



Medtronic

LIFEPAK® 20 Defibrillator/Monitor with ADAPTIV™ Biphasic Technology **Service Manual**



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Preface

This service manual describes how to maintain, test, troubleshoot, and repair the LIFEPAK 20 defibrillator/monitor. A separate publication, the **LIFEPAK 20 Defibrillator/Monitor Operating Instructions**, is for use by physicians, clinicians, and emergency care providers. The operating instructions provide step-by-step instructions as well as operator-level testing and maintenance.

Note: Hyperlinks appear in **blue text**. Text that indicates a control, buttons, message, or screen overlay appears as small caps. For example, ADVISORY control and EVENT button.

This section covers the following topics:

Trademarks

Using Bookmarks

Using Thumbnails

Navigating Through the Manual

Topic Navigation

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Contacting Medtronic
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Trademarks

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Using Bookmarks

Bookmarks appear in a column on the left side of the screen. They enable you to easily navigate to main sections of the manual, similar to a table of contents.

To view the bookmarks column:

- Select the **BOOKMARKS** tab located to the far left of the screen.
- Click the **SHOW/HIDE NAVIGATION PANE** button  on the tool bar.

To close the bookmarks column:

- Click the **SHOW/HIDE NAVIGATION PANE** button  on the tool bar..

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Using Bookmarks (Continued)

To move to a topic using bookmarks:

1. Display the bookmarks column.
2. Click the desired bookmark caption.

Note: A plus sign to the left of the bookmark caption indicates subordinate bookmarks are available under that caption. Click the plus sign to reveal the subordinate bookmarks. Click the plus sign a second time to hide the subordinate bookmarks.

3. Click the bookmark text or double-click the page icon to the left of the bookmark name to jump to the desired topic.


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Using Thumbnails

A thumbnail is a miniature view of each page in the document. You can use thumbnails to jump quickly to a page.

To jump to a page by using its thumbnail:


1. Click the SHOW/HIDE NAVIGATION PANE button  to display thumbnail images. Thumbnail images appear in the overview area of a window.
2. Click a thumbnail to move to the page it represents.

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Navigating Through the Manual

To jump from topic to topic:

- Click on any **highlighted text** or **link** to jump to that topic. The pointer changes to a pointing finger  when positioned over a link.

To jump from page to page:

- Click  **Table of Contents** located in the page footer to jump to the table of contents.
- Click  **Section Contents** located in the page footer to jump to the section contents for the section you are currently viewing.
- Click  **Index** located in the page footer to jump to the index.
- Click  **Back** located in the page footer to retrace your steps in a document, returning to each screen in the reverse order visited.
- Click  **Next Page** located in the page footer or press the RIGHT ARROW on your keyboard to jump to the next page of the manual.
- Click  **Previous Page** located in the page footer or press the LEFT ARROW on your keyboard to jump to the previous page of the manual.

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Topic Navigation

On many pages in the manual, a second line of navigation options appears directly above the page footer. This second line provides jumps between pages with multiple topics that are closely related.

Accessing Acrobat Help

For additional assistance using the Acrobat Reader program that came with this package, access `READER HELP` in the Help menu.

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Viewing Other Medtronic Documents

The following additional online documents are included on this CD-ROM:

- [LIFEPAK 20 Defibrillator/Monitor Operating Instructions](#)
- [LIFEPAK 20 Defibrillator/Monitor Performance Inspection Procedure Checklist](#)

You may view these documents by opening the file in Acrobat Reader or by clicking a link to the appropriate document. Click on a document's table of contents, section contents, index, or bookmarks to jump to a specific area within each document.

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Service Personnel Qualifications

Service personnel must be properly qualified and thoroughly familiar with the operation of the LIFEPAK 20 defibrillator/monitor. They must meet at least one of the following requirements (or the equivalent):

- Associate of Applied Science, with an emphasis in biomedical electronics
- Certificate of Technical Training, with an emphasis in biomedical electronics
- Equivalent biomedical electronics experience

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Contacting Medtronic

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Responsibility for Information

This service manual describes the methods required to maintain, test, and repair the LIFEPAK 20 defibrillator/monitor. This manual does not cover operation of the LIFEPAK 20 defibrillator/monitor. **Qualified service personnel** must consult both the **LIFEPAK 20 Defibrillator/Monitor Operating Instructions** and the LIFEPAK 20 Defibrillator/Monitor Service Manual to obtain a complete understanding of the use and maintenance of the device.

It is the responsibility of our customers to ensure that the appropriate person(s) within their organization have access to the information in this manual, including any warnings and cautions used throughout the LIFEPAK 20 Defibrillator/Monitor Service Manual.

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Device Tracking

The U.S. Food and Drug Administration requires defibrillator manufacturers and distributors to track the location of their defibrillators. The address to which this particular device was shipped is now listed as the current tracking location. If the device is located somewhere other than the shipping address or the device has been sold, donated, lost, stolen, exported, or destroyed, or if the device was not obtained directly from Medtronic, please call the device tracking coordinator at 1.800.426.4448 to update this vital tracking information.

General information related to device tracking:

It is important to maintain accurate records of defibrillator location within your facility or system. Maintenance of such records eases the process of locating defibrillators should it be necessary to modify them. Defibrillators should be tracked by both the manufacturer's part number and serial number. Internal asset or tracking numbers may also be useful in maintaining adequate control of defibrillators.

Preface

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Service Information

Before attempting to clean or repair any assembly in this device, service personnel should be familiar with the information provided in the **Preventive Maintenance** section of this manual.

Service personnel should inspect any defibrillator that has been dropped, damaged, or abused to verify that the device is operating within the performance standards listed in the **Performance Inspection Procedure (PIP)**, and that the leakage current values are acceptable.

Replacement procedures for the LIFEPAK 20 defibrillator/monitor are limited to those items accessible at the subassembly level. Replacements and adjustments must be made by **service personnel** qualified by appropriate training and experience. Replacements at the subassembly level simplify repair and servicing procedures, and help ensure correct device operation and calibration.

To obtain Medtronic service and maintenance for your LIFEPAK 20 defibrillator/monitor, contact your local service or sales representative. In the USA, call Medtronic Technical Services at 1.800.442.1142. Outside the USA, contact your local Medtronic representative.

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Warranty Information

Refer to the warranty statement included in the [LIFEPAK 20 Defibrillator/Monitor Operating Instructions – Maintaining the Equipment](#).

Masimo Use Agreement

No Implied License — Possession or purchase of this device does not convey any express or implied license to use the device with replacement parts that would, alone, or in combination with this device, fall within the scope of one or more of the patents relating to this device.

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Configuration Information

This service manual covers existing LIFEPAK 20 defibrillator/monitor devices and options through the following revisions:

- LIFEPAK 20 defibrillator/monitor basic device with ECG
- Pacing Option
- SpO2 Option

Preface

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Glossary

The following are definitions of terms used throughout this service manual.

- Automated External Defibrillator (AED) — The LIFEPAK 20 defibrillator/monitor uses an ECG analysis Shock Advisory System (SAS) to advise the device operator if it detects a shockable or nonshockable rhythm. For more information about CPSS and SAS, see the [operating instructions – Shock Advisory System](#).
- Biphasic — Property of the shock waveform generated by the LIFEPAK 20 defibrillator/monitor. The biphasic waveform is characterized by a positive current phase followed by a reverse current phase of shorter duration and decreased magnitude. The waveform pulse characteristic is biphasic truncated exponential (BTE).
- CODE SUMMARY™ Report — A summary report that includes the ECG segments associated with key events such as analysis or shock. See the [operating instructions – Data Management](#) for a sample CODE SUMMARY Report.

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Glossary (Continued)

- Continuous Patient Surveillance System (CPSS) — A feature that monitors the patient ECG in LEADS or PADDLES for a potentially shockable rhythm. CPSS is active when the AED Mode indicator is illuminated or the VF/VT ALARM is selected after pressing the ALARMS control (manual mode). The CPSS operates in conjunction with the Shock Advisory System™ (SAS). For more information about CPSS and SAS, refer to the [operating instructions – Shock Advisory System](#).
- Event Log Summary — A report summarizing important events for a particular patient record; part of the CODE SUMMARY Report.
- FAST-PATCH® disposable defibrillation/ECG electrodes — An electrode system that allows delivery of defibrillation therapy to the patient.
- QUIK-COMBO™ pacing/defibrillation/ECG electrodes — An electrode system that allows delivery of pacing and defibrillation therapy to the patient.
- QUIK-COMBO patient simulator — A combination lead tester/patient cardiac rhythm simulator. The simulator is designed for use in training clinical personnel in the operation of the LIFEPAK 20 defibrillator/monitor.
- REDI-PAK™ preconnect system — A variant of the QUIK-COMBO pacing/defibrillation/ECG electrodes system. The system allows QUIK-COMBO pacing/defibrillation/ECG electrode cable connection without removing the electrodes from their air-tight sealed pouch until needed.

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Glossary (Continued)

- Shock Advisory System™ (SAS) — A computerized ECG analysis system for use in the detection of a shockable rhythm. For more information about CPSS and SAS, see the [operating instructions – Shock Advisory System](#).
- SpO2 — A noninvasive pulse oximeter that checks the saturation of oxygen in arterial blood.
- Test Load — A device that provides an external defibrillation test load for the defibrillator/monitor. The test load connects to the patient connector on the device.

Preface

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Acronyms

The following is a list of acronyms and abbreviations used in this manual.

Term	Description
AAMI	Association for the Advancement of Medical Instrumentation
ADC	Analog-to-Digital Conversion
AED	Automated External Defibrillator
AHA	American Heart Association
ANSI	American National Standards Institute
BTE	Biphasic Truncated Exponential
BF	Electrically isolated, external body connection
BPM	Beats Per Minute
CF	Electrically isolated, direct cardiac connection
CPR	Cardiopulmonary Resuscitation
CPU	Central Processing Unit
CPSS	Continuous Patient Surveillance System
DUART	Dual Universal Asynchronous Receiver/Transmitter
DMM	Digital Multimeter
ECG	Electrocardiogram

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Preface

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Acronyms (Continued)

Term	Description
EMS	Emergency Medical Service
ESD	Electrostatic Discharge
ESU	Electrosurgical Unit
HR	Heart Rate
IEC	International Electrical Commission
LCD	Liquid Crystal Display
LED	Light Emitting Diode
NHAAP	National Heart Attack Alert Program
NSR	Normal Sinus Rhythm
OEM	Original Equipment Manufacturer
RR	Respiration Rate
PC	Personal Computer
DSP	Digital Signal Processor
PCB	Printed Circuit Board
PIP	Performance Inspection Procedure
PPM	Pulses Per Minute

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Acronyms (Continued)

Term	Description
RISC	Reduced Instruction Set Computer
RTC/NVRAM	Real-Time Clock/Non-Volatile Random-Access Memory
SAS	Shock Advisory System
SSD	Static-Sensitive Device
TCP	Test and Calibration Procedure
UUT	Unit Under Test
VF	Ventricular Fibrillation
VT	Ventricular Tachycardia

Safety

This section describes the general safety conventions, terms, and symbols used in this service manual or on the LIFEPAK 20 defibrillator/monitor. This information is intended to alert service personnel to recommended precautions in the care, use, and handling of this medical device.

Terms

General Warnings and Cautions

Symbols

Safety

2-2

Terms

The following terms are used in this service manual or on the various configurations of the LIFEPAK 20 defibrillator/monitor. Familiarize yourself with their definitions and significance.

Danger: Immediate hazards that will result in serious personal injury or death.

Warning: Hazards or unsafe practices that could result in serious personal injury or death.

Caution: Hazards or unsafe practices that could result in device or property damage.

Note: Points of particular interest for more efficient or convenient device operation; additional information or explanation concerning the subject under discussion.

Safety

2-3

General Warnings and Cautions

The following are general warnings and cautions. Keep these warnings and cautions in mind when working with the LIFEPAK 20 defibrillator/monitor. More specific warnings and cautions appear throughout this service manual and the LIFEPAK 20 defibrillator/monitor Operating Instructions.

WARNINGS!

Possible fire or explosion. Do not service this device in the presence of flammable gases, anesthetics, or oxygen sources.

Shock or fire hazard. Do not immerse any portion of this device in water or other fluids. Avoid spilling any fluids on the device or accessories. If the device is ever immersed in water or other fluids, remove the batteries and disconnect ac power until the device can be serviced.

Patient hazard. Do not mount the device directly above patient. Place the device in a location where it cannot harm the patient should it fall from its shelf or other mount.

Shock or fire hazard. Equipment or accessories improperly interconnected to each other can be a source of ignition or cause a shock. Make sure that all equipment is interconnected safely.

Safety

2-4

General Warnings and Cautions (Continued)

WARNING!

Shock hazard. Servicing of this device must be performed by properly trained individuals. This device may retain potentially lethal charges accessible inside the device at any time – even when off. Follow procedures carefully for discharging the A13 Energy Storage Capacitor.

CAUTION!

Possible equipment damage. This device may be damaged by mechanical or physical abuse such as immersion in water or dropping. If the device has been abused, remove it from use and contact qualified service personnel.

Safety

2-5

Symbols

The following list includes symbols that may be used in this service manual or on various configurations of the LIFEPAK 20 defibrillator/monitor and accessories. Some symbols may not be relevant to your device or used in every country.



[signal] Input



[signal] Output



ac voltage



Alarm off



Alarm on



Attention, consult accompanying documents



Biphasic defibrillator shock



Canadian Standards Association certification for Canada and the United States

Safety

2-6

Symbols (Continued)



Date of manufacture



DC voltage



Defibrillation protected, type BF patient connection



Defibrillation-proof type CF terminal



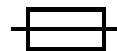
Equipotential connector



Event marker



For USA audiences only

Fragile/Breakable
Handle with care

Fuse



Greater than

Safety

2-7

Symbols (Continued)



Heart Rate



HOME SCREEN button



Indoor use only

J

Joules



Less than



LIFEPAK 20 defibrillator/monitor to LIFEPAK 20 defibrillator/monitor cable



Lot number (batch code)

MIN

Manufacturers Item Number




Mark of conformity according to the European Medical Device Directive 93/42/EEC

Safety

2-8

Symbols (Continued)

—	Negative terminal
○	Off (power: disconnection from the ac mains)
	On (power: connection to the ac mains)
↑	Pace arrow, internal pacing
▲	Pace arrow, noninvasive pacing
+	Positive terminal
ⓘ	Power on/off
☂	Protect from water
▼	R-wave sense marker
	Recognized component mark for Canada and the United States

Safety

2-9

Symbols (Continued)



Recycle this item

REF

Reorder number (catalog number)



Safety ground. Protective earth connection



SHOCK button



Shock count (x) on screen



Single use only



Static-sensitive device (SSD)



Switch off



Switch on



Sync in / ECG out

Safety

2-10

Symbols (Continued)



System connector/Data in



This end up



Turn counterclockwise to unlock



Type BF patient connection



Use by date shown: yyyy-mm-dd



VF/VT alarm on



VF/VT alarm silenced



Warning, high voltage

Device Description

This section includes the following topics:

Introduction

Physical Description and Features

Ordering Devices, Supplies, and Accessories

System Context Diagram

Functional Description

Introduction

3-2

About the Device

The LIFEPAK 20 defibrillator/monitor is a complete acute cardiac care response system with both manual and semiautomatic defibrillation operation. When clinically indicated, the LIFEPAK 20 defibrillator/monitor enables the operator to deliver a brief, high-energy pulse of electricity to the patient's heart. Operators may preconfigure the device to reduce complexity during normal operation.

Energy Delivery

The LIFEPAK 20 defibrillator/monitor generates a Biphasic Truncated Exponential (BTE) shock pulse for defibrillation. The standard method of energy delivery is through self-adhesive QUIK-COMBO pacing/defibrillation/ECG electrodes. When using these Disposable Defibrillation Electrodes (DDEs), internal circuitry continuously measures the impedance between the electrodes and allows defibrillation only when the defibrillation electrodes are attached to the patient. The user may select from a variety of optional accessories for energy delivery (for example, standard hard paddles or internal paddles).

Manual Mode Operation

In manual mode (AED MODE indicator off), the device enables the operator to manually select an energy level, initiate a charge sequence, and apply energy in either direct or synchronized modes. When the operator selects the VF/VT ALARM from the Alarms menu, the Continuous Patient Surveillance System (CPSS) monitors the patient's ECG for a shockable rhythm. A suspect rhythm

Introduction

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AED Mode Operation

alerts the operator with a priority tone and screen. The operator can then follow locally established guidelines for the administration of defibrillation therapy.

In the AED mode (ADVISORY indicator on), the device uses the CPSS to monitor the patient's ECG for a shockable rhythm. A suspect rhythm alerts the operator with a priority tone and screen. The operator may continue by pressing the ANALYZE button, which allows the Shock Advisory System (SAS) to analyze the ECG rhythm and make recommendations. The operator can then follow locally established guidelines for the administration of defibrillation therapy. For more information about CPSS and SAS, see the [operating instructions – Appendix D](#).

Device Primary Functions

The device has four primary functions:

- Defibrillation
 - Manual or semi-automatic (AED) defibrillation
 - Synchronized cardioversion in manual mode
 - Leads off detection for therapy and ECG electrodes
- Noninvasive Pacing
 - Demand and nondemand modes of operation

(Continued on next page)

Introduction

3-4

Device Primary Functions (Continued)

- Capture Patient Information
 - Stores both patient and device data at each event
 - Real-time clock provides time stamps for events
 - Provides operator review of started events for printout
- Patient Signal Monitoring
 - Displays up to two waveforms at once
 - Displays a continuous pulse oximetry (SpO₂) readout
 - Displays a continuous heart rate readout
 - Displays waveform pace and sense markers
 - Monitors for ventricular fibrillation/ventricular tachycardia and sounds warning alarm
 - Prints continuous ECG data

Service features include calibration and diagnostic functions.

Introduction

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Assemblies

The LIFEPAK 20 defibrillator/monitor consists of a three-piece case assembly that encloses the following modules:

1. System Control Module
2. Patient Parameter Module
3. Power Module
4. Therapy Module
5. User Interface Module
6. OEM Module

and the following OEM and mechanical components:

1. Display
2. Speaker
3. User Controls and Indicators
4. Printer
5. SpO2 Acquisition
6. Patient Connector Panel
7. System Connector Panel Module
8. Internal AC to DC Power Supply
9. Internal Battery
10. Internal Cables

(Continued on next page)

Introduction

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Assemblies (Continued)

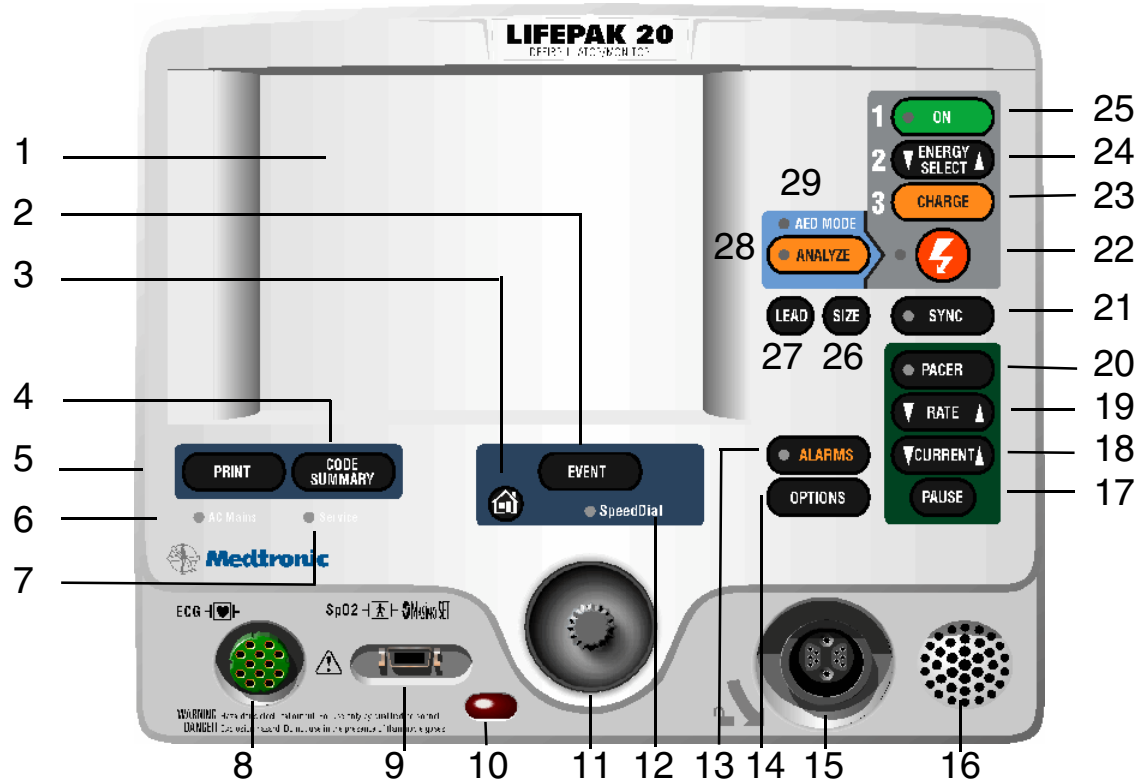
and the following Medtronic attachments:

1. ECG 3- or 5-Wire Cables
2. QUIK-COMBO Cable
3. SpO2 Cable
4. Internal Paddles
5. Sterilizable Hard Paddles
6. Standard Hard Paddles

Physical Description and Features

Front Panel

For information about any controls, indicators, or connectors, click the appropriate right arrow on the bar at the bottom of the screen.



Items 1–7 ▶

Items 8–14 ▶

Items 15–21 ▶

Items 22–29 ▶

Physical Description and Features

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Number	Description
1	Display screen — Color Liquid Crystal Display (LCD) screen displays operating messages, waveforms, status messages, setup screens, and so forth.
2	Event control — Press to activate user-defined events.
3	Home Screen control — Press to return to the home screen of the particular option or feature you are configuring. Pressing this button does not take you to a specific screen; instead, it returns to the home screen for the mode or event you are configuring.
4	CODE SUMMARY control — Press to print the CODE SUMMARY critical event record.
5	Print control — Press to start and stop the printer.
6	AC Mains light — Indicates that ac power (line power) is connected and also indicates that the battery is charging.
7	Service indicator — Lights when the device enters service error codes into the error log (accessed through the Service Mode). Refer to Troubleshooting for information about the error codes.

[Items 8–14](#)[Items 15–21](#)[Items 22–29](#)[Back to Device](#)

Physical Description and Features

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Number	Description
8	ECG cable connector — Connection point for the electrically isolated ECG patient cable.
9	SpO2 cable connector — Connection point for the pulse oximeter.
10	IrDA port connector — Infrared connection point provides wireless communications to data management devices (this feature is not available with this release).
11	Speed Dial selector — When active (Speed Dial light illuminated), turn (either direction) to make selections from the menu or overlay shown on the screen; press to confirm your selections.
12	Speed Dial LED — Lights when selector is active.
13	Alarms control — Press to activate and silence alarms.
14	Option control — Press to access options menu.

Physical Description and Features

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Number	Description
15	Therapy cable connector — Connection point for the following: <ul style="list-style-type: none"> – QUICK-COMBO electrodes (standard) – FAST-PATCH electrodes (with optional cable) – REDI PAK electrodes (optional) – Standard adult and pediatric paddles (optional) – External sterilizable paddles (optional) – Internal paddles (optional) – Posterior paddle (optional)
16	Speaker — Provides audio voice prompts and alert tones.
17	Pause control — Press to temporarily slow the pacing rate.
18	Current control — Press to adjust the pacing current.
19	Rate control — Press to select a pacing rate.
20	Pacer control — Press to activate the pacer function.
21	Sync control — Press to activate the synchronized mode.

Physical Description and Features

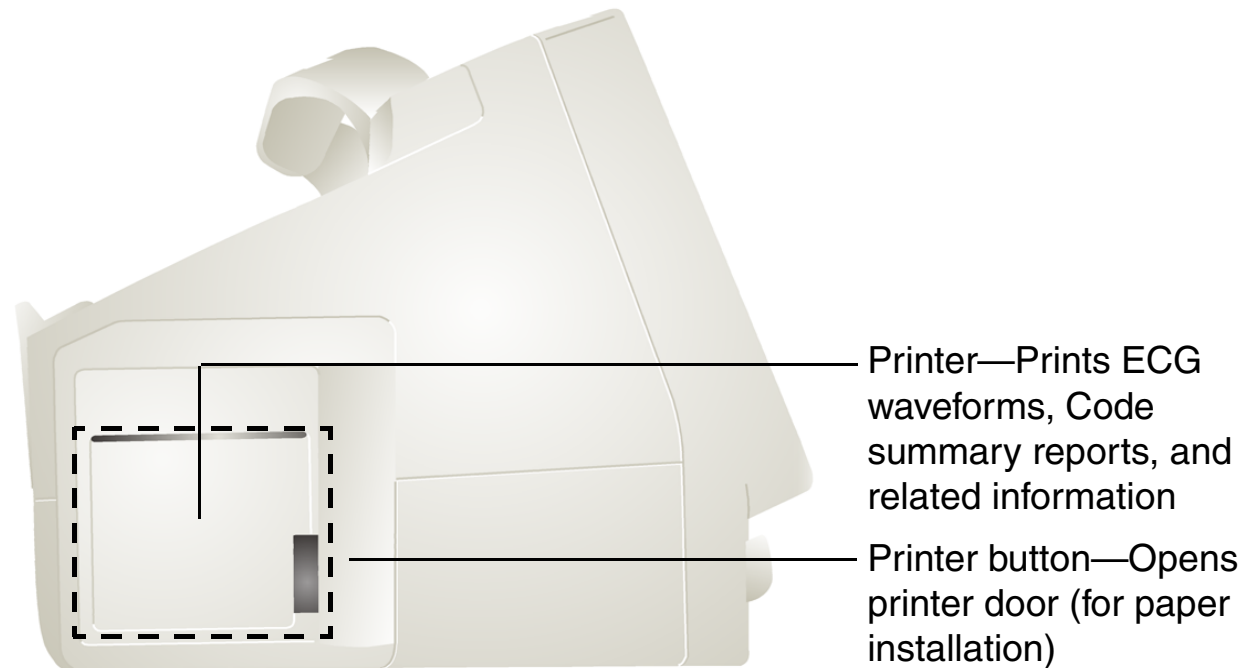
3-11

Number	Description
22	Shock control — Press to discharge the defibrillator.
23	Charge control — Press to charge the defibrillator.
24	Energy Select control — Press to select the energy levels in manual mode.
25	On control — Press to turn the LIFEPAK 20 defibrillator/monitor on and off. Illuminates when defibrillator is turned on.
26	Size control — Press to change the ECG size.
27	Lead control — Press to change the ECG lead.
28	Analyze control — Press to activate the Shock Advisory System (SAS).
29	AED mode indicator— Illuminates when defibrillator is in AED mode.

Physical Description and Features

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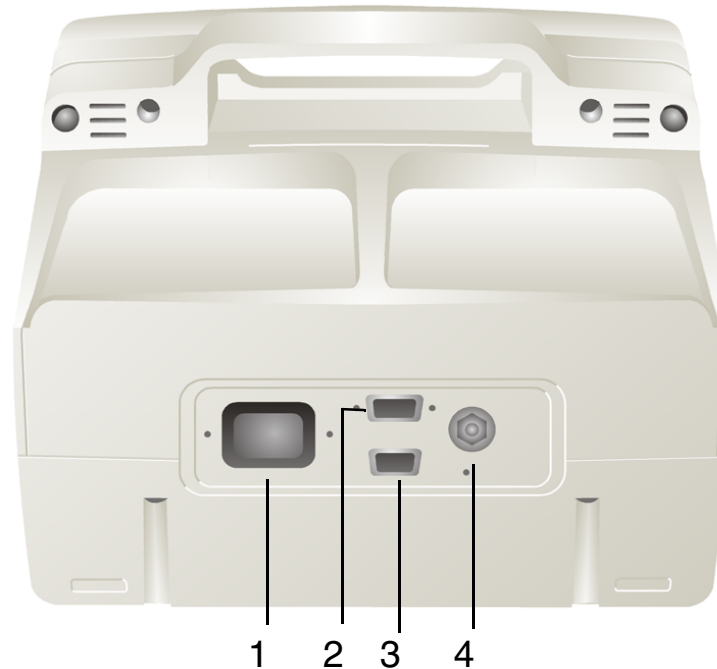
Side Panel



Physical Description and Features

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Back Panel



No.	Description
-----	-------------

1	AC power connector — Connection point for ac (line) power.
---	--

2	System connector — Connection point for RS-232 serial interface.
---	--

3	ECG/Sync connector.
---	---------------------

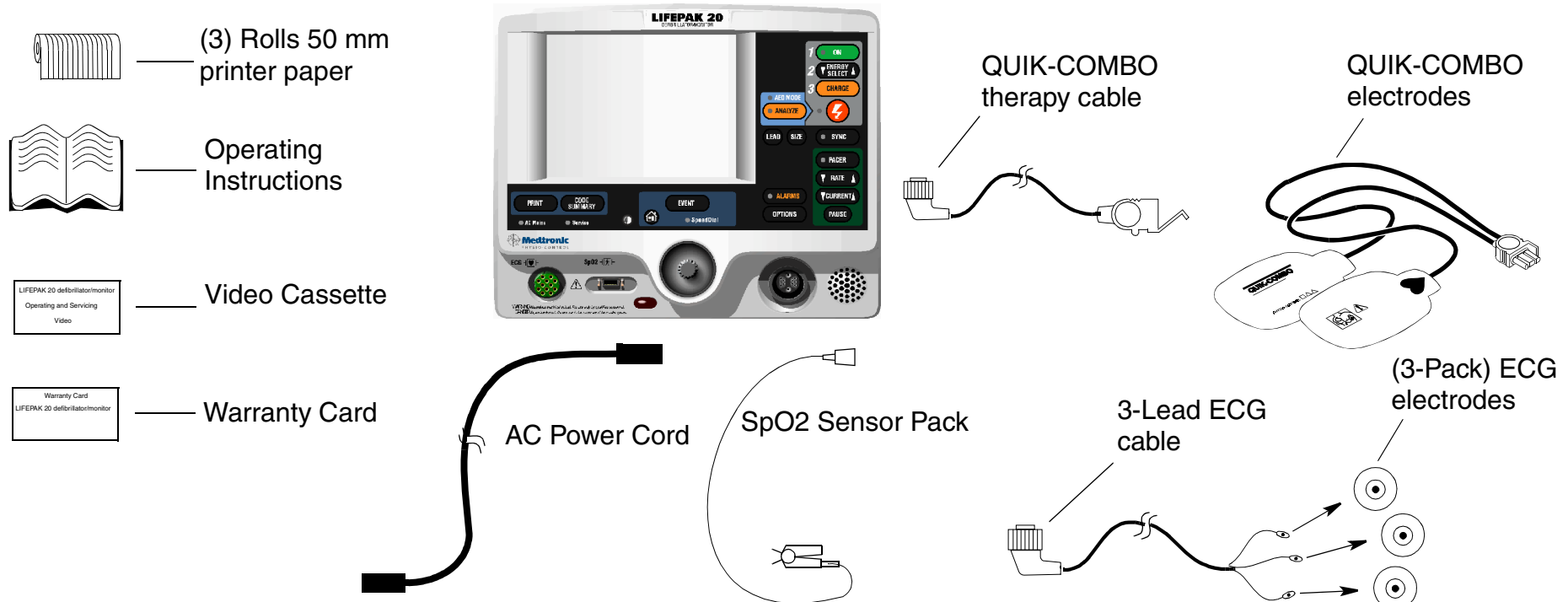
4	Grounding stud.
---	-----------------

Physical Description and Features

3-14

What Is Shipped with a Basic Device

A basic device includes the components shown below. For additional information about components, see Accessories, Supplies, and Training Tools in the LIFEPAK 20 Defibrillator/Monitor [Operating Instructions – Maintaining the Equipment](#).



Ordering Devices, Supplies, and Accessories

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The following table (provided for reference) summarizes optional configurations, supplies, and accessories that are available. For ordering instructions, refer to [How to Order Parts](#).

Item	Description	Part Numbers
LIFEPAK 20 Defibrillator/Monitor		
Basic Device	Device with Printer. Includes:	
	■ Device Operating Instructions	3200750
	■ Printer Paper	804700
	■ Video Cassette (AED)	3202372
	■ Video Cassette (Manual)	3202373
	■ Power Cord	803650
	■ Warranty Card	805963
	■ Accessory Order Form	3202149
ECG Options	■ 3-Lead ECG Cable (AHA and IEC)	3006218
	■ ECG Electrodes	800139

Ordering Devices, Supplies, and Accessories

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Item	Description	Part Numbers
QUIK-COMBO	■ QUIK-COMBO Therapy Cables	3006570
	■ REDI-PAK QUIK-COMBO Electrodes	3008497
	■ QUIK-COMBO Test Plug	3201673
SpO2	■ Masimo SpO2 Sensor Pack	3201655-009
	■ SpO2 Cable 2.4 m (8 ft)	3201655-001
5-Lead ECG	■ 5-lead ECG Cable (AHA)	3200496-00
	■ 5-lead ECG Cable (IEC)	3200496-01
	■ LIFE-PATCH ECG Electrodes	800139
Docking Station*	■ Docking Station and Installation Template	3201551

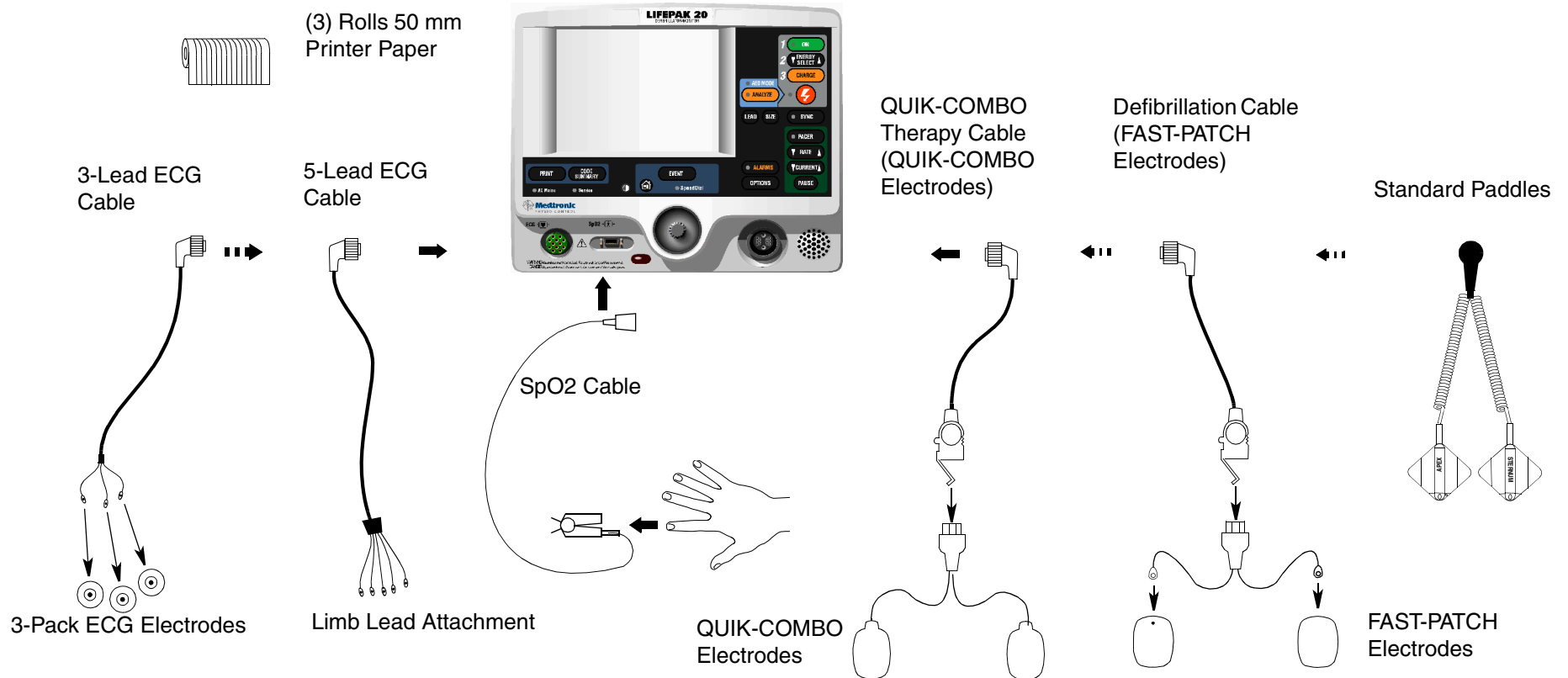
* You can install the docking station on any flat surface using the installation template provided with the device. Place the template where you want to install the docking station and use it as a guide to drill the holes for the screws that secure the device.

Note: Ensure that the LIFEPAK 20 defibrillator/monitor has an adequate turning radius before installing the docking station.

System Context Diagram

Front of Device

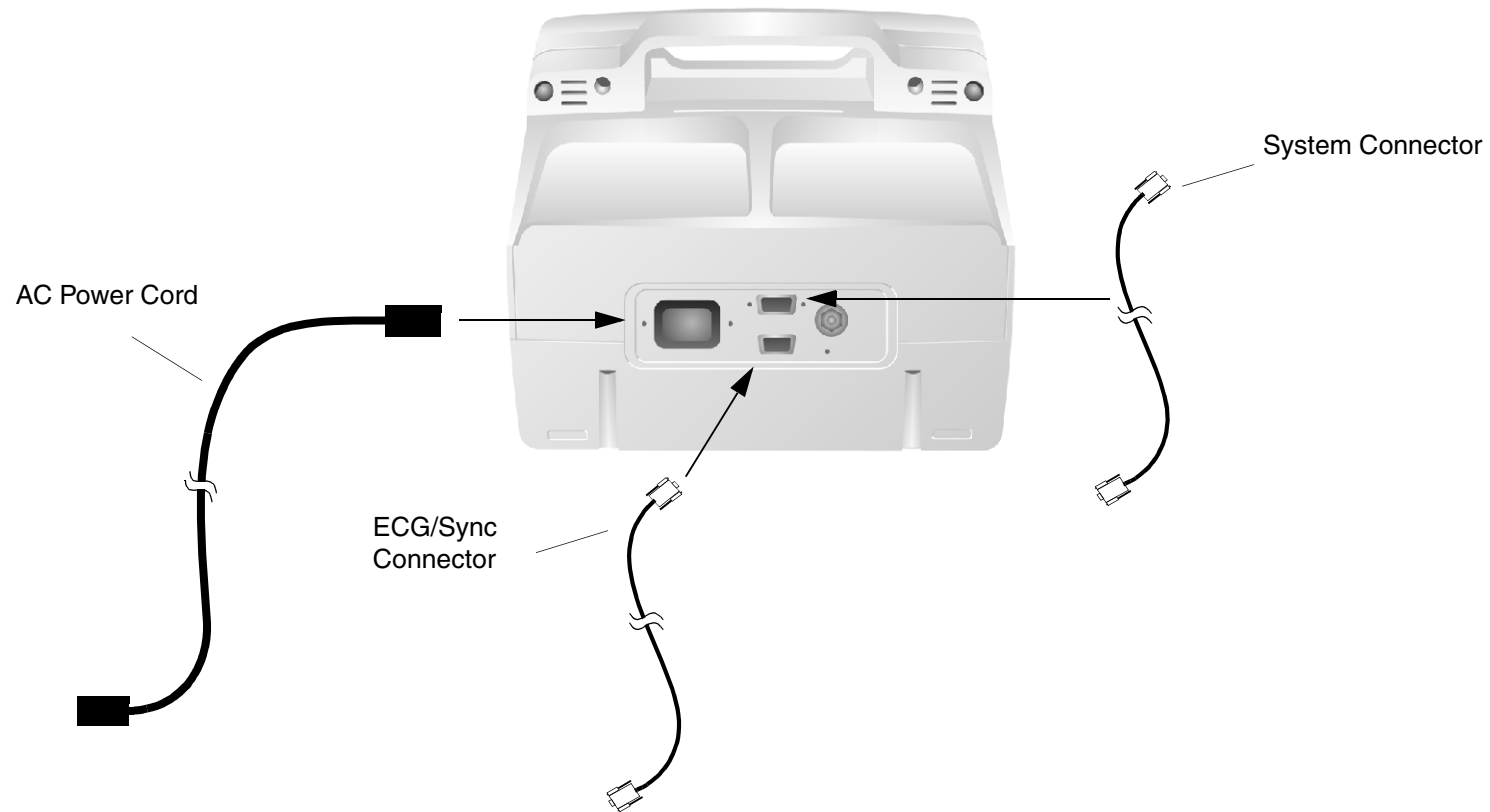
The system context diagrams below and on page 3-18 illustrate how the device connects with external equipment, including accessories, batteries, and power devices.



System Context Diagram

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Back of Device



Functional Description

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Introduction

The LIFEPAK 20 defibrillator/monitor is a medical device capable of combining a variety of therapeutic and monitoring features. In addition to automatic defibrillation, semiautomatic defibrillation, manual defibrillation, and noninvasive pacing, the LIFEPAK 20 defibrillator/monitor offers SpO₂ and ECG monitoring. This device should be used indoors only (for example: hospital, therapy center) and is powered by ac (line) power. There is an additional internal battery for use as a backup to ac power.

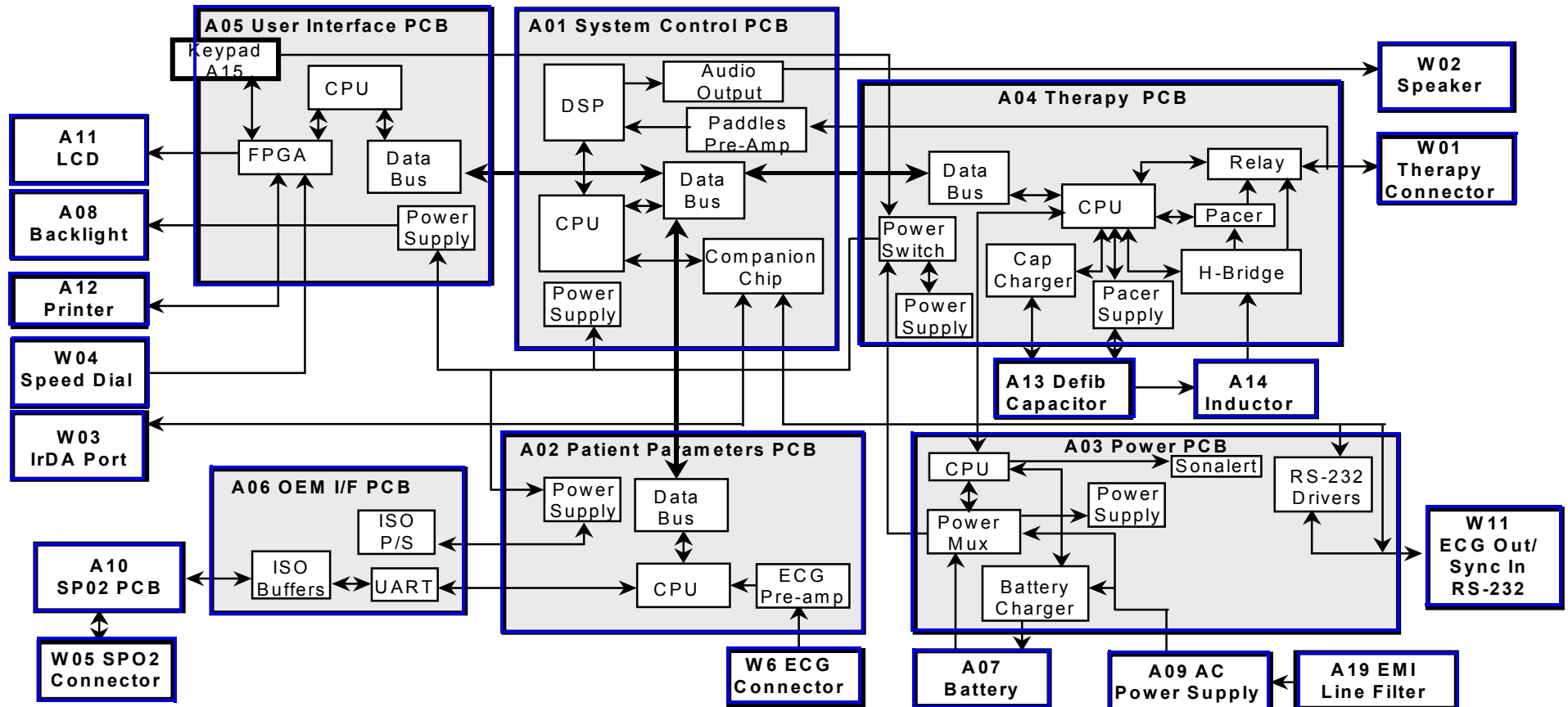
The following functional description is intended to provide service personnel with a basic understanding of the LIFEPAK 20 defibrillator/monitor design. Its purpose is to assist qualified service personnel in troubleshooting to the subassembly level. Troubleshooting below the subassembly level outside the factory is not recommended, nor is it within the scope of this service manual to provide the detail necessary to support such repairs.

Refer to the LIFEPAK 20 Defibrillator/Monitor System Block Diagram on the next page as you review the descriptions that follow.

Functional Description

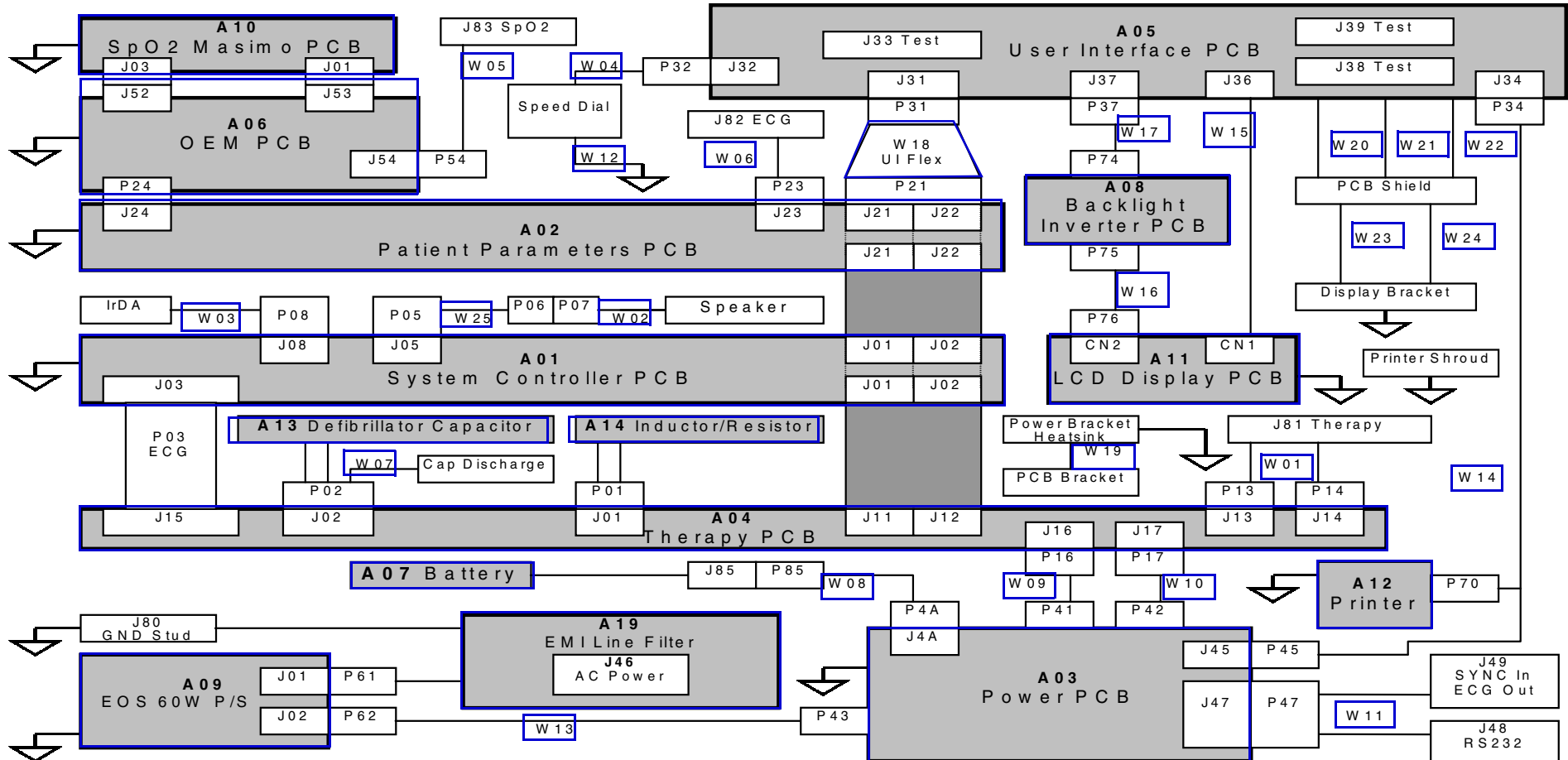
3-20

Click the modules and subassemblies in the System Block Diagram below and the System Interconnect Diagram, on the next page, to view the descriptive text.



Functional Description

System Interconnect Diagram



Functional Description

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A01 System Control Module

The A01 System Control module provides the central control for the LIFEPAK 20 defibrillator/monitor. A Reduced Instruction Set Computing (RISC) processor, along with a real-time clock and digital memory, serve as the central processing unit (CPU). A companion chip provides most of the discrete interfaces required within the defibrillator, including the RS-232 and IrDA external communication ports. The data bus provides high-speed communication between the system control PCB and other PCBs within the LIFEPAK 20 defibrillator/monitor.

The following subsections discuss the major subsystems on the A01 System Control module and their basic functions:

- **Power Supplies** — The A01 System Control PCB uses SW_VBatt (switched battery voltage) from the A04 Therapy PCB to originate five power supplies for use throughout the PCB as follows:
 - ± 5 V analog power for the analog ECG out, audio output circuitry, and bus control
 - +3.3 V logic power for the processor memory, companion chip and CPU I/O
 - +2.5 V logic power for the digital signal processor
 - +2.0 V logic power for the CPU processor chip
 - Patient-isolated ± 10 and ± 5 V analog power for the paddles pre-amp

(Continued on next page)

Functional Description

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A01 System Control Module (Continued)

- **Paddles ECG Pre-Amplifier** — The paddles ECG pre-amplifier performs patient-isolation, low-pass bandwidth filtering, and ECG sampling by means of an analog-to-digital conversion (ADC) for the ECG signal received via the therapy paddles. Results from the ADC are fed into the digital signal processor (DSP) for additional filtering. Electrostatic discharge (ESD) and defibrillation protection are provided for these signals as they pass through the A04 Therapy PCB. Patient impedance is also measured using a 57.1 kHz carrier and measures change in impedance (motion).
- **Digital Signal Processor (DSP)** — The DSP completes ECG digital signal processing to a diagnostic quality bandwidth, acceptable for SAS, heart rate algorithm processing, and continuous ECG storage by the CPU. In addition, the DSP provides the necessary audio processing for voice prompts and tones, providing digital audio signals to the audio output circuitry.
- **Audio Output** — The audio output circuitry provides digital-to-analog conversion, filtering, and power analog drive circuitry for the audio tones and voice prompts. Up to 2 W of amplification is provided to drive the W02 Speaker located on the defibrillator's front case.

Functional Description

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A02 Patient Parameter Module

The A02 Patient Parameter module collects all of the patient data (3- and 5-lead ECG and SpO2 for the LIFEPAK 20 defibrillator/monitor), with the exception of the paddles ECG data, and provides preprocessed data to the system controller for AED and R-wave algorithms, alarm control, operator display and printout, and storage. Algorithms performed on the data before it is sent to the A01 System Control include leads off detection and internal pacer detection. A digital signal processor (DSP) with digital memory makes up the central processing unit (CPU) that performs these algorithms. Communication is provided to the A01 System Control PCB through the data bus.

The following subsections discuss the major subsystems on the A02 Patient Parameter module and their basic functions:

- **Power Supplies** — The A02 Patient Parameter PCB uses switched power from the A04 Therapy module with dc power from the A07 Battery to originate three power supply voltages for use throughout the PCB as follows:
 - +3.3 V logic power to drive the CPU digital signal processor and memory
 - +5 V analog power to drive the A06 OEM Interface PCB
 - ± 5 V patient-isolated supply to drive the ECG pre-amp

(Continued on next page)

Functional Description

3-25

A02 Patient Parameter Module (Continued)

- **ECG Pre-Amplifier** — The ECG pre-amplifier performs the function of patient-isolation, low-pass bandwidth filtering, and ECG sampling through the analog-to-digital conversion (ADC) for the ECG signal received through the W06 ECG Connector. Digital signals are passed over the isolation barrier into the DSP for additional signal processing.

A03 Power Module

The A03 Power module is primarily responsible for selecting the best available source to power the rest of the PCBs in the system from the available power sources. A microcontroller with built-in memory makes up the CPU.

Communication is provided to the A04 Therapy PCB through a serial interface.

The following subsections discuss the major subsystems on the A03 Power module and their basic functions:

- **Power Supplies** — The A04 Power PCB uses ORed_VBatt (battery voltage ORed with dc power from the A09 AC Power Supply) to originate two power supply voltages for use throughout the PCB as follows:
 - +5 V logic power to drive the CPU microcontroller and memory
 - + 3.3 V analog power to drive the power pump for the RS-232 driver circuits

(Continued on next page)

Functional Description

3-26

A03 Power Module (Continued)

- **Power Mux** — The power mux switches battery power in and out of VBatt, depending on power availability and load draw within the LIFEPAK 20 defibrillator/monitor. This circuit is under supervisory control of the CPU and provides the current voltage from the A07 Battery and AC power supply to the CPU. The circuit automatically switches from ac power to battery power, if the voltage from the AC power supply was to rapidly fall. Low voltage is detected by the A09 Power PCB and broadcast to the other PCBs through the device internal communication buses.
- **Battery Charger** — The battery charger is a constant current charger designed specifically to support the A07 NiMH Battery selected for the defibrillator. NiMH batteries are not designed for trickle charging, so the A09 Power PCB keeps track of the amount of time the device has been operating from battery power. Charging is performed following high use incidents and periodically when the batteries are not in high use. Charging can occur while the unit is powered on or while the unit is powered off, depending on need. The battery charger is designed to charge the internal battery usually in less than two hours.

(Continued on next page)

Functional Description

3-27

A03 Power Module (Continued)

- **Sonalert** — The sonalert is an audio tone generator located on the power PCB, that warns the user if the device is turned off while not connected to ac power (which depletes the internal A07 Battery). Sonalert can be turned off through the Service Configuration screens. A shipping mode is provided by means of the Service Configuration screens to temporarily disable this feature when packing the defibrillator for shipment.
- **RS-232 Drivers** — The RS-232 drivers are provided to level shift the RS-232 communications from TTL provided by the A01 System Control PCB to the standard RS-232 ± 12 V prior to leaving the device through the system connector.

Functional Description

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A04 Therapy Module

The A04 Therapy module controls the pacing and defibrillation therapy features. The primary communication between the A04 Therapy PCB and the remainder of the defibrillator is through the data bus. A microprocessor and digital memory make up the central processing unit (CPU) that manages communication with the A01 System Control PCB.

The following subsections discuss the major subsystems on the A04 Therapy module and their basic functions:

- **Power Supplies** — The A04 Therapy PCB uses SW_VBatt (switched battery voltage) from the A03 Power PCB to originate five power supply voltages for use throughout the PCB as follows:
 - +5 V logic power to drive the CPU microprocessor and memory
 - ± 15 V analog power for the pacing and therapy drive circuit
 - Patient-isolated 5 V analog power for the pacing and therapy circuits
 - Patient-isolated 15 V analog power for the pacing and therapy circuits
 - Patient-isolated 30 V analog power for the pacing and therapy circuits

(Continued on next page)

Functional Description

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A04 Therapy Module (Continued)

- **Power Switch** — A power switch is a control circuit that detects the ON button selection from the A05 User Interface PCB or a timer event from the A01 System Control PCB to power up the device. This portion of the A04 Therapy PCB is powered at all times, with very low quiescent current draw. When a power on request is detected, this circuit switches VBatt (battery and/or ac converted dc power) provided by the A03 Power PCB to the remaining PCBs in the device. Low Battery (Battery Fail) is detected and a discrete signal is broadcast to other modules if battery voltage falls rapidly, or reaches the point where normal operation is no longer feasible.
- **Cap Charger** — The cap charger is a high-voltage, patient-isolated circuit that charges the A13 Energy Capacitor to the correct voltage for biphasic defibrillation (2 to 360 joules). Control is provided by the CPU, and capacitor voltage is provided back to the CPU for feedback. The cap charger is designed to nominally provide maximum charge rates and auto scale back to slower charge rates when low battery voltage is detected.
- **Pacer Power Supply** — The pacer power supply is a patient-isolated circuit that charges up the A13 Energy Capacitor to the correct voltage for pacing. Control is provided by the CPU and voltage regulation is maintained locally within the pacer supply. Capacitor voltage is provided back to the CPU for control through the cap charger circuitry.

(Continued on next page)

Functional Description

3-30

A04 Therapy Module (Continued)

- **H-Bridge** — The H-Bridge is a patient-isolated circuit that creates the biphasic defibrillation waveform. A combination of silicon controlled rectifiers (SCR) and insulated gate bipolar transistors (IGBT) are used to place a positive-oriented defibrillation pulse across the patient load, followed immediately by a negative-oriented defibrillation pulse. The defibrillation pulse is delivered through the relay and W1 Therapy Connector to the external therapy cable on the outside of the device.
- **Pacer** — The pacer is a patient-isolated circuit that creates the pacing waveform. A portion of the H-Bridge circuitry is used to support the pacer by providing energy from the A13 Defibrillation Capacitor. A current drive is used to control the amount of current provided to the patient during pacing.
- **Relay** — The relay provides patient isolation from the pacing and defibrillation circuitry when not in use. The relay is closed when the pacing current is set above zero and stays closed until the pacing current is set back to zero.

Functional Description

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A05 User Interface Module

The A05 User Interface (UI) module is responsible for the presentation of the acquired data to the screen display and to the printer, and for receiving all user input. The primary communication between the UI PCB and the remainder of the LIFEPAK 20 defibrillator/monitor is through the data bus. A RISC processor and digital memory make up the CPU that manages communication with the A01 System Control PCB. The W18 UI Flex Cable provides physical connection between the A05 UI PCB and the A02 Patient Parameter module.

The following subsections discuss the major subsystems on the A05 UI module and their basic functions:

- **Power Supplies** — The A05 User Interface module uses SW_VBatt (switched battery voltage) from the A04 Therapy PCB to originate four power supplies for use throughout the PCB as follows:
 - +3.3 V logic power to drive the A11 Liquid Crystal Display (LCD) and the A10 Printer
 - +3.3 V logic power for the CPU processor and memory
 - +2.5 V logic power for the field-programmable gate array

(Continued on next page)

Functional Description

3-32

A05 User Interface Module (Continued)

- **Field-Programmable Gate Array (FPGA)** — The Field-Programmable Gate Array (FPGA) provides the interface between the CPU and all of the user interface peripherals. The FPGA works in conjunction with the CPU to provide the 1/4 VGA signals to the A11 Display, the data and strobe signals to the A12 Printer, and drive circuitry for the keypad LEDs. The FPGA converts the inputs from the keypad switch matrix and W4 Selector into digital words that can be read by the CPU.
- **Keypad** — The keypad is the primary user input control for the LIFEPAK 20 defibrillator/monitor. It consists of two parts, the keypad domes, which are located on the rear side of the A05 UI PCB, and the elastomer keypad cover that attaches to the front case. The keypad domes protrude through holes in the front case and enable the keycovers to activate the domes when pressed by the user. The user key presses are decoded by the FPGA and sent to the CPU for processing. The A05 UI PCB does not recognize the ON switch. It passes the signal to the A04 Therapy PCB.

A06 OEM and Mechanical Components Module

The A06 OEM Interface module provides power to and collects SpO2 data from the A10 SpO2 PCB. Its primary function is to provide patient isolation between the SpO2 PCB and the rest of the LIFEPAK 20 defibrillator/monitor design. In addition, it provides physical mounting provisions for the A10 SpO2 PCB.

(Continued on next page)

Functional Description

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A06 OEM and Mechanical Components Module (Continued)

The following subsections discuss the major subsystems on the A06 OEM PCB and their basic functions:

- **Power Supplies** — The A06 OEM Interface PCB uses power from the A02 Patient Parameter PCB to provide the 5 V power for the A10 SpO2 PCB.
- **UART and ISO Buffers** — The UART and ISO buffers provide patient isolation for the serial data signals received from the A10 SpO2 PCB and routes them to the A02 Patient Parameter PCB.

A07 Battery

The A07 Battery is a 2.7 amp/hour, 12 V, NiMH battery that is used as an internal backup power source when ac power is not available. This technology was selected due to its light-weight-to-power-storage ratio and low maintenance features. NiMH batteries require a smart, non-trickle, constant-current charge current that is provided by the A03 Power PCB when the device is connected to ac power. The battery wire harness interfaces directly with the A03 Power PCB. The battery is contained within the battery well section of the bottom case. A small bladed screwdriver is required to open the battery door, located on the bottom of the LIFEPAK 20 defibrillator/monitor.

Functional Description

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A08 Backlight Inverter

The A08 Backlight Inverter provides power to the internal fluorescent backlight in A11 Active Display. Filtered SW_VBatt is provided to the A08 Backlight Inverter through the A05 User Interface PCB. The output of the inverter is 1000–1500 RMS, open-circuit power to the internal A11 Active Display backlight.

A09 AC Power Supply

The A09 AC Power Supply is a 60 Watts OEM power supply, designed to meet IEC 60601-1 standards, converting 120/240 VAC (60/50 Hz) input signals to nominal 12 VDC. The ac power supply provides power to the A03 Power PCB for routing to the other modules in the defibrillator. The 12 VDC output from the ac power supply is directly diode ORed into the SW_VBatt (switched battery voltage) to power on the A04 Therapy PCB. The A03 Power PCB sits above the ac power supply and plugs directly into the ac power supply's power connector. Both the A03 Power PCB and the ac power supply are held mechanically in place by the power assembly bracket.

Functional Description

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A10 SpO2 PCB

The A10 SpO2 PCB is a Masimo MS-5 Oximetry PCB. This patented OEM PCB performs all functions related to oxygen saturation measurement, including sensor drive. Measurement results are passed serially through the A06 OEM Interface PCB to the A02 Patient Parameter PCB where the SpO2 data is combined with the patient ECG data and sent to the A01 System Control PCB for display processing and storage. The SpO2 PCB mounts directly to the A06 OEM Interface Board.

A11 Active Display

The A11 Active Display is a 14.5 cm (5.7") (measured diagonally) display that uses 1/4 VGA protocol with a 320 wide by 240 high pixel array. The display has a protective lens held in place against the front case by a sheet metal bracket and has an elastomeric seal. This display features full-color, high-brightness, wide viewing angle capability and is fully visible in bright lighting situations (up to direct sunlight operations). The A11 Active Display also contains an internal backlight for visibility in low light situations. There is no contrast control.

A12 Printer

The A12 Printer is a 50 mm, stepper motor-driven recorder. The printer receives serial data and commands from the A05 User Interface PCB, converts the print data, and controls the motor-drive signals to perform the "muscle" part of printing. The printer returns status signals derived from the paper supply sensor and printer door to the A05 UI PCB.

