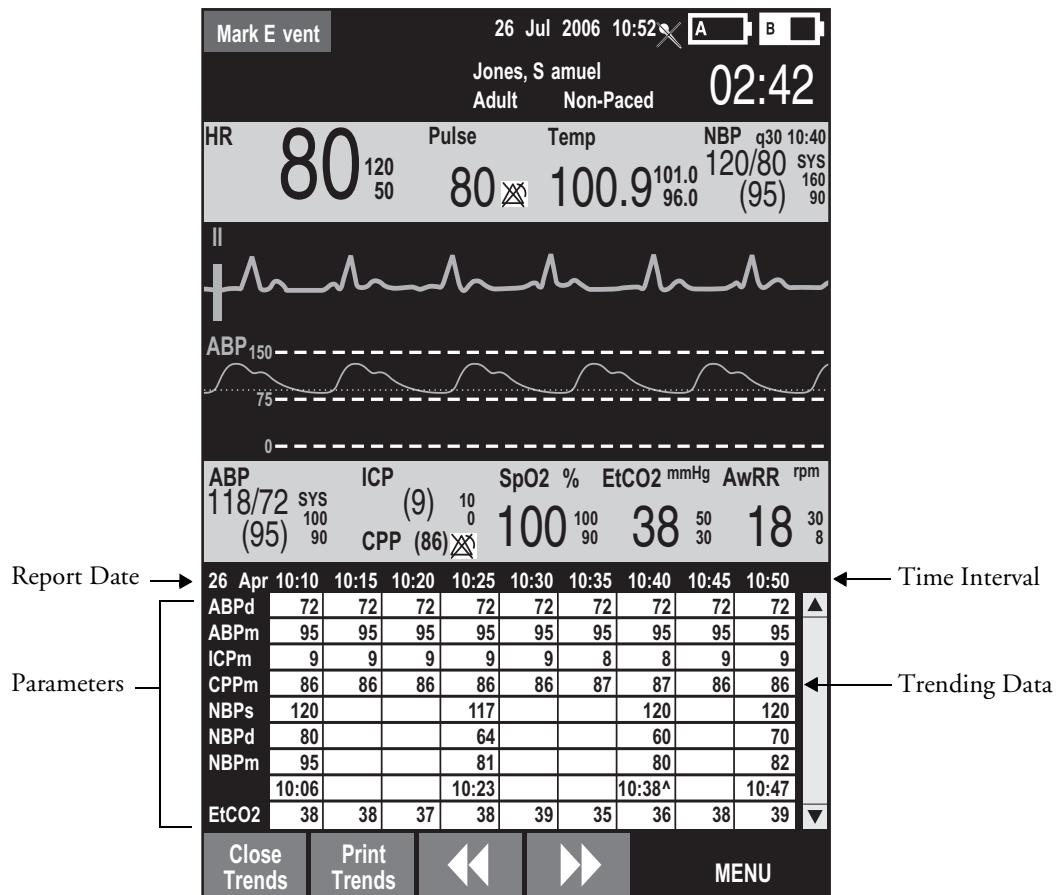
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# Lesson Presentation

## Reviewing Trending Data

1. Turn the Therapy Knob to **Monitor**.
2. Press the **Menu Select** button.
3. Using the **Navigation** buttons, select **Trends** and press **Menu Select**.



## Trending Report Intervals

To adjust the report interval:

1. With Vital Signs Trending active on your display, press the **Menu Select** button.
2. Using the **Navigation** buttons, select **Trend Interval** and press **Menu Select**.
3. Using the **Navigation** buttons, select the trend interval you want and press **Menu Select**.

## Scrolling in the Trending Report

- Use the [**<<**] or [**>>**] softkeys to scroll left and right (backward and forward) in the report.
- Use the **Navigation** buttons to scroll up and down with the vertical scroll bar on the display.

## Printing the Trending Report

Print the Trending Report two ways:

1. Press the soft key under the **Print Trends** label. A report for the displayed period and interval is printed.
2. Press the Summary button, select **Trends**, and then **Trends Interval**. A report for the entire incident period is printed.

## Exiting the Trending Report

To exit the Trending Report and return to a waveform display, simply press the **[Close Trends]** soft key. You will be returned to Monitor Mode.

### Practice Exercise 1

Change report time intervals, scroll through data, and print out sample reports.

