Medtronic

LIFEPAK® 20
LIFEPAK 20e

Defibrillator/Monitor with ADAPTIV™ Biphasic Technology

Service Manual

Click Here for Table of Contents | Click Here for Navigation Help

Click a Topic

Preface

This service manual describes how to maintain, test, troubleshoot, and repair the LIFEPAK 20 defibrillator/monitor or LIFEPAK 20e defibrillator/monitor (device).

Note: Except where specified, the information in this manual pertains to both the LIFEPAK 20 and 20e defibrillator/monitor.

Separate publications, the *LIFEPAK 20 Defibrillator/Monitor Operating Instructions* (MIN 3200750) and *LIFEPAK 20e Defibrillator/Monitor Operating Instructions* (MIN 3205878), are used 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 the name of a button, menu, menu item, screen message, or screen overlay appears in all caps, for example, ANALYZE button and SETUP menu.

This section covers the following topics:

(Continued on next page)

Preface *(continued)*

Trademarks

MIN 3202007-001 / CAT. 26500-002703

Using Adobe Reader

Accessing Adobe Reader Help

This service manual opens in Adobe® Reader, which is included on this documentation CD. For additional assistance using the Adobe Reader program, access ADOBE READER HELP in the HELP menu.

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 or hide the bookmarks column, click the BOOKMARKS tab located to the far left of the screen.

To jump to a bookmark topic, click the desired topic.

Note: A plus sign to the left of a bookmark topic indicates additional topics exist under that bookmark level. Click the plus sign to expand or collapse the bookmarks.

Using Page View

Click the PAGES tab located to the far left of the screen to view miniature images of each page in the document. Scroll through the pages and click an image to jump quickly to that page.

Navigating Through the Manual

Blue text indicates a hyperlink. Click a link to jump to that topic. Click Back in the navigation bar at the bottom of each page to return to your previous location. The pointer changes to a pointing finger when positioned over a link.

A navigation bar at the bottom of each page also provides helpful links. The navigation bar includes:

- Table of Contents Click to jump to the main table of contents for the manual.
- Section Contents Click to jump to the table of contents for the section you are currently viewing.
- Index Click to jump to the index.
- Back Click to retrace your steps in a document, returning to each page in the reverse order visited.
- Next Page Click to jump to the next page of the manual.
- Previous Page Click to jump to the previous page of the manual.

Some pages include an additional navigation bar above the main bar that provides access to closely related topics.

Viewing the PIP Checklist

The **LIFEPAK 20/20e Defibrillator/Monitor Performance Inspection Procedure Checklist** is also included on this CD-ROM:

You can view this document by opening the file in Adobe Reader or by clicking the appropriate links provided in this service manual.

Service Personnel Qualifications

Service technicians must be properly qualified and thoroughly familiar with the operation of the device. 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

Contacting Medtronic

Medtronic Emergency Response Systems
11811 Willows Road Northeast
Redmond, WA 98052-2003 USA
Telephone: 1.425.867.4000
Toll Free (USA only): 1.800.442.1142
Fax: 1.425.867.4121
Internet: **www.medtronic-ers.com**
www.medtronic.com

Medtronic Europe S.A.
Medtronic Emergency Response Systems
Rte du Molliau 31
Case postale 84
1131 Tolochenaz
Switzerland
Telephone: 41.21.802.7000
Fax: 41.21.802.7900

Responsibility for Information

This service manual describes the methods required to maintain, test, and repair the device. It does not address the operation of the device. **Qualified service personnel** must consult the appropriate operating instructions and this 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 has access to the information in this service manual, including any warnings and cautions used throughout the manual.

Device Tracking

!USA Device Tracking:

The U.S. Food and Drug Administration requires defibrillator manufacturers and distributors to track the location of their devices. If your device has been sold, donated, lost, stolen, exported, or destroyed, or if it was not obtained directly from Medtronic, please notify the device-tracking coordinator at 1.800.426.4448. Refer to your operating instructions for more information concerning device tracking.

Service Information

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

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

Replacement procedures for the device are limited to those items accessible at the subassembly level. Replacements and adjustments must be made by qualified service personnel. 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 device, contact your local service or sales representative. In the USA, call Medtronic Emergency Technical Service at 1.800.442.1142. Outside the USA, contact your local Medtronic representative.

Warranty Information

Refer to the warranty statement included in the *Maintaining the Equipment* section in the operating instructions.

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.

Configuration Information

This service manual covers existing devices and options through the following revisions:

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

Glossary

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

- ADAPTIV™ biphasic technology — Property of the shock waveform generated by the device. 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).
- Automated external defibrillator (AED) — The device 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, refer to the *Shock Advisory System* section in the operating instructions.
- CODE SUMMARY™ report — A summary report that consists of a preamble, an event/vital signs log, and waveforms associated with certain events. Refer to the *Data Management* section in the operating instructions for a sample CODE SUMMARY report.

(Continued on next page)

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 on or the VF/VT ALARM is selected after pressing the ALARMS button (manual mode). The CPSS operates in conjunction with the Shock Advisory System (SAS). For more information about CPSS and SAS, refer to the *Shock Advisory System* section in the operating instructions.
- 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 device.
- 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.