Functional Description

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A13 Energy Capacitor

The A13 Energy Capacitor is a metallized film capacitor used for energy storage. The energy capacitor stores energy for both pacing and defibrillation therapies. The actual capacitance of the energy capacitor is calculated during the defibrillation calibration procedure. The nominal value is 196 μ F. The energy on the capacitor is removed when the defibrillator is turned off. Energy is provided to the A04 Therapy PCB for pacing and defibrillation therapy through the A14 Inductor Resistor. The energy capacitor mounts above the A04 Power Board by means of a capacitor support. Wires from the energy capacitor connect directly to the A04 Therapy PCB.

A14 Inductive Resistor

The A14 Inductive Resistor is used as an internal dump load to dissipate energy from the A13 Energy Capacitor. Energy is removed (dumped) from the A13 Energy Capacitor when the defibrillator is turned off, and during operation when energy remains on the capacitor for an extended period of time. The A14 Inductive Resistor provides a nominal 5 ohm load in the energy delivery path. The inductor mounts to the board stack bracket. Wires from the A14 Inductive Resistor connect directly to connectors on the A04 Therapy PCB.

Functional Description

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A15 Elastomer Keypad

The A15 Elastomer Keypad displays the common device controls (those not available using the Speed Dial). The number of keys on this keypad varies, depending on the features installed in a specific defibrillator.

A16 Bottom Case

The A16 Bottom Case is the lower shell of the defibrillator that holds the following assemblies and connectors in position: A03 Power Module, battery, boardstack assembly, printer assembly, therapy connector, ECG connector, IrDA port, and SpO2 connector.

A17 Top Case

The A17 Top Case is the upper shell of the defibrillator that stores the paddles.

A18 Front Case

The A18 Front Case is the front shell of the defibrillator that holds the following assemblies and connectors in position: display assembly, UI PCB, Speed Dial assembly, and the speaker assembly.

A19 AC Input Power Filter

The A19 AC Input Power Filter provides input current overload and electromagnetic interference (EMI) protection for the LIFEPAK 20 defibrillator/monitor. The filter is a potted module containing passive filter elements (inductors and capacitors) with in-line fuses in both the line and neutral leads. The A19 AC Input Power Filter is designed to meet the safety requirements in IEC 60601-1.

Functional Description

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W01 Therapy Connector

The W01 Therapy Connector provides a patient connection point used for delivery of either defibrillation or pacing therapeutic energies. The standard and premium models allow the attachment of all available electrode accessories, including QUIK-COMBO pacing/defibrillation/ECG electrodes, external hard paddles (with built-in pediatric paddles), and internal paddles with discharge control. The W01 Therapy Connector mounts directly to the defibrillator bottom case and the wire harness plugs directly into the A04 Therapy PCB at J13 and J14. The therapy connector protrudes through a hole in the defibrillator front case to provide user access for connecting the various external cable options.

Note: The defibrillator supports all existing LIFEPAK 12 accessories (including external sterilizable paddles, internal paddles, and external adult paddles with posterior attachments).

W02 Speaker Assembly

The W02 Speaker Assembly is used to deliver device tones and voice prompts, including warnings and alarms. The OEM W02 Speaker is a small, compact, low-profile speaker capable of producing a 1 W output with a frequency response from 300 to 7000 Hz. The input to the speaker is from the audio power amp in the A01 System Control PCB. The speaker is mounted directly on the defibrillator front case and the speaker wire harness plugs into the W25 Speaker Harness Extension Cable.

Functional Description

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W03 Infrared Data (IrDA) Assembly (Not active at this time)

The W03 IrDA Assembly is used to provide high-speed wireless communications to data management devices. The OEM W03 IrDA Port supports IrDA version 1.1 communications with asynchronous serial rates up to 4 Mbits/second. The IrDA port is mounted directly on the defibrillator bottom case and the flex circuit connects directly to the A01 System Control PCB at J08. An infrared lens is molded into the defibrillator front case directly in front of the IrDA port. The IrDA port and front case lens are aligned so that direct communications can easily be made with a portable data receiver held by an operator or placed on a table.

W04 Speed Dial Assembly

The W04 Speed Dial Assembly is a rotary data entry device mounted on the LIFEPAK 20 defibrillator/monitor front case. It is used to control menu access and selection for user functions that are not supported directly by hard keys on the keypad. The selector detects rotation, in either the clockwise or counterclockwise direction, and presses (clicks), and passes this information on to the A05 UI PCB at J32 for user input decoding.

W05 SpO2 Assembly

The W05 SpO2 Assembly provides a connecting point for the external SpO2 cable. The SpO2 connector is mounted on the LIFEPAK 20 defibrillator/monitor bottom case and the flex circuit connects directly to the A10 SpO2 PCB.

Functional Description

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W06 ECG Connector

The W06 ECG connector provides a connection point for the standard 3- and 5-lead patient ECG cables. The ECG connector is mounted on the LIFEPAK 20 defibrillator/monitor bottom case and the attached wire harness connects directly with the A05 Patient Parameters PCB at J23. The ECG connector is also compatible with the LIFEPAK 12 3-wire or 4-wire patient ECG cables.

W07 Capacitor Discharge Cable

The W07 Capacitor Discharge Cable provides a capacitor discharge point by connecting to the A04 Therapy PCB at pin 5 of J02.

W08 Battery Cable

The W08 Battery Cable connects the A07 Battery to the A03 Power PCB. The cable is hardwired to the A03 Power PCB and the other end connects to the A07 battery at at J85.

W09 – W10 Power to Therapy PCB Cables

The W09–W10 Power to Therapy PCB Cables connect the A03 Power PCB to the A04 Therapy PCB. W09 is a replaceable cable that connects on the A04 Therapy PCB at J16 and the A03 Power PCB at J41. W10 is hardwired to the A03 Power PCB and connects to the A04 Therapy PCB at J17.

Functional Description

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W11 ECG Sync/System Cable

The W11 ECG Sync/System Cables connect the ECG Sync connector and the system connector to the A03 Power PCB at J47.

W12 Grounding Cable

The W12 Grounding Cable provides a grounding path for the Speed Dial.

W13 AC Power Cable

The W13 AC Power Cable connects the A09 Power Supply at J02 with the A03 Power PCB (hardwired connection).

W14 Printer Cable

The W14 Printer Cable connects the A05 UI PCB at J34 with the A03 Power PCB at J45 and the A12 Printer.

W15 LCD to UI PCB Cable

The W15 LCB to UI PCB Cable connects the A11 LCD Display PCB at CN1 with the A05 UI PCB at J36.

W16 LCD to Backlight Cable

The W16 LCD to Backlight Cable connects the A11 LCD Display PCB at P77 to the A08 Backlight Inverter PCB at CN2.

W17 Backlight to User Interface PCB Cable

The W17 Backlight to UI PCB Cable connects the A08 Backlight Inverter PCB at P74 to the A05 UI PCB at J37.

Functional Description

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W18 UI Flex Cable

The W18 UI Flex Cable connects the A02 Patient Parameters PCB at J21 and J22 to the UI PCB at J31.

W19 – W24 Grounding Cables

The W19 through W24 Grounding Cables provide grounding paths for various device components.

W25 Speaker Harness Extension Cable

The W25 Speaker Harness Extension Cable connects the W02 Speaker Assembly to the A01 System PCB at J5.

Operating Instructions

The LIFEPAK 20 Defibrillator/Monitor Operating Instructions familiarize the operator with basic device functions and identify controls, indicators, and connectors. Qualified service personnel must consult both the LIFEPAK 20 Defibrillator/Monitor Operating Instructions and this service manual for a complete understanding of the use and maintenance of the device.

WARNINGS!

Possible improper device performance. Use only Medtronic QUIK-COMBO or FAST-PATCH electrodes and batteries described in this Service Manual. Substitution of non-Medtronic electrodes or batteries may cause the device to operate improperly.

Possible loss of power during patient care. Using improperly maintained batteries to power the LIFEPAK 20 defibrillator/monitor may cause premature power loss.

Operating Instructions

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Use the following links to the LIFEPAK 20 Defibrillator/Monitor Operating Instructions for operating procedures and related information.

- **Preface**

- About Automated External Defibrillation
- About Defibrillation Therapy
- About Noninvasive Pacing
- About SpO2 Monitoring

- **Safety Information**

- Terms
- General Warnings and Cautions
- Symbols

Operating Instructions

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■ **Basic Orientation**

- Introduction
- Unpacking and Inspecting
- Controls, Indicators, and Connectors
- Entering Patient Data
- Setting Alarms
- Managing Alarms
- Connecting to Power

■ **Monitoring**

- Monitoring the ECG
- Monitoring SpO2

■ **Therapy**

- General Therapy Warnings and Cautions
- Therapy Electrode and Standard Paddle Placement
- Automated External Defibrillation
- Manual Defibrillation
- Pediatric Defibrillation
- Noninvasive Pacing

Operating Instructions

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■ Paddle Accessory Options

- Therapy Electrodes
- Standard Paddle Set (Optional)
- Posterior Defibrillation Paddle (PN 802461)
- External Sterilizable Paddles (PN 3009166)
- Internal Handles with Discharge Control (PN 3010901)
- Cleaning and Sterilization Guidelines

■ Data Management

- Overview of Data Storage and Retrieval
- CODE SUMMARY Report
- Managing Archived Patient Records
- Entering Archives Mode
- Printing Archived Patient Records
- Editing Archived Patient Records
- Deleting Archived Patient Records

Operating Instructions

4-5

- **Maintaining the Equipment**
 - General Maintenance and Testing
 - General Troubleshooting Tips
 - Service and Repair
 - Product Recycling Information
 - Warranty
 - Accessories, Supplies, and Training Tools

Operating Instructions

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■ **Defining Setup Options**

- Setup Options
- Entering Setup Options
- General Setup Menu
- Manual Mode Setup Menu
- AED Mode Setup Menu
- Pacing Setup Menu
- Monitoring Menu
- Events Setup Menu
- Alarms Setup Menu
- Printer Setup Menu
- Clock Setup Menu
- Reset Defaults Setup Menu
- Print Defaults
- Send Configuration Setup Menu
- Set Passcode Setup Menu
- Service Mode

Operating Instructions

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- [Appendix A Specifications and Performance Characteristics](#)
- [Appendix B Clinical Summaries](#)
- [Appendix C Screen Messages](#)
- [Appendix D Operator's Checklist](#)
- [Appendix E Shock Advisory System](#)
- [Appendix F Docking Station](#)
- [Appendix G Declaration of Conformity](#)

Modes of Operation

When the LIFEPAK 20 defibrillator/monitor is turned on, it always operates in one of five modes. Choose from the following links to learn more about a particular operating mode.

[Manual Mode](#)

[AED Mode](#)

[Setup Mode](#)

[Inservice Mode](#)

[Service Mode](#)

Manual Mode

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Manual Mode

Turning On the Defibrillator in Manual Mode

Manual mode enables the user to determine when to deliver a shock.

The LIFEPAK 20 defibrillator/monitor can be configured to turn on in manual mode by selecting `SETUP/MANUAL ACCESS` and selecting the `MANUAL/DIRECT` option. The following table shows all the defibrillator's available turn on options.

Mode/Response	Response Description
Manual/Direct	Turns on in manual; direct access between AED and manual modes.
AED/Direct	Turns on in AED; direct access between AED and manual modes.
AED/Confirm	Turns on in AED; operator confirms manual mode selection, Yes/No.
AED/Passcode	Turns on in AED; operator enters manual mode passcode.

Once the defibrillator/monitor has been placed in manual mode and reset to AED mode using the `ANALYZE` button, there will be no additional manual mode reprompts or passcode requests until the defibrillator power has been cycled.

For a complete description of the setup options, refer to the [operating instructions – Defining Setup Options](#).

Manual Mode

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Starting Manual Mode from AED Mode

If the AED mode indicator is illuminated when the defibrillator is powered on, the defibrillator is in **AED Mode**. To enter manual mode:

- Open the door (if attached to the defibrillator)

-OR-

- Select one of the following buttons:

ENERGY SELECT

CHARGE

PACER

LEAD

There are no intervening steps when going from manual mode to AED mode.

Note: Closing the door when in manual mode does not restart AED mode operation. To restart AED mode, press the **ANALYZE** button or cycle the defibrillator power.

AED Mode

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AED Mode

In automated external defibrillator (AED) mode, the defibrillator automatically evaluates the patient rhythm to determine if a shock is needed and prompts the user to deliver a shock by pressing the **SHOCK** button.

You can configure your LIFEPAK 20 defibrillator/monitor to turn on in manual mode by selecting [MANUAL ACCESS](#) from the Setup screen and activating the desired option. The default setting for the LIFEPAK 20 defibrillator/monitor is to turn on in AED mode.

Set options for AED mode by entering the Setup screen and selecting AED mode. AED mode options include energy protocol, voice prompts, ECG display, CPR time, and others. For a complete description of the options available, refer to the [operating instructions – Defining Setup Options](#).

Note: If configured to turn on in AED mode, opening the door on the LIFEPAK 20 defibrillator/monitor turns off AED mode and places the defibrillator in [manual mode](#). Closing the door does not restart AED mode operation. To restart AED mode, press the **ADVISORY** button or cycle the defibrillator power.

Setup Mode

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Setup Mode

The operating defaults for the defibrillator are configured while you are in setup mode. Options include **manual mode** and **AED mode** operating characteristics, alarms setup, time-of-day clock, and others. After the setup is complete, turn off the device to save the configuration. The next time the device is turned on, the operating defaults last selected will be active.

The information that follows, with references to the operating instructions, shows the options available in the setup mode. There is also a factory reset option that resets the device to the factory default settings except the maintenance interval, which remain unchanged.

Saving the Setup Configuration

If the defibrillator owner has a setup configuration that cannot be disturbed, two choices are available to preserve this setup. The first method is to **print the setup configuration**. When service is complete, you can verify the setup and then **manually reset the configuration**.

The second method is to transfer the **setup configuration to another LIFEPAK 20 defibrillator/monitor**. After service is complete, **transfer the configuration back to the device**.

(Continued on next page)

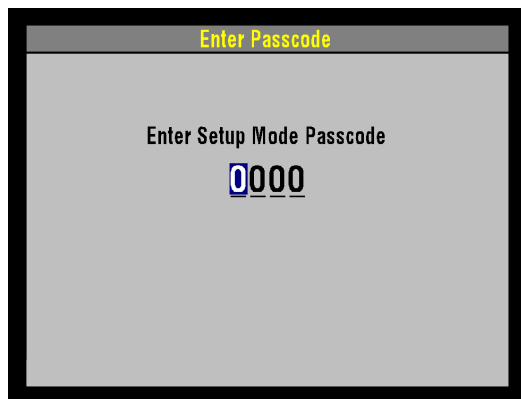
Setup Mode

5-6

Saving the Setup Configuration (Continued)

Note: Saving the configuration using the Transfer and Save Setup Procedures requires that both of the devices have the same software version. Otherwise, unexpected results may occur once the configuration has been restored to the repaired device.

Creating a Passcode



To create a passcode:

1. Hold down the **OPTIONS** and **EVENT** buttons and press the **ON** button. Hold these buttons until the Enter Passcode screen appears. The Speed Dial LED illuminates indicating that the Speed Dial is active.
2. Enter the factory default passcode (0000) or the reserved technician passcode (5433 or LIFE) to gain access to the Setup screen. Use the Speed Dial to scroll through the digits in the highlighted fields. Select numbers by pressing the Speed Dial. As a number is selected, it changes to an asterisk for passcode protection and the next digit in line highlights.
3. When you have entered the passcode, press the Speed Dial. The Setup screen appears. The **PASSCODE INCORRECT-TRY AGAIN** message appears if an incorrect passcode is entered.

(Continued on next page)

Setup Mode

5-7

Creating a Passcode (continued)

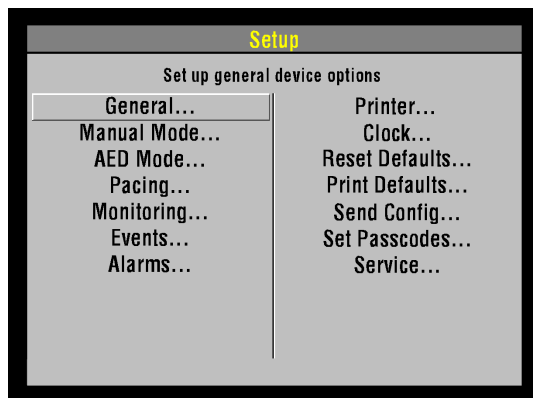
4. Select **SET PASSCODES** from the Setup menu. The Set Passcodes screen appears. The following table defines the options in the Set Passcodes screen.

Option	Description				
Setup Mode	Set passcode to enter setup mode				
Archives Access*	Select a passcode access protocol for archives mode:				
	<table border="0"> <tr> <td>1. No Passcode (default)</td> <td>3. Delete Only</td> </tr> <tr> <td>2. Archives Only</td> <td>4. Archive/Delete</td> </tr> </table>	1. No Passcode (default)	3. Delete Only	2. Archives Only	4. Archive/Delete
1. No Passcode (default)	3. Delete Only				
2. Archives Only	4. Archive/Delete				
Archives Mode	Set passcode to enter archives mode				
Delete Records	Set passcode to delete records in archives mode				

* Set the defibrillator to any of the following protocols:

1. Allow unlimited access to archives mode and allow records to be deleted.
2. Require a password to enter archives mode, but allow records to be deleted.
3. Allow unlimited access to archives mode, but require a password to delete records.
4. Require a password to enter archives mode and delete records.

(Continued on next page)



Setup Mode

5-8

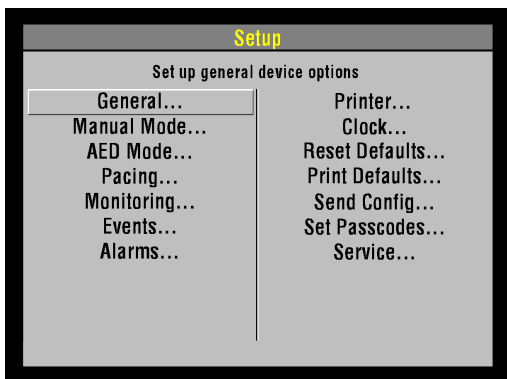
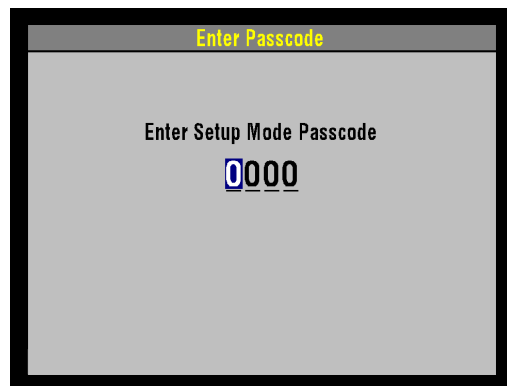
Creating a Passcode (continued)

5. If defining an access protocol, select one of the archives access protocols and return to the previous screen.
-OR-
If setting a passcode, select the desired option. The Enter Passcode screen appears and the first digit in the display is highlighted.
6. Enter the desired passcode.
7. After all numbers have been entered, press the Speed Dial to accept the new passcode.

Setup Mode

5-9

Entering Setup Mode



To enter setup mode:

1. Hold down the **OPTIONS** and **EVENT** buttons and press the **ON** button. Hold these buttons until the Enter Passcode screen appears. The Speed Dial LED illuminates indicating that the Speed Dial is active.
2. Enter the passcode by rotating the Speed Dial to select a number and then pressing the Speed Dial. As a number is selected, it changes to an asterisk for passcode protection and the next digit in line highlights.

Note: The factory default passcode (0000) and the reserved technician passcode (5433 or LIFE) may be used in place of other passcodes to gain access to the Setup and Service screens.

3. When you have entered the passcode, press the Speed Dial. The Setup screen appears. The **PASSCODE INCORRECT-TRY AGAIN** message appears if an incorrect passcode is entered.

(Continued on next page)

Setup Mode

5-10

Entering Setup Mode (continued)

The following table defines the Setup screen option.

Note: Refer to the [LIFEPAK 20 Defibrillator/Monitor Operating Instructions](#) for complete descriptions of all options.

Option	Description
General	Set up general device options
Manual Mode	Set up manual mode defaults
AED Mode	Set up AED mode defaults
Pacing	Set up pacing defaults
Monitoring	Set up monitoring defaults
Events	Set up items to appear on the event screen
Alarms	Set up alarms defaults
Printer	Set up printer defaults
Clock	Set up date and time default
Reset Defaults	Reset all defaults to factory configuration settings

(Continued on next page)

Setup Mode

5-11

Entering Setup Mode (continued)

Option	Description
Print Defaults	Print a report of current configuration settings
Send Config	Send device configuration to another device
Set Passcode	Set passcodes for setup mode and archives mode
Service	Go to the service mode screens

Turn off the defibrillator to exit setup mode.

Inservice Mode

5-12

Inservice Mode

Inservice mode enables users to practice or demonstrate the monitoring functions of the LIFEPAK 20 defibrillator/monitor. The functions include:

- ECG lead selection, size, volume, and moving ECG waveform with heart rate
- SpO2
- Alarms
- Events

Note: No therapy features are available in the inservice mode.

Entering Inservice Mode

To enter inservice mode:

1. Remove all cables from the defibrillator. Inservice mode cannot be entered if cables are attached to the device.
2. Turn on the device while holding down the **HOME** and **EVENT** buttons. Hold these controls down until the Inservice screen appears.

Turn off the defibrillator to exit inservice mode.

Service Mode

5-13

Service Mode

The service mode functions enable qualified service personnel to:

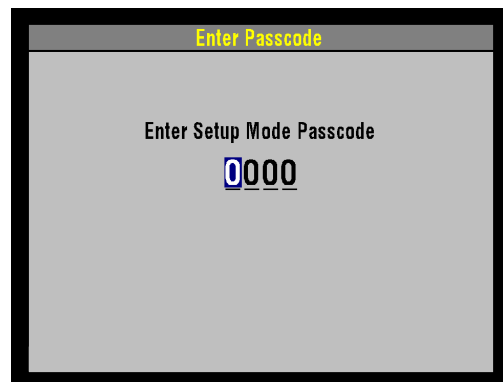
Function	Description
*Perform device calibration routines	<ul style="list-style-type: none"> ■ Defibrillation Calibration
*Perform device tests	<ul style="list-style-type: none"> ■ Keypad Test ■ Pixels Test ■ Printer Test ■ Audio Test
View the device status registers	<ul style="list-style-type: none"> ■ Device Log Status ■ Service Log Status ■ Device Data ■ Counters Status ■ Clear Memory
	Set the service mode passcode
	Set the maintenance prompt interval
	Reset the maintenance prompt interval

* The Performance Inspection Procedure must be performed from start to finish in the order presented.

Service Mode

5-14

Entering Service Mode



Service personnel may enter the Service screen by:

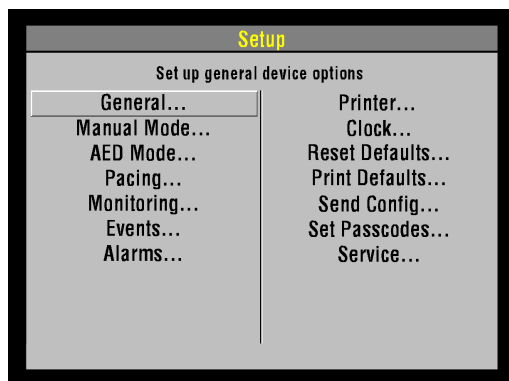
- Selecting SERVICE from the Setup screen.
- At the Setup Passcode screen, enter the service passcode.

To enter service mode by selecting SERVICE from the Setup screen:

1. Hold down the OPTIONS and EVENT buttons and press the ON button. Hold these buttons until the Enter Passcode screen appears. The Speed Dial LED illuminates indicating that the Speed Dial is active.
2. Enter the passcode by rotating the Speed Dial to select a number and then pressing the Speed Dial. As a number is selected, it changes to an asterisk for passcode protection and the next digit in line highlights.

Note: The factory default passcode (0000) and the reserved technician passcode (5433 or LIFE) may be used in place of other passcodes to gain access to the Setup and Service screens.

3. When you have entered the passcode, press the Speed Dial. The Setup screen appears. The PASSCODE INCORRECT-TRY AGAIN message appears, if an incorrect passcode is entered.



(Continued on next page)

Service Mode

5-15

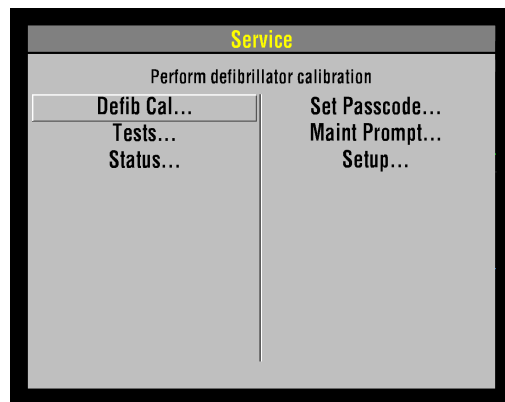
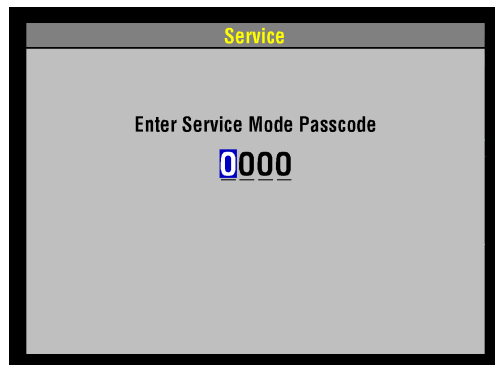
Entering Service Mode (Continued)

4. Select **SERVICE** from the Setup screen. The Service Passcode screen appears.
5. Enter the service passcode.
6. After you enter the passcode, press the Speed Dial. The Service screen appears. The **PASSCODE INCORRECT-TRY AGAIN** message appears, if an incorrect passcode is entered.

The Service screen options include:

Option	Description
Defib Cal	Perform Test and Calibration Procedure
Tests	Perform Performance Inspection Procedure
Status	Display device status
Set Passcode	Set the service mode access passcode
Maint Prompt	Prompt user to perform preventative maintenance
Setup	Return to main Setup screen

Power the unit off to exit service mode.



Service Mode

5-16

Setting the Service Mode Passcode

To set the service mode passcode:

1. Select the **SET PASSCODE** button from the Service screen. The Service/Set Passcode screen appears.
2. Enter the passcode by rotating the Speed Dial to select a number and then pressing the Speed Dial. As a number is selected, it changes to an asterisk for passcode protection and the next digit in line highlights.
3. When the last digit is entered, the Service screen appears.

Service Mode

5-17

Setting the Maintenance Prompt Interval

The LIFEPAK 20 defibrillator/monitor can be set to display a screen message that alerts the user when the maintenance prompt interval date has passed. The screen message `MAINTENANCE DUE` appears on the screen for the first 10 minutes after the device is powered on. The defibrillator maintenance interval can be turned off or set to 3 months, 6 months or 12 months; the factory default is `OFF`, but it can be activated by service personnel.

Note: To turn off the `MAINTENANCE DUE` message or reset the maintenance interval, complete the `Resetting the Maintenance Prompt Interval` procedure on the next page.

To change the scheduled maintenance interval:

1. Enter service mode.
2. From the Service menu, select the `MAINT PROMPT` button to display the `SERVICE/MAINT PROMPT` menu, including the next prompt date for scheduled maintenance.
3. Select `INTERVAL`. The interval choices of `OFF`, `3 MONTHS`, `6 MONTHS`, and `12 MONTHS` appear.
4. Select the desired interval.
5. Turn off the defibrillator.

Service Mode

5-18

Resetting the Maintenance Prompt Interval

After completing scheduled maintenance, reset the maintenance prompt interval counter to clear the MAINTENANCE DUE message and begin the count for the next scheduled maintenance.

To turn off or reset the scheduled maintenance interval:

1. Enter service mode.
2. From the Service menu, select MAINT PROMPT to display the Service/Maint Prompt menu, including the next prompt date for scheduled maintenance.
3. Select RESET. The next prompt date is revised to the new scheduled maintenance date.
4. Turn off the defibrillator.

Performance Inspection Procedures

The Performance Inspection Procedures (PIP) are a set of manual test procedures used for an operational closed-case evaluation of the LIFEPAK 20 defibrillator/monitor. This section describes the test procedures you will perform to determine if the LIFEPAK 20 defibrillator/monitor is operating within the required specifications. Investigate and correct any malfunctions or out-of-tolerance conditions detected during the PIP.

The PIP comprises safety and performance tests recommended by AHA/ASHE (American Hospital Association/American Society for Hospital Engineering) *Maintenance Management for Medical Equipment* and International Electrotechnical Commission (IEC) Technical Report 1288-2, *Maintenance of Cardiac Defibrillators-Monitors*.

Perform the PIP as part of a regularly scheduled preventive maintenance routine. Also, perform the PIP after any repair, replacement, or calibration procedure. Print the PIP Checklist to record the test results. Also refer to the [Operator Checklist](#) for additional items.

[PIP – Scope and Applicability](#)

[PIP – Resource Requirements](#)

[PIP – Test Equipment Requirements](#)

[PIP – Instructions](#)

[PIP – Summary of Leakage Current Specifications](#)

[PIP – Checklist](#)

PIP – Scope and Applicability

6-2

The PIP applies to the LIFEPAK 20 defibrillator/monitor only. To complete the PIP, you perform the manual tests outlined in the **PIP – Instructions** section of this service manual. All PIP tests applicable to the LIFEPAK 20 defibrillator/monitor configuration under test must be performed from start to finish in the order presented.

Refer to the **PIP – Resource Requirements** for a listing of the necessary qualifications for PIP equipment, test equipment verification, workstation power, and personnel.

Refer to the **PIP – Test Equipment Requirements** for a listing of test equipment, including specifications, required to complete the PIP.

You can print the **PIP – Checklist** and use it to record your results.

PIP – Resource Requirements

6-3

This section describes the requirements for PIP equipment, PIP test equipment verification, PIP workstation power, and PIP personnel.

PIP – Equipment

To perform the PIP, you must use the equipment listed in the **PIP – Test Equipment Requirements** table. Although the table lists specific test equipment by manufacturer, test equipment with equivalent specifications may be substituted.

PIP – Test Equipment Verification

All test equipment used to perform the PIP must have a current calibration label, issued by a certified calibration facility.

PIP – Workstation Power

The ac line power to the workstation used must be connected to a grounded power source. The workstation must have **Electrostatic Discharge (ESD) protection**.

PIP – Personnel

Service personnel who perform the PIP must be properly qualified and thoroughly familiar with the operation of the LIFEPAK 20 defibrillator/monitor, meeting the requirements described in **Service Personnel Qualifications**.

PIP – Test Equipment Requirements

6-4

The following is a list of test equipment required to conduct the PIP.

Equipment	Specifications	Manufacturer
Patient Simulator	Simultaneous 12-lead output Rates: 30 bpm, 120 bpm @ 1 mv Rate accuracy: $\pm 1\%$	Fluke Biomedical Corp. 215A/217A
Defibrillator Analyzer ^a	Energy range: 0 to 450 J Load resistance: $50 \Omega \pm 1\%$ Accuracy: $\pm 2\% + 2 \text{ J}$ Waveforms: NSR, VF, and Sine Wave	BIO-TEK [®] QED-6 [™] , with test posts accessory (Software Version 2.07, or greater)
Safety Analyzer	110 or 220 Vac line voltage Current range: 0-1999 μA Current accuracy: 5% of reading or 1 digit (whichever is greater)	Dale Model 600 (120 vac line input) or 600E (240 vac line input)
Function Generator	15 MHz Function/Arbitrary Waveform Resolution: 3 digits, Amplitude and Offset. Accuracy: $\pm 1\%$ (<1 kHz)	Agilent 33120A

a. Some energy meters are not accurate for biphasic waveforms; contact your defibrillator analyzer's manufacturer for more information.

PIP – Test Equipment Requirements

6-5

Equipment	Specifications	Manufacturer
Decade Resistance Box	0 to 9 M Ω resistance box Resolution: 1 Ω ; Accuracy: $\pm 1\%$	IET RS-200 Resistance Substituter
Analog ECG Output Cable	Connects to the DB-15 connector	Medtronic PN 3202553
Remote Sync Output Cable	Connects to the DB-15 connector	Medtronic PN 3202658
QUIK-COMBO test post adapter	Connects to QUIK-COMBO Therapy Cable	Medtronic PN 3005302
3-Lead ECG cable		Medtronic PN 3006218-02
5-Lead ECG cable		Medtronic PN 3200496
General purpose oscilloscope	Bandwidth: dc to 2 MHz Vertical accuracy: $\pm 3\%$ (5 mV – 5 v/div.) Horizontal Time Base Accuracy: $\pm 5\%$	Tektronix® 2232 or equivalent

PIP – Test Equipment Requirements

6-6

Equipment	Specifications	Manufacturer
QUIK-COMBO Electrode Cable		Medtronic PN 3006570
Accessory - Test Plug, QUIK-COMBO		Medtronic PN 3201673
Standard Paddles		Medtronic PN 3200585-00
Chassis Leakage Cable		Dale Model 600/100-2.4 m (8 ft)
LIFEPAK 20 SpO2 Leakage Cable		Medtronic PN 3201832-004, -005, -006

PIP – Instructions

6-7

PIP – General Instructions

This section lists the general instructions for performing the Performance Inspection Procedure (PIP).

- Always start the PIP from the beginning of the procedure.
- Perform the PIP in the presented order.
- Print the PIP Checklist and record your results.

Refer to **Troubleshooting** to correct failures, then repeat the PIP.

PIP – Exterior Physical Inspection

To perform an exterior physical inspection:

Note: Throughout the body of this PIP, the LIFEPAK 20 defibrillator/monitor is referred to as the Unit Under Test or UUT.

1. Inspect the UUT exterior for the following:
 - Damage
 - Excessive wear
 - Improper mechanical function
 - Damaged connectors
2. Pick up and turn over the UUT and listen for loose or rattling hardware. Locate any loose or rattling hardware and tighten or replace it.

(Continued on next page)

PIP – Instructions

6-8

PIP – Exterior Physical Inspection (Continued)

3. Inspect the rubber feet on the underside of the lower enclosure. Reinstall or replace rubber feet as necessary.
4. Inspect the Therapy, ECG, SpO2 (if equipped), DB-9, DB-15, AED door, and IrDA connectors for damage, cracks, or contamination.
5. Inspect the keypads and overlays for damage, cracks, or separations.
6. Check all accessory cables, paddles, SpO2 sensors, and related items for expiration dates, general condition, and suitability for use.
7. Inspect carrying strap and mounts (if the UUT is equipped with them).
8. Record the results on the [PIP Checklist](#).

Cleaning Paddles

To clean the paddle connection:

1. Disconnect the adult paddle plate from the paddle assembly.
2. Clean the spring contact of the adult paddle with alcohol.
3. Clean the pediatric electrode surface with alcohol.
4. Reattach the adult paddle plate to the paddle assembly.

PIP – Instructions

6-9

PIP – Setup

WARNING!

Shock hazard. The UUT discharges up to 360 J of electrical energy through the defibrillator cable. You must safely discharge this electrical energy as described in this PIP. Do not attempt to perform this procedure unless you are thoroughly familiar with the operation of the UUT.

To set up the UUT in preparation for the PIP:

1. Install a roll of paper into the printer.
2. Connect the ac power cord into the UUT.
3. Connect the QUIK-COMBO electrode cable (or optional Standard Paddles) to the Therapy Connector.

PIP – Instructions

6-10

PIP – Power On/ Self-Test



To perform the PIP Power On/Self-Test:

1. Press the **ON** button to initiate the UUT nominal five-second power-on self-test routine.
2. Verify the display lights. The initial display includes Medtronic Logo and LIFEPAK 20 defibrillator/monitor, and the self test in progress, as shown to the upper left.
3. Record the results in the **PIP Checklist**.
4. Turn off the device.
5. Record the results on the **PIP Checklist**.

PIP – Instructions

6-11

PIP – Record Operating Data

Service / Status / Counters

Go back to previous page

Total Shocks		7445
360J	707	2325
225 - 325J	1215	3399
100 - 200J	466	1721
0 - 70J	23	121

Clear All Previous Page...

To record the operating data:

1. Hold down **OPTIONS** and **EVENT** controls and turn on the device. Hold the controls until **Enter Passcode** appears. Enter passcode 5433.
2. Select **SERVICE** from the Setup menu. Enter passcode 5433.
3. Navigate to the **Service/Status/Counters** screen. On the PIP Checklist, record the shocks since last reset (in boxes) and total shocks since the device was built. Select **CLEAR ALL** to reset box counters (if desired).
4. Select **PREVIOUS PAGE**.
5. Select **DEVICE LOG**. Record the following on the **PIP Checklist**:
 - Power Cycle Count
 - Pacing Count
 - Shock Count
 - Power On Time
 - Printer On Time
 - SpO2 Operating Time
6. Continue directly to the next test while still in service mode.

Service / Status / Device Log

Go back to previous page

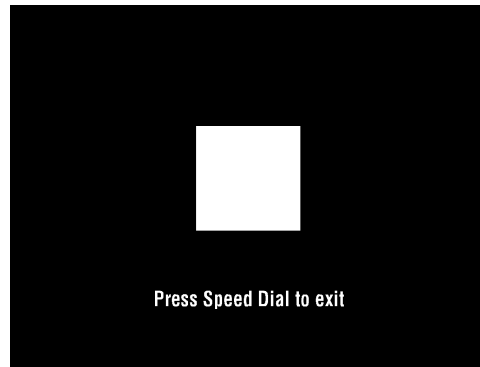
10 May 2001	12:58:36
Fault Messages	Yes
Power Cycle Count	385
Pacing Count	90
Shock Count	1478
Power On Time	221.5
Printer On Time	25.4
SpO2 Operating Time	67.1

Previous Page...

PIP – Instructions


6-12

Contrast Test — LCD



To test screen contrast:

1. Enter the Service/Tests screen and select Contrast. The LCD changes to display a square block in the center of the screen, as shown in the figure on the left.
2. For passive LCD only: rotate the Speed Dial. The background changes from white to black. After five seconds the `PRESS SPEED DIAL TO EXIT` message appears on the screen.
3. Press the Speed Dial to exit the test.

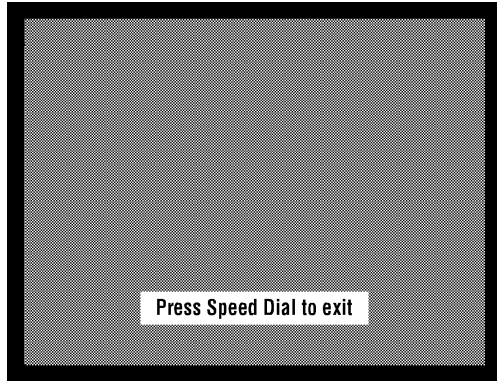
Note: If you accidentally select a pure white or pure black background when exiting the contrast test, press the `CONTRAST` button , rotate the Speed Dial to the desired display, and press the Speed Dial.

4. Proceed to next test.

PIP – Instructions

6-13

Pixels Test



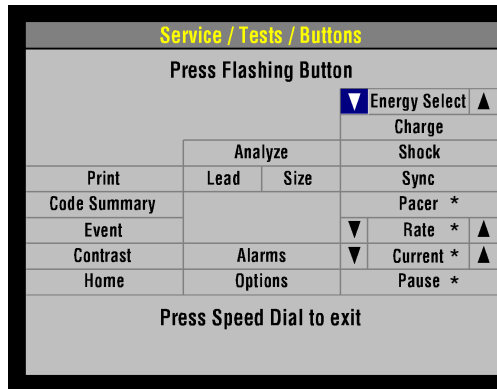
To test the display pixels:

1. Enter the Service/Tests screen and select pixels. The pixels test screen appears, as shown in the figure on the left.
2. Carefully examine the screen for any anomalies. After five seconds, the `PRESS SPEED DIAL TO EXIT` message appears on the screen.
3. Press the Speed Dial to exit the test.
4. Proceed to next test.

PIP – Instructions

6-14

PIP – Keypad



* The button is not available on nonpacing models. Press the keypad in the button's location to verify the button.

Note: To view the location of hidden buttons move to the [elastomer keypad](#).

To test the keypad:

1. Select TESTS... from the on-screen Service menu.
2. Navigate to the Service/Tests/Buttons screen.
3. Press each front panel control when prompted by the flashing control legend (although you may press the controls in any order).
4. Verify with each control pressed that its associated text box is highlighted. All buttons must be tested regardless of defibrillator configuration. See the figure on the left for the location of hidden buttons.

Note: A failure is indicated by a control text box that is not highlighted. It is normal for the controls with up/down arrows to highlight only the arrows.
5. Press the switch, located between the OPTION and PAUSE buttons.

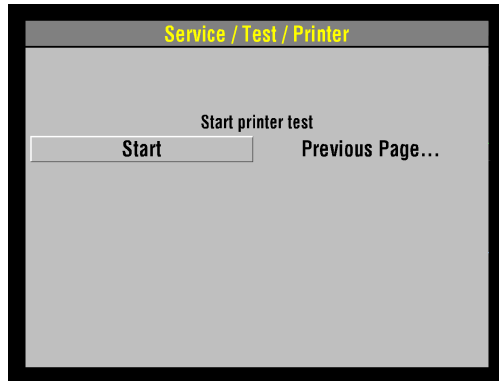
Note: The switch is hidden in the [elastomer keypad](#).
6. Verify the key check sound indicating that the button is working.
7. Press the Speed Dial at the end of the test.
8. Record the results on the [PIP Checklist](#).

(Continued on next page)

PIP – Instructions

6-15

PIP – Printer



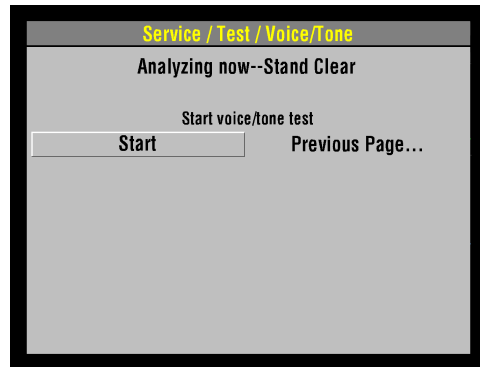
To test the 50 mm printer:

1. Select **PRINTER** from the on-screen Service menu.
2. Select **START** from the Service/Test/Printer screen to print a test strip.
3. Inspect the test strip for the following attributes:
 - The large “X” form is printed without missing dots.
 - Four horizontal lines (one very close to the lower paper margin).
 - The character set is printed clearly without broken characters.
 - Vertical lines spaced 25 mm $\pm 5\%$ apart.
4. Open the printer door and verify the **CHECK PRINTER** message appears at the bottom of the screen.
5. Close the printer door.
6. Select **PREVIOUS PAGE** to return to the Service/Tests sub-menu.
7. Record the results on the **PIP Checklist**.
8. Continue directly to the next test while still in Service Mode.

PIP – Instructions

6-16

PIP – Audio



To test the UUT voice prompts and tones:

1. Select `VOICE/TONE...` from the `Service/Tests` sub-menu.
2. Select `START`. Voice prompts sound in the speaker.
3. When satisfied that the voice prompts are clearly audible and reproduced without distortion, turn off the device.

Note: You may listen to a complete replay of all voice prompts and tones, but it is not required for verification of this function.

4. Record the results on the [PIP Checklist](#).
5. Turn off the UUT.
6. This completes PIP testing using the service mode test feature.

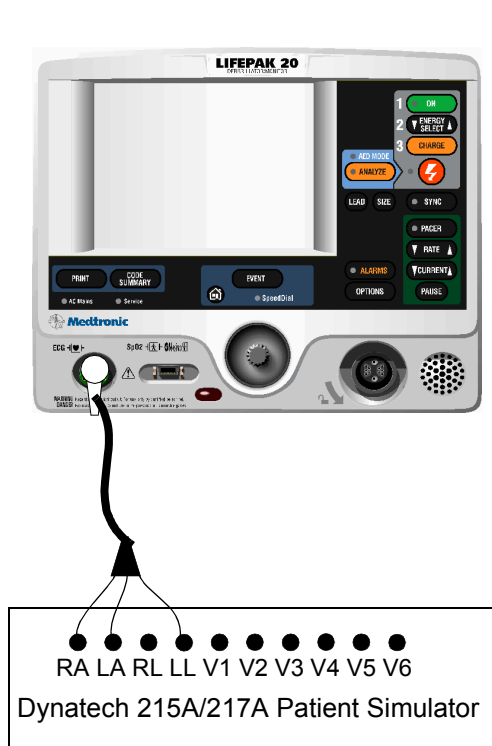
PIP – Instructions

6-17

PIP – 3-Lead ECG Characteristics

To test 3-Lead ECG leads off detection:

1. Connect the 3-lead ECG cable between the UUT and patient simulator as shown at the left.
2. Program the patient simulator output for a 60 BPM, NSR.
3. Turn on the UUT.
4. Set the UUT lead selection to LEAD II.
5. Remove the LL lead from the patient simulator.
6. Verify the UUT displays a LL LEADS OFF screen message.
7. Reconnect the LL lead.
8. Remove the RA lead from the patient simulator.
9. Verify the UUT displays an ECG LEADS OFF screen message.
10. Reconnect the RA lead.
11. Set the UUT lead selection to LEAD I.
12. Remove the LA lead from the patient simulator.



(Continued on next page)

PIP – Instructions

6-18

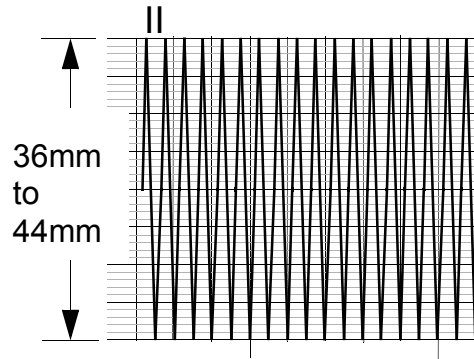
PIP – 3-Lead ECG Characteristics (Continued)

13. Verify the UUT displays a LA LEADS OFF screen message.
14. Record the results on the **PIP Checklist**.
15. Reconnect the LA lead, then continue directly to the next page with this setup in place.

PIP – Instructions

6-19

PIP – 3-Lead ECG Characteristics (Continued)



To test 3-Lead ECG gain:

1. Program the patient simulator output for a 1 mv, 10 Hz, sine wave.
2. Set the ECG size to 4.0.
3. Set the UUT lead selection to LEAD II.
4. Record five seconds of ECG Lead II and confirm the printed signal amplitude is 36 mm to 44 mm peak-to-peak as shown in the figure on the left.
5. Repeat Steps 3 and 4 for Lead I, substituting the signal amplitudes given in the table at the left.
6. Record the results on the [PIP Checklist](#).
7. Depending upon the UUT configuration, continue directly to [PIP — QUIK-COMBO Impedance Sense](#) or [PIP — Standard Paddles User Test](#).

Lead	Printed Peak-to-Peak
I	18 mm to 22 mm
II	36 mm to 44 mm

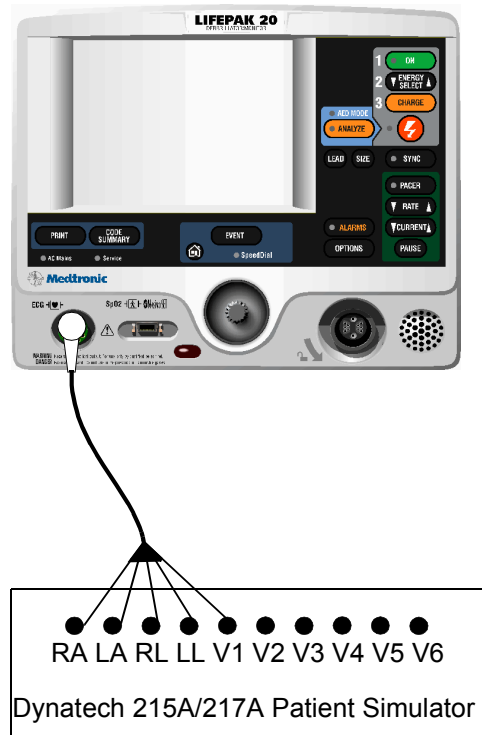
PIP – Instructions

6-20

PIP – 5-Lead ECG Characteristics

To test 5-Lead ECG Leads Off detection:

1. Connect the 5-Lead ECG cable between the UUT and patient simulator as shown at the left.
2. Program the patient simulator output for a 60 BPM, NSR.
3. Turn the UUT on.
4. Set the UUT lead selection to LEAD II.
5. Remove the LL lead from the patient simulator.
6. Verify the UUT displays a LL LEADS OFF screen message.
7. Reconnect the LL lead.
8. Remove the RA lead from the patient simulator.
9. Verify the UUT displays a RA LEADS OFF screen message.
10. Reconnect the RA lead.
11. Remove the RL lead from the patient simulator.
12. Verify the UUT displays a ECG LEADS OFF screen message.



(Continued on next page)

PIP – Instructions

6-21

PIP – 5-Lead ECG Characteristics (Continued)

13. Set the UUT lead selection to LEAD I.
14. Remove the LA lead from the patient simulator.
15. Verify the UUT displays a LA LEADS OFF screen message.
16. Reconnect the LA lead.
17. Set the UUT lead selection to LEAD C.
18. Remove the C lead from the patient simulator.
19. Verify the UUT displays a C LEADS OFF screen message.
20. Record the results on the **PIP Checklist**.
21. Reconnect the C lead, then continue directly to the next page with this setup in place.

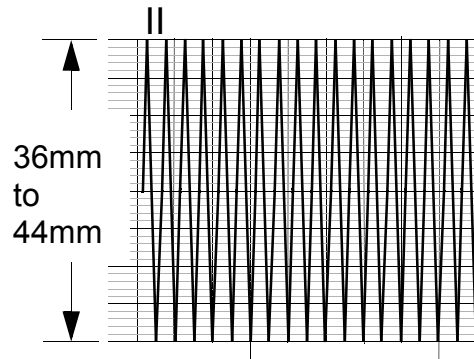
PIP – Instructions

6-22

PIP – 5-Lead ECG Characteristics (Continued)

To test 5-Lead ECG gain:

1. Program the patient simulator output for a 1 mV, 10 Hz sine wave.
2. Set the ECG size to 4.0.
3. Set the UUT lead selection to LEAD II.
4. Record five seconds of ECG Lead II and confirm the printed signal amplitude is 36 mm to 44 mm peak-to-peak.
5. Repeat Steps 3 and 4 for Lead I and C, substituting the signal amplitudes give in the table at the left.
6. Record the results on the [PIP Checklist](#).
7. Depending upon the UUT configuration, continue directly to [PIP — QUIK-COMBO Impedance Sense](#) or [PIP — Standard Paddles User Test](#).



Lead	Printed Peak-to-Peak
I	18 mm to 22 mm
II	36 mm to 44 mm
C	36 mm to 44 mm

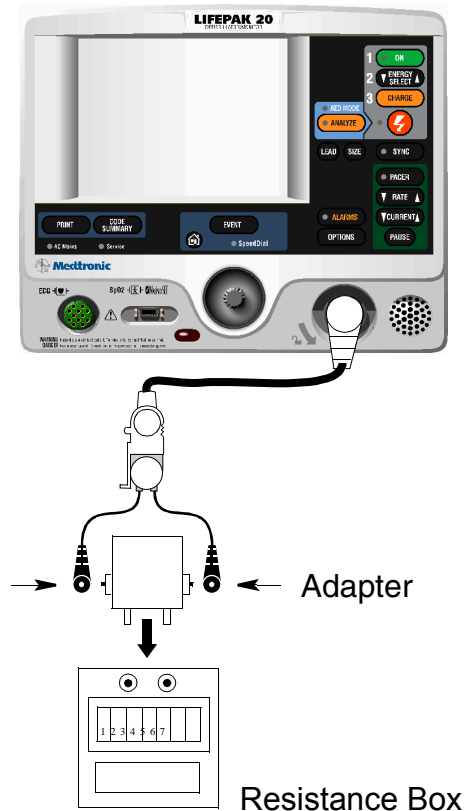
PIP – Instructions

6-23

QUIK-COMBO Impedance Sense

To test QUIK-COMBO Impedance Sense circuitry:

1. Connect the QUIK-COMBO Test Post snaps to a decade resistance box, using whatever adapter is appropriate to make connections, as shown at the left.
2. Place the UUT into manual mode (ADVISORY off).
3. Set the UUT lead selection to PADDLES.
4. Set the decade resistance box to 248 Ω .
5. Verify the UUT display displays the PADDLES LEADS OFF message.
6. Record the results on the PIP Checklist.
7. Set the decade resistance box to 182 Ω .
8. Verify the PADDLES LEADS OFF message is removed from the UUT display.
9. Record the results on the **PIP Checklist**.
10. Remove the decade resistance box.
11. Continue directly to PIP – QUIK-COMBO User Test.



PIP – Instructions

6-24

QUIK-COMBO or FAST-PATCH Therapy Cable User Test

To test the QUIK-COMBO or the FAST-PATCH cable:

1. Connect the QUIK-COMBO test plug into the QUIK-COMBO or the FAST-PATCH Therapy Cable.
2. Press the **OPTIONS** button and select **USER TEST** from the Options screen.
3. Select **YES** from the Options/Users Test screen.
4. Push Speed Dial to initiate the self test and the user test. The self test and the user test are performed. A User Test Succeeded report is printed when test is complete.
5. Record the results on the **PIP Checklist**.
6. Continue directly to PIP – QUIK-COMBO Delivered Energy on the next page.

Note: The unit automatically turns off after successfully completing the test.

PIP – Instructions

6-25

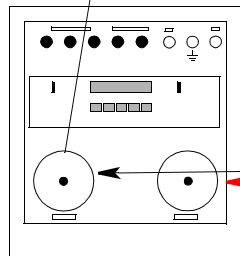
PIP – QUIK-COMBO Delivered Energy



QUIK-COMBO Electrode Cable

QUIK-COMBO Test Post Adapter

Test Posts Installed



Defibrillator Analyzer

To test delivered energy using QUIK-COMBO electrodes:

Note: For Standard Paddles, refer to **PIP – Standard Paddles Delivered Energy**.

1. Set up the device and defibrillator analyzer as shown at the left.
2. Turn on the UUT, then press the ENERGY SELECT button to select 2 J.
3. Press the CHARGE button and wait for the UUT to reach full charge. Then press the SHOCK button to discharge the UUT.

(Continued on next page)

PIP – Instructions

6-26

PIP – QUIK-COMBO Delivered Energy (Continued)

4. Verify the defibrillator analyzer indicates the delivered energy is within the acceptable output limits, shown below.

Energy Level (J)	Acceptable Output (J)
2	1.0 to 3.0
70	65.1 to 74.9
360	334.8 to 385.2

5. Repeat Steps 2 through 4 for the remaining energy levels specified in the table.

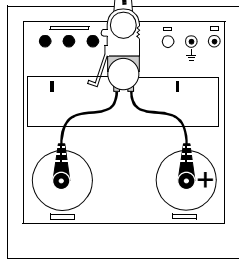
Note: Perform the [TCP – Defibrillator Calibration](#) if the delivered energy falls outside of the acceptable output range.

6. Record the results on the [PIP Checklist](#).
7. Continue directly to PIP – QUIK-COMBO ECG Characteristics on the next page.

PIP – Instructions

6-27

PIP – QUIK-COMBO ECG Characteristics



To test QUIK-COMBO ECG gain:

Note: If using Standard Paddles, refer to **PIP – Standard Paddles ECG Characteristics**.

1. Program the defibrillator analyzer output for a 1 mV, 10 Hz sine wave.
2. Set the UUT ECG Size to 4.0.
3. Set the UUT lead selection to PADDLES.
4. Record 10 seconds of Paddles ECG and confirm the printed signal amplitude is 36 mm to 44 mm peak-to-peak.

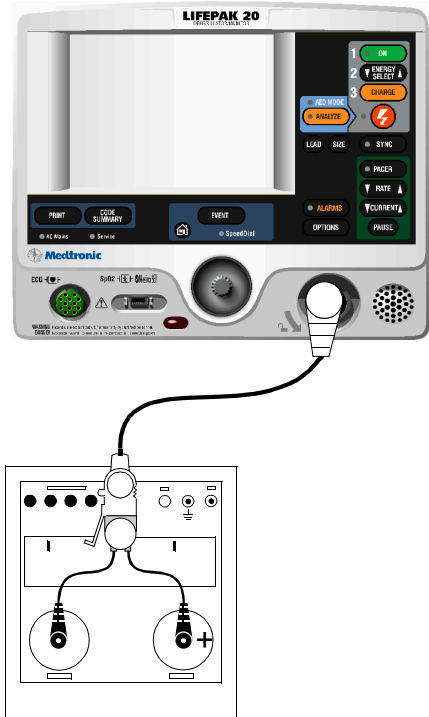
Note: The BIO-TEK QED-6 produces a 1.1 mV output; confirm the printed signal amplitude is 38 mm to 50 mm peak-to-peak.

5. Record the results on the **PIP Checklist**.
6. Continue directly to the next page with this setup in place.

PIP – Instructions

6-28

PIP – QUIK-COMBO Synchronous Cardioversion: R-Wave



To test Synchronous Cardioversion R-Wave using QUIK-COMBO electrodes:

Note: If using Standard Paddles, refer to [PIP – Standard Paddles Synchronous Cardioversion](#).

WARNING!

Shock hazard. Electrical energy is discharged during this procedure. Do not allow the electrodes to contact any person or conductive surfaces except as described below.

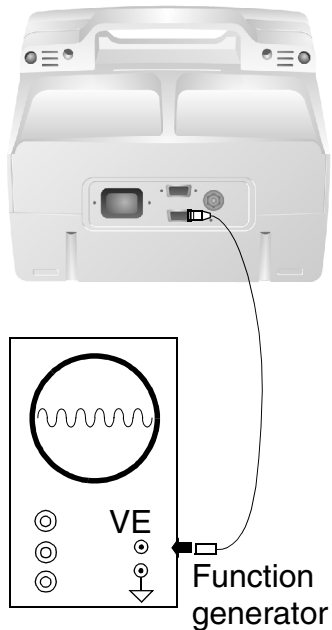
1. Set the UUT: manual mode, ECG Size to 1.0, lead selection to PADDLES.
2. Set the defibrillator analyzer to measure SYNC.
3. Press the SYNC button ON and select LOCAL, if Remote Sync is set to on.
4. Verify the SYNC LED turns on and R-wave markers appear on the ECG waveform.
5. Charge the UUT to 10 J. Upon reaching full charge, press the SHOCK button to discharge the UUT.
6. Verify the defibrillator analyzer measures a sync R-wave of 60 ms or less.
7. Record the results on the [PIP Checklist](#).

(Continued on next page)

PIP – Instructions

6-29

PIP – QUIK-COMBO Synchronous Cardioversion: Remote Sync



To test Remote Sync using QUIK-COMBO electrodes:

1. Set the function generator to provide a pulse train 5 Vp-p (0-5 V), 5 to 200 mS wide, 120 PPM (2 Hz).

Note: Recommend use an Agilent 33120 A: A Square Wave 5 Vpp, 2.5 VDC Offset, Frequency @ 100 Hz. Set to burst mode: burst count to 1, burst phase to 0, burst rate to 5 Hz.

2. Connect Remote Sync cable between the UUT and the Function Generator.
3. On the Manual Mode Setup page, set the UUT to Remote Sync ON.
4. Turn off the UUT, then turn on the UUT.
5. Set the UUT: manual mode, lead selection to PADDLES.
6. Press the SYNC button on the UUT.
7. On the Sync Mode screen, select REMOTE.
8. Verify the SYNC LED is flashing.

(Continued on next page)

PIP – Instructions

6-30

PIP – QUIK-COMBO Synchronous Cardioversion: Remote Sync (Continued)

9. Charge the UUT to 200 J. Upon reaching full charge, press the **SHOCK** button to discharge the UUT.
10. Verify the UUT displays an **ENERGY DELIVERED** screen message.
11. Record the results on the **PIP Checklist**.
12. Continue directly to PIP – Standard Paddles User Test on the next page.

PIP – Instructions

6-31

PIP – Standard Paddles User Test

To perform the Standard Paddles User Test:

1. Place the paddles in the paddle wells.
2. Set the UUT lead selection to PADDLES.
3. Press the **OPTIONS** button and select **USER TEST** from the Options screen.
4. Select **YES** from the Options/Users Test screen.
5. Press the Speed Dial to initiate the self test and the user test. The self test and the user test are performed. A User Test Succeeded report is printed when the test is complete.
6. Record the results on the **PIP Checklist**.
7. Continue directly to PIP – Standard Paddles Delivered Energy on the next page.

Note: The unit automatically turns off after successfully completing the test.

PIP – Instructions

6-32

PIP – Standard Paddles Delivered Energy

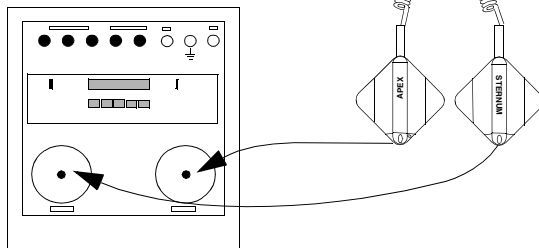
To test delivered energy using Standard Paddles:

Note: For QUIK-COMBO electrodes, refer to **QUIK-COMBO Delivered Energy**.

1. Set up the device and defibrillator analyzer as shown at the left.
2. Turn on the UUT.
3. Press the ENERGY SELECT button to select 2J.
4. Press the apex paddle CHARGE button and wait for the UUT to reach full charge. Then press the paddles SHOCK switches to discharge the UUT.



Defibrillator Analyzer



(Continued on next page)

PIP – Instructions

6-33

PIP – Standard Paddles Delivered Energy (Continued)

5. Verify the defibrillator analyzer indicates the delivered energy is within the acceptable output limits, shown below.

Energy Level (J)	Acceptable Output (J)
2	1.0 to 3.0
70	65.1 to 74.9
360	334.8 to 385.2

6. Repeat Steps 2 through 4 for the remaining energy levels specified in the table.

Note: Perform the TCP – Defibrillator Calibration if the delivered energy falls outside of the acceptable output range.

7. Record the results on the [PIP Checklist](#).
8. Continue directly to PIP – Standard Paddles Defibrillation Isolation on the next page.

PIP – Instructions

6-34

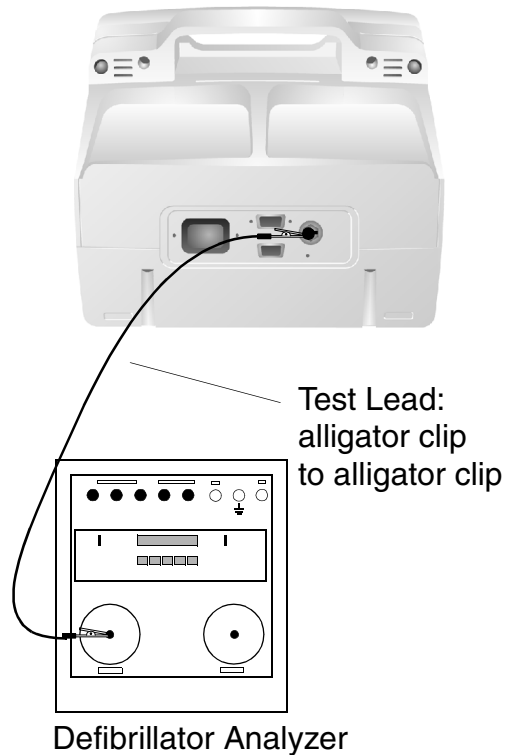
PIP – Standard Paddles Defibrillation Isolation

To test defibrillation isolation with Standard Paddles:

WARNING!

Shock hazard. Electrical energy is discharged during this procedure. Do not allow the paddle electrodes to contact any person or conductive surfaces except as described below.