#### Questions

1. Does the layout of a report change in any way when you increase or decrease the time interval?
2. Does the information on a printout differ from what you see on the display?

#### **Notes:**

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## Review

Please answer the following questions related to the Vital Signs Trending Report.

1. Which of the following statement(s) are TRUE regarding data displayed on the Trending Report?
  - a. If you scroll left to view older data, the screen will not update to new data when available.
  - b. Questionable data is indicated by -?.
  - c. Unavailable data is indicated by an empty space.
  - d. A ^ after the timestamp indicates multiple measurements taken during the interval.
2. For the one-minute time interval, data from continuous measurements is the average reading for that one-minute period. T or F

# Data Management

## Lesson Introduction

This lesson describes the data management features of the HeartStart MRx.

### Objectives

Upon completion of this lesson, you should be able to:

1. Identify MRx data management features.
2. Mark patient events.
3. Identify characteristics associated with printing Event Summaries.

### Notes:

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# Lesson Presentation

## Overview

- MRx marks events in Event Summaries.
- MRx automatically creates Event Summaries.
- Event Summaries:
  - Have an event ID number and date/time stamp.
  - Contain parameter measurements.
  - Include trending and associated 12-Lead Reports,
  - Are stored in internal memory.
  - Can be copied to a data card.
  - Can be printed out.
- Monitoring and defibrillation functions are disabled.

## Notes:

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## Marking Events

To annotate the Event Summary and the ECG strip with an event:

1. Press the Mark Event button.
2. Using the Navigation buttons, select the desired event from the **Events** menu and press Menu Select.

## Printing the Event Summary

- Press the Summary button and select **Event Summary** from the **Print** menu to print the current or most recent Event Summary.
- To print an Event Summary stored on the removable data card, download the information to the HeartStart Event Review Pro data management system.

## Printing the Vital Signs Trending Report

- To print the current or most recent Vital Signs Trending Report, press the Summary button, select Trends and then **Trends Interval** from the menu. Alternatively, press the soft key under the **[Print Trends]** label to print the current report.

### Notes:

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## Using Data Management - Internal Memory

To copy Event Summaries and 12-Lead ECG Reports stored in internal memory to an external data card:

1. Insert a data card into MRx.
2. Turn the Therapy Knob to **Monitor**.
3. Press the Menu Select button.
4. Using the Navigation buttons, select **Other** and press Menu Select.
5. Select **Data Management** and press Menu Select.
6. Press Menu Select to acknowledge the message *Leaving Normal Operational Mode*.
7. Use the **[Prev Item]** and **[Next Item]** soft keys to select an Event Summary.
8. Press Menu Select to display the Data Management menu.
9. Select **Copy** and press Menu Select.

## Using Data Management - Data Card

To display a list of Event Summary and 12-Lead ECG Report identifiers located on the data card:

1. Turn the Therapy Knob to **Monitor**.
2. Press the Menu Select button.
3. Using the Navigation buttons, select the **Other** menu and press Menu Select.
4. Select **Data Management** and press Menu Select.
5. Press Menu Select to acknowledge the message *Leaving Normal Operational Mode*.
6. Press Menu Select to display the Data Management menu.
7. Select **View Data Card** and press Menu Select.

Use the **[Prev Page]** and **[Next Page]** soft keys to navigate to additional display pages. Use the **Erase Card** menu option to delete the data card contents.

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## Review

Please answer the following questions related to MRx data management.

1. Which of the following statement(s) are TRUE related to MRx's data management?
  - a. Data management includes Event Summaries that have a unique event identification number and are automatically stored in internal memory.
  - b. New Event Summaries are initiated by valid SpO<sub>2</sub>, CO<sub>2</sub>, or invasive pressure data.
  - c. The amount of patient data collected is determined by the amount of data card space available.
  - d. When using the Data Management function, monitoring and defibrillation modes are disabled.
2. The Mark Event button can be configured to print a 6-second ECG strip real time or prepended with the previous 10 seconds of data leading up to the marked event. T or F
3. For a 'Shock delivered' or 'Shock failed' event, the MRx will print a 12-second string, if so configured. T or F



# Maintenance

## Lesson Introduction

This lesson describes how to care for your HeartStart MRx and includes a brief look at battery maintenance and cleaning.

### Objectives

Upon completion of this lesson, you should be able to:

1. Identify the meaning of each Ready For Use status.
2. Identify the appropriate steps to complete a shift check.
3. Perform the necessary steps to complete an operational check on the MRx.
4. Identify the appropriate steps related to battery maintenance.
5. Identify the appropriate steps to clean the MRx and its associated accessories.