(Continued on next page)

Glossary *(continued)*

- Shock Advisory System (SAS) — A computerized ECG analysis system used to detect a shockable rhythm. For more information about CPSS and SAS, refer to the *Shock Advisory System* section in the operating instructions.
- SpO2 — A noninvasive pulse oximeter that checks the saturation of oxygen in arterial blood.
- Test plug — An accessory used to connect the test load to the patient connector on the device.

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
Ah	Ampere hour
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

(Continued on next page)

Acronyms *(continued)*

Term	Description
ECG	Electrocardiogram
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

(Continued on next page)

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
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 device. This information is intended to alert service personnel to recommended precautions in the care, use, and handling of this medical device.

Terms

The following terms are used in this service manual or on the various configurations of the device. 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.

General Warnings and Cautions

The following are general warnings and cautions. Keep these warnings and cautions in mind when working with the device. More specific warnings and cautions appear throughout this service manual and the 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 the 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.

(Continued on next page)

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.

Symbols

The following list includes symbols that may be used in this service manual or on various configurations of the device 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
CAT.	Catalog number used for placing orders

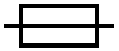
(Continued on next page)

Symbols *(continued)*

	Date of manufacture
	DC voltage
	Defibrillation protected, type BF patient connection
	Defibrillation-proof type CF terminal
	Do not dispose of this product in the unsorted municipal waste stream. Dispose of this product according to local regulations. See http://recycling.medtronic.com for instructions on the proper disposal of this product.
	Equipotential connector
	Event marker
	For USA audiences only
	Fragile/breakable, handle with care

(Continued on next page)

Symbols *(continued)*

	Fuse
>	Greater than
	Heart rate
	HOME SCREEN button
	Indoor use only
J	Joules
<	Less than
	Device to device cable
LOT YYWW	Lot number (batch code)
MIN	Manufacturer’s item number

(Continued on next page)

Symbols *(continued)*

CE 0123	Mark of conformity according to the European Medical Device Directive 93/42/EEC
–	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

(Continued on next page)

Symbols *(continued)*

	Recognized component mark for Canada and the United States
	Recycle this item
REF	Reorder number
	Safety ground. Protective earth connection
	SHOCK button
	Shock count (x) on screen
	Single use only
	Static-sensitive device (SSD)
	Switch off
	Switch on

(Continued on next page)

Symbols *(continued)*


Sync in/ECG out


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

About the Device

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

Energy Delivery

The device 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 can select from a variety of optional accessories for energy delivery (for example, standard hard paddles or internal paddles).

Introduction *(continued)*

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

AED Mode Operation

In **AED mode** (AED MODE 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 message. 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, refer to *Appendix E* in the operating instructions.

Introduction *(continued)*

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
- 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 a warning alarm
  - Prints continuous ECG data

Service features include calibration and diagnostic functions.

Introduction *(continued)*

Assemblies

The device consists of a three-piece case assembly that encloses the following modules/PCBs:

1. System Control PCB
2. Patient Parameter PCB
3. Power module
4. Therapy PCB
5. User Interface PCB
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

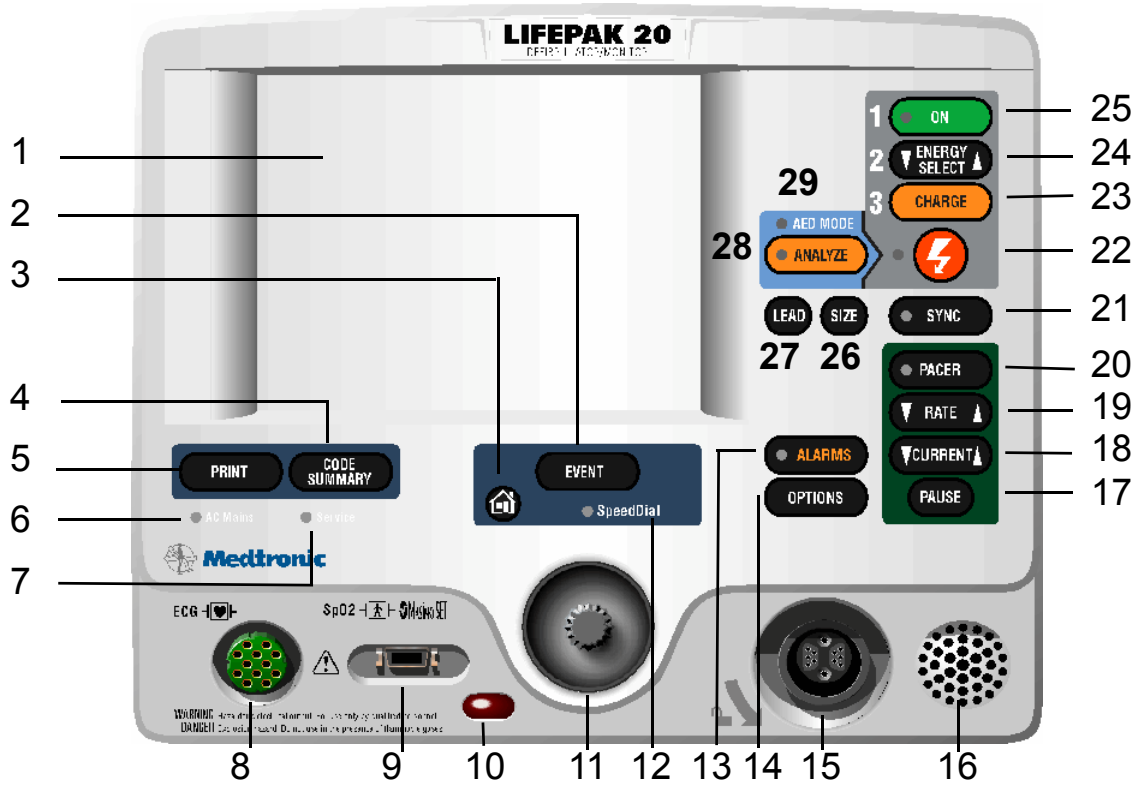
and the following Medtronic attachments:

