
User's Guide

Including:

- HP M2475B CodeMaster 100 Portable Defibrillator/Monitor with 12-Lead ECG option
- HP M2480B Battery Support System
- HP M2478A DC Power Module
- HP M2479A AC Power Module

HP CodeMaster 100 Portable Defibrillator/Monitor

HP Part No. M2475-91980

Printed in USA February 1999

Edition 1

Notice

Notice

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Before using the HP CodeMaster 100 , the battery support system, or the power modules, read this guide and become thoroughly familiar with the contents.

Responsibility of the Manufacturer

Hewlett-Packard only considers itself responsible for any effects on safety, reliability and performance of the HP CodeMaster 100 , the battery support system and the power modules if:

- assembly operations, extensions, re-adjustments, modifications or repairs are done by persons authorized by Hewlett-Packard, and
- the electrical installation complies with the IEC or national requirements, and
- the instrument is used according to the instructions for use presented in this manual.

WARNING

As with all electronic equipment, Electromagnetic Interference (EMI) between the defibrillator and any existing EMI transmitting or receiving equipment at the installation site, including electrosurgical equipment, should be evaluated carefully and any limitations noted before the equipment is placed in service.

Do not attempt to perform pacing during surgery. Monitoring during quiescent periods of electrosurgery is possible but electromagnetic interference generated by electrosurgical tools during operation is sufficient to mask cardiac signals. A momentary recovery period is required for the monitor to return to normal operation and will be longer if the diagnostic monitoring mode is used. Defib or monitoring electrodes should be placed as far from the surgical area as reasonable while still performing normal functions to minimize the possibility of burns. EMI frequency generation from electrosurgical equipment and close proximity transmitters may seriously degrade performance of the HP CodeMaster 100 .

Hewlett-Packard assumes no liability for failures resulting from EMI between HP medical electronics and any radio frequency generating equipment at levels exceeding those established by applicable standards.

CAUTION

Federal law (USA) restricts this device to sale by or on the order of a physician.

THIS PRODUCT IS NOT INTENDED FOR HOME USE.

This product complies with the requirements of the Medical Device Directive 93/42/EEC and carries the CE₀₁₂₃ marking accordingly. Authorized EU-representative: Hewlett-Packard GmbH, Department MPG-E Regulations, Herrenberger Str. 110-140, 71034 Boblingen (FAX: +49-7031-14-2346)

This product complies with the telecom regulatory standards for internal modems set by the Federal Communications Commission (FCC) in the United States, Industry Canada, and the Department of Trade and Industry in the United Kingdom.

Notice

Associated Documents

Document Title	HP Part Number
HP M2475B CodeMaster 100 Portable Defibrillator/Monitor Quick Reference Guide	M2475-97800
HP CodeMaster Series Defibrillator/Monitor Pacing Application Note	M1722-94920
Understanding Pulse Oximetry SpO ₂ Concepts	M1722-93950
HP M2475B CodeMaster 100 Portable Defibrillator/Monitor Service Manual	M2475-90905
Sensor Guide	M1722-93970
Predictive Instruments Physician's Guide	M1792-93900
HP M2476B & M2477B Battery Evaluation and Care	M2475-92100
M3710A Carry Bag Instructions for Use	M2475-94000

Printing History

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Symbol Definitions






Symbol Definitions

The following symbols appear on the HP CodeMaster 100 :





	Monitor On (Do not confuse with 1 Joule)
	Off (Standby)
	On/Off
	Ground
	Shock hazard
	Caution - See operating instructions in user's guide
	Meets IEC type BF leakage current requirements and is defibrillator protected (Patient Applied Part is isolated and defib-proof suitable for direct patient contact except the heart or major arteries.)
	Meets IEC type CF leakage current requirements and is defibrillator protected (Patient Applied Part is isolated and defib-proof suitable for direct patient contact including the heart and major arteries.)
	Equipotential
	Protective earth (ground)
	Nickel-Cadmium rechargeable battery. Must be recycled or disposed of properly
	Recyclable material
	Audible tone
	Alarms are active
	Alarms are inactive

Symbol Definitions








The following symbols appear on the HP M2480B battery support system.

	Do not use in the presence of flammable anesthetics or in oxygen rich environments
AC ~	AC power on
	Start battery capacity test
	Battery charging
	Battery capacity test
	Additional information

The following symbols appear on the HP M2478A DC power module.

	Power
	Caution - See operating instructions
	Battery charging
==	DC power
	Input
	Output

The following symbols appear on the HP M2479A AC power module:

	Attention - See operating instructions.		Green LED: power on
	Battery charging.		Protective earth (ground).
==	DC power.		AC Alternating current
	Fuse replacement value		Output

Conventions

This manual uses the following conventions:

WARNING

Warning statements describe conditions or actions that can result in personal injury or loss of life.

CAUTION

Caution statements describe conditions or actions that can result in damage to the equipment or loss of data.

NOTE

Notes contain additional information on usage.

TEXT represents the labels that appear on the display.

Bold represents buttons/controls on the device.

Bold Italic represents softkeys (temporary key labels) that appear on the 12-Lead display.

Preface

Introduction

This Preface provides general information which you should review before using the HP M2475B CodeMaster 100 Portable Defibrillator/Monitor with 12-Lead ECG option.

About the HP Codemaster 100

The HP CodeMaster 100 is a portable, battery-powered defibrillator/monitor with built in non-invasive pacing, pulse oximetry (SpO₂), and 3- or 5-wire ECG monitoring capability. It also offers an optional Shock Advisory mode as well as an option to acquire a 12-lead ECG. The Shock Advisory mode detects whether the rhythm is shockable and guides the user through the process of defibrillation. It comes with an Advisory Event Summary to simplify documentation. The 12-lead ECG option allows users to acquire, store, and transmit 12-lead ECGs for help with early detection of acute cardiac ischemia, acute myocardial infarction and other arrhythmias.

The HP CodeMaster 100 is used as an advanced defibrillator/monitor in the pre-hospital arena and as a transport defibrillator in the hospital environment. It can be used with adult paddles, pediatric paddles, and multi-function defib electrodes. Multi-function defib electrodes allow the user to pace, monitor, and defibrillate from the same electrodes.

Theory of Defibrillator Operation

Defibrillation is a recognized means of terminating certain potentially fatal arrhythmias, such as ventricular fibrillation and symptomatic ventricular tachycardia. A direct current defibrillator applies a brief, high-energy pulse of electricity to the heart muscle (up to 360 joules). The HP CodeMaster 100 delivers this energy through multi-function defib electrodes or paddles applied to the patient's chest. Delivery of this energy in the synchronized mode is useful in treating supraventricular tachycardia, atrial fibrillation, atrial flutter, and, in relatively stable patients, ventricular tachycardia.

Preface

Intended Use

The HP CodeMaster 100 is for use by emergency care personnel specifically trained in the operation of the device and qualified by training in advanced cardiac life support, basic life support or other physician-authorized emergency medical response. It must be used by or on the order of a physician.

When operating as a manual defibrillator, the HP CodeMaster 100 is suitable for use by personnel trained in advanced cardiac life support. In Shock Advisory Mode, the HP CodeMaster 100 is suitable for use by EMS personnel with basic life support training.

Indications and Contraindications

Defibrillation

Indications

Defibrillation therapy is indicated for patients that exhibit the following *combination* of symptoms:

- unconsciousness
- absence of breathing
- absence of detectable pulse
- ventricular fibrillation or ventricular tachycardia

Preface

Defibrillation

Contraindications

Defibrillation therapy is contraindicated for patient that exhibit any of the following:

- consciousness
- presence of breathing
- presence of detectable pulse

In addition, the HP CodeMaster 100 should not be used in Shock Advisory Mode (where it functions like an AED) for:

- children who weigh under 90 pounds
- patients who have an implanted pacemaker

NOTE

The shock advisory algorithm is not designed or tested to interpret pediatric cardiac arrhythmias or administer energy at pediatric joule settings. For children older than 8 years, the American heart Association recommends that standard operating procedures for AEDs be followed. American heart Association *Textbook of Advanced Cardiac Life Support*. Dallas, Tex.: AHA;1994.

NOTE

The shock advisory algorithm is not designed to handle erratic spiking problems caused by a properly or improperly functioning pacemaker.

Preface

Noninvasive Pacing

Indications

The HP CodeMaster 100 provides non-invasive pacing that delivers an electrical stimulus to the heart, causing cardiac depolarization and myocardial contraction. The energy is delivered through multifunction defib electrodes placed on the chest. Non-invasive pacing, as a therapy, is indicated for use in patients with symptomatic bradycardia or asystole. In addition to noninvasive pacing, other supportive measures may be necessary.

Among other factors, successful pacing of a patient is related to the length of time between the onset of a dysrhythmia and the initiation of pacing. Rapid pacing and prompt follow-up care are essential. The physiologic state of the patient may affect the likelihood of successful pacing or of skeletal muscle activity. The failure to successfully pace a patient is not a reliable indicator of pacemaker performance. Similarly, the patient's muscular response to pacing is not a reliable indicator of energy delivered.

Contraindications

Contraindications for noninvasive pacing include ventricular fibrillation.

Preface

12-Lead Electrocardiography

Indications

The American Heart Association (AHA) and the National Heart Attack Alert Program (NHAAP) recommend prehospital 12-Lead ECG with computer analysis and transmission to the emergency department for patients with chest pain and possible Acute Myocardial Infarction (AMI).

The prehospital 12-Lead ECG offers paramedics and emergency physicians significant advantages over the single lead ECG typically available in EMS. The prehospital 12-Lead ECG not only provides a diagnostic quality ECG for use in the detection of AMI, but also allows the knowledgeable paramedic to determine the area of myocardial injury, anticipate associated potential complications, and implement treatment strategies accordingly. In addition, the prehospital 12-Lead ECG provides a baseline for serial ECG evaluations.

Contraindications

None known.

SpO₂ Monitoring

Indications

Pulse oximetry through plethmography (SpO₂) is a measure of oxygen saturation in arterial blood. It is indicated for use when determining a patient's level of hypoxemia.

Contraindications

None known.

Preface

Electromagnetic Compatibility

When using the HP CodeMaster 100 (with or without the external Power Module), electromagnetic compatibility with surrounding devices should be assessed.

A medical device can either generate or receive electromagnetic interference. Testing for electromagnetic compatibility (EMC) has been performed according to the international standard for EMC for medical devices (IEC 601-1-2). This IEC standard has been adopted in Europe as the European Norm (EN 60601-1-2).

The EMC standards describe tests for both emitted and received interference. Emission tests deal with interference generated by the device being tested. According to the EMC standards, the CodeMaster 100 defibrillator/monitor does not generate abnormal interference.

Reducing Electromagnetic Interference

The HP CodeMaster 100 is susceptible to interference from other RF energy sources and continuous, repetitive, power line bursts. Examples of other sources of RF interference are medical devices, cellular products, information technology equipment and radio/television transmission. Should interference be encountered, as demonstrated by artifact on the ECG or dramatic variations in SpO2 values, attempt to locate the source. Assess the following:

- Is the interference intermittent or constant?
- Does the interference occur only in certain locations?
- Does the interference occur only when in close proximity to certain medical devices?
- Does the SpO2 value change dramatically when the external device is unplugged?

Once the source is located, attempt to attenuate the EMC coupling path by distancing the defibrillator from the source as much as possible. If assistance is needed, call your local HP service representative.

Preface

Restrictions for Use

Artifact on the ECG caused by electromagnetic interference should be evaluated by a physician or physician authorized personnel to determine if it will negatively impact patient diagnosis or treatment.

Immunity Level

The EMC standards state that manufacturers of patient-coupled equipment must specify immunity levels for their systems. It is recognized that the HP CodeMaster 100 is designed to receive and amplify low level signals in the same bandwidth as the interference.

Immunity is defined in the standard as the ability of a system to perform without degradation in the presence of an electromagnetic disturbance. Degradation in ECG quality is a qualitative assessment which can be subjective.

Caution should, therefore, be taken in comparing immunity levels of different devices. The criteria used for degradation are not specified by the standard and may vary with the manufacturer.

NOTE

For additional information about compliance with the EMC standards, please see the Declaration of Conformity Statement shipped with the device.

Telecom Regulatory Information

United States

In compliance with the Federal Communications Commission (FCC), the following information is provided:

- This equipment complies with Part 68 of the FCC rules. This unit bears a label which contains the FCC registration number and Ringer Equivalence Number. If requested, this information must be provided to the telephone company.
- This equipment uses the following standard jack types for network connection: RJ11C.
- This equipment contains an FCC compliant modular jack. It is designed to be connected to the on-premises telephone network wiring using compatible modular plugs and cabling which complies with the requirements of FCC Part 68 rules.
- The Ringer Equivalence Number, or REN, is used to determine the number of devices that may be connected to the telephone line. An excessive REN may cause the equipment not to ring in response to an incoming call. In most areas, the sum of the REN's of all equipment on a line should not exceed five (5.0).
- In the unlikely event that this equipment causes harm to the telephone network, the telephone company can temporarily disconnect your service. The telephone company will try to warn you in advance of any such disconnection, but if advance notice isn't practical, it may disconnect the service first and notify you afterwards. In the event such a disconnection is deemed necessary, you will be advised of your right to file a complaint with the FCC.
- From time to time, the telephone company may make changes in its facilities, equipment, or operations which could affect the operation of this equipment. If this occurs, the telephone company is required to provide you with advance notice so that you can make the modifications necessary to maintain uninterrupted service.
- For servicing information, see "Service" on page 12-21.
- For troubleshooting transmission problems, see "Identifying Transmission Problems" on page 12-17.

Telecom Regulatory Information

Canada

In compliance with the Industry Canada, the following information is provided:

- **NOTICE:** The Industry Canada label identifies certified equipment. This certification means that the equipment meets telecommunications network protective Technical Requirements document(s). The department does not guarantee the equipment will operate to the user's satisfaction.
- Before connecting this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also use an acceptable method of connection. The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.
- Repairs to certified equipment should be coordinated by a representative designated by Hewlett-Packard. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.
- Users should ensure, for their own protection, that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may not be particularly important in rural areas.

CAUTION

Users should not attempt to make electrical ground connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

- **NOTICE:** The Ringer Equivalence Number (REN) assigned to each terminal device provides an indication of the maximum number of terminals allowed to be connected to a telephone interface. The termination on an interface may consist of any combination of devices subject only to the requirement that the sum of the Ringer Equivalence Numbers of all the devices does not exceed five (5.0).

Telecom Regulatory Information

United Kingdom

In compliance with the Department of Trade and Industry, the following information is provided:

Although this equipment can use either loop disconnect or DTMF signaling, only DTMF signaling is subject to regulatory requirements for correct operation. It is, therefore, strongly recommended that the equipment is set to use DTMF signaling for access to public or private emergency services. DTMF signaling also provides faster call set up.

Telecom Regulatory Information

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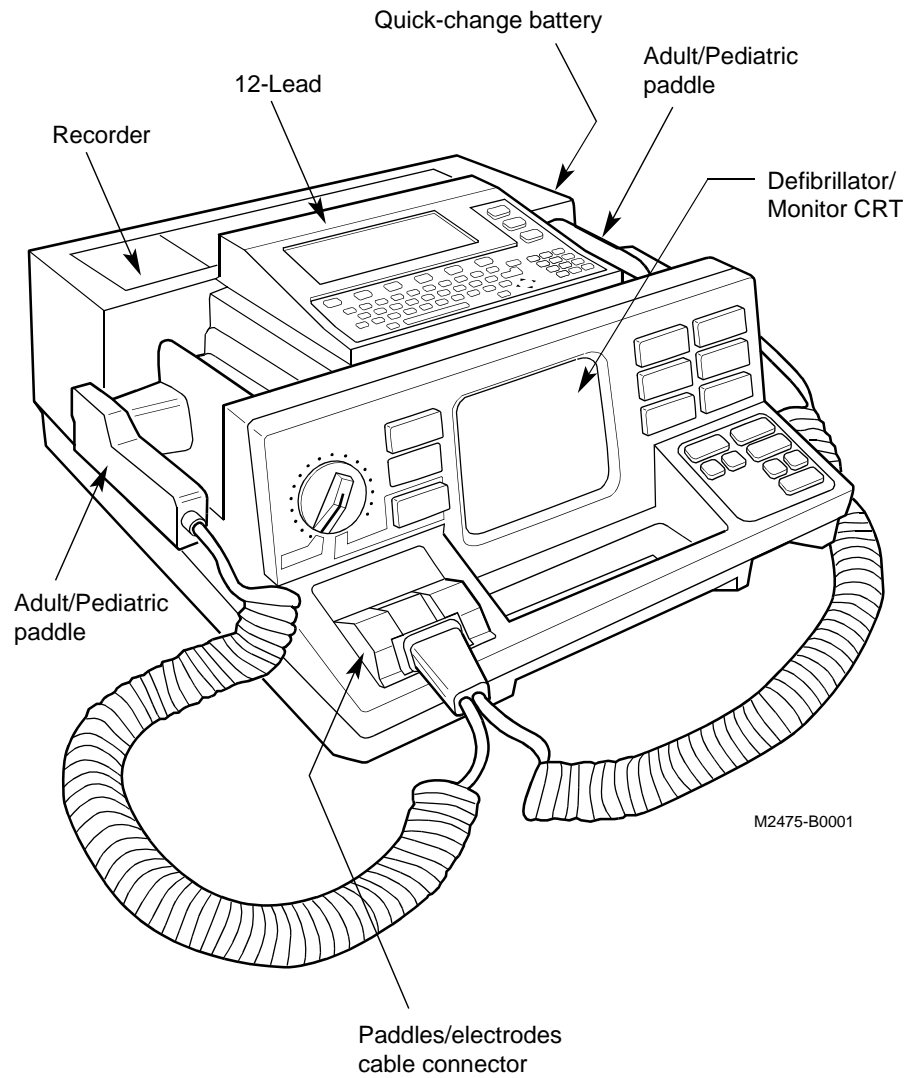
Getting Acquainted

This user's guide provides operational and basic maintenance instructions for safe use and proper care of the HP CodeMaster 100. It also details setup, configuration, and troubleshooting procedures.

This section serves two purposes: to familiarize you with the major CodeMaster 100 features and to show their respective locations on the device. Figures 1-1 and 1-2 identify the main features of the HP CodeMaster 100.

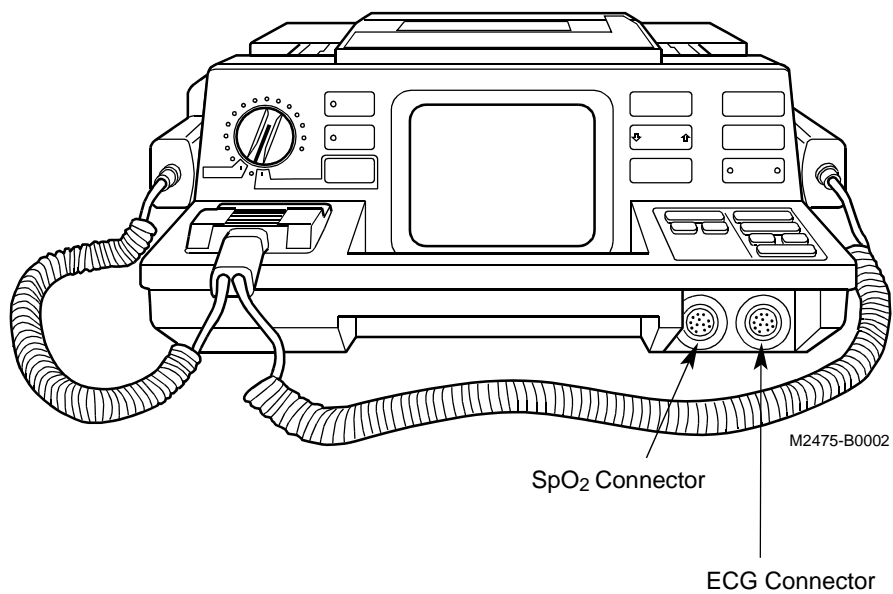
The HP CodeMaster 100 enables you to change from manual mode (the default) to Shock Advisory (optional) which guides you through defibrillation.

Figure 1-1



The CodeMaster 100 Defibrillator/Monitor with 12-Lead ECG Option Overview (Top View)

Figure 1-2



**The CodeMaster 100 Defibrillator/Monitor with 12-Lead ECG Option Overview
(Front View)**

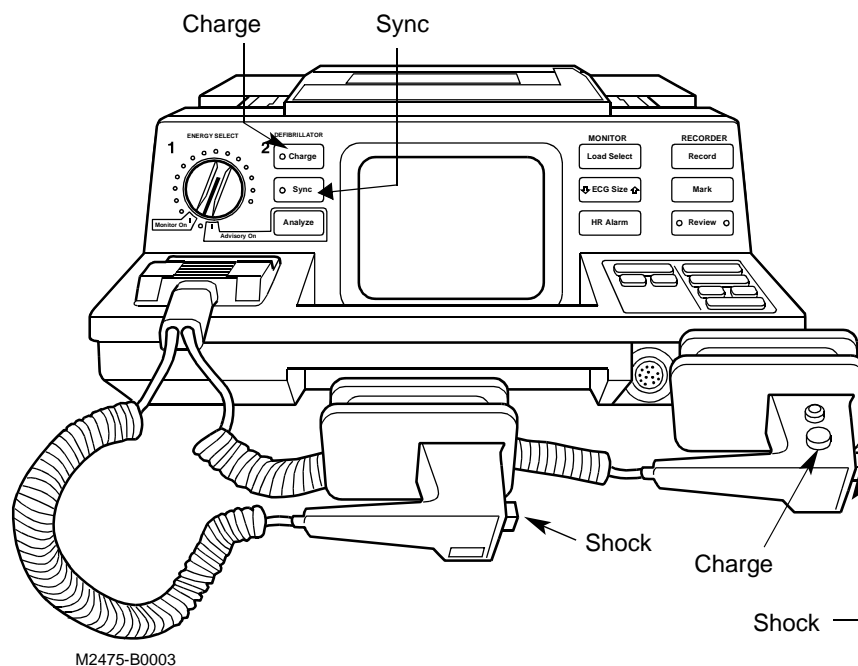
Operating Controls and Indicators

This topic provides figures and tables which detail the controls and indicators on the HP CodeMaster 100.

Defibrillator Operating Controls

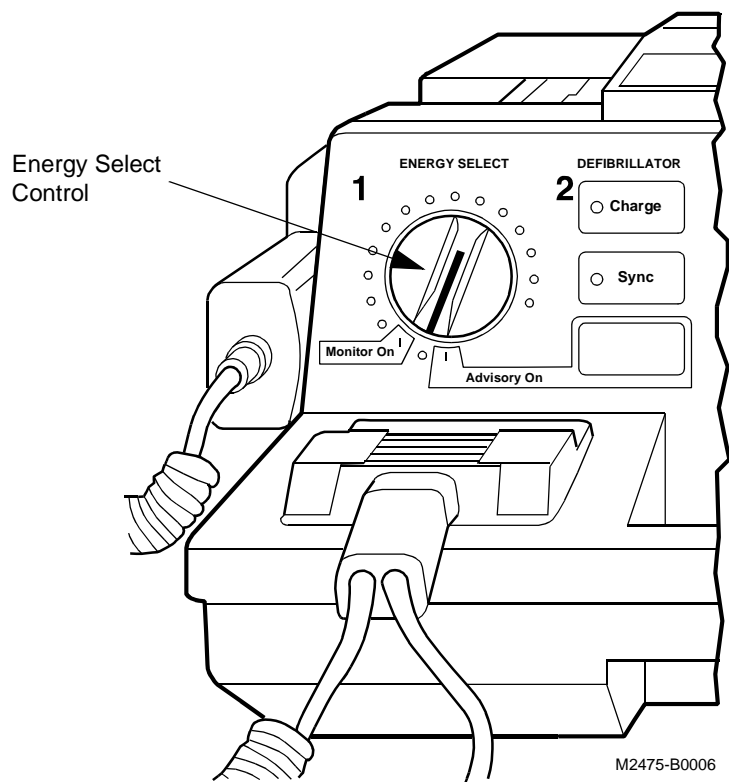
The defibrillating operating controls on the HP CodeMaster 100 include **Energy Select**, **Charge**, **Sync**, and **Shock**. See Figures 1-3 and 1-4.

Figure 1-3



Defibrillator Operating Controls (1 of 2)

Figure 1-4



Defibrillator Operating Controls (2 of 2)

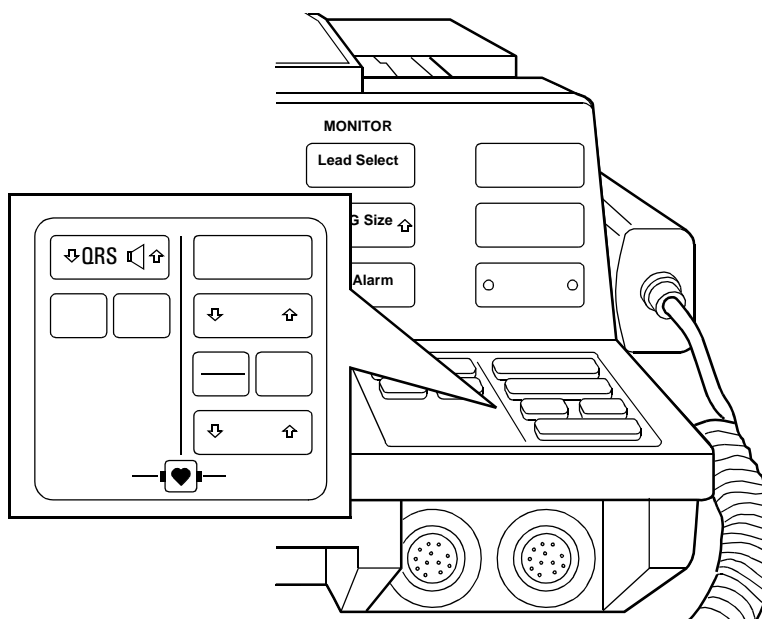
<u>Control/Button</u>	<u>Function</u>
Energy Select	The Energy Select or Power Control turns the CodeMaster 100 power on and off. This control also selects the energy level (Joules) for delivering a shock.
Charge	The Charge button charges the defibrillator to the energy level set on the Energy Select control. Charge buttons are located on the front panel of the CodeMaster 100 and on the apex paddle.
Sync	The Sync button changes the operating mode between immediate shock (asynchronous) mode and synchronized with next R-wave shock (Sync) mode. Note that the default is asynchronous mode.
Shock	The orange Shock buttons, located on both paddles, administer a shock when pressed simultaneously.

Refer to Chapter 3, “Defibrillating” for more information.

Monitor Operating Controls


This section details the operating controls on the HP CodeMaster 100 that enable you to monitor a patient. Refer to Figure 1-5. Refer to Chapter 5, “Monitoring” for more information about patient monitoring.

Figure 1-5



Monitor Operating Controls

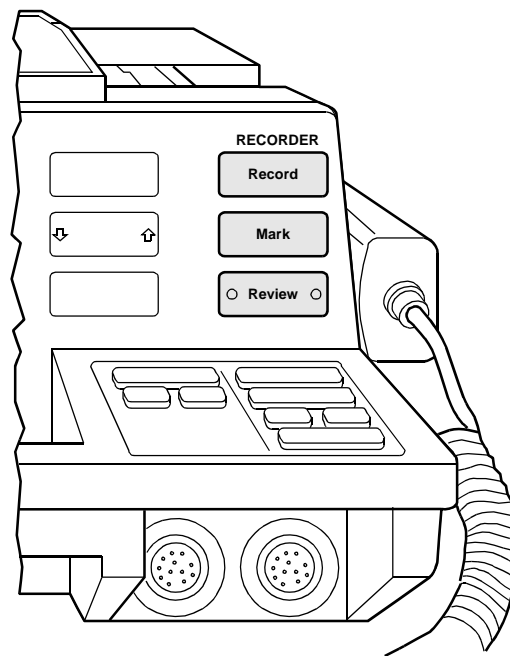
Getting Acquainted
Operating Controls and Indicators

<u>Control/Button</u>	<u>Function</u>
Lead Select	Selects an ECG source to monitor.
ECG Size	Changes the displayed ECG size.
HR Alarm	Controls heart rate alarms.
	Controls the volume of the QRS beeper.
ECG Output connector	Located on the right side of the unit - provides analog 1V/mV output for external monitoring

Recorder Operating Controls

This section details the recorder operating controls associated with the recorder (printer) on the HP CodeMaster 100. Refer to Figure 1-6.

Figure 1-6



M2475-B0005

Recorder Operating Controls

<u>Control/Button</u>	<u>Function</u>
Record	Starts and stops the recorder. Record does not enter an event into the Event Summary record.
Mark	Annotates the ECG strip and/or prints an ECG strip. Mark enters the event into the Event Summary record.
Review	Prints an Event Summary record.

The function of **Mark** depends on the state of the recorder.

- When the recorder is running, pressing **Mark** annotates the ECG and enters that event into the Event Summary record.
- If the recorder is not running and the unit is configured to do so, pressing the **Mark** key prints an ECG strip and enters the event into the Event Summary.

This annotation can be configured to print on the ECG strip immediately when **Mark** is pressed or after a 6 second delay.

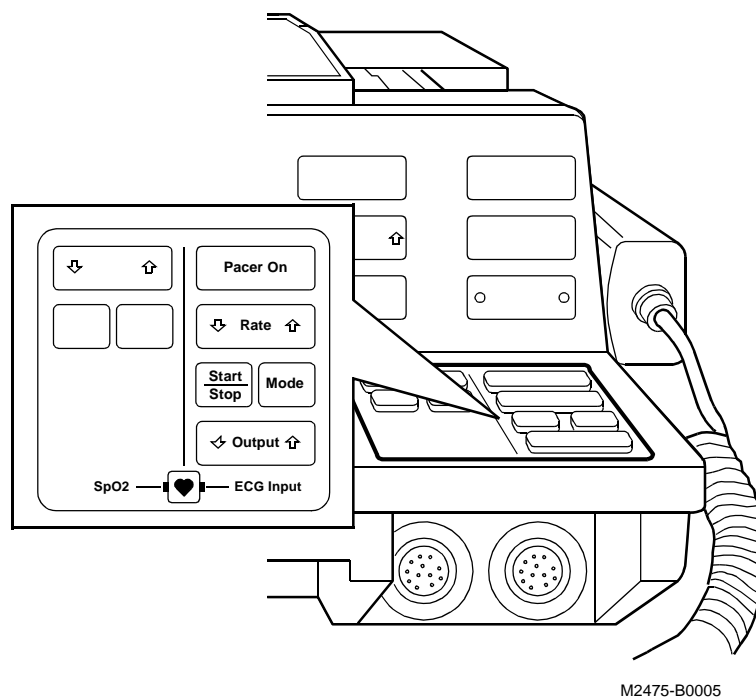
Refer to Chapter 2, “Setup and Configuration” to configure the HP CodeMaster 100 for recording when **Mark** is pressed.

When you press **Review** to print an Event Summary record, the message “ES” is printed at the top of the ECG strip. To print an Event Summary record after starting the recorder, first press **Record** to stop the recorder, then press **Review**. See *“Printing the Event Summary Record” on page 5-12* for more information.

Pacer Operating Controls

This section details the pacer operating controls associated with pacing. Refer to Figure 1-7.

Figure 1-7



Pacer Operating Controls

Getting Acquainted
Operating Controls and Indicators

<u>Control/Button</u>	<u>Function</u>
Pacer On	Provides setup functionality.
Rate	Adjusts the pacer rate (ppm) higher or lower.
Start/Stop	Starts and stops pacing.
Output	Adjusts the pacer output current (mA) up or down.
Mode	Changes between fixed and demand pacing modes.

NOTE

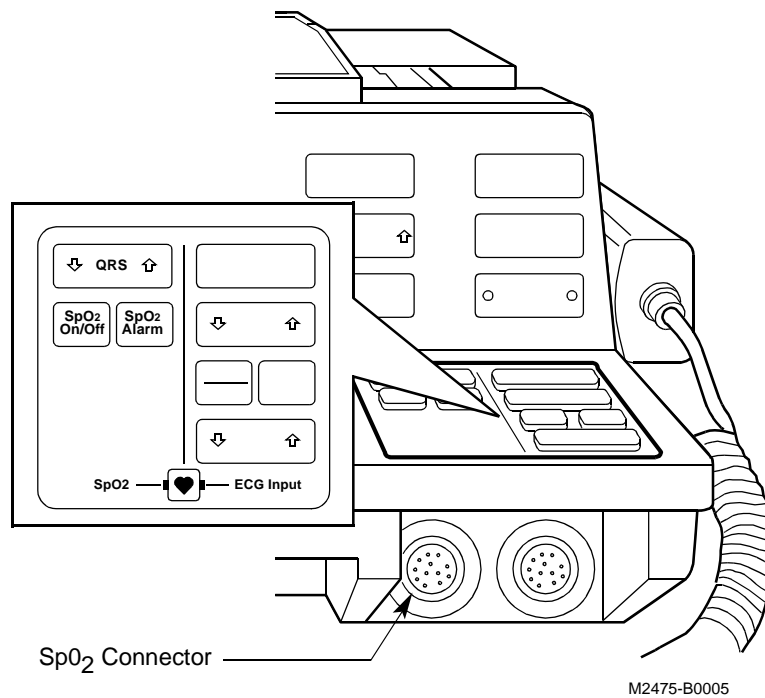
Pacing does not start until you press **Start/Stop**. Pressing **Pacer On** enables the pacer setup function, but does not start pacing.

Refer to Chapter 8, “Pacing” for more information about using the pacer.

SpO₂ Operating Controls

This topic details the SpO₂ operating controls associated with the SpO₂ feature on the HP CodeMaster 100. Refer to Figure 1-8.

Figure 1-8



SpO₂ Operating Controls

SpO₂ Operating Controls

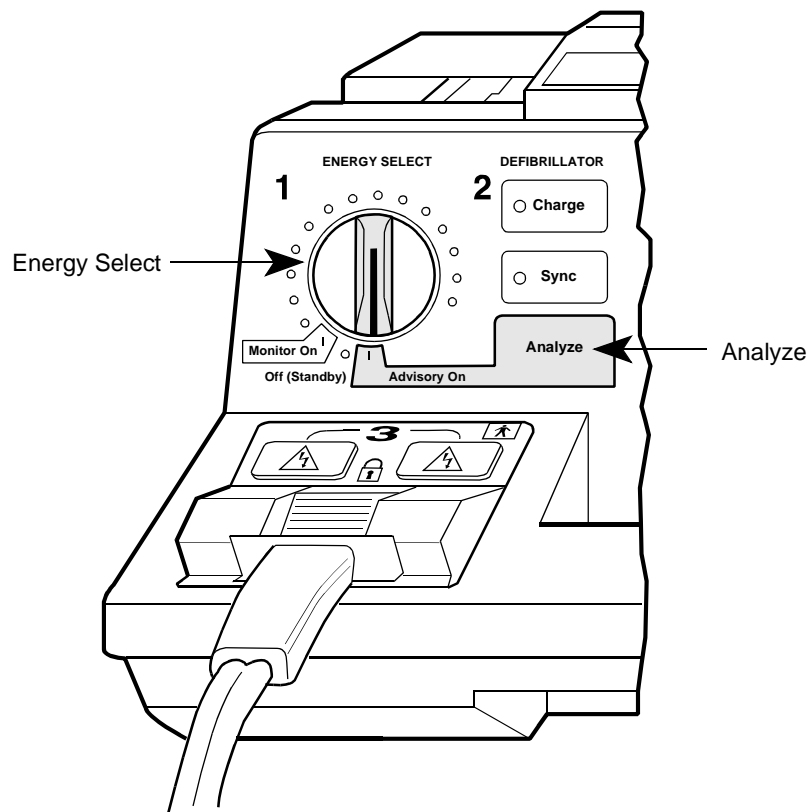
<u>Control/Button</u>	<u>Function</u>
SpO₂ On/Off	Starts and stops the pulse oximeter.
SpO₂ Alarm	Controls SpO ₂ alarms.
SpO ₂ Connector	SpO ₂ sensors and adapter cables plug into the SpO ₂ input connector.

Chapter 9, “SpO₂ Monitoring” contains further information about using the pulse oximeter.

Advisory Mode Operating Controls (Optional)

This section details the operating controls for the HP CodeMaster 100 in Advisory Mode. Figure 1-9 illustrates the placement of the controls.