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# Lesson Presentation

## Automated Tests

Three automated tests assess MRx's operational performance and notify you of any problems.

- Hourly: Tests batteries, internal power supplies, and internal memory.
- Daily: Tests batteries, internal power supplies, internal memory, internal clock battery, defibrillation, pacing, monitoring parameters, Bluetooth, and printer.
- Weekly: Performs the Daily test and delivers a high energy internal discharge to further exercise the defibrillation circuitry.

Test results include Pass, Fail/DX (device error that may affect therapy), Fail/BF (battery failure), and Fail/D (device error that does not affect therapy).

## Ready For Use Indicator

The Ready For Use (RFU) indicator provides four statuses:

- Blinking black hourglass: sufficient battery power and is ready for use.
- Blinking red “X” with or without a periodic chirp: low battery or no battery.
- Solid red “X” and a periodic chirp: device failure that may prevent shock delivery, pacing, or ECG acquisition.
- Solid red “X” without a periodic chirp: no power or device failure.

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## Shift Check

- The American Heart Association (AHA) recommends completion of a checklist (shift check) at the beginning of each change in personnel to ensure that defibrillators are ready when needed.
- Checklist activities include:
  - Device exterior
  - Cables
  - Connectors
  - Paddles/Pads
  - Monitoring electrodes
  - Batteries
  - AC/DC power
  - Printer paper
  - Data card
  - SpO<sub>2</sub> sensor
  - NBP cuffs and tubing
  - CO<sub>2</sub> FilterLine
  - Invasive pressure transducer
  - Temperature sensor
  - Compression sensor
  - Compression sensor adhesive pads

## Weekly Shock Test

Perform either a weekly shock test or an Operational Check (Op Check) once a week to verify the ability to deliver defibrillation therapy. To perform a weekly shock test:

1. If using:
  - External paddles, make sure the paddles are secure in their pockets and that the Patient Contact Indicator (PCI) LEDs located on the sternum paddle are not lit. If the LEDs light, adjust the paddles in their pockets. If the LEDs continue to light, clean both the adult and pediatric paddle electrode surfaces.
  - Multifunction electrode pads, attach a test load to the end of the patient Therapy cable.
2. Turn the Therapy knob to 150J.
3. Press the Charge button.

If it is necessary to disarm the defibrillator, press the **[Disarm]** soft key.

4. If using:
  - External paddles, simultaneously press the shock buttons located on the paddles to deliver a shock into the paddle tray.
  - Pads, press the Shock button on the MRx to deliver a shock into the test load.
5. Confirm on the strip print that the energy delivered to the test load is  $150J \pm 23J$  (127J to 173J). If not, take the device out of use and call for service.

## Operational Check

The Op Check verifies performance of a variety of device features, functions, and accessories.

To perform the Op Check:

1. Insert a charged battery (capacity of 20% or greater).
2. Turn the Therapy Knob to **Monitor**.
3. Press the Menu Select button.
4. Using the Navigation buttons, select **Other** and press Menu Select.
5. Select **Operational Check** and press Menu Select.
6. Select **Run Op Check** and press Menu Select.
7. Press Menu Select to acknowledge the *Leaving Normal Operating Mode* message.
8. Read and respond to setup instructions.
9. Read and respond to applicable test prompts.

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## Operational Check Summary

To display and print an Operational Check Summary:

1. Turn the Therapy Knob to **Monitor**.
2. Press the Menu Select button.
3. Using the Navigation buttons, select **Other** and press Menu Select.
4. Select **Operational Check** and press Menu Select.
5. Using the Navigation buttons, select **Op Check Summary** and press Menu Select.
6. Press Menu Select to acknowledge the message *Leaving Normal Operating Mode*.  
The Operational Check Summary screen is displayed.
7. Press the **[Print]** soft key to print the report.