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 the buttons, indicators and connectors shown below, click the appropriate right arrow on the items bar at the bottom of the page.



(Continued on next page)

Physical Description and Features *(continued)*

Front Panel *(continued)*

Number	Description
1	Display screen — Color liquid crystal display (LCD) screen displays operating messages, waveforms, status messages, setup menus, 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 LED — When the ac power (line power) is connected, the AC mains light is steady.

(Continued on next page)

Physical Description and Features *(continued)*

Front Panel *(continued)*

Number	Description
7	Service indicator LED — Illuminates when the device enters service error codes into the Service Log (accessed through the SERVICE menu). Refer to **Troubleshooting** for information about the error codes.
8	ECG cable connector — Connection port for the electrically isolated ECG patient cable.
9	SpO2 cable connector — Connection port for the pulse oximeter.
10	IrDA port connector — Infrared connection port provides wireless communications to data management devices (this feature is not available with this release).
11	SPEED DIAL selector — When active (SPEED DIAL LED is on), turn (either direction) to make a selection from the menu or overlay shown on the screen; press to confirm your selection.
12	SPEED DIAL LED — Illuminates when the SPEED DIAL is active.
13	ALARMS control — Press to activate and silence alarms.

(Continued on next page)

Physical Description and Features *(continued)*

Front Panel *(continued)*

Number	Description
14	OPTIONS control — Press to access the OPTIONS menu.
15	Therapy cable connector — Connection port for the following: – 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.

(Continued on next page)

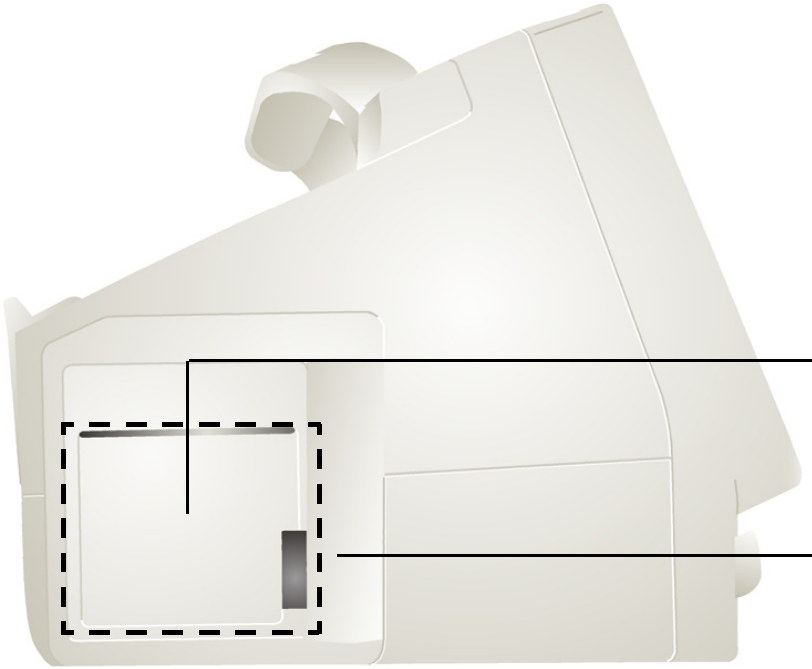
Physical Description and Features *(continued)*

Front Panel *(continued)*

Number	Description
20	PACER control — Press to activate the pacer function.
21	SYNC control — Press to activate the synchronized mode.
22	SHOCK control — Press to discharge the device.
23	CHARGE control — Press to charge the device.
24	ENERGY SELECT control — Press to select the energy levels in manual mode.
25	ON control — Press to turn the device on and off. Illuminates when the device 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 LED — Illuminates when device is in AED mode.