Figure 1-9



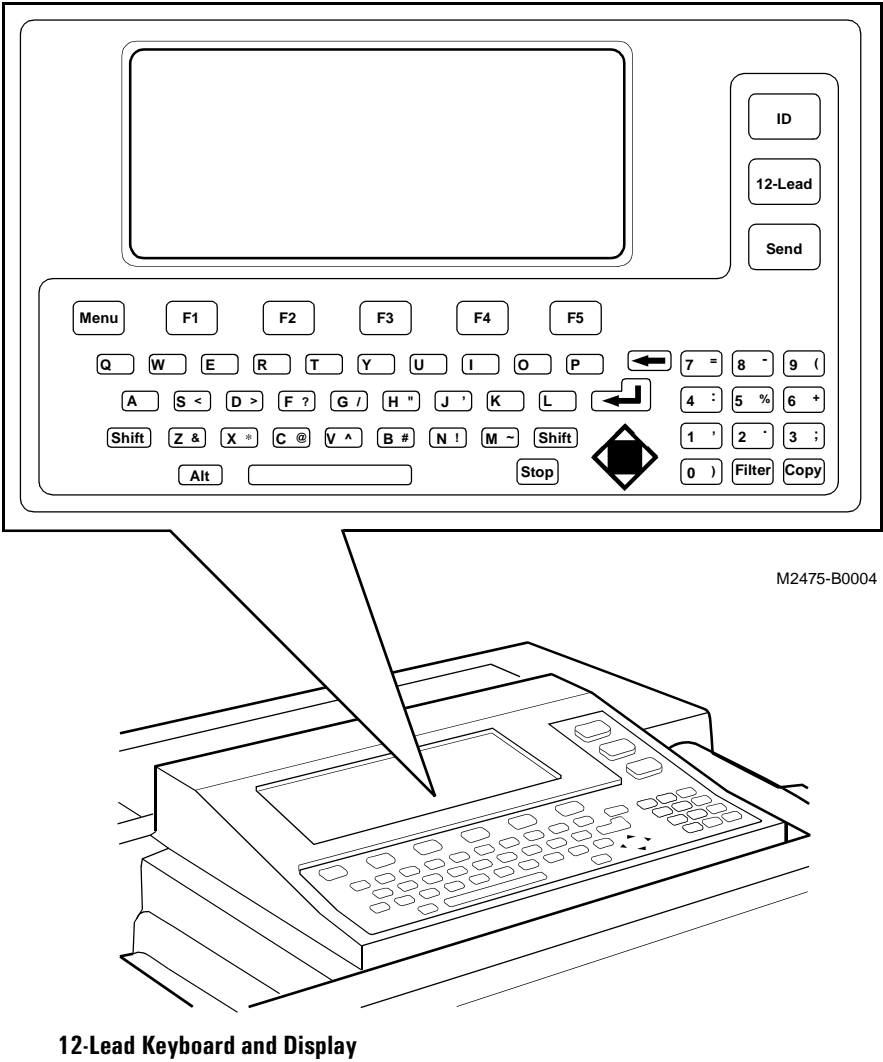
Advisory Mode Operating Controls

<u>Control/Button</u>	<u>Function</u>
Advisory On	Places the CodeMaster 100 in advisory mode.
Analyze	Starts automatic analysis of ECG waveforms.

12-Lead Operating Controls

This section provides an overview of the 12-Lead portion of the CodeMaster 100. Figure 1-10 shows the keypad and operator buttons that you use to setup, acquire, and transmit patient data. Refer to Chapter 6, “Using the 12-Lead Option” for more information.

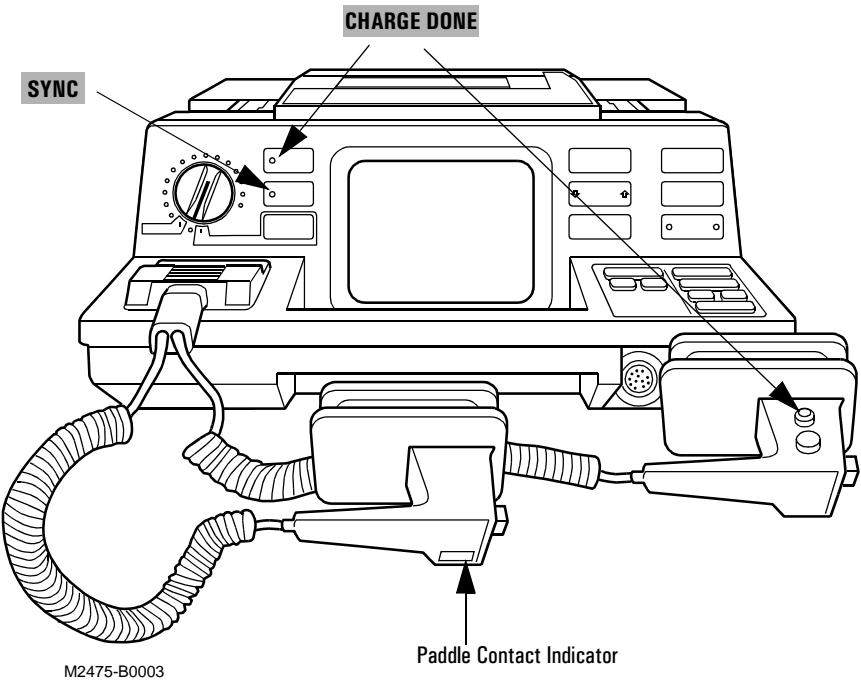
Figure 1-10



Indicator Lights

The HP CodeMaster 100 contains several status lights that illuminate to indicate the device status. This topic provides details for each indicator. Refer to Figures 1-11 and 1-12. Table 1-1 lists audible indicators.

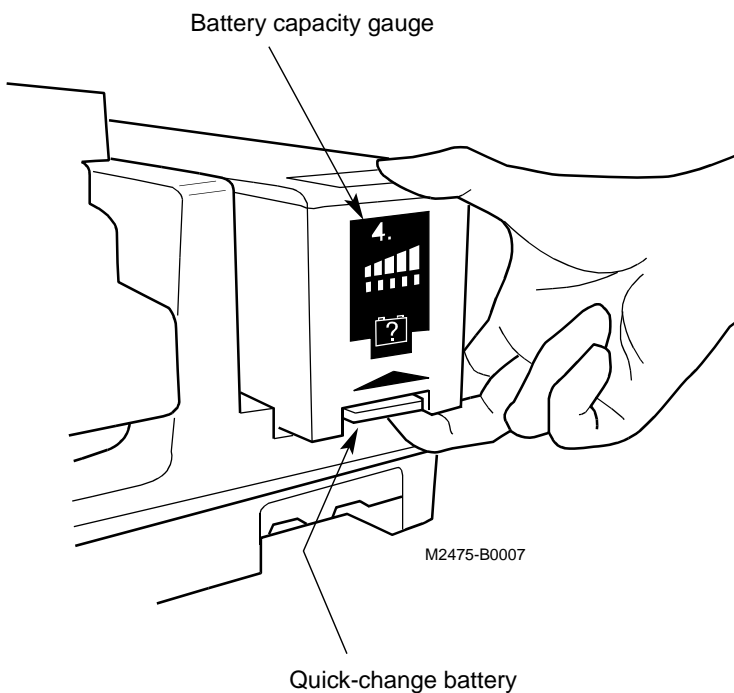
Figure 1-11



Indicator Lights

<u>Indicator</u>	<u>Function</u>
Charge Done	Indicates that the unit is charged and ready to use.
Sync	Light indicates that the unit is in synchronized shock mode as opposed to defibrillator mode. Flashes off each time an R-wave is detected.
Paddle Contact Indicator	PCI on the Sternum paddle indicates how well the paddles contact the patient.

Figure 1-12

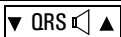


Battery Indicator Lights

<u>Indicator</u>	<u>Function</u>
Battery Capacity Gauge	After you press the button below the indicator, the battery capacity gauge indicates the remaining battery charge.

Table 1-1

Audible Indicators

Indicator	Description
Charge Done tone	Sounds when the instrument is charged and ready to deliver a shock. It can be disabled in setup.
Auto disarm tone	Sounds during the last ten seconds of the Charge Done tone. Beeps intermittently until disarmed.
QRS beeper	Sounds whenever an R-wave is detected. Volume controlled by  located on the lower right keypanel.
CRT/Screen alerts	Three beeps each time a message appears on the screen. It can be disabled in setup.
HR alarms	Sounds if the heart rate is above the higher alarm limit or below the lower alarm limit.
Shutdown warning	Alternating pitch sounds for 60 seconds when the system is about to turn off. An alert to replace the battery.
Check battery alert	Set of 3 beeps with a message CHECK BATTERY on the monitor indicating that the battery is faulty or not latched securely.
Low battery alert	Continuous beeps with a message LOW BATTERY on the monitor indicating that the battery needs to be replaced.


Safety Considerations

The HP CodeMaster 100 stores high voltage energy and is capable of delivering up to 360 joules of DC energy to a 50 ohm impedance.

To remove power from the instrument, you must turn the **Energy Select** control to **Off**.

Disarming the Defibrillator

There are three ways to disarm a charged instrument:

- Turning the **Energy Select** control from an energy level setting to the **Monitor On** position.
- Placing the paddles in their holders and depressing both shock () buttons simultaneously.
- Waiting for the instrument to automatically disarm. The unit disarms automatically after it has been left charged for 60 seconds in the Manual mode and after 30 seconds in the Advisory Mode.

CAUTION

Do not leave the instrument turned on when it is not in use.

Do not discharge the defibrillator with the paddles shorted together which can cause burning and pitting of the metal paddle contacts.

Disconnect any other medical electronic equipment from the patient during defibrillation unless labeled as defibrillator protected () ().

WARNING

Avoid open paddle discharges. Dangerous high voltage exists on the paddles when the defibrillator is discharged. Contact with this high voltage could cause death or serious injury.

Avoid touching any metal surfaces on the instrument during discharge.

Avoid connecting the patient to several devices at once, because leakage current limits may be exceeded.

Never touch the bed, gurney, the patient, or any equipment connected to the patient during defibrillation.

Keep the HP CodeMaster 100 and the immediate area clean and dry at all times to avoid creating potentially dangerous electrical paths.

Never open the instrument case. Dangerous high voltages can be exposed. Only qualified service personnel can service the instrument.

Do not use the defibrillator in a flammable or oxygen-rich atmosphere. This will cause an explosion hazard.

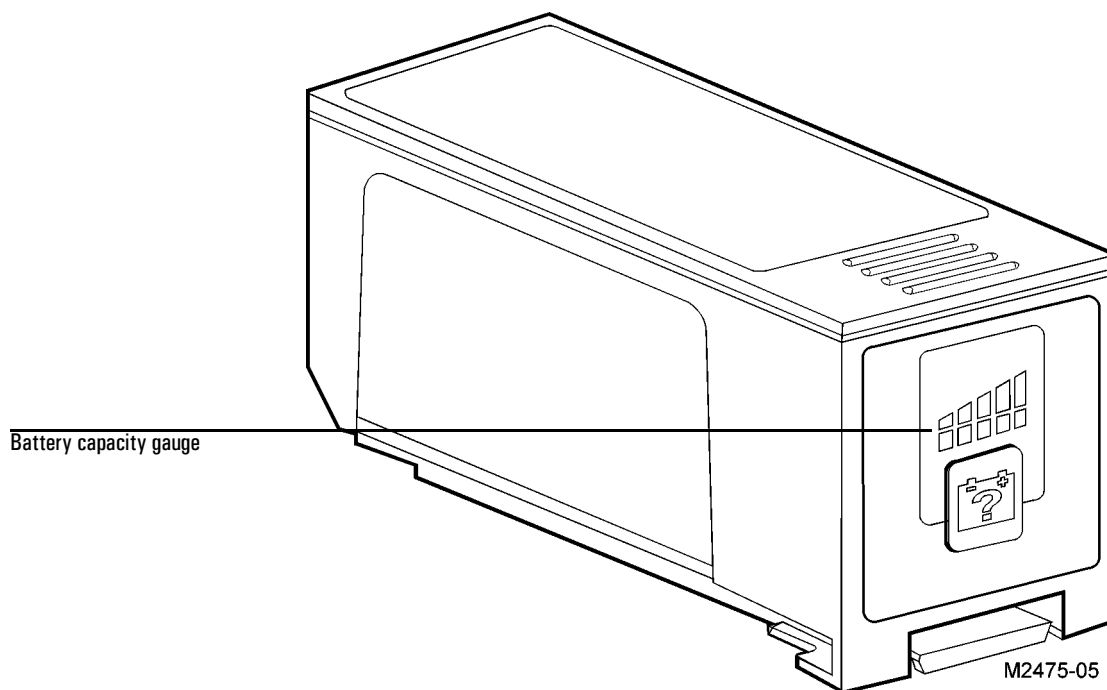
Do not rely entirely upon heart rate alarms. Rate meters on pacemaker patients can continue to count the pacemaker rates during cardiac arrest or some arrhythmias. Keep pacemaker patients under close observation.

Avoid moving a charged defibrillator. If you drop the unit, it may discharge.

Battery Operation

The HP CodeMaster 100 operates from a nickel-cadmium battery (Figure 1-13). This battery provides optimum performance and battery life when charged and maintained using the HP M2480B Battery Support System.

Figure 1-13



HP M2476B/M2477B Battery

In addition to the standard M2476B 2.5 amp-hour battery, Hewlett-Packard offers the M2477B 4.0 amp-hour battery, which provides more monitoring time and more charge-shock cycles.

Supported Battery Replacements

Replace the battery only with one of the batteries listed in Table 1-2.

Table 1-2

Battery Specifications

Battery	360 Joules Charge-Shock Cycles	Monitoring Time	Approximate Recharging Time
M2476B 2.5 amp-hour battery	50	2 hours	2 hours
M2477B 4.0 amp-hour battery	75	3 hours	3 hours

Testing a Battery

To test the remaining charge in the battery, press the button below the battery capacity gauge. Lights within the battery capacity gauge show the amount of charge left in the battery. Each light represents 20% of the battery capacity. When only one light is on, the battery has between zero and 20% capacity remaining. When all lights are on, the battery has between 80 and 100% capacity remaining.

Recharging a Battery

To recharge the battery, remove it from the defibrillator and insert it into the Battery Support System. To charge the battery, see “Charging the Battery” on page 13-14.

The battery support system can recharge two batteries simultaneously.

Test the capacity of a new battery or one that has been stored more than one month as described in “Battery Capacity Test” in Chapter 13, “Maintenance”.

NOTE

Continuous recording reduces the monitoring time available.

CAUTION

When the LOW BATTERY message is displayed on the monitor, replace the battery pack with a charged battery pack.

From the time the LOW BATTERY message appears until the battery is fully depleted and the instrument shuts down, there is approximately thirty minutes of monitoring and five 360 joule charge-shock cycles.

If the battery is defective, there may be significantly less monitoring time or charge capacity after the LOW BATTERY message appears than if the battery is merely depleted. Recording during this time will also impact monitoring time and the number of charge shock cycles remaining.

Getting Acquainted
Battery Operation

Setup and Configuration

This chapter provides steps for setting up and configuring the HP CodeMaster 100. Your HP CodeMaster 100 ships protected within a carry bag. For instructions on s how to attach the side-pouches and shoulder strap, refer to *M3710A Carry Bag Instructions for Use* (M2475-94000).

Setting Up the CodeMaster 100

The HP CodeMaster 100 is ready for operation after you perform the following tasks:

- Insert the Battery.
- Load Recorder Paper.
- Seat and lock the paddles or defib electrode cable.
- Connect the patient cable.
- Select configuration settings for both the CodeMaster 100 and the 12-Lead option including such parameters as;
 - date and time
 - 12-Lead keyboard to uppercase or lowercase mode
 - 12-Lead telephone directory for transmission
 - 12-Lead acquisition information
 - 12-Lead report content information
 - 12-Lead location and ID codes

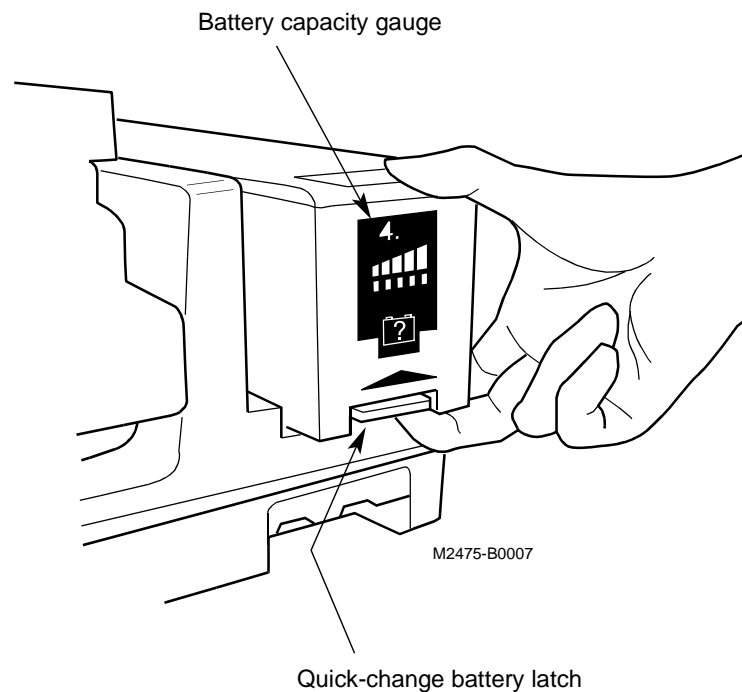
Inserting the Battery

Before using the battery supplied with your HP CodeMaster 100, make sure it is fully charged and functional. Remove the battery from the defibrillator by pinching the latch and pulling the battery out and up.

Perform the “Battery Capacity Test” on page 13-15 to charge and test the battery.

Insert a fully charged and tested battery into the CodeMaster 100 (Figure 2-1). Insert the battery into the compartment with the connector to the inside. Slide the battery into the compartment until it latches.

Figure 2-1



Loading the Battery into the CodeMaster 100

NOTE

If the battery is not properly seated in the battery compartment of the CodeMaster 100, the instrument will display the warning message **CHECK BATTERY** accompanied by an audible warning when you power on the instrument.

Loading the Recorder Paper

The HP CodeMaster 100 recorder uses 50mm wide, thermal recorder paper (HP 40457C/D). To load the paper, refer to “Changing the Recorder Paper” on page 13-7.

Connecting the Paddles or Multifunction Defib Electrodes and Patient Cables

The defibrillator has a paddles/electrode adapter cable for attaching external paddles, internal paddles, or multifunction defib electrodes. It also has an ECG Input connector for attaching ECG leads.

Connecting Paddles or Multifunction Defib Electrodes

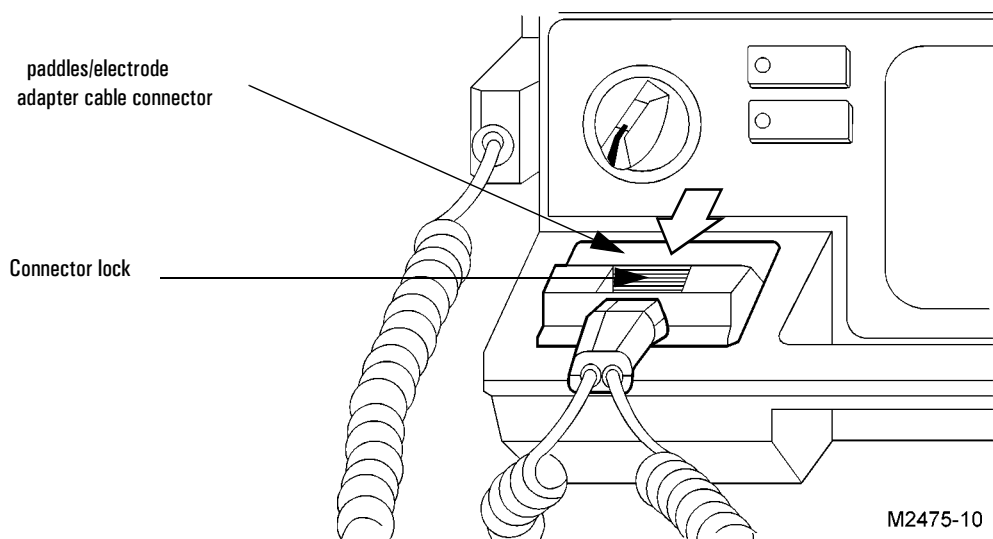
To connect the paddles/electrode adapter cable to the defibrillator, perform the following steps:

- 1 Slide the paddle connector lock on the paddles plug to the **unlock** position. To do this, push the lock towards the top of the connector.
- 2 Insert the paddles/electrode adapter cable plug into the cable connector on the defibrillator (Figure 2-2).
- 3 Slide the cable connector latch to the **lock** position, to secure the plug in place.

NOTE

To remove the paddles/electrode adapter cable, slide the paddle connector lock to the unlock position and pull the connector housing up and out.

Figure 2-2



Connecting External Paddles, Internal Paddles, or Multifunction Defib Electrodes

ECG Input Connector

WARNING

The HP patient cable supplied with this device, or an HP approved substitute patient cable, is an integral part of the defibrillator/monitor safety features. Using any other patient cable may compromise defibrillation protection as well as performance. Only qualified personnel may service the device.

The ECG Input connector on the defibrillator is a 12-pin connector.

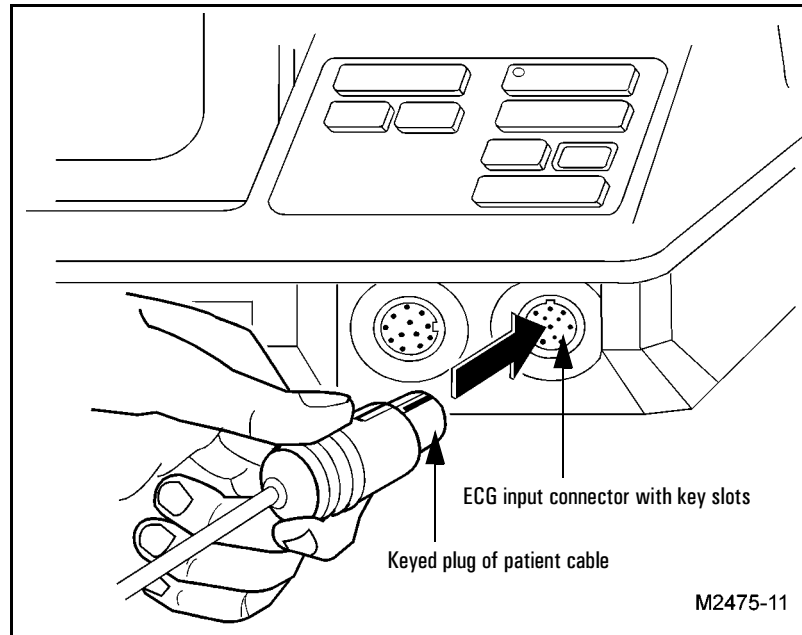
Connecting the Patient Cable The 3-wire, 5-wire, and 10-wire patient cables connect to the ECG Input connector located on the front right side of the defibrillator, below the QRS volume and pacer controls. The patient cable plug has 12-pins. To install the patient cable (Figure 2-3):

- 1** Align the keyed cable plug with the slot in the ECG Input connector.
- 2** Push the cable plug firmly into the ECG Input connector.

NOTE

If Leads is selected as the ECG source, the message **LEADS OFF** will appear on the monitor display if the patient electrode becomes disconnected. A dashed line appears on the display in place of an ECG trace.

Figure 2-3



Connecting a Patient Cable

Configuring the CodeMaster 100 and 12-Lead ECG Option

This section provides instructions for configuring the CodeMaster 100 and 12-Lead ECG option.

To configure general items such as the date and time, as well as all defibrillating and monitoring settings, use the Setup Menus accessible through the front panel keys and front display. Table 2-1 and Table 2-2 list the selections available on the Setup Menus.

To configure 12-Lead ECG and transmission settings, use the Configuration Menu accessible from the top keypad and upper display. Table 2-3 lists the selections available on the Configuration Menu.

A small internal battery provides back up power to store the configuration information. Under normal conditions, the backup battery may last for five years. Extreme conditions (such as prolonged high temperatures) may reduce the life of the backup battery.

After running the “Delivered Energy and Shock Button Functional Test” on page 13-3, you may see a CHECK SETUP message on the screen. This message appears when the backup battery has approximately 90 days of life remaining.





CAUTION

When you see the CHECK SETUP message on the screen, call service to replace the backup battery.

If you do not replace the backup battery, the SETUP LOST message appears on the screen after the internal battery depletes, and you may have to reconfigure the instrument.

Configuring the CodeMaster 100

Perform the following steps to configure the CodeMaster 100.

- 1 Depress **Sync** and **HR Alarm** while turning the **Energy Select** control from **Off** to **Monitor On**. A Setup/Diagnostic menu will appear with the following choices.
 - CALIBRATE DEFIB
 - SETUP MENU 1
 - SETUP MENU 2
 - RESTORE FACTORY SETTINGS
 - PRINT LOG
 - TEST DEFIB
 - TEST ECG
 - TEST CRT
 - TEST RECORDER
 - TEST CONTROLS
 - TEST INDICATORS
 - TEST BATTERY
 - TEST PACER
 - TEST 12-LEAD
- 2 Select SETUP MENU 1 by pressing the  and  arrows on the **ECG Size** key until the highlight appears on SETUP MENU 1.
- 3 Press **Lead Select**. SETUP MENU 1 will appear with the current setup values displayed.
- 4 Press the  and  arrows on the **ECG Size** key until the highlight appears on the value you wish to change.
- 5 Press **Lead Select**.
- 6 Press **ECG Size** to scroll through the available choices for this parameter.
- 7 Press **Lead Select** to set your selection.
- 8 Press **ECG Size** until the highlight appears on the next value you wish to change.

- 9 Repeat steps 5 through 8 until you are finished configuring the settings in Setup Menu 1.
- 10 Depress both sides of the **ECG Size** key simultaneously to return to the Setup/Diagnostic Menu.
- 11 To change settings in Setup Menu 2, select **SETUP MENU 2** from the Setup/Diagnostic Menu and repeat the above steps.
- 12 Turn the **Energy Select** control to **Off** to exit Setup/Diagnostic mode.

Restoring Factory Settings

You can use the factory setting for most values by selecting **RESTORE FACTORY SETTINGS** from the Setup/Diagnostic Menu. Highlighting and selecting this setting does NOT bring up an additional menu. Selecting this line will undo user configured parameters and restore factory defaults. This process restores factory settings on the defibrillator/monitor and not on the 12-Lead option.

WARNING

HP recommends that you not use the 12-Lead option to acquire, view, store, print or transmit when in Diagnostic Mode as the ECG may be lost and the 12-Lead capability may be reset.

Setup and Configuration
Configuring the CodeMaster 100

Example

To set the time on the CodeMaster 100:




- 1 Press **Sync** and **HR Alarm** at the same time while turning the **Energy Select** control from **Off** to **Monitor On**.
 - 2 Press  **ECG Size** once to highlight SETUP MENU 1.
 - 3 Press **Lead Select**. SETUP MENU 1 appears.
 - 4 Press  **ECG Size** seven times to highlight Time.
 - 5 Press **Lead Select**.
 - 6 Press **ECG Size** until the hours setting contains the correct time.
 - 7 Press **Lead Select**.
 - 8 Press  **ECG Size** to select minutes.
 - 9 Press **Lead Select**.
 - 10 Press **ECG Size** until the minutes setting contains the correct time.
 - 11 Press **Lead Select**.
 - 12 Depress both sides of the **ECG Size** key simultaneously to return to the Setup/Diagnostic Menu.
 - 13 Turn the **Energy Select** control to **Off**.
-

Table 2-1 and Table 2-2 show configurable parameters on the instrument. Default values are shown in boldface type.

Table 2-1 Setup Menu 1 Settings

Setting	Choices	Description
Language	English , Dutch, Swedish, French, German, Italian, Spanish, Norwegian, Finnish	Printed and displayed text language
Upper Alarm Limits (UAL)	120, 140, 160 , 20 to 280 in increments of 5	Upper heart rate limits LAL to 280
Lower Alarm Limits (LAL)	40, 60, 90 , 20 to 280 in increments of 5	Lower heart rate limits 20 to UAL
Time	HH:MM	Current time
Date	DD MMM YY	Current date
Armed Tone	ON , OFF	Beep on Charge done
CRT Alerts	ON , OFF	Beep on alert message
Alert Volume	3 to 15	Alerts volume
Mode after CV	SYNC , DEFIB	Specifies mode after cardioversion
Pacer Rate	70 (ppm) , 40 to 180 in increments of 10	Sets the pacer rate and the initial power-on default rate.
Pacer Output	30 (mA) , 10 to 200 in increments of 10	Sets the pacer current and the initial power-on default pacer current.

Setup and Configuration
Configuring the CodeMaster 100

Table 2-2 Setup Menu 2 Settings

Setting	Choices	Description
Recorder Delay	Delay 6 S. Delay	Printout is delayed 6 seconds or immediate
Recorder BW	Monitor , Diagnostic	Bandwidth (recorder only). Monitoring bandwidth: 0.5–40 Hz. Diagnostic bandwidth: 0.05–150 Hz.
Advisory Energy	200, 200, 360 or 200, 300, 360	Sets the desired advisory mode delivered energy sequence.
Record on Mark	ON , OFF	Records during mark
Record on Charge	ON , OFF	Records during charge
Record on Shock	ON , OFF	Records during discharge
Record on Alarms	ON , OFF	Records during alarms.
Post Shock Data	ON , OFF	ON prints the delivered energy statistics. OFF prints Energy Select control setting.
Power On Lead	PADDLES , LEAD I, LEAD II, LEAD III aVR, aVL, aVF, V	Sets the ECG monitoring source that appears when you turn on the instrument.
Patient Cable	3 WIRE , 5 WIRE	
Notch Filter	60 HZ , 50 HZ, ON , OFF	
ECG Trace	SWEEP , SCROLL	ECG trace style.

NOTE

If you use a 10-wire cable, the leads which may be monitored are dependent upon whether the defibrillator is configured to **monitor a 3 or 5-wire patient cable**.

Configuring the 12-Lead Option







This topic provides procedures for configuring the 12-Lead option. Table 2-3 lists the selections available on the Configuration Menu.

Table 2-3 12-Lead Configuration Menu Settings



Menu Selection	Function
Setup ID Entry	Identify which patient information fields will be used. Define the text contained in user-defined fields.
Setup 12-Lead Settings	Identify ECG lead format and nomenclature used on printed 12-Lead ECG reports
Setup ECG Filters	Identify which filters will be used to clarify ECGs in noisy environments
Setup Miscellaneous	Set the Institution label; set type of interpretation; set the number of ECG copies printed; set 12-Lead keypad to upper or lower case; set 12-Lead location code and ID.
Setup Transmission	Define modem initialization strings, cellular dialing prefix.
Setup Gateway	Define telephone number for gateway if a gateway is used.
Setup Telephone Directory	Define names, telephone numbers, and type of equipment used at receiving sites.
Setup Automated Operations	Enable automatic transmission of ECGs if desired.

Navigating the Configuration Menus

When you need to edit the 12-Lead configuration, use the following techniques:

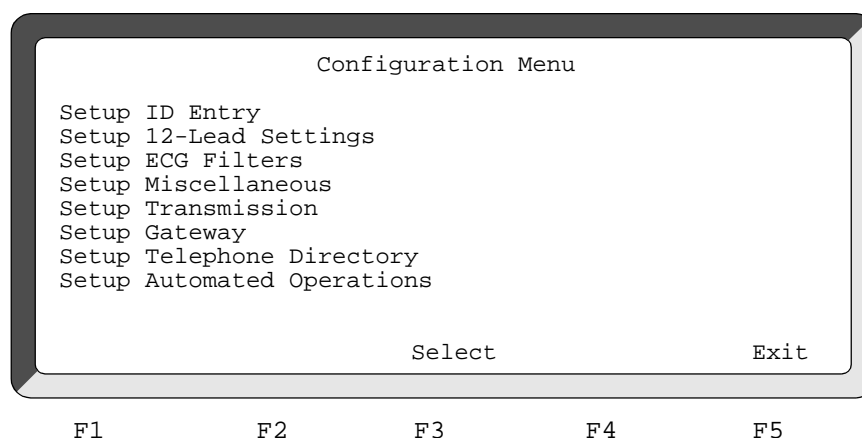
- To enter the 12-Lead configuration menu, press the Menu key on the keyboard.
- To select from a menu, press  to move the cursor down, or press  to move the cursor up until the desired menu line is highlighted, then press **F3** to display the selected item.
- To select a field on a data entry screen, press  or  to move the cursor down, or press  or  to move the cursor up until the desired entry line is highlighted. To save the settings, exit the Configuration menu.
- To change a field, select **F3** to step through the choices available.
- To exit the Configuration menu and save your configuration data, press **F5**.

Adjusting Display Screen Contrast

Press **Shift** with the  or  key to lighten or darken the contrast on the 12-Lead display.

Using the 12-Lead Configuration Menu

The 12-Lead option can be customized to meet your particular requirements. Using the Configuration Menu, you can choose the screens from which you can set the 12-Lead configuration. When you select Configure 12-Lead from the Main Menu, the Configuration Menu appears:



Each Configuration Menu choice is described briefly in a list, then each is described in more detail in the sections that follow. Default configuration settings are also listed in the tables.

Setting Up Patient Information

The Setup ID Entry screen allows you to choose the patient identification entries requested prior to recording an ECG. The following screen shows the patient identification entries available for configuration. Enter data for patient information. Use **F3** to change the value of a field.

Setup ID Entry

ID Entry?	Yes
Name Entry?	Yes
Age Entry?	Yes - Years
Sex Entry?	Yes
Chest/LA Pain Entry?	Yes
Acute Ischemic Sx Time Entry?	No
History Diabetes Entry?	No
History Hypertension Entry?	No
Blood Pressure Entry?	No
Height Entry?	No

Change

Next

Exit

F1

F2

F3

F4

F5

NOTE

The patient age, sex and height and weight affect the standard interpretation of the ECG. For the most accurate interpretation, include them in the patient ID entry. At a minimum, enter age and sex. If you do not enter data into these fields, the analysis software or 12-Lead algorithm will use default values for the analysis.

Setting Up 12-Lead Fields

This screen allows you to choose the default formats that will be used when you power-on the system. Table 2-4 shows the available report formats. Use **F3** to change a field.

Table 2-4

Configurable Report Characteristics

Parameter	Choices ^a	Comments
Lead Format	Standard Cabrera	
12-Lead Report Format	3x4 3x4, 1R 3x4, 3R	
Custom Rhythm Leads for: 3x4 1R	I, II, III, aVR, aVL, aVF, V1/C1, V2/C2, V3/C3, V4/C4, V5/C5, V6/C6	Select any lead
3x4 3R, Custom 3	I, II, III, aVR, aVL, aVF, V1/C1, V2/C2, V3/C3, V4/C4, V5/C5, V6/C6	Select any V three leads
Phone Line	Tone Pulse Direct Cell	

a. Default values are shown in boldface type.

Setup and Configuration
Configuring the 12-Lead Option

Setup 12-Lead Settings

Lead Format:

Standard

12-Lead Report Format:

3x4

Custom Rhythm Leads for-

3x4 1R:

II

3x4 3R, Manual 3:

II

aVF

V2

Phone Line:

Tone

Change
Format

Exit

F1

F2

F3

F4

F5

Setting Up Filters

From the Configuration Menu, select Setup ECG Filters. The 12-Lead option has been factory-configured with the filter settings which remove the most noise from the ECG. In addition to the default settings, 12-Lead offers a choice of several filter configurations. These filter settings are detailed below and in Table 2-5.

The screenshot shows a menu titled "Setup ECG Filters". It contains two sections of settings:

- 12-Lead Report Filters -**
 - Wander Filter: 1.5 Hz
 - Noise Filter: 40 Hz
- Front Panel Filter Key-**
 - Muscle Artifact Filter: Yes
 - 40 Hz Noise Filter: Yes
 - 0.5 Hz Wander Filter: Yes

At the bottom of the menu, there are two options: "Change Value" and "Exit". Below the menu, there are five labels: F1, F2, F3, F4, and F5.

- The 0.5 Hz Baseline Wander filter suppresses the greatest amount of baseline wander.
- The 0.15 Hz Baseline Wander filter provides some baseline wander suppression without distorting the ECG's ST segment.
- The 0.05 Hz Baseline Wander filter delivers the highest fidelity signal, but provides the least baseline wander suppression.
- The 40 Hz Noise filter offers maximum noise suppression, but reduces the fidelity of the signal.
- The 100 Hz Noise filter provides some noise suppression while offering an accurate signal representation.
- The 150 Hz Noise filter delivers the highest fidelity signal, but provides the least high-frequency noise suppression.

Setup and Configuration
Configuring the 12-Lead Option

- The Muscle Artifact filter will be enabled when the **Filter** key is pressed. It removes small-amplitude, high-frequency signals, characteristic of muscle tremor.

NOTE

When the front panel Filter key is on, the user-configured combination of the Artifact, 0.5 Hz Wander, and 40 Hz Noise filters is enabled and the `Filter` status message appears in the upper-right corner of the display. Refer to Table 2-5 for information on configuring the **Filter** key.

Table 2-5

Configurable Filters

Parameter	Choices ^a	Comments
Wander Filter	0.05 Hz 0.15 Hz 0.5 Hz	Select one baseline wander filter for ECGs.
Noise Filter	40 Hz 100 Hz 150 Hz	Select one noise filter for 12-Lead ECGs.
Front Panel Filter Key		
Muscle Artifact filter	Yes or No	Select whether or not the artifact, baseline wander
0.5 Hz Baseline Wander filter	Yes or No	and noise filters are activated by the Filter key.
40 Hz Noise Filter	Yes or No	

a. Default values are shown in boldface font.