1. Establish the setup shown in the figures at the left and on the next page.
2. Turn on the UUT.
3. Verify the defibrillator analyzer is on and the display displays ENERGY. If not, turn on the defibrillator analyzer and press the ENRG softkey.
4. Select 360 J.
5. Press the apex paddle CHARGE button.
6. Upon reaching full charge, place the apex paddle on the defibrillator analyzer apex (+) test pad while holding the sternum paddle in open air.



(Continued on next page)

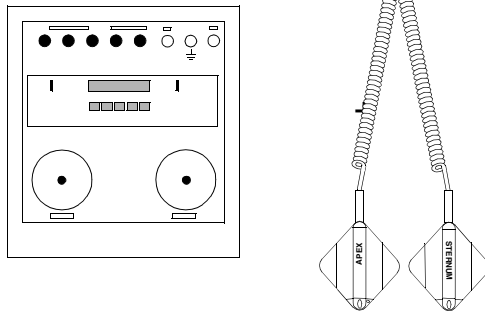
PIP – Instructions

6-35

PIP – Standard Paddles Defibrillation Isolation (Continued)



Defibrillator Analyzer



7. Simultaneously press the paddles **SHOCK** switches to discharge the UUT.
8. Verify the defibrillator analyzer indicates a delivered energy of less than 18 J.
9. Change the alligator clip lead to the other defibrillator analyzer test post.
10. Press the apex paddle **CHARGE** button.
11. Upon reaching full charge, place the sternum paddle on the defibrillator analyzer sternum (–) test pad while holding the apex paddle in open air.
12. Simultaneously press the paddles **SHOCK** switches to discharge the UUT.
13. Verify the defibrillator analyzer indicates a delivered energy of less than 18 J.
14. Turn off the device.
15. Record the results on the **PIP Checklist**.
16. Continue directly to PIP – Standard Paddles ECG Characteristics on the next page.

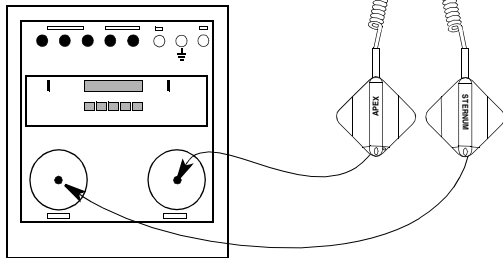
PIP – Instructions

6-36

PIP – Standard Paddles ECG Characteristics



Defibrillator Analyzer



To test Paddles ECG gain:

Note: If using QUIK-COMBO electrodes, refer to [PIP – QUIK-COMBO ECG Characteristics](#).

1. Program the defibrillator analyzer output for a 1 mV, 10 Hz sine wave.
2. Set the UUT ECG Size to 4.0.
3. Set the UUT lead selection to PADDLES.
4. Place the paddles on the defibrillator analyzer test pads.
5. Record 10 seconds of Paddles ECG and confirm the printed signal amplitude is 36 mm to 44 mm peak-to-peak.

Note: BIO-TEK QED-6 produces a 1.1 mV output; confirm the printed signal amplitude is 38 mm to 50 mm peak-to-peak.

6. Record the results on the [PIP Checklist](#).
7. Continue directly to the next page with this setup in place.

PIP – Instructions

6-37

PIP – Standard Paddles Synchronous Cardioversion: R-Wave

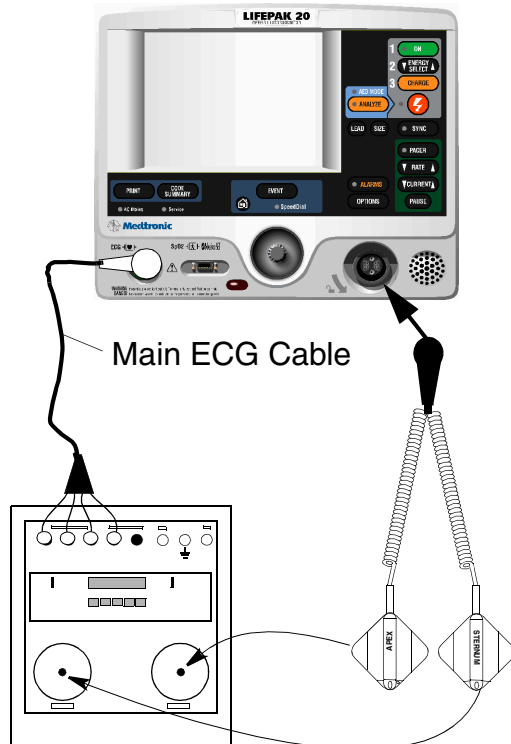
To test Synchronous Cardioversion using Standard Paddles:

Note: If the UUT does not have “sync in paddles” feature, skip this test. If using QUIK-COMBO electrodes, refer to **PIP – QUIK-COMBO Synchronous Cardioversion**.

WARNING!

Shock hazard. Electrical energy is discharged during this procedure. Do not allow the paddles to contact any person or conductive surfaces except as described below.

1. Connect the 3- or 5-Lead ECG Cable between the UUT and defibrillator analyzer as shown at the left.
2. Set the UUT: manual mode, ECG Size to 1.0, lead selection to LEAD II.
3. Set the defibrillator analyzer to measure Sync.
4. Press the SYNC button ON and select LOCAL, if Remote Sync is set to on.
5. Verify the SYNC CONTROL LED turns on and R-wave markers appear on the ECG waveform.
6. Charge the UUT to 10 J.



(Continued on next page)

PIP – Instructions

6-38

PIP – Standard Paddles Synchronous Cardioversion R-Wave (Continued)

7. Upon reaching full charge, simultaneously press both paddles' **SHOCK** buttons to discharge the UUT.
8. Verify the defibrillator analyzer measures a sync R-wave of 60 ms or less.
9. Record the results on the **PIP Checklist**.

PIP – Instructions

6-39

PIP – Standard Paddles Synchronous Cardioversion: Remote Sync

To test Remote Sync using Standard Paddles:

1. Set the function generator to provide a pulse train 5 Vp-p (0-5 V), 5 to 200 mS wide, 120 PPM (2 Hz).

Note: Recommend use an Agilent 33120 A: A Square Wave 5 Vpp, 2.5 VDC Offset, Frequency @ 100 Hz. Set to burst mode: burst count to 1, burst phase to 0, burst rate to 5 Hz.

2. Connect Remote Sync cable between the UUT and the Function Generator.
3. On the Manual Mode Setup page, set the UUT to Remote Sync On.
4. Turn off the UUT, then turn on the UUT.
5. Set the UUT: manual mode, lead selection to PADDLES.
6. Press the SYNC button on the UUT.
7. On the Sync Mode screen, select REMOTE.
8. Verify the SYNC LED is flashing.

(Continued on next page)

PIP – Instructions

6-40

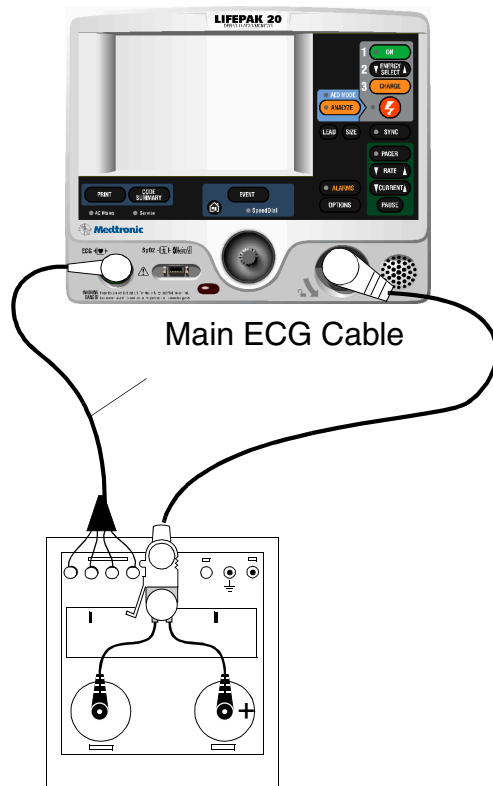
PIP – Standard Paddles Synchronous Cardioversion: Remote Sync (Continued)

9. Charge the UUT to 200 J. Upon reaching full charge, press the **SHOCK** button to discharge the UUT.
10. Verify the UUT displays an **ENERGY DELIVERED** screen message.
11. Record the results on the **PIP Checklist**.

PIP – Instructions

6-41

PIP – Pacer Option Characteristics



To test Pacer leads off detection:

Note: Skip this test if using a nonpacing defibrillator.

1. Set the defibrillator analyzer to measure peak current pacing parameters.
2. Press the PACER control on the UUT.
3. Verify the PACER control LED lights and the PACER overlay appears.
4. Disconnect one of the Test Post Adapter snaps from the defibrillator analyzer.
5. Verify the PACING STOPPED/CONNECT ELECTRODES overlay appears accompanied by an audible alarm.
6. Reconnect the Test Post Adapter snap. Verify the overlay CONNECT ELECTRODES disappears and the alarm stops.
7. Record the results on the **PIP Checklist**.
8. Continue directly to the next page with this setup in place.

(Continued on next page)

PIP – Instructions

6-42

PIP – Pacer Option Characteristics (Continued)

To test the Pacer Output Current:

1. Set the defibrillator analyzer to output PACE, MEAS.
2. At 40 PPM Rate, press the UUT CURRENT button to select a pacer current of 10 mA.
3. Verify the defibrillator analyzer indicates the pacer output current is within the acceptable output limits, shown below.
4. In this manner, check the peak pacer current for the following settings:

Peak Current Level (mA)	Acceptable Output (mA)
10	5 to 15
50	45 to 55
100	95 to 105
150	142.5 to 157.5
200	190 to 210

5. Record the results on the [PIP Checklist](#).
6. Continue directly to the next page with this setup in place.

PIP – Instructions

6-43

PIP – Pacer Option Characteristics (Continued)

To test the Pacer Pulse Width:

1. At 40 PPM Rate, press the UUT CURRENT button to select a pacer current of 200 mA.
2. Verify the defibrillator analyzer indicates the pacer pulse width is between 19.0 and 21.0 ms.
3. Press the UUT PACER control to terminate pacing.
4. Record the results on the **PIP Checklist**.
5. Continue directly to PIP – ECG Analog Output on the next page.

PIP – Instructions

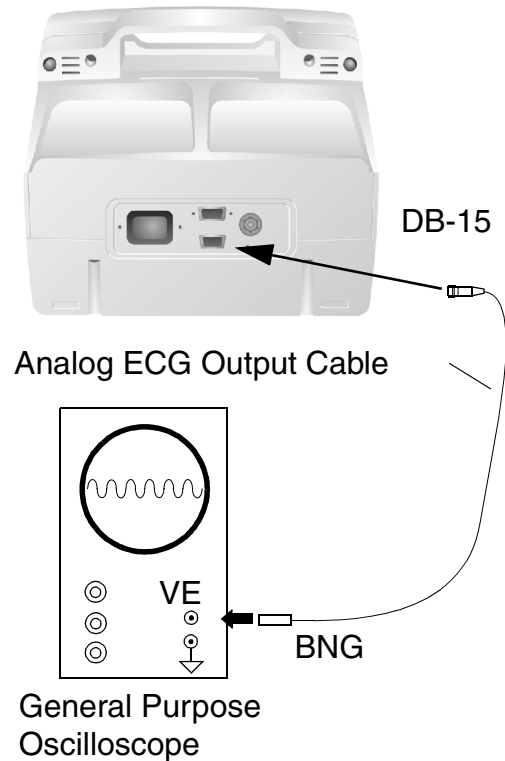
6-44

PIP – ECG Analog Output

To test the ECG analog output:

Note: This test is optional. Perform only if this feature is used.

1. Establish the test setup as shown at the left.
2. Using the ECG cable supplied with the UUT, input a 1 mV 10 Hz sine wave from the patient simulator.
3. Set the UUT lead selection to LEAD II. (The ECG analog output is in real time at a nominal 1 v/mV and is not affected by the device ECG size setting.)
4. Verify the amplitude of the signal displayed on the oscilloscope is between 0.85 Vp-p and 1.15 Vp-p.
5. Record the results on the **PIP Checklist**.
6. Disconnect the Analog ECG Output Cable from the UUT and oscilloscope.
7. Continue directly to the PIP – Oximeter test on the next page.



PIP – Instructions

6-45

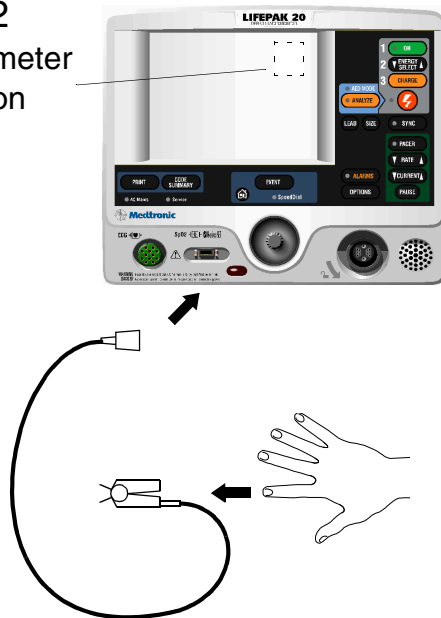
PIP – Oximeter

To test the SpO2 Oximeter:

Note: Complete only if the UUT is equipped with the SpO2 Oximeter option.

1. Connect the Oximeter finger probe to the SpO2 connector as shown at the left.
2. Verify the SpO2 parameter region appears on the display.
3. Place your index finger into the SpO2 probe. Allow several seconds for the probe to find your pulse. Confirm the SpO2 reading is between 90% and 100%.
4. Disconnect the SpO2 probe.
5. Turn off the UUT.
6. Record the results on the [PIP Checklist](#).
7. Continue directly to the PIP – Ground Resistance test on the next page.

SpO2
Parameter
Region

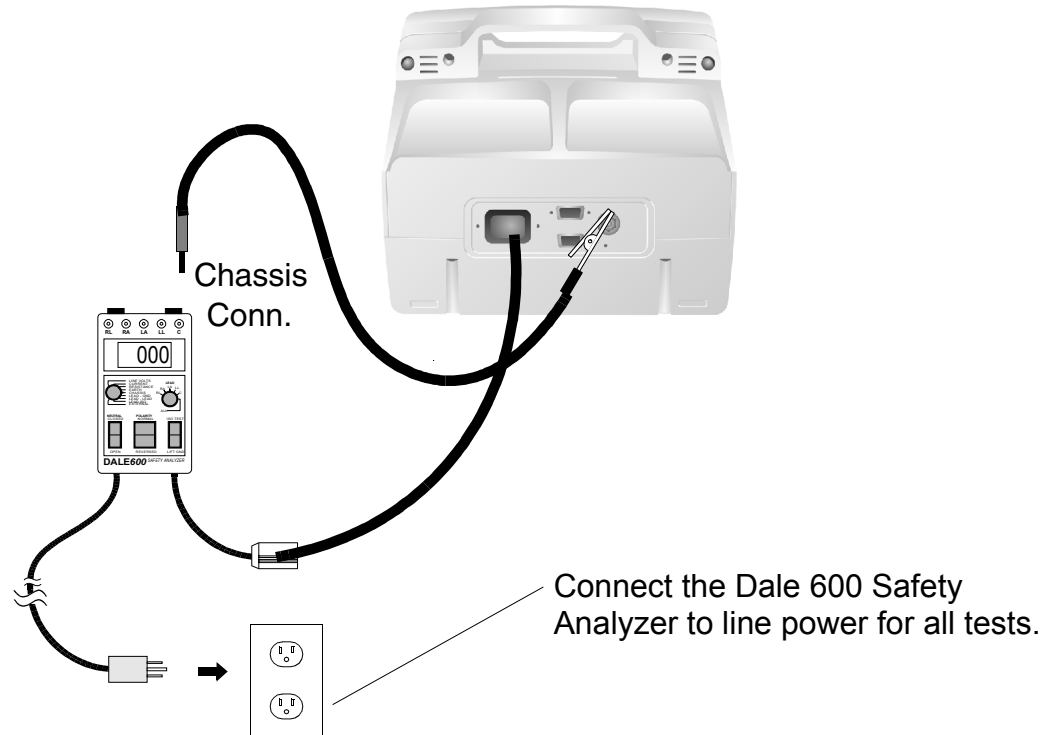


PIP – Instructions

6-46

PIP – Ground Resistance Test Setup

To test the Ground Resistance Test, set up the safety analyzer and UUT as shown below. Continue to the PIP – Ground Resistance Test Procedure on the next page when you complete the setup.



PIP – Instructions

6-47

PIP – Ground Resistance Test Procedure

To test Ground Resistance Test:

1. Establish the PIP – Ground Resistance Test Setup as shown in the figure on the previous page. **The UUT is off for this test.**
2. Set the safety analyzer controls to:

Neutral	Polarity	Mode	Lead
Any	Center	Ohms Resistance	Any

3. Verify measured ground resistance test is less than 0.5 ohms.
4. Record the results in the [PIP Checklist](#).
5. Continue directly to the PIP – Leakage Current test on the next page.

PIP – Instructions

6-48

PIP – Leakage Current

Check the leakage current in accordance with the following industry standards:

- AAMI/ANSI (Association for the Advancement of Medical Instrumentation/ American National Standards Institute) DF2-1989, DF39-1993
- IEC (International Electrotechnical Commission) 601-1 and 601-2-4

WARNING!

Shock Hazard. Failure to properly perform these tests could result in a failure to detect excessive leakage current. Make sure you are familiar with your test equipment and these test performance procedures.

Note: Due to the variety of safety analyzers that may be used for these tests, this service manual provides only general instructions. For information about configuration and testing methods, refer to your safety analyzer operating instructions.

Note: When operating the Polarity Switch, be sure to pause in the Off (middle) position when switching between Normal and Reversed Polarities.

(Continued on next page)

PIP – Instructions

6-49

PIP – Leakage Current (Continued)

Each test result applies to a safety analyzer operating from a 120 vac source or 240 vac source, unless indicated otherwise. For exceptions, the test result includes the safety analyzer operating source. For example, 300 μA (120 vac) or 500 μA (240 vac). All test results are summarized in the [Leakage Current Specifications Summary Table](#).

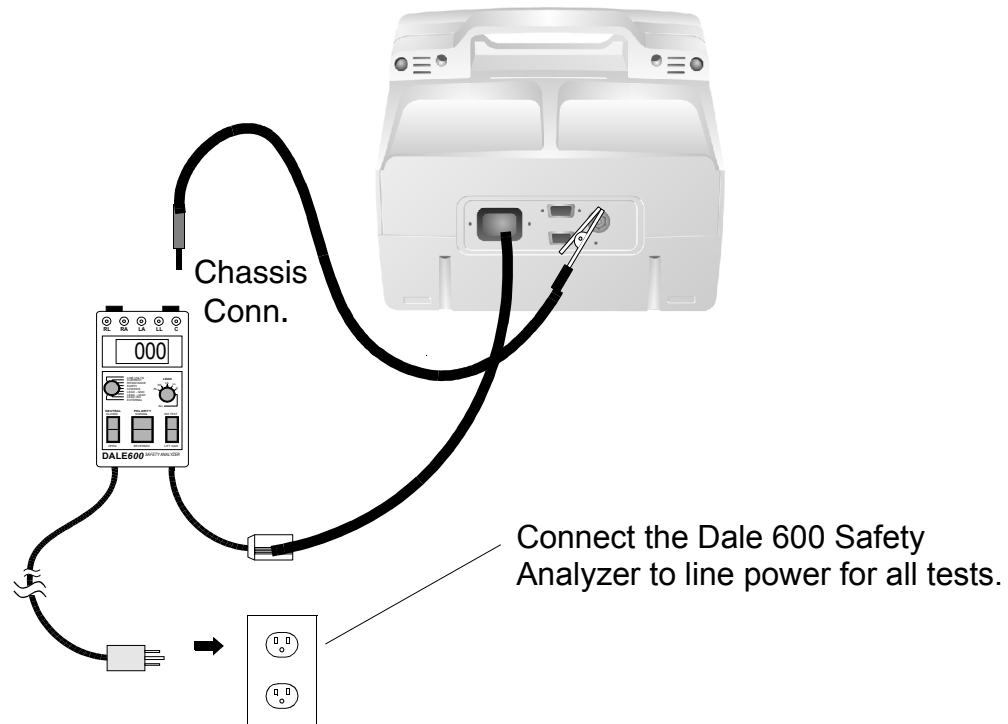
Proceed directly to the [PIP – Chassis Leakage Current Setup](#).

PIP – Instructions

6-50

PIP – Chassis Leakage Current Setup

To test chassis leakage current, set up the safety analyzer and LIFEPAK 20 defibrillator/monitor (UUT) as shown below. Continue to the PIP – Chassis Leakage Current Procedure when you complete the setup.



PIP – Instructions

6-51

PIP – Chassis Leakage Current Procedure

To test Chassis Leakage Current:

1. Establish the PIP – Chassis Leakage Current Setup as shown in the figure on the previous page.
2. Set the safety analyzer controls to:

Neutral	Polarity	Mode	Lead
Closed	Normal	Leakage μ A	Chassis
			All

3. Connect the analyzer clip to the Ground stud.
4. Turn the UUT on.
5. Verify measured current is less than 90 μ A.
6. Press the LIFT GND button on the safety analyzer.
7. Verify measured current is less than 270 μ A (120 VAC) or less than 450 μ A (240 VAC).

(Continued on next page)

PIP – Instructions

6-52

PIP – Chassis Leakage Current Procedure (Continued)

8. Release the LIFT GND button and set the safety analyzer controls to:

Neutral	Polarity	Mode	Lead
Closed	Reversed	Leakage μ A	Chassis

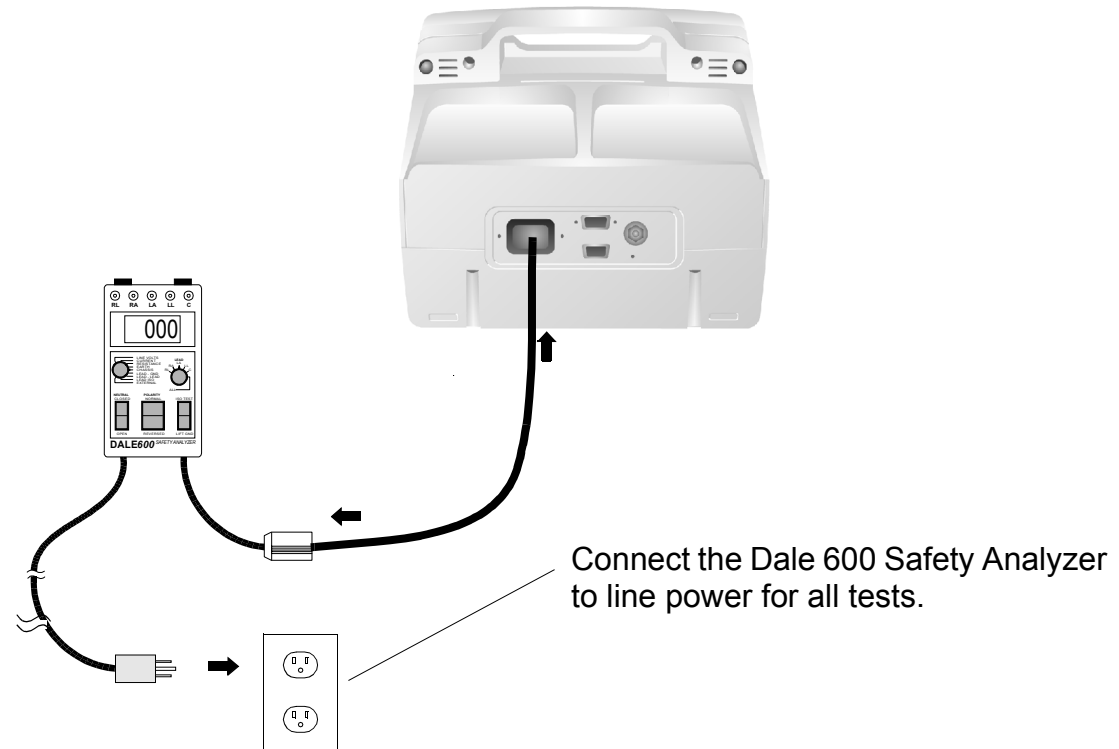
9. Verify measured current is less than 90 μ A.
10. Press the LIFT GND button on the safety analyzer.
11. Verify measured current is less than 270 μ A (120 Vac) or less than 450 μ A (240 Vac).
12. Release the LIFT GND button on the safety analyzer.
13. Record all results on the [PIP Checklist](#).
14. Continue directly to the next leakage current test.

PIP – Instructions

6-53

PIP – Earth Leakage Current Setup

To test earth leakage current, set up the safety analyzer and UUT as shown below. Continue to the PIP – Earth Leakage Current Procedure when you complete the setup.



PIP – Instructions

6-54

PIP – Earth Leakage Current Procedure

To test Earth Leakage Current:

1. Establish the PIP – Earth Leakage Current Setup shown in the figure on the previous page.
2. Set the safety analyzer controls to:

Neutral	Polarity	Mode	Lead
Closed	Normal	Leakage μ A Earth	Any

3. Verify measured current is less than 450 μ A.
4. Set the safety analyzer controls to:

Neutral	Polarity	Mode	Lead
Closed	Reversed	Leakage μ A Earth	Any

5. Verify measured current is less than 450 μ A.
6. Record the results in the [PIP Checklist](#).

(Continued on next page)

PIP – Instructions

6-55

PIP – Earth Leakage Current Procedure (Continued)

7. Set the safety analyzer controls to:

Neutral	Polarity	Mode	Lead
Open	Normal	Leakage μ A	Earth

8. Verify measured current is less than 900 μ A.
9. Set the safety analyzer controls to:

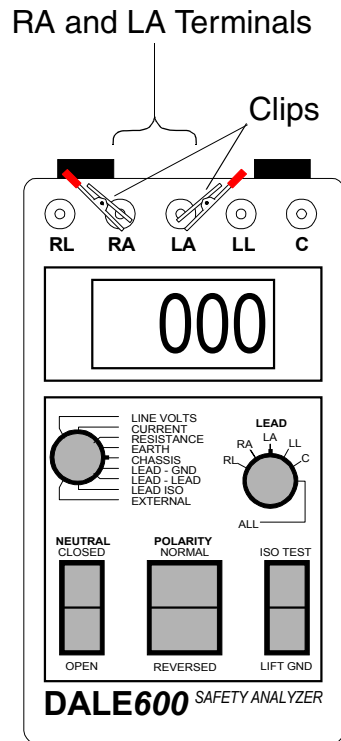
Neutral	Polarity	Mode	Lead
Open	Reversed	Leakage μ A	Earth

10. Verify measured current is less than 900 μ A.
11. Record the results in the [PIP Checklist](#).
12. Continue directly to the next leakage current test.

PIP – Instructions

6-57

PIP – Paddles Source Leakage Current Procedure



To test paddles Source Leakage Current:

1. Establish the PIP – Paddles Source Leakage Current Setup shown in the figure on the previous page.
2. Turn on the UUT.
3. Set the safety analyzer controls to:

Neutral	Polarity	Mode	Lead
Closed	Normal	Leakage μ A	Lead – Gnd

4. Verify the measured current is less than 10 μ A.
5. Press the LIFT GND button on the safety analyzer.
6. Verify the measured current is less than 50 μ A.
7. Release the LIFT GND button.
8. Set the safety analyzer controls to:

Neutral	Polarity	Mode	Lead
Closed	Reversed	Leakage μ A	Lead – Gnd

(Continued on next page)

PIP – Instructions

6-58

PIP – Paddles Source Leakage Current Procedure (Continued)

9. Verify the measured current is less than 10 μA .
10. Press the **LIFT GND** button on the safety analyzer.
11. Verify the measured current is less than 50 μA .
12. Release the **LIFT GND** button.
13. Record the results in the **PIP Checklist**.
14. Set the safety analyzer controls to:

Neutral	Polarity	Mode	Lead
Closed	Normal	Leakage μA	Lead – Gnd RA

15. Repeat Steps 4 through 7 for the RA Lead.
16. Set the safety analyzer controls to:

Neutral	Polarity	Mode	Lead
Closed	Reversed	Leakage μA	Lead – Gnd RA

17. Repeat Steps 9 through 13 for the RA Lead.

(Continued on next page)

PIP – Instructions

6-59

PIP – Paddles Source Leakage Current Procedure (Continued)

18. Set the safety analyzer controls to:

Neutral	Polarity	Mode	Lead
Closed	Normal	Leakage μ A	Lead – Gnd LA

19. Repeat Steps 4 through 7 for the LA Lead.

20. Set the safety analyzer controls to:

Neutral	Polarity	Mode	Lead
Closed	Reversed	Leakage μ A	Lead – Gnd LA

21. Repeat Steps 9 through 13 for the LA Lead.

22. Set the safety analyzer controls to:

Neutral	Polarity	Mode	Lead
Closed	Normal	Leakage μ A	Lead – Lead LA or RA

23. Repeat Steps 4 through 7 for Lead – Lead leakage.

(Continued on next page)

PIP – Instructions

6-60

PIP – Paddles Source Leakage Current Procedure (Continued)

24. Set the safety analyzer controls to:

Neutral	Polarity	Mode	Lead
Closed	Reversed	Leakage μ A	Lead – Lead LA or RA

25. Repeat Steps 9 through 13 for Lead – Lead leakage.

26. Turn off the UUT.

27. Continue directly to the next leakage current test.

PIP – Instructions

6-62

PIP – Paddles Sink Leakage Current Procedure

To test Paddles Sink Leakage Current:

1. Establish the PIP – Paddles Sink Leakage Current Setup shown in the figure on the previous page. **The UUT is off for this test.**

WARNING!

Shock hazard. During sink leakage tests high voltage is present on the safety analyzer electrode snaps. Do not touch the analyzer snaps or UUT connections during these tests.

2. Set the safety analyzer controls to:

Neutral	Polarity	Mode	Lead
Closed	Normal	Leakage μ A	Lead Iso
			All

3. Momentarily press the ISO TEST button on the safety analyzer and observe the measured current reading.
4. Release the ISO TEST button.
5. Verify the measured current is less than 90 μ A (120 vac) or 450 μ A (240 vac).
6. Record the results in the **PIP Checklist**.

(Continued on next page)

PIP – Instructions

6-63

PIP – Paddles Sink
Leakage Current
Procedure (Continued)

7. Continue directly to the next leakage current test.

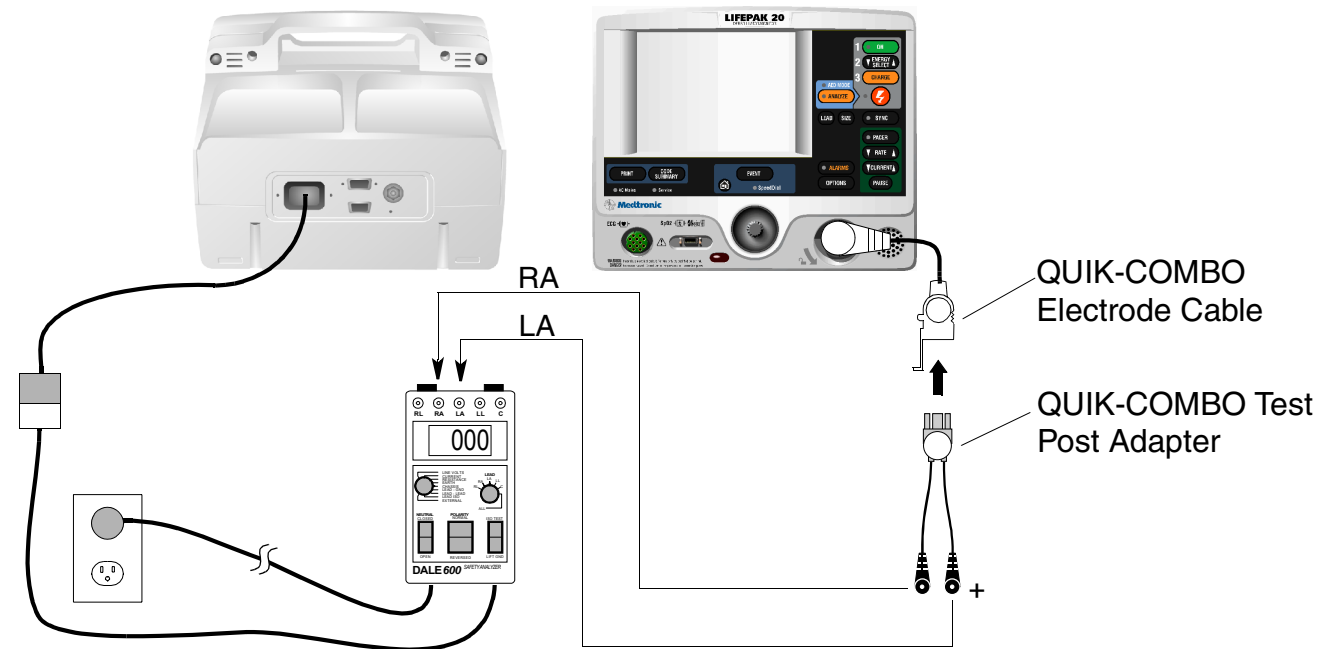
PIP – Instructions

6-64

PIP – QUIK-COMBO Source Leakage Current Setup

Note: If the UUT is configured for use with Standard Paddles, refer to **PIP – Paddles Source Leakage Current**.

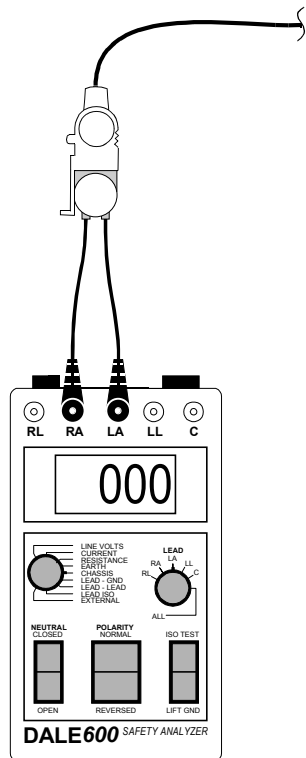
To test QUIK-COMBO source leakage current, set up the safety analyzer and UUT as shown below. Continue to the PIP – QUIK-COMBO Source Leakage Current Procedure when you complete the setup.



PIP – Instructions

6-65

PIP – QUIK-COMBO Source Leakage Current Procedure



To test QUIK-COMBO Source Leakage Current:

1. Establish the PIP – QUIK-COMBO Source Leakage Current Setup shown in the figure on the previous page.
2. Turn on the UUT.
3. Set the safety analyzer controls to:

Neutral	Polarity	Mode	Lead
Closed	Normal	Leakage μ A	Lead – Gnd

4. Verify the measured current is less than 10 μ A.
5. Press the LIFT GND button on the safety analyzer.
6. Verify the measured current is less than 50 μ A.
7. Release the LIFT GND button.
8. Set the safety analyzer controls to:

Neutral	Polarity	Mode	Lead
Closed	Reversed	Leakage μ A	Lead – Gnd

(Continued on next page)

PIP – Instructions

6-66

PIP – QUIK-COMBO Source Leakage Current Procedure (Continued)

9. Verify the measured current is less than 10 μA .
10. Press the **LIFT GND** button on the safety analyzer.
11. Verify the measured current is less than 50 μA .
12. Release the **LIFT GND** button.
13. Record the results in the **PIP Checklist**.
14. Set the safety analyzer controls to:

Neutral	Polarity	Mode	Lead
Closed	Normal	Leakage μA	Lead – Gnd RA

15. Repeat Steps 4 through 7 for the RA Lead.
16. Set the safety analyzer controls to:

Neutral	Polarity	Mode	Lead
Closed	Reversed	Leakage μA	Lead – Gnd RA

17. Repeat Steps 9 through 13 for the RA Lead.

(Continued on next page)

PIP – Instructions

6-67

PIP – QUIK-COMBO Source Leakage Current Procedure (Continued)

18. Set the safety analyzer controls to:

Neutral	Polarity	Mode	Lead
Closed	Normal	Leakage μ A	Lead – Gnd LA

19. Repeat Steps 4 through 7 for the LA Lead.

20. Set the safety analyzer controls to:

Neutral	Polarity	Mode	Lead
Closed	Reversed	Leakage μ A	Lead – Gnd LA

21. Repeat Steps 9 through 13 for the LA Lead.

22. Set the safety analyzer controls to:

Neutral	Polarity	Mode	Lead
Closed	Normal	Leakage μ A	Lead – Lead LA or RA

23. Repeat Steps 4 through 7 for Lead – Lead leakage.

(Continued on next page)

PIP – Instructions

6-68

PIP – QUIK-COMBO Source Leakage Current Procedure (Continued)

24. Set the safety analyzer controls to:

Neutral	Polarity	Mode	Lead
Closed	Reversed	Leakage μ A	Lead – Lead LA or RA

25. Repeat Steps 9 through 13 for Lead – Lead leakage.

26. Turn off the UUT.

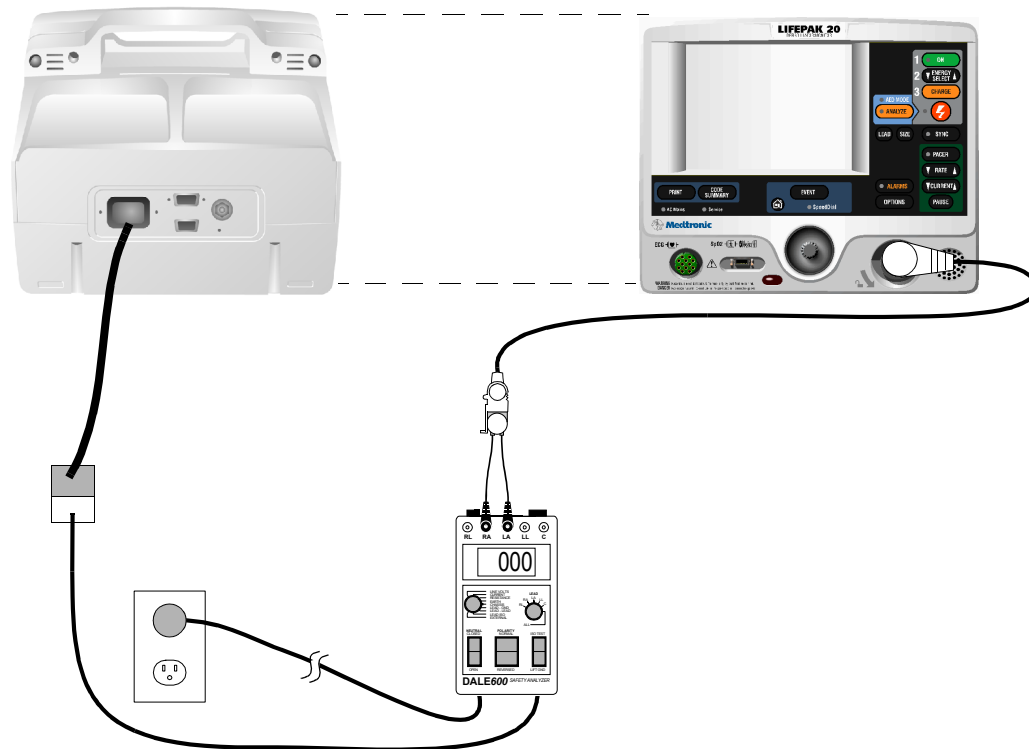
27. Continue directly to the next leakage current test.

PIP – Instructions

6-69

PIP – QUIK-COMBO Sink Leakage Current Setup

To test the QUIK-COMBO sink leakage current, set up the safety analyzer and UUT as shown below. Continue to the PIP – QUIK-COMBO Sink Leakage Current Procedure on the next page when you complete the setup.



PIP – Instructions

6-70

PIP – QUIK-COMBO Sink Leakage Current Procedure

To test QUIK-COMBO Sink Leakage Current:

1. Establish the PIP – QUIK-COMBO Sink Leakage Current Setup shown in the figure on the previous page. **The UUT is off for this test.**

WARNING!

Shock hazard. During sink leakage tests high voltage is present on the safety analyzer electrode snaps. Do not touch the analyzer snaps or UUT connections during these tests.

2. Set the safety analyzer controls to:

Neutral	Polarity	Mode	Lead
Closed	Normal	Leakage μ A	Lead Iso
			All

3. Momentarily press the ISO TEST button on the safety analyzer and observe the measured current reading.
4. Release the ISO TEST button.
5. Verify the measured current is less than 90 μ A (120 vac) or 450 μ A (240 vac).
6. Record the results on the [PIP Checklist](#).

(Continued on next page)

PIP – Instructions

6-71

PIP – QUIK-COMBO Sink Leakage Current Procedure (Continued)

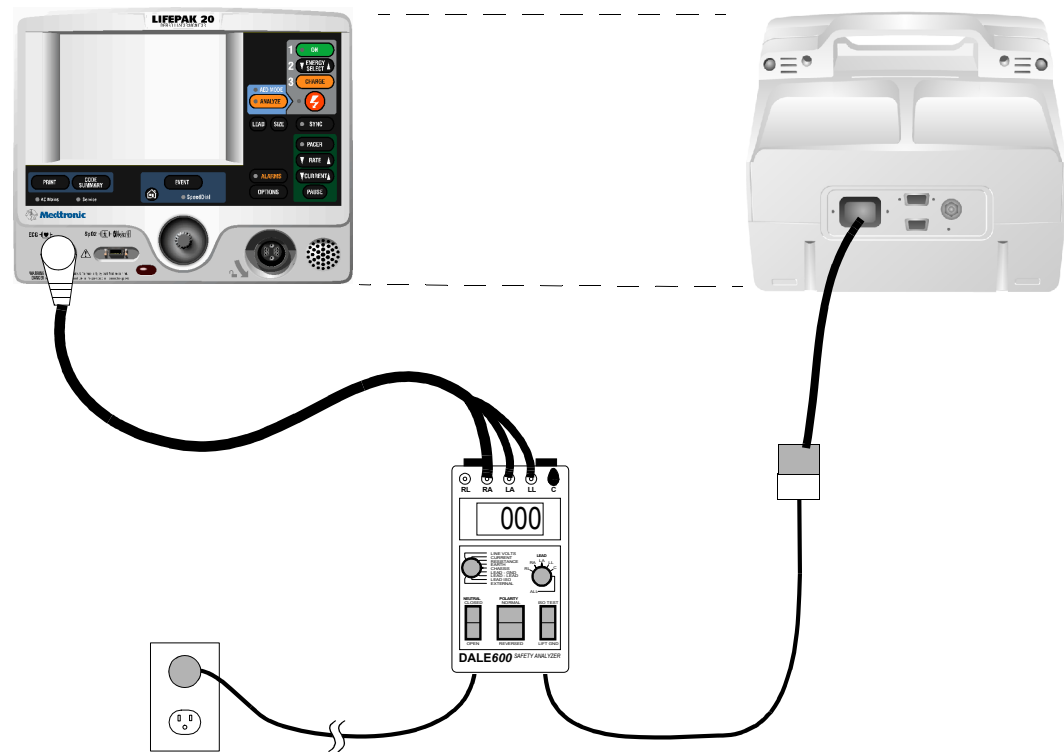
7. Continue directly to the next leakage current test.

PIP – Instructions

6-72

PIP – ECG 3-Lead Source Leakage Current Procedure Setup

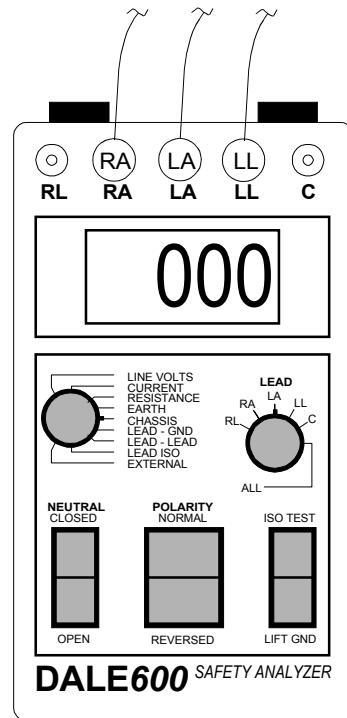
To test the ECG 3-Lead Source Leakage Current, set up the safety analyzer and UUT as shown below. Continue to the PIP – ECG 3-Lead Source Leakage Current Procedure on the next page when you complete the setup.



PIP – Instructions

6-73

PIP – ECG 3-Lead Source Leakage Current Procedure



To test ECG 3-Lead Source Leakage Current:

1. Establish the PIP – ECG 3-Lead Source Leakage Current Setup shown in the figure on the previous page.
2. Turn on the UUT.
3. Set the safety analyzer controls to:

Neutral	Polarity	Mode	Lead
Closed	Normal	Leakage μ A	Lead – Gnd RA

4. Verify the measured current is less than 10 μ A.
5. Press the LIFT GND button on the safety analyzer.
6. Verify the measured current is less than 50 μ A.
7. Release the LIFT GND button.
8. Repeat Steps 4 through 7 for the remaining (LA and LL) leads.
9. Set the safety analyzer controls to:

Neutral	Polarity	Mode	Lead
Closed	Reversed	Leakage μ A	Lead – Gnd RA

(Continued on next page)

PIP – Instructions

6-74

PIP – ECG 3-Lead Source Leakage Current Procedure (Continued)

10. Verify the measured current is less than 10 μ A.
11. Press the LIFT GND button on the safety analyzer.
12. Verify the measured current is less than 50 μ A.
13. Release the LIFT GND button.
14. Repeat Steps 10 through 13 for the remaining (LA and LL) leads.
15. Record all results on the PIP Checklist.
16. Set the safety analyzer controls to:

Neutral	Polarity	Mode	Lead
Closed	Normal	Leakage μ A	Lead – Lead RA

17. Verify the measured current is less than 10 μ A.
18. Press the LIFT GND button on the safety analyzer.
19. Verify the measured current is less than 50 μ A.
20. Release the LIFT GND button.
21. Repeat Steps 17 through 20 for the remaining (LA and LL) leads.

(Continued on next page)

PIP – Instructions

6-75

PIP – ECG 3-Lead Source Leakage Current Procedure (Continued)

22. Set the safety analyzer controls to:

Neutral	Polarity	Mode	Lead
Closed	Reversed	Leakage μ A	Lead – Lead RA

23. Verify the measured current is less than 10 μ A.

24. Press the LIFT GND button on the safety analyzer.

25. Verify the measured current is less than 50 μ A.

26. Release the LIFT GND button.

27. Repeat Steps 23 through 26 for the remaining (LA and LL) leads.

28. Record all results on the **PIP Checklist**.

29. Turn off the UUT.

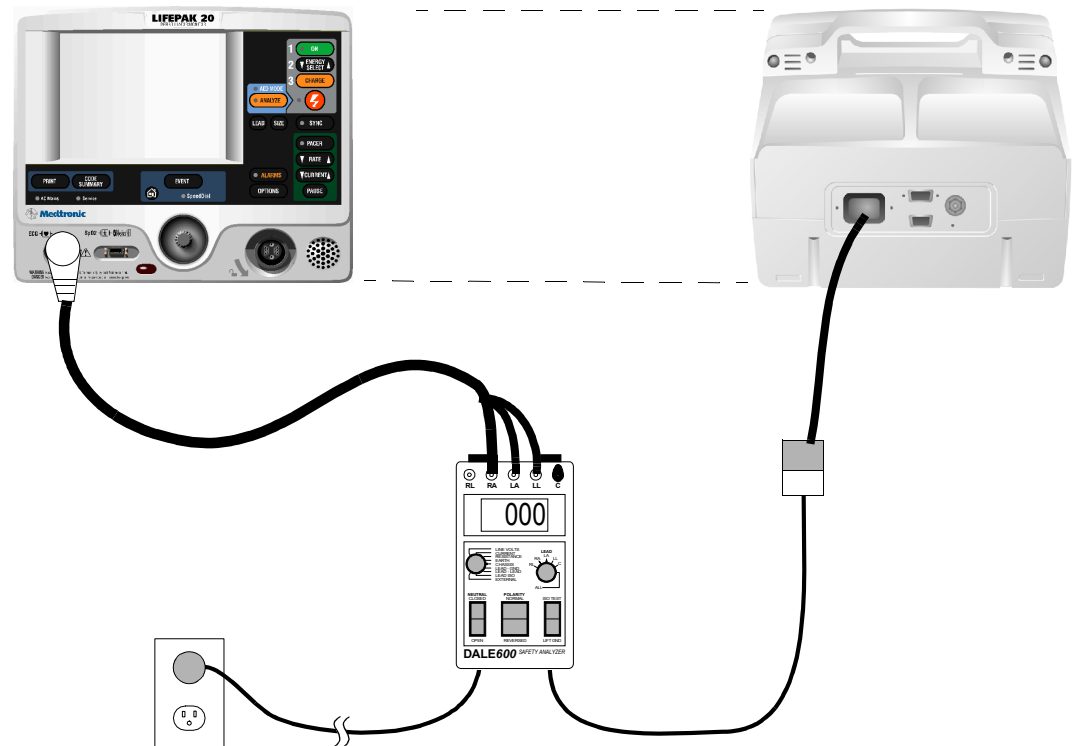
30. Continue directly to the next leakage current test.

PIP – Instructions

6-76

PIP – ECG 3-Lead Sink Leakage Current Setup

To test the ECG 3-Lead Sink Leakage Current, set up the safety analyzer and UUT as shown below. Continue to the PIP – ECG 3-Lead Sink Leakage Current Procedure on the next page when you complete the setup.



PIP – Instructions

6-77

PIP – ECG 3-Lead Sink Leakage Current Procedure

To test ECG 3-Lead Sink Leakage Current:

1. Establish the PIP – ECG 3-Lead Sink Leakage Current Setup shown in the figure on the previous page. **The UUT is off for this test.**

WARNING!

Shock hazard. During sink leakage tests high voltage is present on the safety analyzer electrode snaps. Do not touch the analyzer snaps or UUT connections during these tests.

2. Set the safety analyzer controls to:

Neutral	Polarity	Mode	Lead
Closed	Normal	Leakage μ A	Lead Iso
			All

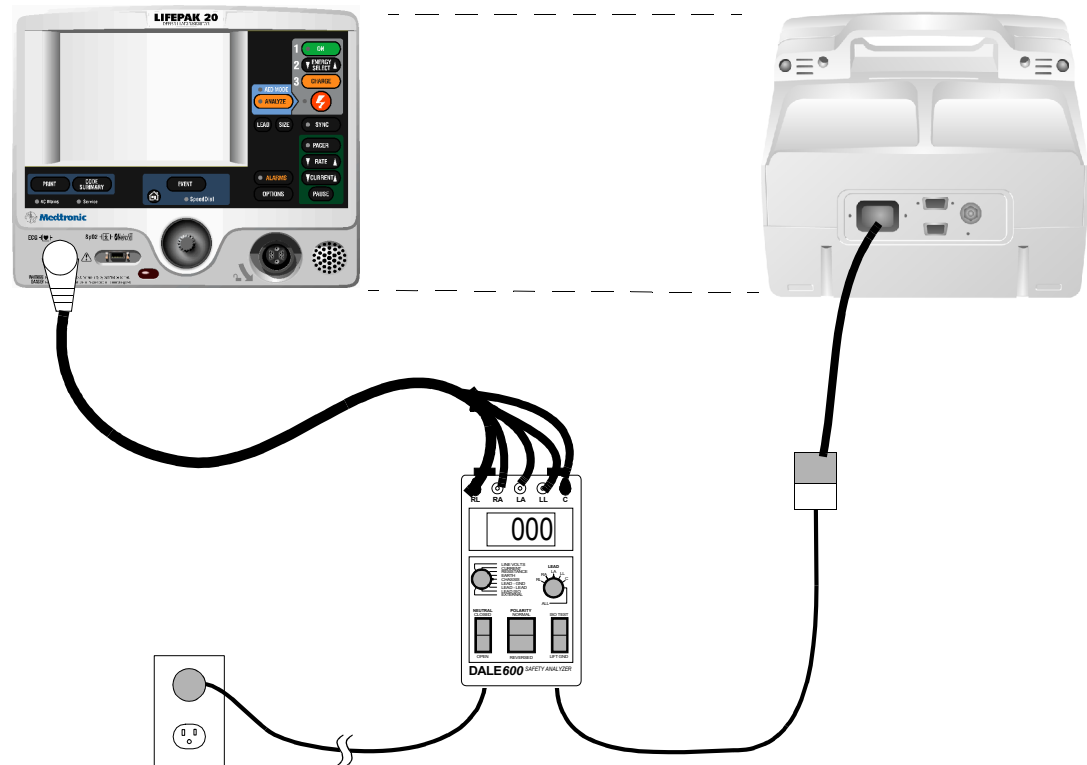
3. Momentarily press the ISO TEST button on the analyzer and observe the current reading.
4. Release the ISO TEST button.
5. Verify the measured current is less than 45 μ A.
6. Record the results on the [PIP Checklist](#).
7. Continue directly to the next leakage current test.

PIP – Instructions

6-78

PIP – ECG 5-Lead Source Leakage Current Procedure Setup

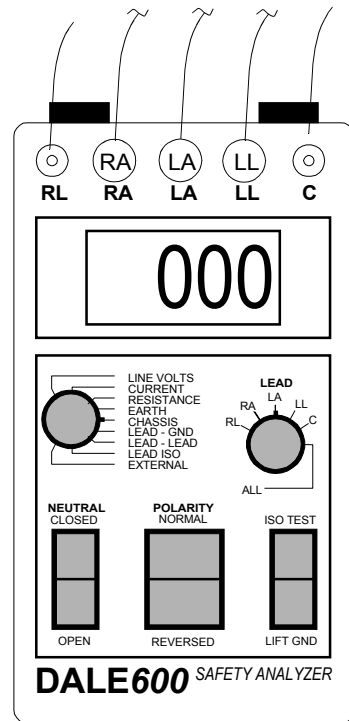
To test the ECG 5-Lead Source Leakage Current, set up the safety analyzer and UUT as shown below. Continue to the PIP – ECG 5-Lead Source Leakage Current Procedure on the next page when you complete the setup.



PIP – Instructions

6-79

PIP – ECG 5-Lead Source Leakage Current Procedure



To test ECG 5-Lead Source Leakage Current:

1. Establish the PIP – ECG 5-Lead Source Leakage Current Setup shown in the figure on the previous page.
2. Turn on the UUT.
3. Set the safety analyzer controls to:

Neutral	Polarity	Mode	Lead
Closed	Normal	Leakage μ A	Lead – Gnd RL

4. Verify the measured current is less than 10 μ A.
5. Press the LIFT GND button on the safety analyzer.
6. Verify the measured current is less than 50 μ A.
7. Release the LIFT GND button.
8. Repeat Steps 4 through 7 for the remaining (LA, RA, LL, and C) leads.
9. Record the results in the PIP Checklist.

(Continued on next page)

PIP – Instructions

6-80

PIP – ECG 5-Lead Source Leakage Current Procedure (Continued)

10. Set the safety analyzer controls to:

Neutral	Polarity	Mode	Lead
Closed	Reversed	Leakage μA	Lead – Gnd RL

11. Verify the measured current is less than 10 μA .
12. Press the **LIFT GND** button on the safety analyzer.
13. Verify the measured current is less than 50 μA .
14. Release the **LIFT GND** button.
15. Repeat Steps 11 through 14 for the remaining (LA, RA, LL, and C) leads.
16. Record all results on the **PIP Checklist**.
17. Set the safety analyzer controls to:

Neutral	Polarity	Mode	Lead
Closed	Normal	Leakage μA	Lead – Lead RL

18. Verify the measured current is less than 10 μA .

(Continued on next page)

PIP – Instructions

6-81

PIP – ECG 5-Lead Source Leakage Current Procedure (Continued)

19. Press the **LIFT GND** button on the safety analyzer.
20. Verify the measured current is less than 50 μ A.
21. Release the **LIFT GND** button.
22. Repeat Steps 18 through 21 for the remaining (LA, RA, LL, and C) leads.
23. Record all results on the **PIP Checklist**.
24. Set the safety analyzer controls to:

Neutral	Polarity	Mode	Lead
Closed	Reversed	Leakage μ A	Lead – Lead RL

25. Verify the measured current is less than 10 μ A.
26. Press the **LIFT GND** button on the safety analyzer.
27. Verify the measured current is less than 50 μ A.
28. Release the **LIFT GND** button.
29. Repeat Steps 25 through 28 for the remaining (LA, RA, LL, and C) leads.
30. Record all results on the **PIP Checklist**.

(Continued on next page)

PIP – Instructions

6-82

PIP – ECG 5-Lead
Source Leakage
Current Procedure
(Continued)

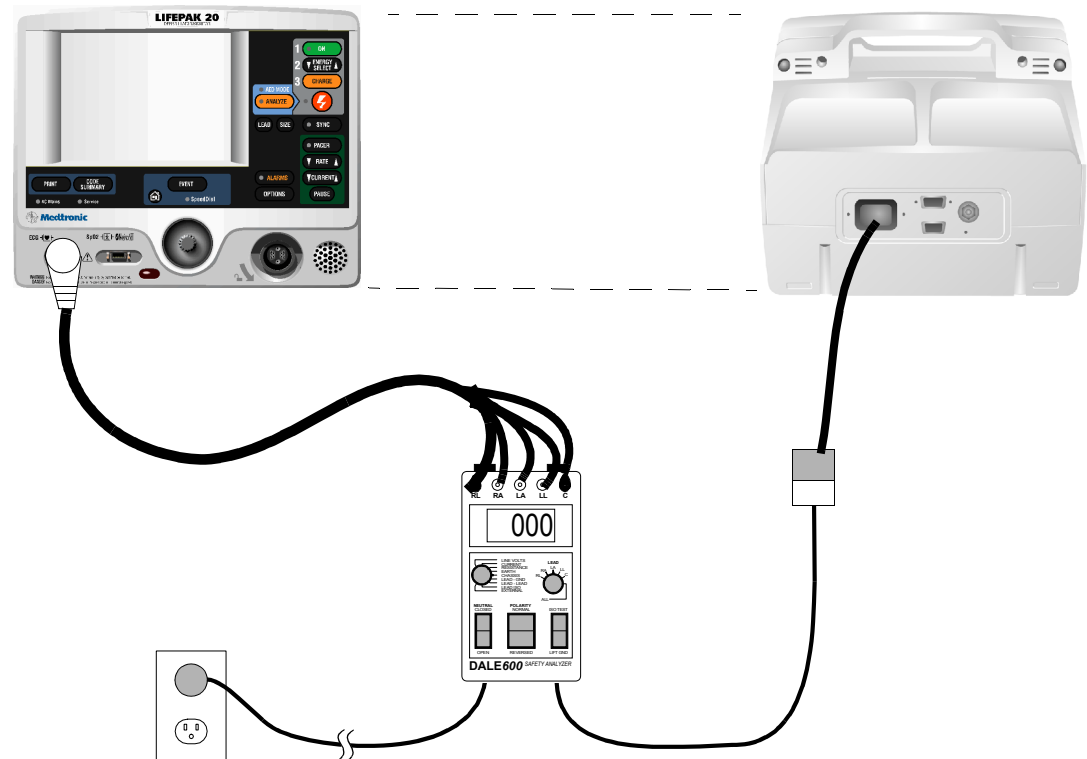
31. Turn off the UUT.
32. Continue directly to the next leakage current test.

PIP – Instructions

6-83

PIP – ECG 5-Lead Sink Leakage Current Setup

To test the ECG 5-Lead Sink Leakage Current, set up the safety analyzer and UUT as shown below. Continue to the PIP – ECG 5-Lead Sink Leakage Current Procedure on the next page when you complete the setup.



PIP – Instructions

6-84

PIP – ECG 5-Lead Sink Leakage Current Procedure

To test ECG 5-Lead Sink Leakage Current:

1. Establish the PIP – ECG 5-Lead Sink Leakage Current Setup shown in the figure on the previous page. **The UUT is off for this test.**

WARNING!

Shock hazard. During sink leakage tests high voltage is present on the safety analyzer electrode snaps. Do not touch the analyzer snaps or UUT connections during these tests.

2. Set the safety analyzer controls to:

Neutral	Polarity	Mode	Lead
Closed	Normal	Leakage μ A	Lead Iso
			All

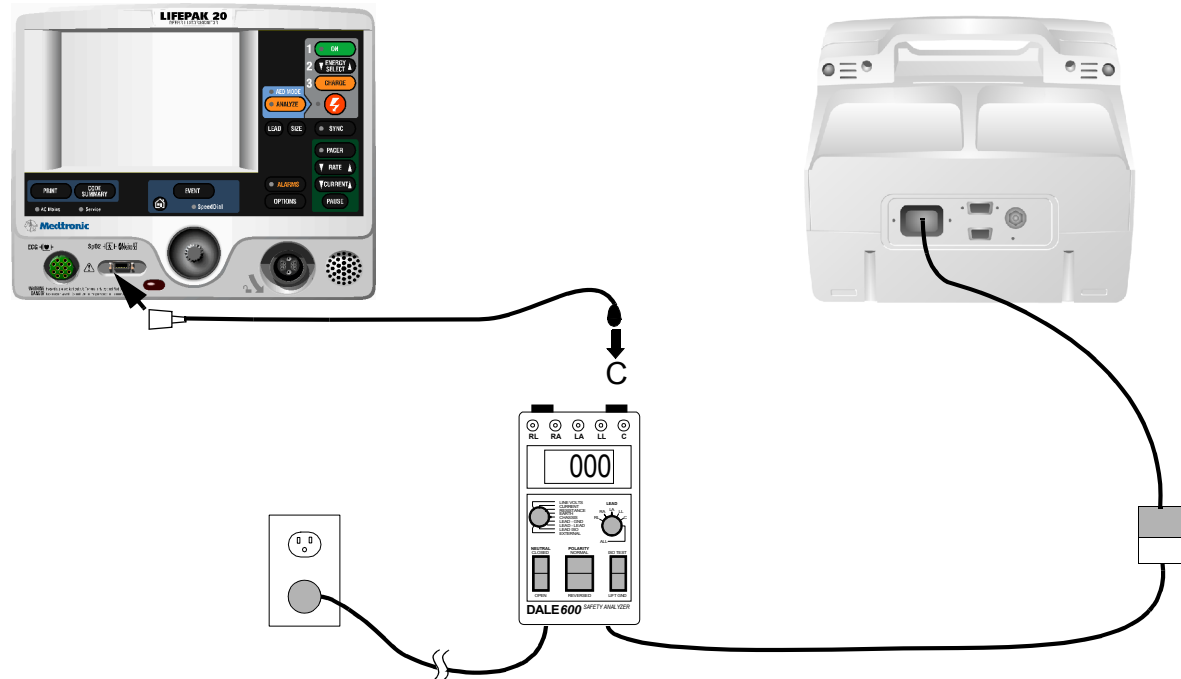
3. Momentarily press the ISO TEST button on the analyzer and observe the current reading.
4. Release the ISO TEST button.
5. Verify the measured current is less than 45 μ A.
6. Record the results on the [PIP Checklist](#).
7. Continue directly to the next leakage current test.

PIP – Instructions

6-85

PIP – SpO2 Source Leakage Current Setup

Note: Complete the following only for UUTs equipped with the SpO2 option. To test SpO2 Source Leakage Current, set up the safety analyzer, UUT as shown below. Continue to the PIP – SpO2 Source Leakage Current Procedure when you complete the setup.



PIP – Instructions

6-86

PIP – SpO2 Source Leakage Current Procedure

To test SpO2 Source Leakage Current:

1. Establish the PIP – SpO2 Source Leakage Current Setup shown in the figure on the previous page.
2. Turn on the UUT.
3. Set the safety analyzer controls to:

Neutral	Polarity	Mode	Lead
Closed	Normal	Leakage μ A	Lead – Gnd C

4. Verify the measured current is less than 10 μ A (120 vac) or 100 μ A (240 vac).
5. Record the results on the [PIP Checklist](#).
6. Press the LIFT GND button on the safety analyzer.
7. Verify the measured current is less than 50 μ A (120 vac) or 500 μ A (240 vac).
8. Record the results in the [PIP Checklist](#).