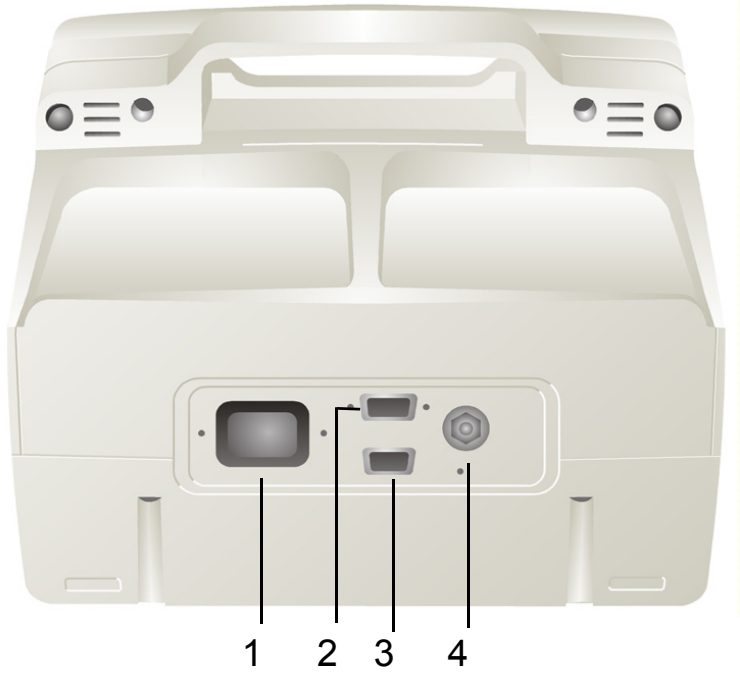
Physical Description and Features *(continued)*

Side Panel



Physical Description and Features *(continued)*

Back Panel

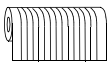


Number	Description
1	AC power connector — Connection port for ac (line) power
2	System connector — Connection port for RS-232 serial interface
3	ECG/Sync connector
4	Grounding stud

Physical Description and Features *(continued)*

What Is Shipped with a Basic Device

A basic device includes the components shown below. For additional information about components, refer to *Accessories, Supplies, and Training Tools* in the *Maintaining the Equipment* section of the operating instructions.

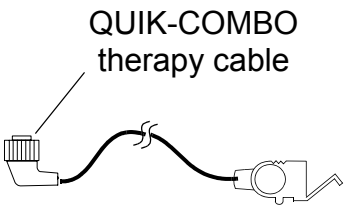


(3) rolls 50 mm printer paper

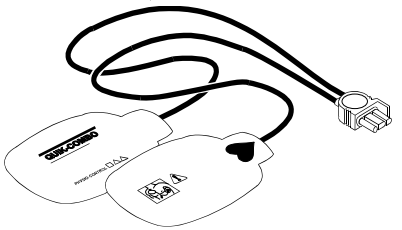
Operating instructions

In-Service Video (VHS)

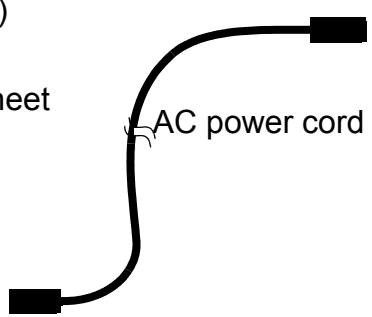
Warranty sheet



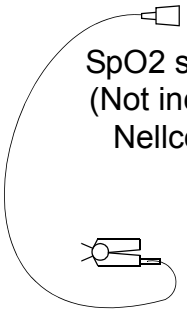
QUIK-COMBO therapy cable



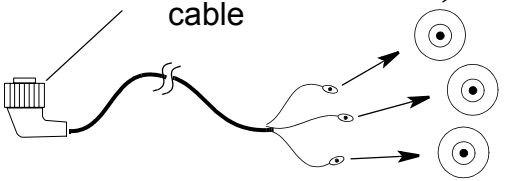
QUIK-COMBO electrodes



AC power cord



SpO2 sensor pack (Not included with Nellcor option)



3-lead ECG cable

(3-pack) ECG electrodes

Ordering Devices, Supplies, and Accessories

The following table (provided for reference) summarizes optional configurations, supplies, and accessories that are available. For ordering instructions, refer to **Ordering Parts**.

Item	Description	MIN	CAT.
LIFEPAK 20/20e defibrillator/monitor			
Basic device	Device with printer; includes:		
	■ LIFEPAK 20 operating instructions, English	3200750	26500-002538
	■ LIFEPAK 20e operating instructions, English	3205878	26500-002570
	■ 50-mm printer paper (package of 3)	804700-003	11240-000013
	■ In-Service Video, AED Mode (NTSC) ■ In-Service Video, Manual Mode (NTSC)	3202372-001 3202373-001	26500-001217 26500-002160
	■ Power cord, North America	803650-03	11140-000015
	■ Warranty statement	805963	26500-000590
	■ Accessory order form	3202149	26500-001050
ECG options	■ 3-lead ECG cable (AHA)	3006218-02	11110-000029
	■ 3-lead ECG cable (IEC)	3006218-03	11100-000030
	■ ECG electrodes (package of 3)	800139	11100-000001

(Continued on next page)