Setting Up Interpretation, Copy Count, Institution Label, and Keyboard Parameters

Setup Miscellaneous

Institution Label:
Hewlett-Packard 12-Lead

Interpretation:
Standard Adult/Pediatric

Copy Count: 2

Set Keyboard: lowercase

12-Lead location code: 00000

12-Lead ID: 0000

Erase Exit

F1 F2 F3 F4 F5

Changing the Institution Label

The Institution name is printed and transmitted with all ECGs and is displayed at the top of the Main Menu. Press **F1** to clear the field, then type a name. There are 30 character spaces available in this field.

Setup and Configuration
Configuring the 12-Lead Option

Setting Interpretation Values

Interpretation values determine which analysis is applied to an ECG report.

The settings are:

None	Selecting None disables printing of all computer generated interpretation of the ECG. The waveform prints along with the following fields: Patient ID, Patient Name, Date and Time
Measurements Only	Selecting this setting provides an additional page containing the basic measurements and all entered ID fields. Basic measurements are defined in Chapter 6, “Using the 12-Lead Option”.
Standard Adult/Pediatric	Selecting this setting prints waveform, patient ID, basic measurements summary, and standard adult or pediatric (depending on age entered) computer generated diagnostic statements.
ACI-TIPI	Selecting ACI-TIPI provides waveform, patient ID, basic measurements summary, all available patient demographics and computer calculated probability of acute cardiac ischemia.
TPI	Selecting TPI provides waveform, patient ID, basic measurements summary, all available patient demographics and predicts patient outcomes (mortality) with and without administering thrombolytics.

Setting Copy Count

Determines how many copies are printed when you press the **Copy** key. You can enter a value from 1-4. The default value is 2.

Setting Keyboard Values

Keyboard mode determines whether characters will be entered in uppercase or lowercase. Press *F3* to change from lowercase to UPPERCASE and vice versa. The keyboard is initially set to lowercase. Use the shift key to enter the opposite case.

Setting 12-Lead Location Code

The 12-Lead location code identifies a specific department or EMS Service that acquired the ECG. The number prints at the bottom of the report. If set to zero (default), this field will be suppressed from the printed report. This parameter can be any five digit numeric code.

Setting 12-Lead ID

The 12-Lead ID code identifies the particular CodeMaster 100 unit that was used to acquire the ECG. The number prints at the bottom of the report. If set to zero (default), this field will be omitted from the printed report. This parameter can be any four digit numeric code.

Setup Transmission

This menu allows the configuration of both the internal and an external modem. Note that your CodeMaster 100 with the 12-Lead option is pre-configured using Hayes™-compatible settings. Hewlett-Packard recommends that you not change any default settings if you are using the internal modem or a Hayes-compatible external modem.

NOTE

You must select the correct country to ensure compliance with telecom regulatory standards.

Modem initialization string is used for modem initialization commands **only** and should not contain dialing information. Fax initialization string is used for fax initialization commands **only** and should not contain dialing information. Cellular initialization string is used for cellular initialization commands **only** and should not contain dialing information.

Setup Transmission

Country: USA/Canada *(This field will only appear if an internal modem is present)*

Modem Initialization String:
AT &F M0 E0 &C1 &D2 S0=0 &S0 &M0 &W
AT %E0

Fax Initialization String:
AT &F M0 E0 &C1 &D2 &S0 +FCLASS=1

Cellular Initialization String:
AT &F M0 E0 &C1 &D2 S0=0 &S0 &M0 &W
AT

Cellular dialing prefix:

EraseExit

F1F2F3F4F5

Setup Transmission Fields

The modem initialization strings are sent from the 12-Lead option to the modem before dialing begins. This string must be present before sending ECGs using the modem. There is a string for landline, fax, and cellular communications.

Cellular Dialing Prefix

If the receiving modem does not support MNP-10EC cellular enhanced protocol, an optional prefix may be used to enable data transfer over the cellular phone via your service provider's modem pool. This prefix may be obtained from your cellular service provider.

Setup Gateway

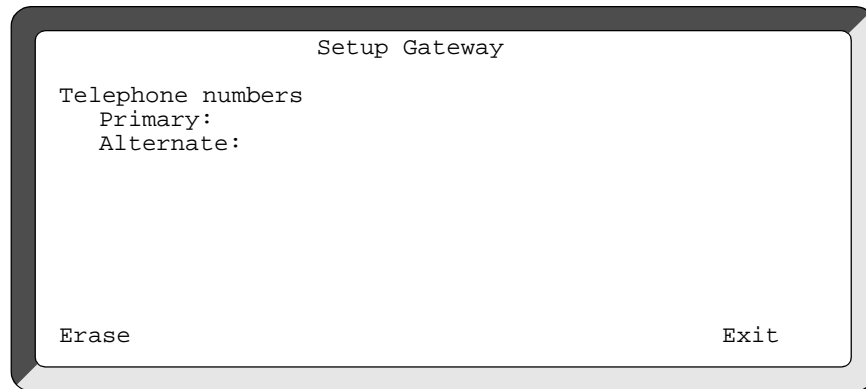
The Gateway is where the ECG Manager PC gateway resides. To setup the ECG Manager gateway function, configure the Gateway in the Setup Gateway field.

You can configure the ECG Manager gateway by entering phone numbers on the Telephone Directory screen. After an ECG is acquired from the patient, it can be transmitted through the ECG Manager gateway by pushing the **Send** key. Select the desired final destination site on the Telephone Directory screen. This is the site where the ECG Manager gateway will forward the ECG report, automatically. These ECGs can also be autoforwarded to other destinations set up in the telephone directory.

During the transmission process, the HP CodeMaster 100 will dial the Gateway phone number and transmit the ECG report along with the phone number of the final destination.

Setup and Configuration
Configuring the 12-Lead Option

In the Gateway Setup menu, there are two telephone fields: Primary and Alternate. The Primary field will be the first Gateway number dialed. If this number fails, the Alternate gateway number will be used. The Alternate field can be left blank if no alternate gateway number is available.



Setup Gateway

Telephone numbers
Primary:
Alternate:

Erase Exit

Setting Up the Telephone Directory

To transmit ECGs, you must identify the receiving site, its telephone number and the type of transmission to send. You can enter the telephone numbers of up to 18 sites in the directory. To setup the telephone directory, perform the following steps:

- 1 From the Configuration Menu, press **F3** to select Setup Telephone Directory.

#	Name	Primary Number	Rcvr Type
1			
2			
3			
4			
5			
6			
7			
8			
9			
Change Entry			

Next Exit

F1 F2 F3 F4 F5

- 2 Press **F1**. The system displays the setup fields for this directory entry.

Setup Telephone Directory
Entry 1 of 18

Name:

Telephone numbers
Primary:
Alternate:

Receiver Type: Receiving Station
Speed: 57600

Erase Next Entry Exit

Setup and Configuration
Configuring the 12-Lead Option

- 3 Enter the name, primary and alternate telephone numbers, receiver type, and speed. Press or to move the cursor to a blank field line.

Note that the modem ignores spaces and hyphens in the telephone number. Use the following special symbols to specify how you want the modem to dial the telephone number:

- **comma(,):** causes the modem to pause for two seconds before continuing to dial.
- **W:** causes the modem to wait for a second dial tone before continuing to dial. Use this symbol if you have to dial 9, wait for a dial tone, and then dial the telephone number to place a call outside your house telephone system.
- **P:** indicates pulse dialing (with a rotary dial), instead of tone (with a keypad).

For example, if you are using a pulse telephone with your modem, and your house telephone system requires dialing a 9 before placing an outside call, you would enter the telephone number as:

P9W5553334444

- 4 Select the transmission type by pressing **F3** until the appropriate transmission type appears. The transmission type will cycle through Receiving Station, Fax, TraceMaster A/B, PageWriter XLi, PageWriter 200/300, Other SCP-HP1, Other DT, Event Summary. Event Summary is the **only** transmission type displayed if configuring entries 10-18 (Screen 2 of 2).
- 5 Select the transmission speed for your transmission type by pressing **F3** until the appropriate transmission speed appears. The following table shows the recommended transmission speed for each type of transmission. Your equipment may require a different speed.

Table 2-3

Remote Sites, Transmission Types, and Recommended Speeds

Receiver Type	Recommended Speed
TraceMaster	2400 9600
PageWriter XLi	2400
PageWriter 200/200i/300pi	2400
PC Running ECG Manager	19200

- 6 Press **F5** twice to exit the directory and return to the Configuration Menu.

Setup Automated Operations

This field allows you to configure the steps to send ECGs after acquisition.

If you enter Yes into this field, the device will automatically go to the telephone directory immediately after an ECG is acquired. In this case, you will not be required to push the Send button until after you have selected the site for which the ECG is to be sent. This automated function removes one step in the process for sending an ECG.

If you enter No into this field, the instrument will return to the Home screen after an ECG is acquired. To send an ECG, you will always be required to push the **Send** button to enter into the telephone directory. Once you are in the telephone directory, select the site for which the ECG is to be sent and push the **Send** button again.

Setup and Configuration
Configuring the 12-Lead Option

Defibrillating

This chapter contains information about defibrillating a patient using different paddle sets or multifunction defib electrodes. Refer to “Defibrillator Operating Controls” on page 1-4.

Defibrillating a Patient

This section describes the three steps to defibrillating a patient:

- 1 Select Energy
- 2 Charge
- 3 Shock

Note that for quick reference, these steps appear on both the outer case of the HP CodeMaster 100 and on the quick reference card attached to the carry bag.

1. Select Energy

- 1 Turn the **Energy Select** control to the desired energy level. The defibrillator is now on.
- 2 Prepare the paddles by following these steps:
 - a. Remove the paddles from their holders by grasping the handles and lifting them straight up.
 - b. Holding both paddles in one hand, apply electrolyte medium to the electrode surface of each paddle.

CAUTION

Placing the electrode surfaces together increases the risk of an accidental paddle-to-paddle discharge and can cause damage to the surface of the paddles.

WARNING

Do not spread electrolyte medium between the paddle electrodes on the chest. The patient can be burned if the medium forms a path between the electrodes.

To avoid risk of electrical shock, do not allow the electrolyte medium to accumulate on your hands or on the paddle handles

Use of a defibrillator in the presence of flammable agents or in an oxygen enriched atmosphere presents an explosion and fire hazard.

Do not touch the patient or patient cable during defibrillation. Death or injury may occur from the electric shock delivered by the defibrillator.

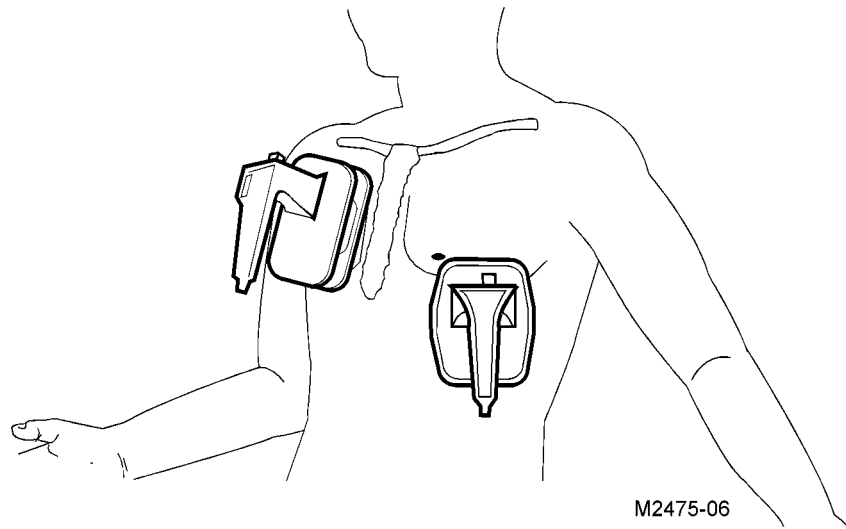
Be sure that the electrodes or lead wire tips do not come in contact with any other conductive materials, including earth-grounded materials, especially when connecting or disconnecting electrodes to/from a patient.

Avoid contact between parts of the patient's body such as exposed skin of head or limbs, conductive fluids such as gel, blood or saline and metal objects such as bed frame or stretcher.

Disconnect any other medical electronic equipment from the patient during defibrillation unless labeled as defibrillator protected () ().

- 3 Apply the paddles as follows:
 - a. Place the Sternum paddle near the upper sternum in the patient's right mid-clavicular line, just below the clavicle. (See Figure 3-1.)
 - b. Place the Apex paddle on the chest just below and to the left of the patient's left nipple, in the anterior-axillary line.
- 4 Rub the paddles lightly against the skin to distribute the electrolyte medium and increase contact between the patient skin and the paddles. Then keep the paddles still to reduce motion artifact on the monitor.
- 5 Apply 10 to 12 kg (22 - 25 lb.) of pressure per paddle. (Refer to the paddle contact indicator on the Sternum paddle to verify paddle contact.)

Figure 3-1



Placing the Paddles for Defibrillation

2. Charge

- 1 Press **Charge** on either the Apex paddle or on the instrument front panel.
- 2 Call out “Clear!” to alert personnel to stand away from the patient.
- 3 Wait for the charge done indicators: **CHARGE DONE** light and Charge Done tone. When the unit is armed, the monitor shows the Delivered Energy available (in joules).

If the defibrillator does not charge, refer to “If the Defibrillator does not Charge” on page 12-3

Resetting the Selected Energy Level

To increase or decrease the selected energy level after pressing the **Charge** button, perform the following steps.

- 1 Move the **Energy Select** control to the new energy level.
- 2 Wait for the charge done indicators.


3. Shock

To shock the patient, perform the following steps.

- 1 Briefly adjust the paddle pressure and placement to optimize patient contact, as registered on the **Paddle Contact Indicator** located on the Sternum paddle.
- 2 Verify that no one is in contact with the patient, the monitoring cable or leads, the bed rails, or another potential current pathway.
- 3 Call out "Clear!" to alert personnel to stand away from the patient.

WARNING

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

- 4 Press and briefly hold both **Shock** buttons (labelled , one on each paddle) simultaneously, to deliver energy to the patient.

If the defibrillator does not shock, refer to the “If the Defibrillator does not Deliver a Shock” on page 12-4.

NOTE

If you must disarm the charged defibrillator (if counter shock is not needed), turn the **Energy Select** control to **Monitor On**. Any stored energy will be discharged internally and the available energy on the display will scroll down to 0.

Preparing the Defibrillator for the Next Use

If you want to print an Event Summary now, press **Review**. (See “*Printing the Event Summary Record*” on page 5-12.) After you use the defibrillator, perform the following steps to prepare the defibrillator for its next use:

- Clean all paddles, controls, and cables. Visually check the patient cables, paddles, paddle cables, and pads adapter cables for wear, insulation nicks, and other damage. Refer to the *Maintenance* chapter for additional information.
- Turn on the HP CodeMaster 100. If the instrument displays **LOW BATTERY**, replace the battery pack with a charged battery.
- Perform the test described in “*Delivered Energy and Shock Button Functional Test*” on page 13-3.
- Turn the **Energy Select** control to **Off** and return the HP CodeMaster 100 to its storage location.
- Check that sufficient recorder paper and electrolyte medium or multifunction defib electrodes are available for the next use of the defibrillator.
- Make sure that a battery is in the battery support system being charged. See “Charging the Battery” on page 13-14.

Defibrillation with Alternate Paddle Sets or Multifunction Defib Electrodes

The HP CodeMaster 100 will defibrillate with several different paddles/electrode sets, including:

- Adult/Pediatric, Anterior/Anterior External Paddles
- Adult, Anterior/Posterior External Paddles
- Multifunction Defib Electrodes

WARNING

Do not switch paddle sets in an environment where water may get in the paddles/electrodes connector receptacle.

Performing Pediatric Defibrillation

The HP CodeMaster 100 paddle set comes with pediatric paddles. To use the pediatric paddle set, depress the release latch at the front of the standard external paddles while pulling forward on the adult paddle surface. This action will remove the adult paddle contact surface and expose the smaller pediatric contact surface.

Refer to “Defibrillating a Patient” on page 3-1 for defibrillation procedures.

WARNING

The clinician must select an appropriate energy level for the pediatric patient. There is no energy limit lockout for the pediatric paddle set.

Defibrillating through Multifunction Defib Electrodes

The HP CodeMaster 100 has a multifunction electrode adapter cable (M2472A). This adapter cable allows defibrillation through multifunction defib electrodes. Defib electrodes have several advantages:

- Allows "hands off" defibrillation.
- Provides good quality monitoring.
- You can perform synchronized cardioversion without using an ECG lead set, while monitoring through the electrodes.
- You can switch between the pacing and defibrillation modes of operation quickly.

WARNING

The defibrillator will deliver defibrillator energy levels to an open electrodes set. The message PADS OFF appears when there is poor electrode-to-patient contact. Check all patient connections if this message appears.

- 1 Attach the electrode adapter cable (M2472A) to the paddle connector (Figure 3-2) on the front of the defibrillator.
- 2 Slide the cable connector latch to the lock position to secure the cable.
- 3 Attach the multifunction defib electrodes to the patient as instructed on the package.
- 4 Connect the defib electrodes to the electrodes adapter cable. The defib electrodes are correctly connected when the locking ring is twisted, locking the ears of the connector to the adapter cable.

WARNING

Be sure to correctly connect the defib electrodes to the electrodes adapter cable. Incorrectly connecting the defib electrodes to the electrode adapter cable can result in a failure to deliver energy to the patient.

Defibrillating
Defibrillating a Patient

If the PADS OFF monitor message displays, check all patient connections.


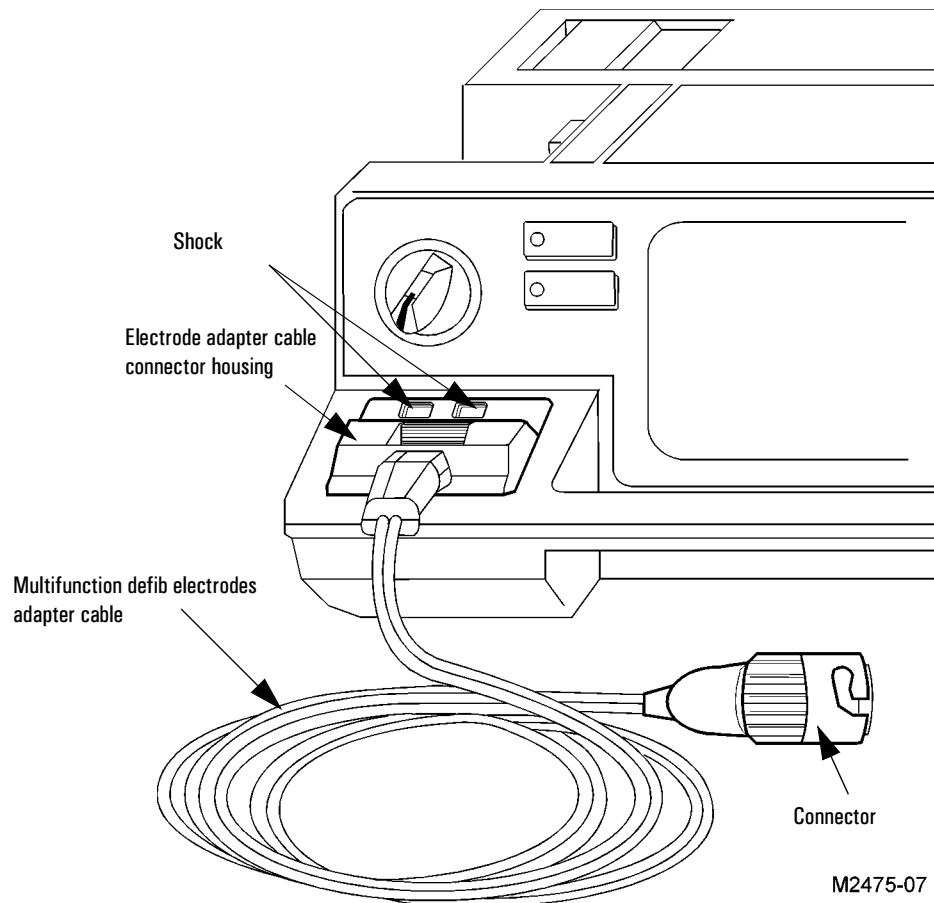
- 5 Select pads as the ECG source by pressing **Lead Select** until PADS appears on the display under the heart rate.
- 6 Set the **Energy Select** control to desired energy.
- 7 Press **Charge**.
- 8 Call out "Clear!" to alert personnel to stand away from the patient.
- 9 Wait for the charge done indicators.
- 10 Press both **Shock** buttons simultaneously to defibrillate. The **Shock** () buttons for the multifunction defib electrodes are on the cable connector housing. (Figure 3-2).

Figure 3-2



Multifunction Defib Electrode Adapter Cable

Defibrillating with Anterior/Posterior Paddles

The HP M2495A Anterior/Posterior Paddles are similar to the anterior/anterior paddles, but provide a posterior electrode placed on the patient's back. Refer to the packaging provided with the paddles for placement and usage guidelines.

Defibrillating
Defibrillating a Patient

Using Shock Advisory Mode (Optional)

This chapter details the use of Shock Advisory, an option that is available with the HP CodeMaster 100.

In shock advisory mode, the HP CodeMaster 100 acts as a semi-automatic external defibrillator.

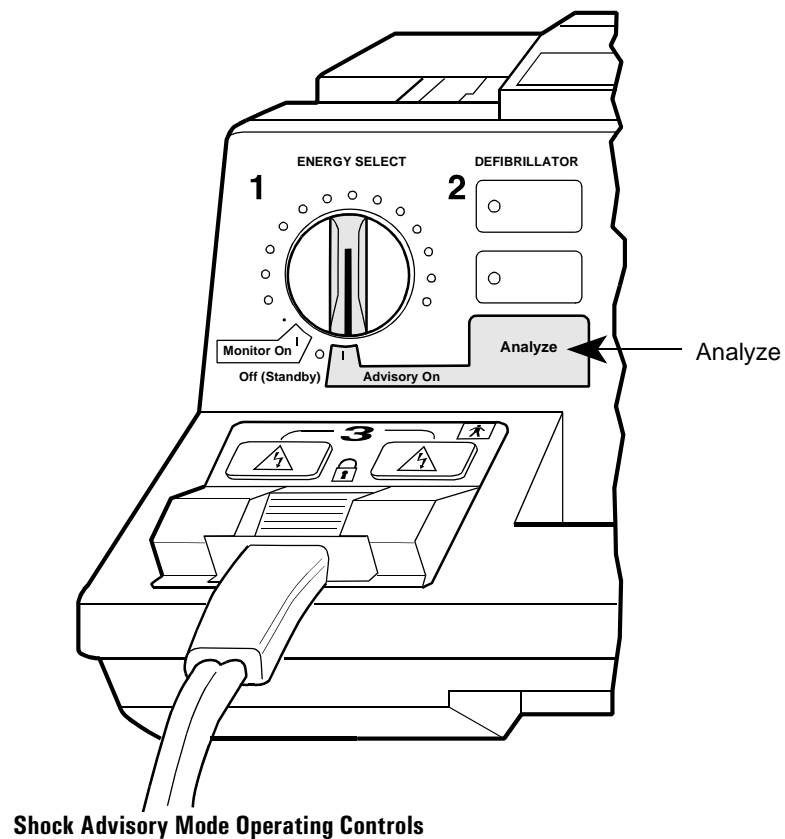
When in shock advisory mode the HP CodeMaster 100 can:

- analyze the patient's ECG rhythms
- advise when a shock should be administered
- automatically charge the defibrillator when a shock is advised
- prompt the user to deliver the shock
- provide advisory event documentation

Understanding Shock Advisory Operating Controls

The Shock Advisory mode operating controls on the HP CodeMaster 100 include the **Advisory On** selection on the **Energy Select** control and the **Analyze** button. See Figure 4-1.

Figure 4-1



Using Shock Advisory Mode

This section provides instructions for using the HP CodeMaster 100 in Shock Advisory mode. Make certain that you observe all safety precautions noted throughout this chapter.

WARNING


Do not use the HP CodeMaster 100 in Shock Advisory mode for:

- **children who weigh less than 90 pounds**
- **patients who have an implanted pacemaker**

The advisory algorithm is not designed to detect pediatric cardiac arrhythmias or handle erratic spiking problems caused by a properly or improperly functioning pacemaker.

The advisory algorithm does not charge the defibrillator to energy levels appropriate for pediatric patients.

To use advisory mode, first verify patient condition. Then:

- A** Select **Advisory On**.
- B** Apply multifunction defib electrodes to the patient.
- C** Stop patient motion. Press **Analyze**. If **SHOCK ADVISED**, stand clear.
- D** When you hear the charge done tone, press both electrode adapter cable **Shock**  buttons simultaneously.

Verify Patient Condition

Confirm that the patient is:

- unresponsive
- breathless
- pulseless

A. Select Advisory On

Turn the **Energy Select/Power Control** to **Advisory On** to turn on the defibrillator and operate it in advisory mode. The monitor displays:

FOR ANALYSIS , 200J
PRESS ANALYZE SELECTED

where 200J is the first energy setting. You can configure the energy settings for the first, second, and third shocks by using the Setup Menu (refer to Chapter 2, “Setup and Configuration”).

NOTE

You must turn the **Energy Select/Power Control** to **Advisory On** before analyzing the ECG. Pressing **Analyze** has no effect unless the **Energy Select/Power On** control is set to **Advisory On**.


In advisory mode, you can use the HP CodeMaster 100 to:

- analyze the patient’s cardiac rhythms by pressing **Analyze** to determine whether a defibrillation shock is needed
- record events with the advisory event summary

In advisory mode, the HP CodeMaster 100 emits distinct sounds as described in Table 4-1.

Table 4-1

Audible Indicators in Advisory Mode

Indicator	Description
Charge Done tone *	Continuous tone sounds when the instrument is charged and ready to deliver a shock.
Auto disarm tone	Sounds during the last ten seconds of the Charge Done tone. Beeps intermittently until disarmed.
QRS beeper	Sounds whenever an R-wave is detected. Volume controlled by  located on the lower right keypad.
CRT/Screen alerts *	Three beeps each time a message appears on the screen and when a shockable rhythm is detected.
Shutdown warning	Alternating pitch sounds for 60 seconds when the system is about to turn off. An alert to replace the battery.
Check battery alert	Set of 3 beeps with a message CHECK BATTERY on the monitor indicating that the battery is faulty or not latched securely.

*You cannot disable the charge done tone and CRT/screen alerts for advisory mode in setup.

Using Shock Advisory Mode (Optional)
Using Shock Advisory Mode

When you turn the **Energy Select** control to **Advisory On**, you disable other HP CodeMaster 100 functions including:

- charge key
- 12-Lead option
- pacing
- synchronized cardioversion
- SpO₂ monitoring
- lead selection
- leads monitoring
- heart rate alarms
- automatic recordings
- standard event summary generation
- recorder delay mode
- external paddles
- pediatric energy levels

To restore these functions, turn the **Energy Select** control to **Monitor On** or an energy setting.

NOTE

If you turn the **Energy Select** control to **Monitor On** or a specific energy setting, you place the HP CodeMaster 100 in manual mode and the advisory features are disabled.

WARNING

In Advisory Mode, the Charge button is disabled and the defibrillator cannot be charged manually. To perform manual defibrillation, refer to “Defibrillating a Patient” on page 3-1.

Do not use advisory mode for long term monitoring. Turn the defibrillator to **Monitor On** for long term patient monitoring.

NOTE

The Heart Rate (HR) meter is the same for manual or advisory mode when displaying or printing HR information.

The shock advisory algorithm uses a HR meter specifically developed for use by the algorithm for making shock decisions when rate information is required.

B. Apply Defib Electrode

WARNING

You must use the electrode adapter cable and multifunction defib electrodes in the Apex-Anterior position to analyze patient cardiac rhythms when in Advisory mode.

You must use the electrode adapter cable and multifunction defib electrodes when in advisory mode. The HP CodeMaster 100 will not analyze patient cardiac rhythms through external or internal paddle sets. The message ATTACH PADS CABLE displays if the defib electrode adapter cable is not connected.

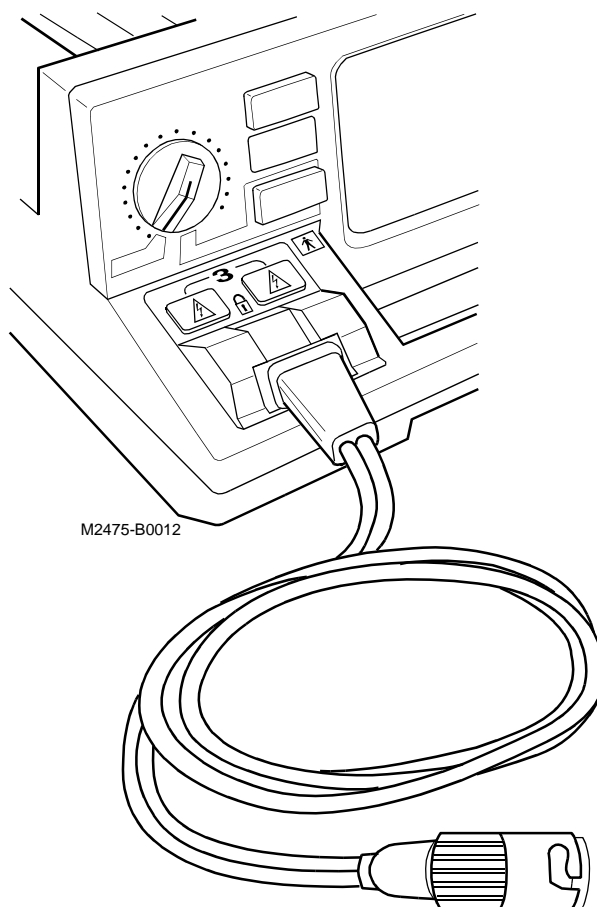
The defib electrodes allow accurate analysis of the cardiac rhythms and allow the defibrillator shock to be delivered. You must ensure the electrodes are correctly placed on the patient and attached to the electrode adapter cable. Also ensure the electrode adapter cable is correctly connected to the HP CodeMaster 100.

WARNING

The unit will deliver defibrillator energy levels to a set of multifunction defib electrodes even if they are not attached to a patient. The message PADS OFF appears when there are no electrodes or there is poor electrodes-to-patient contact. Check all patient connections if one these messages appears.

- 1 Attach the electrode adapter cable (M2472A) to the paddle connector on the front of the defibrillator.
- 2 Slide the paddle connector lock towards the front of the defibrillator to secure the cable. See Figure 4-2.

Figure 4-2



Connect Electrode Adapter Cable

- 3 Attach the multifunction defib electrodes to the patient as instructed on the package.

WARNING

Use the Apex-Anterior electrode application shown on the package. This results in the modified Lead II configuration upon which the advisory algorithm was designed and tested.

Using Shock Advisory Mode (Optional)
Using Shock Advisory Mode

- 4 Connect the electrodes to the electrode adapter cable. The electrodes are correctly connected when the locking ring is twisted, locking the ears of the connector to the adapter cable.

WARNING

Be sure to correctly connect the electrodes to the electrode adapter cable. Incorrectly connecting the electrodes to the adapter cable can result in a failure to deliver energy to the patient.

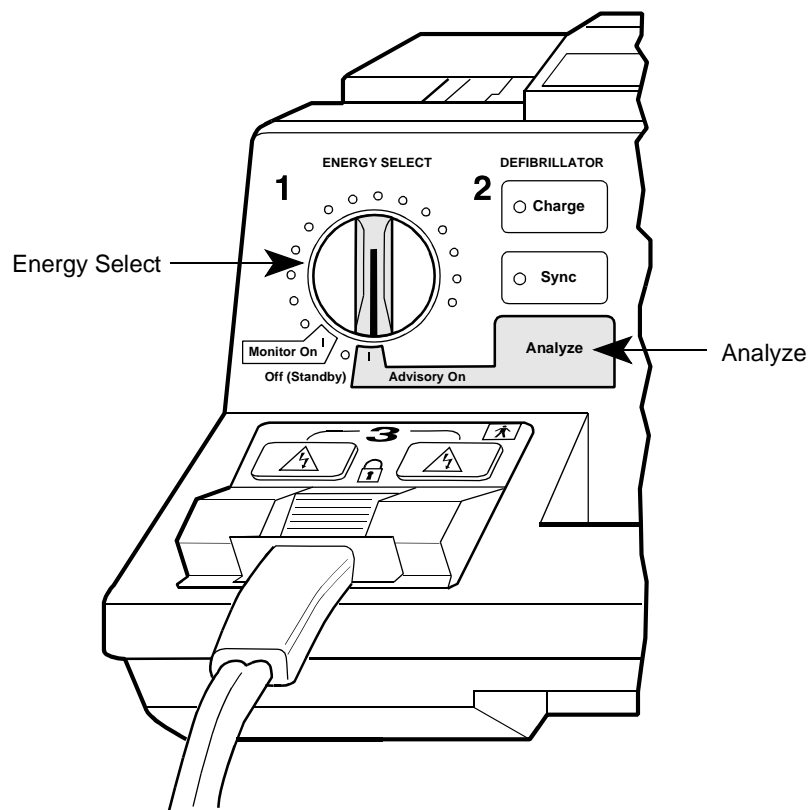
C. Press the Analyze Button

When you place the HP CodeMaster 100 in Advisory mode, the monitor displays the following message:

```
FOR ANALYSIS ,      200J  
PRESS ANALYZE.      SELECTED
```

Begin analyzing the patient's ECG by pressing **Analyze** on the instrument front panel. See Figure 4-3.

Figure 4-3



Analyze Button

When you press **Analyze**, the monitor displays:

ANALYZING ECG	nnnJ
DO NOT TOUCH PATIENT	SELECTED

where nnn is the configured setting for the energy sequence.

WARNING

To perform accurate analysis, you must not touch or move the patient during this time. Stop CPR, ventilation and transport.

Using Shock Advisory Mode (Optional)
Using Shock Advisory Mode

The advisory algorithm needs 7 to 10 seconds of continuous, artifact free ECG data to decide whether the patient requires defibrillating.

If excessive artifact due to CPR or patient transport is detected, the monitor displays the messages:

ARTIFACT DETECTED
DO NOT TOUCH PATIENT.

If the artifact ends within 20 seconds, analysis continues. Otherwise, the following messages appear on the monitor, and analysis stops. You can restart analysis by pressing **Analyze**.

ARTIFACT DETECTED
CANNOT ANALYZE

NOTE

Pressing the **Analyze** key during analysis will stop analysis. The message ANALYSIS STOPPED will be displayed momentarily, and then the following message appears:

FOR ANALYSIS , 200J
PRESS ANALYZE SELECTED

NOTE

If the multifunction defib electrodes are not properly attached to the patient when you press **Analyze**, the following message appears.

FOR ANALYSIS , 200J
ATTACH PADS SELECTED

The electrodes must be attached to the patient and the electrode adapter cable to start analysis.

NOTE

If the electrode adapter cable is not connected to the HP CodeMaster 100, the message ATTACH PADS CABLE appears. The electrode adapter cable must be connected to start analysis.

D. Follow Prompts

Look frequently at the monitor and follow the displayed instructions. The monitor may display SHOCK ADVISED or NO SHOCK ADVISED.

Shock Advised

When a shockable rhythm is detected, the message SHOCK ADVISED displays and the defibrillator begins charging. The defibrillator charges to the pre-set energy select sequence for the first, second, and third shocks. Subsequent shocks are delivered at the third shock energy level. The charge done tone sounds to alert you that the defibrillator is charged, and the system displays the following messages:

CLEAR PATIENT!
PRESS SHOCK BUTTONS

Defibrillating a Patient


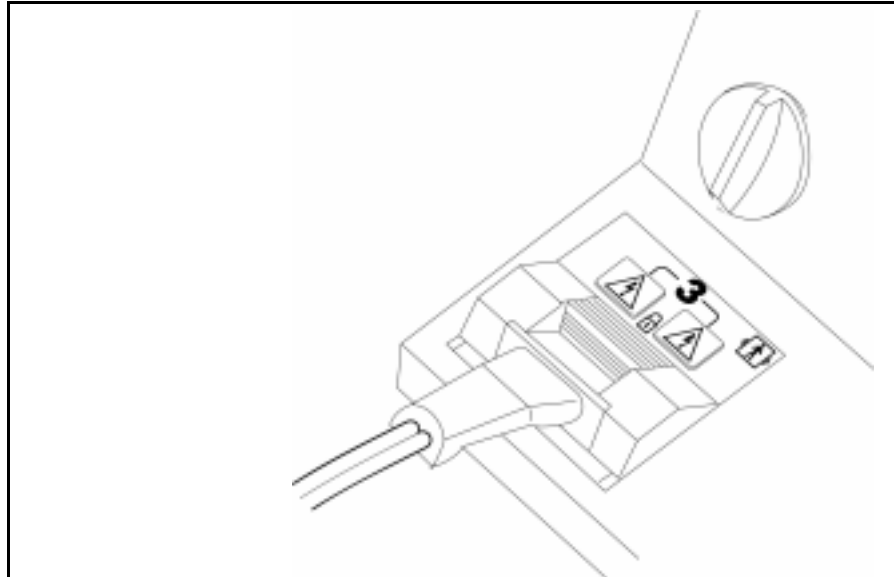
- 1** Verify that no one is in contact with the patient, the cable or pad electrodes, the bed rails, or other potential current path.
- 2** Call out “Clear!” to alert personnel that a defibrillator shock is about to be delivered and to remain away from the patient.
- 3** Press both **Shock** buttons simultaneously to defibrillate. The **Shock**  buttons are on the cable connector housing shown in Figure 4-4. If the defibrillator does not shock, refer to Chapter 12, “Troubleshooting”.