(Continued on next page)

PIP – Instructions

6-87

PIP – SpO2 Source Leakage Current Procedure (Continued)

9. Release the LIFT GND button.
10. Set the safety analyzer controls to:

Neutral	Polarity	Mode	Lead
Closed	Reverse	Leakage μ A	Lead – Gnd C

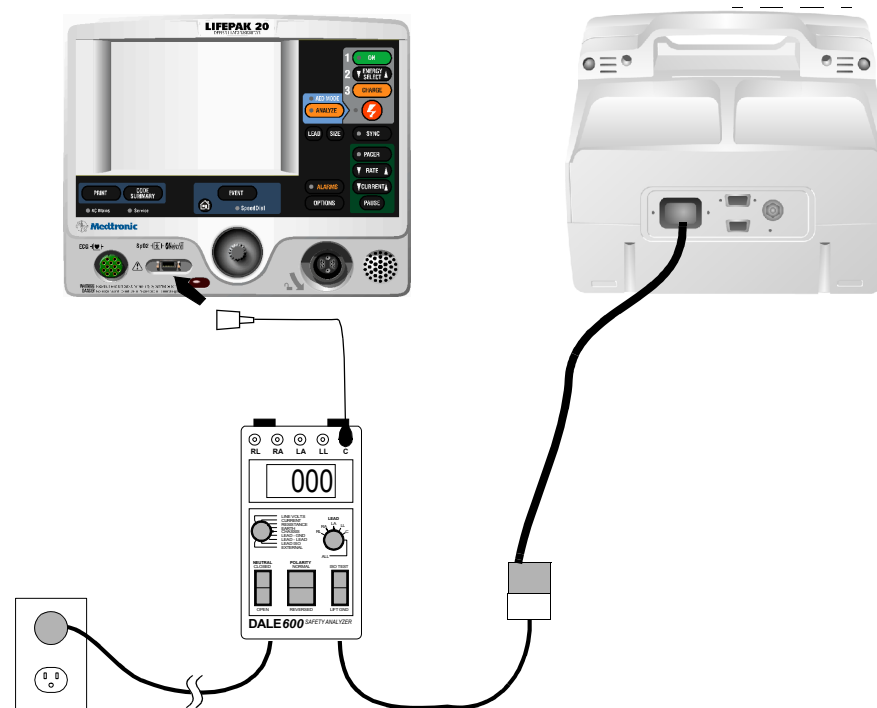
11. Repeat Steps 4 through 9.
12. Record all results on the [PIP Checklist](#).
13. Turn off the UUT.
14. Continue directly to the next leakage current test.

PIP – Instructions

6-88

PIP – SpO2 Sink Leakage Current Setup

Note: Complete the following only for UUTs equipped with the SpO2 option. To test SpO2 Source Leakage Current, set up the safety analyzer and UUT as shown below. Continue to the PIP – SpO2 Sink Leakage Current Procedure on the next page when you complete the setup.



PIP – Instructions

6-89

PIP – SpO2 Sink Leakage Current Procedure

To test SpO2 Sink Leakage Current:

1. Establish the PIP – SpO2 Sink Leakage Current Setup shown in the figure on the previous page. **The UUT is off for this test.**

WARNING!

Shock hazard. During sink leakage tests high voltage is present on the safety analyzer electrode snaps. Do not touch the analyzer snaps or UUT connections during these tests.

2. Set the safety analyzer controls to:

Neutral	Polarity	Mode	Lead
Closed	Normal	Leakage μ A	Lead Iso C

3. Momentarily press the ISO TEST button on the safety analyzer and observe the measured current reading.
4. Release the ISO TEST button.
5. Verify the measured current is less than 90 μ A (120 vac) or 450 μ A (240 vac).
6. Record the results on the [PIP Checklist](#).

PIP – Summary of Leakage Current Specifications

6-90

The following summarizes leakage current specifications.
 NC=Normal Condition SFC = Single Fault Condition

Leakage Test		Maximum Leakage Current Specifications	
Type of Test	Lead Test	Analyzer @ 120 vac	Analyzer @ 240 vac
Chassis Leakage	Contact of Ground Stud	NC: 90 μ A	NC: 90 μ A
		SFC: 270 μ A	SFC: 450 μ A
Earth Leakage	Closed Neutral	450 μ A	450 μ A
	Open Neutral	900 μ A	900 μ A
Paddles Source LEAD-GND	All-GND	NC: 10 μ A	NC: 10 μ A
		SFC: 50 μ A	SFC: 50 μ A
	RA-GND	NC: 10 μ A	NC: 10 μ A
		SFC: 50 μ A	SFC: 50 μ A
	LA-GND	NC: 10 μ A	NC: 10 μ A
		SFC: 50 μ A	SFC: 50 μ A
Paddles Source LEAD-LEAD	RA or LA	NC: 10 μ A	NC: 10 μ A
		SFC: 50 μ A	SFC: 50 μ A
Paddles Sink Leakage	ISO Test	90 μ A	450 μ A

PIP – Summary of Leakage Current Specifications

6-91

Leakage Test		Maximum Leakage Current Specifications	
Type of Test	Lead Test	Analyzer @ 120 vac	Analyzer @ 240 vac
QUIK-COMBO Source LEAD-GND	All-GND	NC: 10 μ A	NC: 10 μ A
		SFC: 50 μ A	SFC: 50 μ A
	RA-GND	NC: 10 μ A	NC: 10 μ A
		SFC: 50 μ A	SFC: 50 μ A
	LA-GND	NC: 10 μ A	NC: 10 μ A
		SFC: 50 μ A	SFC: 50 μ A
QUIK-COMBO Source LEAD-LEAD	RA or LA	NC: 10 μ A	NC: 10 μ A
		SFC: 50 μ A	SFC: 50 μ A
QUIK-COMBO Sink Leakage	ISO Test	90 μ A	450 μ A
3-Lead ECG Source LEAD-GND	All-GND	NC: 10 μ A	NC: 10 μ A
		SFC: 50 μ A	SFC: 50 μ A
	RA-GND	NC: 10 μ A	NC: 10 μ A
		SFC: 50 μ A	SFC: 50 μ A

PIP – Summary of Leakage Current Specifications

6-92

Leakage Test		Maximum Leakage Current Specifications	
Type of Test	Lead Test	Analyzer @ 120 vac	Analyzer @ 240 vac
3-Lead ECG Source LEAD-GND (Continued)	LA-GND	NC: 10 μ A	NC: 10 μ A
		SFC: 50 μ A	SFC: 50 μ A
	LL-GND	NC: 10 μ A	NC: 10 μ A
		SFC: 50 μ A	SFC: 50 μ A
3-Lead ECG Source LEAD-LEAD	RA	NC: 10 μ A	NC: 10 μ A
		SFC: 50 μ A	SFC: 50 μ A
	LA	NC: 10 μ A	NC: 10 μ A
		SFC: 50 μ A	SFC: 50 μ A
	LL-GND	NC: 10 μ A	NC: 10 μ A
		SFC: 50 μ A	SFC: 50 μ A
3-Lead ECG Sink Leakage	ISO Test	45 μ A	45 μ A

PIP – Summary of Leakage Current Specifications

6-93

Leakage Test		Maximum Leakage Current Specifications	
Type of Test	Lead Test	Analyzer @ 120 vac	Analyzer @ 240 vac
5-Lead ECG Source LEAD-GND	RA	NC: 10 μ A	NC: 10 μ A
		SFC: 50 μ A	SFC: 50 μ A
	LA	NC: 10 μ A	NC: 10 μ A
		SFC: 50 μ A	SFC: 50 μ A
	RL	NC: 10 μ A	NC: 10 μ A
		SFC: 50 μ A	SFC: 50 μ A
	LL	NC: 10 μ A	NC: 10 μ A
		SFC: 50 μ A	SFC: 50 μ A
	C	NC: 10 μ A	NC: 10 μ A
		SFC: 50 μ A	SFC: 50 μ A
5-Lead ECG Source LEAD-LEAD	RA	NC: 10 μ A	NC: 10 μ A
		SFC: 50 μ A	SFC: 50 μ A

PIP – Summary of Leakage Current Specifications

6-94

Leakage Test		Maximum Leakage Current Specifications	
Type of Test	Lead Test	Analyzer@ 120 vac	Analyzer @ 240 vac
5-Lead ECG Source LEAD-LEAD (Continued)	RL	NC: 10 μ A	NC: 10 μ A
		SFC: 50 μ A	SFC: 50 μ A
	LA	NC: 10 μ A	NC: 10 μ A
		SFC: 50 μ A	SFC: 50 μ A
	LL	NC: 10 μ A	NC: 10 μ A
		SFC: 50 μ A	SFC: 50 μ A
	C	NC: 10 μ A	NC: 10 μ A
		SFC: 50 μ A	SFC: 50 μ A
5-Lead ECG Sink Leakage	ISO Test	45 μ A	45 μ A
SpO2 Source LEAD-GND	SpO2	NC: 10 μ A	NC: 100 μ A
		SFC: 50 μ A	SFC: 500 μ A
SpO2 Sink Leakage	ISO Test	90 μ A	450 μ A

Instrument Calibration

The Instrument Calibration section contains the Test and Calibration Procedure (TCP). Perform the procedures in this section as necessary after replacement of device components or to correct out-of-specification conditions detected during the PIP. The following procedures may be performed in any order.

Note: Anytime the device is calibrated or opened for repair or component replacement, it must successfully pass all portions of the closed-case **Performance Inspection Procedure (PIP)**.

TCP – Scope and Applicability

TCP – Resource Requirements

TCP – Test Equipment Requirements

TCP – Setup

TCP – Defibrillator Calibration Menu Access

TCP – Defibrillator Calibration

TCP – Delivered Energy Test

TCP – Defibrillator Output Waveform Test (Optional)

TCP – Scope and Applicability

This TCP applies to the LIFEPAK 20 defibrillator/monitor exclusively. You may perform the procedures outlined in this section in any order.

Note: Prior to its return to active use, the LIFEPAK 20 defibrillator/monitor must successfully pass all portions of the closed-case Performance Inspection Procedure (PIP) anytime the device is opened for repair, component replacement, or after calibration.

Refer to [TCP – Resource Requirements](#) for necessary equipment, test equipment verification, workstation power, and qualifications of the TCP personnel.

Refer to [TCP – Test Equipment Requirements](#) for a listing of test equipment, including specifications, required to complete the TCP.

TCP – Resource Requirements

7-3

This section describes the requirements for TCP equipment, TCP test equipment verification, TCP workstation power, and TCP personnel.

TCP – Equipment

To perform the TCP, you must use the equipment listed in the TCP – Test Equipment Requirements table on the next page. Although the table lists specific test equipment by manufacturer, test equipment with equivalent specifications may be substituted.

TCP – Test Equipment Verification

All test equipment used to perform the TCP must have a current calibration label. The calibration label must be issued by a certified calibration facility.

TCP – Workstation Power

The ac power to the workstation used must be connected to a grounded power source. The workstation must have **electrostatic discharge (ESD) protection**.

TCP – Personnel

Technicians who perform the PIP must be properly qualified and thoroughly familiar with the operation of the LIFEPAK 20 defibrillator/monitor, meeting the requirements described in **Service Personnel Qualifications**.

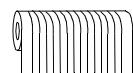
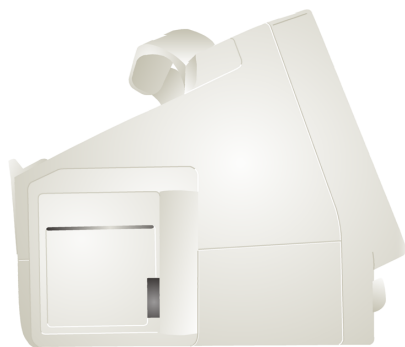
TCP – Test Equipment Requirements

You need the following test equipment, or equivalent, to conduct the TCP.

Equipment	Specifications	Manufacturer
Defibrillator Analyzer ^a	Energy range: 0 to 450 J Load resistance: 50 Ω \pm 1% Accuracy: \pm 2% +2 J Waveforms: NSR, VF, and Sine Wave	BIO-TEK [®] QED-6 [™] , with test posts accessory (software version 2.07, or greater)
QUIK-COMBO test post adapter	Connects to QUIK-COMBO therapy cable	Medtronic PN 3005302
QUIK-COMBO Electrode Cable		Medtronic PN 3006570
General purpose oscilloscope	Bandwidth: dc to 2 MHz Vertical accuracy: \pm 3% (5 mV – 5 v/div.) Horizontal Time Base Accuracy: \pm 5%	Tektronix [®] 2232 or equivalent

a. Some energy meters are not accurate for biphasic waveforms; contact your defibrillator analyzer's manufacturer for more information.

TCP – Setup



Printer
Paper

The following describes the LIFEPAK 20 defibrillator/monitor setup for the TCP.

WARNING!

Shock hazard. When discharged during this TCP, the device discharges up to 360 J of electrical energy through the defibrillator cable. You must safely discharge this electrical energy as described in this TCP. Do not attempt to perform this procedure unless you are thoroughly familiar with the operation of the device.

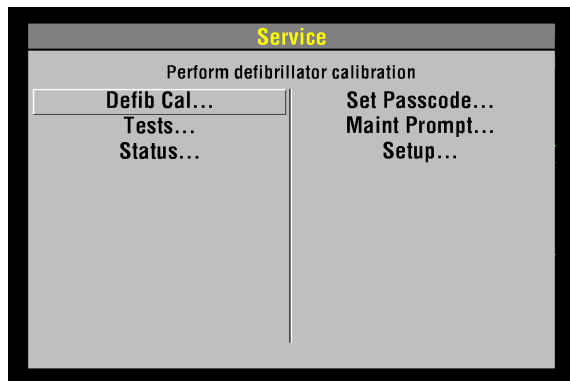
To set up the LIFEPAK 20 defibrillator/monitor for the TCP: Install a roll of paper into the printer.

Note: Ensure that the LOW BATTERY screen message does not appear when the device is turned on and during defibrillator calibration by installing a fully functional battery in the UUT.

Note: If the A12 Printer was replaced, save the piece of paper inside the printer that has the printhead resistance written down.

Note: Do not connect anything to the therapy connector, except as directed during this procedure.

TCP – Defibrillator Calibration Menu Access



To enter the Service screen:

1. Complete the TCP – Setup.
2. Place the UUT in service mode.
3. Select DEFIB CAL.. from the Service screen. The Service/Calibration screen appears.

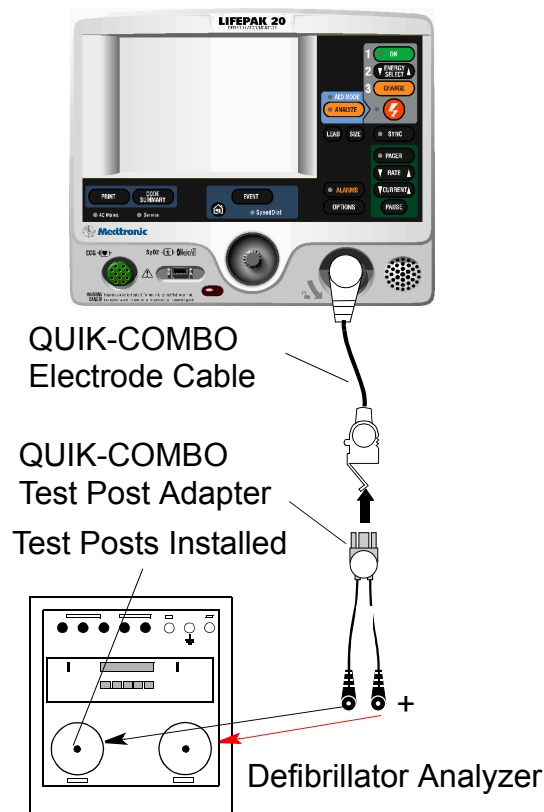
TCP – Defibrillator Calibration

To perform the defibrillator calibration procedure:

1. Connect the UUT to the defibrillator analyzer. Make sure the QUIK-COMBO (+) terminal is connected to apex (+).

Note: Adapt this procedure to use standard paddles, if desired.

2. Set the defibrillator analyzer to measure energy, with the appropriate scale.
3. Access the Defib Calibration submenu.
4. Select DEFIB CAL from the Service Screen.
5. Select START to initiate the calibration routine.
6. Follow the instructions on the UUT screen.
7. Turn off the UUT.
8. Continue directly to TCP – Delivered Energy Test on the next page.



TCP – Delivered Energy Test

WARNING!

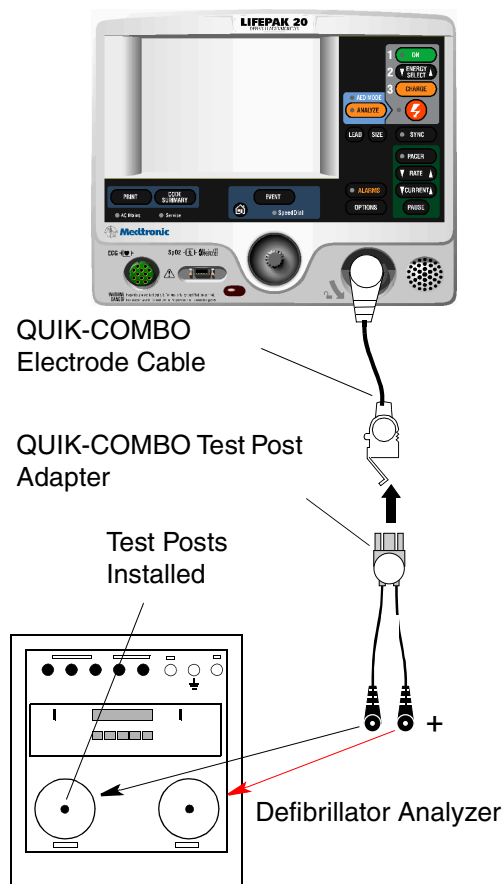
Shock hazard. Avoid contact with the energy meter. Dangerous voltages will be present on energy meter electrode plates/posts.

To verify the defibrillator delivered energy:

1. Connect the UUT to the defibrillator analyzer. Make sure the QUIK-COMBO (+) terminal is connected to apex (+).

Note: Adapt this procedure to use standard paddles, if desired.

2. Set the defibrillator analyzer to measure energy, with the appropriate scale.
3. Turn on the UUT. Verify that the *ADVISORY* indicator is off. If not, refer to **Entering Manual Mode**.
4. Press the *ENERGY SELECT* control to select 2 J.
5. Press the *CHARGE* control and wait for the UUT to reach full charge. Press the *SHOCK* control to discharge the UUT energy.
6. Verify that the defibrillator analyzer shows an energy level between 1.0 and 3.0 J.



(Continued on next page)

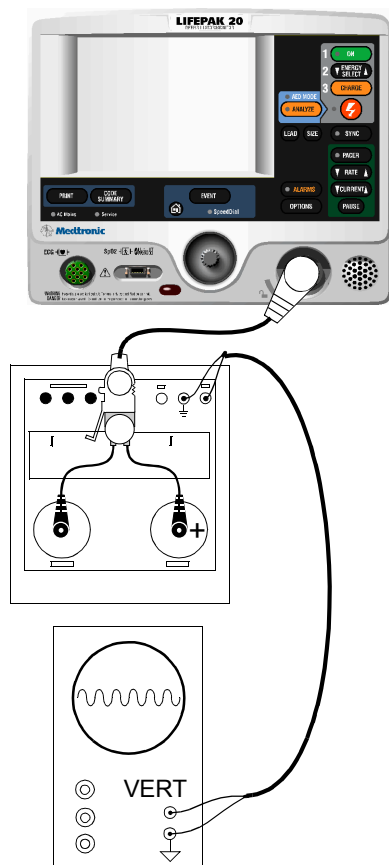
TCP – Delivered Energy Test

Note: Not all energy levels listed in the Delivered Energy Test table (below) are available on every UUT.

- Repeat Steps 4 through 6 for the remaining available energy levels specified in the Delivered Energy Test table below.

Energy Level (J)	Acceptable Output (J)	Energy Level (J)	Acceptable Output (J)
2	1.0 to 3.0	70	66.5 to 73.5
10	9.0 to 11.0	100	97.5 to 102.5
15	14.0 to 16.0	360	351.0 to 369.0
50	47.5 to 52.5		

TCP – Defibrillator Output Waveform Test (Optional)



The Defibrillator Output Waveform Test is an optional test.

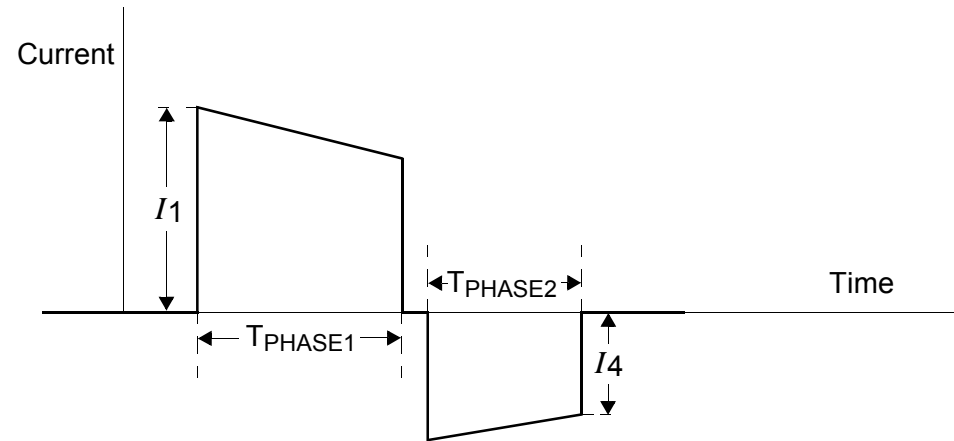
1. Connect the UUT to a defibrillator analyzer using the QUIK-COMBO electrode cable. Set the defibrillator analyzer to ENERGY, 1000 J scale.
2. Connect the DEFIB and GND terminals on the defibrillator analyzer to an oscilloscope vertical channel input and ground input. Set the oscilloscope to 0.5 V/div, 2 ms/div, + slope, store mode, and single sweep.

Note: 1 V on the oscilloscope = 29 A defibrillator output current using the QED-6 energy meter. When using other energy meters, refer to the manufacturer's specifications. You may need to slow down the horizontal sweep and/or turn on the triggering high-frequency reject to successfully capture the waveform.

3. Turn on the UUT. Press the ENERGY SELECT control and select 360 J.
4. Press the CHARGE control. After the capacitor charges (the SHOCK indicator is blinking), press the SHOCK control to deliver the energy to the analyzer.
5. Verify that the waveform meets specifications.
6. When testing is complete, turn off the UUT and disconnect the test setup.

(Continued on next page)

TCP – Defibrillator Output Waveform Test (Optional)



Patient Impedance (Ω)	T_{PHASE1} (ms)		T_{PHASE2} (ms)		Tilt	
	Min	Max	Min	Max	Min	Max
50	6.8	7.9	4.5	5.3	63.9	71.0

1. Delivered waveform at 360 J into given resistive load.
2. Discharge polarity is APEX positive, STERNUM negative for Phase 1.
3.
$$\text{Tilt} = \frac{(I_1 - |I_4|)}{I_1}$$

Troubleshooting

The Troubleshooting section describes error code usage, interpretation, and corrective action, and provides a separate Troubleshooting Chart keyed to the Performance Inspection Procedures (PIP) and individual troubleshooting tests that require operator interpretation. Choose from the following topics:

[Processing Error Codes](#)

[Troubleshooting Chart](#)

[Error Code Table](#)

[Using the Service/Status Features](#)

[The Device Log](#)

[The Device Data Screen](#)

[Service Log](#)

[Counters](#)

[Clear Memory](#)

[The SERVICE Indicator](#)

[The Device User Test](#)

Processing Error Codes

8-2

Introduction

The LIFEPAK 20 defibrillator/monitor logs an error code and lights the **SERVICE** indicator whenever an internal program or process fails to execute properly. Errors rarely occur and should be investigated thoroughly by qualified service personnel before a device that displayed an error code is placed back into active use. Always complete the **Performance Inspection Procedure (PIP)** after encountering and clearing any error code(s).

Error codes stored in the **Service Log** may not necessarily indicate a permanent error. Error codes can indicate transient electromagnetic interference (EMI) or **electrostatic discharge (ESD)**. If you suspect transient EMI or ESD as the source of an error, clear error code(s), turn the device off and then back on. If the error code does not reoccur, it may be the result of EMI or ESD.

Processing Error Codes

To process an Error Code:

1. Note any problems with the defibrillator and consult the **Troubleshooting Chart**.
2. Review error codes by displaying the **Service Log**. Record any errors, including the date, time, error, and error extension.
3. Use the Speed Dial to select **CLEAR LOG**, then turn off the device.

Processing Error Codes

8-3

Processing Error Codes

Error Code Category	
Axxx	Page 8-14
Bxxx	Page 8-14
0xxx	Page 8-14
1xxx	Page 8-15
2xxx	Page 8-18
3xxx	Page 8-18
4xxx	Page 8-20
5xxx	Page 8-21
6xxx	Page 8-27
8xxx	Page 8-29
9xxx	Page 8-29

- Complete the **Performance Inspection Procedure (PIP)**. If completed successfully, go to Step 5. If the SERVICE indicator lights at any time during the PIP, stop the PIP, then continue to Step 6.
- By virtue of passing the PIP, the device may be returned to regular use. The error code(s) may have been related to EMI or ESD. If the errors repeat, continue this procedure starting at Step 5.
- Compare your PIP failure with the **Troubleshooting Chart**.
-OR-
Compare the error codes against the Error Code Categories listed in the table on the left, and click the appropriate category to find the correct error code in the Error Code Table.
- Find the error code in the Error Code Table.
- Read the corrective action(s). If the corrective action calls for the replacement of a part, click on that part caption in the footer at the bottom of the page to jump to the corrective action process.
- Service the device based on these inputs, then repeat the PIP.
- For persistent error codes, contact your local Medtronic service or sales representative.

Troubleshooting Chart

8-4

Area	Observed Symptom	Suggested Corrective Action
Physical Inspection	Loose or broken hardware	Locate and tighten or replace loose items. Locate and replace broken components.
	Evidence of dirt, fluids, or foreign objects	Perform External Cleaning .
	Damaged keypad or labels	Replace Elastomer Keypad. Replace product identification label. Replace explosion/hazard label. Replace operating instruction label.
Power Off	Device beeps when turned off.	Connect defibrillator to ac power source. Disable AC Loss Alert alarm .
Power On	No power on	Make sure the defibrillator is plugged into ac power. Check the P21 for 3.3 V to ground. <ul style="list-style-type: none"> ■ If the A3 pin has 3.3 V to ground <ul style="list-style-type: none"> – Check or replace the W18 UI Flex Cable. – Replace UI PCB. ■ If the A3 pin does not have 3.3 V to ground <ul style="list-style-type: none"> – Check or replace the power module.

Troubleshooting Chart

8-5

Area	Observed Symptom	Suggested Corrective Action
Power On (Continued)	No display (white or blue screen)	<ol style="list-style-type: none"> 1. Check A05 UI PCB for 3.3 V to ground at C96 and 2.5 V to ground at C93. <ul style="list-style-type: none"> ■ If either is not present, replace the A05 UI PCB. 2. Check P21 for 3.3 V to ground. <ul style="list-style-type: none"> ■ If 3.3 V is present, check or replace the W18 UI Flex Cable. ■ If 3.3 V is present, replace the A05 UI PCB. ■ If 3.3 V is not present, replace the A01 System PCB.
	No display (blank screen)	<p>Check 12 V on P21 to ground.</p> <ul style="list-style-type: none"> ■ If 12 V is present <ul style="list-style-type: none"> – Replace the W18 UI Flex Cable. – Replace UI backlight/display assembly. ■ If no 12 V <ul style="list-style-type: none"> – Check for 12 V at P17 between pin 1 and 3. – If 12 V present, replace A04 Therapy PCB. – If no 12 V, replace the power module.

Troubleshooting Chart

8-6

Area	Observed Symptom	Suggested Corrective Action
Power On (Continued)	Display on, no power on LED	Check or replace the W18 UI Flex Cable. Check or replace the A05 UI PCB. Replace the A04 Therapy PCB.
	Continuous reset	Replace the A01 System PCB.
	Frozen at the power on screen	Check or replace the W18 UI Flex Cable. Replace the A01 System PCB.
	Distorted display	Replace the A05 UI PCB.
	SERVICE indicator remains on	Refer to Processing Error Codes for assistance.
Keypad	MAINTENANCE DUE indicator remains on	Perform Setting the Maintenance Prompt interval. Perform Resetting the Maintenance Prompt interval.
	Improper button response	Run Keypad test. Check or replace the elastomer keypad. Replace the A05 UI PCB.
	HARD PADDLE key	Run Keypad test. Check or replace hard paddles. Check or replace the W01 Therapy Connector. Replace the A04 Therapy PCB.

Troubleshooting Chart

8-7

Area	Observed Symptom	Suggested Corrective Action
Printer	Not printing	Run printer test. Check for proper paper. Check for 3.3 V on pins 14 and 16 on the J38 test connector on the A05 UI PCB. <ul style="list-style-type: none"> ■ If either voltage higher than 3.3, replace the W14 Printer Flex Cable. ■ If both lower than 3.3, check or replace the A12 Printer Assembly. <ul style="list-style-type: none"> – Replace the A05 UI PCB.
	Light print	Verify use of proper paper. Check the W14 Printer Flex Cable connection. Check or replace the A05 UI PCB.
	Missing or broken characters	Verify use of proper paper. Clean the printhead. Check or replace the A12 Printer Assembly.

Troubleshooting Chart

8-8

Area	Observed Symptom	Suggested Corrective Action
Audio	Inaudible or garbled audio	Run the Voice Tone test. Check the speaker connection. Check or replace the W02 Speaker Assembly . Check or replace the A01 System PCB .
Power Source Management	No backup battery operation	Replace the A07 Battery . Check or replace the power module .
QUIK-COMBO or Standard Paddles Delivered Energy	Unable to complete auto test	Rerun test with proper test load shorting. Check continuity of the test plug or shorting bar. Check continuity of the QUIK-COMBO Cable. Check or replace the W01 Therapy Connector . Replace the A04 Therapy PCB .
	Delivered energy out of tolerance	Perform defibrillator calibration.
Patient impedance channel broken	Abnormal energy delivery	Check or replace the A14 Inductive Resistor (less than 5 ohms). Check or replace the A04 Therapy PCB . Replace the A01 System PCB .

Troubleshooting Chart

8-9

Area	Observed Symptom	Suggested Corrective Action
Patient impedance channel broken (Continued)	Low patient impedance	If test into a 50 ohm load during 3 A.M. test, rerun test with correct test plug. If test passes, complete PIP. If test fails, replace the A01 System PCB.
	Therapy cable leads off (QUIK-COMBO only)	Check continuity of the QUIK-COMBO cable, replace if necessary. Check continuity of the W01 Therapy Connector , replace if necessary. Replace the A01 System PCB.
QUIK-COMBO or Standard Paddles Synchronous Cardioversion	No paddles channel Sync mark	Check or replace the therapy cable. Check or replace the W01 Therapy Connector. Replace the A01 System PCB.
	No lead channel Sync mark	Check for noisy ECG signal. Check or replace the patient cable. Check or replace the W06 ECG connector. Check or replace the A02 Patient Parameter PCB. Replace the A01 System PCB.

Troubleshooting Chart

8-10

Area	Observed Symptom	Suggested Corrective Action
QUIK-COMBO or Standard Paddles Synchronous Cardioversion (Continued)	Failure to transfer coincident with Sync mark	<p>Check Sync marker placement on R-wave. Run Keypad test</p> <ul style="list-style-type: none"> ■ if test fails, replace the A05 UI PCB. ■ If test passes, run user test and troubleshoot error code.
Pacer Option Characteristics	Pacer does not turn on	<p>Verify manufacturer configuration bit setting. Run Keypad test:</p> <ul style="list-style-type: none"> ■ If test fails, check key tactile feedback. <ul style="list-style-type: none"> – Replace the elastomer keypad. – Replace the A05 UI PCB. ■ If test passes, follow error code procedure.
	Pacing current/rate out of tolerance	Check or replace the A04 Therapy PCB.
3 or 5-Lead ECG Characteristics	No ECG	<p>Check or replace the ECG cable. Check or replace the W06 ECG connector. Replace the A02 Patient Parameter PCB.</p>

Troubleshooting Chart

8-11

Area	Observed Symptom	Suggested Corrective Action
3 or 5-Lead ECG Characteristics (Continued)	Saturated ECG	Replace the A02 Patient Parameter PCB.
	No amplitude ECG	Check or replace the ECG cable. Replace the A02 Patient Parameter PCB.
	ECG gain out of tolerance	Check simulator output. Check or replace the ECG cable. Check or replace the A02 Patient Parameter PCB.
QUIK-COMBO ECG Characteristics	ECG gain out of tolerance	Check simulator output. Check or replace the therapy cable. Check or replace the A01 System PCB.
	ECG analog out (missing or out of tolerance)	Check simulator output. Check ECG on display. Check W11 ECG out connector.
Standard Paddles ECG Characteristics	ECG gain out of tolerance	Check simulator output. Check or replace the therapy cable. Check or replace the A01 System PCB.

Troubleshooting Chart

8-12

Area	Observed Symptom	Suggested Corrective Action
Oximeter	No SpO2 response (no cable detected)	Check or replace the SpO2 cable. Check or replace the SpO2 sensor. Check or replace the W05 SpO2 Assembly.
	Saturation reading missing or out of tolerance	Check or replace the SpO2 cable. Check or replace the SpO2 sensor. Check or replace the W05 SpO2 Assembly. Check or replace the A06 OEM PCB.
Speed Dial	Speed Dial not functioning	Check or replace the W04 Speed Dial Assembly. Replace the A05 UI PCB.
Remote Sync	No remote Sync	Turn on remote sync function. Check ECG Out/Sync In connector. If bad, replace the power module. Check or replace the W09 Power Cable. Check or replace the A01 System PCB. Check or replace the power module.

Troubleshooting Chart

8-13

Area	Observed Symptom	Suggested Corrective Action
No ac power reminder tone	No alert	Check configuration setting. Replace the power module.
Leakage Current	Fails chassis leakage test	Replace the power module.
Grounding Resistance	Fails ground resistance test	Check or replace the power cord. Replace the power module.

Error Code Table

8-14

Error	Error Description	Corrective Action
A00b	Printer communication lost	■ Reload the system software
A00e	Printer initialization error	■ Reload the system software
B011	System behavior manager error	■ Reload the system software
B012	Energy cap charging time out	■ Reload the system software
B013	Shock advisory system error	■ Reload the system software
B014	Shock advisory system time out	■ Reload the system software
B016	Motion detect timer error	■ Reload the system software
B017	Shock result time out	■ Reload the system software
000a	System ADC Background test failed	■ Replace the A01 System PCB
000b	System ADC failed self calibration	■ Replace the A01 System PCB
000c	System Flash memory I.D. unknown	■ Replace the A01 System PCB
000d	System Hardware/Software configuration lost	■ Replace the A01 System PCB

A01 System PCB

W14 Printer Flex Cable

Error Code Table

8-15

Error	Error Description	Corrective Action Code
0002	System Flash memory voltage error	■ Replace the A01 System PCB
0003	Can not erase System Flash memory	■ Replace the A01 System PCB
0004	Can not write to System Flash memory	■ Replace the A01 System PCB
0006	System ADC read error	■ Replace the A01 System PCB
0007	System DAC not responding	■ Replace the A01 System PCB
0008	ECG OUT DAC self test failed	■ Replace the A01 System PCB
100e	UI – System communication lost	<ol style="list-style-type: none"> 1. Replace the W18 UI Flex Cable 2. Replace the A05 UI PCB 3. Replace the A01 System PCB
100f	Display update timer error	<ol style="list-style-type: none"> 1. Reload the system software 2. Replace the A01 System PCB
1010	Display update Queue error	<ol style="list-style-type: none"> 1. Reload the system software 2. Replace the A01 System PCB

A01 System PCB

A05 UI PCB

W18 UI Flex Cable

Error Code Table

8-16

Error	Error Description	Corrective Action Code
1013	System detected unexpected UI reset	<ol style="list-style-type: none"> 1. Replace the W18 UI Flex Cable 2. Replace the A05 UI PCB
1014	Voice Prompt/Audio watchdog failure	<ol style="list-style-type: none"> 1. Reload the system software 2. Replace the A01 System PCB
1c01	UI FPGA Programming error	■ Replace the A05 UI PCB
1c02	UI FPGA Verification error	■ Replace the A05 UI PCB
1c03	UI FPGA Program file error	<ol style="list-style-type: none"> 1. Reload the UI Software 2. Replace the A05 UI PCB
1c04	UI ADC Not functioning	■ Replace the A05 UI PCB
1c05	Printer ADC out of tolerance (Temperature)	<ol style="list-style-type: none"> 1. Check the W14 Printer Flex Cable 2. Replace the A12 Printer 3. Replace the A05 UI PCB
1c06	Printer ADC out of tolerance (voltage)	<ol style="list-style-type: none"> 1. Check the W14 Printer Flex Cable 2. Replace the A12 Printer 3. Replace the A05 UI PCB
1c07	UI Voltage out tolerance (5v)	■ Replace the A05 UI PCB

A01 System PCB

A05 UI PCB

A12 Printer

W14 Printer Flex Cable

W18 UI Flex Cable

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Error Code Table

8-17

Error	Error Description	Corrective Action
1c08	UI Voltage out of tolerance (3.3v)	■ Replace the A05 UI PCB
1c09	UI Voltage out of tolerance (2.5v)	■ Replace the A05 UI PCB
1c0a	UI Voltage out of tolerance (35v)	■ Replace the A05 UI PCB
1c0b	UI Voltage out of tolerance (SW VBATT)	■ Replace the A05 UI PCB
1c0c	UI Voltage out of tolerance (Ground)	■ Replace the A05 UI PCB
1c0f	UI Hardware I.D. corrupted	■ Replace the A05 UI PCB
1c10	UI Boot program corrupted	■ Replace the A05 UI PCB
1c11	UI Application Flash memory corrupted	1. Reload the UI Software 2. Replace the A05 UI PCB
1c12	UI Font Flash memory corrupted	1. Reload the UI Software 2. Replace the A05 UI PCB
1c13	UI FPGA Flash memory corrupted	1. Reload the UI Software 2. Replace the A05 UI PCB
1c16	UI CPU RAM test failed on Power on	■ Replace the A05 UI PCB
1c17	UI CPU RAM test failed during normal operation	■ Replace the A05 UI PCB

A05 UI PCB

Error Code Table

8-18

Error	Error Description	Corrective Action
1fff	Additional information related to Error Code that is logged before 1fff	■ No Action required for 1fff, refer to Error Code logged before 1fff
2004	System cannot initialize serial port (System connector)	■ Replace the A01 System PCB
2005	System cannot initialize driver for serial port (System connector)	<ol style="list-style-type: none"> 1. Reload the system software 2. Replace the A01 System PCB
300a	System cannot clear DM memory	<ol style="list-style-type: none"> 1. Reload the system software 2. Replace the A01 System PCB
300b	System error writing DM record	<ol style="list-style-type: none"> 1. Clear memory (service mode) 2. Reload the system software 3. Replace the A01 System PCB
300c	System cannot read archived DM record	<ol style="list-style-type: none"> 1. Clear memory (service mode) 2. Reload the system software 3. Replace the A01 System PCB
3fff	Additional information related to Error Code that is logged before 3fff	■ No Action required for 3fff, refer to Error Code logged before 3fff

A01 System PCB

Error Code Table

8-19

Error	Error Description	Corrective Action
3001	System cannot use Data Management (DM) Flash memory	<ol style="list-style-type: none"> 1. Reload the system software 2. Replace the A01 System PCB
3002	System Data Management Flash memory corrupted	<ol style="list-style-type: none"> 1. Clear memory (service mode) 2. Reload the system software 3. Replace the A01 System PCB
3005	System cannot delete DM record	<ol style="list-style-type: none"> 1. Clear memory (service mode) 2. Reload the system software 3. Replace the A01 System PCB
3007	System cannot create new DM record	<ol style="list-style-type: none"> 1. Clear memory (service mode) 2. Reload the system software 3. Replace the A01 System PCB
3008	System could not store DM record	<ol style="list-style-type: none"> 1. Clear memory (service mode) 2. Reload the system software 3. Replace the A01 System PCB
3009	System could not erase oldest DM record	<ol style="list-style-type: none"> 1. Clear memory (service mode) 2. Reload the system software 3. Replace the A01 System PCB

A01 System PCB

Error Code Table

8-20

Error	Error Description	Corrective Action
400a	System Program Flash memory corrupted	<ol style="list-style-type: none"> 1. Reload the system software 2. Replace the A01 System PCB
400c	System ADC voltage low	■ Replace the A01 System PCB
400d	System ADC voltage high	■ Replace the A01 System PCB
4fff	Additional information related to Error Code that is logged before 4fff	■ No Action required for 4fff, refer to Error Code logged before 4fff
4005	System NVRAM error log	<ol style="list-style-type: none"> 1. Replace the coin cell battery 2. Reload the system software 3. Replace the A01 System PCB
4006	Error Log Queue not functioning	<ol style="list-style-type: none"> 1. Reload the system software 2. Replace the A01 System PCB
4008	Error Log Count corrupted	<ol style="list-style-type: none"> 1. Reload the system software 2. Replace the A01 System PCB
4009	System RAM test failed	<ol style="list-style-type: none"> 1. Reload the system software 2. Replace the A01 System PCB

A01 System PCB

Coin Battery Replacement

Error Code Table

8-21

Error	Error Description	Corrective Action
4010	Service LED failed	<ol style="list-style-type: none"> 1. Replace the W18 UI Flex Cable 2. Replace the A05 UI PCB 3. Replace the A04 Therapy PCB
4012	Voice Flash memory corrupted	■ Reload the System Voice software
4013	Voice/Font Flash memory invalid	■ Reload the System Voice software
500a	Coin Cell Battery not detected	<ol style="list-style-type: none"> 1. Replace the Coin Cell Battery 2. Replace the A01 System PCB
500b	Cannot use System NVRAM	<ol style="list-style-type: none"> 1. Reload the system software 2. Replace the A01 System PCB
500c	System application start error	<ol style="list-style-type: none"> 1. Reload the system software 2. Replace the A01 System PCB
500d	System software initialization time out	<ol style="list-style-type: none"> 1. Reload the system software 2. Replace the A01 System PCB
500e	System application start error	<ol style="list-style-type: none"> 1. Reload the system software 2. Replace the A01 System PCB
500f	Sc application software error	■ Reload the system software

A01 System PCB

A04 Therapy PCB

A05 UI PCB

W18 UI Flex Cable

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Error Code Table

8-22

Error	Error Description	Corrective Action
501a	NVRAM Corrupted	■ Replace the Coin Cell Battery
501c	RTC not running	1. Replace the Coin Cell Battery 2. Replace the A01 System PCB
501d	RTC out of sync	1. Replace the Coin Cell Battery 2. Replace the A01 System PCB
501e	System software execution error	■ Reload the system software
501f	System software read error	■ Reload the system software
5003	System watchdog failed	■ Replace the A01 System PCB
5004	System watchdog reset	1. Reload the system software 2. Replace the A01 System PCB
5005	System CPU error during boot up	■ Replace the A01 System PCB
5006	System RAM failed during boot up	■ Replace the A01 System PCB
5007	System Checksum failure during boot up	1. Reload the system software 2. Replace the A01 System PCB
5008	System Boot program failure	■ Replace the A01 System PCB

A01 System PCB

Coin Battery Replacement

Error Code Table

8-23

Error	Error Description	Corrective Action
5009	Real-time clock (RTC) access failed	<ol style="list-style-type: none"> 1. Reload the system software 2. Replace the A01 System PCB
5010	Configuration Mismatch	■ Replace the Coin Cell Battery
5011	NVRAM Configuration Cata error	<ol style="list-style-type: none"> 1. Replace the Coin Cell Battery 2. Reload the system software
5012	Configuration Data Bad	■ Replace the Coin Cell Battery
5013	System meter initialization error	■ Reload the system software
5014	System meter mismatch	■ Replace the Coin Cell Battery
5016	MFG Data Mismatch	■ Replace the A01 System PCB
5017	NVRAM MFG Data Lost	■ Replace the A01 System PCB
5018	Watchdog Reset Failed	■ Replace the A01 System PCB
5019	NVRAM Corrupted	■ Replace the Coin Cell Battery
502a	UI USB did not initialize	<ol style="list-style-type: none"> 1. Replace the W18 UI Flex Cable 2. Replace the A05 UI PCB
502b	UsB system failed	■ Replace the A01 System PCB

A01 System PCB

A05 UI PCB

W18 UI Flex Cable

Coin Battery Replacement

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Error Code Table

8-24

Error	Error Description	Corrective Action
502f	Device type invalid	<ol style="list-style-type: none"> 1. Check configuration code 2. Set device type 3. Replace the A01 System PCB
5020	System software write error	■ Reload the system software
5021	System software error	■ Reload the system software
5022	System software exception code	■ Reload the system software
5023	System software exception code	■ Reload the system software
5024	System software exception code	■ Reload the system software
5026	NVRAM low battery interrupt	■ Replace the Coin Cell Battery
5027	System USB did not initialize	■ Replace the A01 System PCB
5028	PP USB did not initialize	■ Replace the A02 PP PCB
5029	Therapy USB did not initialize	■ Replace the A04 Therapy PCB
5030	PP USB disconnect	■ Replace the A02 PP PCB
5031	UI USB disconnect	<ol style="list-style-type: none"> 1. Replace the W18 UI Flex Cable 2. Replace the A05 UI PCB

A01 System PCB

A02 PP PCB

A04 Therapy PCB

W08 Batt. Conn. Cable

Coin Battery Replacemnt

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Error Code Table

8-25

Error	Error Description	Corrective Action
5032	Therapy USB disconnect	■ Replace the A04 Therapy PCB
5033	PP USB download time out	■ Reload the System and PP software
5036	USB initialization failed	■ Reload the system software ■ Replace the A01 System PCB
5037	USB initialization error	1. Reload the system software 2. Replace the A01 System PCB
510a	Battery <10volts after 20minutes of charging	1. Replace the A07 Battery 2. Replace the Power assembly
510b	Does not switch to Battery power	■ Replace the Power assembly
510c	Does not detect AC disconnect	■ Replace the Power assembly
510d	Battery powered when connected to AC power	■ Replace the Power assembly
510e	Battery <10volts after charge cycle	■ Replace the A07 Battery
510f	Battery charge cycle stopped	1. Check battery connection 2. Replace the A07 battery 3. Replace the Power assembly

A01 System PCB

A04 Therapy PCB

Power Assembly

Main Battery

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Error Code Table

8-26

Error	Error Description	Corrective Action
5105	Battery failed to reach charge in 2.5 hours	<ol style="list-style-type: none"> 1. Replace The A07 battery 2. Replace the Power assembly
5106	Power Supply out of tolerance	<ol style="list-style-type: none"> 1. If power supply voltage is <14volts dc, Replace AC power supply 2. If >14volts dc, Clear error / PIP
5107	Power Board Ram error	■ Replace the Power assembly
5108	Power Board Self test Diagnostic error	■ Replace the Power assembly
5110	AC isolation Diode Shorted	■ Replace the Power assembly
5112	Battery not detected	<ol style="list-style-type: none"> 1. Check the A07 Battery connection 2. Check W08 Battery connector wire harness 3. Check for valid Power HW I.D. in Service Menu (Status, Device Data) 4. Invalid Power HW I.D. replace Power assembly 5. Valid Power HW I.D. replace the A04 Therapy PCB

A04 Therapy PCB

W08 Battery Conn. Cable

Power Assembly

Main Battery

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Error Code Table

8-27

Error	Error Description	Corrective Action
5115	Battery Thermistor >400 Ohms	<ol style="list-style-type: none"> Check Battery Thermistor <ul style="list-style-type: none"> Replace the Battery if >400 Ohms Replace the Power assembly if <400 Ohms
600c	SpO2 misconfigured	<ol style="list-style-type: none"> Check configuration Reload the PP software
600e	PP reset	<ol style="list-style-type: none"> Reload PP and System software Replace the A02 PP PCB
600f	OEM configuration error	<ol style="list-style-type: none"> Check Confiburation Reload the PP Software
6fff	Additional information related to error code that is logged before 6fff	<ul style="list-style-type: none"> No action required for 6fff, refer to error logged before 6fff
6002	PP program corrupted	<ul style="list-style-type: none"> Reload the PP software
6003	PP Program not found	<ul style="list-style-type: none"> Reload the PP software
6004	PP boot up error	<ul style="list-style-type: none"> Reload the PP software

A02 PP PCB

Power Assembly

Main Battery

Error Code Table

8-28

Error	Error Description	Corrective Action
6009	No PP data	■ Reload the PP and System software
6010	PP initialization error	■ Reload the system software
680b	SpO2 board error	■ Replace the A10 SpO2 PCB
6801	PP power supply out of Tolerance	■ Replace the A02 PP PCB
6802	PP pre-amp data invalid	1. Clear error / PIP 2. Replace the A02 PP PCB
6804	PP data Ram test error	1. Clear error / PIP 2. Replace the A02 PP PCB
6805	PP Ram test error	1. Clear error / PIP 2. Replace the A02 PP PCB
6806	PP CRC test error	1. Clear error / PIP 2. Replace the A02 PP PCB
6807	PP ECG test error	1. Clear error / PIP 2. Replace the A02 PP PCB

A02 PP PCB

A10 SpO2 PCB

Error Code Table

8-29

Error	Error Description	Corrective Action
800a	System DSP error	■ Reload the system software
8fff	Additional information related to error code that is logged before 8fff	■ No action required for 8fff, refer to error logged before 8fff
8013	Voice format error	■ Reload the voice software
8014	No paddles data	<ol style="list-style-type: none"> 1. Reload the system software 2. Replace the A01 System PCB
8105	Impeadance channel out of cal	■ Replace the A01 System PCB
8108	Paddles data out of sync	<ol style="list-style-type: none"> 1. Reload the system software 2. Replace the A01 System PCB
8109	Paddles preamp user test failed	<ol style="list-style-type: none"> 1. Rerun the user test 2. Replace the A01 System PCB
900f	Unable to initialize Therapy control	<ol style="list-style-type: none"> 1. Check the stack connector 2. Replace the A04 Therapy PCB
9004	Unable to initialize Therapy control	■ Replace the A01 System PCB

A01 System PCB

A04 Therapy PCB

Error Code Table

8-30

Error	Error Description	Corrective Action
9005	Defib disable	■ Replace the A01 System PCB
9007	Shock not delivered	■ Reload the system software
9009	Defib charge time expired	■ Replace the A07 battery
901a	Pacer reate storage corrupted	■ Reload the system software
901b	Therapy PCB communication lost	1. Check the stack connector 2. Replace the A04 Therapy PCB
9011	Pacer fault	1. Reload the Therapy software 2. Replace the A04 Therapy PCB
9017	Pacer diable	■ Reload the system software
9C0a	Therapy Relay idle coil voltage out of range	■ Replace the A04 Therapy PCB
9C0b	Therapy Relay enabled coil voltage out of range (5ms)	■ Replace the A04 Therapy PCB
9C0c	Therapy Relay enabled coil voltage out of range (100ms)	■ Replace the A04 Therapy PCB
9C0d	Therapy Relay drive enabled coil voltage out of range	■ Replace the A04 Therapy PCB

A01 System PCB

A04 Therapy PCB

Main Battery

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Error Code Table

8-31

Error	Error Description	Corrective Action
9C0f	Therapy/Power pcba communication error	<ol style="list-style-type: none"> 1. Check Power assembly 26-pin ribbon cable to J16 or A04 Therapy PCB 2. Replace the Power assembly 3. Replace the A04 Therapy PCB
9C03	Therapy processor Unplanned reset	■ Replace the A04 Therapy PCB
9C04	Therapy/System Controller Communication watchdog	■ Replace the A01 System PCB
9C08	Therapy ROM Cyclic Redundancy Check (CRC) failed	<ol style="list-style-type: none"> 1. Reload the Therapy software 2. Replace the A04 Therapy PCB
9C09	Therapy RAM pattern write test failed	■ Replace the A04 Therapy PCB
9C1a	3AM H bridge test: NW leg shorted	■ Replace the A04 Therapy PCB
9C1b	3AM H bridge test: SW leg shorted	■ Replace the A04 Therapy PCB
9C1c	3AM H bridge test: East side stuck open	■ Replace the A04 Therapy PCB
9C1d	3AM H bridge test: West side stuck open	■ Replace the A04 Therapy PCB

A01 System PCB

A04 Therapy PCB

Power Assembly

Error Code Table

8-32

Error	Error Description	Corrective Action
9C1e	3AM H bridge test: Charge time out of range	<ol style="list-style-type: none"> 1. Energy Capacitor not connected or open 2. Replace the A04 Therapy PCB
9C1f	3AM shorted paddles relay contact test: relay shorted	<ol style="list-style-type: none"> 1. Inductive resister not connected or open 2. Replace the A04 Therapy PCB 3. Replace the A01 System PCB
9C11	Capacitor Dump failed	■ Replace the A04 Therapy PCB
9C12	Therapy pcba 5 volt out of range	■ Replace the A04 Therapy PCB
9C13	Therapy pcba 15 volt out of range	■ Replace the A04 Therapy PCB
9c14	Therapy pcba -15 volt out of range	■ Replace the A04 Therapy PCB
9c15	Therapy ADC time out error	■ Replace the A04 Therapy PCB
9C18	3AM H bridge test: NE leg shorted	■ Replace the A04 Therapy PCB
9C19	3AM H bridge test: SE leg shorted	■ Replace the A04 Therapy PCB

A01 System PCB

A04 Therapy PCB

Error Code Table

8-33

Error	Error Description	Corrective Action
9C2a	3AM redundant controls test: enable 2 stuck on	■ Replace the A04 Therapy PCB
9C2b	3AM redundant controls test: enable 1 stuck on	■ Replace the A04 Therapy PCB
9C2c	Capacitor voltage per pacing pulse too high	■ Replace the A04 Therapy PCB
9C2d	Capacitor current per pacing pulse too high	■ Replace the A04 Therapy PCB
9c2e	Cap current per pacing pulse too high	■ Replace the A04 Therapy PCB
9C2f	Pacing current and selected current out of range	■ Replace the A04 Therapy PCB
9C20	3AM shorted paddles relay contact test: relay shorted	■ Replace the A04 Therapy PCB
9C21	3AM pace drive test: pace power supply stuck on	■ Replace the A04 Therapy PCB
9C22	3AM pace drive test: pace power supply inoperable	■ Replace the A04 Therapy PCB
9C23	3AM pace drive test: relay contacts shorted	■ Replace the A04 Therapy PCB
9C24	3AM pace drive test: relay drive low side shorted	■ Replace the A04 Therapy PCB
9C25	3AM pace drive test: relay drive high side shorted	■ Replace the A04 Therapy PCB
9C26	3AM pace drive test: pace FET shorted	■ Replace the A04 Therapy PCB

A04 Therapy PCB

Error Code Table

8-34

Error	Error Description	Corrective Action
9C27	3AM pace drive test: pace current path open	■ Replace the A04 Therapy PCB
9C28	3AM pace drive test: pace setpoint error	■ Replace the A04 Therapy PCB
9C29	3AM redundant controls test: redundant controls stuck on	■ Replace the A04 Therapy PCB
9C3a	Energy capacitor overvoltage error	■ Replace the A04 Therapy PCB
9c3b	3am redundant control test charge rate stuck on	■ Replace the A04 Therapy PCB
9c3e	Therapy software error	■ Replace the A04 Therapy PCB
9c3f	Therapy software error	■ Replace the A04 Therapy PCB
9C30	Pacing pulse width too short	■ Replace the A04 Therapy PCB
9C31	Pacing pulse width too long	■ Replace the A04 Therapy PCB
9C32	Capacitor voltage and predicted capacitor voltage mismatch	1. Energy capacitor not connected or open 2. Replace the A04 Therapy PCB
9C33	Capacitor charge time >25seconds	1. Check Energy Capacitor connection 2. Replace the A04 Therapy PCB

A04 Therapy PCB

Error Code Table

8-35

Error	Error Description	Corrective Action
9C35	Therapy CPU instruction test failed	■ Replace the A04 Therapy PCB
9C36	Therapy software stack overflow	■ Install new therapy software

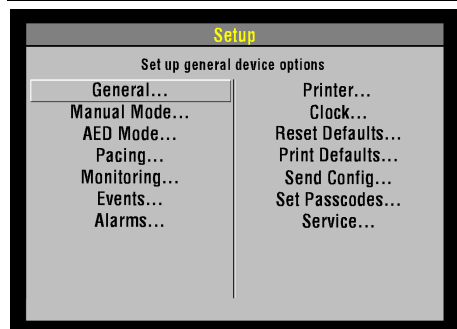
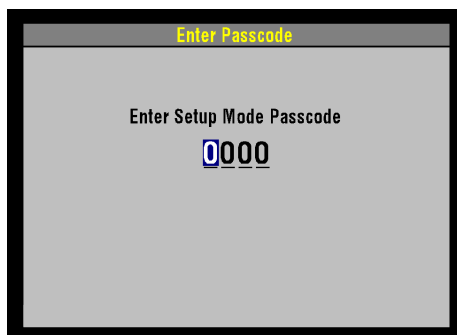
Using the Service/Status Features

8-36

Introduction

The device includes a series of Service/Status screens and menus that detail device data such as stored manufacturing data, recorded errors, and counters for shock and pacing operation.

The Service/Status Screen



To display the Service/Status screen:

1. Hold down the **OPTIONS** and **EVENT** buttons and press the **ON** button. Hold these buttons until the Setup Mode screen appears. The Speed Dial LED illuminates indicating that the Speed Dial is active.
2. Enter the passcode by rotating the Speed Dial to select a digit and then pressing the Speed Dial. As a digit is selected, it changes to an asterisk, for passcode protection, and the next digit in line highlights.

Note: The factory default passcode (0000) and the reserved technician passcode (5433 or LIFE) may be used in lieu of other passcodes to gain access to the Setup and Service screens.

3. When you have entered the passcode, press the Speed Dial. The Setup screen appears. The **PASSCODE INCORRECT-TRY AGAIN** message will appear if an incorrect passcode is entered.

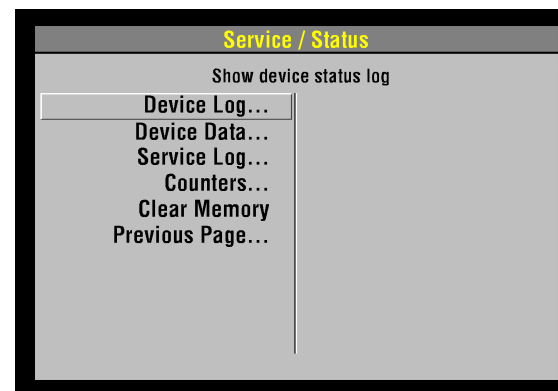
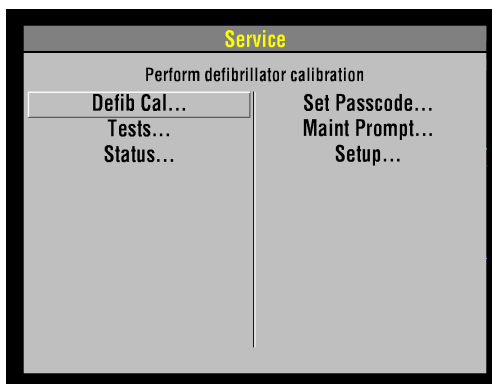
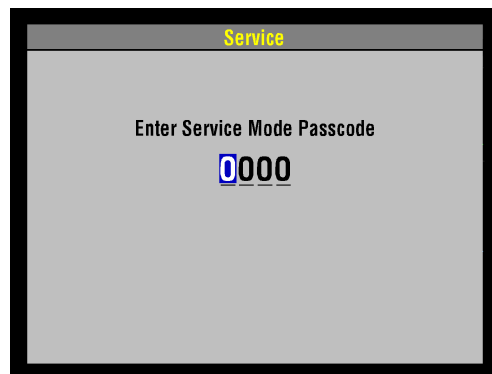
(Continued on next page)

Using the Service/Status Features

8-37

The Service/Status Screen (Continued)

4. Select **SERVICE** from the Setup screen. The Service Passcode screen appears.
5. Enter the Service passcode by using the Speed Dial to scroll through the digits in the highlighted fields. As a digit is selected, it changes to an asterisk for passcode protection. When a correct digit is entered, the next number in line highlights.
6. When you have entered the passcode, press the Speed Dial. The Service screen appears. The **PASSCODE INCORRECT-TRY AGAIN** message will appear, if an incorrect passcode is entered.
7. Select **STATUS** from the Service screen. The Service/Status screen appears.



(Continued on next page)

Using the Service/Status Features

8-38

The Service/Status Screen (continued)

The Service/Status screen options include:

Option	Description
Device Log	Show device status log
Device Data	Show device data
Service Log	Show service log
Counters	Display shock counters
Clear Memory	Clear data management memory

The Device Log

8-39

Introduction

The Device Log displays essential device characteristics such as when the operating software was installed, and accumulative device operations such as the shock count.

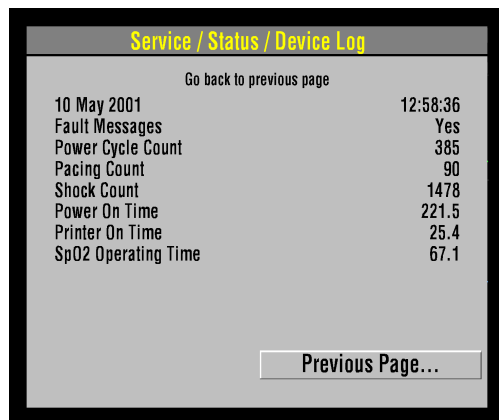
The Device Log

To display the Device Log:

- Open the Service/Status screen and select `DEVICE LOG`. The Service/Status/Device Log screen appears.

The Device Log Data includes:

Data	Description
Manufacturing Date	Records the date when the device was manufactured, specifically, when the operating software was loaded.
Fault Message	Records YES or NO to whether there are any error codes stored in the Error Code Log. (Refer to Processing Error Codes.)
Power Cycle Count	Records the number of times the device has been turned on.



(Continued on next page)

The Device Log

8-40

The Device Log (Continued)

Data	Description
Pacing Count	Records the total pacing pulses delivered by the device.
Shock Count	Records the total times the device defibrillation capacitor has been charged.
Power On Time	Records the total device power-on time.
Printer On Time	Records the total printer running time.
SpO2 Operating Time	Records the total SpO2 running time.

The Device Data Screen

8-41

Introduction

Device Data

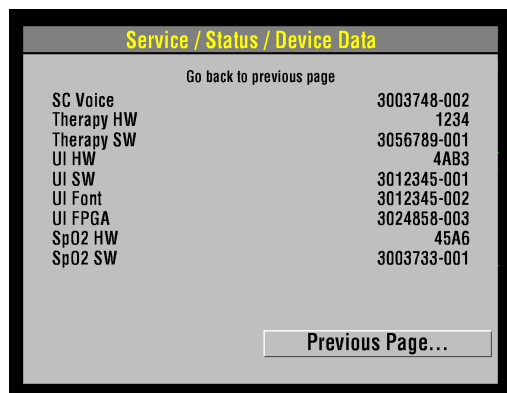
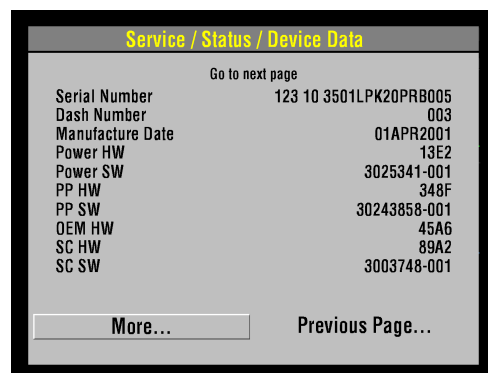
The Device Data screen displays essential device characteristics such as the serial number, and accumulative device operations such as the shock count.