Ordering Devices, Supplies, and Accessories *(continued)*

Item	Description	MIN	CAT.
QUIK-COMBO	■ QUIK-COMBO therapy cables	3006570	11110-000040
	■ REDI-PAK QUIK-COMBO electrodes, English	3008497-661	11996-000017
	■ QUIK-COMBO test plug	3201673	11113-000002
SpO2	■ LNOP® reusable adult finger sensor	3201655-003	11171-000007
	■ LNOP SpO2 cable, 2.4 m (8 ft)	3201655-001	11171-000008
	■ LNCS reusable adult finger sensor	3201655-011	11171-000017
	■ LNCS SpO2 cable, 3.6 m (10 ft)	3201655-010	11171-000016
5-lead ECG	■ 5-lead ECG cable (AHA)	3200496-00	11110-000066
	■ 5-lead ECG cable (IEC)	3200496-01	11110-000067
	■ ECG electrodes (package of 3)	800139	11100-000001
Docking station*	■ Docking station and installation template	3201551	21330-000996

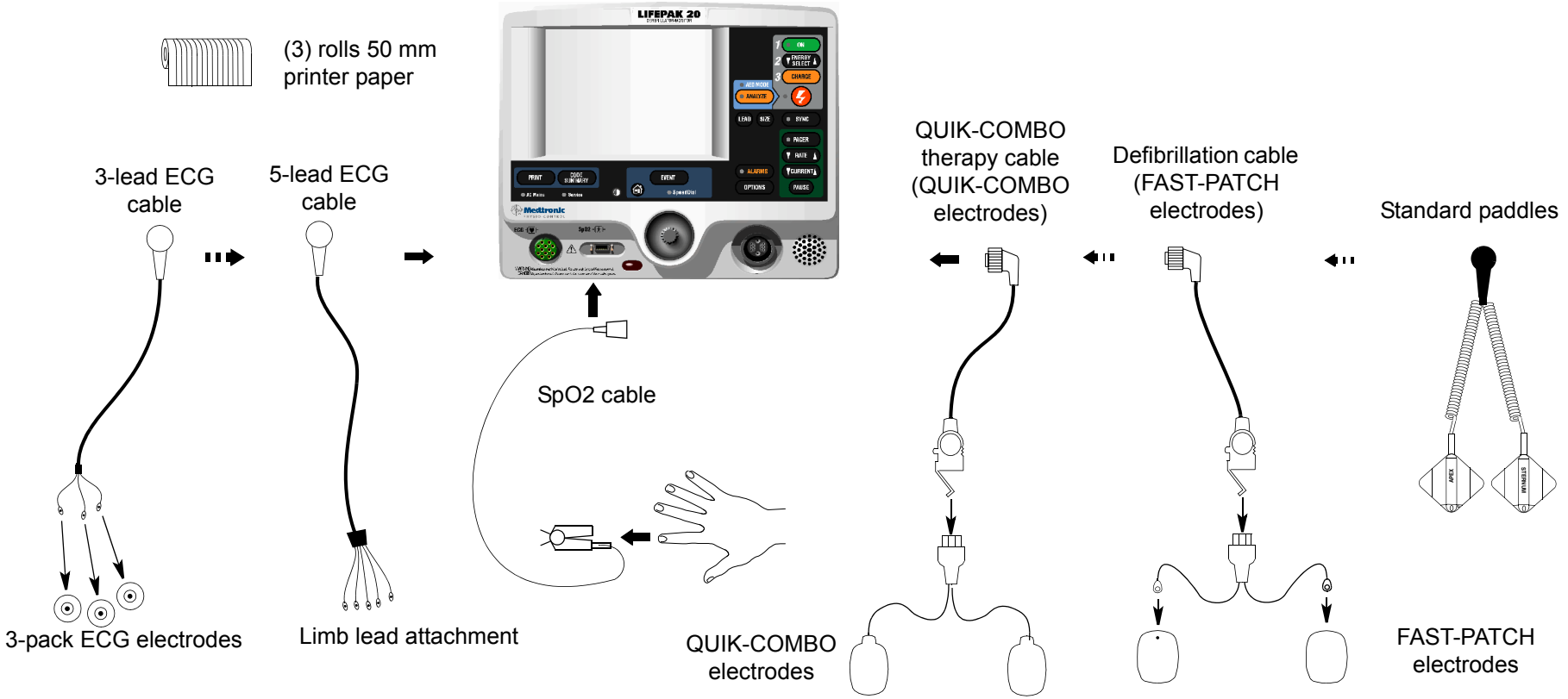
You can install the docking station on any flat surface using the installation template provided with the device. Place the template where you want to install the docking station and use it as a guide to drill the holes for the screws that secure the device.

Note: Ensure that the device has an adequate turning radius before installing the docking station.