Figure 4-4



Shock Buttons

- 4 After the defibrillator charges, press the **Shock** buttons promptly. If the shock is not delivered within 30 seconds, the HP CodeMaster 100 disarms and the energy level remains the same for the next shock.

NOTE

You can disarm the defibrillator by switching the **Energy Select** control to the **Off** or **Monitor On** positions. If you disarm the defibrillator by turning the **Energy Select** control to **Off**, the energy select sequence is reset to its original charge settings.

No Shock Advised

If a non-shockable rhythm is detected, the message NO SHOCK ADVISED displays for about 30 seconds. Continue CPR and basic life support, as directed by your system's protocol. At any time, you can analyze the patient's cardiac rhythm again to determine if shock is needed by pressing **Analyze**.

After Using the Defibrillator

If you want to print an Event Summary now, press **Review**. (See “*Printing the Advisory Event Summary Record*” on page 4-16.) After you use the defibrillator, perform the following steps to prepare the defibrillator for its next use.

- O Clean all paddles, controls, and cables. Visually check the patient cables, paddles, paddles cables, and pads adapter cables for wear, insulation nicks, and other damage. Refer to Chapter 13, “Maintenance” for additional information.
- O Turn on the HP CodeMaster 100. If the instrument displays **LOW BATTERY**, replace the battery pack with a charged battery.
- O Perform the test described in “*Delivered Energy and Shock Button Functional Test*” on page 13-3.
- O Turn the **Energy Select** control to **Off** and return the HP CodeMaster 100 to its storage location.
- O Check that sufficient recorder paper and electrolyte medium or multifunction defib electrodes are available for the next use of the defibrillator.
- O Make sure that a battery is in the battery support system being charged. See “Charging the Battery” on page 13-14.

Printing the Advisory Event Summary Record

The advisory event summary record contains information about the resuscitation attempt while in advisory mode. When you print the summary, a header record and event summary directory print before the stored ECGs. ECGs related to events print after the directory record.

NOTE

The advisory event summary record, which is available only in advisory mode, is independent of the event summary described in “Printing the Event Summary Record” on page 5-12, which is available only in manual mode.

CAUTION

Passing through the Off position on the Energy Select switch more than once from Advisory Mode to Manual Mode and the initiation of an Event creates a new patient summary record which could cause data loss.

Figure 4-5

PATIENT _____		COMMENT []
OPERATOR _____		
POWER ON	21 AUG 00 13:55:22	
LAST EVENT	21 AUG 00 13:57:39	
TOTAL SHOCKS 2		

PADS ON	13:55:23	CHARGING TO 200J	13:56:13
ANALYZING	13:55:25	SHOCK # 2	13:56:17
SHOCK ADVISED	13:55:33	PADS OFF	13:56:25
CHARGING TO 200J	13:55:33	NO PADS	13:56:31
SHOCK # 1	13:55:39	PADS ON	13:56:35
PADS OFF	13:55:45	ANALYZING	13:56:43
PADS ON	13:55:47	NO SHOCK ADVISED	13:56:49
ANALYZING	13:55:51	ANALYZING	13:56:53
NO SHOCK ADVISED	13:55:57	SHOCK ADVISED	13:57:01
ANALYZING	13:56:05	CHARGING TO 360J	13:57:05
MARK	13:56:09	DISARM	13:57:39
SHOCK ADVISED	13:56:11		

Advisory Event Summary Record

To print the advisory event summary record, press **Review**.

To stop printing the advisory event summary, press **Review** or **Record**.

To review the advisory event summary after the instrument has been turned off or is turned to manual mode, turn the **Energy Select** control to **Advisory On** and press **Review**.

The header record lists when power on occurred, when the last event occurred, and how many shocks were delivered. The record also includes areas for you to write in the patient's name, the operator's name, and any comments about the event.

The directory lists all events that occurred during the resuscitation attempt and the time of their occurrence.

Using Shock Advisory Mode (Optional)
Printing the Advisory Event Summary Record

The following table lists the events the directory shows.

Table 4-2

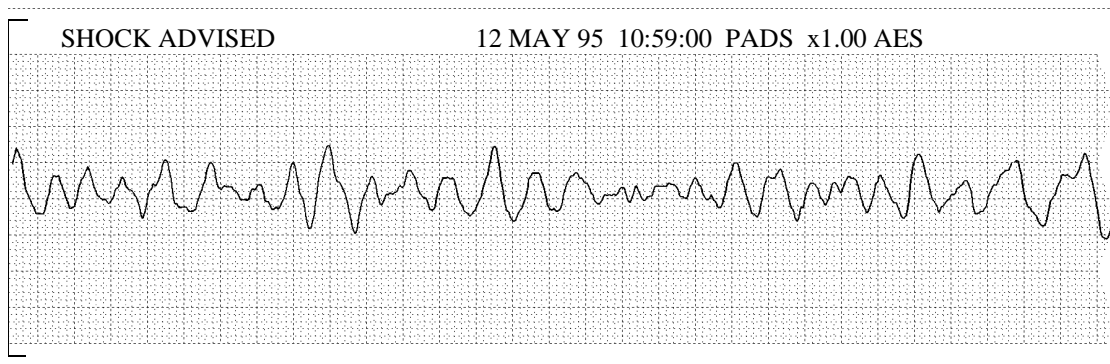
Advisory Event Summary Record Information

Event	Description	Notes
Analyzing	Indicates when the advisory algorithm started analysis (Analyze pressed).	
Artifact Detected	Indicates that the advisory algorithm detected excessive artifact.	
Shock Advised	Indicates when the advisory algorithm detected a shockable rhythm and advised a shock.	ECG strip recorded
No Shock Advised	Indicates that the advisory algorithm detected a non-shockable rhythm and did not advise a shock.	ECG strip recorded
Cannot Analyze	Indicates that the advisory algorithm could not analyze the cardiac rhythm due to excessive artifact.	ECG strip recorded
Analysis Stopped	Indicates that the user stopped the advisory algorithm analysis by pressing the Analyze key during analysis.	
Pads Off	Indicates that the multifunction defib electrodes were removed from the patient.	
No Pads	Indicates when electrode adapter cable was disconnected from defibrillator.	
Pads On	Indicates when multifunction defib electrodes were connected to the patient.	
Mark	Marker symbol (t) annotates strip when Mark was pressed.	ECG strip recorded
Charging to nnnJ	Indicates when automatic charge sequence began (after advisory algorithm advised a shock).	
Shock	Indicates when shock was delivered, delivered energy, peak current and patient impedance.	ECG strip recorded
Disarm	Indicates when the defibrillator performed an internal disarm sequence.	

The HP CodeMaster 100 automatically records 11 second ECG strips for Shock Advised, No Shock Advised and Cannot Analyze events. You can record other events by pressing **Mark**. For **Mark** events and shock events, ECGs are written from 3 seconds before the event to 8 seconds after the event is over. Approximately 200 events and 50 ECG strips can be stored.

Figure 4-6 shows a sample ECG strip.

Figure 4-6



Sample ECG Strip

Clearing Advisory Event Memory

The instrument retains event information after you turn the instrument off. Memory clears when the HP CodeMaster 100 is turned on, placed in Advisory Mode, and **Analyze** pressed or a new ECG strip is recorded (see Table 4-2, "Advisory Event Summary Record Information"). Memory does not clear if the HP CodeMaster 100 is simply turned on, or if the instrument is used in manual mode. This allows you to turn the instrument off or enter manual mode and later return to advisory mode to print the advisory event summary record.

NOTE

Turn the defibrillator off between patients to ensure that the advisory event summary records are patient specific.

Advisory Mode Default Settings

The HP CodeMaster 100 contains default settings for use in Advisory mode. Some of the settings can be altered using the Setup Menu.

The following settings can be changed:

- Default energy select sequence. You can choose to change the sequence from the factory default settings for a sequence of 200, 200, and 360 Joules, to a sequence of 200, 300, and 360 Joules. The energy level for the third shock and all subsequent shocks will be 360 Joules.
- Post Shock Data: On/Off.

When operating in Advisory mode, the following settings cannot be changed:

- Charge done tone: always sounds.
- CRT alert tones: always sounds.
- Alert tone volume: always at the maximum volume.
- Recorder delay: no delay.
- Recorder Bandwidth: always Monitor bandwidth.
- Automatic Recordings: always off.
- Power on Lead: always PADS/PADDLES.
- Notch Filter: always on.

Monitoring

This chapter contains information about monitoring a patient with the HP CodeMaster 100, details of patient preparation that apply to the synchronized cardioversion, and pacing procedures.

The HP CodeMaster 100 can be used for either short-term or long-term cardiac monitoring. A fully charged HP M2476B 2.5 amp-hour NiCd battery provides a minimum of two hours of continuous monitoring. A fully charged HP M2477B 4.0 amp-hour NiCd battery provides a minimum of three hours of continuous monitoring time.

CAUTION

Not intended for use with internal electrodes.

Using Leads to Monitor

The monitoring functions of the HP CodeMaster 100 may be performed through any of the ECG sources shown in Table 5-1. The leads which may be monitored are dependent upon the ECG source and whether the defibrillator is configured to monitor a 3 or 5-wire patient cable. Once an ECG source is determined, the **Lead Select** control is used to choose the desired lead to monitor.

Table 5-1 lists ECG sources and appropriate Lead Select choices for each source.

Table 5-1

Cardiac Monitoring Configurations

For this ECG source...	Use this lead wire set/cable type...	Set Lead Select to... ¹
3-wire:	12-pin - M1605A/M1500A (AAMI) or 12-pin - M1615A/M1510A (IEC)	I, II, III
5-wire:	12 pin - M1625A/M1520A (AAMI) or 12-pin - M1635A/M1530A (IEC)	I, II, III, aVR, aVL, aVF, V ²
10-wire	12 pin patient cable - M3714A (AAMI) or 12 pin patient cable - M3715A (IEC)	I, II, III, aVR, aVL, aVF, V ³
Multifunction Defib Electrode	Electrode adapter cable: M2472A	PADS
Paddles	Standard with instrument M2471A	PADDLES

¹The Lead Select choices are always I, II, III when the defibrillator is configured for a 3-wire cable; the choices are always I, II, III, aVR, aVL, aVF, V when configured for a 5-wire cable.

²The actual V lead shown is dependent upon electrode placement.

³V₁ with 12-Lead only will be displayed when the V lead is selected.

NOTE

When multifunction defib electrodes are used to pace-on-demand, an alternate ECG source must be used for monitoring and **Lead Select** should be set to the desired monitoring lead.

Preparing the Leads for Monitoring

You can configure the HP CodeMaster 100 to use either a 3-wire, 5-wire, or 10-wire patient cable (with the 12-Lead option). Use the procedure as described in Table 2-2 on page 2-12 to set up the patient cable type (3-wire, 5-wire, 10-wire).

3-Wire Patient Cable

Table 5-2 describes typical lead-wire placement using the 3-wire patient cable. Table 5-3 shows how the individual leads are formed using the individual leadwires.

Table 5-2

3-Wire Electrode Placement

Electrode	Placement
RA/White	Near right midclavicular line, directly below the clavicle.
LA/Black	Near the left midclavicular line, directly below the clavicle.
LL/Red	Below the left pectoral muscle on the left midclavicular line.

Table 5-3

Lead Formation

Lead	+	—	ref
I	LA	RA	LL
II	LL	RA	LA
III	LL	LA	RA

5-Wire Patient Cable/10-Wire Patient Cable

Table 5-4 describes a typical lead-wire placement using the 5-wire or 10-wire patient cable. Table 5-5 shows how the individual leads are formed using the individual leadwires.

Table 5-4

Electrode Placement

Electrode	Placement
RA/White	Near right midclavicular line, directly below clavicle.
LA/Black	Near left midclavicular line, directly below clavicle.
LL/Red	Below the left pectoral muscle on the left midclavicular line.
RL/Green	Below the right pectoral muscle on the right midclavicular line.
V/Brown	As appropriate for the V lead to be monitored (V1 - V6). Note that for the 10-wire patient cable, all V ₁ -V ₆ leads are monitored on the 12-Lead display and that the CRT only displays V ₁ .

Table 5-5

Lead Definitions

Lead	Lead Formation
I	LA – RA
II	LL – RA
III	LL – LA
aVR	$RA - \frac{LA + LL}{2}$
aVF	$LL - \frac{RA + LA}{2}$
aVL	$LA - \frac{RA + LL}{2}$
V _x	$V - \frac{RA + LA + LL}{3}$

Preparing the Patient

Proper application and placement of electrodes is essential for quality ECG monitoring. Good contact between the electrode and the skin reduces the effects of motion artifact and signal interference.

- 1 If necessary, shave hair from the site to ensure good electrode to skin contact.
- 2 Clean and abrade the skin then wipe it dry.

NOTE

You can safely monitor a patient during defibrillation. However, monitoring electrodes can become polarized during defibrillation shock, causing the ECG waveform to briefly disappear from the display. You can reduce this effect by using silver-silver chloride electrodes.

WARNING

Be sure that the electrodes or lead wire tips do not come in contact with any other conductive materials, including earth-grounded materials, especially when connecting or disconnecting electrodes to/from a patient.

- 3 Attach disposable monitoring electrodes by performing the following steps:
 - a. Peel the protective backing from the electrode. Be careful to keep adhesive surface free from electrolyte medium.
 - b. Apply the electrodes firmly to the patient's skin, pressing around the entire edge of the electrode.
 - c. Snap lead wires onto electrodes, assuring good contact between the electrode and the lead end. Tape the lead wire to the skin to prevent the electrode or lead from loosening.
 - d. Plug the patient cable connector into the ECG input connector on the lower front of the defibrillator, behind the carrying handle.

Monitoring
Preparing the Patient

NOTE

The HP 12-Lead patient cable can only be used with snap ECG monitoring electrodes. Use only Hewlett-Packard approved ECG monitoring electrodes. Do not mix reusable and disposable electrodes.

Be careful to correctly align the cable plug when connecting the patient ECG leads cable to the HP CodeMaster 100. Correctly orient the cable plug key with the connector slot. If the ECG leads cable falls out or is incorrectly connected, the message **LEADS OFF** appears on the display.

ECG Monitoring Electrodes

Using Multifunction Defib Electrodes

Multifunction defib electrodes (M3501A, M3502A, M3503A, M3504A) allow you to monitor, defibrillate, and perform synchronized cardioversion. In order to perform pacing, you must attach both ECG monitoring electrodes and defib electrodes. To use defib electrodes, perform the following steps.

- 1 Attach multifunction defib electrodes as instructed on the package.
- 2 Attach the electrode adapter cable (M2472A) to the defibrillator.
- 3 Connect the defib electrodes to the electrode adapter cable. The electrodes are correctly connected when the locking ring is twisted, locking the ears of the connector to the adapter cable.
- 4 Use the **Lead Select** button to select PADS as the ECG source.

Using Paddles

For an emergency evaluation you can monitor a patient's ECG through the paddles electrodes when leads are not attached to the patient.

WARNING

Do NOT use paddles to monitor the ECG during elective cardioversion procedures when the HP CodeMaster 100 is in synchronous (SYNC) mode. Refer to Chapter 7, "Performing Synchronized Cardioversion", for detailed information on performing elective cardioversion.

Monitoring a Patient the CodeMaster 100

Refer to “Monitor Operating Controls” on page 1-7. To monitor a patient's ECG with the HP CodeMaster 100, perform these steps:

- 1 Prepare the patient for ECG monitoring as described in “Preparing the Patient” on page 5-5.
- 2 Turn the **Energy Select** control to the **Monitor On** position.
- 3 Press **Lead Select** to select the ECG source. The selected source appears in the upper right corner of the display. For example, **PADS** appears on the display when it has been selected.

If the message **LEADS OFF** or **PADS OFF** appears on the display, inspect the electrodes, patient cable, leadwires, and associated connections. If the selected ECG source is not connected, a dashed line replaces the normal ECG trace.

- 4 Ensure that the ECG size has been automatically adjusted for optimal size. If you wish to reduce the ECG size, press **ECG Size**. The "gain bar" along the left side of the display represents 1 mV of signal amplitude.

NOTE

Autogain allows an initial quick set up when the HP CodeMaster 100 is turned on to automatically size the ECG based on the signal from the patient. To turn off Autogain, press **ECG Size**. You then must adjust the ECG size manually.

It is recommended that you manually adjust the gain during routine patient monitoring.

-
- 5 Adjust the QRS beeper volume (using ) to the desired volume.

Heart Rate Alarms

The HP CodeMaster 100 provides three configurable pairs of upper and lower heart rate alarm limits. Each pair of heart rate alarm limits can be defined as described in Table 2-1 on page 2-11. While monitoring, you can select and enable any pair of pre-defined limits using **HR Alarm**.

When heart rate alarms are inactive, the monitor will display .

To select a pair of heart rate alarm limits, press **HR Alarm** until the pair of limits you wish to use are displayed. If you do not press the key again, the displayed heart rate alarm limits become active and the limits are replaced by the bell symbol.

If the heart rate alarm limits are violated, the heart rate alarm limits replace the bell symbol, and the violated limit is highlighted. Pressing **HR Alarm** at this point will turn off the heart rate alarms.

If the heart rate alarms are active and you wish to review the limits, press **HR Alarm**. The currently active pair of heart rate alarm limits are displayed momentarily.

If the heart rate alarms are active and you wish to select another pair of limits, press **HR Alarm** until the pair of limits you wish to use are displayed. Pressing **HR Alarm** repeatedly cycles through the three pairs of heart rate alarm limits and the heart rate alarms inactive choice.

NOTE

Heart rate alarms are automatically turned off when you press **Charge**.

Recording

Recording operating controls are detailed in “Recorder Operating Controls” on page 1-9.

Recording/Printing ECG and Monitoring Data

To print a record of the current ECG and of the monitor status, press **Record**.

- The upper line of the ECG strip contains a periodic report of monitor parameters (Date, Time, Heart Rate, ECG Source, ECG Size, and Recorder mode).
- The lower line of the ECG strip records asynchronous events such as Shock delivery or Heart Rate Alarm violations.
- Several graphic symbols are used to annotate events such as Shock, Heart Rate Alarms, Mark, or Sync.

You can print a 1 mV, 200 ms calibration pulse on the ECG strip by pressing both arrows on the **ECG Size** key simultaneously.

Table 2-2 on page 2-12 contains a list of configuration settings which affect recorder operation. The recorder can be configured for either monitor or diagnostic ECG bandwidth data. Delayed (6 seconds) or non-delayed operation is also configurable.

Automatic Recordings

As described in Table 2-2 on page 2-12, you can enable or disable any of the following automatic recordings:

- Record on Mark
- Record on Charge
- Record on Shock
- Record on Alarms

The automatic recordings for both delayed and non-delayed recorder modes of operation are defined in Table 5-6. All event summaries (except for shock advisory) are 3 seconds pre- and 8 seconds post-events. If in delayed mode, each event prints with a 6 second pre-event strip prior to the event.

Table 5-6

Automatic Recordings

Event	Delayed mode Post-event time	Non-Delayed mode Post-event time
Mark pressed	3 seconds	3 seconds
Charge	Until Shock or Disarm event	Until Shock or Disarm event
Shocking the patient	12 seconds	12 seconds
Alarms violation	6 seconds	6 seconds
Disarm	3 seconds	3 seconds
Test discharge	3 seconds	3 seconds

Post Shock Data

As described in Table 2-2 on page 2-12, you can enable or disable the recording of post shock statistics.

- If Post Shock Data is enabled, the defibrillator will record the shock delivery statistics (Actual Delivered Energy, Patient Impedance, Peak Current).
- If Post Shock Data is disabled, the defibrillator will record the energy to which it was charged as the delivered energy. For example, if the unit was charged to 200J, the delivered energy annotation on the ECG strip would be DEL 200J.

Printing the Event Summary Record

During defibrillator usage, the monitor stores up to 28 ECG strips of critical information called events. Events include all shocks, heart rate alarm violations, SpO₂ alarm violations, and mark events. Each event record includes date of event, heart rate, SpO₂ reading, ECG source, and size setting as shown in Table 5-7. The time annotated on the ECG strip is within 8 seconds of the recorded event. The message "ES" is printed at the top of the ECG strip when you print the Event Summary record.

Table 5-7

Event Summary Record Information	
Event	Event Summary Description
Shock	Shock#, Delivered energy, peak current and patient impedance.
Heart Rate Alarms violation	Heart Rate alarm limits.
SpO ₂ Alarms violation	SpO ₂ alarm limits.
Mark	Marker symbol (▼) annotates strip at point Mark was pressed.

- To print the Event Summary on the recorder, press **Review**. The recorder must not be printing to print an Event Summary with this key.
- To stop printing the Event Summary, press **Review** or **Record**.
- To review the Event Summary later, turn the unit on and press **Review**.

NOTE

The Event Summary record is cleared each time the defibrillator is turned on and a new event occurs. This allows you to turn off the defibrillator and return later to review event information such as code statistics.

Turn the defibrillator off between uses to ensure that Event Summary records are patient specific.

Recorder Errors

The message `CHECK RECORDER` appears on the screen if an error occurs while recording. If this message appears, check the recorder paper supply. This message may also appear if the recorder door is open.

External Monitoring

The ECG output provides an analog 1V/mV ECG signal for connection to a Hewlett-Packard external monitor. Hewlett-Packard compatible external monitoring divider cables are as follows.

Table 5-8

External Monitoring Cables

1000:1 Voltage Divider Cable Connector Type	HP Part No.
Twelve Pin	M1783A
Six Pin	M1782A

NOTE

The ECG output is also compatible with the interface to the HP Viridia Information Center and other HP central stations.

NOTE

Do not use the ECG output to synchronize another defibrillator. (The ECG-In to ECG-Out delay is 35 milliseconds.)

WARNING

The connection of external equipment may increase leakage currents. Always request that local safety personnel verify that multiple connected equipment comply with local regulatory standards before putting such equipment into service.

Using the 12-Lead Option

Introduction

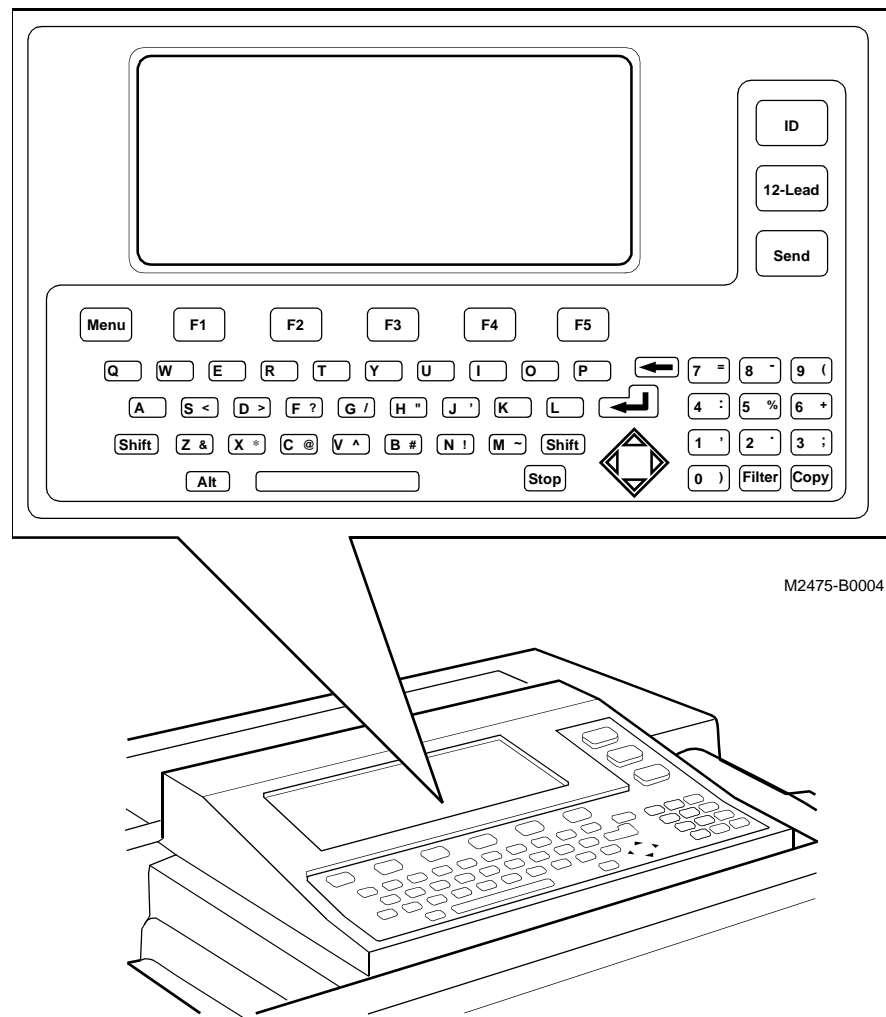
The 12-Lead option adds 12-Lead electrocardiograph capabilities to the HP CodeMaster 100. It enables you to view, acquire, store, print, and transmit 12-Lead ECGs. You can configure this feature to provide an interpretation of the ECG to further aid in patient diagnosis. The 12-Lead option includes:

- 12-Lead acquisition and printing for on-site interpretation
- preview display to scroll through all 12 leads
- computerized ECG analysis or interpretation
- internal modem (US, Canada, and UK) and combined landline/cellular for ECG transmission
- RS-232 port for use with external modem
- phone directory with auto dial with storage of up to 18 transmission sites
- storage of up to 30 ECGs
- backlit LCD display
- shared patient cable connector with the HP CodeMaster 100
- compatible with HP TraceMaster ECG Management System (M1730B or M1729B) and HP ECG Manager (M1765A)

12-Lead Keyboard and Display

This section discusses the 12-Lead keyboard and provides detailed descriptions of all the function keys. Refer to Figure 6-1 for an illustration of the 12-Lead keyboard.

Figure 6-1



12-Lead Keyboard and Front Panel

Using the 12-Lead Option
12-Lead Keyboard and Display

Table 6-1

12-Lead Keyboard







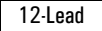














Key	Description
	Displays the Main menu, unless an ECG report is in-process. Use the STOP key to return to the home screen on the 12-Lead display.
	These five keys (F1 – F5), located directly beneath the display window, perform different functions at different times. They are called “softkeys.” When a softkey is active, a label describing its function is displayed above it on the screen. Press the key to perform the function displayed on the screen.
	Used to enter shifted characters.
	To enter the characters shown above the letter keys (see Figure 6-2 for language-specific keys), press the  key with the desired letter.
	Allows patient identification entry, review, and edit.
	Initiates 12-Lead ECG acquisition.
	Initiates ECG transmission.
	Turns filters on and off. The filter (or filters) controlled by this key are selected during 12-Lead configuration.
	The Enter key.
	Halts any 12-Lead activity and restores the normal ECG display.
	Prints a copy of the last ECG. If an ECG is not in the Copy buffer, the system displays the Manage Stored ECGs screen and prompts you to select the ECG to print. The setting for this key defaults to the number of copies set in the Copy Count feature (1-4 copies with a default of 2).
	To view lead groups, use the  or  keys to move to the next lead group, and the  or  keys to move to the previous lead group. The  or  keys move the cursor down on configuration displays and patient ID information screens. The  and  keys move the cursor up.

Figure 6-2

Key	English		French		German		Dutch		Spanish		Italian		Norwegian		Swedish		Finnish	
	alt	ALT	alt	ALT	alt	ALT	alt	ALT	alt	ALT	alt	ALT	alt	ALT	alt	ALT	alt	ALT
A	à		à		ä		ä		á		à		ä		ä		ä	
B	#	}	#	}	#	}	#	}	#	}	#	}	#	}	#	}	#	}
C	@		@		@		@		@		@		@		@		@	
D	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>
E			é				é		é		é		æ					
F	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
G	/	\	/	\	/	\	/	\	/	\	/	\	/	\	/	\	/	\
H	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
I			í						í		í							
J	‘	’	í		‘	’	‘	’	í		í		‘	’	‘	’	‘	’
K																		
L			ù						ñ		è							
M	~]	~]	~]	~]	ñ		é		~]	~]	~]
N	ı		ı		ı		ı		ı		ı		ı		ı		ı	
O			ô		ö		ö		ó		ò		ø		ö		ö	
P			ç		ß		f											
Q			à												å		å	
R															Ä		Ä	
S	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
T			û		ü		ü		ú		ù				ü		ü	
U			û		ü		ü		ú		ù				ü		ü	
V	^	{	^	{	^	{	^	{	^	{	^	{	^	{	^	{	^	{
W			ë						ó		ò							
X	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Y			ý		ÿ		ÿ		ý		ÿ							
Z	&	\$	&	\$	&	\$	&	\$	&	\$	&	\$	&	\$	&	\$	&	\$

Characters by Language

Patient and Operational Safety Notes

The HP CodeMaster 100 with the 12-Lead option isolates all connections to the patient from electrical ground. This reduces the possibility of hazardous currents passing from the device through the patient's heart to ground. To ensure the patient's safety and your own, observe the following reminders:

WARNING

The HP patient cable supplied with this device, or an HP approved substitute patient cable, is an integral part of the defibrillator/monitor safety features. Using any other patient cable may compromise defibrillation protection as well as performance. Only qualified personnel may service the device.

WARNING

Do not use the HP CodeMaster 100 with 12-Lead near flammable anesthetics. It is not intended for use in explosive environments.

Do not use the HP CodeMaster 100 with 12-Lead in the presence of electrosurgical or diathermy instruments.

Do not touch the patient or patient cable during defibrillation. Death or injury may occur from the electrical shock delivered by the defibrillator.

Be sure that the electrodes or connectors do not come in contact with any other conductive materials, including earth-grounded materials, especially when connecting or disconnecting electrodes to/from a patient.

The use of multiple instruments connected to the same patient may pose a safety hazard due to the summation of leakage currents from each instrument. Any combination of instruments should be evaluated by local safety personnel before being put into service.

Do not pull on the paper while a report is being printed. This can cause distortion of the waveform and can lead to potential misdiagnosis.

WARNING

The connection of an external modem or other telecommunications equipment may increase leakage currents beyond levels that are acceptable in a patient care environment. Always request that local safety personnel verify that multiple connected equipment comply with local regulatory standards before putting such equipment into service.

Acquiring a 12-Lead ECG

This section describes how to:

- prepare the patient for an ECG
- check the signal quality of the patient leads
- enter patient ID and printed report information
- record an ECG
- change the report format
- understand the printed report

To Acquire a 12-Lead ECG:

If your HP CodeMaster 100 with 12-Lead is already configured, you can acquire an ECG by performing the following steps:

- 1** Connect the 12-Lead ECG cable to the patient.
- 2** Turn the **Energy Select** control to **Monitor On**.
- 3** Prepare the patient and apply the electrodes, as described in “Preparing the Patient” on page 6-10.
- 4** Check the signal quality on all leads.
- 5** Press the **ID** key and enter patient ID information.
- 6** Press the **12-Lead** key to obtain an ECG.

If you are using HP ACI-TIPI or TPI, the system prompts you for any missing information required for HP ACI-TIPI or TPI. See “Using HP ACI-TIPI” on page 6-18 and “Using HP TPI” on page 6-19.

The status messages `Acquiring ECG...`, `Processing...`, `Analyzing...`, `Storing ECG...`, and `Printing...` are displayed. Wait for the report to print.

If you have configured the 12-Lead option to Auto Send, the system displays the telephone directory.

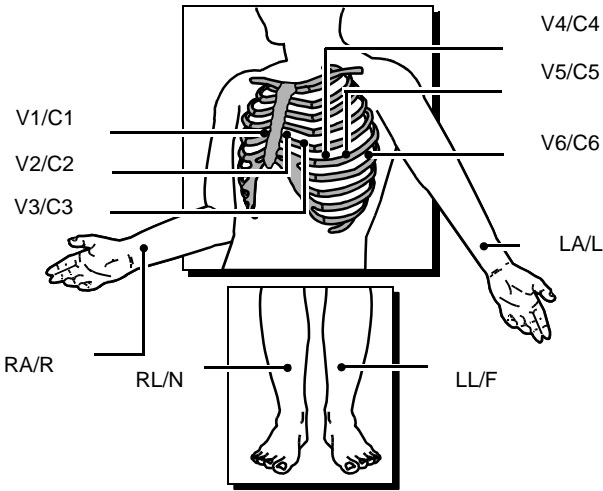
NOTE

If the memory is full and you attempt to store a new ECG, the system will “auto delete” the oldest stored ECG.

Preparing the Patient

For electrode placement information, refer to Figure 6-3.

Figure 6-3



Lead	Position
V1/C1	Fourth intercostal space, at right sternal margin.
V2/C2	Fourth intercostal space, at left sternal margin.
V3/C3	Midway between V2 and V4.
V4/C4	Fifth intercostal space, at left midclavicular line.
V5/C5	Same level as V4, on anterior axillary line.
V6/C6	Same level as V4, at left midaxillary line.
RA/R	Inside of arm, between wrist and elbow.
LA/L	Inside of arm, between wrist and elbow.
RL/N	Inside of calf, between knee and ankle.
LL/F	Inside of calf, between knee and ankle.

Electrode Placement

For tips on proper ECG technique, see the quick reference card included with this product located in the carry bag front/top panel.

NOTE

Proper patient preparation and electrode placement are the most important elements in producing a high quality ECG trace. The patient should be supine when acquiring an ECG. If this is not possible, note the patient's position and ensure this factor is considered for diagnosis.

Prepare the patient by performing the following steps.

- 1** Reassure and relax the patient.
- 2** Make sure the electrode site is not covered by hair or clothing.
Prepare the skin to ensure good contact between the skin and the electrode by gently cleaning and abrading the surface of the skin with dry gauze.
- 3** Place electrodes on the patient.
- 4** Attach each lead wire to the correct electrode.
- 5** The upper-left corner of the screen displays the electrodes that are not placed firmly on the patient and/or the lead wires that are not attached securely to the electrodes. (See Table 6-2.) This is an indication of **'leads off'**. Correct the attachment of any lead/electrode pair that appears on the screen.

Table 6-2

Leads Off Labels

Designator (AHA/IEC)	Meaning
RL/N	Right leg electrode not connected or only right leg electrode is connected and all other limb electrodes are not connected.
RA/R	Right arm electrode is not connected.
LA/L	Left arm electrode is not connected.
LL/F	Left leg electrode is not connected.
V1...V6/ C1...C6	One or more chest electrodes are not connected. For example, V2 means the V2 electrode is not connected.

Checking Signal Quality

You can produce better ECGs by previewing the lead traces on the upper display before you acquire and print the ECG. By observing the traces and adjusting the leads accordingly, you can obtain the best possible ECG report.

The leads are displayed in five groups of three leads each. The groups are listed in Table 6-3.





Restoring the ECG Trace

After application of a defibrillator pulse, reconnecting one or more leads, or any other time the ECG signal is off-center during ECG acquisition, traces can be quickly restored by pressing the **Stop** key.

Table 6-3

Lead Groups

Group	Leads Displayed
Group 1	I, II, III
Group 2	aVR, aVL, aVF
Group 3	V1, V2, V3
Group 4	V4, V5, V6
Group 5	user configurable

- To select which three leads to display on the screen, press the  or  key, or the Space bar, to display the next lead group, or press the  or  key to display the previous lead group.
- Before you connect the electrodes, each lead displays on the screen as a dotted line, indicating that at least one of the electrodes associated with the lead is not connected. **The dotted line is known as a “leads off” trace.** Use the leads off labels (see Table 6-2) to determine which electrodes are off.
- As you connect the electrodes to the patient, the lead waveforms are displayed on the screen.









NOTE

The ECG traces are updated by the erase bar that moves across the screen.

Entering Patient ID



Entering patient ID information is not required to record an ECG. Note that for 12-Lead, some ID fields affect the interpretation of ECGs.



To enter patient identification, perform the following steps (these steps assume all ID fields are enabled).

- 1 Press **ID**. If there is an existing patient ID in the 12-Lead, the question `New patient?` is displayed. If not, the patient ID entry screen is displayed.
 - a. If you press **Yes, Enter New ID** to answer the `New patient?` prompt, the existing patient ID information is cleared and the patient ID entry screen is displayed.
 - b. If you press **No, Edit Old ID** to answer the `New patient?` prompt, the existing patient ID information is displayed for you to review or change, if necessary.
- 2 Type the ID number and press , , or . The next line requests the patient's name.
- 3 Type the patient's name and press the , , or . The next line requests the patient's age. It also allows you to change the age units (Years, Year of Birth, Months, Weeks, Days, or Hours).
- 4 Type the patient's age. Press **F3** until the screen displays the age units you want to use. Press  or .