### Notes:

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## Battery Maintenance

Activity:	When to Perform:
Perform a visual inspection.	As part of the Operational Check
Charge the battery.	Upon receipt, after use, or if the message <b>Batteries Low</b> is displayed
Perform a calibration.	When the Operational Check test results state <b>Calibration Recommended</b> , or every 6 months, whichever comes first
Store batteries in a state of charge in the range of 20% - 40%.	When not in use for an extended period of time
Discard the battery.	When there are visual signs of damage or calibration reports less than 80% capacity

## Notes:

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## Cleaning Instructions

- Use isopropyl alcohol, mild soap and water, chlorine bleach, or quaternary ammonium compounds on the exterior surfaces of the HeartStart MRx, as well as the batteries and data card.
- Use a soft cloth on the display to prevent scratching.
- The MRx, along with its accessories and supplies, may not be autoclaved, ultrasonically cleaned, or immersed unless otherwise indicated in the MRx *Instructions for Use* that accompany the accessories and supplies.
- Do not use abrasive cleaners or strong solvents such as acetone or acetone-based cleaners.
- Do not mix disinfecting solutions (such as bleach and ammonia) as hazardous gases may result.
- Do not clean electrical contacts or connectors with bleach.
- Disinfect the device as determined by your organization's policy to avoid long-term damage to the device.
- To clean the printer printhead:
  1. Push the printer door latch to open the door.
  2. Remove the roll of paper.
  3. Clean the printhead surface (above the brush) with a cotton swab dipped in isopropyl alcohol.
  4. Replace the roll of paper.
- Refer to the Maintenance chapter of the MRx *Instructions for Use* for cleaning instructions on paddles and therapy cable, ECG cable, NBP cuff, SpO<sub>2</sub> sensor and cable, invasive pressure cable, temperature probe and cable, Compression Sensor, and carrying case.

### Notes:

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## Review

Please answer the following questions related to MRx maintenance.

1. Which of the following RFU status indicates MRx may be unable to acquire ECG?
  - a. Blinking red X with a chirp
  - b. Blinking red X without a chirp
  - c. Solid red X with a chirp
  - d. Solid red X without a chirp
2. Which of the following statement(s) are TRUE related to the Operational Check?
  - a. It is automatic. You can start it, leave, and come back later when it's done.
  - b. The Battery Compartment B test checks for BOTH capacity and calibration of battery B.
  - c. An ECG cable must be connected to the MRx to complete the Leads ECG test.
  - d. A pads cable must be connected to complete the Pads ECG test.
3. Which of the following statement(s) are TRUE related to battery maintenance?
  - a. Batteries should be inspected as part of the Operational Check.
  - b. Discard the battery when calibration reports less than 80% capacity.
  - c. Batteries charge automatically if they are in an MRx connected to AC or DC power.
  - d. Frequency and duration of use have a direct correlation on battery life.
4. Which of the following statement(s) are TRUE related to MRx and accessory cleaning?
  - a. You can clean the exterior of the MRx and the batteries with chlorine bleach.
  - b. You can clean the printer printhead surface with isopropyl alcohol.
  - c. You can ETO sterilize the external paddles.
  - d. You can clean the carrying case by hand or machine with mild soap and water.

# Review Answers

## Getting Acquainted

1. Therapy Knob, Charge button, Shock button, Sync button
2. d. Defibrillation therapy may not be available.
3. a. 1
4. False - You can only use the Displayed Waves menu to select the ECG lead for Wave Sector 2.
5. False - You should respond to alarms by acknowledging them and changing limits, if needed vs. pressing the Alarm Pause button.

## ECG and Arrhythmia Monitoring

1. Four wave sectors, INOP area, ECG/HR alarms, HR values, alarm settings
2. False - The Lead Select button can only be used with Sector 1.
3. b. PVC
4. c. Alarms are enabled as soon as you enter Monitor Mode Menu Select if the Sync function is enabled; d. Menu Select AND Navigation buttons can acknowledge alarms.
5. False - Automatic relearning takes places when there is a lead change for Wave Sector 1 only

## Semi-Automated External Defibrillation

1. Event timer, enlarged ECG, shock counter, message window
2. False - Use anterior-anterior placement.
3. a. Turn the Therapy Knob to AED.; b. Follow the voice and screen prompts.; c. Press the orange Shock button, if prompted.
4. a. The MRx automatically checks for proper pads cable and pads connection.; c. The MRx automatically disarms if a shock becomes unnecessary.; d. The MRx automatically analyzes the patient's heart rhythm after a shock is delivered.