To display the Device Data screen:

- Open the Service/Status screen and select `DEVICE DATA`. The Service/Status/Device Data screen appears.

The device data includes:

Data	Description
Serial Number	Device serial number
Dash Number	Device dash number
Manufacture Date	Date device was built
Power HW	Power assembly hardware serial number
Power SW	Power assembly software version number
PP HW	Patient parameter PCB hardware serial number
PP SW	Patient parameter PCB software version number
SpO2 Operating Time	Records the total SpO2 running time



(Continued on next page)

The Device Data Screen

8-42

The Device Data (Continued)

Data	Description
OEM HW	OEM PCB hardware serial number
SC HW	System controller hardware serial number
SC SW	System controller software version number
SC Voice	System controller voice prompt version
Therapy HW	Therapy PCB hardware serial number
Therapy SW	Therapy PCB software version number
UI HW	User interface hardware serial number
UI SW	User interface software version number
UI FPGA	User interface field programmable E program
SpO2 HW	SpO2 hardware serial number
SpO2 SW	SpO2 software version number

Service Log

8-43

Introduction

The Service Log screen displays the device service record.

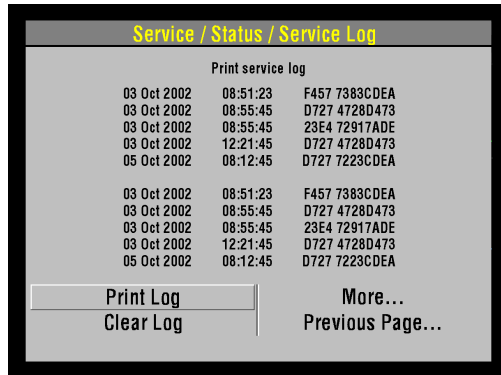
The Service Log

To display the Service Log screen:

- Open the Service/Status screen and select `SERVICE LOG`. The Service/Status/Service Log screen appears.

The Service Log screen data includes:

Data	Description
Service Dates	Service log entries (error codes)
Print Log	Click to print the service log
Clear Log	Click to clear the service log
More	Click to move to additional pages
Previous Page	Click to return to the Service/Status screen



Counters

8-44

Introduction

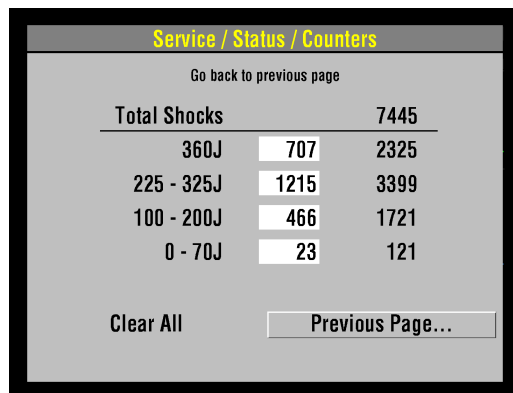
The Counters screen shows the Joule settings, the total number of shocks delivered since the last reset and the total number of shocks delivered since the defibrillator went into operation.

Counters

To display the Counters screen:

- Open the Service/Status screen and select COUNTERS. The Service/Status/Counters screen appears.

Select CLEAR ALL and press the Speed Dial. This resets the boxed sub-total counters, but not the running-total counters. You can also reset the counters using the Clear Memory feature discussed on the next page.



The screenshot shows the 'Service / Status / Counters' screen. At the top, it says 'Go back to previous page'. Below that is a table with 'Total Shocks' and a total count of 7445. The table lists four Joule settings with their respective counts: 360J (707), 225 - 325J (1215), 100 - 200J (466), and 0 - 70J (23). At the bottom left is a 'Clear All' button, and at the bottom right is a 'Previous Page...' button.

Total Shocks		7445
360J	707	2325
225 - 325J	1215	3399
100 - 200J	466	1721
0 - 70J	23	121

Clear All Previous Page...

Clear Memory

8-45

Introduction

The Clear Memory feature is used to clear the flash data management memory on the A02 Memory PCB. Specifically, you clear:

- ECG Data — All stored ECG data (up to 45 minutes of First-In-First-Out continuous ECG waveforms) is permanently deleted.
- Patient Reports — All stored patient reports are permanently deleted.

The data management memory is cleared after the device is placed into new or different use and the old patient data is no longer required. The data management memory is also cleared as part of some service actions.

Note: To save important patient data before clearing the data management memory, print out individual patient data (refer to the [operating instructions – Data Management](#)).

Clearing the Data Management Memory

To clear the Data Management Memory (this is permanent; there is no undo):

1. Display the Service/Status menu.
2. Select CLEAR MEMORY and press the Speed Dial. A count-down timer appears to indicate the clearing process, which requires a nominal 30 seconds.

The SERVICE Indicator

8-46

What the SERVICE Indicator Does

The SERVICE indicator lights when an error code is written to the Service Log. Always examine such instances using Processing Error Codes.

What the SERVICE Indicator Does Not Do

The SERVICE indicator is not used to indicate the presence of errors in the Service Log, rather it is used to indicate when errors are written to the Service Log. For example, you turn on the device and the SERVICE indicator lights. You cycle the power, and the SERVICE indicator does not relight. This does not mean that there are no error codes in the Service Log. You must review the Service Log and resolve what was written there in the first instance.

The Device User Test

8-47

When you turn the device on, a series of self-tests occur. If errors are detected, the SERVICE indicator lights. (Refer to About the SERVICE Indicator on the previous page.) Self-testing does not occur only at power-up; rather, it is continuous while the device is turned on. When you use the Speed Dial to navigate to Options/User Test, the device waits until the next self-test cycle is complete and then reports USER TEST PASSES. Note that selecting OPTIONS/USER TEST does not initiate a self-test cycle; rather, it monitors self-test status and produces reports.

One operation is specific to the Options/User Test feature. This operation consists of one cycle of charging the defibrillation capacitor to 10 J and then dumping the charge. If this operation does not pass, the SERVICE indicator lights and an error is written to the Error Code Log. (Refer to [Processing Error Codes](#).)

Preventive Maintenance

Periodic maintenance, inspection, and testing of the LIFEPAK 20 defibrillator/monitor helps detect and prevent possible electrical and mechanical problems. Use the [Setting the Maintenance Prompt Interval](#) and [Resetting the Maintenance Prompt Interval](#) procedures to set the maintenance interval or to reset the maintenance interval. When scheduled maintenance is due for the device, the MAINTENANCE DUE screen message displays for approximately 10 minutes each time the device is turned on.

For information about battery-related topics, refer to [Battery Maintenance](#). The information in this section includes the following:

[Maintenance and Testing Schedule](#)

[Guidelines](#)

[Cleaning](#)

[Device Useful Life](#)

[Device Support Policy](#)

[Storage Information](#)

[Recycling Information](#)

Preventive Maintenance

9-2

Maintenance and Testing Schedule

Periodic maintenance, inspection, and testing of the device will help prevent possible electrical and mechanical problems. Refer to the [LIFEPAK 20 Defibrillator/Monitor Operating Instructions – Operator Checklist](#) for additional items.

Guidelines

The following table shows the schedule for preventive maintenance activities. For items that should be replaced at regular intervals, refer to scheduled replacement items shown below.

Activity	As Needed	Scheduled
Performance Inspection Procedures (PIP)	X	Annually
Test and Calibration Procedures (TCP)	X	
Exterior Physical Inspection	X	
Interior Physical Inspection	X	
Exterior Cleaning	X	
Interior Cleaning	X	
Coin Battery Replacement		5 years

Preventive Maintenance

9-3

Cleaning

The tools and materials that you will need to perform an external and internal cleaning of the LIFEPAK 20 defibrillator/monitor are shown below.

Product	Description
Static discharge protected work area	Grounded conductive surface and wrist strap
Isopropyl alcohol	
Quaternary ammonium compounds	
Peroxide (peracetic acid) solutions	
Cotton swabs	
Vacuum cleaner	
Soft-bristle brush	Nonmetallic
Cloth	Clean and lint-free
Compressed air	Clean and dry (60 psi, max.)

Preventive Maintenance

9-4

External Cleaning Procedures

WARNING!

Shock or fire hazard. Do not immerse or soak any portion of this device in water or any other fluid. Avoid spilling any fluid on the device or accessories.

CAUTION!

Possible case damage. Do not clean any part of this device or accessories with bleach, bleach dilution, or phenolic compounds. Do not use abrasive or flammable cleaning agents. Do not attempt to sterilize this device or any accessories unless otherwise specified in accessory operating instructions.

Clean the exterior of the LIFEPAK 20 defibrillator/monitor by wiping the surface with any of the following solutions:

- Soap and water
- Quaternary ammonium compounds
- Isopropyl alcohol
- Peroxide (peracetic acid) solutions

Preventive Maintenance

9-5

SpO2 Cleaning Procedures

To clean the SpO2 sensor disconnect it from the patient cable and clean the LNOP DCI by wiping it with a 70% isopropyl alcohol pad. Allow the sensor to dry before placing back in use.

Clean the PC patient cable by wiping it with a 70% isopropyl alcohol pad and allow it to dry. Do not soak or immerse the cable in any liquid solution. Do not attempt to sterilize.

Preventive Maintenance

9-6

Internal Cleaning Procedures

WARNING!

Shock hazard. The energy storage capacitor carries high voltage. Remove the battery and discharge the capacitor before handling.

CAUTION!

Possible case damage. Do not clean any part of this device or accessories with bleach, bleach dilution, or phenolic compounds. Do not use abrasive or flammable cleaning agents. Do not attempt to sterilize this device or any accessories unless otherwise specified in accessory operating instructions.

Clean the interior of the LIFEPAK 20 defibrillator/monitor as described below.

1. Brush interior surfaces and parts with a nonmetallic, soft-bristle brush.
2. Remove loosened dirt and dust using a dry, low-pressure compressed air (60 psi) or vacuum cleaner.
3. Wipe metal surfaces with a soft, nonabrasive cloth that has been dampened with isopropyl alcohol.

Preventive Maintenance

9-7

Device Useful Life

During product development, the LIFEPAK 20 defibrillator/monitor and subassemblies are subjected to rigorous life testing. This testing and the routine testing and maintenance program recommended in this service manual will help to provide reliable device operation for many years.

However, both rapid technological changes and the availability of replacement parts limit the useful life of all modern medical devices. The American Hospital Association suggests a five-year useful life expectancy for defibrillators (*Estimated Useful Lives of Depreciable Hospital Assets, Revised 1998 Edition*). Similarly, the U.S. Army lists an eight-year life expectancy for defibrillators (technical bulletin: *Maintenance Expenditure Limits for Medical Materiel, TB MED 7 Revision 8 October 1993*). Medtronic recommends that you adopt an eight-year useful life expectancy for this device.

Preventive Maintenance

9-8

Device Support Policy

Medtronic provides full technical subassembly-level support and subassembly replacement parts for a period of eight years beyond the device's production retirement date. After this eight-year period, Medtronic provides technical support and subassembly replacement parts as available.

Preventive Maintenance

Storage Information

When not in use or during long periods of storage, connect the LIFEPAK 20 defibrillator/monitor to ac power. If this is not possible, fully charge the batteries at an ambient room temperature, not to exceed 25° C (77° F) prior to storage and before use.

Do not store or ship the LIFEPAK 20 defibrillator/monitor without turning off the AC Loss Alert alarm. The LIFEPAK 20 defibrillator/monitor is equipped with an alarm that beeps when the defibrillator is turned off and not connected to an ac power source. The alarm can be configured to beep at 5, 15 or 30 minute intervals or it can be turned off.

To set or disable the alarm:

1. **Enter the Setup screen.** The Setup screen appears.
2. Click **GENERAL** from the Setup screen. The General screen appears.
3. Click **AC LOSS ALERT** from the General screen. The AC Loss Alert screen appears.
4. Click **5 MINUTES, 15 MINUTES, 30 MINUTES, or NEVER ALERT** to set or turn off the alarm.

Note: Do not store or ship the LIFEPAK 20 defibrillator/monitor without turning off the AC Loss Alert alarm.

Preventive Maintenance

9-10

Recycling Information

Recycle the device at the end of its useful life.

- Recycling Assistance — The device should be recycled according to national and local regulations. Contact your local Medtronic representative for assistance.
- Preparation — The device should be clean and contaminant-free prior to being recycled.
- Recycling of Disposable Electrodes — After using disposable electrodes, follow your local clinical procedures for recycling.
- Recycling of Batteries — Follow local guidelines and instructions given in this service manual for discarding/recycling batteries.
- Packaging — Save or recycle packaging materials.

Battery Maintenance

Follow the guidelines described in this section to help maximize battery life and performance.

Types of Batteries

Charging the Backup Battery

Storing the Battery Packet

Discarding/Recycling Batteries

Battery Maintenance

10-2

Types of Batteries

AC power is the main power source for the LIFEPAK 20 defibrillator/monitor. There is one 10 cell nickel metal hydride (NiMH) backup battery located in the bottom case. This battery is not intended to be used as the primary power source. If the primary power source is removed, due to power outage or other reason, the backup battery will power the unit for at least two hours.

The LIFEPAK 20 defibrillator/monitor also has a coin battery that delivers a continuous flow of power to the internal clock and other accessories. This battery has a five-year life span, it is not rechargeable, and it should be replaced at the end of its life.

Battery Maintenance

10-3

Charging the Backup Battery

The LIFEPAK 20 defibrillator/monitor has a built-in high-current charger that recharges a completely discharged backup battery in approximately two hours. Recharging occurs when ac power is connected to the defibrillator. When the battery is completely charged, the charger does not recharge the battery until primary power is lost/restored or two weeks have passed since the batteries last full recharge.

Battery Maintenance

10-4

Storing the Battery Packet

A battery packet is considered to be in storage when it is not in active use.

The battery packet requires special handling procedures for storage.

- Store the battery packet between -20° C and 50° C (-4° F and 122° F). Lower temperatures reduce the battery initial charge.

Battery Maintenance

10-5

Discarding/Recycling Batteries

A battery is at the end of its useful life if one or more of the following circumstances occur:

- There is physical damage to the battery.
- The battery is leaking.
- The battery is unable to hold a charge.

Recycle batteries according to national and local regulations. Contact Medtronic Technical Support for assistance at 1.800.442.1142.

Replacement Procedures

Replacement procedures are a set of detailed instructions for disassembly, handling, and reassembly of replaceable **LIFEPAK 20 defibrillator/monitor assemblies**.

Perform an interior inspection whenever the LIFEPAK 20 defibrillator/monitor case is opened for service.

When disconnecting cables and wire harnesses, label the cables and connections so that they match easily during reassembly (for example, J1, J3, etc). Refer to the **Interconnect Diagram** for additional information.

Repair Procedures Index

Warnings and Cautions

Static Sensitive Devices (SSD)

Building a Capacitor Discharge Tool

Using the Capacitor Discharge Tool (Continued)

Saving Setup Configuration

Restoring Setup Configuration

Top Case

Front Case

Replacement Procedures (Continued)

Boardstack

11-2

Bottom Case

Final Assembly

Software Replacement and Device Upgrades

Verifying the Device Configuration Data

Defibrillator Part Number and Serial Number

How to Order Parts

Repair Procedures Index

11-3

Choose from the following replacement procedures (procedures are listed in defibrillator disassembly order):

Top Case

[Exploded View](#)[Parts List](#)[Top Case Disassembly](#)[Top Case Reassembly](#)[A07 Battery Removal and Installation](#)[Top Case Removal](#)[Top Case Installation](#)[Handle Removal](#)[Handle Installation](#)

Front Case

[Exploded View \(Without SpO2\)](#)[Exploded View \(With SpO2\)](#)[Exploded View \(Rear View\)](#)[Parts List](#)[Front Case Disassembly](#)

Front Case Reassembly

[Front Case Removal](#)[Front Case Installation](#)[AED Door Removal](#)[AED Door Installation](#)[W18 UI Flex Cable Removal](#)[W18 UI Flex Cable Installation](#)[W04 Speed Dial Assembly Removal](#)[W04 Speed Dial Assembly Installation](#)[A15 Elastomer Keypad Removal](#)[A15 Elastomer Keypad Installation](#)[A11 Active Display Removal](#)[A11 Active Display Installation](#)[A05 User Interface \(UI\) PCB Removal](#)[A05 User Interface \(UI\) PCB Installation](#)[W02 Speaker Assembly Removal](#)[W02 Speaker Assembly Installation](#)

Repair Procedures Index

11-4

Choose from the following replacement procedures (procedures are listed in defibrillator disassembly order):

Boardstack

- [Exploded View \(System PCB\)](#)
- [Exploded View \(Therapy PCB\)](#)
- [Parts List](#)
- [Boardstack Disassembly](#)
- [Boardstack Reassembly](#)
- [Boardstack Removal](#)
- [Boardstack Installation](#)
- [W07 Capacitor Discharge Cable Removal and Installation](#)
- [A10 SpO2 PCB Removal](#)
- [A10 SpO2 PCB Installation](#)
- [A02 Patient Parameter and OEM/SpO2 PCB Removal](#)
- [A02 Patient Parameter and OEM/SpO2 PCB Installation](#)
- [Coin Battery Replacement](#)
- [A01 System PCB Removal](#)
- [A01 System PCB Installation](#)

[A04 Therapy PCB Removal](#)

- [A04 Therapy PCB Installation](#)

Bottom Case

- [Exploded View \(Modules\)](#)
- [Exploded View \(Connectors\)](#)
- [Parts List](#)
- [Repair Procedures Bottom Case Disassembly](#)
- [Bottom Case Reassembly](#)
- [Printer Module Removal](#)
- [Printer Module Installation](#)
- [A13 Energy Capacitor Removal](#)
- [A13 Energy Capacitor Installation](#)
- [Power Module Removal](#)
- [Power Module Installation](#)
- [W06 ECG Connector Removal](#)
- [W06 ECG Connector Installation](#)

Repair Procedures Index

11-5

Choose from the following replacement procedures (procedures are listed in defibrillator disassembly order):

Bottom Case (continued)

[W01 Therapy Connector Removal](#)

[W01 Therapy Connector Installation](#)

[W05 SpO2 Assembly Removal](#)

[SpO2 Flex Cable Removal](#)

[W05 SpO2 Assembly Installation](#)

[W03 IrDA Assembly Removal \(not active\)](#)

[W03 IrDA Assembly Installation](#)

[W25 Speaker Harness Extension Cable Removal](#)

[W25 Speaker Harness Extension Cable Installation](#)

Final Assembly

[Labels Assembly](#)

[Label Languages Parts List](#)

[Manual Latch Label Languages Parts List](#)

[A15 Elastomer Keypad Languages Parts List](#)

[Installing Printer Paper](#)

[Standard Paddles Exploded View](#)

[Standard Paddles Parts Lists](#)

[Standard Paddles Disassembly](#)

[Standard Paddles Assembly](#)

Repair Procedures Index

11-6

Choose from the following replacement procedures (procedures are listed in defibrillator disassembly order):

Service Replacement Kits

[Top Case Handle Kit PN 3202718-000](#)

[Front Case Kit PN 3202718-001](#)

[Therapy PCB \(with Pacing\) Kit PN 3202718-002](#)

[Therapy PCB \(without Pacing\) Kit PN 3202718-003](#)

[System PCB Kit PN 3202718-004](#)

[OEM PCB Kit PN 3202718-005](#)

[Patient Parameter PCB Kit PN 3202718-006](#)

[User Interface PCB Kit PN 3202718-007](#)

[Active Display Kit PN 3202718-008](#)

[Active Display Bracket/Backlight Inverter Kit
PN 3202718-009](#)

[Power Module Kit PN 3202718-010](#)

[Capacitor Bracket Kit PN 3202718-011](#)

[Capacitor Kit PN 3202718-012](#)

[Masimo SpO2 Connector Kit PN 3202718-013](#)

[Therapy Connector Kit PN 3202718-014](#)

[Inductive Resistor Kit PN 3202718-015](#)

Warnings and Cautions

11-7

The following general warnings and cautions apply to all actions you may perform during maintenance of the LIFEPAK 20 defibrillator/monitor.

WARNINGS!

Shock hazard. Servicing of this device must be performed by properly trained individuals. This device may retain potentially lethal charges accessible inside the device at any time—even when off. Follow the procedures carefully for discharging the A13 Energy Capacitor.

Shock hazard. The A13 Energy Capacitor carries high voltage. Discharge the capacitor before handling.

Possible shock and device damage. It is possible to pinch and damage wires during reassembly. To avoid pinching wires, carefully follow reassembly instructions.

CAUTION!

Possible component damage. The PCB assemblies contain static sensitive devices (SSDs). To avoid damage, observe the special handling practices described in the section titled Static Sensitive Device Handling.

Static Sensitive Devices (SSD)

11-8

About SSD Handling

Many electronic semiconductor devices (such as MOS ICs, FETs, optical isolators, or film resistors) can be damaged by the discharge of static electricity. Static charge buildup is very common. Static discharges commonly occur when the operator wears synthetic clothes and transfers the charge to any object touched. These discharges can damage or destroy static sensitive devices (SSDs). In most cases, the discharge is not even perceptible to the person who causes it.

To prevent static discharge damage to SSDs, observe the following precautions during any open-case test, maintenance, or repair procedures:

The SSD Symbol

SSDs are identified with the following warning symbol:



Always perform repair or maintenance on a static-dissipative mat that is connected to earth ground.

Static Sensitive Devices

11-9

Wear a Wrist Strap

Always wear a conductive wrist strap connected to the mat and to ground except when working on energized equipment or when discharging high voltage circuits. The strap must be snug enough to make good contact against bare skin.

WARNING!

Shock hazard. Remove the wrist strap when working on energized equipment or when discharging high voltage circuits.

Transport and Store PCBs Properly

Transport and store PCBs in anti-static racks or inside conductive bags. Label the package that contains the PCBs as static sensitive.

Keep Work Area Static Free

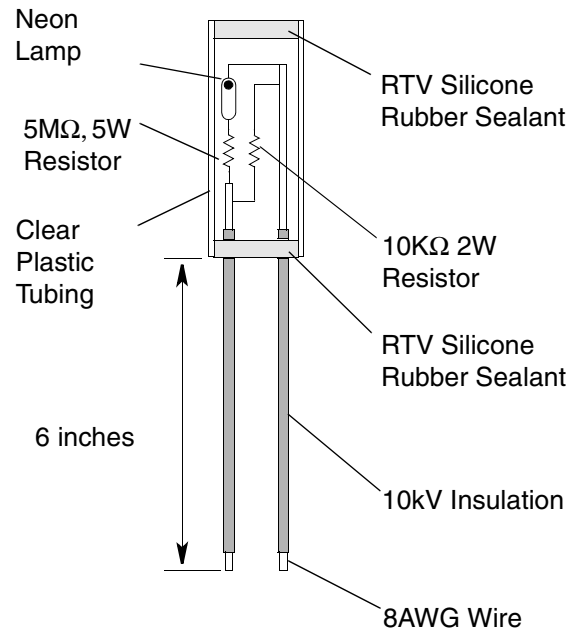
Keep static-generating products such as styrofoam cups or trays away from the work area. Connect all electrical equipment, such as soldering irons and test equipment, to ground with a three-prong plug.

Test Work Area Routinely

Test all the antistatic parts of the work area (mat, straps, cables) routinely. Keep a log of the test results.

Building a Capacitor Discharge Tool

11-10



WARNING!

Shock hazard. Discharge tools that were not designed and labeled for biphasic use are inadequate for use on biphasic defibrillators. They will take several minutes to discharge the energy capacitor. Use only capacitor discharge tool PN 3012102 on biphasic defibrillators.

A capacitor discharge tool is constructed and used to discharge the A13 Energy Storage Capacitor. The following materials are required:

- 10 kΩ, 2 W resistor (ten 1 KΩ 2 W), high-voltage
- 5 MΩ, 5 W resistor, high-voltage
- Neon lamp, NE76, NE2, or NE2H
- 8 AWG copper wire
- Clear plastic tubing, capable of insulating 10 kV
- 10 kV insulation
- RTV, silicone rubber sealant

Refer to Using the Capacitor Discharge Tool on the next page for information to discharge the energy storage capacitor.

Using the Capacitor Discharge Tool

11-11

WARNING!

Shock hazard. Discharge tools that were not designed and labeled for biphasic use are inadequate for use on biphasic defibrillators. They will take several minutes to discharge the energy capacitor. Use only capacitor discharge tool PN 3012102 on biphasic defibrillators.

The capacitor discharge tool is used to discharge the energy storage capacitor before beginning any maintenance on the inner parts of the defibrillator.

To use the capacitor discharge tool:

1. **Remove the battery.**
2. **Remove the top case.**
3. Place one probe on the solder joint on the inductive resistor and hold it steady.
4. Place the other probe in the connection point of the capacitor wire and hold both probes steady.
5. Observe the neon lamp inside the capacitor discharge tool. If a charge of approximately 90 volts is present, the neon lamp will light.

(Continued on next page)

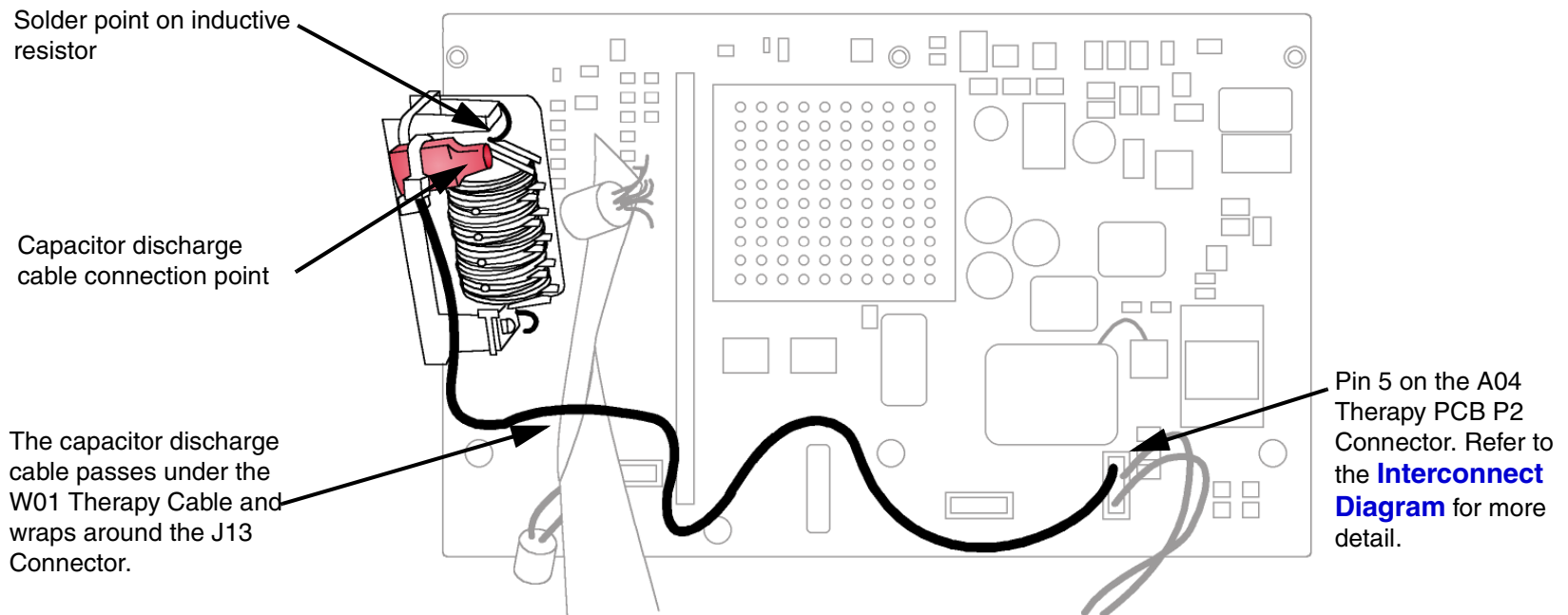
Using the Capacitor Discharge Tool (Continued)

11-12

WARNING!

Shock hazard. Do not assume the capacitor is uncharged if the neon lamp does not light! There may still be a charge on the capacitor. Do not touch capacitor terminals until completing the discharge operation.

6. Continue holding the probes on the points indicated for at least 30 seconds after the neon lamp is no longer lit.



Saving Setup Configuration

11-13

The following procedures illustrate how to save the device setup configuration before beginning any repair action. The best method is to transfer the setup configuration to a spare device, complete repairs, and then transfer the setup configuration back again. To save the configuration in this manner, use the Transfer and Save Setup Procedure. The second method is to print the setup configuration, complete repairs, and then manually reconfigure the device.

Note: Saving the configuration with the Transfer and Save Setup Procedure requires that the software in the device being used for storage of configuration information is of the same revision. Otherwise, potentially unexpected results may occur once the configuration is restored to the repaired device.

Transfer Setup Configuration

To transfer the setup configuration to a spare device:

1. With the power off on both devices, connect a configuration transfer cable (PN 3011538) between the device system connectors.
2. Turn on each device by holding down both the **OPTIONS** and **EVENT** controls and pressing the **ON** button. The Setup screen appears on both devices.
3. Click **SEND CONFIG** from the Setup menu on the device to be repaired. The Send Config screen appears.

(Continued on next page)

Saving Setup Configuration

11-14

4. Click **SEND** on the Send Config screen and press the Speed Dial. The setup configuration transfers to the spare device.
5. Select **PRINT DEFAULTS** from the Setup menu. The printer prints the device setup configuration. Save this backup printout for possible future reference.
6. Turn off both devices.

Print Setup Configuration

To print the setup configuration:

1. Hold down both the **OPTIONS** and **EVENT** controls and turn on the defibrillator. The Setup screen appears.
2. Select **PRINT DEFAULTS** from the Setup menu. The printer prints the device setup configuration. Save this printout for future reference.
3. Turn off the device.

Restoring Setup Configuration

11-15

The following procedures assume you have completed Saving the Setup Configuration using a spare device with the same software version before starting repairs. If you saved the setup using the Transfer and Save Setup Procedure, perform the Restoring by Transfer Procedure. If you saved the setup manually, continue to the Restoring Setup Manually Procedure on the next page.

Restoring by Transfer Procedure

To restore the setup configuration by transfer:

1. Connect the spare device (with the saved setup configuration) and the repaired device with a configuration transfer cable (PN 3011538) between the device system connectors.
2. Turn on each device by holding down both the **OPTIONS** and **EVENT** controls and pressing the **ON** button. The Setup screen appears on both devices.
3. Click **SEND CONFIG** from the Setup menu on the spare device. The Send Config screen appears.
4. Select **SEND** on the Send Config screen and press the Speed Dial. The setup configuration transfers back to the repaired device.
5. Turn off both devices.

Restoring Setup Configuration

11-16

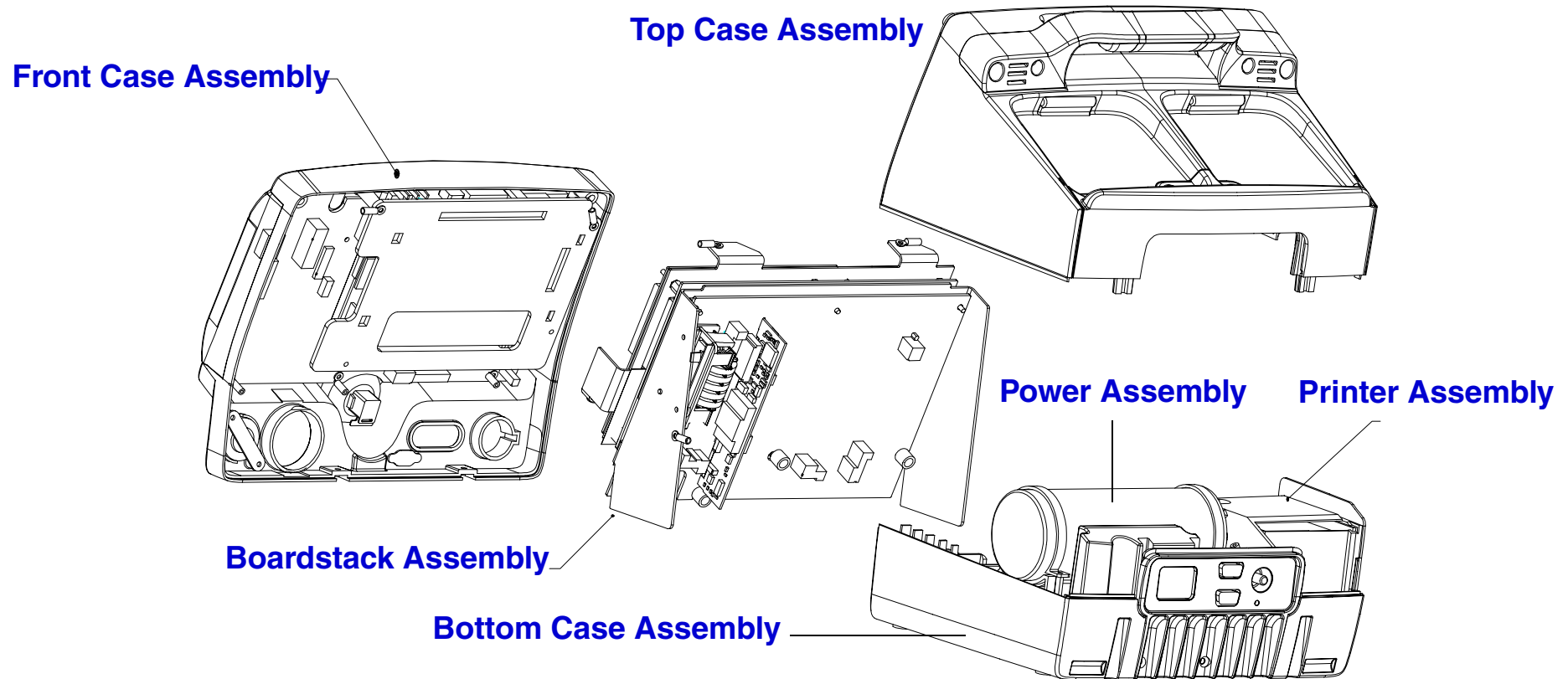
Restoring Setup Manually Procedure

To restore the setup configuration manually:

1. Hold down both the **OPTIONS** and **EVENT** controls and apply power. The Setup overlay screen appears.
2. Using the printout from the Saving the Setup Configuration Procedure, check the settings in each menu and revise as necessary to match the printout.
3. Turn off the device.

Main Assemblies

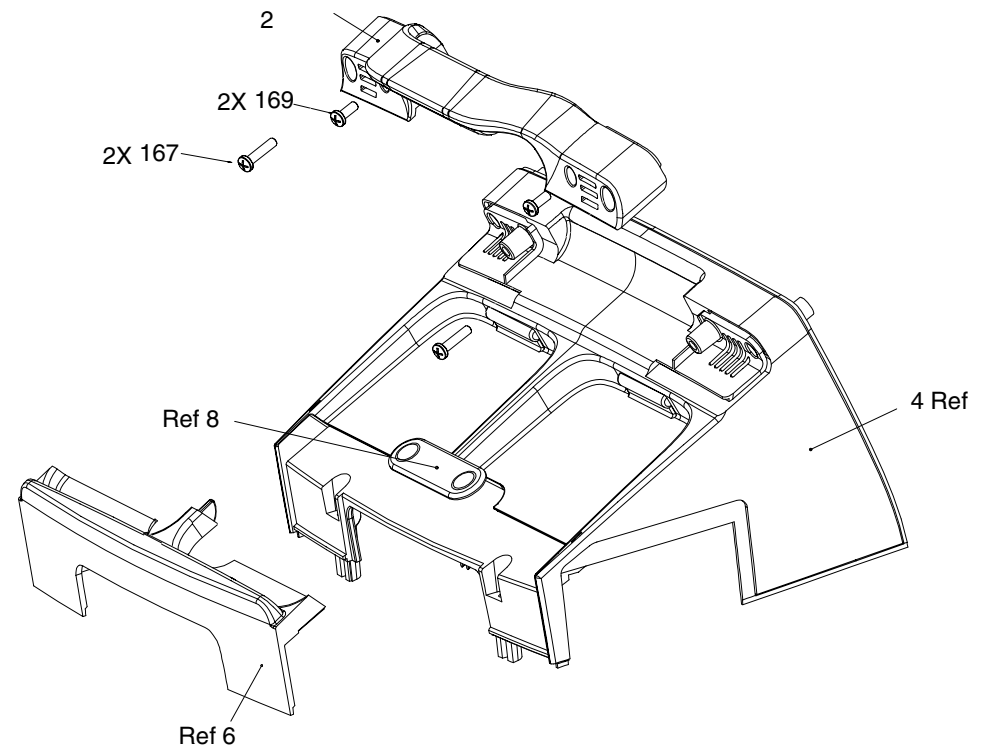
11-17



Top Case

11-18

Exploded View

[Top Case Replacement](#)[A07 Battery Removal](#)[A07 Battery Installation](#)[Top Case Removal](#)[Top Case Installation](#)[Handle Removal](#)[Handle Installation](#)

Parts 2–242

Front Case

Boardstack Assembly

Bottom Case

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Top Case

11-19

Parts List

Item	Quantity	Part Number	Part Description	Note
2	1	3200631-000	Handle	Part of Various Kits
4	1	3200627-002	Top Case	Part of Top Case Assembly
6	1	3200630-002	Paddles Retainer Test Load Cover	Part of Top Case Assembly
8	1	3201531-001	Plate Test Load with Pad	Part of Top Case Assembly
167	2	202253-592	Machine Screws 6-32 × 1.75L	Part of Various Kits
169	2	202253-570	Machine Screws 6-32 × .375L	Part of Various Kits
242	1	3202497-001	Top Case Assembly	

[Top Case](#)
[Front Case Parts List](#)
[Boardstack Parts List](#)
[Bottom Case Parts List](#)
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Top Case

11-20

Repair Procedures

Top Case Disassembly

To disassemble the top case:

1. Disconnect the defibrillator from ac power.
2. **Remove the A07 Battery** from the defibrillator.
3. **Remove the top case** from the defibrillator.

Top Case Reassembly

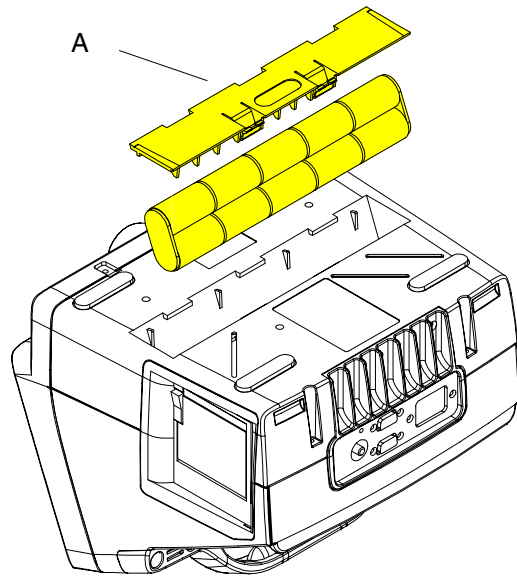
To reassemble the top case:

1. **Install the top case** (complete Steps 1 through 6).
2. **Install the A07 Battery** into the defibrillator.
3. Review the **labels parts list** and install new labels.
4. **Complete the PIP.**

Top Case

11-21

A07 Battery Removal and Installation



To remove the A07 Battery from the defibrillator:

1. Disconnect the defibrillator from ac power.
2. Place the defibrillator top down.
3. Insert two small flat bladed screwdrivers into the door taps and pinch the tabs to remove the battery door (103), A in graphic at left.
4. Disconnect and remove the A07 Battery.

To Install the A07 Battery:

1. Place the defibrillator top down.
2. Connect the W08 Battery Cable to the A07 Battery.
3. Insert the A07 Battery into the battery compartment ensuring that the battery fuse is facing toward the rear of the defibrillator.

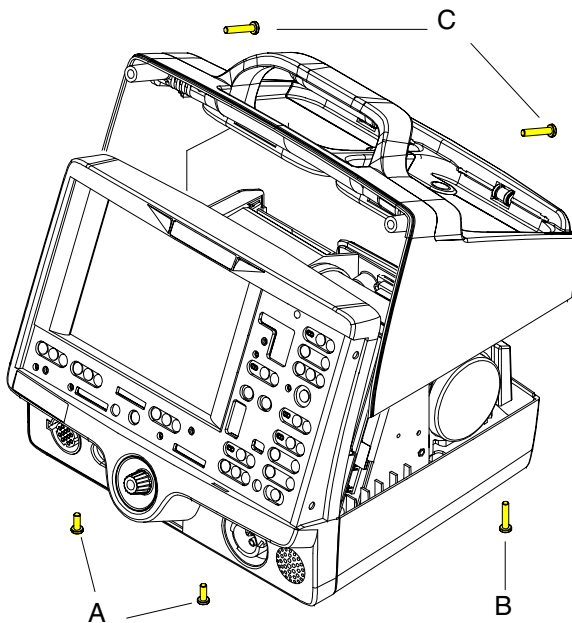
Note: Install the A07 Battery in the compartment with the wire harness facing toward the front of the defibrillator.

4. Close the battery door (103).

Top Case

11-22

Top Case Removal



To remove the top case assembly from the defibrillator:

1. Disconnect the defibrillator from ac power.
2. Place the defibrillator face down.
3. **Remove the A07 Battery.**
4. Remove two 6-32 × .375 screws (169), A in graphic at left, securing the bottom case to the front case.
5. Remove two 6-32 × 1.75 screws (167), B in graphic at left, securing the bottom case to the top case.
6. Place the defibrillator on its bottom.
7. Remove two 6-32 × 1.75 screws (167), C in graphic at left, securing the top case to the front case (outboard screws).
8. Pull the front case slightly away from the top case, and slide the top case up and away from the rest of the defibrillator.
9. **Discharge the A13 Capacitor.**

Top Case

Top Case Parts List

Top Case

11-23

Top Case Installation

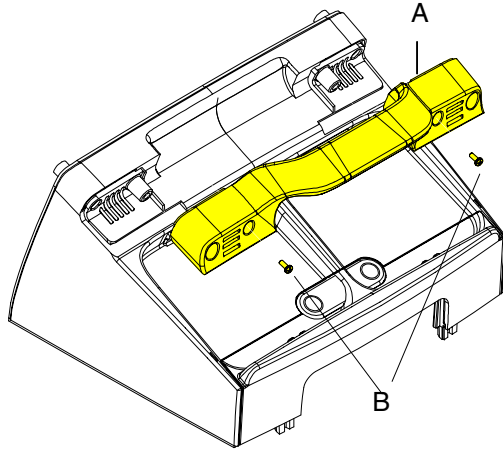
To install the top case:

1. Align the front case to the bottom case.
2. Align the top case to the bottom case.
3. Align the front case to the top case.
4. Secure the top case to the front case with two 6-32 × 1.75 screws (167).
5. Turn the defibrillator face down and secure the front case to the bottom case with two 6-32 × .375 screws (169).
6. Secure the top case onto the bottom case with two 6-32 × 1.75 screws (167).
7. **Install the A07 Battery.**
8. Review the **labels parts list** and install new labels.
9. **Complete the PIP.**

Top Case

11-24

Handle Removal



To remove the handle from the top case:

1. Remove the two inboard 6-32 × .375 screws (169) securing the handle to the top case.
2. Remove the two outboard 6-32 × 1.75 screws (167), if installed.
3. Pull the handle (2) away from the top case.

Handle Installation

To install the handle:

1. Place handle (2) in position on the top case
2. Install two inboard 6-32 × .375 screws (169) into the handle. Remove the two outboard 6-32 × 1.75 screws (167), if installed.
3. Remove the two outboard 6-32 × 1.75 screws (167) to secure top case to front case.

Front Case

11-25

Exploded View
(Without SpO2)

Front Case Replacment

Front Case Removal

Front Case Installation

Door Removal

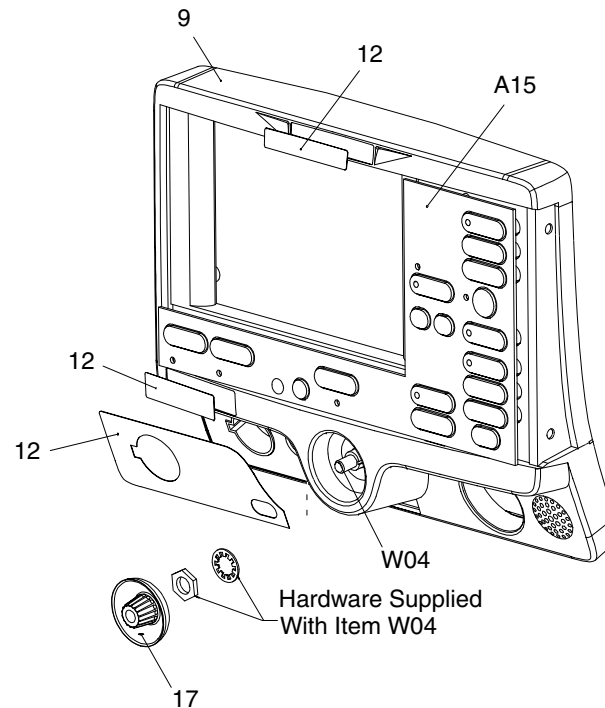
Door Installation

Speed Dial Removal

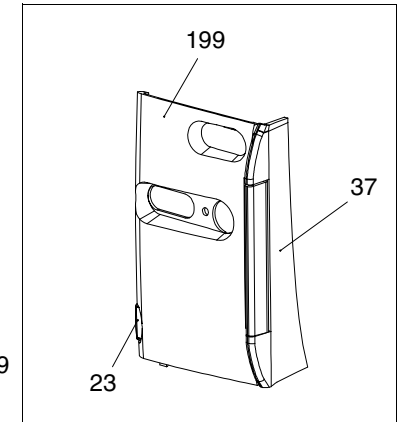
Speed Dial Installation

Elastomer Keypad Removal

**Elastomer Keypad
Installation**



Door Option



Parts A05–W18

Parts 9–47

Parts 55–250

Front Case (SpO2)

Rear View

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Front Case

11-26

Exploded View
(With SpO2)

Front Case Removal

Front Case Installation

Door Removal

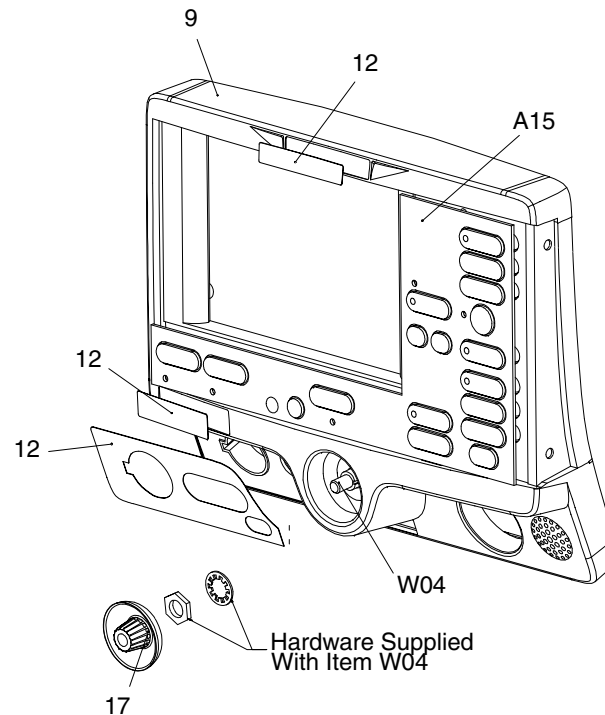
Door Installation

Speed Dial Removal

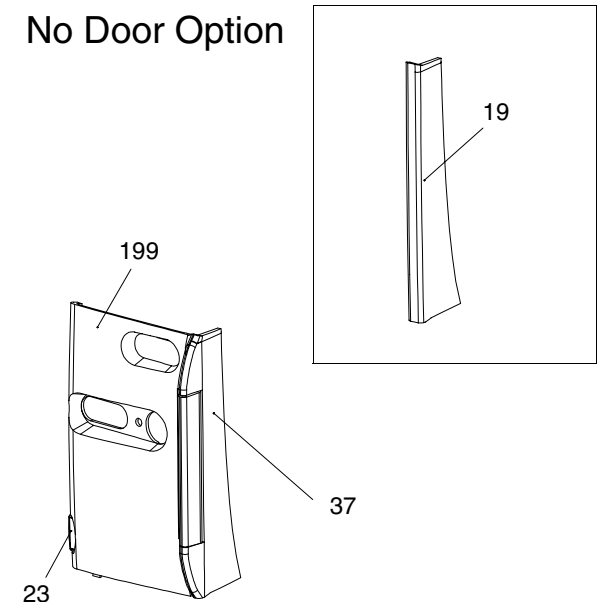
Speed Dial Installation

Elastomer Keypad Removal

Elastomer Keypad Installation



No Door Option



Front Case

11-27

Exploded View (Rear View)

Active Display Removal

- Display Jumper Cable Ext
- Inverter Cable
- Display Bracket
- Active Display Cable
- Backlight Inverter
- Thermal Conductive Pad

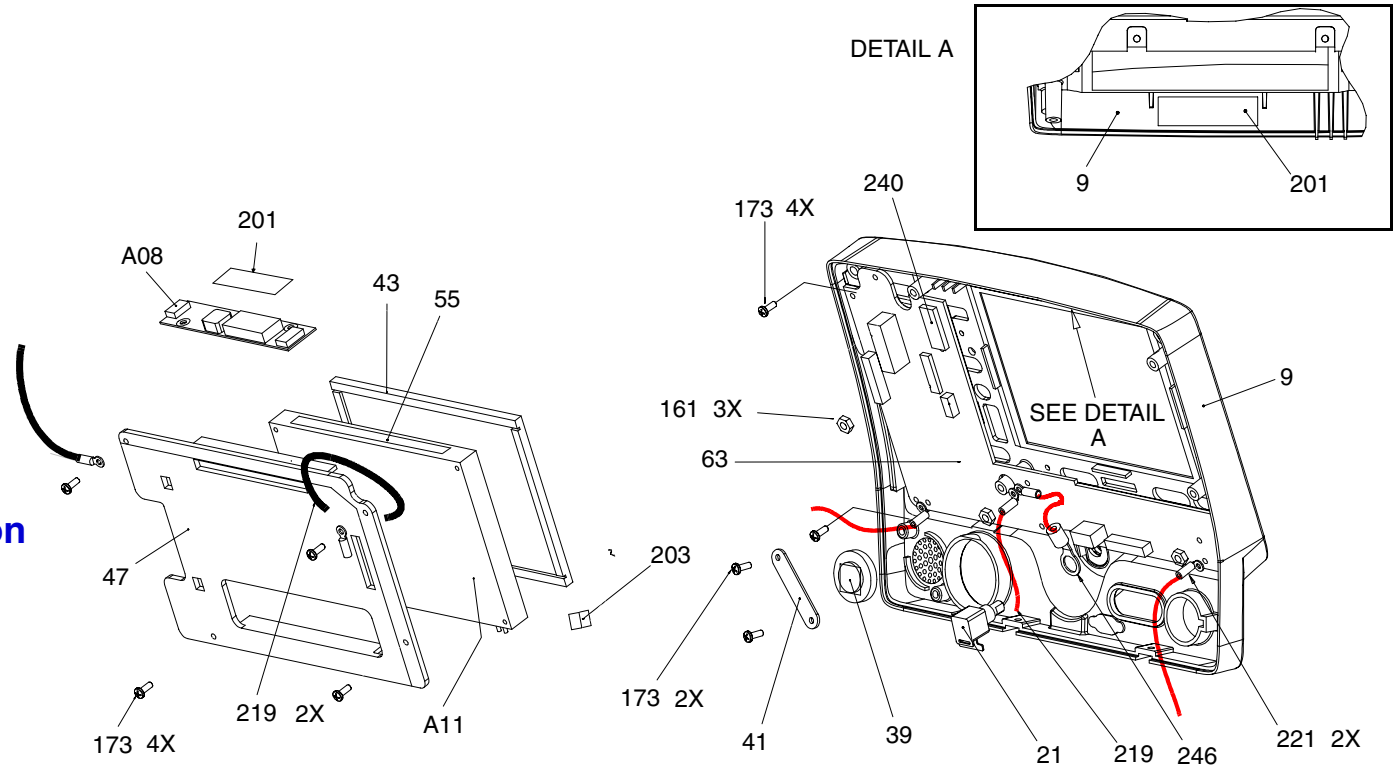
Active Display Installation

User Interface PCB Removal

User Interface PCB Installation

Speaker Removal

Speaker Replacement



Front Case

11-28

Parts List (1 of 3)

Item	Quantity	Part Number	Part Description	Note
A05	1	3201966-004	User Interface PCB	Part of Kit PN 3202718-007
A08	1	3202033-000	Active Color Backlight Inverter	Part of Kit PN 3202718-009
A11	1	3200916-000	Active Matrix Color Display	Part of Kit PN 3202718-008
A15	1	3200642-031	Elastomer Keypad (all options)	Select other language
A15	1	3200642-061	Elastomer Keypad (no pacing)	Select other language
W02	1	3201593-004	Speaker Assembly	
W04	1	3201145-000	Speed Dial Switch	
W15	1	3200995-000	Active Display Cable	Part of Various Kits
W16	1	3202018-000	Display Jumper Cable Extender	Part of Kit PN 3202718-009
W17	1	3200996-002	Active B/L Inverter Cable	Part of Kit PN 3202718-009
W18	1	3201000-002	UI to Stack Flex Cable	

Parts 9–47

Parts 55–250

Front Case (without SpO2)

Front Case (SpO2)

Rear View

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Front Case

11-29

Parts List (2 of 3)

Item	Quantity	Part Number	Part Description	Note
9	1	3200624-006	Front Case	Part of Kit PN 3202718-001
12	(3 parts)	3201640	Label Set (6 labels)	Refer to Label Installation
17	1	3200633-000	Speed Dial Knob	
19	1	3200638-001	Cover Plate	Part of cover plate and hinge
23	1	3201499	Manual Latch Label (Part of Door Kit)	Select other language
37	1	3200637-001	Door Hinge Plate	Part of cover plate and hinge
41	1	3201610	Bracket, Speaker Mounting	
43	1	3200913-001	Display Lens	Part of Kit PN 3202718-001
47	1	3200640-009	Active Display Bracket	Part of Kit PN 3202718-009

Front Case

11-30

Parts List (3 of 3)

Item	Quantity	Part Number	Part Description	Note
55	1	804447-37	Foam Spacer	Part of Kit PN 3202718-007
161	3	200805	Lock Nut 4 × 40	
173	10	202253-761	Machine Screw 4-40 × .312L	
199	1	3202056-002	AED Door Assembly	Part of Door Kit
201	1	3201111-003	Thermally Conductive B/L Inverter Pad	Part of Kit PN 3202718-001
219	3	3202246-000	Grounding Harness	Active Display
221	2	3202246-001	Grounding Harness	User Interface PCB
240	1	804447-041	Foam Spacer	User Interface PCB
250	1	3202246-002	Grounding Harness	

Parts A05–W18

Parts 9–47

Front Case (without SpO2)

Front Case (SpO2)

Rear View

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Front Case

11-31

Repair Procedures

Front Case Disassembly

To disassemble the Front Case:

1. **Remove the A07 Battery.**
2. **Remove the top case.**
3. **Remove the front case** from the defibrillator.
4. **Remove the AED door** (if defibrillator is equipped with a door).
5. **Remove the W04 Speed Dial Assembly.**
6. **Remove the A15 Elastomer Keypad.**
7. **Remove the A11 Active Display.**
8. **Remove the A05 User Interface PCB.**
9. **Remove the W02 Speaker Assembly.**
10. **Replace the front case** and continue to Front Case Reassembly.

Front Case

11-32

Front Case Reassembly

To reassemble the front case:

1. **Install the W02 Speaker Assembly** (complete Steps 1 through 4).
2. **Install the A05 User Interface PCB** (complete Steps 1 through 5).
3. **Install the A11 Active Display** (complete Steps 1 through 8).
4. **Install the W04 Speed Dial Assembly** (complete Steps 1 through 5).
5. **Install the A15 Elastomer Keypad.**
6. **Install the AED door** (if defibrillator is equipped with a door).
7. **Install the front case** (complete Steps 1 through 6).
8. **Install the top case** (complete Steps 1 through 6).
9. **Install the A07 Battery.**
10. Review the **labels parts list** and install new labels.
11. **Complete the PIP.**

Front Case

11-33

Front Case Removal

WARNING!

Possible shock and device damage. Carefully follow disassembly instructions to avoid a shock or damage to wires during disassembly.

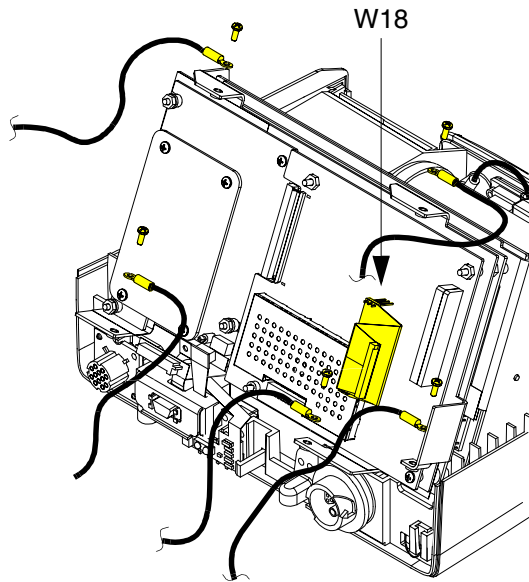
Note: Remove the top case assembly before beginning this disassembly.

To remove the front case assembly from the defibrillator:

1. Using a discharge tool, **discharge the A13 Capacitor.**
2. Disconnect two grounding harnesses (219) connecting the top of the A11 Active Display to the system shield, by removing the two screws (173).

Note: Replace any broken or frayed grounding straps.

3. Pull the front case away from the boardstack assembly and disconnect the W18 UI Flex Cable from the A02 Patient Parameter (PP) PCB at J21 and J22.
4. Disconnect two grounding harnesses (221) connecting the bottom left and right corners of the A05 User Interface (UI) PCB to the PCB support bracket, by removing the two screws (173).



(Continued on next page)

Parts List

Front Case (without SpO2)

Front Case (SpO2)

Rear View

Interconnect

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Front Case

11-34

Front Case Removal (Continued)

5. Disconnect one grounding harness (219) connecting the bottom center of the A05 UI PCB to the system shield by removing one nut (161).

Note: The nut securing the center grounding harness also secures the harness providing a ground to the W04 Speed Dial Assembly.

6. Disconnect the W25 Speaker Harness Extension Cable from the W02 Speaker Assembly.

7. Disconnect the W14 Printer Flex Cable from the A05 UI PCB at J34.

Note: Disconnect the Speed Dial connector to access the printer connector.

8. Pull the front case away from the defibrillator.

Front Case

11-35

Front Case Installation

To Install the front case assembly:

1. Connect the W14 Printer Flex Cable to the A05 UI PCB at J34.
2. Connect the W25 Speaker Harness Extension Cable to the W02 Speaker Assembly.

CAUTION!

Possible component damage. The grounding harnesses must be installed at precise angles to avoid damaging defibrillator components.

3. Install two grounding harnesses (221), connecting the bottom left and right corners of the A05 UI PCB to the PCB support bracket using two screws (173). Refer to [Grounding Harness Orientation](#) for grounding harness placement.
4. Install one grounding harness (219) connecting the lower center of the A05 UI PCB to the boardstack system shield using one nut (161). Refer to [Grounding Harness Orientation](#) for grounding harness placement.

Note: The nut securing the center grounding harness also secures the harness providing a ground to the W04 Speed Dial Assembly.

(Continued on next page)

Front Case

11-36

Front Case Installation (Continued)

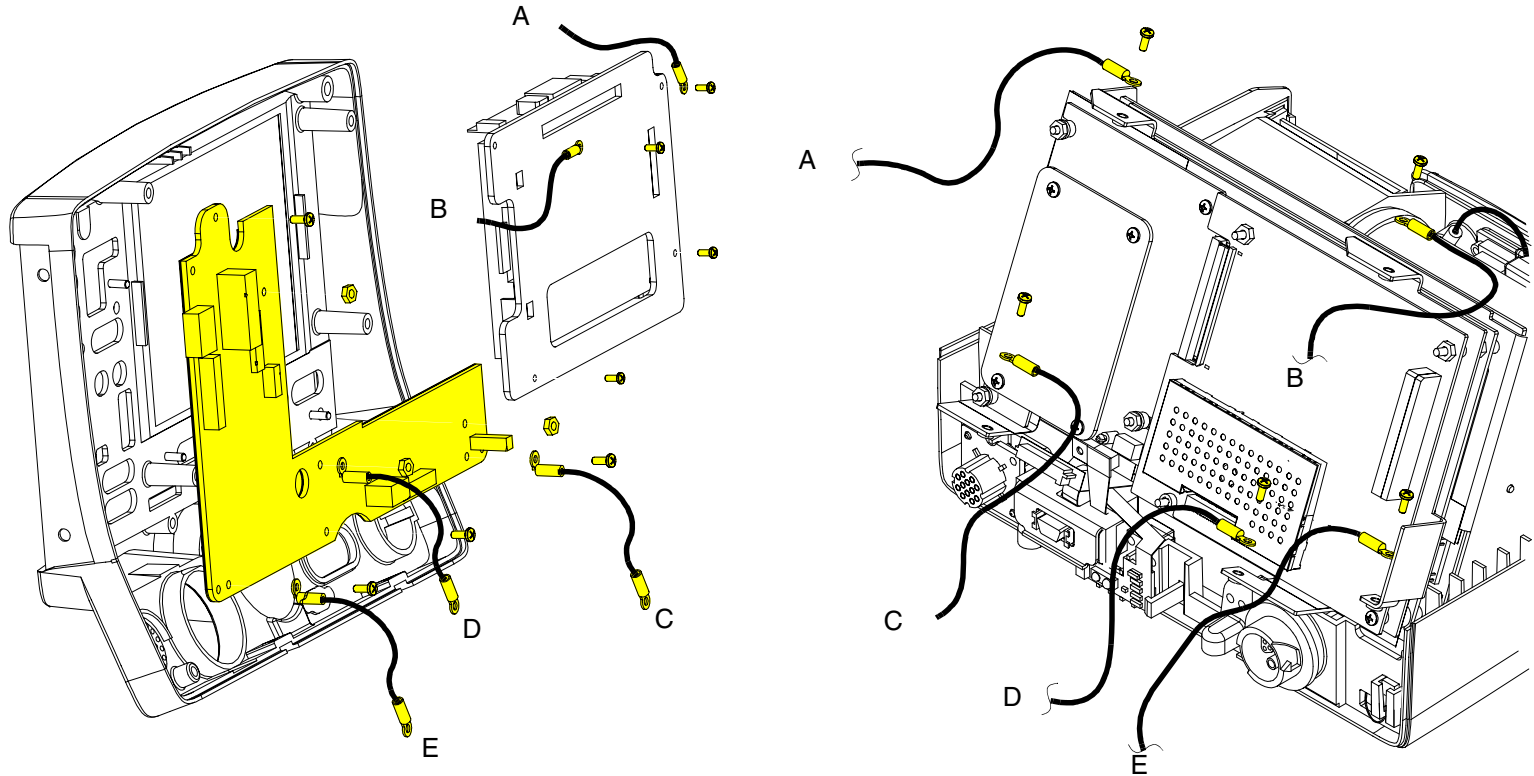
5. Connect the W18 UI Flex Cable to the A02 PP PCB at J21 and J22 and then to the A05 UI PCB at J31.
6. Connect two grounding harnesses (219) connecting the top of the front case to the system shield using two screws. Refer to **Grounding Harness Orientation** for grounding harness placement.
7. **Install the top case** (complete Steps 1 through 6).
8. **Install the A07 Battery.**
9. Review the **labels parts list** and install new labels.
10. **Complete the PIP.**

Front Case

11-37

Grounding Harness Orientation

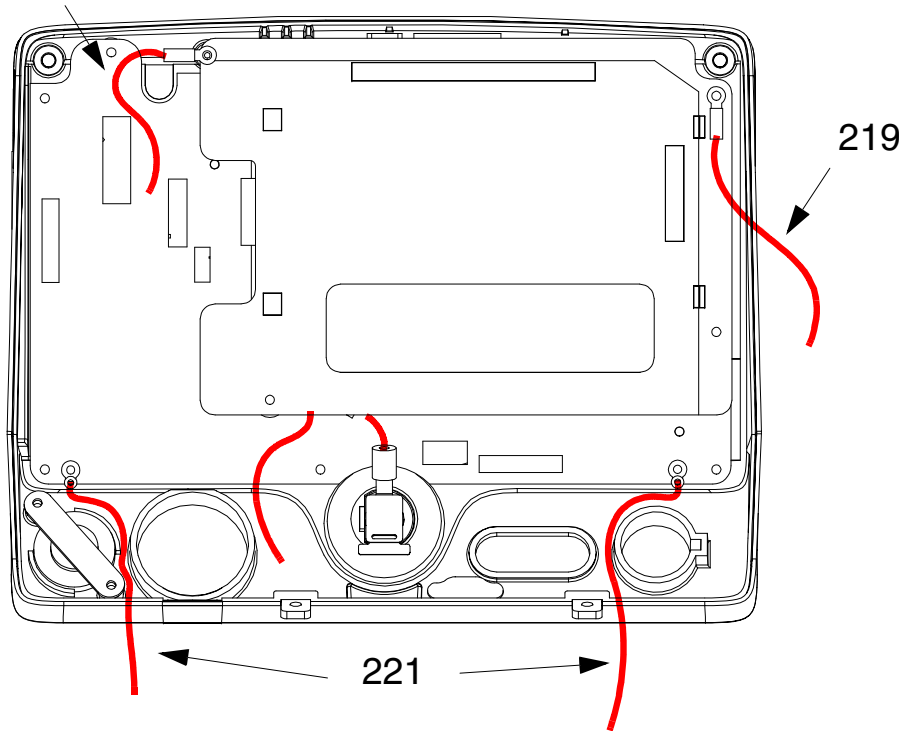
To ensure that the top case, front case and bottom case join correctly, align the grounding harnesses as shown in the graphics on the following 2 pages.