There are more patient ID fields into which you can enter patient information such as Sex and Chest/LA Pain. All of the patient ID fields are shown in Table 6-4 on page 6-16. Note that some (or all) of these fields may be inactive for your configuration.

All these fields are user-configurable through the Configure 12-Lead Menu.

Each time you press the  or , the cursor moves down to the next ID field.

To return to a previous field, move the cursor up by pressing  or .

To change or erase data you have entered, press **F1** Erase or use the **Backspace** key to delete the character to the left of the cursor.

You can stop entering patient ID information at any time by pressing **F5** (or **Stop**).


Reviewing and Changing Patient ID

To review and change the current patient ID information:

- 1** Press the **ID** key. The message `New Patient?` displays.
- 2** Press **No, Edit Old ID**. The current patient ID screen displays, and you can change any field.

Using the 12-Lead Option
Acquiring a 12-Lead ECG

Table 6-4 Patient ID Fields

Prompt	Comments	Entry	Char.# (max)
ID:	Type the ID number.	Alphanumeric	16
Name:	Type the patient name.	Alphanumeric	30
Age:	Type the patient age. Press Change Units to select the age designation: Years Year of Birth Months Weeks Days Hours	Numeric	4
Sex:	Press Change to select Male or Female or type M or F.		
Chest/LA pain?	Press Change to select: Yes, chief complaint Yes, secondary complaint No chest/left arm pain		
Time Since Acute Ischemic Sx?	Press Change Units to select the: (Hrs) and (Mins)		3
History Diabetes?		Yes or No	
History Hypertension?		Yes or No	
Blood Pressure:	Type the systolic value, then press  . Type the diastolic value	Numeric	3 each or 6
Height/Weight:	Type the height/weight.	Numeric	3
Requested by:	Type name or number of the person requesting the ECG	Alphanumeric	16
Custom Field One:	This label can be configured as needed.	Alphanumeric	16
Custom Field Two:	This label can be configured as needed.	Alphanumeric	16
Set ECG Mgmt Priority to STAT		Yes or No	

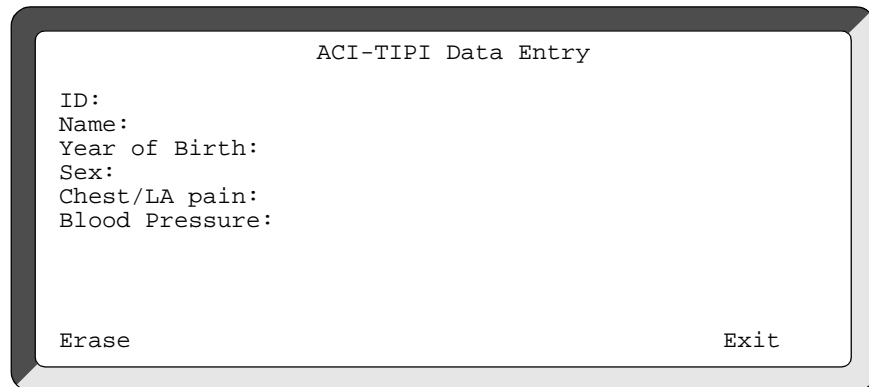
NOTE

To obtain high fidelity ECG tracings suitable for manual interpretation of the ST segment, use the 0.05 Hz or 0.15 Hz bandwidth filter selections. The 0.5 Hz baseline wander filter should not be used for manual interpretation of the ST segment.

Using HP ACI-TIPI

The 12-Lead option includes the HP Acute Cardiac Ischemia Time-Insensitive Predictive Instrument (ACI-TIPI). This feature is used to provide the predicted probability of acute cardiac ischemia by using patients demographics and ECG information.

If you have configured HP ACI-TIPI as your interpretation option, when you press the **12-Lead** key, the system displays the HP ACI-TIPI Data Entry screen as follows:

A screenshot of a medical device screen titled "ACI-TIPI Data Entry". The screen is white with a black border. It contains the following text: "ID:", "Name:", "Year of Birth:", "Sex:", "Chest/LA pain:", and "Blood Pressure:". At the bottom left, there is a button labeled "Erase", and at the bottom right, there is a button labeled "Exit".

ACI-TIPI Data Entry

ID:
Name:
Year of Birth:
Sex:
Chest/LA pain:
Blood Pressure:

Erase Exit

This screen only appears if you have not pressed the **ID** key and entered all necessary fields required for HP ACI-TIPI. The system acquires the ECG and prints a report with the HP ACI-TIPI probability.

Using HP TPI

The 12-Lead option includes the HP Thrombolytic Predictive Instrument (TPI). This feature is used to identify patients having acute myocardial infarction (AMI) who might benefit from thrombolytic therapy. Patient age, gender, time since ischemic symptom onset, history of diabetes, history of hypertension, blood pressure, and ECG features are used to predict patient outcome probabilities.

If you have configured HP TPI as your interpretation option, when you press the **12-Lead** key, the system displays the HP TPI Data Entry screen as follows:

The screenshot shows a terminal-style window titled "TPI Data Entry". Inside the window, the following text is displayed:

```
ID:
Name:
year of Birth:
Sex:
Chest/LA pain:
Time Since Acute Ischemic Sx (Min):
History of Diabetes?
History of Hypertension?
Blood Pressure:
```

At the bottom left of the window is the text "Erase", and at the bottom right is the text "Exit".

This screen only appears if you have not pressed the **ID** key and entered all necessary fields required for HP TPI. The system acquires the ECG and prints a report with the HP TPI probability.

NOTE

If the patient does not meet the HP TPI criteria, the HP CodeMaster 100 will print the standard interpretation report, in place of the HP TPI report. For HP TPI criteria, refer to the *HP Predictive Instruments Physician's Guide*.

Making Additional Printed Copies of the ECG Reports

If you require additional copies of an ECG, you may print a copy of the last ECG that was recorded. To print a copy of the ECG just acquired, press the **Copy** key. The message `Printing . . .` is displayed and the copy is printed.

Setting Up the Printed Report

This section describes the ECG report. Note that a physician must review the preliminary report. Like any computer-assisted ECG interpretation program, the Hewlett-Packard predictive instrument evaluation is not a substitute for the physician's decision process. Just as cardiologists may disagree on ECG interpretations, they may also, at times, disagree with an interpretation given by the HP predictive instruments evaluation.

Configuring the Contents of the Report

The 12-Lead option prints a report that can include a summary of all 12-leads, interpretation statements, and measurements. See Table 6-5.

Select the report type through the Setup Miscellaneous selection on the Configuration Menu. The reports that are available include:

- 12-Lead ECG
- 12-Lead ECG with HP ACI-TIPI
- 12-Lead ECG with HP TPI
- 12-Lead ECG with Measurements only
- 12-Lead ECG with Standard Adult/Pediatric

Changing the Layout and Content of the Printed Reports

The default format is set through the Configuration Menu. You can change the format and size (gain) through the ECG main screen. To change the report lead format:

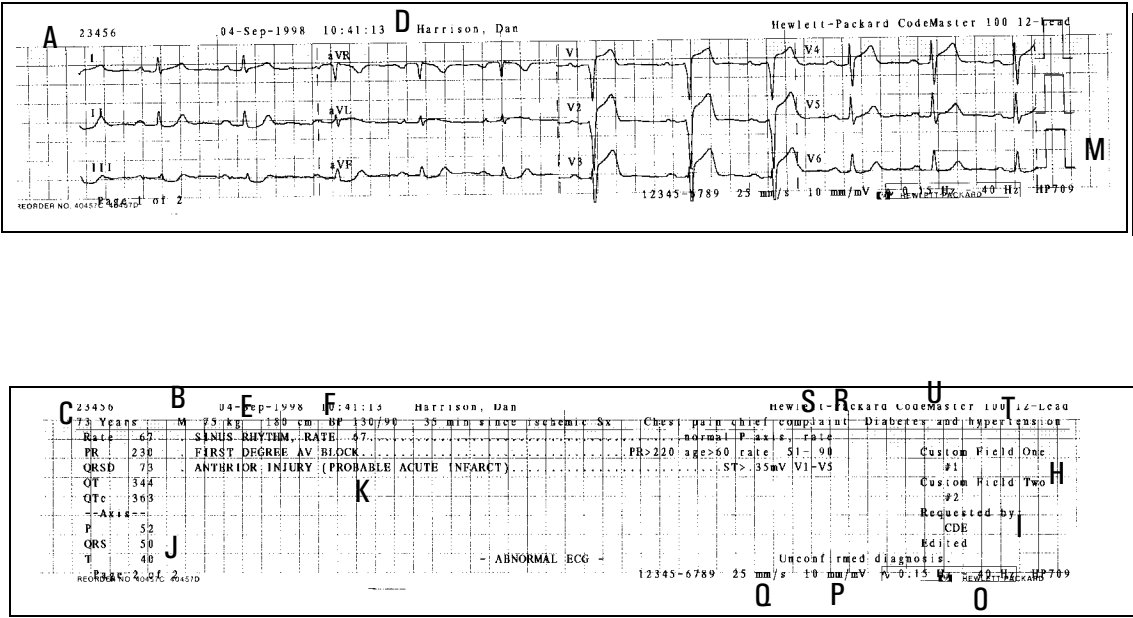
- 1** Press **Stop**.
- 2** Use the **F2** softkey to toggle through the available formats. Press **F4** to change the size.

The ECG Report

Figure 6-4 shows a sample report with all the fields identified in Table 6-5. Note that some fields must be selected in order to properly interpret/analyze the acquired ECG. Figure 6-4 illustrates a two page report.

Using the 12-Lead Option
Setting Up the Printed Report

Figure 6-4



The ECG Report

Table 6-5

Report Annotations

	Description
A	ID number
B	Sex
C	Age
D	Patient Name
E	Height/Weight
F	Systolic/Diastolic Blood Pressure (BP)
H	Custom Field One Custom Field Two Note: These fields are for user-defined labels, such as insurance number or medications.
I	Requested by: the name of the requesting physician
J	Basic measurements. See Table 6-6
K	Interpretation/Reasons
M	Calibration signal. See Table 6-7.
O	Filter settings: * Artifact filter (F) * AC Filter * Frequency response * Baseline Wander filter (W)
P	settings for speed, and for limb and chest lead sensitivity.
Q	Location code and 12-Lead ID number
R	Chest Pain Status
S	Acute Ischemic Sx Time
T	History Hypertension/History Diabetes
U	Name of Institution

Basic Measurements

The basic measurements table gives standard interval and duration measurements in milliseconds, and limb lead axis measurements in degrees. These are representative values for the dominant beat pattern in the ECG.

Table 6-6

Basic Measurements







Item	Description	Units
RATE	Heart rate	beats per minute
PR	PR interval	milliseconds
QRSD	QRS duration	milliseconds
QT	QT interval	milliseconds
QT _c	QT interval corrected for rate	milliseconds
P	Frontal P axis	degrees
QRS	Frontal mean QRS axis	degrees
T	Frontal T axis	degrees

Calibration Signals

The following table shows how the height of the calibration pulse indicates ECG sensitivity.

Table 6-7

Calibration Signals

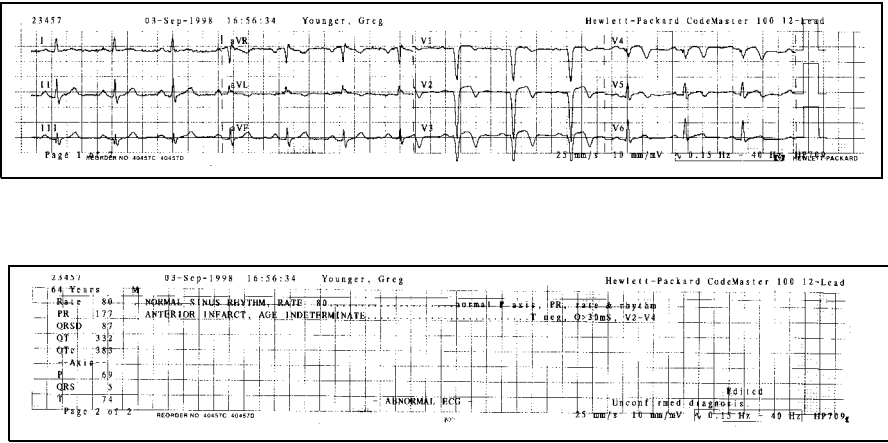
ECG Size (mm/mV)			Calibration Pulse
Display Label	Limb Leads	V-leads V1 - V6	12-Lead
0.5	5	5	
0.5 ½V	5	2.5	
1.0	10	10	
1.0 ½V	10	5	
2.0	20	20	
2.0 ½V	20	10	

Report Examples

The following figures illustrate ECG report formats with standard adult interpretation.

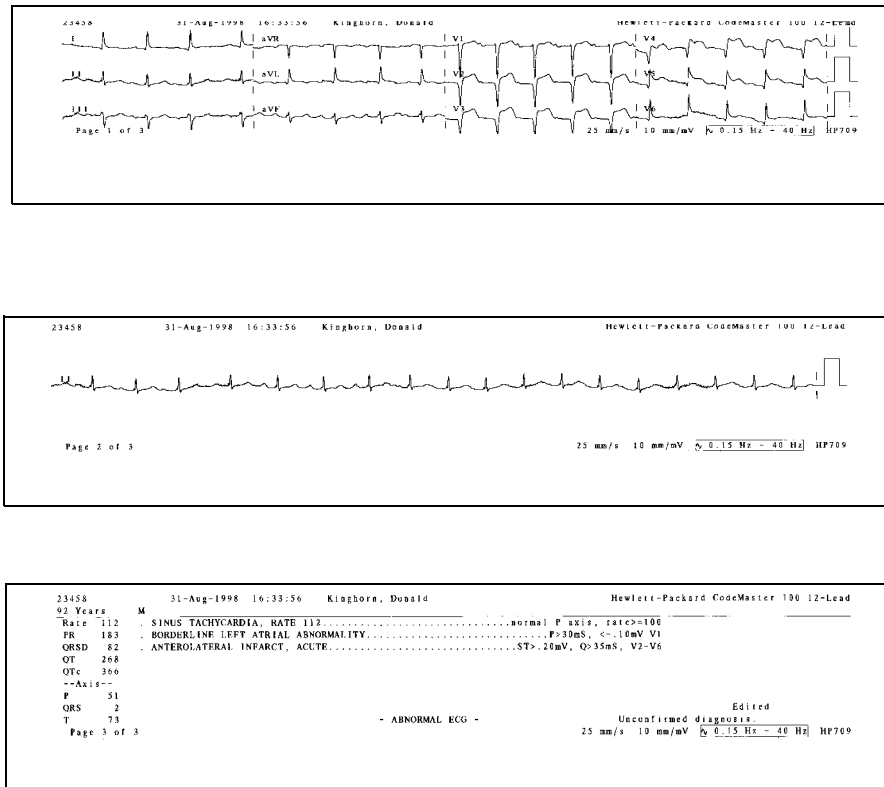
Using the 12-Lead Option
Setting Up the Printed Report

Figure 6-5



A Standard 3x4 ECG (3x4)

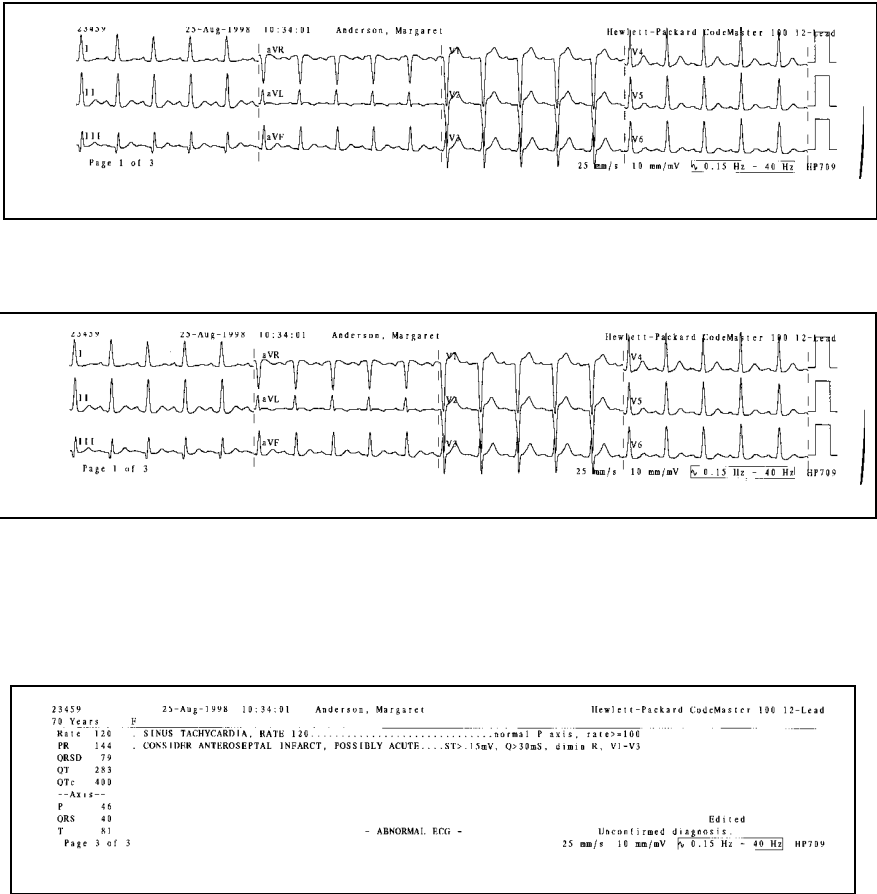
Figure 6-6



3x4 ECG with One Rhythm Strip (3x4, 1R)

Using the 12-Lead Option
Setting Up the Printed Report

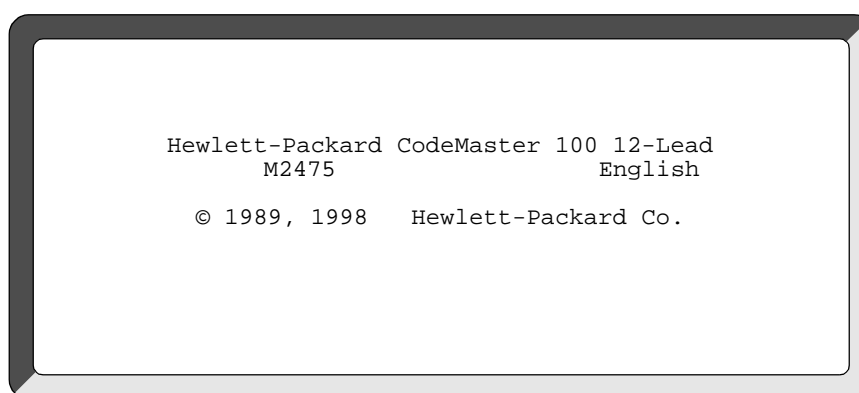
Figure 6-7



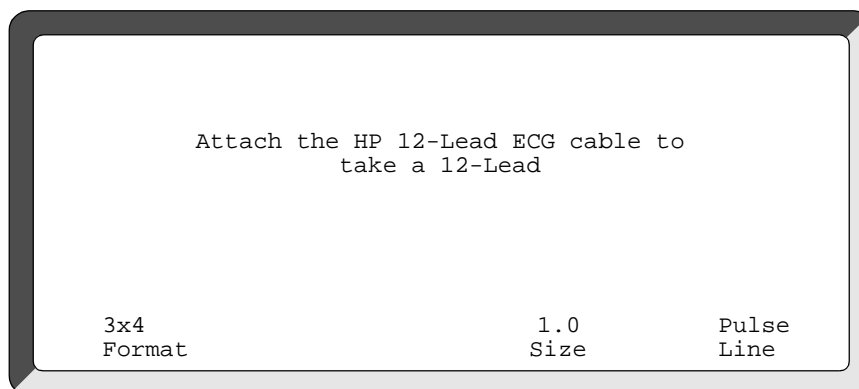
An Auto 3x4 ECG with Three Rhythm Strips (3x4, 3R)

Using the 12-Lead Main Menu

When the 12-Lead first powers on, the initialization screen briefly appears as follows:

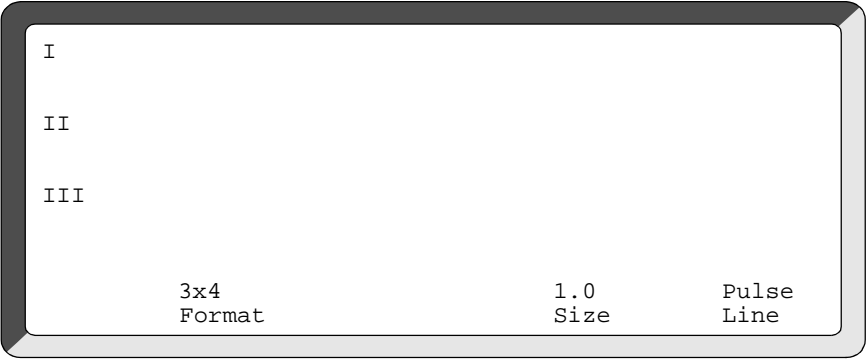


The system displays a message requesting that you attach the 12-Lead patient cable:

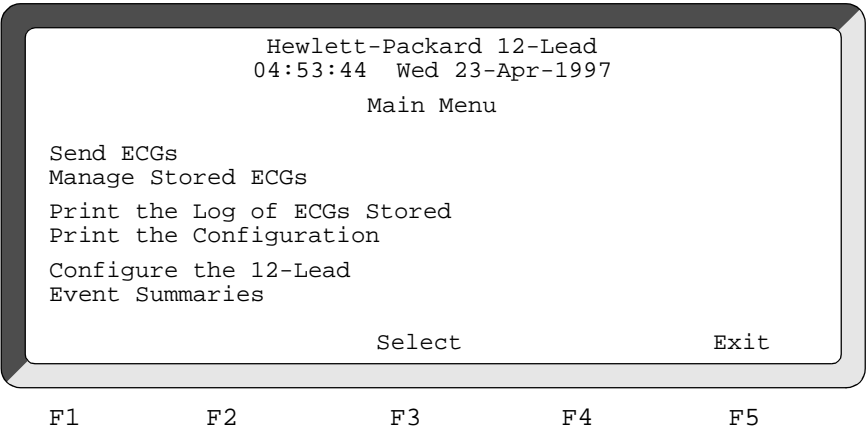


Using the 12-Lead Option
Using the 12-Lead Main Menu

After you attach the cable, the system then displays the ECG home screen as follows:



Press the **Menu** key on the 12-Lead keyboard. The system displays the Main Menu. From the Main Menu you can perform several functions. This section describes how to use each entry on the Main Menu.



Sending ECGs

One or more Stored ECGs can be "Sent" at a time. This is useful for sending ECGs to an HP TraceMaster ECG Management System for long term archival. Stored ECGs appear in this screen. The most recent ECG will appear at the top of the ECG list.

Stored ECGs can be selected and sent in three different ways.

- Highlight the desired ECG by using the Arrow button on the keypad. Once the ECG is highlighted, push the "Send ECGs" soft key. This will take you to the Telephone Directory. Highlight the site for which you want the ECG to be sent and push the "Send" soft key.
- If more than one ECG is to be sent, simply highlight a desired ECG as described above, and then push the "Select" soft key to select that ECG. Once an ECG has been selected, a "*" will appear next to it indicating that it has been selected. Additional ECGs can be selected in the same manner. After ECGs have been selected, choose the "Send" soft key.
- All stored ECGs can be selected at once by choosing the "Select All" soft key. This is a quick and convenient way to select and send all old ECGs, if desired.

The screenshot shows a screen titled "Send ECGs" with the subtitle "Screen 1 of 1" and "(2 ECGs Stored)". The screen displays a list of two ECGs with their Name/ID and Time and Date. Below the list are soft key options: "=Sent", "Select", "Select All", "*=Selected", "Send ECGs", and "Exit".

Name/ID	Time and Date
*Frank Smith ID: 12345678	10:02 10-Apr-97
Charlotte Web ID: 87654321	10:00 10-Apr-97

=Sent		*=Selected
Select	Select All	Send ECGs Exit

F1 F2 F3 F4 F5

Managing Stored ECGs

In this screen, one or more Stored ECGs can be managed at a time. Once selected, ECGs can be Deleted, Printed, or Edited.

To print or edit a stored ECG:

Highlight the desired ECG by using the Arrow button on the keypad. Once the ECG is highlighted, choose the soft key function that you want for managing the ECG.

To print or delete one or more stored ECG(s):

You can select more than one ECG at a time. Simply highlight a desired ECG as above, and then push the "Select" soft key to select that ECG. Once an ECG has been selected, a "*" will appear next to it indicating that it has been selected. Additional ECGs can be selected in the same manner. After ECGs have been selected, choose the soft key function that you want for managing the ECGs.

Manage Stored ECGs

Screen 1 of 1

(2 ECGs Stored)

Name/ID	Time and Date
*Frank Smith	10:02 10-Apr-97
ID: 12345678	
Charlotte Web	10:00 10-Apr-97
ID: 87654321	

=Sent

*=Selected

Print

Delete

Select

Edit

I.D.

Exit

F1

F2

F3

F4

F5

Printing the Log of ECGs Stored

A list of all Stored ECGs can be printed on the printer. The printed ECG Log report includes the date, time, ID, Patient Name, and ECG report format.

Print the Configuration

When you select this entry, the system will print the current configuration.

Send Event Summaries

This functionality will transmit the Event Summary to an event summary host.

HP CodeMaster 100 and 12-Lead Option Interactions

This section describes the interactions that occur between the HP CodeMaster 100 and the 12-Lead option.

- If the HP CodeMaster 100 is reset or a shock is delivered while the 12-Lead option is attempting to acquire or store an ECG, 12-Lead operation is suspended and the ECG will be lost (with no recovery).

The HP CodeMaster 100 resets when the following occurs:

- delivering a shock
- changing modes (manual to shock advisory)
- changing the battery

To resume transmitting after the unit is reset, select the ECG from the Send ECGs Menu and press **Send**.

- The 12-Lead option does not operate while the HP CodeMaster 100 is set to Shock Advisory mode.
- Low Battery information from the HP CodeMaster 100 displays on the 12-Lead screen.
- When the language option is changed in SETUP MENU 1 on the HP CodeMaster 100, the 12-Lead user interface will display the new language upon the next power on .
- Since the HP CodeMaster 100 and 12-Lead option share the 50mm recorder, any action which would normally cause the HP CodeMaster 100 to print will interrupt any report printing on the 12-Lead. Press *Try Again* to resume 12-Lead printing.

Performing Synchronized Cardioversion

This chapter contains information about performing synchronized cardioversion on a patient with the HP CodeMaster 100.

Refer to “Preparing the Patient” on page 5-5 for information on patient preparation.

Performing Cardioversion

Treatment for certain arrhythmias requires synchronizing a defibrillator shock with the ECG’s R-wave. It is essential that this R-wave is detected to avoid inducing ventricular fibrillation.

Monitoring During Cardioversion

Using an External Monitor

WARNING

Whenever possible, Hewlett-Packard recommends that you perform synchronized cardioversion procedures while directly monitoring the patient through the multifunction defib electrodes or ECG leads inputs.

If you use an external monitor as the ECG source, ask your biomedical technician to verify that the CodeMaster 100 defibrillator and external monitor combination will deliver a synchronized shock within 60 ms of the peak of the R-wave. (See the *HP M2475B CodeMaster 100 Portable Defibrillator/Monitor Service Manual* for test procedure.) Use a 1 mV QRS complex with a QRS width of 40 ms. This performance cannot be guaranteed with all commercially available monitors.

Performing Synchronized Cardioversion
Performing Cardioversion

There are three ways to monitor ECG for synchronized cardioversion: use an external ECG monitor; connect ECG electrodes to the HP CodeMaster 100; or use multifunction defib electrodes.

External ECG monitor When the patient is already connected to bedside monitoring equipment, there is an external monitoring cable which plugs into the ECG Output jack of the bedside monitor and connects to the HP CodeMaster 100 ECG Input for monitoring. To use an external monitor, perform the following steps:

- 1** Select Lead I or Lead II on the HP CodeMaster 100.
- 2** Plug the cable into the external monitor ECG Output jack and plug the input end of the cable into the ECG input plug on the HP CodeMaster 100.

Using ECG electrodes with the HP CodeMaster 100 Use a patient cable connected to the patient and select Lead I, Lead II, or Lead III, choosing the best lead that displays a large QRS complex.

Using multifunction defib electrodes Use the electrode adapter cable (M2472A) and defib electrodes, selecting PADS as the ECG source.

Using Paddles for Performing Synchronized Cardioversion

To start cardioversion, perform the following steps.

- 1** Turn the **Energy Select** control to **Monitor On**.
- 2** Select the desired ECG lead by pressing **Lead Select**.
- 3** Press **Sync** once to place the HP CodeMaster 100 in Sync mode. The message SYNC appears on the display.

WARNING

If you select paddles as the ECG source, the message USE LEADS will appear on the display. Although the HP CodeMaster 100 will allow synchronized shock in paddles ECG mode, leads mode is recommended. Artifact induced by moving the paddles may resemble an R-wave and trigger defibrillator shock.

You can perform cardioversion in Autogain mode. Always inspect the displayed ECG before delivering the counter shock. Verify that an R-wave marker (indicating shock point) appears only with each R-wave. If a marker dot does not appear, or if a marker dot is viewed on the T-wave segment of the ECG, follow these instructions:

- Adjust the ECG size by pressing **ECG Size** until the marker dot appears only with each R-wave.
 - Select a different lead or adjust the electrode placement, if necessary, to improve ECG R-wave quality.
- 4** Select the desired energy level with the **Energy Select** control.

Applying the Paddles

- 1 Prepare the paddles by performing the following steps:
 - a. Remove the paddles from their holders by grasping the handles and lifting straight up.
 - b. Holding both paddles in one hand, apply electrolyte medium to both paddle electrode surfaces.

WARNING

To avoid the risk of electrical shock or burns, do not allow electrolyte medium to accumulate on your hands, the paddle handles, or the paddle electrodes on the patients chest.

CAUTION

Do not rub the electrode surfaces together to distribute the applied electrolyte medium. Placing the electrode surfaces together increases the risk of an accidental paddle-to-paddle discharge and may cause damage to the surface of the paddles.

- 2 Apply the paddles to the chest as follows.
 - a. Place the Sternum paddle to the right of the sternum just below the clavicle.
 - b. Place the Apex paddle on the chest just below and to the left of the left nipple, in the anterior-axillary line.
- 3 Rub the paddles lightly against the skin to distribute the electrolyte medium and increase the contact between the patient skin and the paddles.

WARNING

To avoid the risk of burns to the patient, do not spread electrolyte medium between the paddle electrodes on the chest. The patient can be burned if the medium forms a path between the electrodes.

- 4 Apply 10 to 12 kg (22 - 25 lb.) of pressure per paddle. (Refer to the paddle contact indicator on the Sternum paddle to verify paddle contact.)
- 5 Press **Charge** on either the right (Apex) paddle or on the instrument front panel.

- 6 Wait for the Charge Done indicators.

NOTE


If you must disarm the charged defibrillator (if counter shock is not needed), turn the **Energy Select** control to **Monitor On**. Any stored energy will be discharged internally and the available energy on the display will return to 0.

Resetting the Selected Energy Level

To increase or decrease the selected energy level after **Charge** has been pressed, move the **Energy Select** control to the new energy level, and wait for the Charge Done indicators.

Delivering the Synchronized Shock

To perform synchronized cardioversion:

- 1 Verify again that the ECG waveform is stable, and that a marker dot appears only with each R-wave of the cardiac cycle.
- 2 Briefly adjust paddle pressure and placement to optimize contact, as registered on the paddle contact indicator.
- 3 Depress both **Shock** () buttons (one on each paddle) until shock occurs. The defibrillator will shock with the next detected R-wave.
- 4 If additional counter shocks are required, readjust the **Energy Select** control, and repeat the synchronized cardioversion procedure.

NOTE

Depending on how the unit has been configured, it will either remain in the synchronized shock mode or it will return to defibrillator mode following a synchronized shock. Refer to Table 2-1 on page 2-11 for instructions on configuring the defibrillator for operation after synchronized cardioversion.

If the defibrillator does not shock, refer to “If the Defibrillator does not Deliver a Shock” on page 12-4.

Using Multifunction Defib Electrodes for Performing Synchronized Cardioversion

This section provides details for performing synchronized cardioversion with multifunction defib electrodes. Multifunction defib electrodes can be selected as the ECG source for cardioversion because they provide a reliable contact for monitoring.

Applying the Multifunction Defib Electrodes

- 1** Attach the electrode adapter cable (M2472A) to the defibrillator.
- 2** Attach the multifunction defib electrodes to the patient as instructed on the electrode package.
- 3** Connect the electrode cable connector to the electrode adapter cable. The electrodes are correctly connected when the locking ring is twisted, locking the ears of the connector to the adapter cable.

- 4** Turn the **Energy Select** control to **Monitor On**.

If the PADS OFF monitor message is displayed, check all patient connections.

- 5** Select pads as the ECG source by pressing **Lead Select**.
- 6** Press **Sync** once to place the HP CodeMaster 100 in Sync mode. The message SYNC will appear on the display.

You can perform cardioversion in Autogain mode. Always inspect the displayed ECG before delivering the counter shock. Verify that an R-wave marker (indicating shock point) appears only with each R-wave. If a marker dot does not appear, or if a marker dot is viewed on the T-wave segment of the ECG, follow these instructions:

- Adjust the ECG size by pressing **ECG Size** until the marker dot appears only with each R-wave.
- Adjust the placement of the multifunction defib electrodes to improve ECG R-wave quality.

7 Press **Charge** on the front panel of the HP CodeMaster 100.

8 Wait for the Charge Done indicators.

NOTE

If you must disarm the charged defibrillator (if counter shock is not needed), turn the **Energy Select** control to **Monitor On**. Any stored energy will be discharged internally and the available energy on the display will return to 0.

Resetting the Selected Energy Level

To increase or decrease the selected energy level after you press **Charge**, move the **Energy Select** control to the new energy level. Wait for the Charge Done indicators.

Delivering the Synchronized Shock

To perform synchronized cardioversion refer to the following steps:

- 1** Verify again that the ECG waveform is stable and that a marker dot appears only with each R-wave of the cardiac cycle.
- 2** Depress both **Shock** buttons on the cable connector simultaneously until shock occurs. The defibrillator will shock with the next detected R-wave.

- 3 If additional counter shocks are required, readjust the **Energy Select** control as necessary, and repeat the synchronized cardioversion procedure.

NOTE

Depending on how the unit has been configured, the HP CodeMaster 100 will either remain in the synchronized shock mode or it will return to defibrillator mode following a synchronized shock. Refer to Table 2-1 on page 2-11 for instructions on configuring the defibrillator for operation after synchronized cardioversion.

If the defibrillator does not shock, refer to “If the Defibrillator does not Deliver a Shock” on page 12-4.

After Using the Defibrillator

If you want to print an Event Summary now, press **Review**. (See “*Printing the Event Summary Record*” on page 5-12.) After you use the defibrillator, perform the following steps to prepare the defibrillator for its next use.

- Clean all paddles, controls, and cables. Visually check the patient cables, paddles, paddles cables, and electrode adapter cables for wear, insulation nicks, and other damage. Refer to the Chapter 13, “Maintenance” for additional information.
- Turn on the HP CodeMaster 100. If the instrument displays **LOW BATTERY**, replace the battery pack with a charged battery.
- Perform the test described in “*Delivered Energy and Shock Button Functional Test*” on page 13-3.
- Turn the **Energy Select** control to **Off** and return the HP CodeMaster 100 to its storage location.
- Check that sufficient recorder paper and electrolyte medium or multifunction defib electrodes are available for the next use of the defibrillator.
- Make sure that a battery is in the battery support system being charged. See “Charging the Battery” on page 13-14.

Pacing

This chapter contains instructions for using the pacer. For more concise details regarding noninvasive pacing, refer to *HP CodeMaster Series Defibrillator/Monitor Pacing Application Note*.

What is Noninvasive Transcutaneous Pacing?

Noninvasive transcutaneous pacing is a technique of electrically stimulating the heart externally through a set of electrodes. Pacing is required when the heart's own conduction system slows dangerously.

The HP CodeMaster 100 with the pacer can perform external transcutaneous pacing. The pacer provides demand (synchronous) and fixed (asynchronous) pacing modes. The patient is connected to the pacer by multifunction defib electrodes. The patient can be paced and defibrillated through the same set of electrodes.

Pacer Operating Controls

The pacer operating controls on the HP CodeMaster 100 are detailed in “Pacer Operating Controls” on page 1-11.

WARNING

While pacing, avoid touching the gelled area of the multifunction defib electrodes or the patient to prevent electrical shock.