## Manual Defibrillation and Cardioversion

1. Event timer, heart rate, enlarged ECG, shock counter
2. a. Turn the Therapy Knob to **Manual Defib** on a desired energy level.; b. Press the Charge button.; c. Press the Shock button.
3. a. The device sounds a continuous high-pitched tone.; b. The Charged value on the display matches the Therapy Knob setting.; d. The Shock button flashes.
4. a. Turn the Therapy Knob to **Monitor** and press the Sync button.; b. Turn the Therapy Knob to **Manual Defib** on a desired energy level.; c. Press the Charge button.; d. Press and hold the Shock button.

## Q-CPR

1. True
2. False - The pads need to be in an anterior/anterior position for interpretation.
3. False - The sensor should be placed on the lower half of the sternum, at the normal CPR hand location.
4. True
5. True
6. True

## Noninvasive Pacing

1. a. The device requires a 3-, 5- or 10-Lead ECG cable and monitoring electrodes during demand mode pacing.; c. The Pacing status area indicates pacing mode, status, rate, and output.
2. b. Verify that white R-wave markers appear above or on the ECG waveform.

## Pulse Oximetry Monitoring

1. False - You cannot monitor SpO<sub>2</sub> in AED Mode.
2. False - The wave is auto scaled with a good signal.
3. False - SpO<sub>2</sub> alarms are on unless turned off during use while pulse rate alarms are off unless turned on.
4. d. 60

## Noninvasive Blood Pressure Monitoring

1. a. Systolic and diastolic pressure; b. Alarm limits; c. Automatic measurement schedule; d. Time stamp
2. True
3. True

## Carbon Dioxide Monitoring

1. True
2. False - The CO<sub>2</sub> waveform displays where it is configured to display; it fills the first available empty wave sector if the configured wave sector is full.
3. True
4. False - AwRR alarms are enabled unless disabled during use.

## Invasive Pressures Monitoring

1. True
2. b. Controls for scale and alarm settings automatically appear after selecting a new label.; c. You can not select the same label for both pressure channels.; d. The available pressure wave scale spans from 300 to -20 in mmHg and from 38 to -2.5 in kPa.
3. a. You must zero a pressure every time you reconnect the transducer cable to the MRx.; b. Before zeroing a pressure, you must vent pressure transducers to atmospheric pressure and close the stopcock to the patient.; d. The message **Unable to zero** message displays if the zeroing process fails.
4. a. All invasive pressure alarms cease when their alarm condition no longer exists.; b. The **PAPd High** message means the pulmonary artery diastolic pressure has exceeded the high alarm limit.; d. When CPP and ICP are displayed together, only one of them can have related alarms enabled.
5. True

## Temperature Monitoring

1. False - All settings (including alarm limits) associated with a label become active as soon as you change the label.
2. a. All temperature alarms cease when their alarm condition no longer exists. b. The **Tesoph Low** message means the esophageal temperature has fallen below the low alarm limit. d. Changing the label may change the alarm limits.

## 12-Lead

1. b. Waveforms are presented at a rate of 25mm/sec.; c. A dashed line which indicates a lead can't be derived.
2. False - Once ECG acquisition is complete, ECG analysis begins automatically.
3. b. 10
4. a. It displays standard interval and duration measurements and waveform morphology.; b. It can be configured to include ALL 12 leads and related measurements.

## 12-Lead Transmission via Bluetooth

1. True
2. c. both the Bluetooth device and MRx.
3. c. You can put additional reports in queue for transmittal while transmission is in progress.

## Vital Signs Trending

1. a. If you scroll left to view older data, the screen will not update to new data when available. c. Unavailable data is indicated by an empty space. d. A ^ after the timestamp indicates multiple measurements taken during the interval.
2. True

## Data Management

1. a. Data management includes Event Summaries that have a unique event identification number and are automatically stored in internal memory.; b. New Event Summaries are initiated by valid SpO<sub>2</sub>, CO<sub>2</sub>, or invasive pressure data.; d. When using the Data Management function, monitoring and defibrillation modes are disabled.
2. True
3. True

## Maintenance

1. c. Solid red X with a chirp
2. b. The Battery Compartment B test checks for BOTH capacity and calibration of battery B.; d. A pads cable must be connected to complete the Pads ECG test.
3. a. Batteries should be inspected as part of the Operational Check.; b. Discard the battery when calibration reports less than 80% capacity.; c. Batteries charge automatically if they are in an MRx connected to AC or DC power.; d. Frequency and duration of use have a direct correlation on battery life.
4. a. You can clean the exterior of the MRx and the batteries with chlorine bleach.; b. You can clean the printer printhead surface with isopropyl alcohol.





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