System Context Diagrams

Front of Device

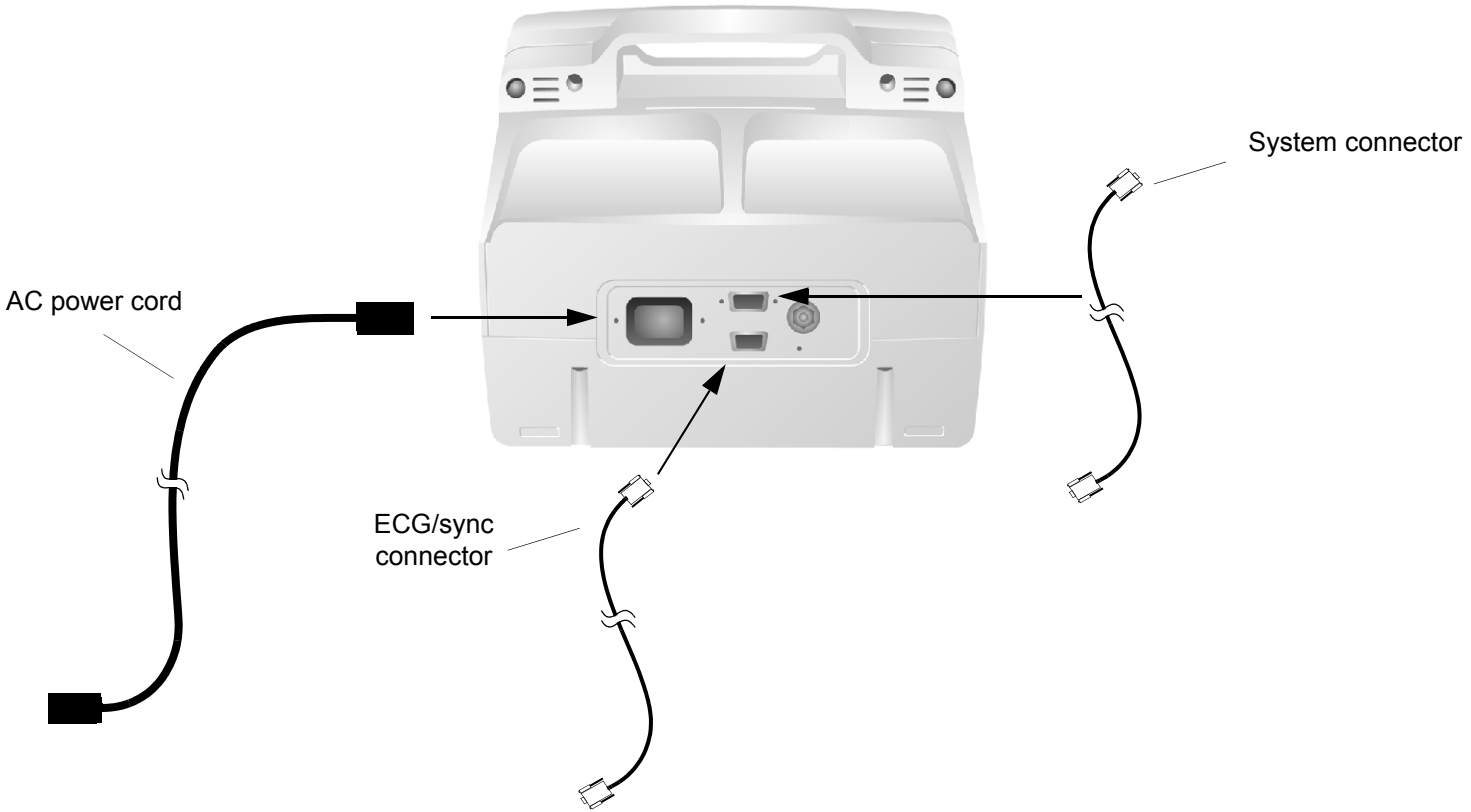
The system context diagrams illustrate how the device connects with external equipment, including accessories, batteries, and power devices.



(Continued on next page)

System Context Diagrams *(continued)*

Back of Device



Functional Description

Introduction

The LIFEPAK 20/20e 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 device offers SpO2 and ECG monitoring. This device should be used indoors only (for example, a hospital or therapy center) and is powered by ac (line) power. There is an additional internal battery for use as a backup to ac power.