Use only Hewlett-Packard recommended electrodes with the external pacer. The HP CodeMaster 100 delivers pacer pulses through a low-impedance multifunction defib electrode. The HP CodeMaster 100 does not pace effectively with high-impedance, pace-only electrodes.

Do not use the same defib electrodes for more than eight hours of continuous pacing.

Using the Pacer

To use the pacer, perform the following steps:

- 1 Apply the multifunction defib electrodes as instructed on the package.
- 2 Attach the ECG monitoring electrodes as instructed in “Preparing the Leads for Monitoring” on page 5-3.
- 3 Attach the patient cable to the ECG Input connector of the HP CodeMaster 100.
- 4 Attach the patient cable leads to the ECG monitoring electrodes.
- 5 Attach the electrode adapter cable (M2472A) to the defibrillator output connector. Pull the latch connector toward the front of the defibrillator to lock the connector in place.

- 6 Attach the multifunction defib electrodes to the electrode adapter cable. The electrodes are correctly connected when the locking ring is twisted, locking the ears of the connector to the adapter cable.
- 7 Turn the **Energy Select** control to the **Monitor On** position.
 - If the message NO PADDLES is displayed, check that the pads adapter cable connector is properly seated and latched.
 - If the message PADS OFF is displayed, check the electrodes connection to the patient and to the electrode adapter cable.
- 8 Press **Pacer On** to set up the pacer. Pacer parameters will now be displayed at the bottom of the display (PACER STOP, DEMAND MODE, 70 PPM 30 MA). The rate (ppm) and output (mA) settings for when the pacer is turned on can be selected in Setup Menu 1. The original rate and output settings from the factory are 70 ppm and 30mA. The pacer is always in Demand mode when it is turned on.

NOTE

At this point, no pacer pulses are being delivered to the patient. The pacer must be started before the pacer pulses are delivered at the selected rate (ppm) and output (mA).

If the pacing mode is **ON** and the configuration settings are altered, the user can move in and out of pacing (provided the defibrillator is not shut off) and the settings will not revert back to the factory default. For example, if the user is pacing, then shocking, then pacing again, the pacing mode will return to the last pacing configuration before shocking. If the defibrillator is turned off after pacing is configured, then when pacing is turned on again, the settings will return to the factory default.

- 9 Press **Lead Select** to select the best lead for monitoring while pacing. You can only select Leads as the ECG source when the pacer is on.
 - If LEADS OFF is displayed, check all patient cable connections.
- 10 Press **Rate** to adjust the rate. The monitor displays the selected rate (ppm).
- 11 Press **Mode** to select the pacing mode (demand mode/fixed mode). The monitor displays the selected mode.

Pacing
Using the Pacer

Demand Mode Pacing When in demand mode, the pacer will only deliver pacer pulses when the patient's heart rate is lower than the selected pacer rate.

Fixed Mode Pacing When in fixed mode, the pacer will deliver pacer pulses at the selected pacer rate.

WARNING

Use demand pacing mode whenever possible. Use fixed pacing mode (asynchronous) for cases when reliably monitoring the patient is impractical. For example, use fixed mode when there is motion artifact or other ECG noise that makes R-wave detection unreliable.

- 12** Press **Start/Stop** to start pacing. The monitor displays the message **PACING** as well as the selected mode, rate, and output.

The pacer will not start pacing if there is a problem with either the multifunction defib electrode connections or the ECG monitoring electrode connections. If there is a problem with the multifunction defib electrode connection, the message **ATTACH PADS** will be displayed briefly when you press **Start/Stop**.

- 13** Verify that the pacer pulses are well positioned in the diastole.
- 14** Increase output (mA) by pressing **Output** until the beat is captured. Selecting an alternate lead can help you determine capture.

- 15 To set the lowest possible output level to capture, decrease the current by decrements of 5 mA by pressing **Output**.

NOTE

If the monitoring ECG lead falls off while pacing in demand mode, the pacer will stop delivering pulses and the messages **PACER STOP** and **LEADS OFF** will appear. To resume pacing, reattach the lead and press **Start/Stop**.

Pacing in fixed mode does not require ECG leads to be attached for the pacer to deliver pulses.

If a multifunction defib electrode comes off during pacing, the pacer will stop delivering pulses and the messages **PACER STOP** and **PADS OFF** will appear. To resume pacing, reattach the electrode and press **Start/Stop**.

WARNING


HR meters and HR alarms function during pacing, but they can be unreliable. The HR meter attempts to count QRS activity in both demand and fixed pacing modes. Observe the patient closely while pacing. Do not rely on heart rate alarms or the indicated heart rate as a measure of the patient's perfusion status.

NOTE

If the battery runs out during pacing and you replace it with a charged battery, the instrument may no longer be in pacing mode. To resume pacing, press **Pacer On** and **Start/Stop**.

Defibrillation During Pacing

If the patient must be defibrillated during pacing, perform the following steps.

- 1 Set the desired energy level with the **Energy Select** control.
- 2 Press **Charge**. The defibrillator will automatically turn off the pacer and start charging. The pacer status messages will be cleared and replaced with the defibrillator delivered energy display.
- 3 Call out "Clear!" to alert personnel to stand away from the patient.
- 4 Wait for the Charge Done Indicators.
- 5 Simultaneously press and briefly hold both **Shock** () buttons, located on the cable connector. The shock will be delivered through the multifunction defib electrodes.

After the shock, the pacer remains off. Press the **Start/Stop** button to resume pacing if it is required.

Pacing
Using the Pacer

SpO₂ Monitoring

This chapter explains how to use the pulse oximeter feature of the HP CodeMaster 100.

SpO₂ monitoring gives information on both cardiac and respiratory systems, and details of oxygen transportation in the body. It is widely used because it is non-invasive, continuous, easily applied and painless.

The quality of SpO₂ measurements depends on careful application of the sensor. Read the following section, to understand the importance of sensor application. For more detailed information, refer to *Understanding Pulse Oximetry Guide*.

You can use the SpO₂ monitor with sensors made by other manufacturers as well as with Hewlett-Packard sensors. For a list of approved sensors, see the *Sensor Guide*.

Understanding Pulse Oximetry

This section provides a brief description of SpO₂.

NOTE

SaO₂ and SpO₂

Hewlett-Packard is adopting the convention of referring to the *SpO₂* parameter. Previously it was referred to as SaO₂.

SaO₂ is the term used to indicate the oxygen saturation of arterial blood.

SpO₂ is the term used to indicate the oxygen saturation of arterial blood *as measured by pulse oximetry*.

What is SpO₂?

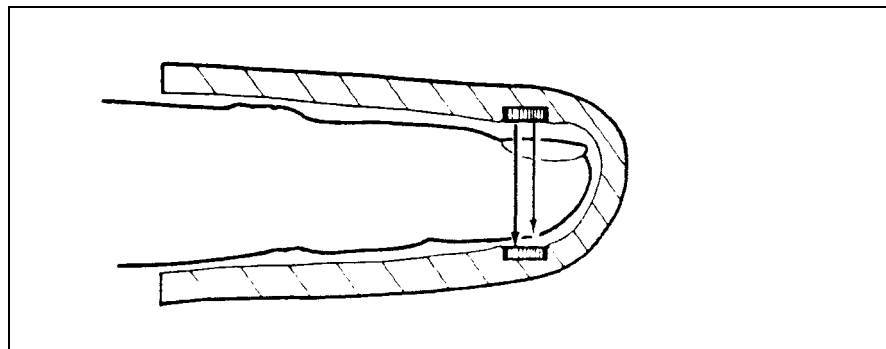
A blood-oxygen saturation reading indicates the percentage of hemoglobin molecules in the arterial blood which are saturated with oxygen. The reading is referred to as SpO₂. Readings vary from 0 to 100%. Normal readings in a healthy adult, however, range from 94% to 100%.

How Does Pulse Oximetry Work?

The pulse oximetry method used for measuring SpO₂ uses LEDs (light emitting diodes) to transmit red and infrared light through suitable peripheral areas of the body, typically the foot in neonates or the finger in adults. The oxygen saturation is gauged by measuring the "redness" of the blood in the arterial pulse.

A photodetector positioned opposite the light emitter compares light absorption before and after pulsation to provide measurements that are displayed on the monitor. If there is no pulse, measurements cannot be made. See Figure 9-1.

Figure 9-1



Positioning of the Light Emitters and Photodetector

For accurate measurements, the following conditions must apply:

- o All transmitted light must pass through the extremity to the detector.
- o The patient must have at least a minimum pulse.
- o The light emitter and the photodetector must be opposite each other.

SpO₂ Operating Controls

The SpO₂ operating controls on the HP CodeMaster 100 SpO₂ Operating Controls are detailed in “SpO₂ Operating Controls” on page 1-13

Patient Monitor Using SpO₂

Sensor Types

There are three types of sensors:

Disposable

Disposable sensors should be used once only and then discarded. However, they can be relocated to a different application site on the patient if the first location does not give the desired results. Disposable sensors must not be reused on different patients.

Semi-Disposable

Semi-disposable sensors can be reused, but the adhesive wrap must be discarded after each use. Semi-disposable sensors are recommended for single-patient use only.

Reusable

Reusable sensors can be reused on different patients.

Using SpO₂

Before you start SpO₂ monitoring, refer to the following steps:

- 1 Estimate the patient's weight and determine the best site for the sensor.
- 2 Use the *Sensor Guide* to select the correct type and size of sensor for the identified location.
- 3 Prepare the sensor:
 - Disposable: Remove protective backing.
 - Semi-Disposable: Apply a new adhesive wrap to the sensor.
- 4 Apply the sensor to the identified location.
- 5 Connect the sensor to the monitor. To connect sensors from other manufacturers, use the HP M1900B Connector Cable.

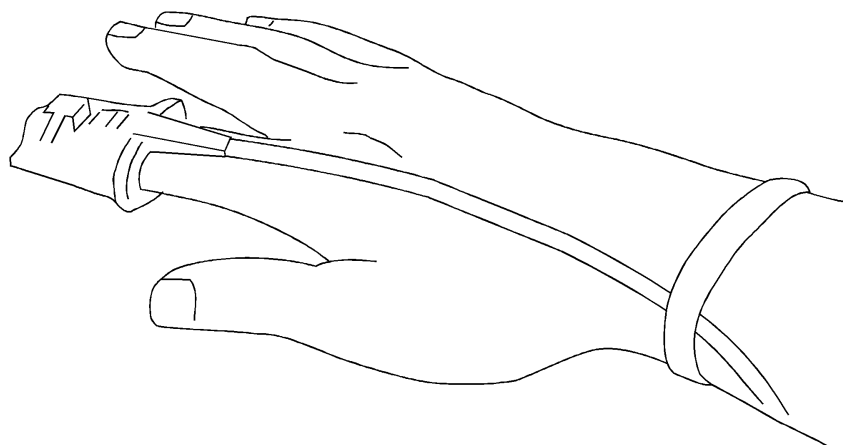
Apply the Sensor to the Patient

Hewlett-Packard supports the use of many sensors. Use the *Sensor Guide* to find the sensor which is best for your case. Follow the manufacturer's guidelines for applying and using the sensor.

Applying the Reusable Sensor

Push the sensor over the fingertip so the cable lies on the back of the hand. Secure the cable to the wrist with the wrist-strap supplied. Make sure the finger is not pinched in the end of the sensor. See Figure 9-2. This ensures that the light sources in the sensor lie over the base of the fingernail, giving the best measurement results. If the sensor is not in the correct position, inaccurate readings result. In extreme cases, the instrument displays dashes instead of an SpO₂ reading. **When correctly positioned, the end of the finger just touches the end of the sensor.**

Figure 9-2



Applying the HP M1190A Reusable Sensor

CAUTION

When non-HP SpO₂ sensors are used, application must be consistent with the manufacturer's own guidelines.

WARNING

Prolonged, continuous monitoring may increase the risk of undesirable changes in skin characteristics, such as irritation, reddening, blistering or pressure necrosis, particularly on neonates and on patients with impaired perfusion and varying or immature skin morphology. Specific attention must be given to sensor site inspection for changes in skin quality, proper optical path alignment and attachment. Check the application site at regular intervals — at least every two hours — and change the site if any compromise in skin quality should occur. More frequent checking may be required due to an individual patient's condition.

Troubleshooting Sensor Application

Failure to apply the sensor properly may cause incorrect measurement of arterial oxygen saturation.

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

Patient Movement

Make sure that the application site chosen does not move excessively, which may adversely affect the performance of the sensor. You may have to replace the sensor to ensure good adhesion, or you may have to choose another application site.

Inspecting the Application Site

Inspect the SpO₂ sensor site at least once every 2 hours to ensure adhesion, skin integrity, and correct alignment of the light emitter and photodetector. Should alterations of skin integrity occur, remove the sensor and reapply at another recommended site. Avoid application of the sensor to edematous or fragile tissue. Check circulation distal to the sensor site routinely.

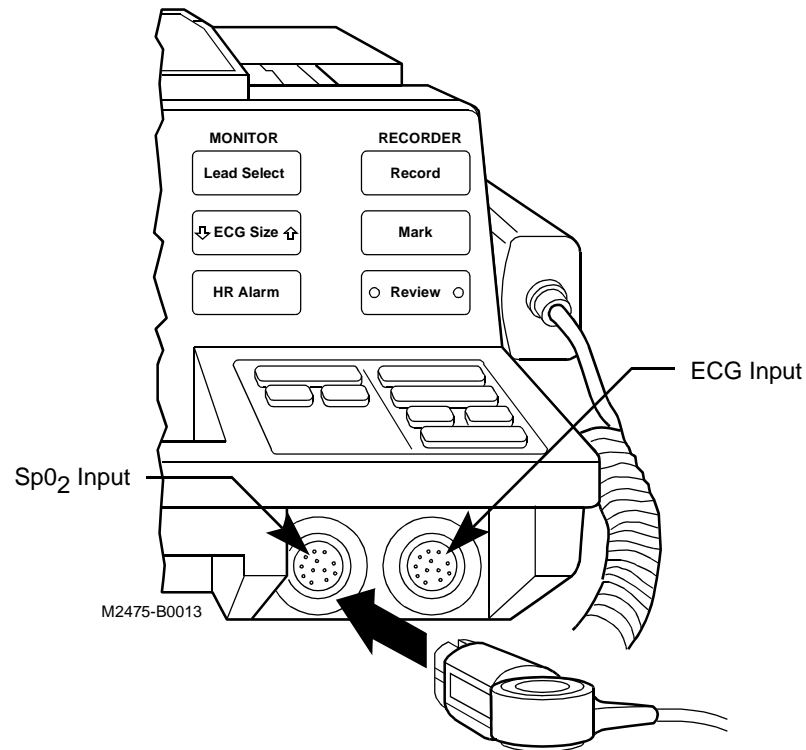
Circulation at Application Site

- Wrapping the tape too tightly, or using supplemental tape, can cause venous pulsations that could potentially lead to inaccurate saturation measurements.
- Avoid wrapping the adhesive too tightly and do not use additional tape to secure the sensor. High positive intrathoracic airway pressures, valsalva maneuvers, or other consequences of impaired venous return may also cause venous pulsations.
- Only use adhesive wraps recommended by Hewlett-Packard.
- Avoid placing the SpO₂ sensor on any extremity with an arterial catheter, blood pressure cuff, or intravascular venous infusion line.

Connecting the Sensor to the Instrument

When you have applied the sensor to the patient, plug the disposable and semi-disposable sensors into the connector cable and plug this cable into the SpO₂ socket on the lower right of the HP CodeMaster 100. Plug the HP M1190A sensor directly into the SpO₂ socket of the HP CodeMaster 100. The plug is keyed and is color-coded blue to distinguish it from the white ECG socket. See Figure 9-3.

Figure 9-3



Connecting the SpO₂ Sensor

CAUTION

To avoid damaging the pins on the cable connector, do not force the SpO₂ connector into the ECG input socket.

Start Monitoring

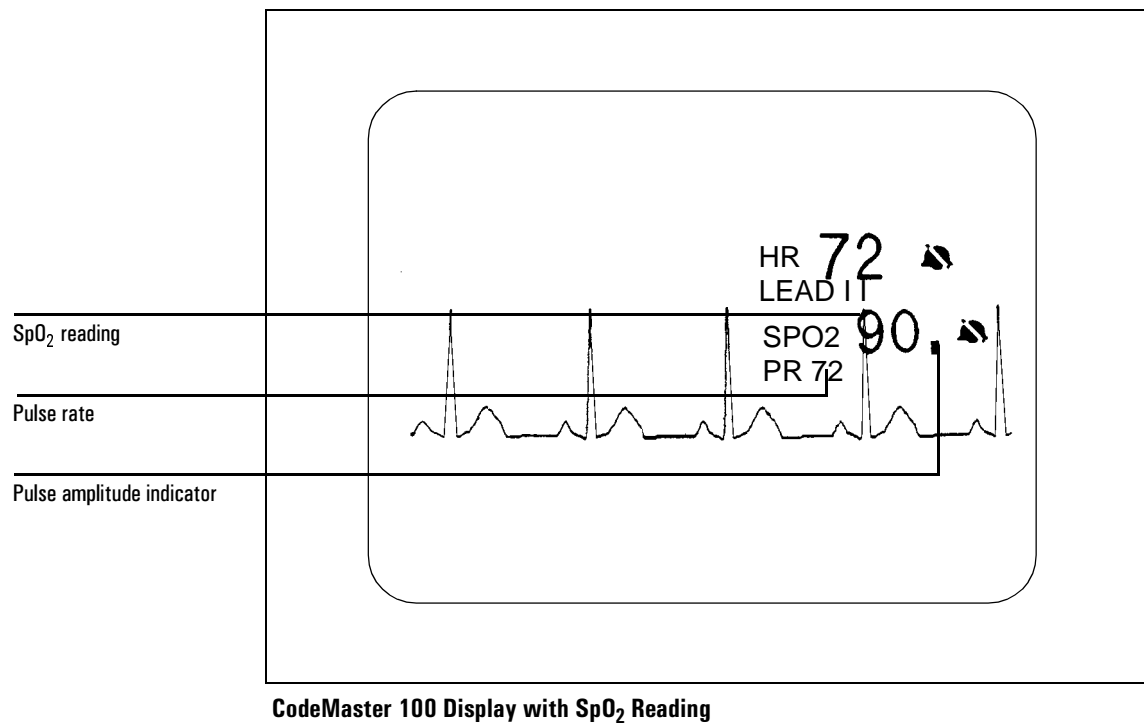
Turn the defibrillator on, if necessary, by turning the **Energy Select** control to **Monitor On**. Press **SpO₂ On/Off** to display the SpO₂ reading in the upper right corner of the display.

SpO₂ Readings

The *pulse amplitude indicator* shows the quality of the SpO₂ signal. Since it is derived from the patient's plethysmograph signal, it varies with the pulse of the patient. If the patient has a very low signal the pulse amplitude indicator does not vary through its full range. If the signal is noisy, the pulse amplitude indicator does not vary rhythmically with the pulse.

The *pulse rate* is derived from the pulse oximeter. It should correlate closely with the patient's heart rate.


Figure 9-4



SpO₂ Alarms

Activating SpO₂ Alarms

There are three preset high/low SpO₂ alarm limits: 100/90, 100/85 and 100/80. Press **SpO₂ alarm** repeatedly to cycle through the alarm options and the no-alarm option. Stop when you see the alarm you would like to choose and


after three seconds that alarm will take effect. A  symbol replaces the limits to show that the alarm is active. To review the limit set, press **SpO₂ alarm**.

If the SpO₂ level falls below the low alarm limit, an alarm sounds and the violated limit is highlighted.

NOTE

SpO₂ alarms are automatically turned off when you press **Charge**.

Deactivating SpO₂ Alarms

Press **SpO₂ alarm**. The  symbol to the right of the SpO₂ display indicates that the alarms are off.

Recorder Output

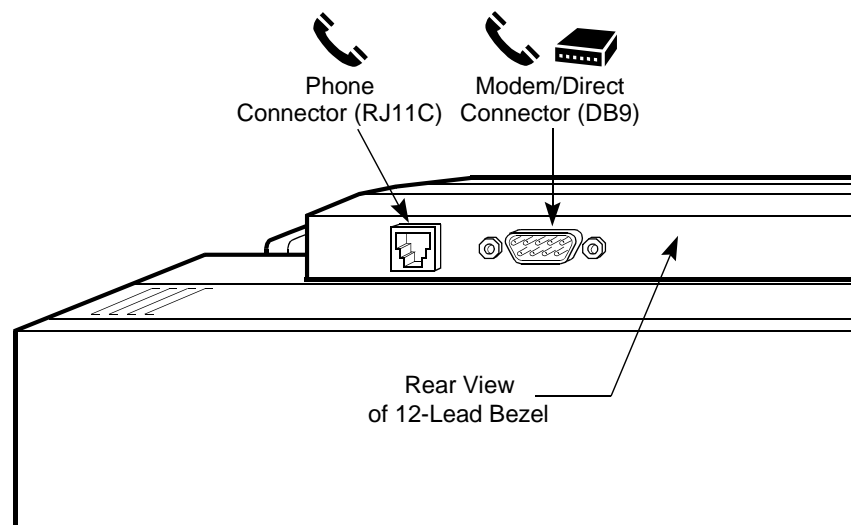
After an alarm event, the recorder prints a strip. The bottom of the strip shows the alarm violation, and the top of the strip shows the SpO₂ reading.

You may print an event summary record, which contains SpO₂ information, as described in “Printing the Event Summary Record” on page 5-12.

Transmitting Data from the 12-Lead Option

This chapter provides instructions for transmitting 12-Lead ECGs and Event Summaries using the 12-Lead option of the HP CodeMaster 100. You can transmit using a landline or cellular phone with data link. The HP CodeMaster 100 supports data transmission from either an internal modem with an RJ11C connector (in US, UK, and Canada only) or an external modem via the RS-232 port. See Figure 10-1.

Figure 10-1



Modem Connections (Rear View of CodeMaster 100 with the 12-Lead Option)

WARNING

The connection of an external modem or other telecommunications equipment may increase leakage currents beyond levels that are acceptable in a patient care environment. Always request that local safety personnel verify that multiple connected equipment comply with local regulatory standards before putting such equipment into service.

NOTE

This product complies with United States, Canadian, and United Kingdom telecom regulatory standards for internal modems. See “Telecom Regulatory Information” on page -xv for further details.

Receiving Devices

The CodeMaster 100 with the 12-Lead option can transmit ECGs to:

- personal computer equipped with HP ECG Manager software (M1765A), referred to as ECG Manager gateway
- Group III facsimile machine
- HP TraceMaster ECG Management System (M1730A/B)
- HP PageWriter XLi cardiograph (M1700A)
- HP PageWriter 300pi/200i/200 cardiograph (M1770A, M1771A) equipped with storage and transmission option #A05

The CodeMaster 100 with the 12-Lead option can transmit the Event Summary to an event summary host.

Transmitting to an HP ECG Manager System HP ECG Manager running on a PC acts as a gateway or receiving station which receives, prints, stores, and forwards 12-Lead ECGs. This is the recommended platform for receiving and printing 12-Lead ECGs acquired and transmitted from the CodeMaster 100 defibrillator/monitor with 12-Lead option.

Transmitting to a Fax Machine You can send ECGs directly to standard fax machines. Transmitting directly to a fax machine does not require a special receiving station, however; transmitting ECGs direct to a fax machine has the following considerations and limitations:

- lengthens transmission time
- cannot forward ECGs to HP TraceMaster
- unable to store and retrieve ECGs elsewhere
- is likely to be used for other business purposes

NOTE

If the FAX machine is used for other business purposes, this increases the risk that it will be busy when emergency medical personnel are attempting to transmit an ECG.

Using Landline Communications

You can attach the CodeMaster 100 with the 12-Lead option to most landline RJ11C connectors (regular phone jack) using either the internal modem or a Hayes-compatible external modem. Note that the RJ11C cable running from the CodeMaster 100 that attaches to the phone jack is a standard phone cable and not provided with the HP CodeMaster 100.

Table 10-1 lists the landline communications capabilities.

Table 10-1 Landline Communications Capabilities

Sent From	Via	Destination
HP CodeMaster 100 12-Lead	Directly with Landline	Fax Machine
HP CodeMaster 100 12-Lead	Directly	HP PageWriter 200, 200i, 300pi & XLi
HP CodeMaster 100 12-Lead	Directly	HP ECG TraceMaster ECG Manager System
HP CodeMaster 100 12-Lead	ECG Manager Receiving Station and Gateway	Fax Machine
HP CodeMaster 100 12-Lead	ECG Manager Receiving Station and Gateway	Laser or Inkjet Printer
HP CodeMaster 100 12-Lead	ECG Manager Receiving Station and Gateway	HP TraceMaster ECG Manager System

Transmitting Data from the 12-Lead Option
Using Landline Communications

Table 10-2 lists the direct communications capabilities via the RS 232 cable. HP recommends that you replace the serial cable on a regular basis based on used rate or at any time communications problems arise through the RS232 port, especially for units used outside of North America and the UK.

Table 10-2 Direct Communications Capabilities

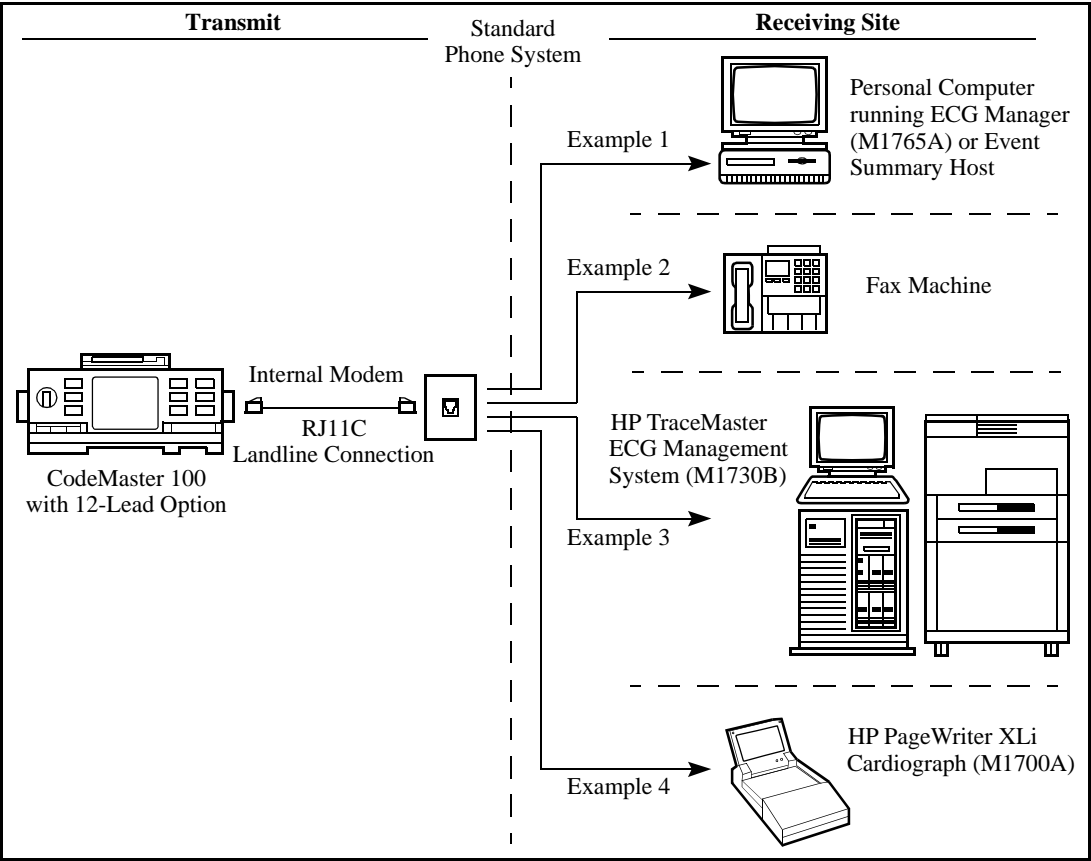
Sent From	Via	Destination
HP CodeMaster 100 12-Lead	Direct Cable	HP PageWriter 200, 200i, 300pi & XLi
HP CodeMaster 100 12-Lead	Direct Cable	HP TraceMaster ECG Manager System

NOTE

The internal modem will not work with a digital phone system or a digital Public Branch Exchange (PBX).

Figure 10-2 illustrates a standard landline connection using the internal modem. Figure 10-3 shows the HP CodeMaster 100 connecting to a landline connection using an external modem.

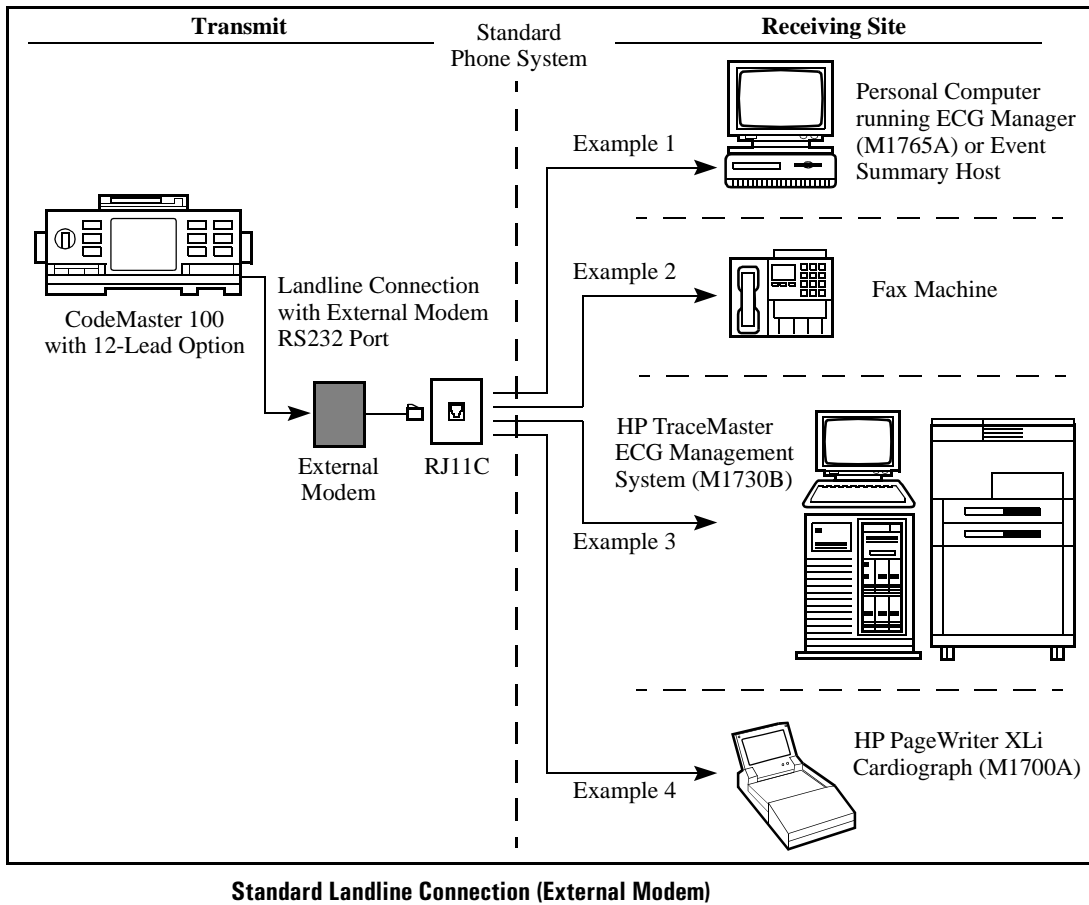
Figure 10-2



Standard Landline Connection (Internal Modem)

Transmitting Data from the 12-Lead Option
Using Landline Communications

Figure 10-3



Using Cellular Communications

Transmitting from the CodeMaster 100 with the 12-Lead option using a portable cellular phone has several advantages:

- can be used in EMS vehicles or outdoors
- can be used when there is no convenient access to a phone jack

Table 10-3 lists the cellular communications capabilities.

Table 10-3 Cellular Communications Capabilities

Sent From	Via	Destination
HP CodeMaster 100 12-Lead	ECG Manager Receiving Station and Gateway	Fax Machine
HP CodeMaster 100 12-Lead	ECG Manager Receiving Station and Gateway	Laser or Inkjet Printer
HP CodeMaster 100 12-Lead	ECG Manager Receiving Station and Gateway	HP TraceMaster ECG Manager System

Figure 10-4 and Figure 10-5 illustrate standard cellular communication connections.

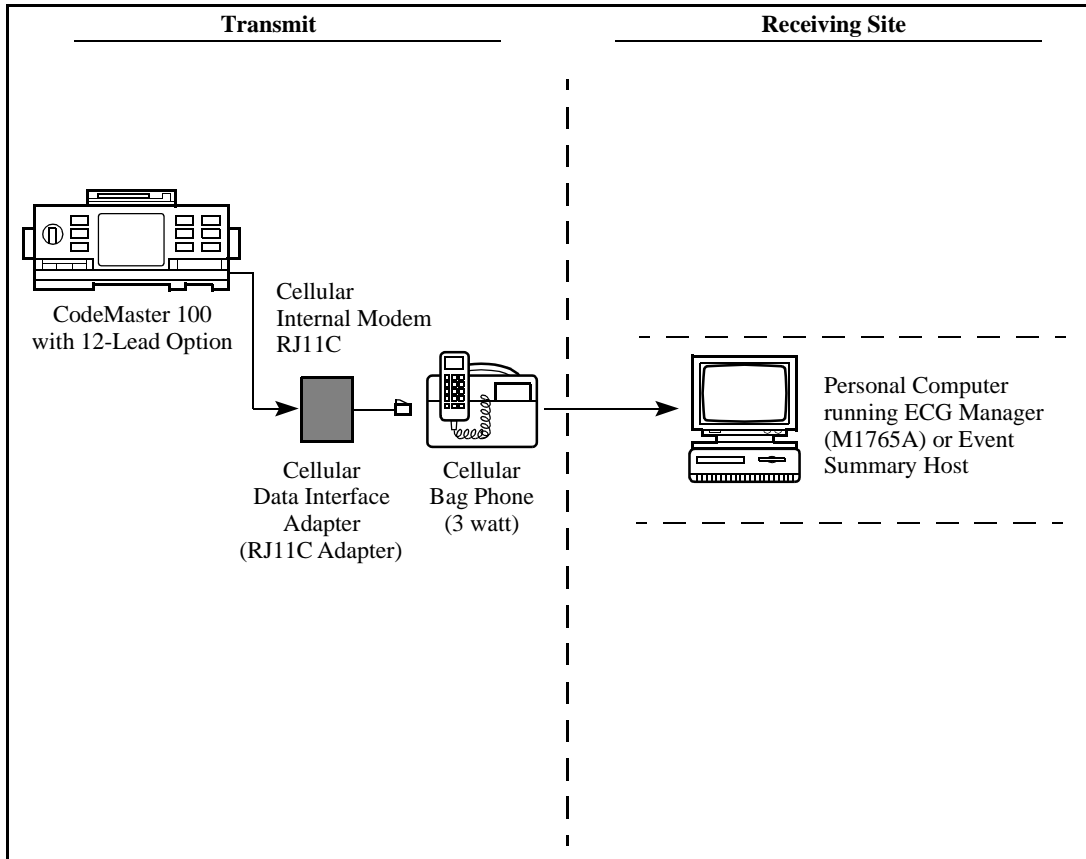
NOTE

Use only a Data Interface Adapter to connect the portable cellular phone to either the internal or external modem. This cellular Data Interface Adapter provides:

- an RJ11C connection from the modem to the cellular phone
 - creates and translates the necessary signals for cellular communication
-

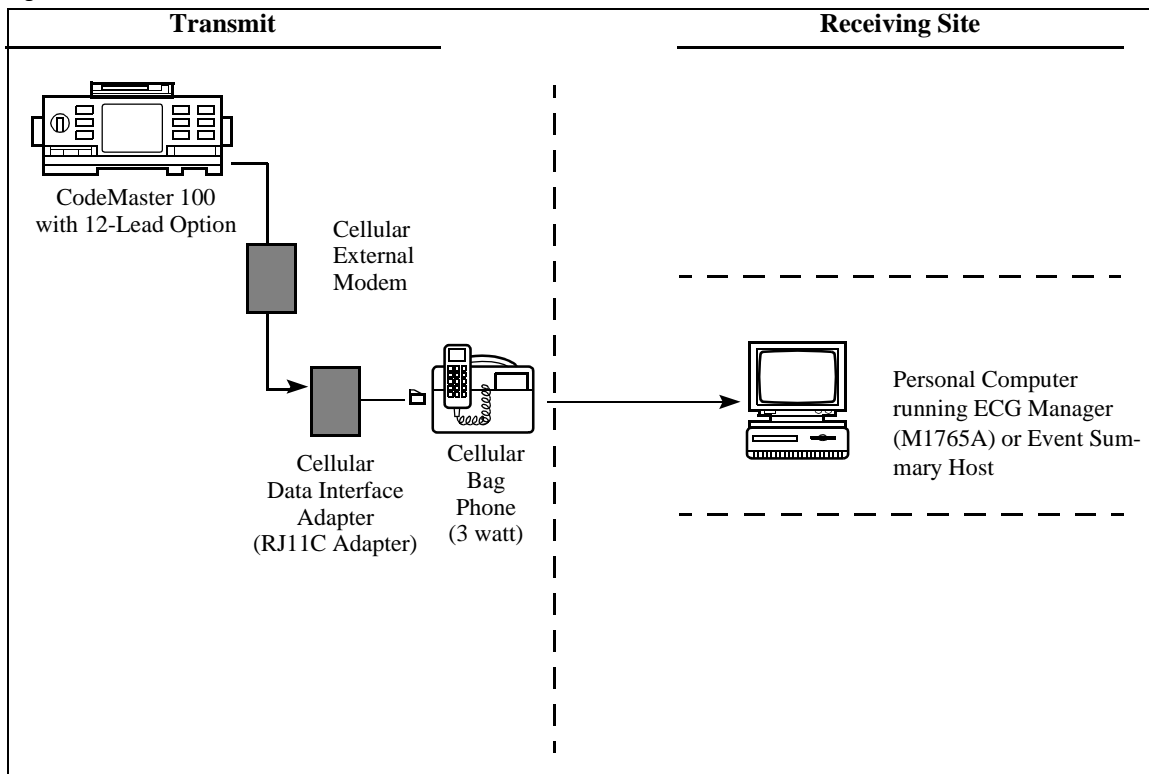
Transmitting Data from the 12-Lead Option
Using Cellular Communications

Figure 10-4



Standard Cellular Connection (Internal Modem)

Figure 10-5



Standard Cellular Connection (External Modem)

For country-specific information about cellular service, contact your local cellular communication service provider.