[Parts List](#)[Front Case \(without SpO2\)](#)[Front Case \(SpO2\)](#)[Rear View](#)[Interconnect](#)[◀ Previous Page](#)[◀◀ Table of Contents](#)[◀◀ Section Contents](#)[◀ Back](#)[Index ▶▶](#)[Next Page ▶](#)

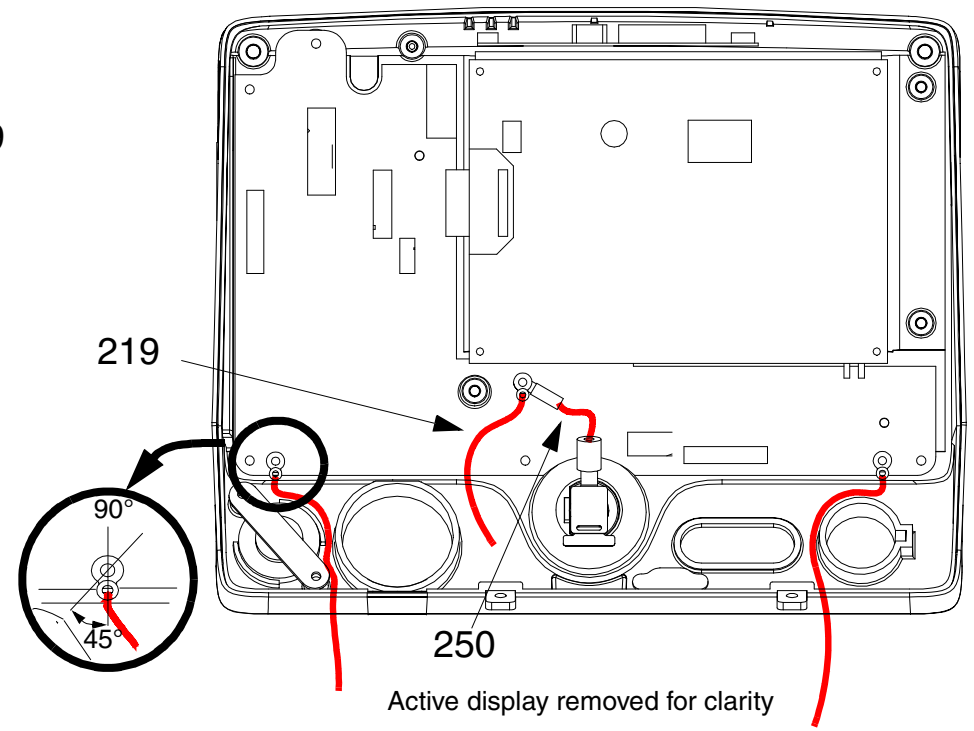
Front Case

Grounding Harness Orientation

219 Grounding Harness Lug Orientation



Grounding Harness Lug Orientation



Front Case

11-39

AED Door Replacement

The AED door assembly is designed to be an, easily replaceable, breakaway assembly. If the door assembly accidentally comes off during use, proceed to AED Door Installation, step 3 for replacement instructions.

AED Door Removal

To remove the entire AED door assembly:

1. Open the AED door.
2. Using a small screwdriver pry the hinge pin center slightly away from door assembly until the door slides free of hinge.
3. Peel the hinge off of the front case.
4. Clean the front case to remove old adhesive.

AED Door Installation

To install a new AED door assembly:

1. Clean the hinge area.
2. Expose the adhesive and secure the door hinge plate (37) to front case.
3. Using a small screwdriver, pry the hinge pin center slightly away from the door assembly until the door slides into the hinge. Ensure that hinge pins snap into securing holes.

Front Case

11-40

W18 UI Flex Cable Removal

Note: The **top case assembly** must be removed before beginning this disassembly.

To remove the W18 UI Flex Cable:

1. From the system shield, disconnect two grounding straps (219) connecting the top of the front case to the system shield, by removing the two screws.

Note: Observe the **positioning on the grounding harnesses**. If they are not reinstalled at the correct angles, the front case will not join with the rest of the defibrillator correctly (refer to graphic on the next page).

2. Pull the front case slightly forward, away from the boardstack assembly, and disconnect the W18 UI Flex Cable from the A02 PP PCB at J21 and J22.
3. Disconnect the W18 UI Flex Cable from the A05 UI PCB at J31 and remove the cable from the defibrillator.

W18 UI Flex Cable Installation

To install the W18 UI Flex Cable:

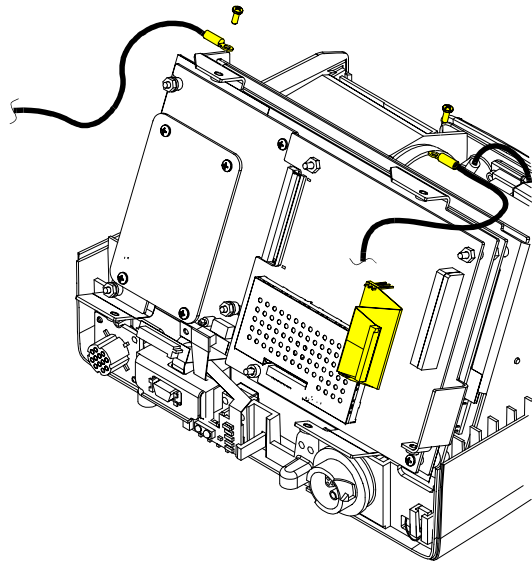
1. With the front case pulled slightly forward and away from the boardstack assembly, connect the W18 UI Flex Cable to the A05 UI PCB at J31.

(Continued on next page)

Front Case

11-41

W18 UI Flex Cable Installation (Continued)



Note: Avoid bending the W18 UI Flex Cable during installation. Excessive bending can damage wires and connectors.

2. Carefully connect the W18 UI Flex Cable to the A02 PP PCB at J21 and J22, ensuring that the pins connect with the connectors evenly avoiding possible pin damage.
3. Connect the two grounding straps (219) connecting the top of the front case to the system shield, by installing the two screws.

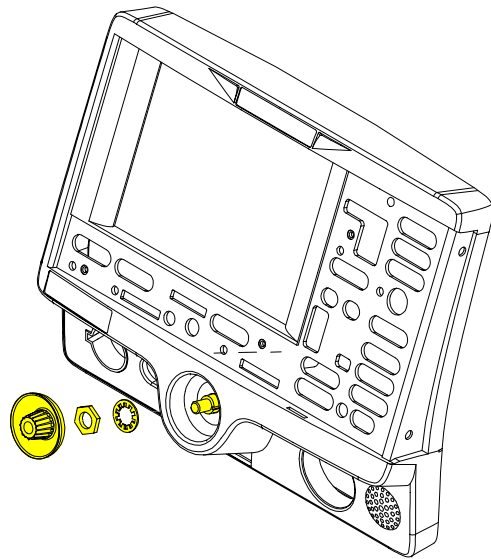
Note: Observe the **positioning of the grounding harnesses**. If they are not reinstalled at the correct angles, the front case will not join with the rest of the defibrillator correctly (refer to graphic at the left).

4. **Install the top case** (complete Steps 1 through 6).
5. **Install the A07 Battery.**
6. Review the **labels parts list** and install new labels.
7. **Complete the PIP.**

Front Case

11-42

W04 Speed Dial Assembly Removal



Note: Remove the following assemblies before beginning this disassembly:

- **Top case**
- **Front case**

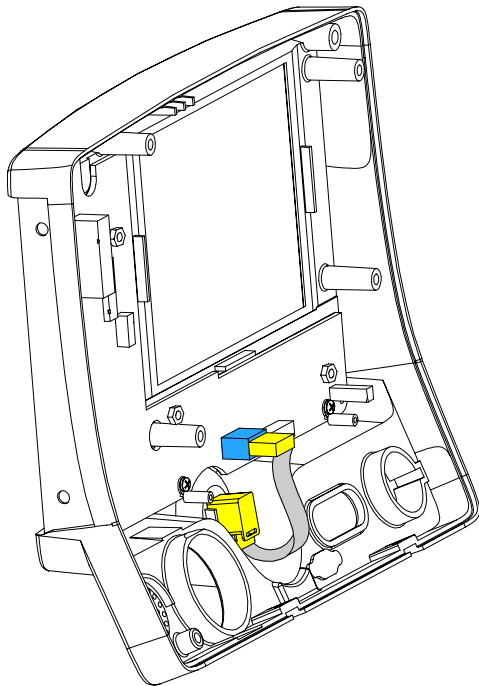
To remove the W04 Speed Dial Assembly:

1. Disconnect the W04 Speed Dial connector from the A05 UI PCB at J32.
2. Turn front case over and remove the Speed Dial knob (17).
3. Loosen and remove the nut from the Speed Dial axle.
4. Remove the washer from the Speed Dial axle.
5. From inside the case, pull the W04 Speed Dial Assembly out of the front case.
6. Remove the grounding harness (250) from the Speed Dial axle.
7. To remove the grounding harness (250) from the front case, first remove it from the Speed Dial axle and then remove the screw (173) securing the other end to the A05 UI PCB.

Front Case

11-43

W04 Speed Dial Assembly Installation



To install the W04 Speed Dial Assembly:

1. Insert the grounding harness (250) onto the Speed Dial axle.
2. From inside the case, install the W04 Speed Dial Assembly into the front case by aligning the key on the assembly to the notch in the front case.
3. Install the washer on to the Speed Dial axle.
4. Install and tighten the nut on the Speed Dial axle.
5. Press the Speed Dial knob (17) onto the axle.
6. Connect the W04 Speed Dial Assembly connector to the A05 UI PCB at J32.
7. **Install the front case** (complete Steps 1 through 6).
8. **Install the top case** (complete Steps 1 through 6).
9. **Install the A07 Battery.**
10. Review the **labels parts list** and install new labels.
11. **Complete the PIP.**

Front Case

11-44

A15 Elastomer Keypad Removal

To remove the A15 Elastomer Keypad:

1. Peel the old keypad away from the front case.
2. Thoroughly clean the front case.

A15 Elastomer Keypad Installation

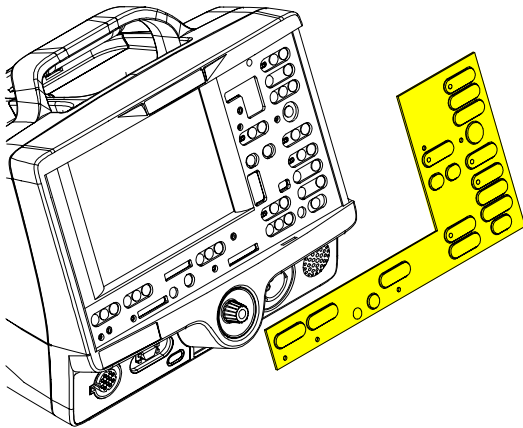
To install the A15 Elastomer Keypad:

1. Select one of the following defibrillator configurations to find the part number for the correct keypad for your defibrillator:

- **All Options**

- **No Pacing**

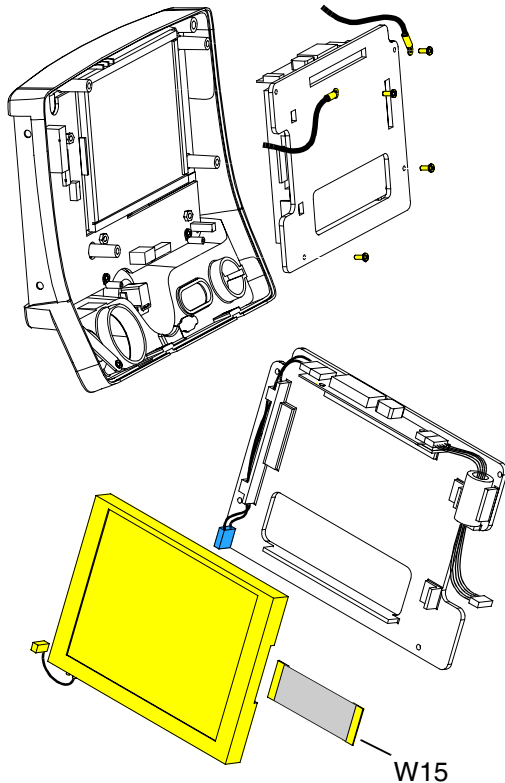
2. Thoroughly clean the front case.
3. Position the left and right bottom edges of the A15 Elastomer Keypad flush against the bottom corners of the front case.
4. Press the A15 Elastomer Keypad onto the front case ensuring that it is flush against the case with no air pockets or gaps.



Front Case

11-45

A11 Active Display Removal



Note: Remove the following assemblies before beginning this disassembly:

- **Top case**
- **Front case**

To remove the A11 Active Display:

1. Disconnect the W15 Active Display Cable (refer to graphic on the left) from the A05 UI PCB at J36.
 - Gently push both sides of the locking tab.
 - Slide the connector out of the socket.
2. Disconnect the W17 Backlight Inverter Cable from the A05 UI PCB at J37.
3. Remove the four 4-40 × .312 screws (173) from the display assembly cover.

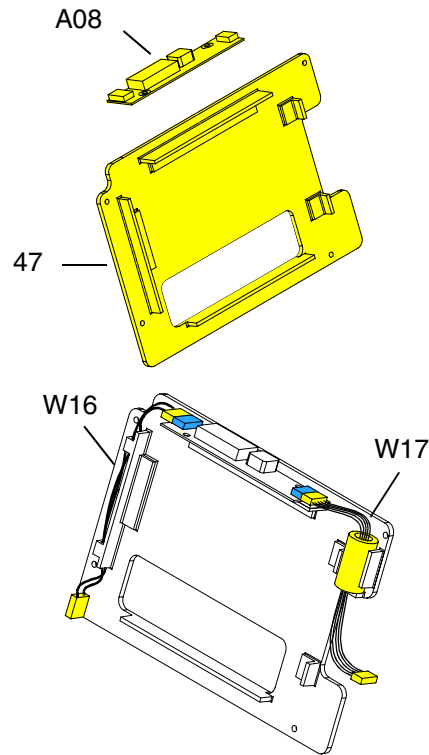
Note: **Remove two grounding harnesses** (219) attached to the top two screws of the display assembly. Replace any broken or frayed grounding harnesses.
4. Remove the display bracket assembly. If replacing the A08 Backlight Inverter or the display bracket, remove the display jumper cable.

(Continued on next page)

Front Case

11-46

A11 Active Display Removal (Continued)



5. Check the condition of the following parts (refer to the graphics on the previous page, this page and the next page) and replace as necessary:

- A08 Backlight Inverter
- W15 Active Display Cable (refer to the graphic on the previous page)
- W16 Display Jumper Cable Extender
- W17 Backlight Inverter Cable
- Display Bracket (47)
- Thermal conductive pad (201), located on the top inside edge of the top case (refer to the graphic on the next page)

Remove and replace any part that has cracks, broken wires, or damaged connectors.

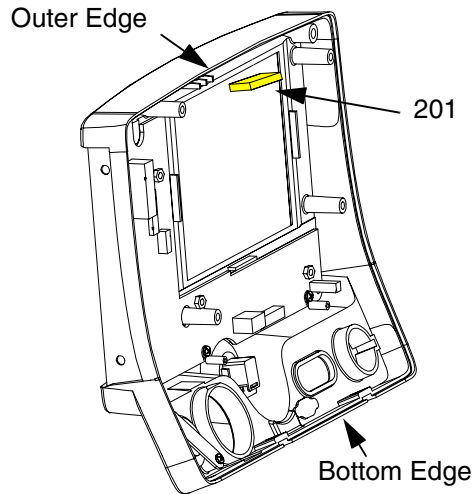
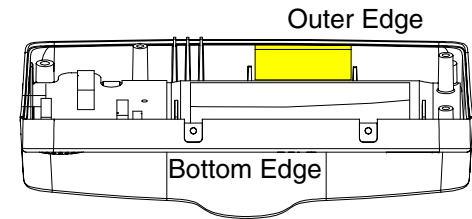
To remove the backlight inverter, pull the backlight inverter away from the display bracket and remove excess adhesive.

To remove the W17 Backlight Inverter cable, W15 Active Display cable, or W16 Display Jumper Cable Extender, pull the cable away from its connector on the A08 Backlight Inverter or the A11 Active Display.

Front Case

11-47

A11 Active Display Installation



To Install the Active Display:

1. Verify the condition of the following parts:

- A08 Backlight Inverter (refer to the graphic on the previous page)
- W15 Active Display Cable (refer to the graphic on the next page)
- W16 Display Jumper Cable Extender (refer to the graphic on the previous page)
- W17 Inverter Cable (refer to the graphic on the previous page)
- Display bracket (47) (refer to the graphic on the previous page)
- Thermal conductive pad (201) (located on the top inside edge of the top case) (refer to the graphic at left)

2. Replace the thermal conductive pad (201) by peeling away the old pad, removing any remaining adhesive, and applying the new pad to the upper inside edge of the top case centered between the locator notches.

Note: The thermal conductive pad (201) must be positioned flush against the outer edge of the front case (past the ends of the locator notches in the front case). Refer to the graphic at left for more detail.

(Continued on next page)

Parts List

Front Case (without SpO2)

Front Case (SpO2)

Rear View

Interconnect

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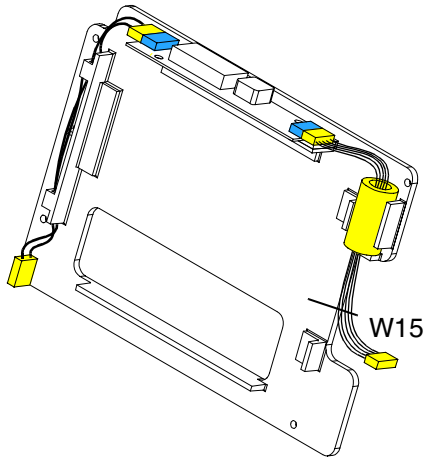
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Front Case

11-48

A11 Active Display Installation (Continued)



3. Peel off the adhesive and attach the A08 Backlight Inverter to the display bracket (47), if previously removed.
4. Position the A11 Active Display inside the display bracket.
5. Place the active display bracket assembly in position in the front case.
Note: A08 Backlight PCB must make contact with the thermal conductive pad (201) on the front case.
6. Route the W16 Display Jumper Cable Extender through the cable guides on the display bracket and connect to the A08 Backlight Inverter.
7. Connect the W17 Backlight Inverter Cable to the A08 Backlight Inverter and seat the ferrite bead in the housing on the display bracket.

CAUTION!

Possible component damage. The grounding harnesses must be installed at precise angles to avoid damaging defibrillator components.

8. Install two grounding harnesses (219) onto the top two screws. Refer to [Grounding Harnesses Orientation](#) for grounding harness placement..

(Continued on next page)

Front Case

11-49

A11 Active Display Installation (Continued)

9. Install four 4-40 × .312 screws (173) to secure the display assembly to the front case.
10. Connect the W15 Active Display Cable (in the graphic on the left) to the A05 UI PCB at J36.
 - Open the J36 Connector Lock.
 - Insert the W15 Display Cable (metal contacts down) into the connector lock.
 - Close the connector lock to secure cable.

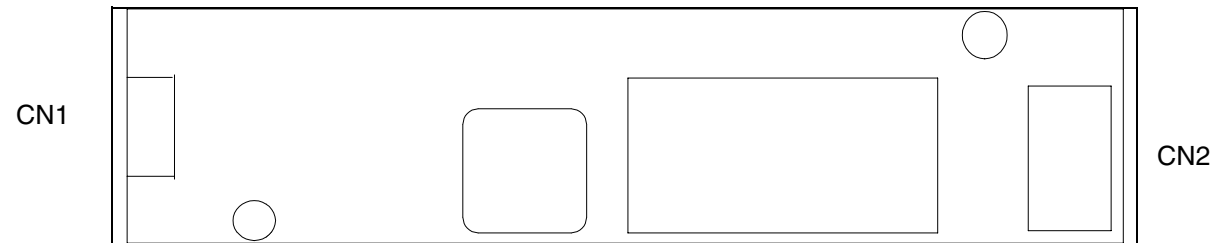
Note: The cable connector must be square with the connector lock.

11. Connect the inverter cable to the A05 UI PCB at J37.
12. **Install the front case** (complete Steps 1 through 6).
13. **Install the top case** (complete Steps 1 through 6).
14. **Install the A07 Battery.**
15. Review the **labels parts list** and install new labels.
16. **Complete the PIP.**

Front Case

11-50

A08 Backlight Inverter
PCB
PN 3200916

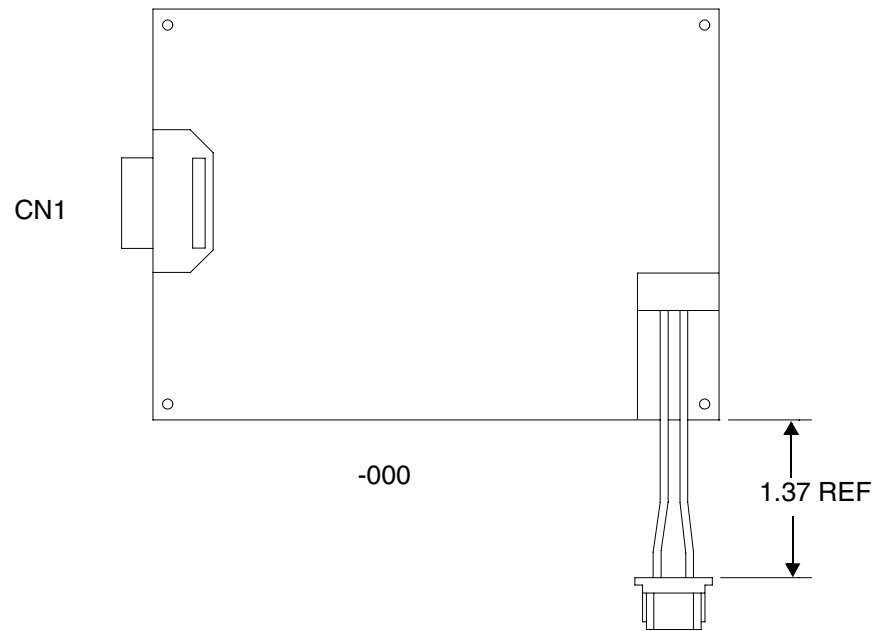


Interconnect

Front Case

11-51

A11 Active Display
PN 3200916

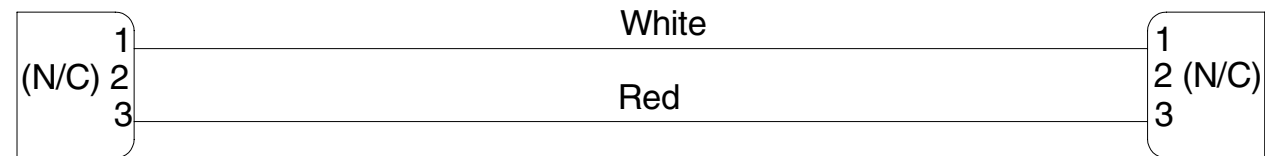
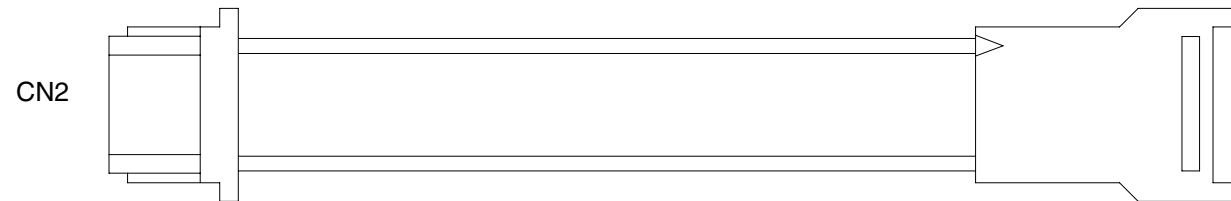


Interconnect

Front Case

11-52

W16 Display Jumper
Cable Extender
PN 3202018

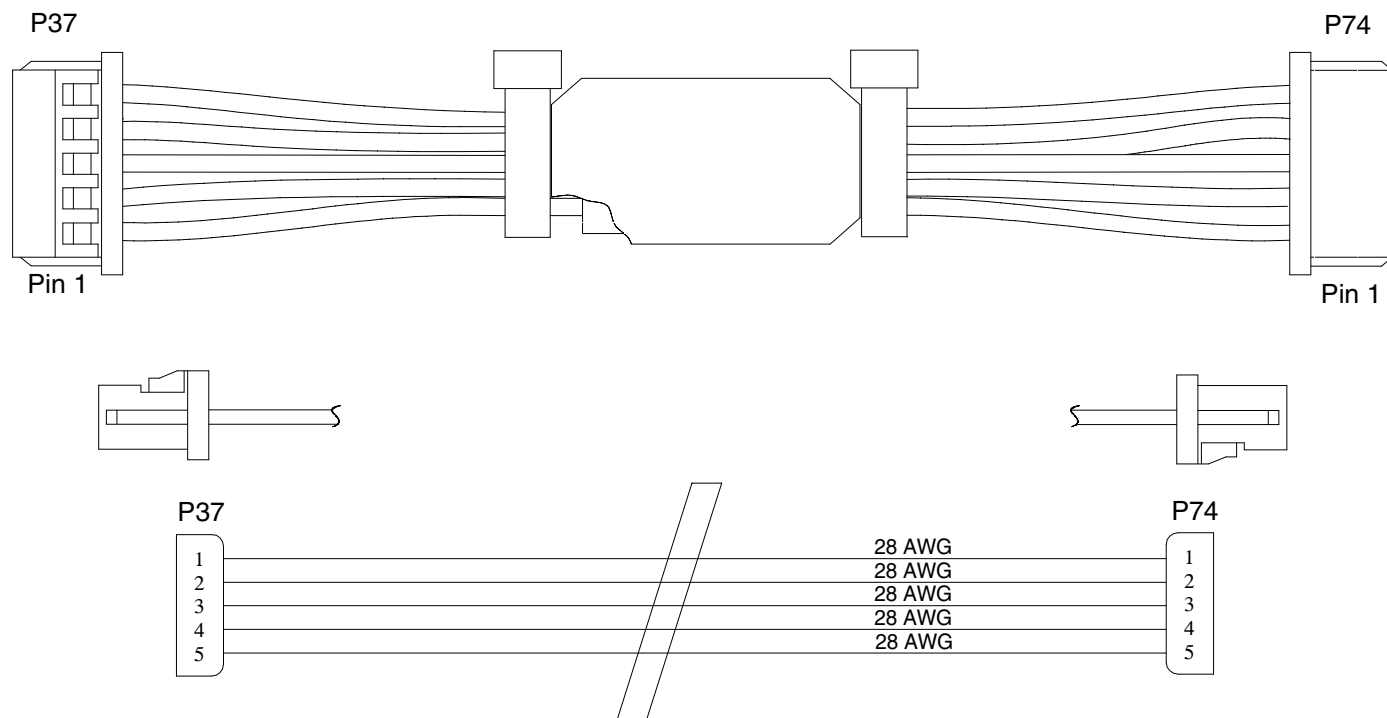


Interconnect

Front Case

11-53

A17 Backlight Inverter Cable PN 3200996

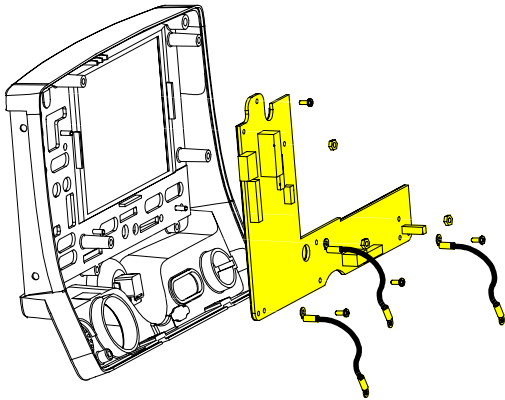


Interconnect

Front Case

11-54

A05 User Interface (UI) PCB Removal



Note: The following assemblies must be removed before beginning this disassembly:

- **Top case**
- **Front case**
- **Active display assembly**

To remove the A05 UI PCB:

1. Disconnect the W18 UI Flex Cable from the A05 UI PCB at J31.
2. Remove the Speed Dial connector from the A05 UI PCB at J32.
3. Remove three 4-40 × .312 screws (173) from the bottom edge of the A05 UI PCB. **Remove two grounding harnesses** (221) attached to the left and right corner screws.

Note: Replace any broken or frayed grounding harnesses.

Note: If replacing A05 UI PCB, transfer grounding harnesses to new PCB.

(Continued on next page)

Front Case

11-55

A05 User Interface (UI) PCB Removal (Continued)

4. Remove one 4-40 × .312 screw (173) from the top left corner of the A05 UI PCB.
5. Remove three 4-40 nuts (161) from the A05 UI PCB. Remove two grounding harnesses attached to the center nut.
6. Remove the A05 UI PCB from the front case.

A05 User Interface (UI) PCB Installation

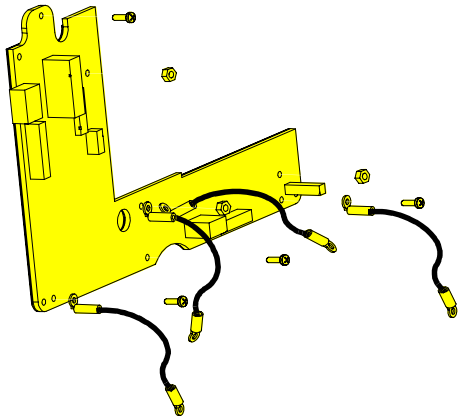
To install the A05 UI PCB:

1. Position the A05 UI PCB onto the front case.

CAUTION!

Possible component damage. The grounding harnesses must be installed at precise angles to avoid damaging defibrillator components.

2. Insert the grounding harness (246) from the W04 Speed Dial Assembly and a second grounding harness (219) to the lower center stud and install three 4-40 nuts (161) onto the A05 UI PCB. Refer to [Grounding Harness Orientation](#) for grounding harness placement.



(Continued on next page)

Front Case

11-56

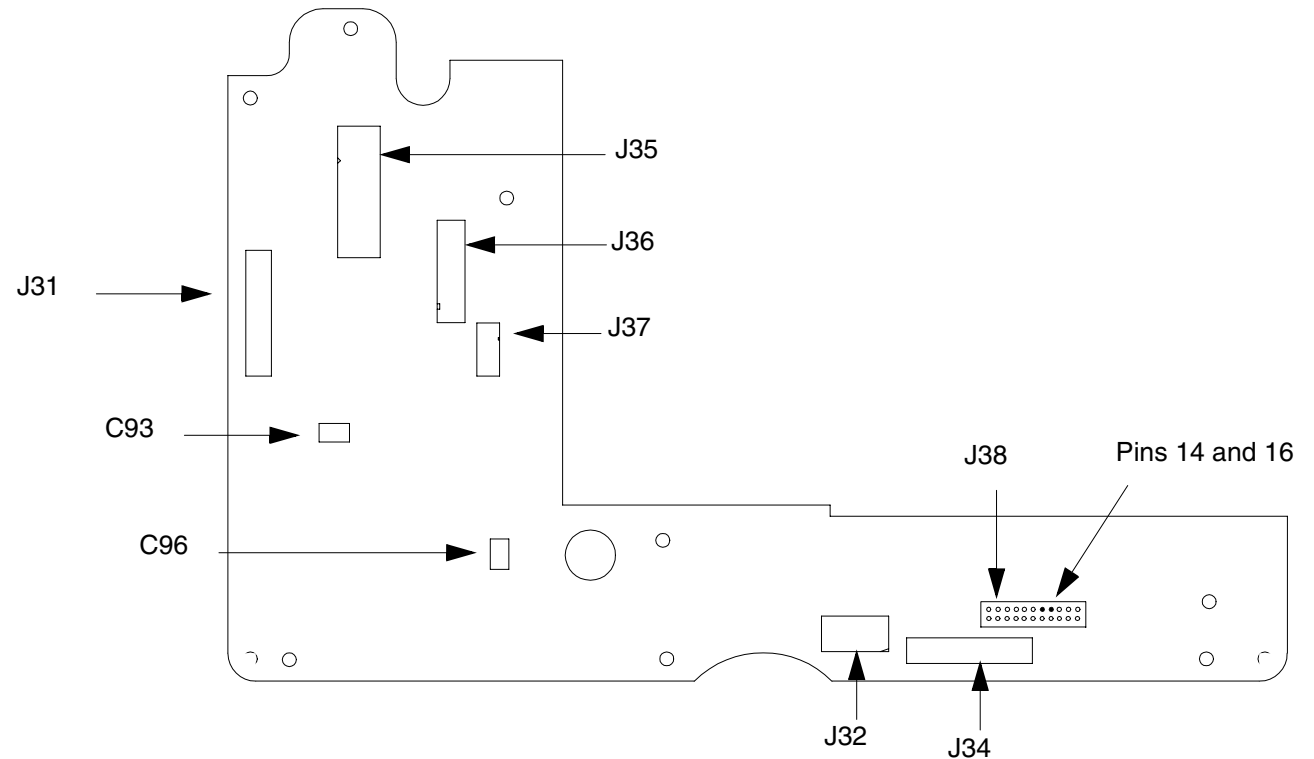
A05 User Interface (UI) PCB Installation (Continued)

3. **Install two grounding harnesses** (221) onto the lower left and right 4-40 × .312 screws (173).
4. Install four 4-40 × .312 screws (173) onto the A05 UI PCB. Refer to **Grounding Harness Orientation** for grounding harness placement.
Note: Replace any broken or frayed grounding straps.
5. Install the Speed Dial connector to the A05 UI PCB at J32.
6. Connect the W18 UI Flex Cable to the A05 UI PCB at J31.
7. **Install the active display** assembly (complete Steps 1 through 9).
8. **Install the front case** (complete Steps 1 through 6).
9. **Install the top case** (complete Steps 1 through 6).
10. **Install the A07 Battery.**
11. Review the **labels parts list** and install new labels.
12. **Complete the PIP.**

Front Case

11-57

A05 User Interface PCB
PN 3201996

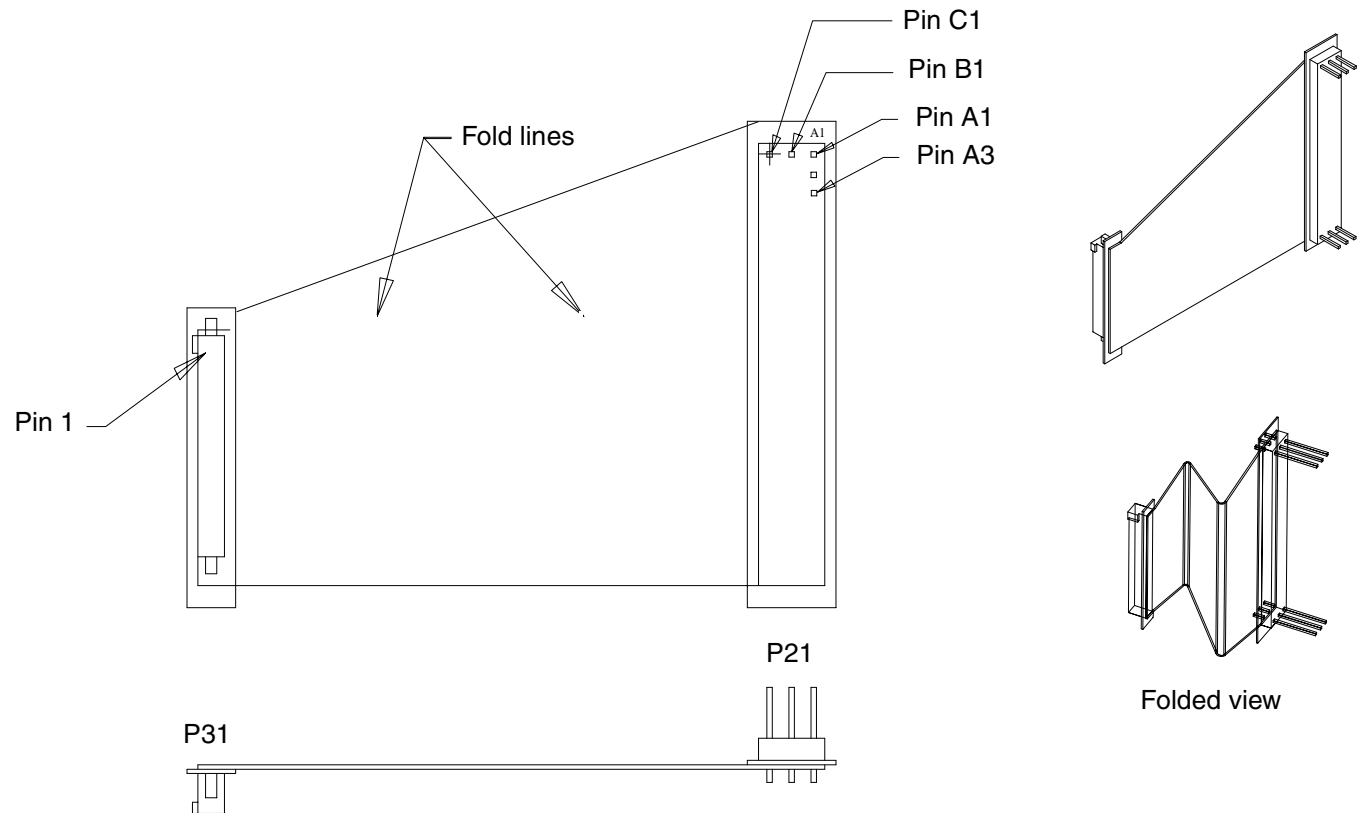


Interconnect

Front Case

11-58

W18 UI Flex Cable
PN 3201000



Interconnect

Front Case

11-59

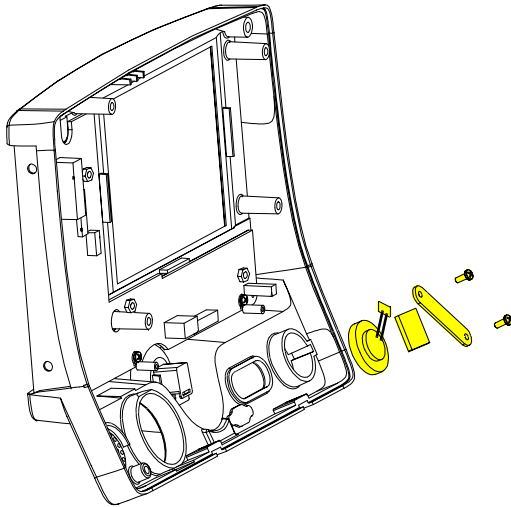
W02 Speaker Assembly Removal

Note: The following assemblies must be removed before beginning this disassembly:

- **Top case**
- **Front case**

To remove the W02 Speaker Assembly:

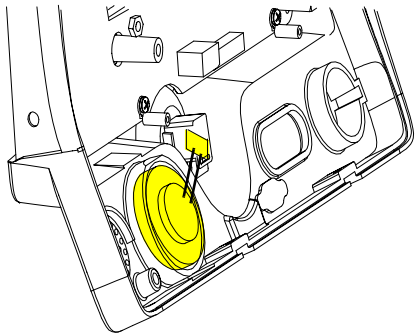
1. Disconnect the speaker cable from the W25 Speaker Harness Extension Cable connector.
2. Remove two 4-40 × .312 screws (173) from the speaker mounting bracket (41) and remove the speaker mounting bracket from the front case.
3. Remove the W02 Speaker Assembly from the front case.



Front Case

11-60

W02 Speaker Assembly Installation



To install the W02 Speaker Assembly:

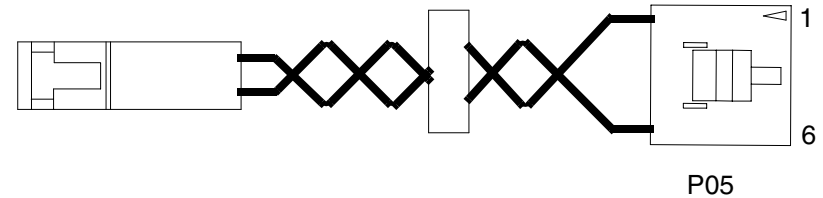
1. Fit the W02 Speaker Assembly into the front case and position cable at the 2:00 position, refer to the graphic at the left.
2. Place the speaker mounting bracket (41) over the foam spacer and install two 4-40 × .312 screws (173).
3. Connect the speaker cable to the W25 Speaker Harness Extension Cable connector. Refer to the W25 Speaker Harness Extension Cable Removal and Installation for more information on the extension cable.
4. **Install the front case** (complete Steps 1 through 6).
5. **Install the top case** (complete Steps 1 through 6).
6. **Install the A07 Battery.**
7. Review the **labels parts list** and install new labels.
8. **Complete the PIP.**

Front Case

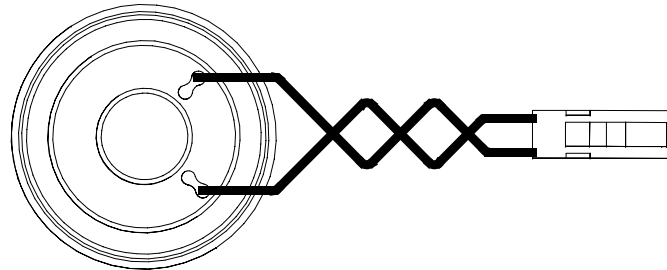
11-61

W02 Speaker Assembly and W25 Speaker Harness Extension Cable

Speaker Assembly, Extension Cable (Bottom Case)
PN 3201593-002



Speaker Assembly (Front Case)
PN 3201593-002



Interconnect

Boardstack

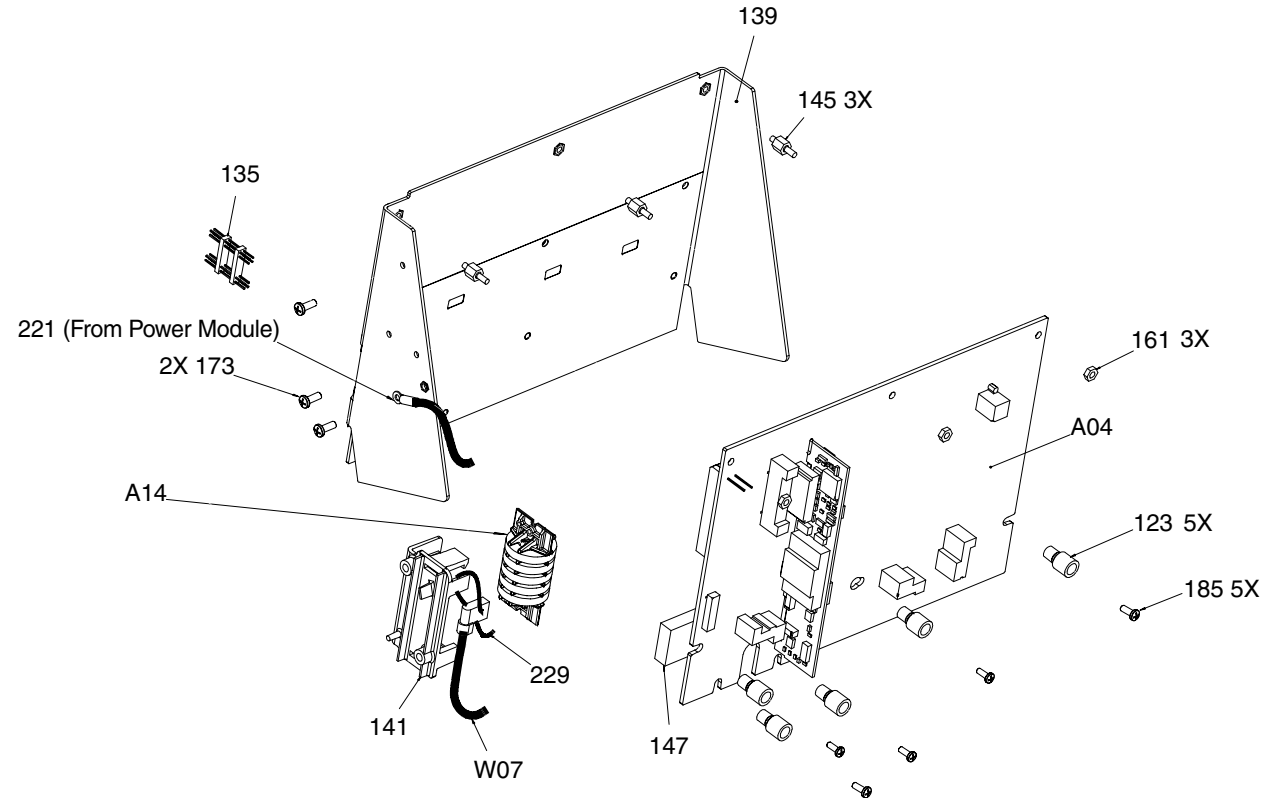
11-63

Exploded View (Therapy PCB)

Therapy PCB Removal

■ Inductive Resistor

Therapy PCB Installation



Parts A01–129

Parts 135–252

System View

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Boardstack

11-64

Parts List (1 of 2)

Item	Quantity	Part Number	Part Description	Note
A01	1	3201964-005	System PCB	Part of Kit PN 3202718-004
A02	1	3202621	Patient Parameter PCB	Part of Kit PN 3202718-006
A04	1	3202611-000	Therapy PCB (With Pacing)	Part of Kit PN 3202718-002
A04	1	3202611-001	Therapy PCB (Without Pacing)	Part of Kit PN 3202718-003
A06	1	3201950	OEM PCB (SpO2 Models Only)	Part of Kit PN 3202718-005
A10	1	3200928-001	SpO2 Module	Masimo MS5 Rev E
A14	1	3010212-007	Inductive Resistor	Part of Kit PN 3202718-015
W07	1	3202383-001	Capacitor Discharge Cable	Part of Kit PN 3202718-012
121	1	3201511-250	Standoff Round Snap, Nylon	Part of Kit PN 3202718-005
123	6	3201374-005	ISO Mount Therapy/System	Part of Various Kits
125	1	202253-771	Screw 4-40 × .937L	Part of Kit PN 3202718-004
127	1	3200927-004	PCB Stack Shield	
129	5	3201375-004	Standoff-M/M .250 hex, .375	

Parts 135–252

System View

Therapy View

Boardstack

11-65

Parts List (2 of 2)

Item	Quantity	Part Number	Part Description	Note
135	1	3201007-002	Board Stack Connector	Part of Kit PN 3202718-004
139	1	3200639-003	PCB Support Bracket	
141	1	3201415-003	Inductive Resistor Bracket	Part of Kit PN 3202718-015
145	3	3201375-005	Standoff .250M/M, .250L	
147	1	3201111-000	Thermally Conductive Pad	Part of Various Kits
149	4	3201374-004	ISO Mount OEM/PP	Standoff
161	9	200805	Hex Nut 4-40	
173	6	202253-761	Machine Screw 4-40, .312L	
185	5	202253-764	Machine Screw 4-40, .500L	Part of Various Kits
229	1	200536-001	Cable Tie Retainer	
232	1	3009482-002	Dielectric Shield .48 x .70	Part of Kit PN 3202718-005
252	6	201874-270	Machine Screw SEMS 4-40, .312L	

Parts A01–129

System View

Therapy View

Boardstack

11-66

Repair Procedures

Boardstack Disassembly

To disassemble the boardstack:

1. **Remove the A07 Battery.**
2. **Remove the top case.**
3. **Remove the front case** from the defibrillator.
4. **Remove the boardstack assembly** from the defibrillator.
5. **Remove the A10 SpO2 PCB.**

Note: Do not remove the A10 SpO2 PCB unless it is being replaced.

6. **Remove the A06 OEM/A02 PP PCB.**
7. **Remove the A01 System PCB.**
8. **Remove the A04 Therapy PCB.**

Boardstack

11-67

Boardstack Reassembly

To reassemble the boardstack:

1. **Install the A04 Therapy PCB.**
2. **Install the A01 System PCB.**
3. **Install the A06 OEM/A02 PP PCB.**
4. **Install the A10 SpO2 PCB**, if removed.

Note: Do not remove the A10 SpO2 PCB unless it is being replaced.

5. **Install the boardstack assembly** into the defibrillator.
6. **Install the front case** (complete Steps 1 through 6).
7. **Install the top case** (complete Steps 1 through 6).
8. **Install the A07 Battery.**
9. Review the **labels parts list** and install new labels.
10. **Complete the PIP.**

Boardstack

11-68

Boardstack Removal

WARNING!

Possible shock and device damage. It is possible to pinch and damage wires during disassembly. To avoid pinching wires, carefully follow disassembly instructions.

Note: Remove the following assemblies before beginning this disassembly:

- **Top case**
- **Front case**

To remove the boardstack assembly:

1. Turn the defibrillator so the ECG and therapy connectors are in view and turn the defibrillator on its left side.
2. Disconnect one grounding harness (219), connecting the power module to the PCB support bracket (139), by removing the screw .

Note: Replace the grounding harness if broken or frayed.

3. Turn the defibrillator so the ac power connector is in view.
4. Disconnect the W10 4-pin Power Cable from the A04 Therapy PCB at J17.

(Continued on next page)

Boardstack

11-69

Boardstack Removal (Continued)

5. Lift the boardstack assembly out of its track and tilt forward to make the lower connections accessible.
6. Disconnect the W09 26-pin cable from the A04 Therapy PCB at J16 by releasing the outer tabs.
7. Disconnect the W01 Therapy Control cable from the A04 Therapy PCB at J14.
8. Disconnect the W07 Capacitor cable from the A04 Therapy PCB at J2.
9. Disconnect the QUICK-COMBO cable at J13.
10. Turn the device so that the ECG and therapy connectors are in view.
11. Disconnect the W03 IrDA flex cable from the A01 System PCB at J8 by removing one screw (252).

(Continued on next page)

Boardstack

11-70

Boardstack Removal (Continued)

CAUTION!

Possible component damage. The OEM/SpO2 flex cable is secured to locking posts. Remove the plug and the locking post simultaneously to avoid damage to the Connector.

12. Disconnect the W05 SpO2 Flex Cable from the A06 OEM/SpO2 PCB at J54.
13. Disconnect the W06 ECG Flex Cable from the A02 PP PCB at J23.
14. Disconnect the W25 Speaker Harness Extension Cable from the A01 System PCB at J5.
15. Lift the boardstack assembly away from the bottom case.
16. Disconnect the A14 Inductive Resistor Cable from the A04 Therapy PCB at J1.
17. Remove two 4-40 × .312 screws (173) connecting the A14 Inductive Resistor to the PCB support bracket (139).

Boardstack

11-71

Boardstack Installation

To install the boardstack assembly:

1. Turn the defibrillator so that the power connector is visible and lower the boardstack assembly into its track. The boardstack assembly will not seat in the tracks correctly if the therapy wires do not slide into the notch cut for them in the boardstack assembly.
2. Place the A14 Inductive Resistor in the inductive resistor bracket (141).
3. Install the inductive resistor bracket (141) onto the PCB support bracket (139) using two 4-40 × .312 screws (173).
4. Connect the A14 Inductive Resistor Cable to the A04 Therapy PCB at J1. Route the cable as shown on [page 11-12](#).
5. Tie wrap the W07 Capacitor Discharge Cable to the inductive resistor bracket (141).
6. Connect A13 Energy Capacitor Cable to the A04 Therapy PCB at J2.
7. Route the W07 Capacitor Discharge Cable with the inductive resistor cable.

(Continued on next page)

Boardstack

11-72

Boardstack Installation (Continued)

8. Connect the 6-pin therapy connector to the A04 Therapy PCB at J13.
9. Connect the 10-pin therapy connector to the A04 Therapy PCB at J14.
10. Connect the W09 26-Pin Power Cable to the A04 Therapy PCB at J16.
11. Seat the boardstack assembly into the bottom case.
Note: Ensure that the therapy connector cable slides into the slot in the A04 Therapy PCB.
12. Connect the 4-pin power module connector to the A04 Therapy PCB at J17.
13. Turn the device so that the ECG and therapy connectors are in view.
14. Connect the W25 Speaker Harness Extension Cable to the A01 System PCB at J5.
15. Connect the ECG cable to the A02 PP PCB at J23.

(Continued on next page)

Boardstack

11-73

Boardstack Installation (Continued)

16. Connect the W05 SpO2 Cable (if included) to the OEM PCB at J54.
Note: Carefully align the SpO2 and IrDA connectors to the sockets, and gently press the connectors into the sockets using steady pressure to avoid damage to connector pins.
17. Connect the W03 IrDA Flex Cable to the A01 System PCB at J08 using one 4-40 × .312 screw (252).
18. Install the grounding harness (219) from the power module to the support bracket (139) using one screw (173).
19. **Install the front case** (complete Steps 1 through 6).
20. **Install the top case** (complete Steps 1 through 6).
21. **Install the A07 Battery.**
22. Review the **labels parts list** and install new labels.
23. **Complete the PIP.**

Boardstack

11-74

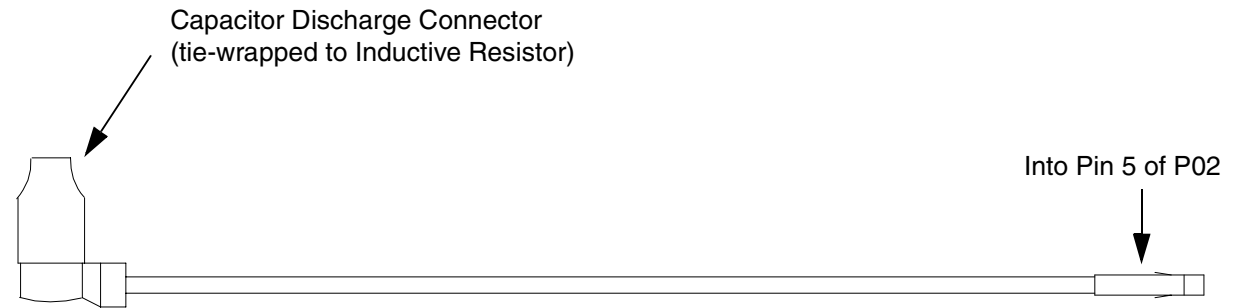
W07 Capacitor Discharge Cable Removal and Installation

The W07 Capacitor Discharge Cable is part of the capacitor replacement kit. Complete the [A13 Energy Capacitor Removal procedure](#) to remove the cable. Complete the [A13 Energy Capacitor Installation procedure](#) to install the cable.

Boardstack

11-75

W07 Capacitor
Discharge Cable
PN 3202383

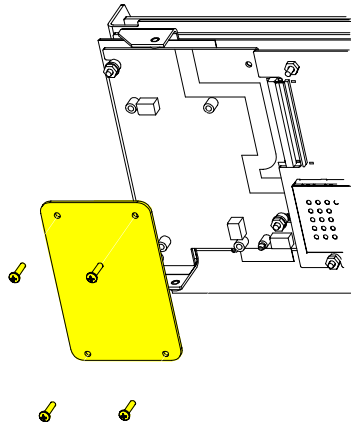


Interconnect

Boardstack

11-76

A10 SpO2 PCB Removal



Note: Remove the following assemblies before beginning this disassembly:

- **Top case**
- **Front case**
- **Boardstack assembly** (optional removal)

To remove the SpO2 PCB:

1. Remove four 4-40 × .312 screws (252) from the A10 SpO2 PCB.
2. Lift the A10 SpO2 PCB away from the boardstack assembly.

A10 SpO2 PCB Installation

To Install the A10 SpO2 PCB:

1. Position the A10 SpO2 PCB into position over the A06 OEM PCB.
2. Install four 4-40 × .312 screws (252) into the A10 SpO2 PCB.
3. **Install the front case** (complete Steps 1 through 6).

(Continued on next page)

Boardstack

11-77

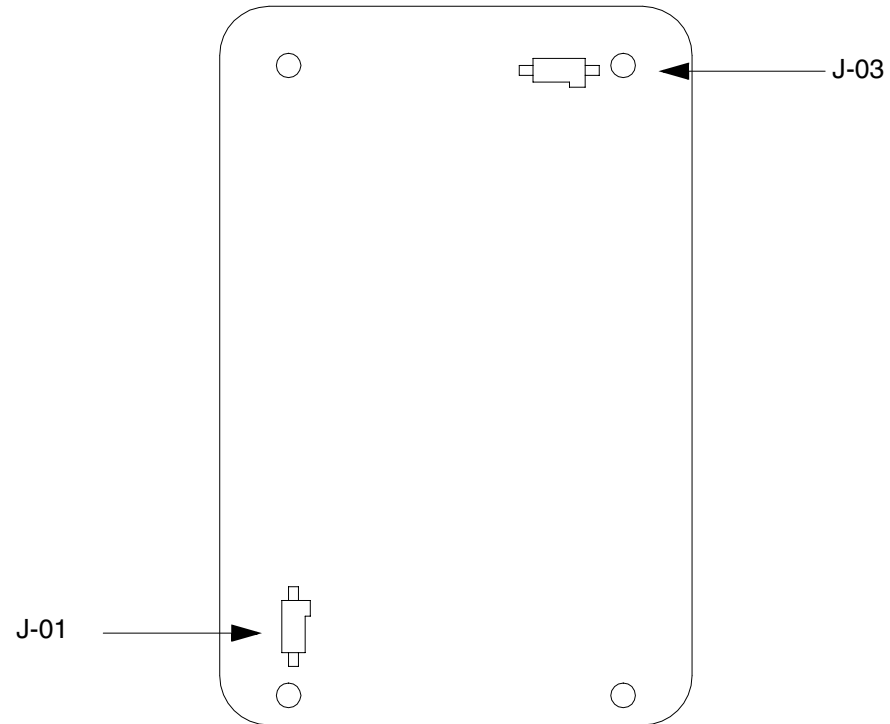
A10 SpO2 PCB Installation (Continued)

4. **Install the top case** (complete Steps 1 through 6).
5. **Install the A07 Battery.**
6. Review the **labels parts list** and install new labels.
7. **Complete the PIP.**

Boardstack

11-78

A10 SpO2 PCB
PN 3200928



Interconnect

Boardstack

11-79

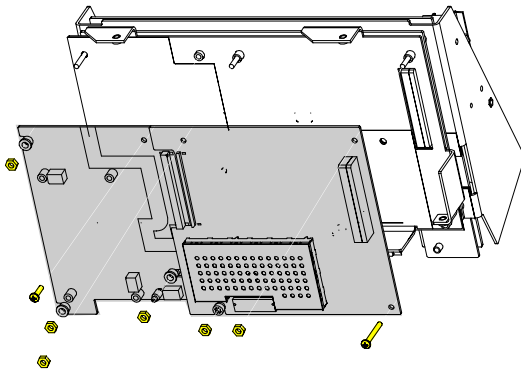
A02 Patient Parameter and OEM/SpO2 PCB Removal

Note: Remove the following assemblies before beginning this disassembly:

- **Top case**
- **Front case**
- **Boardstack** assembly (optional removal)
- **A10 SpO2** (optional removal)

To remove the A02 Patient Parameter and A06 OEM/SpO2 PCB assemblies:

1. Remove three 4-40 nuts (161) from the A02 Patient Parameter PCB. One nut is secured to an insulated standoff.
2. Remove one 4-40 × .937 screw (125) from the A02 Patient Parameter PCB.
 - If your LIFEPAK 20 defibrillator/monitor has A06 OEM/SpO2, proceed to Step 3.
 - If your LIFEPAK 20 defibrillator/monitor does not have A06 OEM/SpO2, proceed to Step 5.
3. Remove three 4-40 nuts (161) from three insulated standoffs on the A06 OEM/SpO2 PCB assembly .

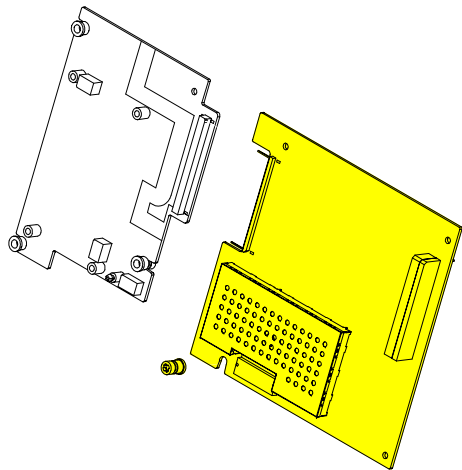


(Continued on next page)

Boardstack

11-80

A02 Patient Parameter and OEM/SpO2 PCB Removal (Continued)



4. Remove one 4-40 × .312 screw (252) from the A06 OEM/SpO2 PCB assembly.
5. Lift the A02 Patient Parameter PCB (and A06 OEM/SpO2 PCB assembly, if applicable) away from the boardstack assembly. Ensure that the PCB clears the lip on the frame in the lower right corner.
6. Separate the A02 Patient Parameter PCB from the A06 OEM/SpO2 PCB (if applicable) at J24.
7. Ensure that one insulated standoff is installed in the Patient Parameter PCB and three are installed in the OEM PCB (if applicable). Verify the condition of the standoffs.