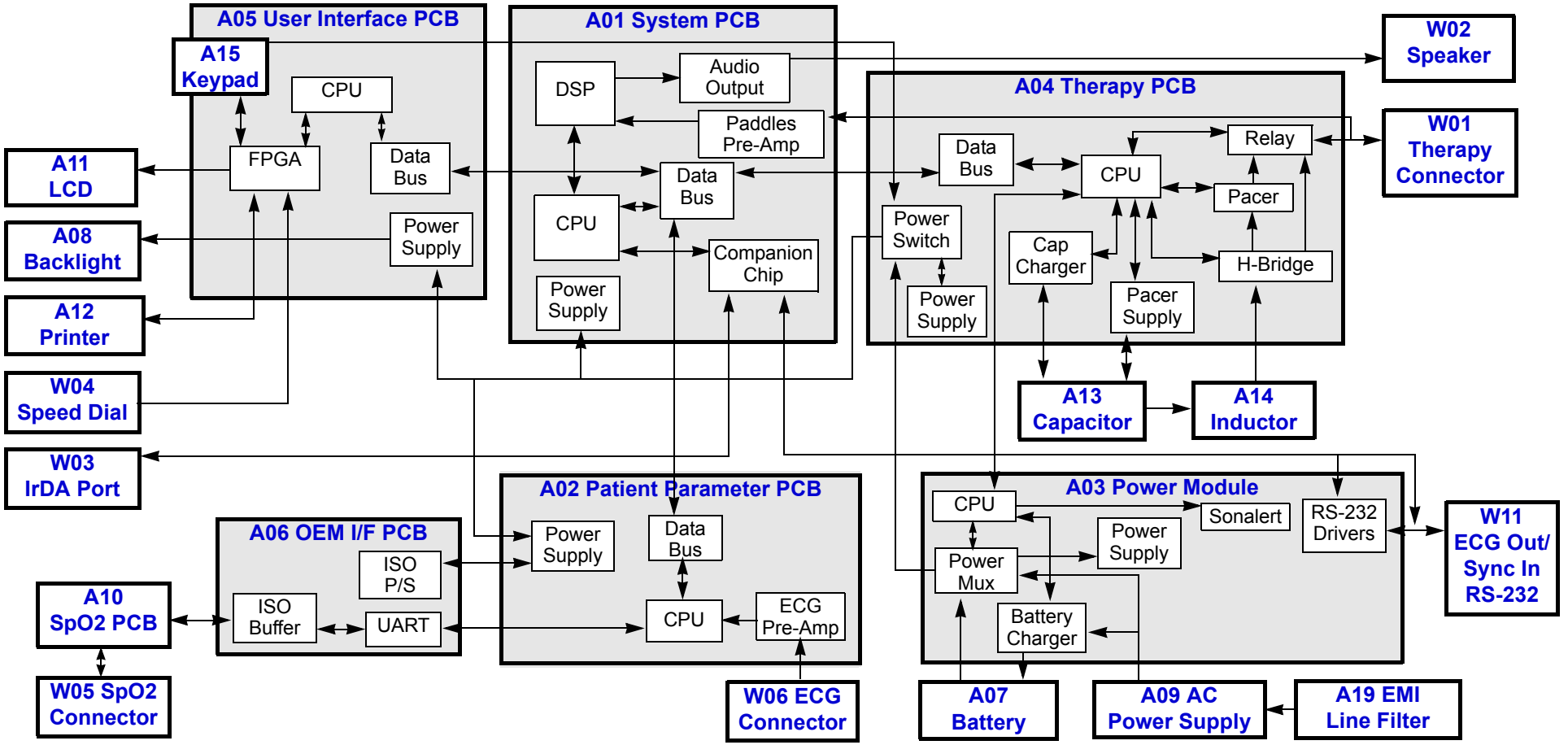
The following functional description is intended to provide service personnel with a basic understanding of the device design. Its purpose is to assist qualified service technicians in troubleshooting to the subassembly level. Troubleshooting below the subassembly level outside the factory is not recommended,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

Refer to the diagrams on the next two pages as you review the descriptions that follow.

Functional Description *(continued)*

System Block Diagram

Click a link in the diagram below to view the descriptive text.



Functional Description *(continued)*

A01 System Control PCB

The **A01 System Control PCB** provides the central control for the device. 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 device, including the RS-232 and IrDA external communication ports. The data bus provides high-speed communication between the A01 System Control PCB and other PCBs within the device.

The major subsystems on the A01 System Control PCB are as follows:

- **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 *(continued)*

A01 System Control PCB *(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. Change in patient impedance is also measured using a 57.1 kHz carrier.
- **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 are provided to drive the W02 Speaker located on the front case of the device.

Functional Description *(continued)*

A02 Patient Parameter PCB

The **A02 Patient Parameter PCB** collects all the patient data (3- and 5-lead ECG and SpO2 for the device), 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 PCB 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 major subsystems on the A02 Patient Parameter PCB are as follows:

- **Power Supplies** — The A02 Patient Parameter PCB uses switched power from the A04 Therapy PCB 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 *(continued)*

A02 Patient Parameter PCB *(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 modules/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 major subsystems on the A03 Power Module are as follows:

- **Power Supplies** — The A03 Power Module uses ORed_VBatt (battery voltage ORed with dc power from the A09 AC Power Supply Module) 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 *(continued)*

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 device. This circuit is under supervisory control of the CPU and provides the current voltage from the A07 Battery and A09 AC Power Supply Module to the CPU. The circuit automatically switches from ac power to battery power if the voltage from the ac power supply falls rapidly. Low voltage is detected by the A09 AC Power Supply Module and broadcast to the other PCBs through the device internal communication buses.
- **Battery Charger** (LIFEPAK 20 defibrillator/monitor) — The battery charger is a constant current charger designed specifically to support the A07 NiMH Battery selected for the device. NiMH batteries are not designed for trickle charging, so the A09 AC Power Supply Module 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 *(continued)*

A03 Power Module *(continued)*

- **Battery Charger** (LIFEPAK 20e defibrillator/monitor) — The battery charger is a constant current-constant voltage charger designed specifically to support the A07 Lithium Ion Battery selected for the device. Li-ion batteries are not designed for trickle charging, so the A09 AC Power Supply Module keeps track of the Li-ion battery's state-of-charge and, when it drops below 85%, the battery charger initiates charging of the battery (provided the temperature is between 0° and 50° C). Charging can occur while the device is powered on or while the device is powered off, depending on need. The battery charger is designed to typically charge the internal battery in less than four hours when the device is powered off and AC power is applied.
- **Sonalert** — The sonalert is an audio tone generator located on the power module that warns the user if the device is turned off while not connected to ac power (which depletes the internal A07 Battery). This **ac loss alert alarm** can be turned off. A shipping mode setup is provided to temporarily disable this feature when packing the device for shipment.
- **RS-232 Drivers** — The RS-232 signal originates on the A01 System Control PCB. The RS-232 drivers shift the signal levels to ±12 V prior to the system connector output.