NOTE

Cellular service is not reliable in all areas. Check with your local cellular service provider for details of coverage area.

Transmitting a 12-Lead ECG

To transmit an ECG:

- 1 Connect the cellular or landline connection cable to the modem.
- 2 Select the ECGs to send. Press the **Send** key or select Send ECGs from the Main Menu. The Send ECG Display appears:

The screenshot shows a screen titled "Send ECGs" with the subtitle "Screen 1 of 1" and "(2 ECGs Stored)". It displays a list of ECGs with columns for "Name/ID" and "Time and Date". The list includes two entries: "*Frank Smith" with ID "12345678" and time "10:02 10-Apr-97", and "Charlotte Stephens" with ID "87654321" and time "10:00 10-Apr-97". Below the list, there are navigation options: "=Sent" (underlined), "Select", "All", "Send ECGs", and "Exit". At the bottom, there are five function keys labeled F1, F2, F3, F4, and F5.

Name/ID	Time and Date
*Frank Smith ID: 12345678	10:02 10-Apr-97
Charlotte Stephens ID: 87654321	10:00 10-Apr-97

=Sent *Selected

Select Select Send
 All ECGs Exit

F1 F2 F3 F4 F5

Press **F1** or **F2** to highlight the ECGs. Press **F4**. The telephone directory appears.

NOTE

Immediately after an ECG has been acquired and printed, it can be transmitted by pressing the **Send** button on the key pad. This will take you to the Telephone Directory screen. Once in the Telephone Directory, use the Arrow button on the key pad to highlight the destination for which you want to send the ECG and press the **Send** softkey or the **Send** button on the keypad again.

If Auto Send Acquired ECG has been enabled, then you will automatically be taken to the Telephone Directory after the ECG has been acquired and printed. Select the destination and press either the **Send** softkey or the **Send** button on the keypad.

- 3 Choose the transmission destination for the ECG from the phone directory using the arrow keys. Use the **F4** key to move through the different directory pages.
- 4 Press **F2** or **Send** to transmit the ECG.
- 5 The system displays a message indicating successful transmission and then returns to the home display. If the ECG does not transmit, the system displays the Send ECGs screen.

If the system does not transmit the ECG successfully, refer to the section “Identifying Transmission Problems” on page 12-17.

NOTE

Press the **STOP** key to halt the transmission process.

For configuration information, refer to *Chapter 2, "Setup and Configuration"*.

Transmitting an Event Summary

To transmit an event summary:

- 1 Connect the cellular or landline connection cable to the modem.
- 2 Select Event Summaries from the Main Menu. The Event Summaries screen appears. Press the **Send** key or select Send Event Summaries from the Main Menu. The Event Summaries screen appears:

The screenshot shows a terminal window titled "Event Summaries". It contains two event entries. The first entry is for "ADVISORY EVENT SUMMARY" for "Frank Smith" with ID "12345678" and Incident ID "00105567", dated "10:02 10-Apr-97". The second entry is for "EVENT SUMMARY" for "Charlotte Stephens" with ID "87654321", dated "10:00 10-Apr-97". Below the entries, it says "γ=Transmitted" and "*=Selected". At the bottom, there are four options: "Select", "Edit I.D.", "Send E.S.", and "Exit". Below the screen, five function keys are labeled: F1, F2, F3, F4, and F5.

Event Summaries	
ADVISORY EVENT SUMMARY	Time and Date
*Frank Smith	
ID: 12345678	10:02 10-Apr-97
Incident ID: 00105567	
EVENT SUMMARY	
Charlotte Stephens	
ID: 87654321	10:00 10-Apr-97
γ=Transmitted	*=Selected
Select	Edit I.D.
Send E.S.	Exit

F1 F2 F3 F4 F5

- 3 Select the Event Summaries you want to send. Press the **Send** key or **F4 Send**. The Event Summary Telephone Directory screen appears.
- 4 Press **F2** or **Send** to transmit the event summary.

The HP CodeMaster 100 transmits the event summary and indicates that it is executing the dialing sequence. The system then confirms the number it is dialing and that the sequence is being sent.

- 5 The system displays a message indicating successful transmission and then returns to the home display. If the event summary does not transmit, the system displays the Event Summaries screen.

If the system does not transmit the event summary successfully, refer to the section “Identifying Transmission Problems” on page 12-17.

NOTE

Press the **STOP** key to halt the transmission process.

For configuration information, refer to *Chapter 2, "Setup and Configuration"*.

Transmitting Data from the 12-Lead Option
Transmitting an Event Summary

Using Auxiliary Power

This section provides instructions for using auxiliary power sources with the HP CodeMaster 100 AC (HP M2479A) and DC (HP M2478A) Power Modules.


The AC Power Module

The HP M2479A AC Power Module is designed to charge the battery installed in the HP CodeMaster 100 while the battery is in the unit. The AC Power Module connects to an AC power source to:

- provide continuous charging and ensure that the battery is ready for use when an emergency situation arises.
- power the HP CodeMaster 100 and provide for long term monitoring without the need to change the battery.

Using the AC Power Module

To use the AC power module:

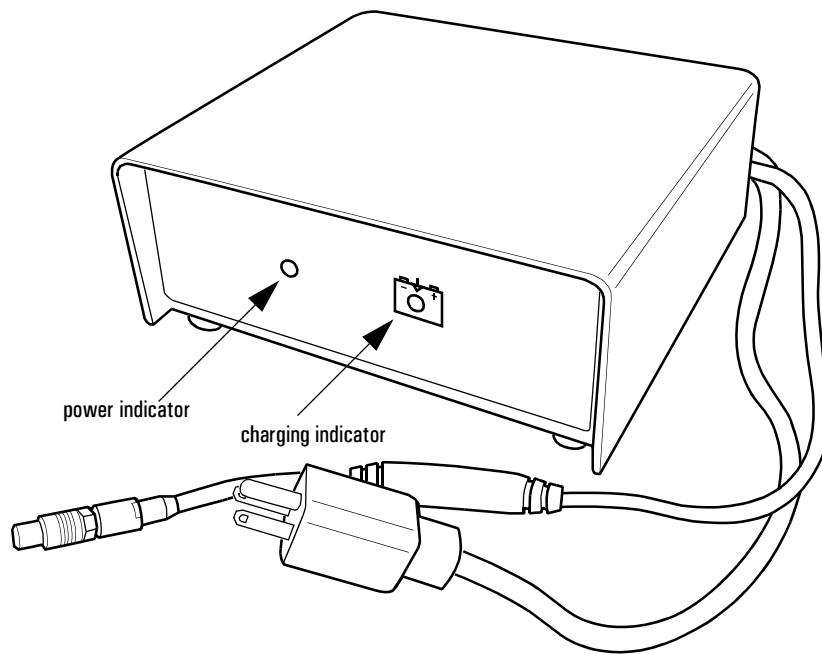
1. Plug the AC Power Module power cord into an AC power source. Verify that the power indicator lights up to show that power is supplied to the module (See Figure 11-1).
2. Connect the AC Power Module defibrillator interface cable to the HP CodeMaster 100. To do so, position the cable with the red dot on the connector facing down and insert the connector into the 12 volt receptacle.
3. Check that the  light appears on the HP CodeMaster 100 (See Figure 11-4). If a battery is installed in the HP CodeMaster 100, also verify that the charging indicator lights up on the AC Power Module.

WARNING

Battery technology used in this device still requires maintenance. The power module will not cycle/recondition batteries. Refer to Chapter 13, "Maintenance".

Indicators

Figure 11-1



AC Power Module Indicators

Charging Indicator

The charging indicator appears when the battery is installed in the HP CodeMaster 100 and the battery is being charged.

Power Indicator

The power indicator lights up when power is supplied to the AC Power Module.

Using the DC External Power Module

The HP M2478A external power module is a 12-Volt DC power source for the HP CodeMaster 100. This module is designed specifically for emergency vehicles with 12 Volt electrical systems. With this module, your vehicle's 12 Volt system can power the HP CodeMaster 100, saving the defibrillator/monitor battery for remote use. Additionally, the HP CodeMaster 100 battery is recharged when it is attached to the external power module.

External Power Module Indicators

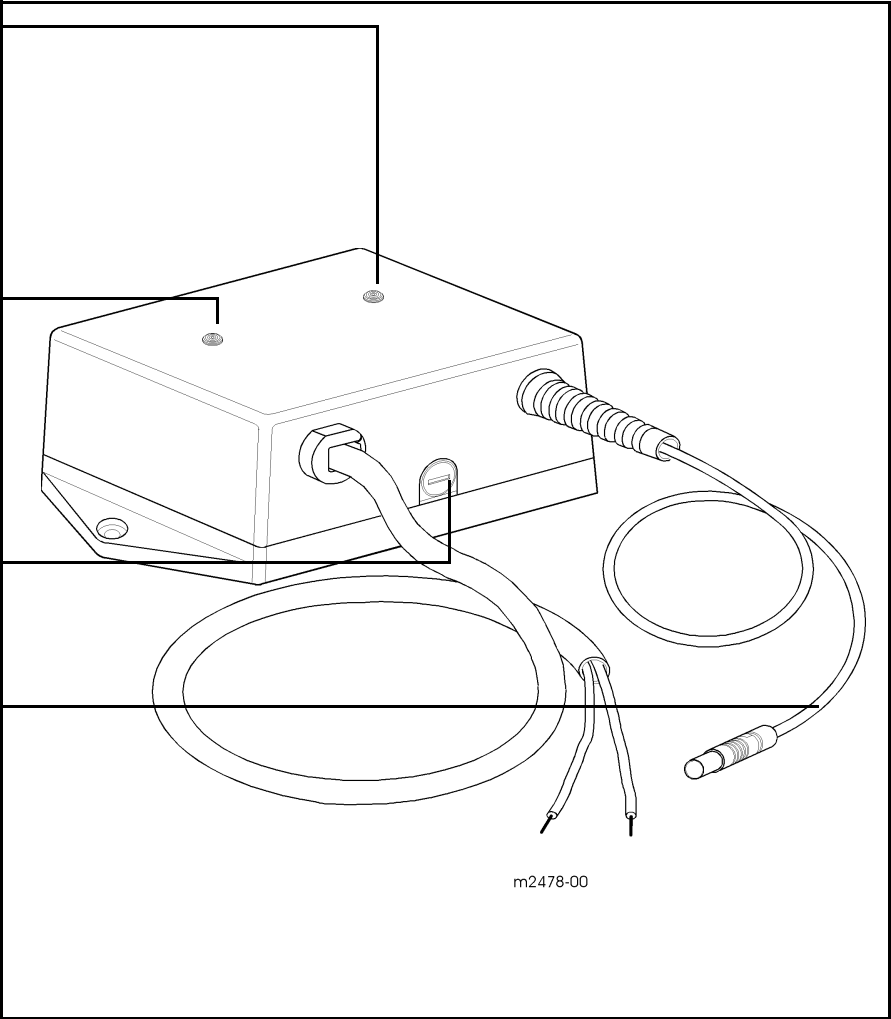
Figure 11-2

The charging indicator appears when the battery is installed in the HP CodeMaster 100 Defibrillator and the battery is being charged.

The power indicator appears when power is supplied to the external power module.

Access the fuse through the fuse holder.

Do not disconnect the HP M2475-69531 Defibrillator/Monitor connector cable under normal use. This connection prevents damage in case you forget to disconnect the defibrillator from external power before moving it.



External Power Module Indicators

Installing the External DC Power Module

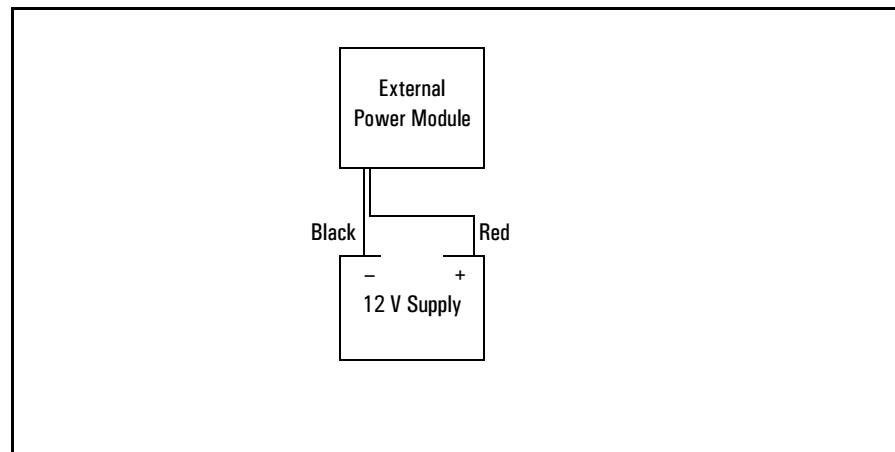
You must be a qualified mechanic or electrician to install the power module. If the cable provided for input to the External Power Module is not long enough, make sure that you use 14 gauge or larger wire to extend the cable.

CAUTION

Incorrect polarity connection will cause fuse to open.

Figure 11-3

Connect the black wire to ground and the red wire to +12 Volts.



Connection of External Power Module

The External Power Module can be connected to any 12 Volt negative ground source. The circuit which supplies power to the external power module should be protected by a fuse between 10 amps and 20 amps. This allows sufficient power to operate the External Power Module and still provides electrical protection in case of faulty or defective wiring to the External Power Module.

The power module attempts to draw power from the vehicle 12 Volt system whenever the defibrillator/monitor is on and whenever the defibrillator/monitor battery is charging. If you do not want power drawn from the vehicle when the vehicle is not running then install the External Power Module so that it is electrically disconnected when the vehicle is off.

Testing the External Power Module Installation

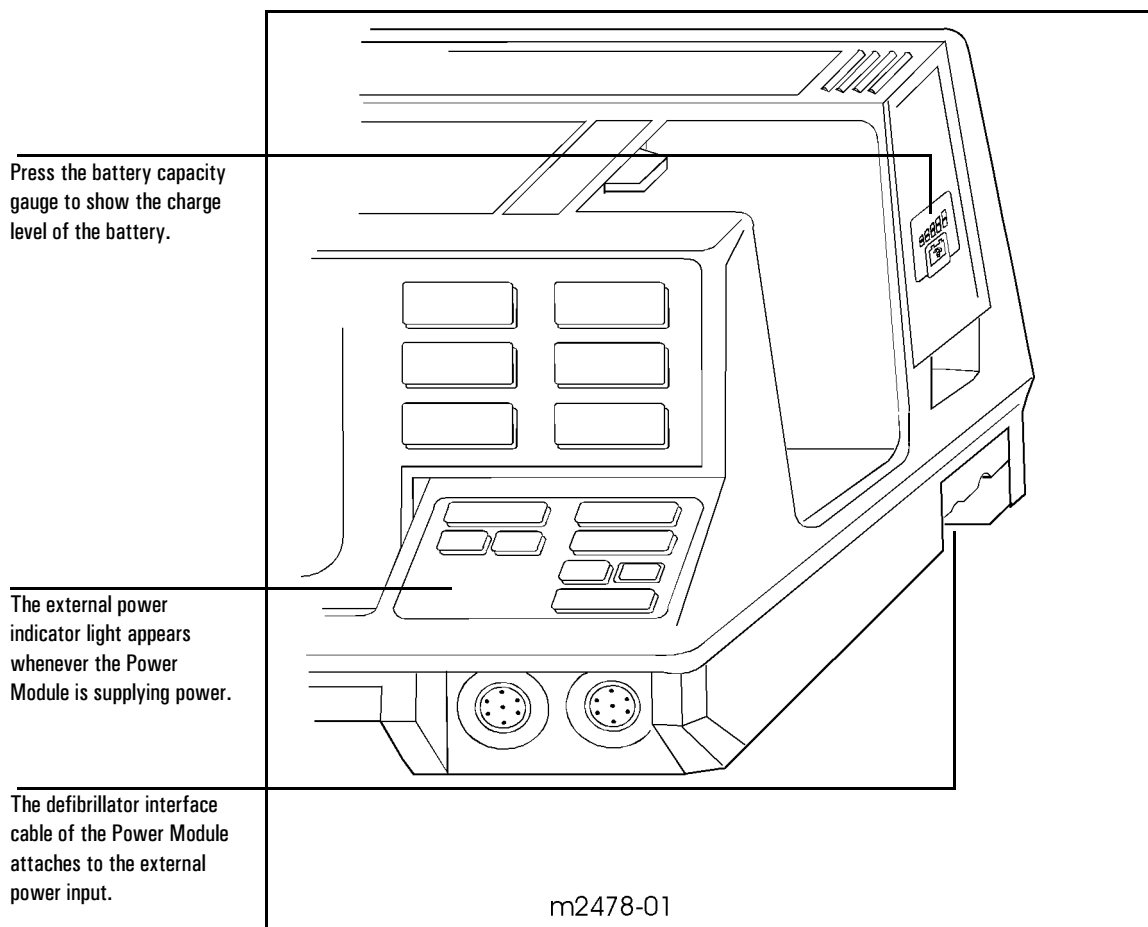
To verify that the External Power Module is correctly installed:

- 1** Connect the external power module to the HP CodeMaster 100 external power input. Verify that the power indicator on the external power module and the external power indicator on the HP CodeMaster 100 both appear.
- 2** Install a battery in the HP CodeMaster 100 and verify that the charging indicator appears on the External Power Module.
- 3** Remove the battery and turn the **Energy Select/Monitor On** control on the HP CodeMaster 100 to 360J. Press **Charge** and verify that the defibrillator charged to 360J in 15 seconds or less.

CodeMaster 100 External Power Indicators

This section discusses the external power indicators on the HP CodeMaster 100 (see Figure 11-4).

Figure 11-4



CodeMaster 100 External Power Indicators

Monitoring with External Power

Turn the **Energy Select/Power Control** to **Monitor On** to monitor while using the Power Module. Power for monitoring comes from the Power Module and does not deplete the defibrillator/monitor battery.

Charging the Battery with an Auxiliary Power Module

If the battery is not already charged and it is at operating temperature, it will charge whenever you plug the external power module into the defibrillator. The charging indicator on the external power module appears when the battery is charging. The indicator may disappear briefly after you turn the defibrillator off. When you charge the defibrillator the battery does not charge, so the indicator disappears until the defibrillator is charged.

NOTE

The Power Module charges the battery more quickly if the defibrillator is in **Off** mode. If you turn the **Energy Select/Power Control** to **Monitor On** or to an energy level, the battery still charges, but not as quickly.

The battery charges more slowly when the temperature is below 5° C (41° F) or above 40° C (104° F). The battery does not charge at temperatures above 60° C (140° F).

Repeated charging at very high or very low temperatures may shorten the life of your battery.

The Power Module charges only the HP M2476B and HP M2477B batteries. Use it only with the HP CodeMaster 100.

CAUTION

The Power Module does not replace the HP M2480B Battery Support System. If you regularly charge batteries with the Power Module, perform a battery capacity test on each battery with the battery support system every 30 days. Remember that a battery capacity test takes approximately 24 hours and leaves the battery fully charged.

Defibrillating with External Power

If a battery is installed in the HP CodeMaster 100, energy to charge the defibrillator comes from the battery. If the battery is depleted, not functioning or not present, the Power Module provides energy for defibrillation. The Power Module is not intended to eliminate the battery, however.

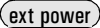
Although you can operate the defibrillator with the Power Module and without a battery in the defibrillator, you should only do so if a battery is unavailable.

NOTE

The defibrillator may take up to 15 seconds to charge to 360 J when running under external power with the battery absent.

Performing Operational Checks

The following operational checks should be performed along with the shift checks described in the *HP M2475B Portable Defibrillator/Monitor Quick Reference*:

- Unplug the Power Module. Turn on the HP CodeMaster 100. If it displays the LOW BATTERY message, replace the battery with a charged battery. Turn off the defibrillator.
- Plug in the Power Module. Make sure that the power indicator on the Power Module appears and that the  indicator on the CodeMaster appears.
- Remove the battery from the HP CodeMaster 100. Make sure that the charging indicator light goes out on the Power Module. Re-insert the battery.

Troubleshooting

CodeMaster 100

This chapter contains information about troubleshooting and performing diagnostics on the CodeMaster 100, the pacer, SpO2, advisory, the external power module and the 12-Lead option.

Refer to the following table for messages that relate to the CodeMaster 100 display and actions to take to correct them.

Table 12-1

Failure Messages

Message	Possible Solutions
DEFIB FAILURE	Use a back-up defibrillator and call service.
MONITOR FAILURE	Use a back-up defibrillator and call service. If there is no alternative, try to use the defibrillator without the monitor. Use Charge Done indicators to verify defibrillator functionality.
SYSTEM FAILURE	Use a back-up defibrillator and call service. If there is no alternative, try to use the defibrillator. Use Charge Done indicators to verify defibrillator functionality.

Troubleshooting the Defibrillator

Table 12-2

Defibrillator Messages

Message	Cause	Possible Solutions
NO PADDLES	Paddle set is not connected to the defibrillator.	Attach external paddles, internal paddles, or electrode adapter as required.
LEADS OFF	Leads are not securely attached to the patient or the cable is not connected to the defibrillator.	Attach lead.

Table 12-2

Defibrillator Messages (*Continued*)

Message	Cause	Possible Solutions
USE LEADS	Paddles are connected to the defibrillator and:	
	<ul style="list-style-type: none"> ● Sync was pressed when PADDLES is selected. ● Defibrillator is in sync mode and PAD-DLES is selected. ● Defibrillator is in defib mode and PADDLES is selected when leads are attached to the patient. ● Defibrillator is in defib mode, PAD-DLES is the ECG source when attaching leads to the patient. 	<ul style="list-style-type: none"> ● Press Sync to remove the defibrillator from sync mode. ● Select LEAD I, II, or III instead of PAD-DLES. ● Select LEAD I, II, or III instead of PAD-DLES. ● Select LEAD I, II, or III instead of PAD-DLES.
50J MAXIMUM	Internal paddles are attached and the Energy Select control has been turned past 50 joules.	CodeMaster 100 defibrillator/monitor will charge to 50 joules.
LOW BATTERY	Battery voltage is below the low battery threshold.	Install a charged battery.
SETUP LOST	The internal battery which backs up the configuration memory has depleted.	Call for service.
DEFIB DISARMED	CodeMaster 100 defibrillator/monitor has internally discharged energy and is now disarmed.	(Solution not applicable.)
CHECK RECORDER	The recorder door is open. or The recorder is out of paper.	Close the recorder door or replace the paper roll as described in Changing the Recorder Paper (page 13-7).

Table 12-2

Defibrillator Messages (*Continued*)

Message	Cause	Possible Solutions
CHECK BATTERY	The battery pack is not fully inserted into the defibrillator or it is faulty.	Reinsert the battery pack, making sure it latches. If the message reappears, perform a battery capacity test.
CHECK SETUP	The backup battery for the setup configuration memory is low.	Call service to replace the backup battery.


If the Defibrillator does not Charge

If the defibrillator does not charge, perform the following steps:

- 1 Verify the proper setting of the **Energy Select** control.
- 2 If it is correct, follow these steps.
 - a. Turn the **Energy Select** control to **Off**, and then back to the desired energy setting.
 - b. Press **Charge** again.
- 3 If the instrument remains unable to charge, turn the **Energy Select** control to **Off** and use a backup defibrillator.
- 4 Press **Review** to print an event summary and keep any ECG strips from the defibrillator for later evaluation.
- 5 Alert HP service personnel.

If the Defibrillator does not Deliver a Shock

If the defibrillator does not deliver a shock, perform the following steps:

- 1** Make sure the unit is not in synchronized shock mode by checking that the **Sync** light is not on.
- 2** If the unit discharges internally (that is, the energy display decrements slowly then beeps three times and displays the screen message DEFIB DISARMED) verify proper connections from the patient to the defibrillator. This includes connections to the pads/paddles adapter cable if one is being used. Also check for worn or broken areas along the cables.
- 3** Press **Charge** again, wait for the Charge Done indicators.
- 4** Press the **Shock** () buttons again.
- 5** If the unit remains unable to shock, turn the **Energy Select** control to the **Monitor On** or **Off** position and use a back-up defibrillator.
- 6** Press **Review** to print an event summary and keep any ECG strips from the defibrillator for later evaluation.
- 7** Contact HP service personnel as soon as possible.

Troubleshooting the Pacer

Table 12-3

Pacer Messages

Message	Cause	Possible Solutions
PACER FAILURE	The unit detected a delivered current error.	<ol style="list-style-type: none"> 1 Change electrodes and make sure electrode adapter cable is properly connected. 2 Restart the pacer. If PACER FAILURE happens again, use a back-up pacer and call for service.
PACER OUTPUT LOW Pacer current highlighted on the display.	The pacer cannot deliver the required current.	<ol style="list-style-type: none"> 1 Stop the pacer. 2 Change the pads and check the pads adapter cable for proper connection. 3 Restart the pacer.
STOP PACER	An attempt was made to change pacing mode while pacing.	Stop the pacer before you change the pacing mode.
NO PADS	Pacer is on and one of the following occurs: <ul style="list-style-type: none"> ● No electrode adapter attached. ● Paddles attached. ● Internal paddles attached. 	Attach electrodes for pacing.
PADS OFF	Electrode adapter cable is attached and an electrode is not connected.	Attach electrode for pacing.
ATTACH PADS	Electrode adapter cable is attached. Charge is pressed and electrodes are not attached. Start/Stop is pressed and electrodes are not attached.	Attach the pacer electrode.

Troubleshooting SpO₂

Table 12-4

SpO₂ Messages

Message	Cause	Possible Solutions
SPO2 FAILURE	The unit detected a failure in SpO ₂ subsystem hardware. This failure does not affect other parts of the instrument.	Press SpO₂ On/Off twice to power cycle SpO ₂ . If the error happens again, call for service.
SPO2 SENSOR FAIL	The sensor or adapter cable is broken.	Replace the sensor or adapter cable.
SPO2 CABLE OFF	Sensor or cable is disconnected.	Check SpO ₂ connections between HP CodeMaster 100 portable defibrillator/ monitor and the sensor cable or adapter cable.
Dashes appear on display instead of SpO ₂ reading.	Can't derive measurement because: <ul style="list-style-type: none"> • The sensor is not on the patient. • No pulse is detected. • The sensor is incorrectly positioned. • The sensor is defective. 	Check the patient for a pulse. Reapply the sensor, and make sure it is correctly positioned. If it doesn't work, replace the sensor.
SPO2 NOISY SIGNAL	Irregular pulse patterns. Patient motion.	Reapply sensor. Consider using a different sensor site.
SPO2 LIGHT INTERF	Too much interference from external light. Damage to sensor or adapter cable.	Reapply sensor. Turn off lights in the room. If other options do not work, replace the sensor.

Table 12-4

SpO₂ Messages

Message	Cause	Possible Solutions
SPO2 LOW SIGNAL	Bad connection to patient, or patient has poor perfusion.	Check the patient for poor perfusion. Reapply disposable and semi-disposable sensors. Readjust reusable sensors. Consider using a different sensor site.
SpO ₂ perfusion reading is high or erratic	EMI/RFI	Investigate the source of the interference. Remove the device or relocate the patient.

Troubleshooting the Advisory Mode

Table 12-5

Advisory Mode Messages

Message	Cause	Possible Solutions
ATTACH PADS CABLE	The electrode adapter cable is not connected to the defibrillator.	Connect the electrode adapter cable to the defibrillator.
FOR ANALYSIS, ATTACH PADS	Defib electrodes are not attached to the electrode adapter cable or defib electrodes are not attached to the patient.	Check electrode connections.
ARTIFACT DETECTED; DO NOT TOUCH PATIENT	Excessive noise was detected by the advisory algorithm during analysis.	Do not touch, move, perform CPR, ventilate or transport the patient while the advisory algorithm is analyzing cardiac rhythms. Repeat analysis.
PADS OFF	The electrode adapter cable is attached, but no defib electrodes are connected.	Attach defib electrodes to electrode adapter cable and to patient.

Troubleshooting the External Power Module (M2478A or M2479A)

Table 12-6

External Power Module Problems

Problem	Cause	Possible Solutions
Power indicator on external power module does not appear.	External power module is not receiving power.	<ol style="list-style-type: none"> 1 Check connections. 2 Check fuse. 3 Check that vehicle power supply voltage is within range. 4 Call your local HP service representative to replace the external power module.
Charging indicator does not appear on battery.	Battery is not charging.	<ol style="list-style-type: none"> 1 Make sure that external power is on. 2 Check connections. 3 Make sure battery is properly installed in the defibrillator. 4 Make sure battery temperature is less than 60° C (140° F). 5 Replace the battery with another battery. 6 Call your local HP service representative to replace the external power module.
Fuse opens.	Installed with incorrect polarity.	<ol style="list-style-type: none"> 1 Replace fuse. 2 Install with correct polarity.
	Electrical problems during operation.	<ol style="list-style-type: none"> 1 Replace fuse. 2 Check vehicle power supply. 3 Call your local HP service representative to replace the external power module.

Table 12-6

External Power Module Problems (*Continued*)

Problem	Cause	Possible Solutions
External power indicator on defibrillator does not appear.	Defibrillator is not receiving power.	<ol style="list-style-type: none"> 1 Check that external power module power indicator is on. 2 Check connections. 3 Call your local HP service representative to replace the external power module.
Charge time greater than 15 seconds with battery removed.		<ol style="list-style-type: none"> 1 Check that any wire used for installation is 14 gauge or larger. 2 Check connections. 3 Call your local HP service representative to replace the external power module.

Replacing the External Power Module Fuse

Replace the M2478A External Power Module fuse with a 10A Fast Blow fuse, HP 2110-0051.

The M2479A External Power Module has a 5A Fast Blow fuse (HP 2110-0709) located under the power cord strain relief on the back of the module.

Performing Diagnostics

The following procedure allows functional inspection of the CodeMaster 100 portable defibrillator/monitor.

- 1** Turn the **Energy Select** control to the **Monitor On** position. The monitor trace will appear within ten seconds.
- 2** Press **Lead Select** until Lead I is displayed and verify that the message **LEADS OFF** appears, indicating that one or more leadwires are not connected.
- 3** Press **Lead Select** to return to the paddles ECG selection.
- 4** With the paper installed, press **Record** once to turn on the recorder.
 - a. Allow the recorder to run for approximately 20 seconds and check that Date, Time, HR (heart rate), SpO₂, PADDLES (ECG source), and AUTOGAIN (ECG gain mode) are noted on the ECG strip.
 - b. Press **Mark** and verify that the mark (▼) symbol is printed. It will be delayed 6 seconds if the recorder is in the delayed mode.
 - c. Press **Record** to stop the recorder.
- 5** Press **HR Alarm**. Verify that the configured alarm limits appear briefly, then are replaced by the bell symbol in the upper right of the display. With no ECG signal, an audible alarm tone should sound within four seconds.
- 6** Press **HR Alarm** to turn off the alarms.
- 7** Verify that the adult paddle electrodes are installed.
- 8** Turn the **Energy Select** control to 100 joules.
- 9** Leaving the paddles in their holders, press the **Charge** on front panel or on the right (Apex) paddle.
 - The Charge Done indicators should occur within two seconds when operated with a fully charged battery.
 - The Delivered Energy display should indicate 100 joules.

WARNING

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

- 10** Grasp the paddle handles, and without removing the paddles from their holders, press both Shock buttons simultaneously. A brief automatic recorder run prints the delivered energy test report.
- 11** Press **Sync** to place the instrument in Sync mode.
- 12** Verify that the messages SYNC and USE LEADS appear on the display.
- 13** Press **Lead Select** once to select Lead I, and verify that the message USE LEADS no longer appears. The message LEADS OFF should now appear, indicating that one or more leads are not connected.
- 14** Turn the **Energy Select** control to **Off**.

The defibrillator is ready for use if it passes the above checklist.

A more extensive test of defibrillator/monitor functionality can be performed using the diagnostic service mode described in the *HP M2475B CodeMaster 100 Portable Defibrillator/Monitor Service Manual*.

The 12-Lead Option

If you have problems with an ECG, there are several things you may check before calling for service. This chapter tells how to solve basic ECG problems.

Checking ECG Technique

Many problems in taking an ECG may be related to electrode application.

- Review “Preparing the Patient” on page 6-10 to ensure the patient leads are properly attached to the patient.
- Refer to “Checking Signal Quality” on page 6-12 for information about ensuring a good recording by using the preview screen.

Identifying ECG Problems

The following table shows symptoms and solutions to problems that can occur when recording an ECG.

Table 12-7 ECG Problems and Solutions




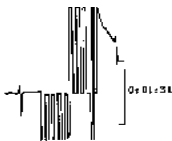
Problem	Cause	Possible Solutions
Power line AC Interference	Poor electrode contact. Dry or dirty electrodes.	Abrade skin. Use new electrodes. Reapply electrodes. Check expiration date on disposable electrodes.
	Lead wires may be picking up interference from poorly grounded equipment near the patient.	Route lead wires along limbs and away from other electrical equipment. Fix or move poorly grounded equipment.
	Patient cable is too close to the power cords.	Move other electrical equipment away from patient. Unplug electric bed.
Wandering Baseline	Patient movement.	Reassure and relax the patient.
	Electrode movement. Poor electrode contact and skin preparation.	Be sure that the lead wires are not pulling on the electrodes. Reapply electrodes. Press the Filter key if it is configured for Baseline Wander.
	Respiratory interference.	Move lead wires away from areas with the greatest respiratory motion.
Tremor or Muscle Artifact	Poor electrode placement. Poor electrode contact. Patient is cold.	Clean the electrode sites. Reapply electrodes. Be sure the limb electrodes are placed on flat, non-muscular areas. Warm the patient.
	Tense, uncomfortable patient.	Reassure and relax the patient. Press the Filter key if it is configured for Artifact.
	Tremors.	Attach the limb electrodes near the trunk. Press the Filter key if it is configured for Artifact.

Table 12-7 ECG Problems and Solutions (*Continued*)

Problem	Cause	Possible Solutions
Intermittent or Jittery Waveform 	Poor electrode contact. Dry electrodes. Faulty lead wires.	Clean the electrode site. Reapply electrodes. Check expiration date on disposable electrodes. Replace faulty patient cable.
After powering on the unit or during normal operation, the message "Attach the HP 12-Lead ECG cable to take a 12-Lead" displays	The cable isn't properly connected	Attach the 12-Lead cable to the device.

Identifying Recorder Problems

The following table shows symptoms and solutions to problems that can occur when the recorder will not start.

Table 12-8 Recorder Problems and Solutions

Problem	Cause	Possible Solutions
After acquiring an ECG, the associated report does not print	The recorder or paper is out and the message "Check recorder" displays	Load the paper and check recorder door.

If you continue to have problems with the 12-Lead option, call your local Hewlett-Packard service representative (see "Service" on page 12-21).

Sampling Characteristics of the 12-Lead Option

Physiological factors such as breathing can cause variation in amplitudes of heart beats, independent of the heart rate. In addition, sampled systems (as opposed to continuous systems) may show changes in the apparent height of the R-wave when sampling of the R-wave occurs slightly off-peak. Because the sampling rate and the heart rate are asynchronous, the time between the peak and an adjacent sample can vary from one QRS complex to the next. This results in a slight variation of displayed QRS amplitude. This effect is more pronounced with narrower signals, more commonly found in some pediatric electrocardiograms and in pacemaker pulses. The CodeMaster 100 with 12-Lead option minimizes this effect by:

- using an integrating-type A/D converter
- sampling all leadwires simultaneously
- oversampling the signals
- processing the oversampled signals with appropriate digital signal processing techniques

Identifying Storage Problems

The following table shows symptoms and solutions to problems that can occur when storing an ECG.