Note: If replacing the A02 Patient Parameter PCB or A06 OEM PCB, remove the standoffs from the old PCBs, note the condition, and install on the new PCBs. Replace the standoffs if broken or cracked.

Boardstack

11-81

A02 Patient Parameter and OEM/SpO2 PCB Installation

To Install the A02 Patient Parameter and A06 OEM/SpO2 PCB:

1. Ensure that the five threaded standoffs are tight and in good condition.
2. If your defibrillator has A06 OEM/SpO2, connect the A02 Patient Parameter to the A06 OEM/SpO2 PCB at J24.
3. Install the A02 Patient Parameter (OEM/SpO2) PCB onto the five threaded standoffs. Ensure that the PCB clears the lip in the lower right corner and that the 60-pin connector seats correctly.
4. Install three 4-40 nuts (161) and one 4-40 × .937 screw (125) onto the A02 Patient Parameter PCB.
5. If included, install three 4-40 nuts (161) and one 4-40 × .312 screw (252) onto the A06 OEM/SpO2 PCB assembly.
6. **Install the A10 SpO2 PCB** (if previously removed).
7. **Install the front case** (complete Steps 1 through 6).
8. **Install the top case** (complete Steps 1 through 6).
9. **Install the A07 Battery.**

(Continued on next page)

Boardstack

11-82

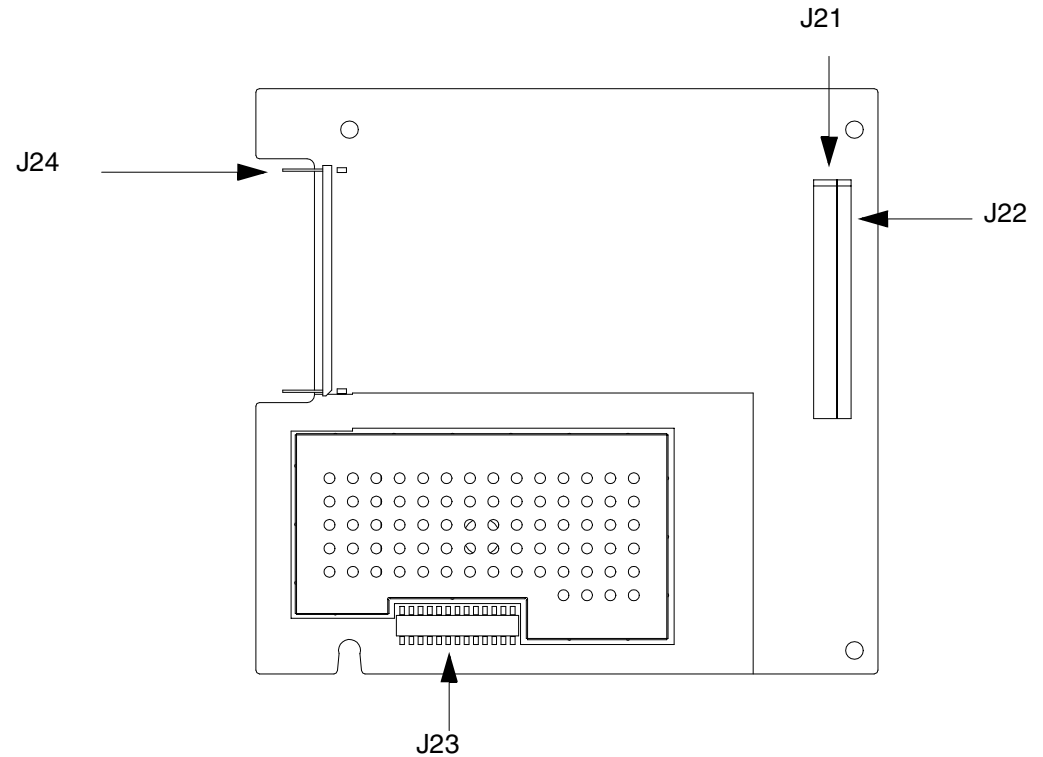
A02 Patient Parameter and OEM/SpO2 PCB Installation

10. Review the **labels parts list** and install new labels.
11. **Complete the PIP.**

Boardstack

11-83

A02 Patient Parameter
PCB PN 3201948

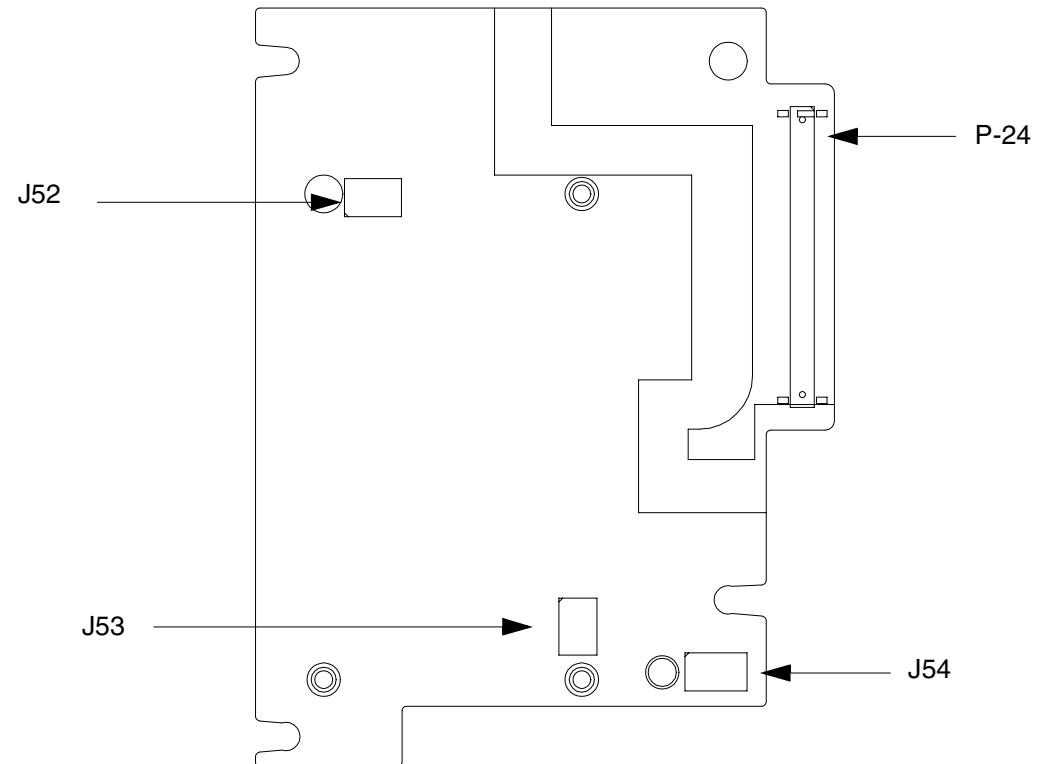


Interconnect

Boardstack

11-84

A06 OEM PCB
PN 3201950



Interconnect

Boardstack

11-85

Coin Battery Replacement

Note: Remove the following assemblies before beginning this disassembly:

- **Top case**
- **Front case**
- **Boardstack assembly** (optional removal)
- **A02 Patient Parameter PCB** (SpO2/OEM PCB if applicable)

To replace the coin battery:

1. Remove the patient parameter shield (127).
2. Lift up the left side of the battery until it is released by the housing.
3. Install new coin battery.
4. Replace the PCB shield (127).
5. **Install the A02 Patient Parameter PCB and A06 OEM PCB assembly.**
6. **Install the A10 SpO2 PCB** (if previously removed).
7. **Install the front case** (complete Steps 1 through 6).

(Continued on next page)

Boardstack

11-86

Coin Battery Replacement (Continued)

8. **Install the top case** (complete Steps 1 through 6).
9. **Install the A07 Battery.**
10. Review the **labels parts list** and install new labels.
11. **Complete the PIP.**

Boardstack

11-87

A01 System PCB Removal

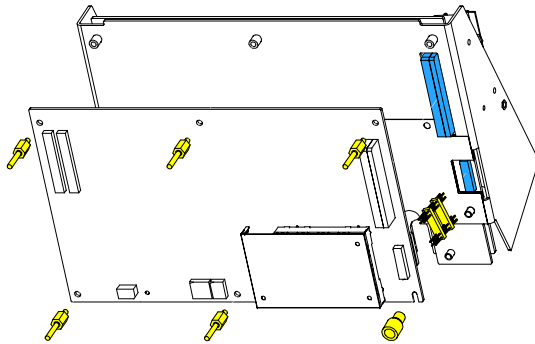
Note: Remove the following assemblies before beginning this disassembly:

- **Top case**
- **Front case**
- **Boardstack** assembly (optional removal)
- **A02 Patient Parameter PCB** (and A06 OEM/SpO2 PCB, if applicable)

To remove the A01 System PCB:

1. Remove the PCB shield (127).
2. Remove five threaded standoffs (129) from the A01 System PCB.
3. Remove one round, snap-in standoff (149) from the A01 System PCB.
4. Remove the A01 System PCB from the PCB Support bracket (139).
5. Locate the 8-pin stack connector (135) (connecting the A01 System PCB J03 with the A04 Therapy PCB J15) and safeguard it for reuse.

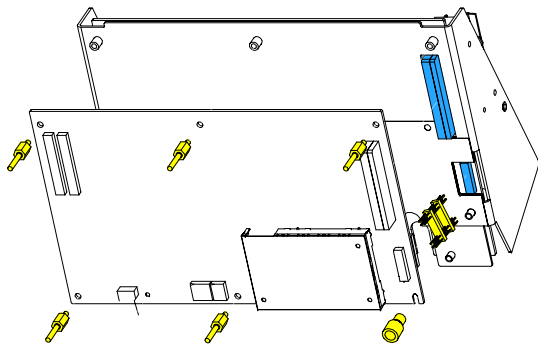
Note: The 8-pin stack connector can remain connected to the A04 Therapy PCB, the A01 System PCB or it could fall out completely, when the A01 System PCB is removed. Be sure to account for it immediately.



Boardstack

11-88

A01 System PCB Installation



To install the A01 System PCB:

1. If you are replacing the A01 System PCB, ensure that the plastic standoff (149) is correctly positioned, large end up, on the A01 System PCB.
2. Insert the 8-pin stack connector (135) into the A04 Therapy PCB at J15.
3. Carefully position the A01 System PCB over the PCB support bracket (139) and slide it down the support bracket standoffs. Ensure that, as the A01 System PCB slides down, the support bracket standoffs and that the pins on the 8-pin and 60-pin stack connectors seat with their connectors evenly.
4. Install five threaded standoffs (129), long end up, into the support bracket.
Note: Do not install a screw in the insulated standoff in the lower right corner at this time.
5. **Replace the coin battery** if needed.
6. Install the PCB shield (127) by sliding it down the five threaded standoffs on the A01 System PCB.

(Continued on next page)

Boardstack

11-89

A01 System PCB Installation (Continued)

7. **Install the A02 Patient Parameter PCB and A06 OEM PCB assembly.**
8. **Install the A10 SpO2 PCB** (if previously removed).
9. **Install the front case** (complete Steps 1 through 6).
10. **Install the top case** (complete Steps 1 through 6).
11. **Install the A07 Battery.**
12. Review the **labels parts list** and install new labels.
13. **Complete the PIP.**

Boardstack

11-90

A01 System PCB
PN 3201964

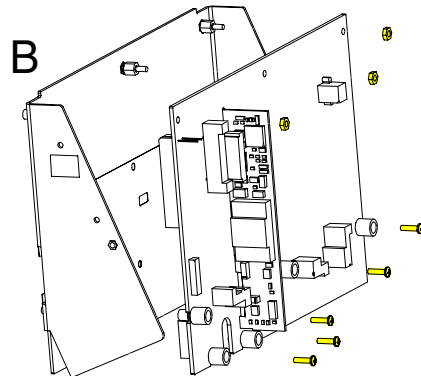
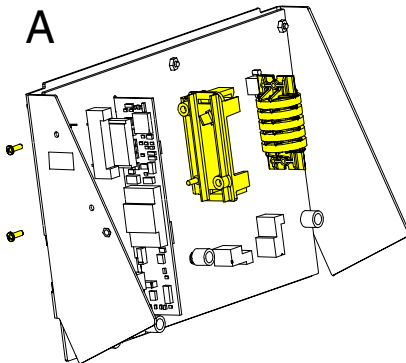


Interconnect

Boardstack

11-91

A04 Therapy PCB Removal



Note: Remove the following assemblies before beginning this disassembly:

- **Top case**
- **Front case**
- **Boardstack assembly**

To remove the A04 Therapy PCB:

1. Remove two 4-40 × .312 screws (173) connecting the inductive resistor bracket (141) to the PCB support bracket (139). Refer to graphic A at left.
2. Remove the inductive resistor bracket (141). Refer to graphic A at left.
3. Remove five 4-40 × .500 screws (185) located inside the five insulated standoffs. Refer to graphic B at left.

Note: The standoffs should remain with the A04 Therapy PCB.

4. Remove three 4-40 nuts (161) from the metal standoffs along the top edge of the A04 Therapy PCB. Refer to graphic B at left.
5. Remove the A04 Therapy PCB from the PCB support bracket (139). Refer to graphic B at left.

(Continued on next page)

Boardstack

11-92

A04 Therapy PCB Removal (Continued)

6. Locate the 8-pin stack connector (135) (connecting the A01 System PCB at J3 with the A04 Therapy PCB at J15) and safeguard it for reuse.

Note: The 8-pin stack connector can remain connected to the A04 Therapy PCB, the A01 System PCB or it could fall out completely, when the A01 System PCB is removed. Be sure to account for it immediately.

Note: If replacing the A04 Therapy PCB, remove the five insulated standoffs (149) from the old Therapy PCB; note the condition, and reinstall them, large end up, on the new A04 Therapy PCB.

Note: Verify the condition of the conductive (147) pad in the lower left corner of the A04 Therapy PCB and replace if worn or damaged.

A04 Therapy PCB Installation

To install the A04 Therapy PCB:

1. If you are replacing the Therapy PCB, ensure that the five plastic standoffs (149) are correctly positioned, large end up, on the PCB.

(Continued on next page)

Boardstack

11-93

A04 Therapy PCB Installation (Continued)

2. If the A01 System PCB is installed on the boardstack assembly, ensure that the 8-pin stack connector (135) and the 60-pin stack connector are securely positioned on the A01 System PCB.
3. Carefully align the A04 Therapy PCB (151) with PCB support bracket (139) and press it into position. Ensure that, as the A04 Therapy PCB slides down the support bracket standoffs, the pins on the 8-pin and 60-pin stack connectors seat with their connectors evenly.
4. Install five 4-40 × .500 screws (185) in the five insulated standoffs (149).
5. Install three 4-40 nuts (161) onto the metal standoffs along the top edge of the A04 Therapy PCB.
6. Secure the A14 Inductive resistor to the PCB support bracket (139) with two 4-40 × .312 screws (173).
7. Route the A14 Inductive Resistor Cable as shown on page 11-11.

(Continued on next page)

Boardstack

11-94

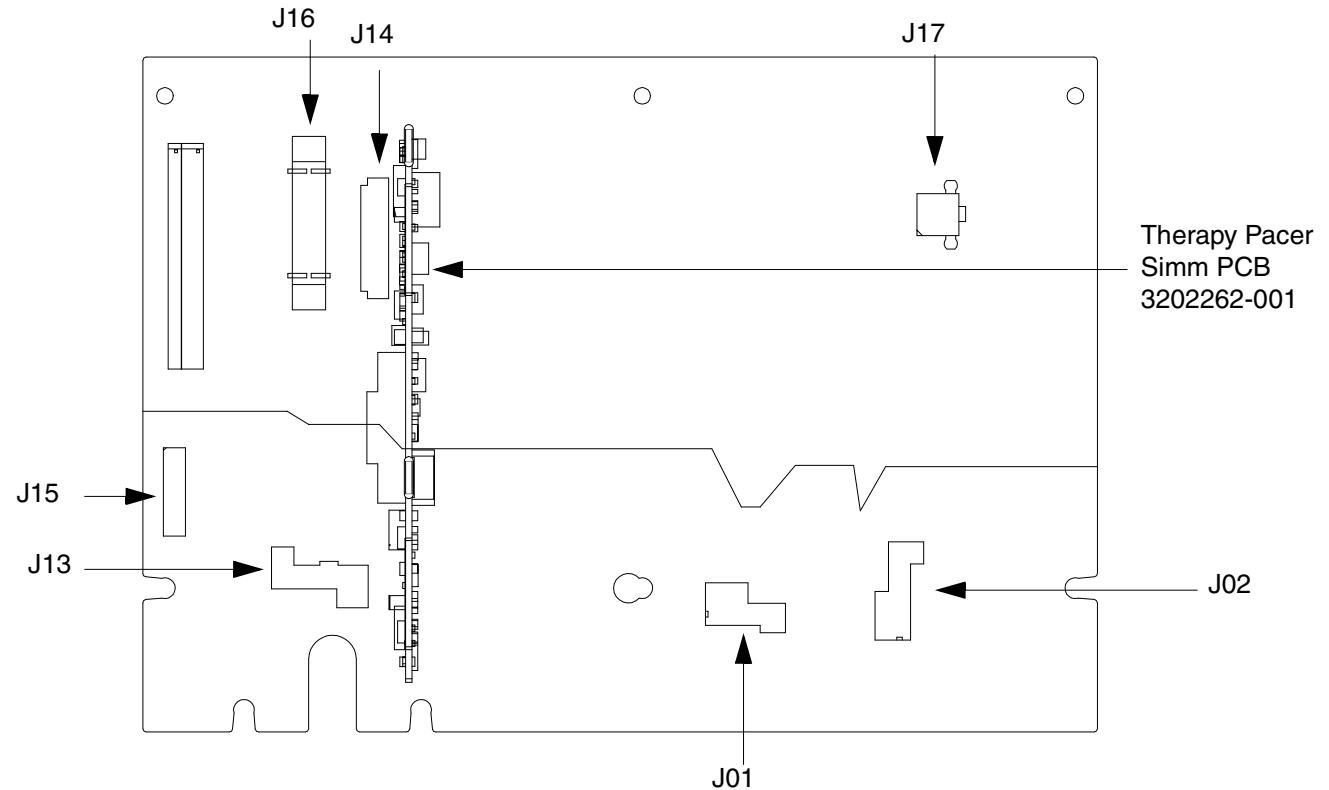
A04 Therapy PCB Installation (Continued)

8. **Install the boardstack assembly** (complete Steps 1 through 18).
9. **Install the front case** (complete Steps 1 through 6).
10. **Install the top case** (complete Steps 1 through 6)
11. **Install the A07 Battery.**
12. Review the **labels parts list** and install new labels.
13. **Complete the PIP.**

Boardstack

11-95

A04 Therapy PCB
(with Pacing)
PN 3202611-000

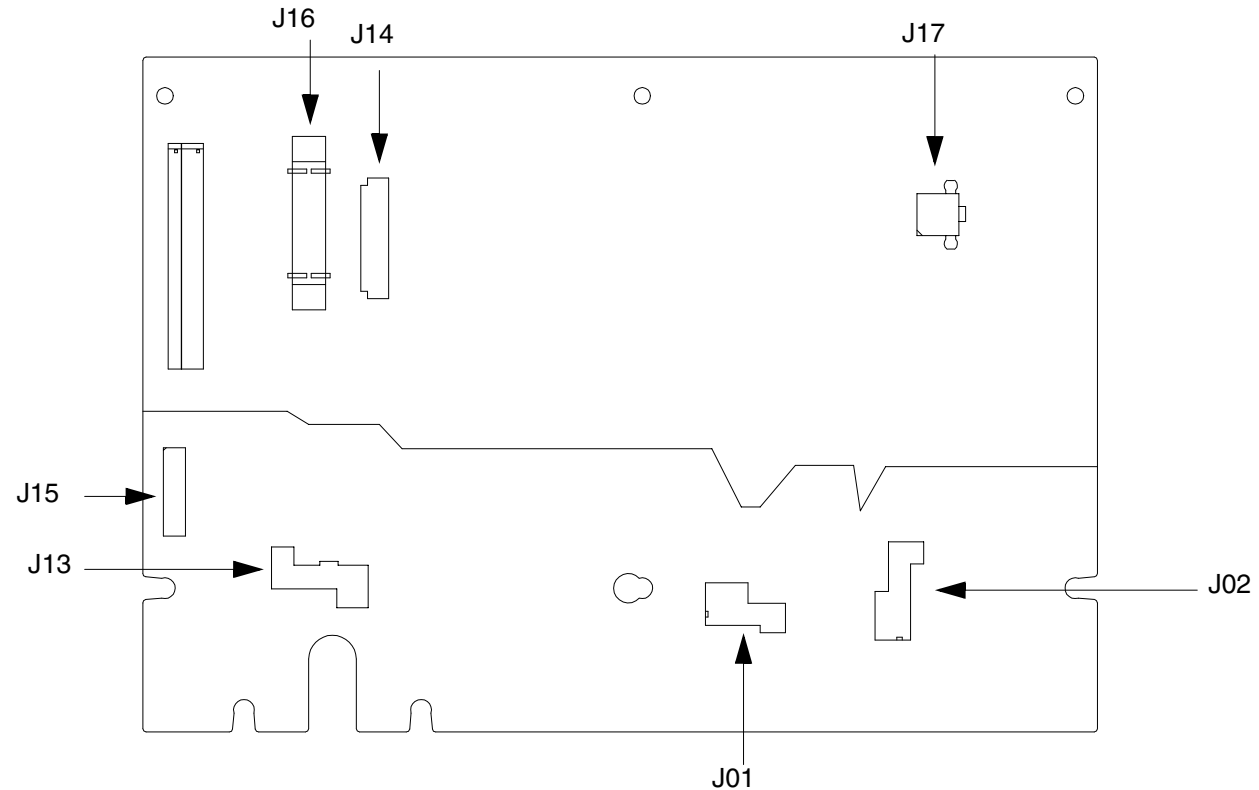


Interconnect

Boardstack

11-96

A04 Therapy PCB
(without Pacing)
PN 3202611-001



Interconnect

Bottom Case

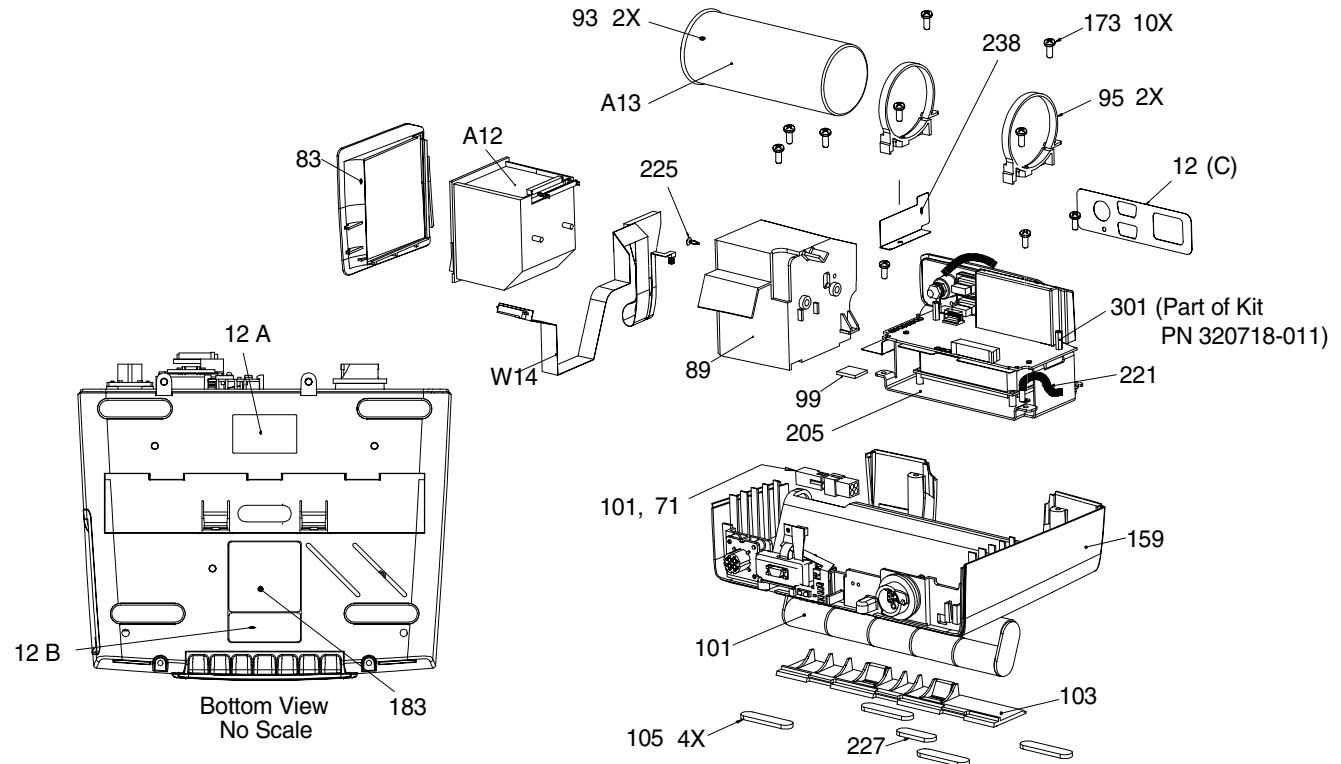
11-97

Exploded View (Modules)

Bottom Case Reassembly Printer Module Removal Printer Module Installation

- Printer
- Printer Flex Cable
- Printer Bezel
- Printer Shroud

Power Module Removal Power Module Installation Capacitor Removal Capacitor Installation



Parts A12–83

Parts 89–162

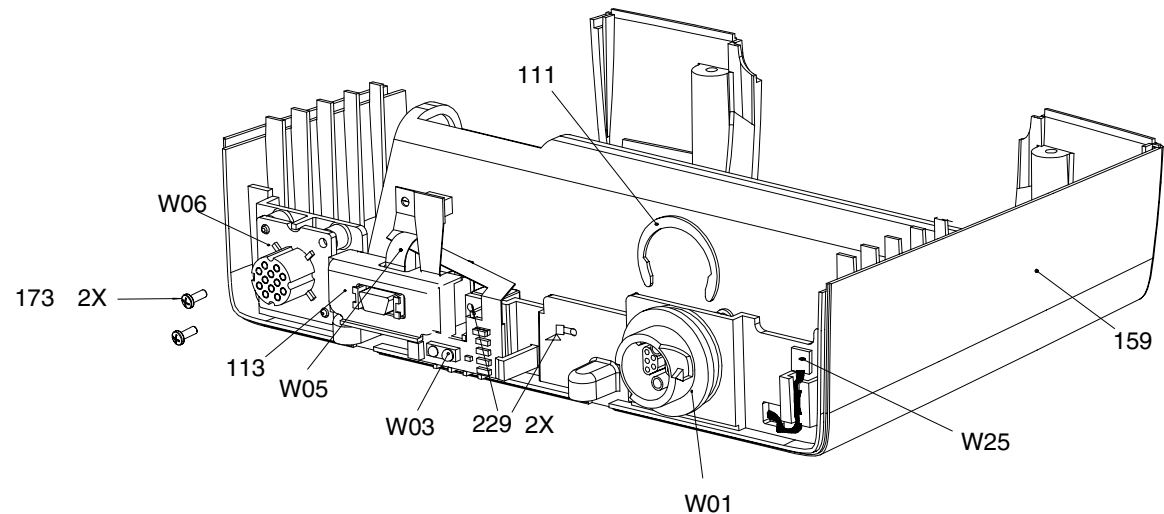
Parts 167–238

Connectors View

Bottom Case

11-98

Exploded View (Connectors)

[Battery Removal](#)[Battery Installation](#)[Therapy Connector Removal](#)[Therapy Connector Installation](#)[ECG Connector Removal](#)[ECG Connector Installation](#)[SpO2 Connector Removal](#)[SpO2 Connector Installation](#)[IrDA Connector Removal](#)[IrDA Connector Installation](#)

Parts A12–83

Parts 89–162

Parts 167–238

Modules View

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Bottom Case

11-99

Parts List (1 of 3)

Item	Quantity	Part Number	Part Description	Note
A12	1	3200920	Printer, Chart Recorder Xena2	White 38-Pin IC
A13	1	3200846-001	Energy Capacitor	Part of Kit PN 3202718-012
W01	1	3200474-004	Therapy Connector Assembly	Part of Kit PN 3202718-014
W03	1	3200926-003	IrDA Flex Assembly	
W05	1	3200925-003	SpO2 Flex Assembly	Part of Kit PN 3202718-013
W06	1	3201010-002	ECG 7 Contact Wired Receptacle	
W09	1	3201241-000	Power to Therapy 26-Pin Cable	
W14	1	3201001-003	Printer Flex Cable	
W25	1	3201593-003	Speaker Assy Harness Extension	
12	(3 parts)	3201640	Label Set (6 labels)	Refer to Label Installation
83	1	3201408	Printer Bezel	

Parts 89–162

Parts 167–238

Modules View

Connectors View

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Bottom Case

11-100

Parts List (2 of 3)

Item	Quantity	Part Number	Part Description	Note
89	1	3200626-003	Printer Shroud	
93	2	804447-36	Foam Spacer (Part of A13 Ass)	Part of Kit PN 3202718-012
95	2	3200922	Capacitor Support Bracket	Part of Kit PN 3202718-011
99	1	3201597	EMI Foam Core Gasket	
101	1	3200497	12 V 3AH NiMH Battery Pak	
103	1	3200628-002	Battery Door	
105	4	802885	Mounting Foot	Part of Bottom Case Assembly
111	1	200040-001	Therapy Connector Clip	Part of Kit PN 3202718-014
113	1	3200921	SpO2 Connector Mounting Clip	Part of Kit PN 3202718-013
159	1	3200625-005	Bottom Case Assembly	
162	1	3009787-003	Capacitor Shield (Part of A13 Assemb.)	Part of Kit PN 3202718-012

Parts A12–83

Parts 167–238

Modules View

Connectors View

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Bottom Case

11-101

Parts List (3 of 3)

Item	Quantity	Part Number	Part Description	Note
167	2	202253-592	Machine Screw 6-32 × 1.75L	
173	12	202253-761	Machine Screw 4-40 × .312L	Part of Kit PN 3202718-011
183	1	3201643-002	Serial Number Label	Refer to Label Installation
205	1	3202131-001	Power Module Assembly	Part of Kit PN 3202718-010
221	1	3202246-001	Grounding Harness	
225	1	3202377-010	Fastener	
227	1	802885-01	Mounting Foot	Attached to Battery Door (103)
229	2	200536-001	Cable Tie Retainer	Part of Kit PN 3202718-012
238	1	3202442	Dielectric Shield	Part of Kit PN 3202718-011

Parts A12–83

Parts 89–162

Modules View

Connectors View

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◀◀ Table of Contents

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Bottom Case

11-102

Repair Procedures

Bottom Case Disassembly

To disassemble the bottom case:

1. **Remove the A07 Battery.**
2. **Remove the top case.**
3. **Remove the front case.**
4. **Remove the boardstack assembly.**
5. **Remove the printer module.**
6. **Remove the capacitor.**
7. **Remove the power module.**
8. **Remove the W01 Therapy Connector.**
9. **Remove the W06 ECG Connector.**
10. **Remove the W05 SpO2 Connector.**
11. **Remove the W03 IrDA Connector.**
12. **Remove the W25 Speaker Harness Extension Cable.**

(Continued on next page)

Bottom Case

11-103

Bottom Case Reassembly

To reassemble the bottom case:

1. Get a new bottom case (if replacing case).
2. Inspect and install the bottom case friction foot pads (105), as needed.
3. Inspect and install the mounting foot (227) to the battery door (103), as needed.
4. **Install the W25 Speaker Harness Extension Cable.**
5. **Install the W03 IrDA Connector.**
6. **Install the W05 SpO2 Connector.**
7. **Install the W06 ECG Connector.**
8. **Install the W01 Therapy Connector.**
9. **Install the power module.**
10. **Install the capacitor.**
11. **Install the printer module.**
12. **Install the boardstack assembly** (complete Steps 1 through 18).

(Continued on next page)

Bottom Case

11-104

Bottom Case Reassembly (Continued)

13. **Install the front case** (complete Steps 1 through 6).
14. **Install the top case** (complete Steps 1 through 6).
15. **Install the A07 Battery.**
16. Review the **labels parts list** and install new labels.
17. **Complete the PIP.**

Bottom Case

11-105

Printer Module Removal

WARNING!

Possible shock and device damage. It is possible to pinch and damage wires during disassembly. To avoid pinching wires, carefully follow disassembly instructions.

To remove the Printer Module:

Note: Remove the following assemblies before beginning this disassembly:

- **Top case**
 - **Front case**
 - **Boardstack** (printer cable)
1. Open the printer door and remove the printer paper roll.
 2. Loosen two captured screws located inside the printer on the rear wall.
 3. Pull the A12 Printer out of the printer shroud.
 4. Disconnect the W14 Printer Flex Cable from the printer at printer connection J1.

(Continued on next page)

Bottom Case

11-106

A12 Printer Module Removal (Continued)

Note: If removing the A12 Printer, the removal process is complete. If removing the printer shroud (89) or the W14 Printer Flex Cable, continue with the removal process until the desired part is removed.

5. Slide the printer bezel (83) up and away from the bottom case.
6. Remove three 4-40 × .312 screws (173) from the bottom of the printer shroud.
7. Lift shroud to access the 4-pin power cable.
8. Disconnect the 4-pin power cable from the A03 Power PCB at J45 and feed through the small shroud cutout.
9. Feed the 4-pin power cable and the W14 Printer Flex Cable through the large shroud cutout.
10. Remove the printer shroud (89) from the bottom case.
11. Lift the W06 ECG Cable out of the way and carefully remove the W14 Printer Flex Cable from the bottom case. The cable is held in place by adhesive, so it should be removed evenly to avoid damaging the connectors or the cable.

Bottom Case

11-107

Printer Module Installation

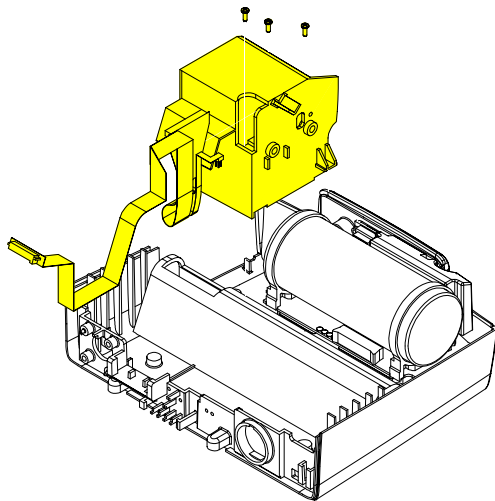
WARNING!

Possible shock and device damage. Carefully follow disassembly instructions to avoid a shock or damage to wires during disassembly.

Note: If installing the A12 Printer, start at Step 8.

To install the printer module:

1. Slide the W14 Printer Flex Cable under the W06 ECG Cable and position the printer cable along right side the guide on the bottom case.
2. Insert the printer cable connector and 4-pin power cable connector through the large slot in the shroud.
3. Insert the 4-pin power connector through the small slot in shroud.
4. Connect the 4-pin power connector to the A03 Power PCB at J45, ensuring that the connector is positioned correctly.
5. Position the printer shroud in the bottom case.
6. Install three 4-40 × .312 screws (173) into the bottom of the printer shroud.

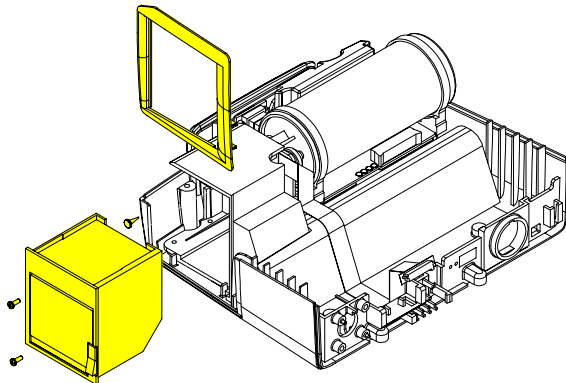


(Continued on next page)

Bottom Case

11-108

A12 Printer Module Installation (Continued)

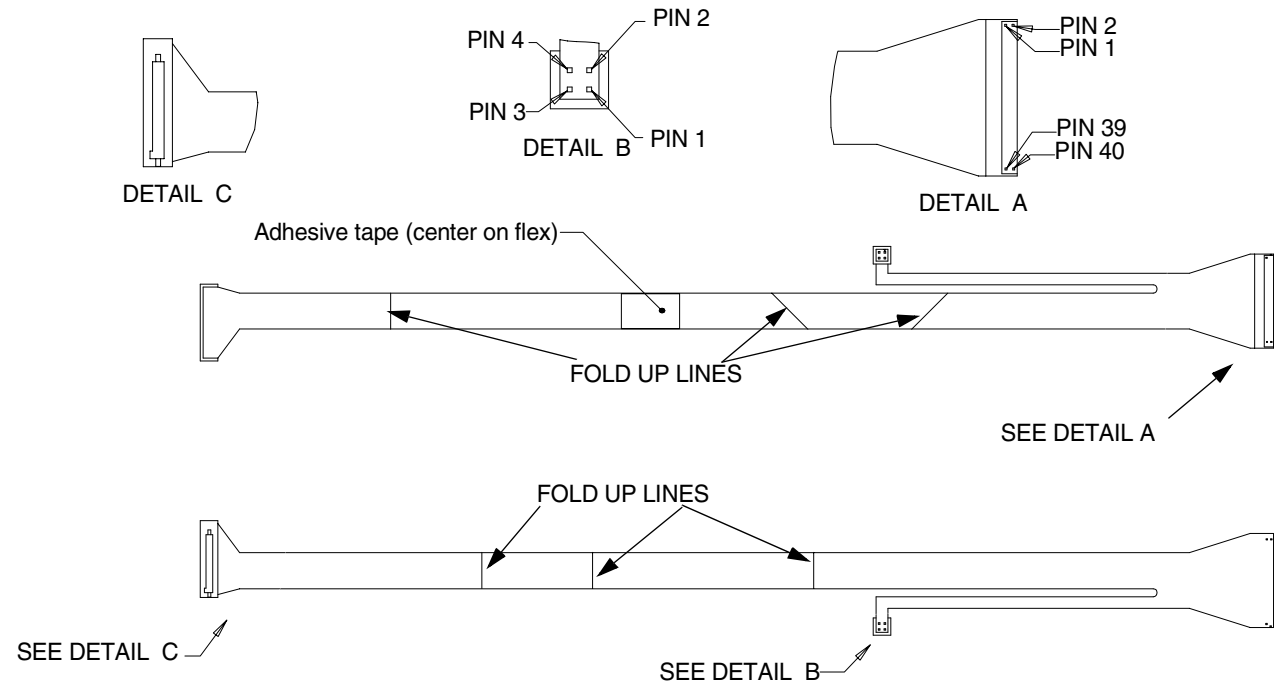


7. If removed, press the fastener (225) into printer shroud to secure the J45 flex connector.
8. Connect the W14 Printer Flex Cable to the J1 connector on the printer. The cable should lay flat against the rear of the printer.
9. Slide the A12 Printer into the printer shroud.
10. Ensure that the W14 Printer Flex Cable lays between the two capture screws.
11. Tighten the two capture screws located in the A12 Printer.
12. Insert the printer bezel (83) ensuring that it is flush with the bottom case.
13. Install the paper roll in the A12 Printer and close the printer door.
14. **Install the boardstack**, if the W14 Printer Flex Cable was replaced.
15. **Install the front case** (complete Steps 1 through 6).
16. **Install the top case** (complete Steps 1 through 6).
17. **Install the A07 Battery**.
18. Review the **labels parts list** and install new labels.
19. **Complete the PIP**.

Bottom Case

11-109

W14 Printer Flex Cable PN 3201001



Interconnect

Bottom Case

11-110

A13 Energy Capacitor Removal

WARNING!

Possible shock and device damage. It is possible to pinch and damage wires during disassembly. To avoid pinching wires, carefully follow disassembly instructions.

Note: Remove the following assemblies before beginning this disassembly:

- **Top case**
- **Front case**

To remove the A13 Energy Capacitor:

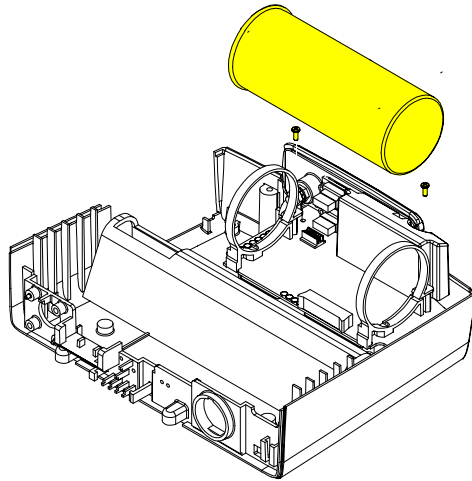
1. If the boardstack assembly is installed in bottom case, disconnect the 4-pin power connector from the A03 Power PCB at J45.
2. Disconnect the W09 26-Pin Cable from the A04 Therapy PCB at J16.
3. Pull the boardstack assembly away from the printer shroud (89) and the power module.
4. Disconnect the Capacitor Cable from the A04 Therapy PCB at J2. The W07 Capacitor Discharge Cable is attached to this connector.

(Continued on next page)

Bottom Case

11-111

A13 Energy Capacitor Removal (Continued)



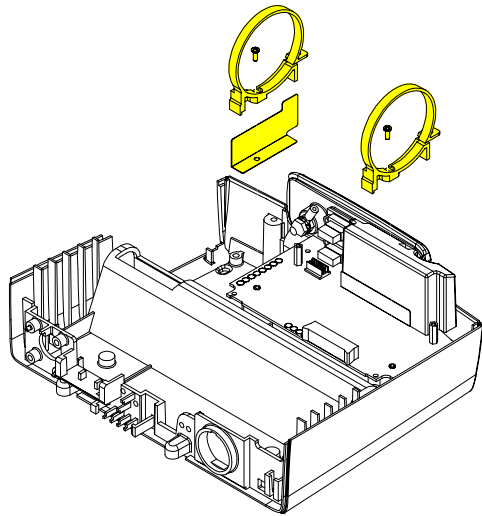
Note: Take care not to damage the adjacent hardware or wires when removing the W07 Capacitor Discharge Cable.

5. Remove the cable tie retainer (229) securing the W07 Capacitor Discharge Cable to the inductive resistor bracket (141).
6. Remove two 4-40 × .312 screws (173) from the rear of the capacitor brackets (95).
7. Lift the capacitor (91) out of the capacitor brackets.
8. If removing the capacitor brackets (95), remove two 4-40 × .312 screws (173) from the front of the capacitor brackets (95) and remove the capacitor brackets (95) and the capacitor shield (238). Refer to the graphic on the next page for more information.

Bottom Case

11-112

A13 Energy Capacitor Installation



To install the A13 Energy Capacitor:

1. Ensure that two capacitor bracket standoffs (22) are on the power module.
2. Install the capacitor shield (238) and two capacitor brackets (95) onto the standoffs using two 4-40 × .312 screws (173), if brackets were removed, as shown in the graphic at left.
3. Inspect the A13 Energy Capacitor ensuring that the plastic sleeve and poron tape are positioned correctly and securely.

Note: The plastic sleeve must be wrapped tightly around the capacitor, with the wrap join at the top of the capacitor. Poron tape must secure the sleeve at both ends of the capacitor.

4. Install the capacitor into the capacitor brackets (95) with the capacitor cable end toward the printer shroud and the warning label visible at the top of the capacitor.
5. Install two 4-40 × .312 screws (173) into the capacitor brackets and tighten, ensuring that the capacitor brackets are centered on the poron tape.

(Continued on next page)

Bottom Case

11-113

A13 Energy Capacitor Installation (Continued)

6. Connect the capacitor cable to the A04 Therapy PCB at J2. The W07 Capacitor Discharge Cable is attached to this connector.
7. Secure the W07 Capacitor Discharge Cable to the inductive resistor bracket (141) with a cable tie retainer (229). Route the cable over the A04 Therapy PCB using the same routing (refer to [Page 11-12](#)) as the inductive resistor cables.
8. install the power module, if not installed.
9. Install the boardstack assembly (complete Steps 1 through 18), if not installed, and connect the 4-pin power cable to the A03 Power PCB at J45 and reseal boardstack assembly.
10. Connect the W09 26-Pin Cable to the A04 Therapy PCB at J16.
11. [Install the front case](#) (complete Steps 1 through 6).
12. [Install the top case](#) (complete Steps 1 through 6).
13. [Install the A07 Battery](#).
14. Review the [labels parts list](#) and install new labels.
15. [Complete the PIP](#).

Bottom Case

11-114

Power Module Removal

WARNING!

Possible shock and device damage. It is possible to pinch and damage wires during disassembly. To avoid pinching wires, carefully follow disassembly instructions.

Note: Remove the following assemblies before beginning this disassembly:

- **Top case**
- **Printer module**
- **Capacitor** (optional removal)
- **Boardstack** (optional removal)

To remove the power module assembly:

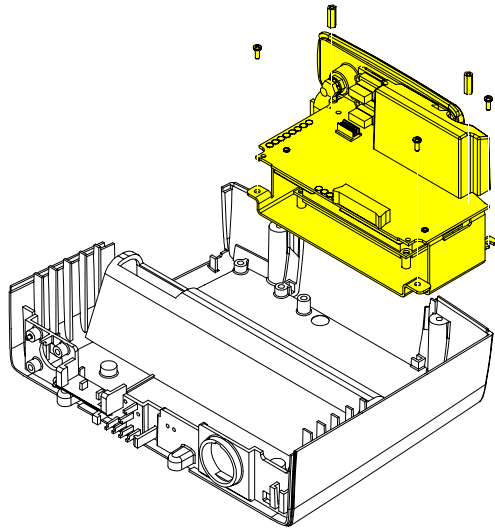
1. If the boardstack assembly is installed in the bottom case, proceed to Step 2. If the boardstack assembly has been removed, proceed to Step 5.
2. Disconnect the 4-pin power cable from the A04 Therapy PCB at J17.
3. Disconnect the W09 26-Pin Cable from the A04 Therapy PCB at J16.

(Continued on next page)

Bottom Case

11-115

Power Module Removal (Continued)



4. Pull the boardstack assembly away from the printer shroud and power module.
5. If replacing the power module, remove the A13 Energy Capacitor, the two capacitor brackets and two capacitor bracket standoffs (22) from the power module.
6. Remove the forward 4-40 × .312 screw (173) securing the right side of the power module.

Note: Remove the grounding harness (221) as you remove the right forward screw. Replace the grounding harness if broken or frayed.

7. Loosen the rear 4-40 × .312 screw (173) securing the right side of the power bracket three turns.
8. Remove one 4-40 × .312 screw (173) to release the left side of the power bracket.
9. Tilt the left side of the power module up, clearing the loosened screw, and remove from the bottom case.

Bottom Case

11-116

Power Module Installation

To install the power module assembly:

1. Ensure that the rear right corner 4-40 × .312 screw (173) is loosely installed (back off 3-5 turns) in the bottom case.
2. Position the power module in the bottom case ensuring that the notch in the rear right lip slips into place under the loosened screw.
3. Install one 4-40 × .312 screw (173) in the power bracket's left forward corner.
4. Insert one 4-40 × .312 screw (173) through the grounding strap (221) ring and install the screw in the power bracket's right forward corner.

Note: If broken or frayed, replace the grounding strap.

5. Tighten the 4-40 × .312 screw (173) in the rear right corner.
6. Install two capacitor bracket standoffs (22) onto the power module.
7. **Install the A13 Energy Capacitor**, if it was removed.
8. **Install the boardstack**, if it was removed.

(Continued on next page)

Bottom Case

11-117

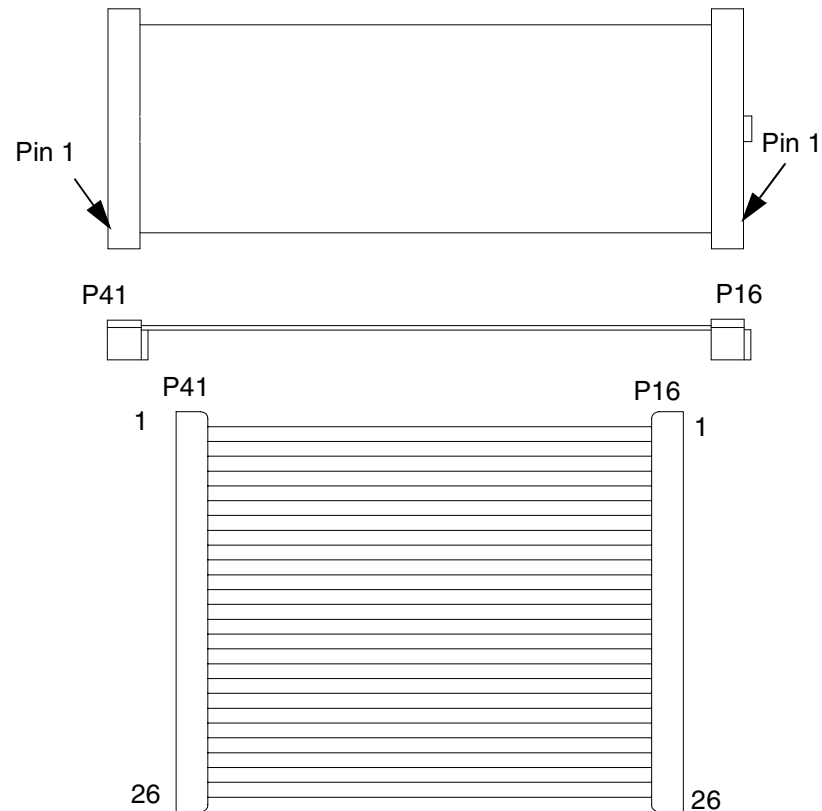
Power Module Installation (Continued)

9. Connect the W09 26-Pin Cable to the A04 Therapy PCB at J16.
10. Connect the 4-pin power cable to the A04 Therapy PCB at J17.
11. Install the A12 Printer Module (complete Steps 1 through 13).
12. **Install the front case** (complete Steps 1 through 6).
13. **Install the top case** (complete Steps 1 through 6).
14. **Install the A07 Battery.**
15. Review the **labels parts list** and install new labels.
16. **Complete the PIP.**

Bottom Case

11-118

W09 26-Pin Cable
PN 3201241

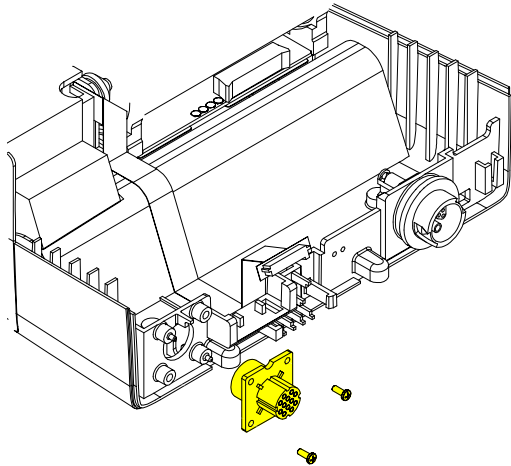


Interconnect

Bottom Case

11-119

W06 ECG Connector Removal



Note: The following assemblies must be removed before beginning this disassembly:

- **Top case**
- **Front case**
- **Boardstack**

To remove the W06 ECG Connector:

1. Remove two 4-40 × .312 screws (173) from W06 ECG Connector located on the bottom case assembly.
2. From outside the case, remove the W06 ECG Connector from the bottom case and feed the ECG cable through the connector hole.

Bottom Case

11-120

W06 ECG Connector Installation

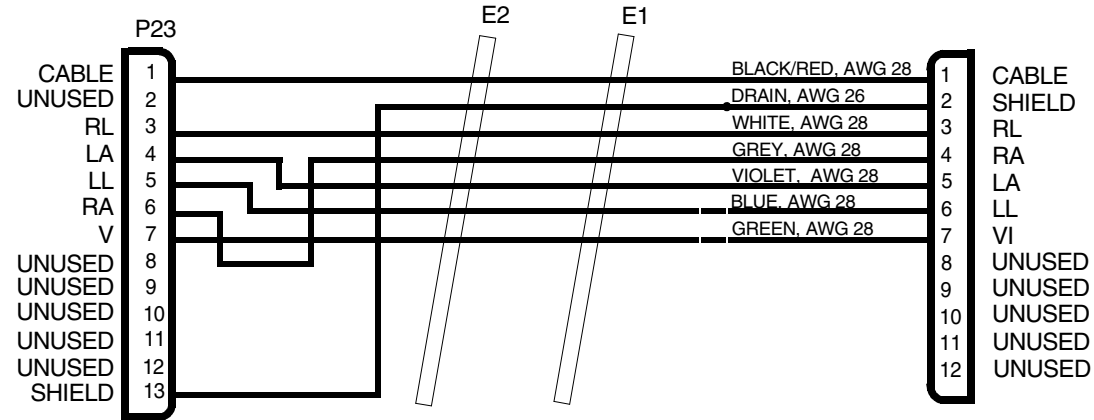
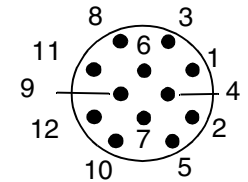
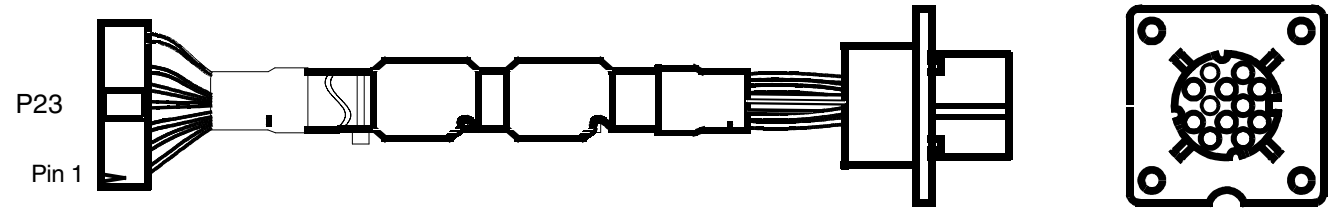
To Install the W06 ECG Connector:

1. On the outside of the case, align the W06 ECG Connector with the connector standoffs and align the key in the connector with the notch in the bottom case and slide the ECG connector into position.
2. Install two 4-40 × .312 screws (173) into the W06 ECG Connector.
3. Position the cable in the slot between the first rib and the forward left corner of the bottom case.
4. Place the first ferrite bead in its slot in the bottom case.
5. **Install the boardstack assembly** (complete Steps 1 through 18).
6. **Install the front case** (complete Steps 1 through 6).
7. **Install the top case** (complete Steps 1 through 6).
8. **Install the A07 Battery.**
9. Review the **labels parts list** and install new labels.
10. **Complete the PIP.**

Bottom Case

11-121

W06 ECG Connector Assembly PN 3201010



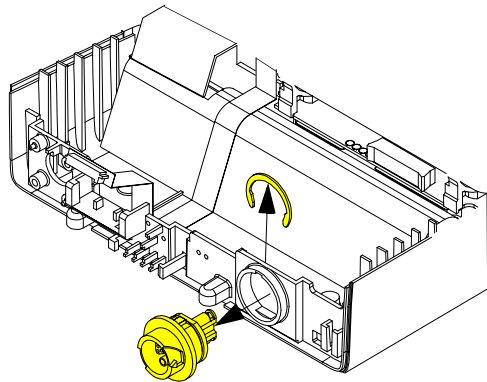
WIRING DIAGRAM

Interconnect

Bottom Case

11-122

W01 Therapy Connector Removal



Note: The following assemblies must be removed before beginning this disassembly:

- **Top case**
- **Front case**
- **Boardstack**

To remove the W01 Therapy Connector:

1. Remove the C-clip (109) from the back of the W01 Therapy Connector.
2. From outside the case, remove the therapy connector from the bottom case and feed the therapy cable through the connector hole.

Bottom Case

11-123

W01 Therapy Connector Installation

To install the W01 Therapy Connector:

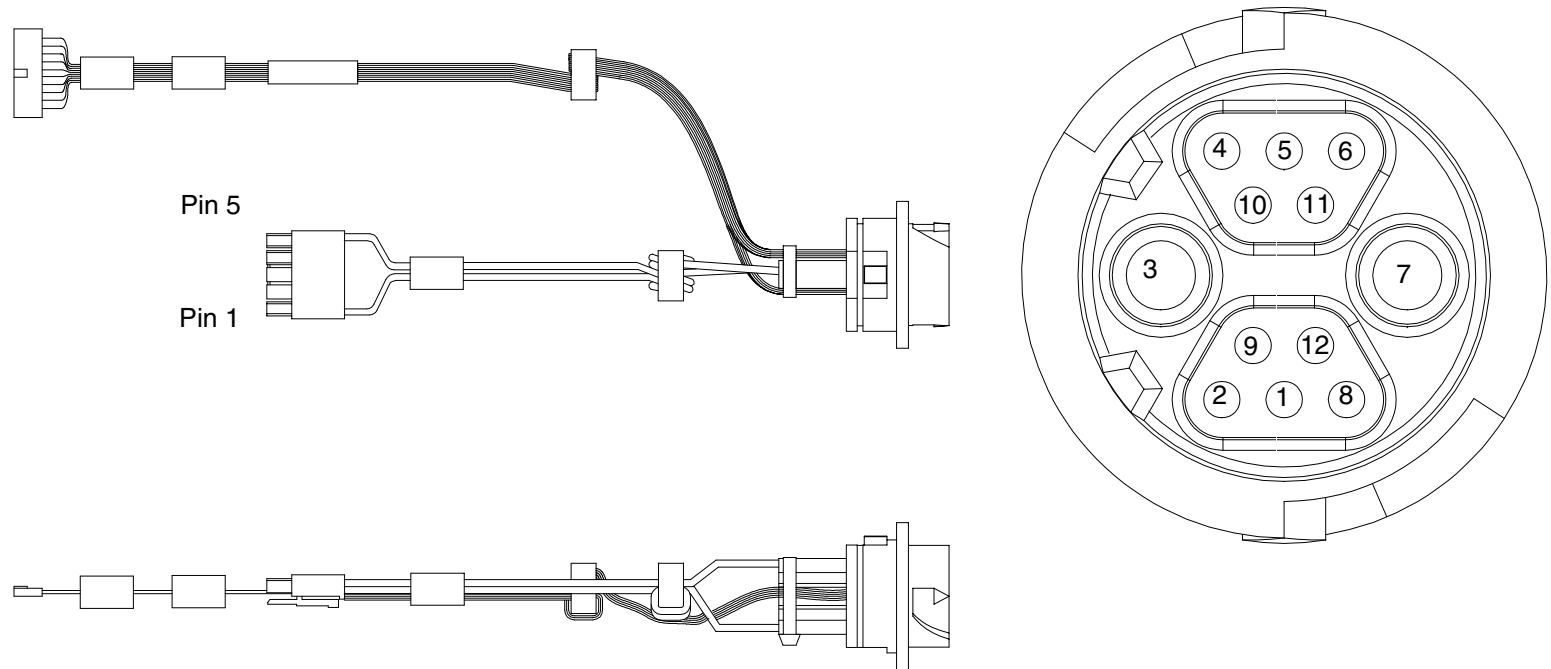
1. From outside the case, align the key on the connector with the notch in the bottom case and slide the W01 Therapy Connector into the bottom case.
2. Install the snap ring (109) onto the back of the W01 Therapy Connector and rotate the ring so that the open end is visible.
3. **Install the boardstack assembly** (complete Steps 1 through 18).
4. **Install the front case** (complete Steps 1 through 6).
5. **Install the top case** (complete Steps 1 through 6).
6. **Install the A07 Battery.**
7. Review the **labels parts list** and install new labels.
8. **Complete the PIP.**

Bottom Case

11-124

W01 Therapy Cable PN 3201998

Therapy Connector

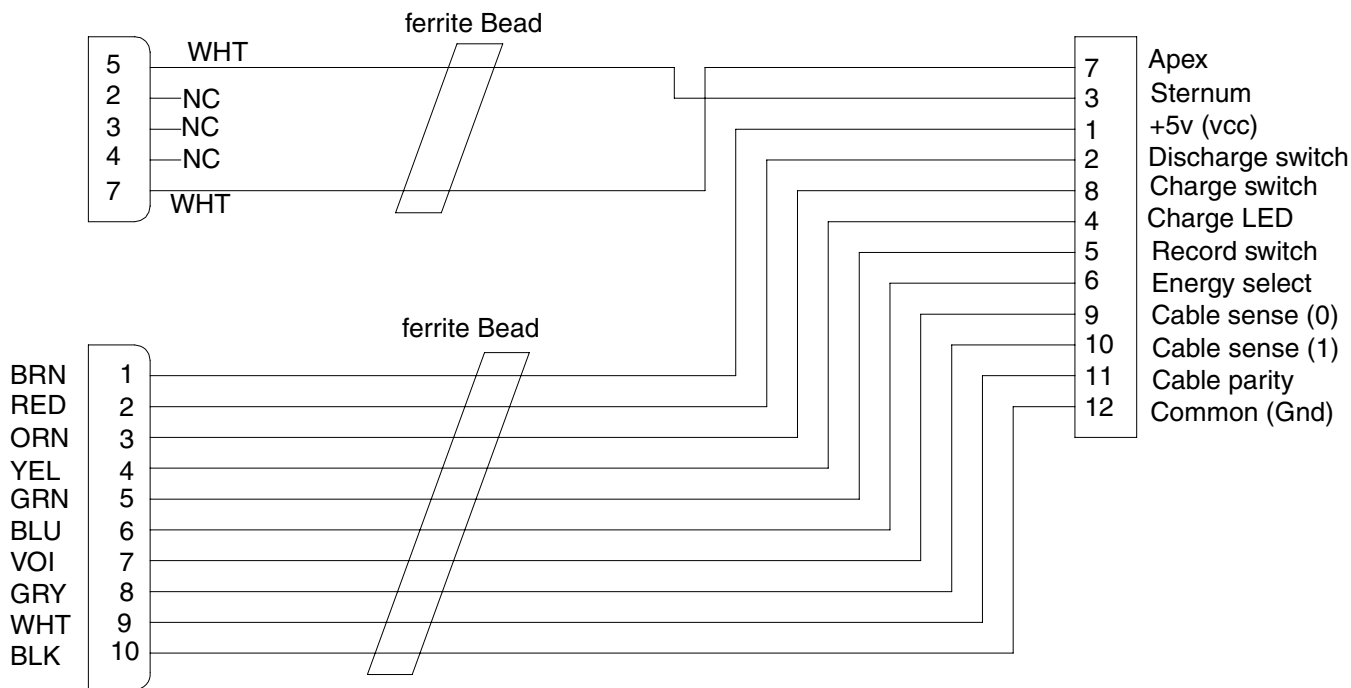


Interconnect

Bottom Case

W01 Therapy Cable PN 3201998

Wiring Diagram



Interconnect

Bottom Case

11-126

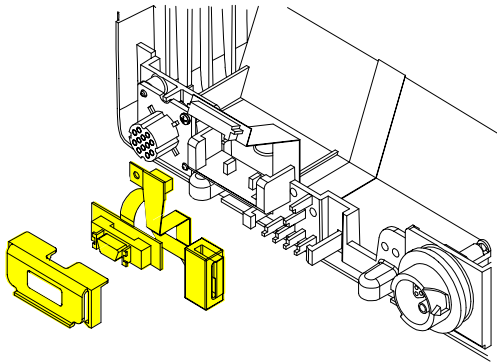
W05 SpO2 Assembly Removal

Note: The following assemblies must be removed before beginning this disassembly:

- **Top case**
- **Front case**
- **Boardstack**
- **W03 IrDA Port**

To remove the W05 SpO2 Assembly:

1. Remove the cable tie retainer (229) securing the SpO2 cable to the bottom case. The W03 IrDA Port must be removed to expose this tie wrap.
2. Gently pull apart the plastic snap arms on the SpO2 connector mounting (113) away from the bottom case.
3. Lift the mounting away from the bottom case.