Table 12-9

Storage Problems and Solutions

Message	Likely Cause	Possible Solutions
ECG too noisy to store	Poor electrode contact. Dry or dirty electrodes.	Use new electrodes. Abrade skin. Reapply electrodes. Check expiration date on disposable electrodes.
	Lead wires may be picking up interference from poorly grounded equipment near the patient.	Route lead wires along limbs and away from other electrical equipment. Fix or move poorly grounded equipment.
Unable to store ECG	A fault exists in the storage hardware.	Retake and store ECG. If problem persists, call HP Service.
Unable to retrieve ECG	A fault exists in the storage hardware.	Retake and store ECG. If problem persists, call HP Service.

Identifying Transmission Problems

The following table shows symptoms and solutions to problems that can occur when transmitting an ECG.

Table 12-10

Transmission Problems and Solutions

Message	Likely Cause	Possible Solutions
Telephone busy, re-dialing	Busy telephone number.	12-Lead will automatically re-dial, waiting 30 seconds between attempts.
No answer, re-dialing	Remote modem not connected.	Report problem to remote site.
	Modem is set to give up after too few rings.	Check configuration of modem register S7. See your modem documentation for more information.
Check telephone cable	No dial tone.	Check the connection to the telephone system. Be sure the telephone system is in operation. Replace the telephone cable. Check with your local telephone administrator. Check that the phone has ringer equivalence number (REN) on bottom or back of phone unit to determine if telephone system is Public Switched Telephone Network (PSTN).
Check modem and cable	No power to modem, or poor modem cable connection.	Check that the modem is turned on. Check the data communication cable connections between the modem and the 12-Lead.
Check cable	Poor cable connection.	Check all cable connections. Replace cable.
No modem at remote site	Remote site answered, but no modem carrier was detected, or a fax machine answered.	Verify transmission type with remote site. Check telephone number. Re-try transmission.

Table 12-10

Transmission Problems and Solutions (*Continued*)

Message	Likely Cause	Possible Solutions
No fax at remote site	Remote site answered, but no fax machine was detected, or a modem answered.	Verify transmission type with remote site. Check telephone number. Re-try transmission.
Check modem configuration	Incompatible or improperly initialized modem.	Verify the modem initialization string. Refer to modem specifications in Chapter 14, "Specifications". Verify that your modem is compatible.
Incompatible fax machine at remote site.	The fax machine at the remote site is not a group III device.	Transmission requires a group III fax machine at remote sites.
Transmission stopped unexpectedly. X of N ECGs sent. Cable/modem problem. Press any key to continue.	No power to modem, or poor modem cable connection.	Check that there is power to the modem. Check the data communication cable connections. Call the other location to verify their modem is functioning correctly.
Transmission stopped unexpectedly. X of N ECGs sent. Modem was disconnected. Press any key to continue.	Problem with telephone line.	Check that the modem is connected to the telephone line. Verify that the telephone line is working.
Transmission stopped unexpectedly. X of N ECGs sent. Remote site stopped communication (nn). Press any key to continue.	Communication speed of the remote device does not match that of the 12-Lead, or remote site modem malfunction.	Call the remote location to verify that the communication speed is correct and that the modem is functioning correctly. Reduce the communication speed of both the 12-Lead and remote site modems.
Cannot send to a TraceMaster A/B, PageWriter 200/300, or PageWriter XLi using a cellular line without the use of a Gateway	Sending ECGs to these receiver types over a cellular line requires the use of a Gateway.	Configure the Gateway phone number with the number of your Gateway. Change the line type on the home screen to Tone or Pulse and use a land landline.

Table 12-10

Transmission Problems and Solutions *(Continued)*

Message	Likely Cause	Possible Solutions
The ECG Manager gateway can only receive one ECG. The first ECG has been successfully sent.	The Gateway is limited to receiving one auto forwarded ECG.	Select one ECG at a time for transmission from the Send ECGs screen.

Sales

For the HP sales office nearest to you, please refer to your local phone book or call your HP regional office:

Troubleshooting
Sales

United States of America:

Hewlett-Packard Company
Medical Products Group
Headquarters
3000 Minuteman Road
Andover, Massachusetts, 01810

Medical Customer Information

1-800-934-7372

Canada:

Hewlett-Packard (Canada) Ltd.
5150 Spectrum Way
Mississauga, Ontario L4W 5G1
(905) 206-4725

Marketing Center Europe:

Hewlett-Packard GmbH
Medical Products Group
Herenberger Strabe 140
71034 Boeblingen
Germany
(+49) 7031 14-5151

Latin America:

Hewlett-Packard Latin America
5200 Blue Lagoon Drive
9th Floor
Miami, Florida 33126
(305) 267-4220

**Medical Distribution
Europe/Middle East/Africa:**

39 rue Veyrot
1217 Meyrin 1
Geneva, Switzerland
(+41) 22 780 4111
(+41) 22 780-4266

Asia Pacific Headquarters:

Hewlett-Packard Asia Pacific Ltd.
17-21/F Shell Tower, Times Square
1 Matheson Street, Causeway Bay
Hong Kong
(+852) 2599 7777

Medical Supplies

To order medical supplies, including batteries:

- In the U.S. only - call 1-800-225-0230
- Worldwide - visit our Medical Supplies website at:
www.hp.com/go/medsupplies

Service

For telephone assistance, call the Response Center nearest to you, or visit our website at: www.hp.com/mpgcsd/.

United States	(800) 548-8833
Canada East	(800) 361-9790
Canada Central	(800) 268-1221
Canada West	(800) 268-1221
Australia	131147
Belgium	32 2 778 35 31
France	0803 35 34 33
Germany	0130-4730
Italy	0292 122999
Netherlands	(0) 20-547-6333
United Kingdom	44-344-366333

Troubleshooting
Service

Maintenance

CodeMaster 100

Operation Checks

These checks are intended to briefly verify the proper operation of the HP CodeMaster 100. Regularly perform a test routine incorporating the following checks along with visual inspection of all cables, paddles, and controls.

Every Shift

Perform the following checks every shift:

- o Make sure that a battery is charging in the battery support system.
- o Turn on the HP CodeMaster 100. If the system displays the **LOW BATTERY** message, replace the battery with a charged battery.
- o Check for adequate thermal paper in the recorder.
- o Check for ECG leads, electrodes, and adequate electrolyte medium.

If you have an external power module, perform these additional checks every shift:

- o Unplug the AC or DC external power module. Turn on the HP CodeMaster 100. If it displays the **LOW BATTERY** message, replace the battery with a charged battery. Turn off the defibrillator.
- o Plug in the external power module. Make sure that the power indicator on the external power module appears and that the external power indicator on the HP CodeMaster 100 appears.
- o Remove the battery from the HP CodeMaster 100. Make sure that the charging indicator on the external power module disappears. Replace the battery.

Every Day

- Inspect the battery in the HP CodeMaster 100 for visible signs of wear.
- Turn on the HP CodeMaster 100. If the instrument displays the **LOW BATTERY** message, replace the battery with a charged battery.
- Visually check the patient cables, paddles, cables, and pads adapter cables for wear, insulation nicks, and other damage.
- Perform the “Delivered Energy and Shock Button Functional Test” on page 13-3.
- Perform the “Electrode Adapter Cable Test” on page 13-4.
- Perform the “Quick Pacer Functionality Test” on page 13-5.
- Make sure that a battery is charging in the battery support system.

If you have the advisory option:

- Turn the **Energy Select** control to **Advisory On**, and check that the instrument turns on.

Delivered Energy and Shock Button Functional Test

To check the HP CodeMaster 100 with the paddles, perform the following steps:


NOTE

The HP CodeMaster 100 is designed to protect against delivering a shock when only one switch on the paddle set is pushed.

- 1** Turn the **Energy Select** control to the 100 joules position.
- 2** Verify that the adult paddle electrodes are installed.
- 3** Push the paddles completely into their holders (Apex paddle in right pocket, Sternum in left) and press either **Charge**. Wait for the Charge Done indicators.

WARNING

Keep hands clear of the paddle electrode edges. Use your thumbs to depress the Shock () buttons on the paddle handles.

- 4** With the paddles in their holders, grasp the paddle handles and press the Apex paddle Shock () button. Verify that the defibrillator does not discharge.
- 5** Release the Apex paddle Shock button, then press the Sternum paddle Shock button. Verify that the defibrillator does not discharge.
- 6** Press **Sync** to place the defibrillator in sync mode.
- 7** Press and hold both Shock buttons. Verify that the defibrillator does not discharge.
- 8** Press **Sync** again to remove the defibrillator from sync mode.
- 9** With the paddles in their holders, press and briefly hold both Shock buttons at once. Verify that the defibrillator discharges.
- 10** The recorder will print a test report. Review the test report for proper operation.

NOTE


Notify Service Personnel if the ECG strip does not print TEST 100J PASSED or if any of the shock button tests fail.

CAUTION

If you see the CHECK SETUP message on the screen, call service to replace the backup battery.

Electrode Adapter Cable Test

To check the electrode adapter cable, perform the following steps:

- 1 Connect the HP M1781A test load to the electrode adapter cable.
- 2 Turn **Energy Select** to 100 joules.
- 3 Press **Charge**. Wait for the Charge Done indicators.
- 4 Press the left Shock () button on the pads adapter cable connector housing. Verify that the defibrillator does not discharge.
- 5 Release the left Shock button and press the right Shock button on the pads adapter cable connector housing. Verify that the defibrillator does not discharge.
- 6 Press **Sync** to place the defibrillator in sync mode.
- 7 Press and hold both Shock buttons. Verify that the defibrillator does not discharge.
- 8 Press **Sync** again to remove the defibrillator from sync mode.
- 9 While holding down **Charge**, press both Shock buttons on the pads adapter cable connector. Verify the defibrillator discharges.

The recorder will print a test report.

NOTE

Notify Service Personnel if the ECG strip does not print TEST 100J PASSED or if any of the shock button tests fail.

CAUTION

If you see the CHECK SETUP message on the screen, call service to replace the backup battery.

10 Disconnect the test load (M1781A) from the electrode adapter cable.

Quick Pacer Functionality Test

- 1** Connect the electrode adapter cable to the defibrillator and the HP M1781A test load to the adapter cable. Turn the defibrillator on by turning the **Energy Select** switch to the **Monitor On** position.
- 2** Press **Pacer On**. (During the test only, ignore the LEADS OFF warning message if it occurs.)
- 3** Put the pacer into the Fixed Mode of operation by pressing **Mode**.
- 4** Adjust the current to 30 mA by pressing **Output**. Adjust the pacer rate to 60 pulses per minute by pressing **Rate**.
- 5** Start the pacer by pressing **Start/Stop** on the pacer keypad, and start the recorder by pressing **Record** on the recorder keypad.
- 6** Verify that pacer pulses are shown on the recorder strip approximately every 5 large boxes.

NOTE

If the recorder is in delay mode it will take several seconds before pulses appear.

Allow the pacer to run for 10-12 seconds.

- 7** Turn the pacer off by pressing **Pacer On** and stop the recorder printing by pressing **Record**. Disconnect the test load from the pads adapter cable.

NOTE

Notify service personnel if the message **PACER FAILURE** is displayed on the monitor, the unit beeps three times and displays the message **PACER OUTPUT LOW** or the pacer pulses are not shown on the recorder strip as described above.

Every Week

Perform the following checks on the internal paddle set every week:

- Check for excessive residue from electrolyte medium on the paddle set and clean as needed. See “Cleaning the Electrodes and Cables” on page 13-10. Oxidation can be an indication the paddle set is old and must be replaced.
- Check for pitting or discoloration on the electrode surfaces. Replace as required.
- Ensure that the cable, connector, and electrodes have no cracks in the insulation.

Every Three Months

Perform the following checks every three months.

- Have the cable set tested for electrical continuity every three months.
- Perform a battery capacity test using the HP M2480B battery support system.

See the *HP M2475B CodeMaster 100 Portable Defibrillator/Monitor Service Manual* for extensive electrical, operational and safety tests to be performed by a qualified Biomedical Equipment Technician (BMET) or equivalent service technician every three to six months.

Maintaining the Defibrillator

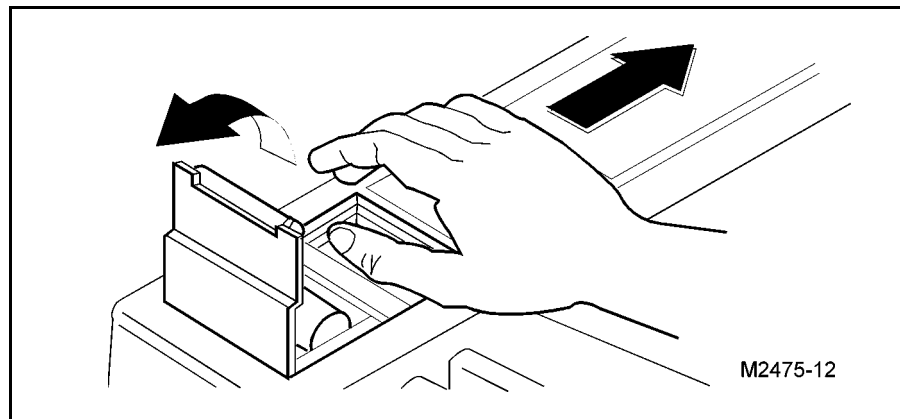
This section contains information about maintaining and cleaning the HP CodeMaster 100.

Changing the Recorder Paper

To change the recorder paper, perform the following steps:

- 1 Slide the recorder door to the right of the defibrillator as shown Figure 13-1. The paper platen will tilt up.
- 2 Pull up on the plastic removal tag to remove the empty or low paper roll.

Figure 13-1



Changing the Recorder Paper

- 3 Place a new roll of recorder paper (HP 40457C/D) in the recorder so that the paper unrolls from the top of the roll and the grid faces down as it comes out of the recorder.
- 4 Pull the end of the paper past the recorder platen.
- 5 While holding the recorder door open (to the right), press the platen down over the paper.
- 6 Allow the door to close over the platen roller.

- 7** Turn on the defibrillator and press **Record** to verify the paper is loaded properly.

Cleaning the Recorder Printhead

If the ECG strip has light or varying density printing, clean the printhead to remove any possible buildup of paper residue.

To clean the printhead, perform the following steps:

- 1** Slide the recorder door to the right of the defibrillator. The paper platen will tilt up.
- 2** Remove the paper roll.
- 3** Clean the printhead surface (above the brush) with rubbing alcohol and a cotton swab.
- 4** Re-install the paper roll.
- 5** While holding the recorder door open (to the right), press the platen down over the paper.
- 6** Allow the door to close over the platen roller.
- 7** Press **Record** to test the printer functionality.

Cleaning Exterior Surfaces

The HP CodeMaster 100 and accessories (except the ECG cable and carry bag) are chemically resistant to common hospital cleaning solutions and non-caustic detergents. The following list includes some approved cleaning solutions:

- 90% Isopropyl alcohol (except adapters and patient cable)
- Soap and water
- Chlorine bleach (30 ml/l water)

The following list includes practices for keeping the HP CodeMaster 100 exterior surfaces clean:

- Keep the outside of the instrument clean and free of dust and dirt. Clean the paddles thoroughly to prevent build-up of dried electrolyte medium.
- Do not allow any fluids to penetrate the instrument case. Avoid pouring fluid on the unit while cleaning.
- Do not use abrasive cleaners, or strong solvents such as acetone or acetone-based compounds.
- Clean the display screen carefully. It is especially sensitive to rough handling and subject to scratching.
- Do not steam sterilize the monitoring leads, submerge them for prolonged periods, or heat them above 50°C. If metallic surfaces become oxidized, clean them with a very light abrasive (toothpaste). Do not use highly abrasive cleaners such as steel wool or silver polish.
- Do not steam or gas sterilize the external paddle set.

Cleaning the Electrodes and Cables

Defibrillator pads are single use and do not require cleaning. Monitoring electrodes are single use and do not require cleaning. Clean the defibrillator paddles and handles, the SpO2 sensors and leads, and the ECG leads with a soft cloth moistened with a recommended disinfectant or cleaning agent from the following list:

- Cidex®
- Alcohol-free hand soap
- 10% solution of Clorox® in water (may discolor cable)

Wring any excess moisture from the cloth before cleaning.

Remove all electrolyte medium from paddle surfaces and handles.

CAUTION

Do not clean the patient cable with alcohol. Alcohol can cause the plastic to become brittle and may cause the cable to fail prematurely.

Do not autoclave the cable or use ultrasonic cleaners.

Do not immerse the patient cable.

Do not use abrasive materials to clean metal surfaces—scratches on them can cause artifacts on the ECG.

Do not wet the connectors, especially the 12-pin connector.

Inspect disposable electrode packaging and disposable defibrillator pads packaging for seal integrity and expiration date before use.

Cleaning the Carry Bag (M3710A)

Remove all contents from the side pouches, including the shorting bar (HP part number M3710-80030) which is stored in a small pocket inside the left pouch. Machine wash the carry bag in cold water with a mild detergent. Do not use bleach or wring. Line dry only.

Cleaning Exterior Surfaces on the AC and DC Power Modules

The Power Module should be kept clean and free of dust. The module is chemically resistant to common hospital cleaning solutions and non-caustic detergents. The following list includes some approved cleaning solutions:

- 90% Isopropyl alcohol
- Soap and water
- Chlorine bleach (30 ml/l water)

When cleaning the Power Module:

- Do not allow fluids to penetrate the instrument case; avoid pouring fluid on the unit.
- Do not use abrasive cleaners or strong solvents such as acetone or acetone-based compounds.

Maintaining the Battery

Use only the HP M2480B battery support system to charge HP M2476B/M2477B battery packs. You should also use only the HP M2480B battery support system to discharge, recondition and perform a capacity test on these batteries. It is recommended that you charge batteries at room temperature (10-30°C).

Be sure to alternate batteries between the HP CodeMaster 100 and the battery support system. Install a freshly charged battery pack in the HP CodeMaster 100 whenever the unit displays the warning message **LOW BATTERY**. Return the depleted battery pack to the battery support system to be charged.

Perform the capacity test on each battery every 90 days or when the battery support system indicates a capacity test should be performed. If capacity test fails, remove the battery pack from service.

Use batteries regularly. If stored longer than 30 days, perform a capacity test on the battery before using it.

NOTES

A new HP M2476B 2.5 amp-hour battery will provide 50 360-joule charge-shock cycles or a minimum of 2.0 hours of monitoring time. Perform a capacity test on the battery when it fails to provide the minimum 2.0 hours of monitoring time or 10 minutes of Low Battery warning time (starting from a fully charged battery).

Using the AC or DC external power module does not eliminate the need to condition the batteries and capacity test every 90 days.

Achieving Optimal Battery Life

The life of the battery depends on many variables, including type of usage and temperature.

The HP CodeMaster 100 portable defibrillator/monitor uses a nickel-cadmium battery, which is not adversely affected by repeated deep discharges or partial charges.

During storage, batteries begin to lose their charge. This occurs in all batteries, including the NiCd batteries (M2476B, M2477B) used in the HP CodeMaster 100. Starting with a fully charged battery, greater than 50% battery capacity will remain after 25 days. The discharge rate can be increased due to the age of the battery and the environment in which it is stored.

You will get the best battery performance if you remove the battery from the HP CodeMaster 100 as soon as you see **LOW BATTERY** on the display. The defibrillator displays this message just after you turn it on. Charge the battery completely before replacing it in the HP CodeMaster 100 portable defibrillator/monitor.

Because it is not always possible to fully charge a battery pack, you can use the HP CodeMaster 100 with a partially charged battery pack.

You may store the battery pack at temperatures from -30°C to 50°C. If storage will last longer than three months, store it below 35°C for optimal performance.

NOTE

A new HP M2477B 4.0 amp-hour battery will provide 75 360-joule charge-shock cycles or a minimum of 3 hours of monitoring time. Replace the battery when it fails to provide the minimum 3 hours of monitoring time or 10 minutes of Low Battery warning time (starting from a fully charged battery).

WARNING

Properly dispose of depleted batteries according to local regulations. Do not disassemble, puncture or incinerate the disposed batteries. Be careful not to short the battery terminals, because this can cause a fire hazard.

New Batteries

To assure optimal performance of a new battery, all newly purchased batteries should be capacity tested in the M2480B charger prior to being put into service. Accomplish this by placing the battery in the charger and performing the "Battery Capacity Test" on page 13-15.

Battery Life

Recommended battery pack replacement:

- After two years of service.
- After failure of battery capacity test.

Replace the battery only with one of the battery packs listed in Table 1-2 on page 1-24.

The operating time of the battery depends on how much the battery pack is charged. Press the capacity gauge button on the battery pack to determine the charge level.

Charging the Battery

Insert battery into the HP M2480B battery support system charging bay. The **CHARGING** indicator appears, to indicate that the battery is charging.

The battery is fully charged when the **READY** indicator appears. A fully discharged HP M2476B 2.5 amp-hour battery takes approximately 2 hours to charge (a fully discharged HP M2477B 4.0 amp-hour battery takes approximately 3 hours to charge).


It may take longer to charge the battery pack if the temperature of the battery is not between 10°C and 40°C. If it is outside these temperatures, the battery support system allows the battery to warm up or cool down before charging.

A flashing **FAULT** indicator indicates a problem with the charging bay next to the indicator. Notify service personnel and do not use that charging bay. The other charging bay is not affected and you can continue to use it.


WARNING


If the **FAULT** indicator appears, the battery did not charge. Remove the battery from service immediately and notify service personnel.

NOTE

If the **START** indicator () flashes, a battery pack capacity test is recommended.

Battery Capacity Test

Perform a battery capacity test every 90 days or when the **START** indicator () flashes after you insert the battery pack into the battery support system for charging.

- 1 Insert the battery into charging bay. The **CHARGING** indicator appears (the **READY** indicator may appear instead).
- 2 Press the start button(). The **TESTING** indicator appears and the **CHARGING** (or **READY**) indicator disappears. Testing the battery takes approximately 24 hours.

Battery capacity testing is complete when the **PASS** indicator appears.

- 3 Record the date of the test on the bottom of the battery.

WARNING

If the **FAULT indicator appears, the battery did not pass the test. Remove the battery from service immediately and notify service personnel.**

NOTE

The battery support system will automatically charge and recondition batteries during the capacity test.

NOTE

Dispose of equipment and accessories at the end of their useful life in accordance with local and national laws.

Supplies

This section provides part numbers for supplies.

Battery

M2476B	2.5 amp-hour battery
M2477B	4.0 amp-hour battery
M2480B	Battery support system

External Power Module

M2478A	DC external power module
M2479A	AC external power module

Patient Cables

M1500A	Trunk cable 3-wire/12-pin - AAMI
M1510A	Trunk cable 3-wire/12-pin - IEC
M1605A	Lead set 3-wire - AAMI
M1615A	Lead set 3-wire - IEC
M1520A	Trunk cable 5-wire/12-pin - AAMI
M1530A	Trunk cable 5-wire/12-pin - IEC
M1625A	Lead set 5-wire - AAMI
M1635A	Lead set 5-wire - IEC
M3714A	Patient cable 10-wire/12-pin - AAMI
M3715A	Patient cable 10-wire/12-pin - IEC

Battery Support System Power Cords

8120-1692	Continental Europe
8120-4464	Australia, New Zealand
8120-1703	United Kingdom, Ireland
8120-2957	Denmark
8120-1692	Italy
8120-5213	North America
8120-2296	Switzerland
8120-4600	South Africa

Paddles

M2471A Anterior/anterior paddle set (black) - PCI (transport)^a

a. Meets CodeMaster 100 defibrillator/monitor specifications for water resistance.

Defib Electrodes

M3501A	Multifunction adhesive electrode pads, adult, AAMI
M3502A	Multifunction adhesive electrode pads, adult, IEC
M3503A	Multifunction adhesive electrode pads, pediatric, IEC
M3504A	Multifunction adhesive electrode pads, pediatric, AAMI
M2472A	Pads adapter cable (black) ^a

a. Meets CodeMaster 100 defibrillator/monitor specifications for water resistance.

Maintenance
CodeMaster 100

Monitoring Electrodes

M2202A Adult snap electrodes

Paper

40457C/D Recorder paper

Cases

M3710A Carry case for 12-Lead option

Specifications

Defibrillator/Monitor

Waveform: Damped sinusoidal (Lown).

Output Energy (Delivered): 2, 3, 5, 7, 10, 20, 30, 50, 70, 100, 150, 200, 300, and 360 joules.

Charge Control: Push-button on apex paddle and on front panel.

Charge Time: Less than 5 seconds to 360 joules with a fully charged battery installed. Time required to charge fully discharged energy storage device to maximum energy (360 joules)

Armed Indicators: Charge done tone, charge done lamp on apex paddle, and available energy indicated on display.

Paddle Contact Indicator: 3-color LED bar graph array on STERNUM paddle indicates quality of defibrillator paddle contact before discharge.

Paddles: Standard paddles are water-resistant, anterior/anterior, adult and pediatric with PCI Contact indicator. External paddles are water resistant. Adult electrodes (83 cm sq.) slide off to expose pediatric electrodes (21 cm sq.). Paddle cord is 10 ft (3 m). Full range of internal paddles available.

Synchronizer: SYNC message appears on monitor and is annotated periodically on recorder while in synchronous mode. An audible beep sounds with each detected R-wave, while a marker on the monitor and sync designator on the recorder strip indicate the discharge point.

Environmental Operating Conditions: 0 to 55°C, 15 to 95% relative humidity (noncondensing) for 24 hours at 40°C, 15,000 ft altitude. (Readability of the 12-Lead display may be degraded outside the range of 0 to 40°C.)

Environmental Storage Conditions: -20 to 70°C, 90% relative humidity (noncondensing) for 24 hours at 65°C, 15,000 ft altitude. (See also Battery Storage Specification.)

Specifications
Defibrillator/Monitor

NOTE

Equipment stored in a car or ambulance under severe climate conditions will function until equipment reaches (adjusts to) operating environment listed above.

Equipment Classification:

- internally powered
- degree of protection against ingress of liquids: IPX4, defibrillator pads and paddles dry connected.
- not suitable for use in the presence of a flammable anesthetic mixture with air or nitrous oxide
- mode of operation: continuous
- patient applied parts classification:



Type BF: defibrillator paddles



Type CF: SpO₂ and ECG

Monitor

Inputs: ECG may be viewed through paddles or patient cable. Lead I, II, III, or PADDLES selectable. Additional leads (aVR, aVF, aVL, V Leads) and PADS are available. Monitor and recorder indicate selected ECG source.

Lead Fault: LEADS OFF message and dashed baseline appear on monitor if a lead becomes disconnected.

Common Mode Rejection: Greater than 90 dB measured as per AAMI standards for cardiac monitors (EC13).

Display Size and Type: 5 inch (12.7 cm) diagonal CRT for 4 seconds of ECG data on screen; non-fade, fixed trace. Scrolling trace is selectable.

Sweep Speed:

-Fixed trace: 25 mm/sec nominal

-Scrolling trace: 28.5 mm/sec nominal

Frequency Response: 0.5 to 40 Hz.

Heart Rate Display: Digital readout on monitor from 15 to 300 BPM.

Heart Rate Alarms: Three configurable pairs of high and low heart rate alarm limits from 20 to 280 BPM.

ECG Output: 1V/mV.

Patient Cable Length: 10 ft (3 m).

External Pacer

Current Pulse Amplitude: 10 mA to 200 mA.

Pulse Width: 20 msec.

Rate: 40 ppm to 180 ppm.

Modes: Demand or fixed rate.

Refractory Period: 340 msec (40 to 80 ppm); 240 msec (90 to 180 ppm).

Specifications
Defibrillator/Monitor

SpO₂

Measurement Range: 0 to 100%.

Accuracy with HP M1190A sensor: 1 standard deviation, 65-100%: $\pm 2.5\%$, resolution: 1%.

Averaging: 8 beats.

SpO₂ alarm limits — range: 100/90, 100/85, 100/80.

SpO₂ alarm delay: ten seconds after value drops below the low alarm setting.

INOP alerts: Triggered by disconnected sensor, noisy signal, light interference or low signal.

Pulse rate measurement range: 30 to 300 bpm $\pm 2\%$; resolution 1 bpm.

Pulse amplitude indicator: Indicates pulsatile activity.

Maximum operating temperature: 35°C.

Thermal Array Recorder

Event Summary: Stores and prints 3 seconds pre- and 8 seconds post-critical event data for up to 28 events. Data retained after unit is turned off.

Annotates: Time, date, HR, SpO₂, event marker, ECG mode, defibrillator mode, selected energy, actual delivered energy, peak current, patient impedance, and pacing current and rate.

Speed: 25 mm/sec.

Paper Size: 50 mm by 30 m (100 ft).

Recorder Mode: Automatically documents events and ECG during defibrillation episodes. The recorder can be configured to run in either real time or with a six second delay.

Frequency Response:

-CodeMaster 100 without the 12-Lead option: 0.5 to 40 Hz

-CodeMaster 100 with the 12-Lead option: 0.05 to 150 Hz selectable.

Size and Weight of the CodeMaster 100 without the 12-Lead Option

Defibrillator dimensions: 6.25 in H by 13.75 in W by 15.125 in D (15.9 cm H by 34.9 cm W by 38.4 cm D).

Defibrillator weight: 21.5 lb (9.75 kg). Includes external paddles, battery, and recorder paper.

Specifications
Defibrillator/Monitor

Advisory Mode (Option C80)

Analysis time: Seven to ten seconds.

Output Energy (Delivered): Available protocol 200J, 200J, 360J and 200J, 300J, 360J.

Analysis Control: Push-button on front panel.

Charge Time: Less than 5 seconds to 360 joules with battery present.

Armed Indicators: Charge done tone and available energy indicated on display.

Advisory Event Summary: Stores approximately 200 events and 50 ECG strips. Data retained after instrument turned off.

Waveform: Damped sinusoidal (Lown).

12-Lead (Option C90)

Basic ECG Controls:

ID, 12-Lead, and Transmit, ON, Copy, and Filter Keys, Alphanumeric QWERTY keyboard

Signal Processing/Recording:

Frequency response: Selectable from these ranges;

0.05-150, 0.15-150, 0.5-150Hz

0.05-100, 0.15-100, 0.5-100Hz

0.05-40, 0.15-40, 0.5-40Hz

When 0.15-150Hz is selected, the 12-Lead recorder tracing meets the Frequency and Impulse Response specification of ANSI/AAMI EC11-1991 Diagnostic Electrocardiographic Devices by methods A, D and E.

Filters:

Noise Filter: On/Off capability. Power line filter always enabled. Configurable baseline wander, noise, and artifact filters.

Storage:

Capacity: 30 ECGs

Type: 2 MB of non-removable flash memory

Transmission of 12-Lead ECGs to HP ECG Manager (PC-Based Receiving Station Software):

-Internal cellular/landline modem with RJ11C connector (US, Canada, UK only)

-RS232 Port for external modem.

Modem Command Interfaces:

Data: Hayes standard AT command set

Fax: EIA/TIA - 578 Service Class I

Recommended Modem Protocols:

-Modulation Protocol: V.34

-Error Correction Protocol: V.42

-Compression Protocol: V.42 bis

-FAX Modulation Protocol: V.17, V.29, V.27ter, V.21 channel 2

Specifications
Defibrillator/Monitor

Reports:

Full 12-Lead ECG report: 12-Lead ECG printed in 3X4 format with configurable rhythm strips.

Size and Weight:

Dimensions:

7.25 in H by 13.75 in W by 15.13 in D (18.5 cm H by 34.9 cm W by 38.4 cm D).

Weight:

23.5lb (10.65 kg). Includes paddles, standard 2.5 Ah battery, and recorder paper.

Additional Standard Accessories:

12-Lead Patient Cable

Starter kit of electrodes

Soft Carrying Case

Battery

HP M2476B 2.5 amp-hour battery

Type: Rechargeable nickel-cadmium battery, 2.5 Ah, 12 V nominal.

Capacity:

M2475B Standard: 2500 mAh; 2.5 hours ECG monitoring or 50 full-energy discharges or 1.75 hours combined ECG and SpO2 monitoring while pacing.

M2475B with the 12-Lead Option: 2500 mAh; 2.0 hours ECG monitoring or 50 full-energy discharges or 1.5 hours combined ECG and SpO2 monitoring while pacing.

Battery Indicators: LOW BATTERY warning message appears on the monitor when approximately 30 minutes of battery capacity remains.

Battery dimensions: 3.35 in H by 2.96 in W by 7.25 in D (85 mm H by 75 mm W by 184 mm D).

Battery weight: 2.7 lb (1.22 kg).

Battery storage: Range of -30 to 50°C. Should not be stored above 35°C for extended periods of time.

HP M2477B 4.0 amp-hour battery

Type: Rechargeable nickel-cadmium battery, 4.0 Ah, 12 V nominal.

Capacity:

M2475B Standard: 4000 mAh; 4 hours ECG monitoring or 75 full-energy discharges or 3 hours combined ECG monitoring while pacing.

M2475B with the 12-Lead Option: 4000 mAh; 3 hours ECG monitoring or 75 full-energy discharges or 2.5 hours combined ECG monitoring while pacing.

Battery Indicators: LOW BATTERY warning message appears on the monitor when approximately 30 minutes of battery capacity remains.

Battery dimensions: 3.34 in H by 2.96 in W by 7.25 in D (85 mm H by 75 mm W by 185 mm D).

Battery weight: 4.3 lb (1.95 kg).

Specifications

HP M2480B Battery Support System

Battery storage: Range of -30 to 50°C. Should not be stored above 35°C for extended periods of time.

HP M2480B Battery Support System

Charging Specifications

Charging capacity: Two batteries.

Charge time: Typically 2 to 3 hours.

Capacity test time: Approximately 24 hours.

Recommended battery charging temperature: 10 to 30°C.

Environmental operating conditions: 0 to 55°C, 15 to 95% relative humidity (noncondensing) for 24 hours at 40°C, 15,000 ft altitude.

Storage conditions: -20 to 70°C, 90% relative humidity (noncondensing) for 24 hours at 65°C, 15,000 ft altitude.

Size and Weight

Dimensions: 5.1 in H by 14.6 in W by 12.5 in D (13.0 cm H by 37.1 cm W by 31.8 cm D).

Weight: 14.5 lb (6.58 kg) not including battery pack.

HP M2478A DC External Power Module

For use only with CodeMaster 100 Defibrillator/Monitor.

Size: 1.75 in H by 5.5 in W by 3.25 in D (4.44 mm H by 14.0 mm W by 8.25 mm D).

Weight: 1.1 lb (0.5 kg).

Input cable: 10 ft (3.0 m).

Output cable: 3.0 ft (0.91 m).

Input: 11.8–16 V DC, 1.0 A, 12 W; 8 A, 100 W maximum.

Battery charging output : 12 V DC, 1.0 A, 12 W; 90.0 mA, 1.1 W trickle.

Instrument operation output: 12 V DC, 1.0 A, 12 W; 7 A, 85 W maximum.

Charge time: With defibrillator/monitor turned to Off/Standby: typically four hours—HP M2476B 2.5 Ah Battery, typically six hours—HP M2477B 4.0 Ah Battery.

Recommended charging temperature: 5° C to 35° C.

Environmental operating conditions: 0° C to 55° C, 5 to 90% relative humidity, non-condensing, 15000 ft altitude (500 hPa).

Transport and storage: -40° C to 70° C, 10 to 100% relative humidity including condensation, 15000 ft altitude (500 hPa).

HP M2479A AC External Power Module

For use only with CodeMaster 100 Defibrillator/Monitor.

Size: 3.625 in H by 8.375 in W by 9.0 in D (9.21 cm H by 21.3 cm W by 22.9 cm D).

Weight: 4.0 lb (1.8 kg).

Input cable: 6.6 ft (2.0 m).

Output cable: 4.0 ft (1.2 m).

Input: 100-240 V AC, .75 A, 75 VA; 2.75 A, 275 VA maximum.

Output :

Battery charging: 12 V DC, 1.0 A, 12 W; 90.0 mA, 1.1 W trickle.

CodeMaster 100 operation: 15 V DC, 1.0 A, 15 W; 7 A, 105 W maximum.

Charge time: With defibrillator/monitor turned to Off/Standby: typically four hours—HP M2476B 2.5 Ah Battery, typically six hours—HP M2477B 4.0 Ah Battery.

Recommended charging temperature: 10° C to 30° C.

Environmental operating conditions: 0° C to 55° C, 5 to 90% relative humidity, non-condensing, 15000 ft altitude (500 hPa).

Transport and storage: -40° C to 70° C, 10 to 100% relative humidity including condensation, 15000 ft altitude (500 hPa).

Equipment classification:

- Classification with respect to protection from electric shock: Class 1;
- Degree of protection against ingress of liquids: IPX0;
- Equipment not suitable for use in the presence of a flammable anesthetic mixture with air or with nitrous oxide;
- Mode of operation: Continuous (battery charging & monitoring)

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