Bottom Case

11-127

SpO2 Flex Cable Removal

To remove the SpO2 flex cable:

1. Pull the front of the SpO2 connector mounting away from the connector.
2. Pull the SpO2 flex cable connector out of the SpO2 connector mounting bracket 4-pin power cable(113).

W05 SpO2 Assembly Installation

To install the W05 SpO2 Assembly:

1. Ensure that the SpO2 flex cable is securely installed in the SpO2 connector mounting bracket (113).
2. Position the SpO2 connector mounting (113) above the mounting block on the bottom case.
3. Press the W05 SpO2 Assembly down onto the bottom case until the snap arms click into position.
4. Install a cable tie retainer (229) to secure the ferrite bead to the bottom case.
5. **Install the W03 IrDA Assembly.**

(Continued on next page)

Bottom Case

11-128

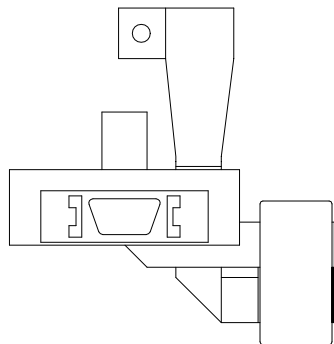
W05 SpO2 Flex Cable Installation (Continued)

6. **Install the boardstack assembly** (complete Steps 1 through 18)
7. **Install the front case** (complete Steps 1 through 6).
8. **Install the top case** (complete Steps 1 through 6).
9. **Install the A07 Battery.**
10. Review the **labels parts list** and install new labels.
11. **Complete the PIP.**

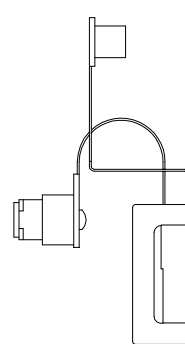
Bottom Case

11-129

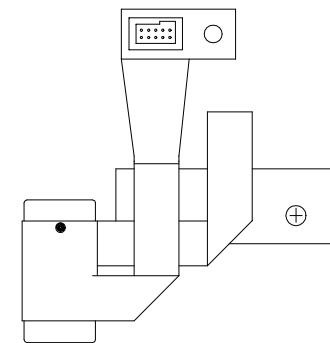
W05 SpO2 Flex Cable PN 3200925



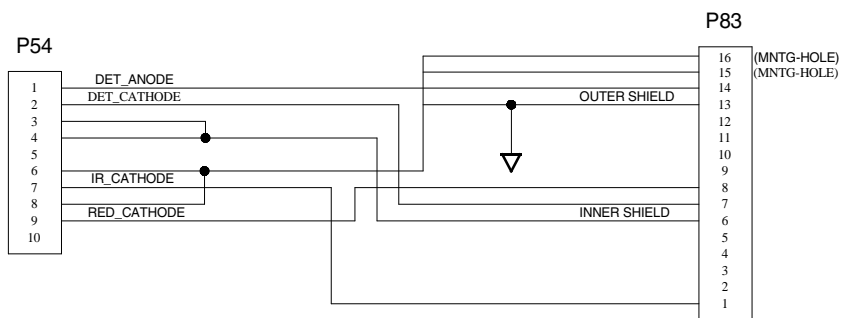
Front View



Side View



Back View



Schematic Diagram



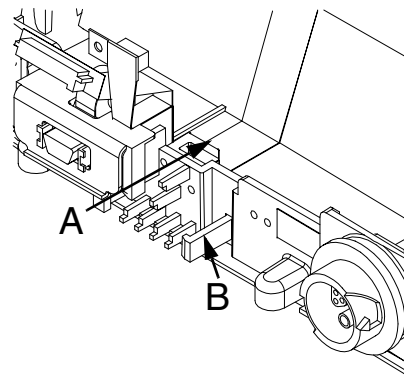
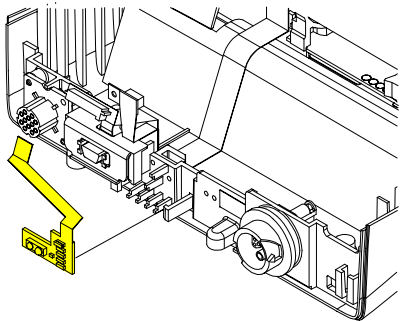
Folding Dimensions

Interconnect

Bottom Case

11-130

W03 IrDA Assembly Removal (not active)



To remove the W03 IrDA Assembly:

Note: The following assemblies must be removed before beginning this disassembly:

- **Top case**
- **Front case**
- **Boardstack** (optional removal)

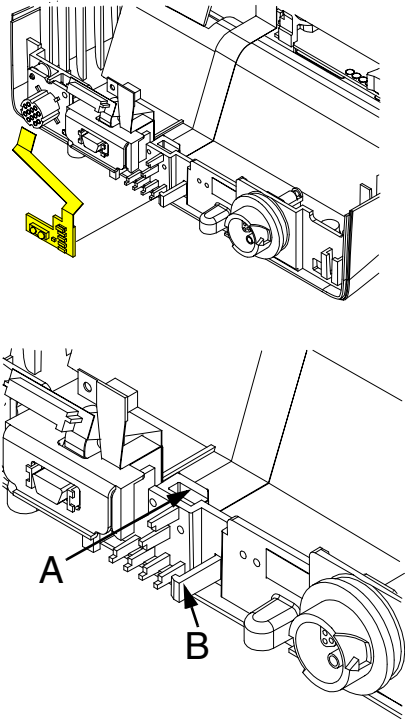
Note: The W03 IrDA Assembly must be removed to gain access to the W05 SpO2 Assembly.

1. Insert a large common screwdriver into the slot between the bottom case cutout (A) and the right snap tab (B).
2. Gently apply pressure to the screwdriver. Bend the right IrDA snap tab (B) outward, slightly, freeing the right edge of the W03 IrDA Assembly.
3. Remove the W03 IrDA Assembly from the bottom case.
4. If the boardstack is still installed in the bottom case, disconnect the IrDA connector from the A01 System PCB at J8.

Bottom Case

11-131

W03 IrDA Assembly Installation



To install the W03 IrDA Assembly:

1. Position the W03 IrDA Assembly on the bottom case. (The IrDA is located near the center of the bottom case's front panel.)
2. Insert a large common screwdriver into the slot between the bottom case cutout (A) and the right snap tab (B).
3. Gently apply pressure to the screwdriver. Bend the right IrDA snap tab (B) outward, slightly,
4. Press the W03 IrDA Assembly down into the snap tabs and release the pressure on the screwdriver. The snap tabs will close around the W03 IrDA Assembly.
5. Ensure that the W03 IrDA Assembly is resting, centered, on the support brackets and snap tabs.
6. Connect the IrDA flex connector to the A01 System PCB at J8, if the boardstack is still installed in the bottom case; otherwise, install the boardstack assembly (complete Steps 1 through 18). The IrDA flex cable is connected during the boardstack installation.

(Continued on next page)

Bottom Case

11-132

W03 IrDA Assembly Installation (Continued)

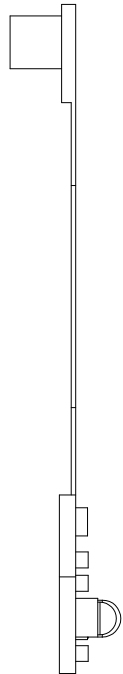
7. **Install the front case** (complete Steps 1 through 6).
8. **Install the top case** (complete Steps 1 through 6).
9. **Install the A07 Battery.**
10. Review the **labels parts list** and install new labels.
11. **Complete the PIP.**

Bottom Case

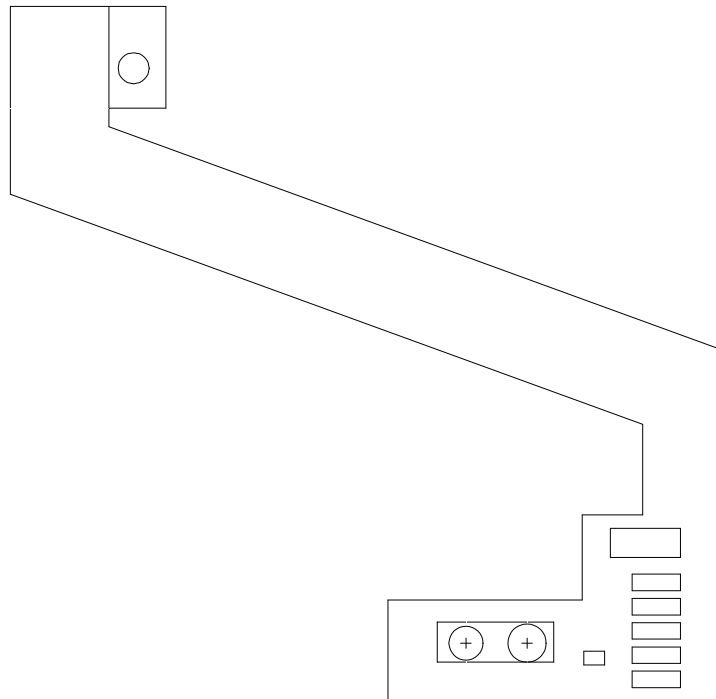
11-133

W03 IrDA Flex Cable PN 3200926

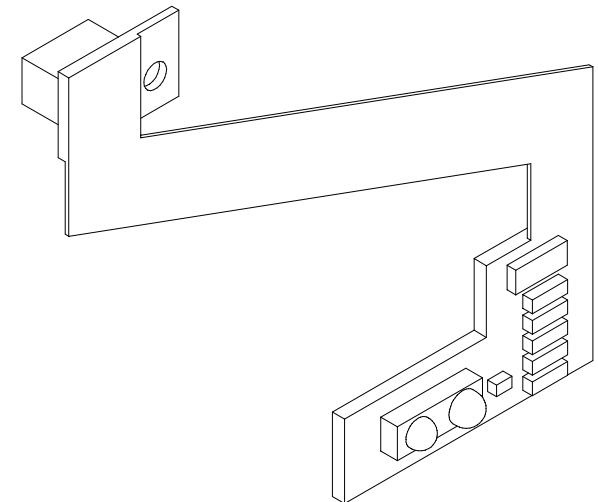
Side View



Front View



Three-Dimensional View



Interconnect

Bottom Case

11-134

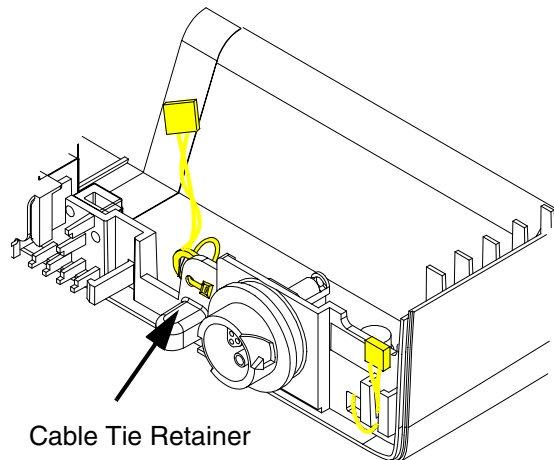
W25 Speaker Harness Extension Cable Removal

To remove the W25 Speaker Harness Extension Cable:

Note: The following assemblies must be removed before beginning this disassembly:

- **Top case**
- **Front case**

1. Disconnect the W25 Speaker Harness Extension Cable from the W02 Speaker Assembly.
2. Disconnect the other end of the W25 Speaker Harness Extension Cable from the A01 System PCB at J5.
3. Cut the cable tie retainer (229) securing the ferrite ring to the bottom case.
4. Remove the connector from the holder and feed the W25 Speaker Harness Extension Cable under the W01 Therapy Connector and remove the cable from the bottom case.



Cable Tie Retainer

Bottom Case

11-135

W25 Speaker Harness Extension Cable Installation

To Install the W25 Speaker Harness Extension Cable:

1. Connect the W25 Speaker Harness Extension Cable to the A01 System PCB at J5.
2. Feed the W25 Speaker Harness Extension Cable under the W01 Therapy Connector.
3. Insert W25 Speaker Harness Extension Cable into holder.
4. Install the cable tie retainer (229) in the set of holes .5 inches to the left of the W01 Therapy Connector, and secure the extension cable's ferrite ring to the bottom case.
5. **Install the front case** (complete Steps 1 through 6).
6. **Install the top case** (complete Steps 1 through 6).
7. **Install the A07 Battery.**
8. Review the **labels parts list** and install new labels.
9. **Complete the PIP.**

Final Assembly

11-136

Labels Assembly

To apply the labels to the LIFEPAK 20 defibrillator:

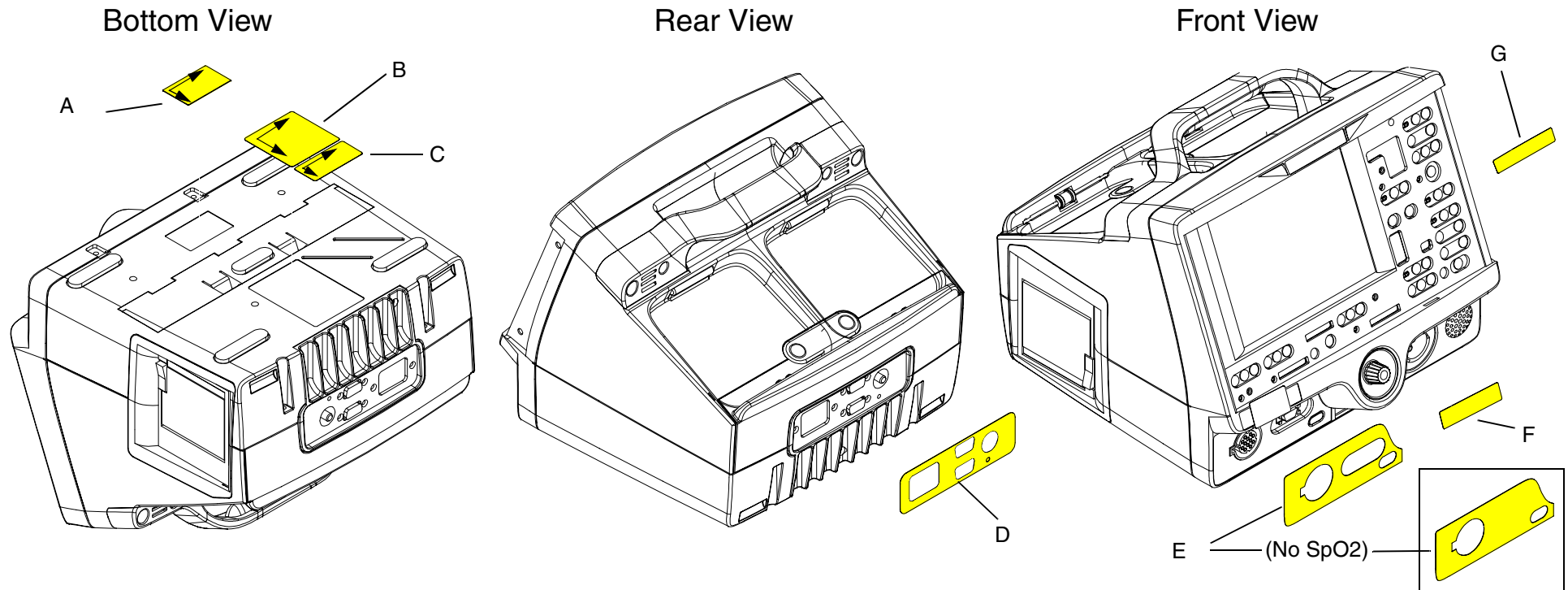
1. Remove the old labels and clean the defibrillator with isopropyl alcohol.
2. Select correct label set from [page 11-138](#) (No SpO2) or [page 11-140](#) (SpO2)
3. Apply labels (Refer to the next page for placement):

Item	Part Number	Part Description	Note
Part of Label Set	3009060	FDA Label	A in the graphic on page 11-137
Part of Label Set	3202375	Masimo Patent Label	C in the graphic on page 11-137
Part of Label Set	3201290	Rear Connector Label	D in the graphic on page 11-137
Part of Label Set	3201274-015	Front Connector Label (SpO2)	E in the graphic on page 11-137
Part of Label Set	3201274-030	Front Connector Label (No SpO2)	E in the graphic on page 11-137
Part of Label Set	3201275	Medtronic Logo Label	F in the graphic on page 11-137
Part of Label Set	3201273	LP20 Logo Label	G in the graphic on page 11-137
23	3201499	Manual Latch Label (Door Assembly)	Select other language
183	3201643	Serial Number Label	B in the graphic on page 11-137

Final Assembly

11-137

Labels Assembly (Continued)



Final Assembly

11-138

LIFEPAK 20 Label Set
(No SpO2)
Languages
(1 of 2)

Language	Part Number	Part Description
English	3201640-122	LIFEPAK 20 Label Set (no SpO2)
French	3201640-123	LIFEPAK 20 Label Set (no SpO2)
German	3201640-124	LIFEPAK 20 Label Set (no SpO2)
Spanish	3201640-125	LIFEPAK 20 Label Set (no SpO2)
Italian	3201640-126	LIFEPAK 20 Label Set (no SpO2)
Swedish	3201640-127	LIFEPAK 20 Label Set (no SpO2)
Danish	3201640-128	LIFEPAK 20 Label Set (no SpO2)
Dutch	3201640-129	LIFEPAK 20 Label Set (no SpO2)
Finnish	3201640-130	LIFEPAK 20 Label Set (no SpO2)
Norwegian	3201640-131	LIFEPAK 20 Label Set (no SpO2)
Polish	3201640-132	LIFEPAK 20 Label Set (no SpO2)

Final Assembly

11-139

LIFEPAK 20 Label Set (No SpO2) Languages (2 of 2)

Language	Part Number	Part Description
Portuguese	3201640-133	LIFEPAK 20 Label Set (no SpO2)
Brazilian	3201640-134	LIFEPAK 20 Label Set (no SpO2)
Japanese	3201640-135	LIFEPAK 20 Label Set (no SpO2)
Chinese	3201640-136	LIFEPAK 20 Label Set (no SpO2)

Final Assembly

11-140

LIFEPAK 20 Label Set (Including SpO2) Languages (1 of 2)

Language	Part Number	Part Description
English	3201640-137	LIFEPAK 20 Label Set (including SpO2)
French	3201640-138	LIFEPAK 20 Label Set (including SpO2)
German	3201640-139	LIFEPAK 20 Label Set (including SpO2)
Spanish	3201640-140	LIFEPAK 20 Label Set (including SpO2)
Italian	3201640-141	LIFEPAK 20 Label Set (including SpO2)
Swedish	3201640-142	LIFEPAK 20 Label Set (including SpO2)
Danish	3201640-143	LIFEPAK 20 Label Set (including SpO2)
Dutch	3201640-144	LIFEPAK 20 Label Set (including SpO2)
Finnish	3201640-145	LIFEPAK 20 Label Set (including SpO2)
Norwegian	3201640-146	LIFEPAK 20 Label Set (including SpO2)
Polish	3201640-147	LIFEPAK 20 Label Set (including SpO2)

Final Assembly

11-141

LIFEPAK 20 Label Set (Including SpO2) Languages (2 of 2)

Language	Part Number	Part Description
Portuguese	3201640-148	LIFEPAK 20 Label Set (including SpO2)
Brazilian	3201640-149	LIFEPAK 20 Label Set (including SpO2)
Japanese	3201640-150	LIFEPAK 20 Label Set (including SpO2)
Chinese	3201640-151	LIFEPAK 20 Label Set (including SpO2)

Final Assembly

11-142

Manual Latch Label Languages (1 of 2)



Note: To order the Manual Latch Label and the AED door together as a kit refer to [Manual Latch Label Kits](#).

Language	Part Number	Part Description
English	3201499-900	AED Door Latch Label
French	3201499-902	AED Door Latch Label
German	3201499-901	AED Door Latch Label
Spanish	3201499-900	AED Door Latch Label
Italian	3201499-060	AED Door Latch Label
Swedish	3201499-901	AED Door Latch Label
Danish	3201499-902	AED Door Latch Label
Dutch	3201499-100	AED Door Latch Label
Finnish	3201499-220	AED Door Latch Label
Norwegian	3201499-901	AED Door Latch Label
Polish	3201499-260	AED Door Latch Label

Final Assembly

11-143

Manual Latch Label Languages (2 of 2)

MANUAL

Note: To order the Manual Latch Label and the AED door together as a kit refer to **Manual Latch Label Kits**.

Language	Part Number	Part Description
Portuguese	3201499-900	AED Door Latch Label
Brazilian	3201499-900	AED Door Latch Label
Japanese	3201499-400	AED Door Latch Label
Chinese	3201499-340	AED Door Latch Label

Final Assembly

11-144

Manual Latch Label Kits

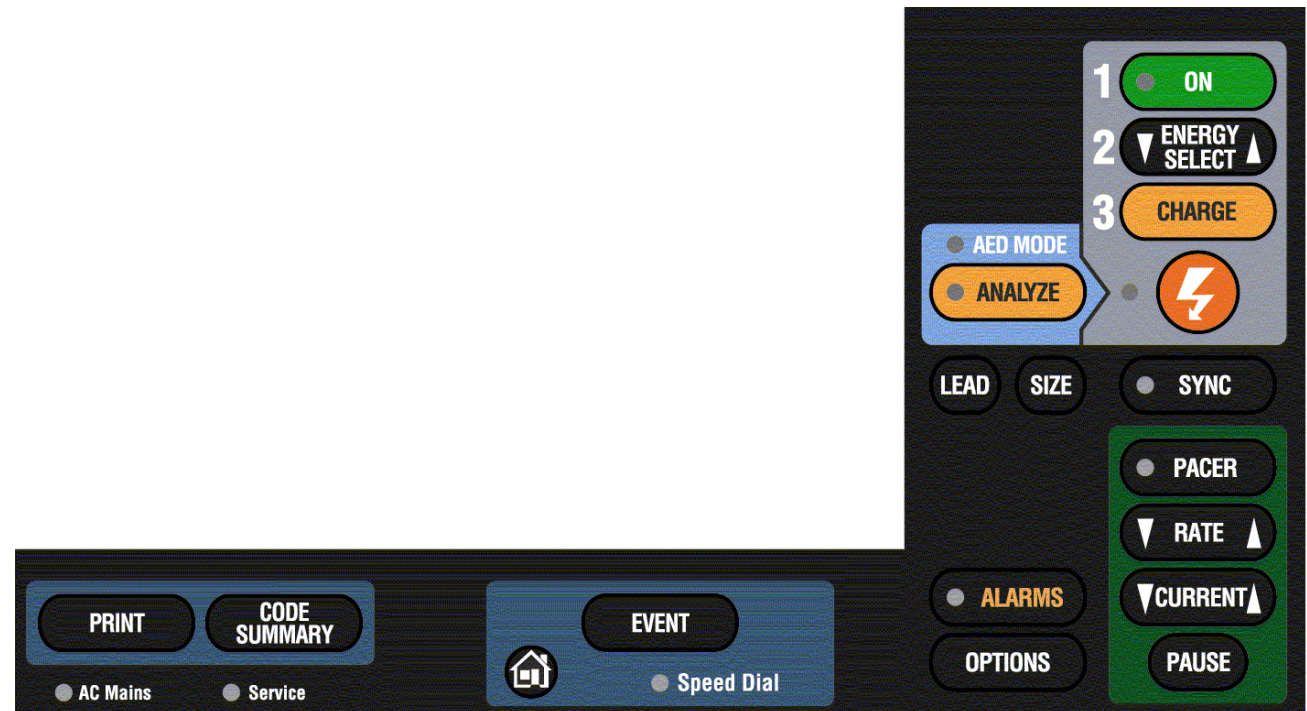
Kit Part Number	Languages	Part Description
3202360-009	English, Spanish, Portuguese, Brazilian	AED Door (3202056-002), Manual Latch Label (3201499-900)
3202360-010	German, Swedish, Norwegian,	AED Door (3202056-002), Manual Latch Label (3201499-901)
3202360-011	Italian	AED Door (3202056-002), Manual Latch Label (3201499-060)
3202360-012	French, Danish	AED Door (3202056-002), Manual Latch Label (3201499-902)
3202360-013	Dutch	AED Door (3202056-002), Manual Latch Label (3201499-100)
3202360-014	Finnish	AED Door (3202056-002), Manual Latch Label (3201499-220)
3202360-015	Polish	AED Door (3202056-002), Manual Latch Label (3201499-260)
3202360-016	Chinese	AED Door (3202056-002), Manual Latch Label (3201499-340)
3202360-017	Japanese	AED Door (3202056-002), Manual Latch Label (3201499-400)

Final Assembly

11-145

Elastomer Keypad All Options

(Refer to the parts list on the next page for language part numbers.)



Keypad No Pacing

Final Assembly

11-146

Elastomer Keypad All Options (Continued)

Language	Part Number	Part Description
English	3200642-091	Keypad, all options
French	3200642-092	Keypad, all options
German	3200642-093	Keypad, all options
Spanish	3200642-094	Keypad, all options
Italian	3200642-095	Keypad, all options
Swedish	3200642-096	Keypad, all options
Danish	3200642-097	Keypad, all options
Dutch	3200642-098	Keypad, all options
Finnish	3200642-099	Keypad, all options
Norwegian	3200642-100	Keypad, all options
Polish	3200642-101	Keypad, all options

Keypad No Pacing

Final Assembly

11-147

Elastomer Keypad All Options (Continued)

Language	Part Number	Part Description
Portuguese	3200642-102	Keypad, all options
Brazilian	3200642-103	Keypad, all options
Japanese	3200642-104	Keypad, all options
Chinese	3200642-105	Keypad, all options

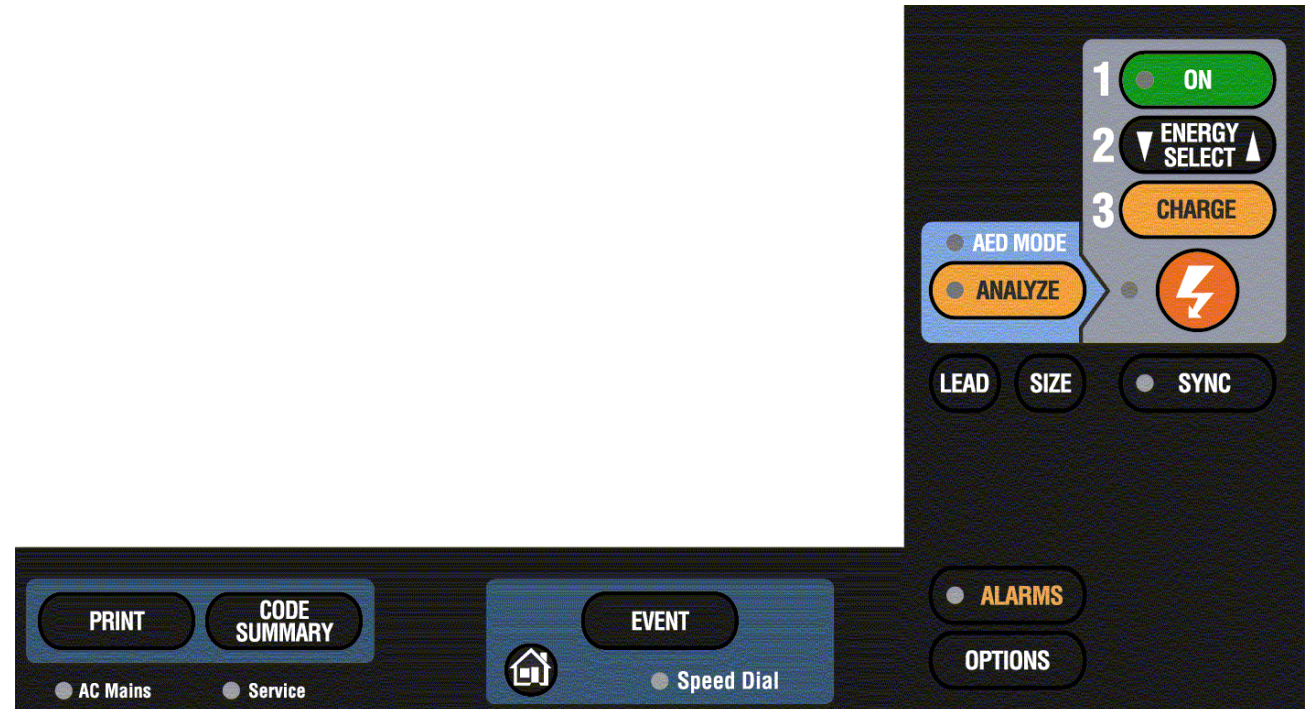
Keypad No Pacing

Final Assembly

11-148

Elastomer Keypad No Pacing

(Refer to the parts list on the next page for language part numbers.)



Keypad All Options

Final Assembly

11-149

Elastomer Keypad No Pacing (Continued)

Language	Part Number	Part Description
English	3200642-106	Keypad, no Pacing
French	3200642-107	Keypad, no Pacing
German	3200642-108	Keypad, no Pacing
Spanish	3200642-109	Keypad, no Pacing
Italian	3200642-110	Keypad, no Pacing
Swedish	3200642-111	Keypad, no Pacing
Danish	3200642-112	Keypad, no Pacing
Dutch	3200642-113	Keypad, no Pacing
Finnish	3200642-114	Keypad, no Pacing
Norwegian	3200642-115	Keypad, no Pacing
Polish	3200642-116	Keypad, no Pacing

Keypad All Options

Final Assembly

11-150

Elastomer Keypad No Pacing (Continued)

Language	Part Number	Part Description
Portuguese	3200642-117	Keypad, no Pacing
Brazilian	3200642-118	Keypad, no Pacing
Japanese	3200642-119	Keypad, no Pacing
Chinese	3200642-120	Keypad, no Pacing

Keypad All Options

Final Assembly

11-151

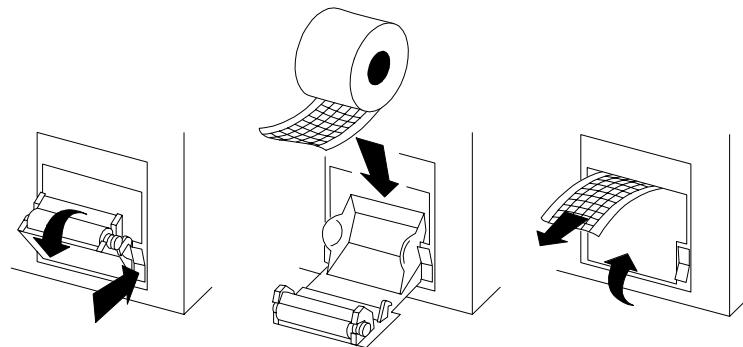
Installing Printer Paper

To install a new roll of printer paper into the printer:

1. Press the **PRINTER ACCESS** button, located on the left side of the defibrillator, to open the printer door.
2. Remove the old roll of paper.
3. Insert the new paper roll, with the end coming from under the roll, into the paper chamber, refer to graphic below.

Note: The printer will not print properly if the paper roll is inserted with the end coming over the top of the roll. The paper roll must be inserted with the end coming from under the roll.

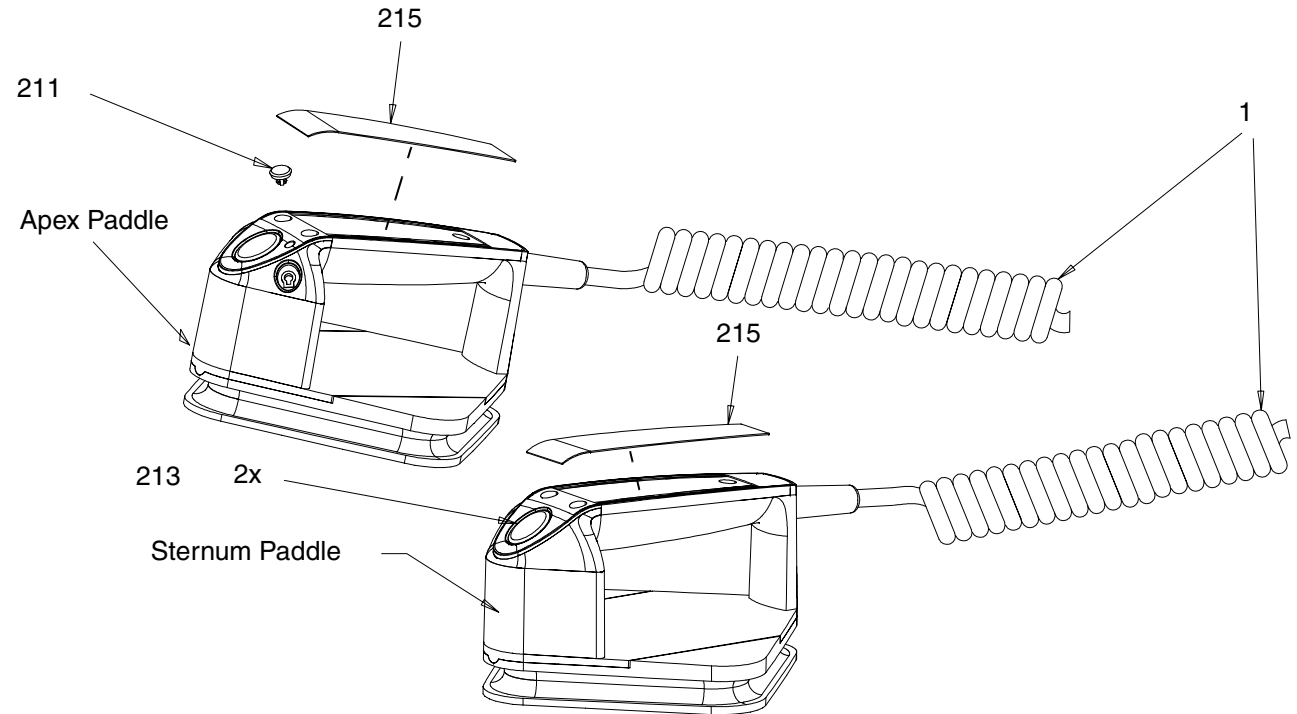
4. Close the printer door. Ensure that the paper end extends out of the side of the printer.



Final Assembly

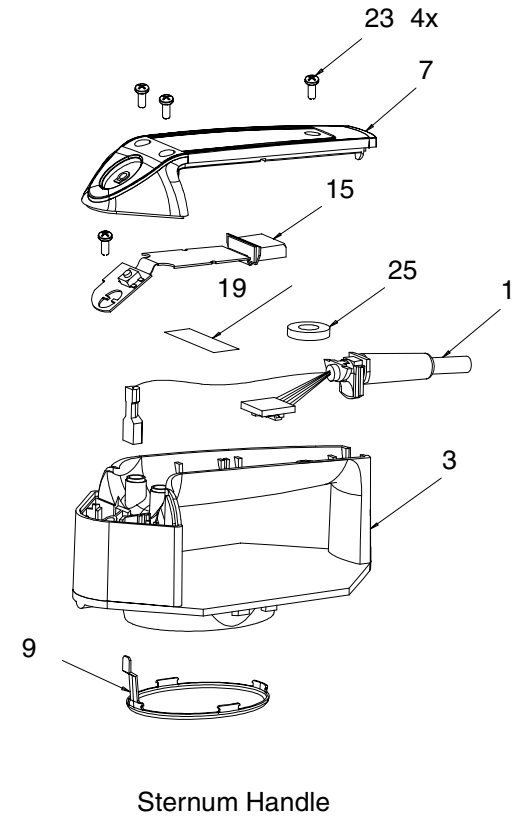
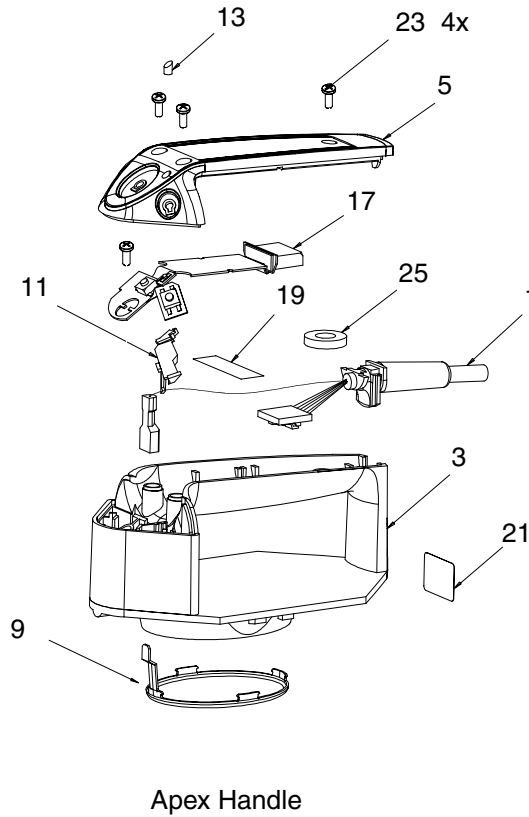
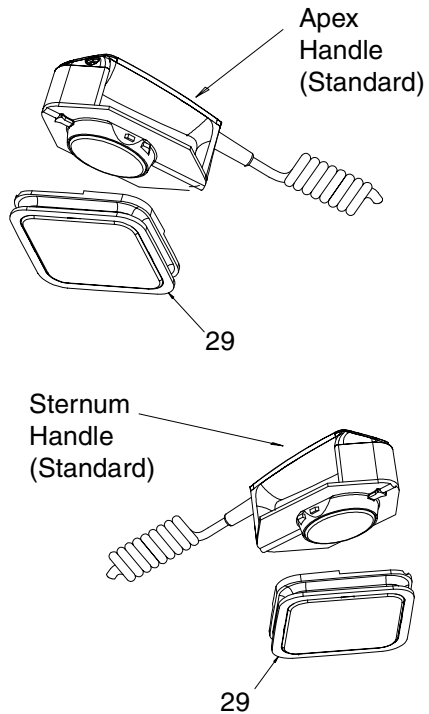
11-152

Standard Paddles Labels and Buttons

[Exploded View](#)[Parts 1–19](#)[Parts 23–215](#)[Label Languages](#)[Charge Button Languages](#)[◀ Previous Page](#)[◀◀ Table of Contents](#)[◀◀ Section Contents](#)[↶ Back](#)[Index ▶▶](#)[Next Page ▶](#)

Final Assembly

Standard Paddles Exploded View



Final Assembly

11-154

Standard Paddles Parts List (1 of 2)

Item	Quantity	Part Number	Part Description	Note
1	1	3202665-000	Cable Assembly	
3	2	3200644-003	Paddle Handle	
5	1	3200645-003	Apex Paddle Cover	
7	1	3201248-003	Sternum Paddle Cover	
9	2	3200939-00	Pediatric Electrode	Part of the paddle handle (3)
11	1	3201675-000	Apex Support Bracket	
13	1	3202172-000	Apex Lightpipe	Part of Apex paddle cover
15	1	3201225-003	Sternum Paddle Flex PCB Assembly	
17	1	3201244-003	Apex Paddle Flex PCB Assembly	
19		253-0038-00	Kapton Tape	

Labels and Buttons

Exploded View

Parts 23–215

Label Languages

Charge Button Languages

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Final Assembly

11-155

Standard Paddles Parts List (2 of 2)

Item	Quantity	Part Number	Part Description	Note
23	8	202253-761	Machine Screw 4.40 x .312L	
25	2	804447-038	Poron Spacer	
29	2	3200941-003	Hard Paddle Adapter Assembly	
211	1	3200648	Charge Button	Refer to Charge Button Languages
213	2	3200943-000	Shock Button	
215	2	3202523	Paddle Label	Refer to Standard Paddle Label Languages

Labels and Buttons

Exploded View

Parts 1–19

Label Languages

Charge Button Languages

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Final Assembly

11-156

Standard Paddles Label Language (1 of 2)

Language	Part Number	Part Description
English	3202533-000	Paddle Labels
French	3202533-000	Paddle Labels
German	3202533-000	Paddle Labels
Spanish	3202533-001	Paddle Labels
Italian	3202533-002	Paddle Labels
Swedish	3202533-000	Paddle Labels
Danish	3202533-000	Paddle Labels
Dutch	3202533-000	Paddle Labels
Finnish	3202533-003	Paddle Labels
Norwegian	3202533-000	Paddle Labels
Polish	3202533-004	Paddle Labels

Final Assembly

11-157

Standard Paddles Label Language (2 of 2)

Language	Part Number	Part Description
Portuguese	3202533-005	Paddle Labels
Brazilian	3202533-005	Paddle Labels
Japanese	3202533-000	Paddle Labels
Chinese	3202533-006	Paddle Labels

Final Assembly

11-158

Charge Button Languages (1 of 2)

Language	Part Number	Part Description
English	3200648-015	Charge Button
French	3200648-016	Charge Button
German	3200648-902	Charge Button
Spanish	3200648-017	Charge Button
Italian	3200648-018	Charge Button
Swedish	3200648-019	Charge Button
Danish	3200648-020	Charge Button
Dutch	3200648-902	Charge Button
Finnish	3200648-021	Charge Button
Norwegian	3200648-022	Charge Button
Polish	3200648-023	Charge Button

Final Assembly

11-159

Charge Button Languages (2 of 2)

Language	Part Number	Part Description
Portuguese	3200648-903	Charge Button
Brazilian	3200648-903	Charge Button
Japanese	3200648-024	Charge Button
Chinese	3200648-025	Charge Button

Final Assembly

11-160

Standard Paddles Disassembly

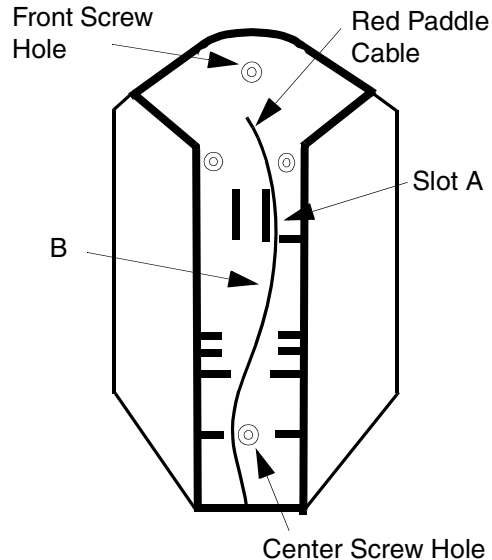
To disassemble the paddles:

1. Remove three screws (23) from the top of the paddle cover (5 or 7).
2. Remove the poron spacer (25) from the paddle handle (3).
3. Remove one screw (23) from the front of the paddle PCB flex assembly (13 or 15) and carefully lift the paddle PCB flex assembly out of the paddle handle.
4. Disconnect the paddle PCB flex assembly (13 or 15) from the paddle cable (1) by pressing in the clip on the underside of the connector.
5. Remove the teflon tape (19) holding the paddle cable in position.
6. Disconnect the red cable from the pediatric electrode connector (located deep in the front of the paddle handle) and lift the paddle cable (1) out of the paddle handle (3).

Final Assembly

11-161

Standard Paddles Assembly



To assemble the paddles:

1. Position the paddle cable (1) in the paddle handle (3) and use needlenose pliers to connect the red cable to the pediatric electrode.
2. Lay the red paddle cable the length of the paddle handle, positioning it through slot A and around the center screw hole.
3. Secure the red paddle cable with teflon tape (19) at location B in the graphic on the left.
4. Connect the paddle PCB flex assembly (13 or 15) to the paddle cable connector (1).
5. Arrange the colored cables around the screw hole in the paddle handle (3).
6. Position the poron spacer (25) on the center screw hole in the paddle handle.
7. Carefully position the front paddle PCB flex assembly (13 or 15) into position. Slide the white guide down into the groove in the paddle handle and position the small tabs into position in the notches the front screw hole.
8. Install one screw (23) into the front screw hole.
9. Install the paddle cover (5 or 7) and secure with three screws (23).

Service Replacement Kits

11-162

The Service Replacement kits include components that support a particular replacement activity.

Kit Part Number	Part Description	Note
3202718-000	Top Case Handle Kit	
3202718-001	Front Case Kit	
3202718-002	Therapy PCB with Pacing Kit	
3202718-003	Therapy PCB without Pacing Kit	
3202718-004	System PCB Kit	
3202718-005	OEM PCB Kit	
3202718-006	Patient Parameter PCB Kit	
3202718-007	User Interface PCB Kit	
3202718-008	Active Display Kit	
3202718-009	Active Display Bracket/Backlight Inverter Kit	
3202718-010	Power Module Kit	
3202718-011	Capacitor Bracket Kit	

Service Replacement Kits

11-163

The Service Replacement kits include components that support a particular replacement activity.

Kit Part Number	Part Description	Note
3202718-012	Capacitor Kit	
3202718-013	Masimo SpO2 Connector Kit	
3202718-014	Therapy Connector Kit	
3202718-015	Inductive Resistor Kit	

Service Replacement Kits

11-164

Top Case Handle Kit PN 3202718-000

Item	Quantity	Part Number	Part Description
2	1	3200631-000	Top Case Handle
167	2	202253-592	Machine Screw 6-32 x 1.75L
169	2	202253-570	Machine Screw 6-32 x .375L

Front Case Kit PN 3202718-001

Item	Quantity	Part Number	Part Description
9	1	3200624-006	Front Case
43	1	3200913-001	Display Lens (Part of Case)
167	4	202253-592	Machine Screw 6-32 x 1.75L
169	2	202253-570	Machine Screw 6-32 x .375L
201	1	3201111-003	Thermally Conductive B/L Inverter Pad

Service Replacement Kits

11-165

Therapy PCB (with
Pacing) Kit
PN 3202718-002

Item	Quantity	Part Number	Part Description
A04	1	3202611-000	Therapy PCB With Pacing
123	5	3201374-005	ISO Standoff
147	1	3201111-000	Thermally Conductive Pad

Therapy PCB (without
Pacing) Kit
PN 3202718-003

Item	Quantity	Part Number	Part Description
A04	1	3202611-001	Therapy PCB Without Pacing
123	5	3201374-005	ISO Standoff
147	1	3201111-000	Thermally Conductive Pad

Service Replacement Kits

11-166

System PCB Kit PN 3202718-004

Item	Quantity	Part Number	Part Description
A01	1	3201964-005	System PCB
123	1	3201374-005	ISO Mount Therapy/System
125	1	202253-771	Machine Screw 4-40 x .937L
135	1	3201007-002	Board Stack Connector

OEM PCB Kit PN 3202718-005

Item	Quantity	Part Number	Part Description
A06	1	3202622-000	OEM PCB
121	1	3201511-250	Standoff Round Snap, Nylon
123	3	3201374-004	ISO Mount Therapy/System
232	1	3009482-002	Dielectric Shield

Service Replacement Kits

11-167

Patient Parameter PCB Kit PN 3202718-006

Item	Quantity	Part Number	Part Description
A02	1	3202621-000	Patient Parameter PCB
123	1	3201374-004	ISO Standoffs

User Interface PCB Kit PN 3202718-007

Item	Quantity	Part Number	Part Description
A05	1	3201966-003	User Interface PCB
W15	1	3200995-00	Active Display Cable
65	1	804447-041	Foam Spacer

Service Replacement Kits

11-168

Active Display Kit PN 3202718-008

Item	Quantity	Part Number	Part Description
A11	1	3200916-000	Active Matric Color Display
W15	1	3200995-00	Active Display Cable

Active Display Bracket/ Backlight Inverter Kit PN 3202718-009

Item	Quantity	Part Number	Part Description
A08	1	3202033-000	Backlight Inverter
W16	1	3202018-000	Display Jumper Cable Extender
W17	1	3200996-002	Active B/L Inverter Cable
47	1	3200640-009	Display Bracket

Service Replacement Kits

11-169

Power Module Kit PN 3202718-010

Item	Quantity	Part Number	Part Description
205	1	3202131-001	Power Module Assembly

Capacitor Bracket Kit PN 3202718-011

Item	Quantity	Part Number	Part Description
95	2	3200922-000	Capacitor Support Bracket
173	4	202253-761	Machine Screw 4-40 x .312L
	1	3202442-000	Dielectric Shield
		3202228-562	3/16" Hex Standoff

Service Replacement Kits

11-170

Capacitor Kit PN 3202718-012

Item	Quantity	Part Number	Part Description
A13	1	3200846-001	Energy Storage Capacitor
W17	1	3202383-001	Capacitor Discharge Cable
93	2	804447-36	Foam Spacer
162	1	3009787-003	Capacitor Shield
229	1	200536-001	Cable Tie Retainer
		3202718-011	Capacitor Bracket Kit

Masimo SpO2 Connector Kit PN 3202718-013

Item	Quantity	Part Number	Part Description
W05	1	3200925-003	SpO2 Flex Assembly
113	1	3200921-000	SpO2 Connector Mounting Clip

Service Replacement Kits

11-171

Therapy Connector Kit PN 3202718-014

Item	Quantity	Part Number	Part Description
W01	1	3200474-004	Therapy Connector
111	1	200040-001	Therapy Connector Clip

Inductive Resistor Kit PN 3202718-015

Item	Quantity	Part Number	Part Description
A14	1	3010212-007	Inductive Resistor
141	1	3201415-003	Inductive Resistor Bracket

Software Replacement and Device Upgrades

11-172

The LIFEPAK 20 defibrillator/monitor software replacement and device upgrade procedures require specialized training and entail information proprietary to Medtronic. These procedures may be performed only by authorized Medtronic personnel.

Contact your local Medtronic representative for assistance.

Verifying the Device Configuration Data

11-173

CAUTION!

Possible inoperable device. The configuration data is critical for proper operation of the device. If the device configuration data is lost, the device **CAN NOT BE USED**. Contact factory support if you lose this data.

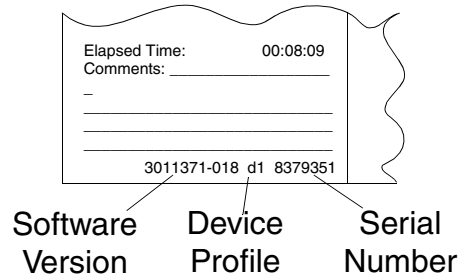
The device configuration data consists of the manufacturing code, device profile (options, features), serial number, calibration data, and user setup configuration. This data is stored on a 32-kilobyte memory device that is powered by a coin battery located on the A01 System PCB. If this coin battery is improperly replaced or is dead, the device configuration data will be lost.

To check if your device has lost the configuration data information, turn on the device and press the `CODE SUMMARY` control. A device that has lost configuration data will not display a serial number on the Code Summary printout and may also list an incorrect device profile (refer to the next page).

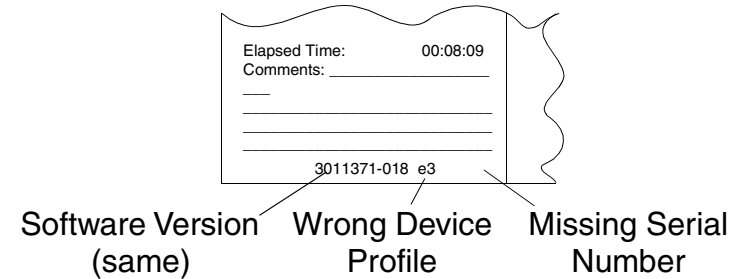
Verifying the Device Configuration Data

11-174

Device with correct configuration data



Device with incorrect configuration data



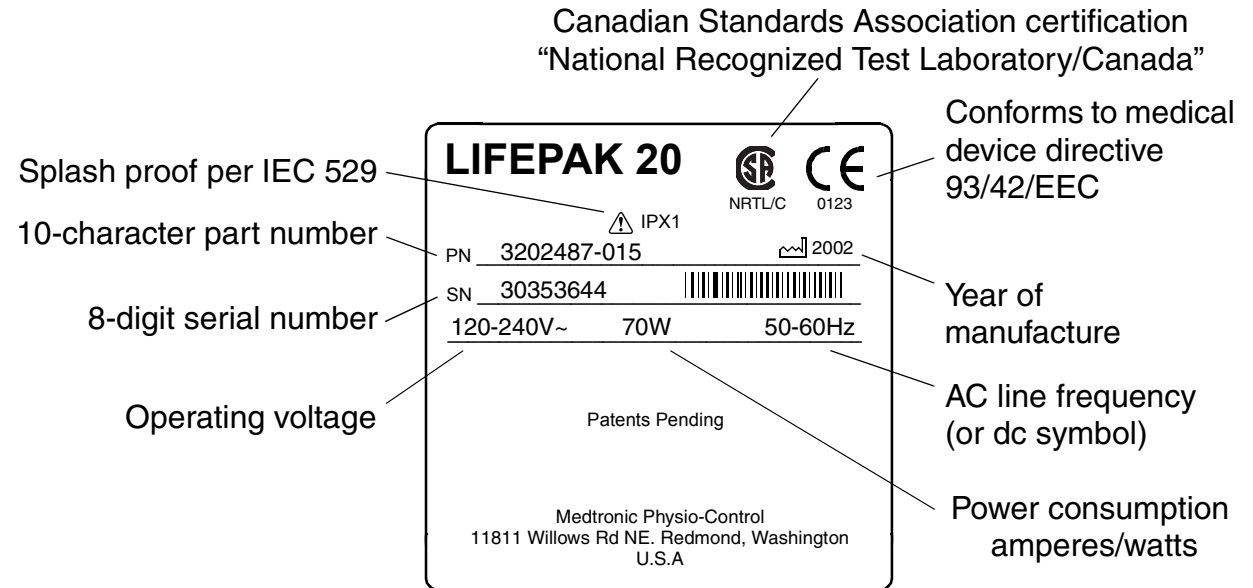
The LIFEPAK 20 defibrillator/monitor configuration data may be loaded only by authorized Medtronic personnel. Contact your local Medtronic representative for assistance.

Defibrillator Part Number and Serial Number

11-175

PN and SN Label

The LIFEPAK 20 defibrillator/monitor serial number (SN) and part number (PN) are noted on a label on the bottom of the device.



Defibrillator Part Number and Serial Number

11-176

Understanding the Part Number

The device part number, for example, VLP20-02-000021, reflects the device options, features, language, operating power, and so forth.

Understanding the Serial Number

The serial number for the LIFEPAK 20 defibrillator/monitor is related to the sales order created during device manufacturing and appears on the serial number label on the bottom of the defibrillator. Use this number when calling to order parts.

How to Order Parts

11-177

Ordering Parts

To order parts, contact your local Medtronic representative. In the USA, call PARTSLINE at 1.800.442.1142. Provide the part number and serial number located on the bottom of the device. Specify all assembly numbers, part numbers, reference designations, and descriptions. Parts may be substituted to reflect device modifications and improvements.

Manufacturing Date

In some cases when ordering parts, you may also need the device manufacturing date. This date is available for viewing by accessing the Device Log and noting the manufacturing date. To access the Device Log, refer to [About the Device Log](#) and review the information for the manufacturing date.

Serial Number

The serial number of the device identifies the manufacturing conditions and elements used in producing your device. When ordering parts, use the serial number (SN) listed on the label on the bottom of the defibrillator.

A

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LIFEPAK 20 Defibrillator/Monitor

Performance Inspection Procedure Checklist



Model # _____

Serial # _____

Department/Location _____

Type of PIP: Post-Repair Annual

Performed By _____

Date _____

Inspection		Pass	Fail	NA	Comments
A	Physical Inspection	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Testing		Pass	Fail	NA	Comments
1	Power On				
	a. Confirm the Service indicator is off.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	b. Confirm the device completes the Power On sequence.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

2	Record Operating Data				
	360 J Shocks	<input type="text"/>	<input type="text"/>	Power Cycle Count	<input type="text"/>
	225–325 J Shocks	<input type="text"/>	<input type="text"/>	Pacing Count (if installed)	<input type="text"/>
	100–200 J Shocks	<input type="text"/>	<input type="text"/>	Shock Count	<input type="text"/>
	0–70 J Shocks	<input type="text"/>	<input type="text"/>	Power On Time	<input type="text"/>
	Total Shocks	<input type="text"/>	<input type="text"/>	Printer On Time	<input type="text"/>
				SpO2 Operating Time (if installed)	<input type="text"/>

3	Keypads Confirm all control text boxes are highlighted.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
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4	Printer Confirm printed test strip and CHECK PRINTER message.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
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5	Audio Confirm voice messages and tones are clear and not distorted.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
----------	---	--------------------------	--------------------------	--------------------------	--

6	5-Lead ECG Characteristics [Alternative: 3-Lead ECG Characteristics]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	a. Confirm leads off screen messages.				
	b. Record 5-lead ECG gain (tolerance 36 to 44 mm).			Amplitude: _____ mm	

7	QUIK-COMBO Impedance Sense	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	a. Confirm display of PADDLES LEADS OFF message. [248 ohms]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	b. Confirm no display of PADDLES LEADS OFF message. [182 ohms]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

8	QUIK-COMBO User Test [Alternative: Standard Paddles User Test] Confirm UUT passes QUIK-COMBO User Test	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
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9	QUIK-COMBO Delivered Energy				
	2 J – Record delivered energy (tolerance 1.0 to 3.0 J).	Energy Level: _____ J	<input type="checkbox"/>		
	70 J – Record delivered energy (tolerance 65.1 to 74.9 J).	Energy Level: _____ J	<input type="checkbox"/>		
	360 J – Record delivered energy (tolerance 334.8 to 385.2 J).	Energy Level: _____ J	<input type="checkbox"/>		

Testing	Pass	Fail	NA	Comments
10 QUIK-COMBO ECG Characteristics [Alternative: Standard Paddles ECG Characteristics] Record QUIK-COMBO ECG gain (tolerance 36 to 44 mm; 38 to 50 mm with QED-6). Amplitude: _____ mm				
11 QUIK-COMBO Synchronous Cardioversion [Alternative: Standard Paddles Synchronous Cardioversion] Record Sync Rwave (maximum 60 ms): Remote Sync : .Sync LED is flashing Sync: _____ ms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
12 Standard Paddles User Test [Alternative: QUIK-COMBO User Test] Confirm UUT passes Standard Paddles User Test	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
13 Standard Paddles Delivered Energy [Alternative: QUIK-COMBO Delivered Energy] 2 J – Record delivered energy (tolerance 1.0 to 3.0 J). 70 J – Record delivered energy (tolerance 65.1 to 74.9 J). 360 J– Record delivered energy (tolerance 334.8 to 385.2 J). Energy Level: _____ J Energy Level: _____ J Energy Level: _____ J				
14 Standard Paddles Defibrillation Isolation Record isolation delivered energy (maximum 18 J). Energy Level: _____ J				
15 Standard Paddles ECG Characteristics [Alternative: QUIK-COMBO ECG Characteristics] Record Standard Paddles ECG gain (tolerance 36 to 44 mm; 38 to 50 mm with QED-6). Amplitude: _____ mm				
16 Standard Paddles Synchronous Cardioversion [Alternative: QUIK-COMBO Synchronous Cardioversion] Record Sync Rwave(maximum 60 ms). Remote Sync: .Sync LED is flashing Sync: _____ ms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
17 Pacer Option Characteristics [Alternative: No Pacer Option Characteristic] a. Confirm leads off detection. b. 10 ma – Record current (tolerance 5 to 15 ma). 50 ma – Record current (tolerance 45 to 55 ma). 100 ma– Record current (tolerance 95 to 105 ma). 150 ma– Record current (tolerance 142.5 to 157.5 ma). 200 ma– Record current (tolerance 190 to 210 ma). c. Record pulse width (tolerance 19.0 to 21.0 ms). Current Level: _____ ma Current Level: _____ ma Current Level: _____ ma Current Level: _____ ma Current Level: _____ ma Pulse Width: _____ ms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
18 ECG Analog Output Record signal amplitude (tolerance 0.85 to 1.15 Vp-p). Amplitude: _____ Vp-p				
19 Oximeter [if SpO2 option is installed] Confirm SpO2 reading is between 90% and 100%.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
20 Ground Resistance Test	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
21 Chassis Leakage Current a. Neutral Closed, Polarity Normal Lead-Chassis, Normal. b. Neutral Closed, Polarity Normal, Lead-Chassis, Fault. c. Neutral Closed, Polarity Reversed, Lead-Chassis, Normal. d. Neutral Closed, Polarity Reversed, Lead-Chassis, Fault.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Testing		Pass	Fail	NA	Comments
22	Earth Leakage Current				
	a. Neutral Closed, Polarity Normal, Earth.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	b. Neutral Closed, Polarity Reversed, Earth.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	c. Neutral Open, Polarity Normal, Earth.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	d. Neutral Open, Polarity Reversed, Earth.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
23	Paddles Source Leakage Current [Alternative: QUIK-COMBO Source Leakage Current]				
	a. Neutral Closed, Polarity Normal, Lead-Gnd, Normal.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	b. Neutral Closed, Polarity Normal, Lead-Gnd, Fault.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	c. Neutral Closed, Polarity Reversed, Lead-Gnd, Normal.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	d. Neutral Closed, Polarity Reversed, Lead-Gnd, Fault.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	e. Neutral Closed, Polarity Normal, Lead-Lead, Normal.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	f. Neutral Closed, Polarity Normal, Lead-Lead, Fault.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	g. Neutral Closed, Polarity Reversed, Lead-Lead, Normal.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	h. Neutral Closed, Polarity Reversed, Lead-Lead, Fault.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
24	Paddles Sink Leakage Current [Alternative: QUIK-COMBO Sink Leakage Current]				
	Neutral Closed, Polarity Normal, Lead Iso.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
25	QUIK-COMBO Source Leakage Current [Alternative: Paddles Source Leakage Current]				
	a. Neutral Closed, Polarity Normal, Lead-Gnd, Normal.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	b. Neutral Closed, Polarity Normal, Lead-Gnd, Fault.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	c. Neutral Closed, Polarity Reversed, Lead-Gnd, Normal.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	d. Neutral Closed, Polarity Reversed, Lead-Gnd, Fault.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	e. Neutral Closed, Polarity Normal, Lead-Lead, Normal.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	f. Neutral Closed, Polarity Normal, Lead-Lead, Fault.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	g. Neutral Closed, Polarity Reversed, Lead-Lead, Normal.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	h. Neutral Closed, Polarity Reversed, Lead-Lead, Fault.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
26	QUIK-COMBO Sink Leakage Current [Alternative: Paddles Sink Leakage Current]				
	Neutral Closed, Polarity Normal, Lead Iso.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
27	ECG 3- or 5-Lead Source Leakage Current				
	a. Neutral Closed, Polarity Normal, Lead-Gnd, Normal.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	b. Neutral Closed, Polarity Normal, Lead-Gnd, Fault.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	c. Neutral Closed, Polarity Reversed, Lead-Gnd, Normal.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	d. Neutral Closed, Polarity Reversed, Lead-Gnd, Fault.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	e. Neutral Closed, Polarity Normal, Lead-Lead, Normal.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	f. Neutral Closed, Polarity Normal, Lead-Lead, Fault.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	g. Neutral Closed, Polarity Reversed, Lead-Lead, Normal.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	h. Neutral Closed, Polarity Reversed, Lead-Lead, Fault.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
28	ECG 3- or 5-Lead Sink Leakage Current				
	a. Neutral Closed, Polarity Normal, Lead Iso.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
29	SpO2 Source Leakage Current [If SpO2 option is installed]				
	a. Neutral Closed, Polarity Normal, Lead-Gnd, Normal.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	b. Neutral Closed, Polarity Normal, Lead-Gnd, Fault.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	c. Neutral Closed, Polarity Reversed, Lead-Gnd, Normal.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	d. Neutral Closed, Polarity Reversed, Lead-Gnd, Fault.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
30	SpO2 Sink Leakage Current [If SpO2 option is installed]				
	Neutral Closed, Polarity Normal, Lead Iso.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	