Functional Description *(continued)*

A04 Therapy PCB

The **A04 Therapy PCB** controls the pacing and defibrillation therapy features. The primary communication between the A04 Therapy PCB and the remainder of the device 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 major subsystems on the A04 Therapy PCB are as follows:

- **Power Supplies** — The A04 Therapy PCB uses SW_VBatt (switched battery voltage) from the A03 Power Module 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 *(continued)*

A04 Therapy PCB *(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 Module to the remaining PCBs in the device. Low Battery (Battery Fail) is detected and a discrete signal is broadcast to other PCBs 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 to automatically 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 the A13 Energy Capacitor up 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 *(continued)*

A04 Therapy PCB *(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 W01 Therapy Connector assembly 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 *(continued)*

A05 User Interface PCB

The **A05 User Interface (UI) PCB** 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 device 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 PCB.

The major subsystems on the A05 UI PCB are as follows:

- **Power Supplies** — The A05 UI PCB 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 A12 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 *(continued)*

A05 User Interface PCB *(continued)*

- **Field-Programmable Gate Array (FPGA)** — The Field-Programmable Gate Array (FPGA) provides the interface between the CPU and all 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 device. 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 key covers to activate the domes when pressed by the user. The 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 PCB

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

(Continued on next page)

Functional Description *(continued)*

A06 OEM and Mechanical Components PCB *(continued)*

The major subsystems on the A06 OEM PCB are as follows:

- **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 Module.
- **UART and ISO buffers** — The UART and ISO buffers provide patient isolation for the serial data signals received from the A10 SpO2 Module and routes them to the A02 Patient Parameter PCB.

A07 Battery

On the LIFEPAK 20 defibrillator/monitor, the **A07 Battery** is a 2.7 Ah, 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 charger that is provided by the A03 Power Module when the device is connected to ac power. The battery wire harness interfaces directly with the A03 Power Module. 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.

(Continued on next page)

Functional Description *(continued)*

A07 Battery *(continued)*

On the LIFEPAK 20e defibrillator/monitor, the Li-ion battery technology was selected for the same reasons as NiMH, but they are even lighter in weight. Li-ion batteries require a constant current-constant voltage charger that is provided by the A03 Power Module when the device is connected to ac power.

A08 Backlight Inverter PCB

The **A08 Backlight Inverter** provides power to the internal fluorescent backlight in the 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 to 1500 RMS, open-circuit power to the internal A11 Active Display backlight.

A09 AC Power Supply Module

The **A09 AC Power Supply Module** is a 60-Watt 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 Module for routing to the other PCBs in the device. 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 Module sits above the ac power supply and plugs directly into the ac power supply's power connector. Both the A03 Power Module and the ac power supply are held mechanically in place by the power assembly bracket.

Functional Description *(continued)*

A10 SpO2 Module

The **A10 SpO2 Module** is a Masimo MS-5 (LIFEPAK 20 defibrillator/monitor) or Masimo MS-11 oximetry module. This patented OEM module 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 module mounts directly to the A06 OEM Interface PCB.

A11 Active Display/ Lens

The **A11 Active Display** measures 14.5 cm (5.7-inch) (measured diagonally) and 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 an elastomeric seal. This display features full-color, high-brightness, wide-viewing-angle capability, and is fully visible in bright-light 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 Module

The **A12 Printer Module** 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 *(continued)*

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 μF. The energy on the capacitor is removed when the device 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 PCB 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 device 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 *(continued)*

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 device.

A19 AC Input Power Filter

The **A19 AC Input Power Filter** provides input current overload and electromagnetic interference (EMI) protection for the device. 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.

W01 Therapy Connector Assembly

The **W01 Therapy Connector Assembly** provides a patient connection port 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 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 front case to provide user access for connecting the various external cable options.

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

Functional Description *(continued)*

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 one-watt output with a frequency response from 300 to 7000 Hz. The input to the speaker is from the audio power amplifier in the A01 System Control PCB. The speaker is mounted directly on the front case and the speaker wire harness plugs into the W25 Speaker Harness Extension Cable.

W03 Infrared Data (IrDA) Assembly

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 bottom case and the flex circuit connects directly to the A01 System Control PCB at J08. An infrared lens is molded into the device 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.

Functional Description *(continued)*

W04 Speed Dial Assembly

The **W04 Speed Dial Assembly** is a rotary data entry device mounted on the LIFEPAK 20/20e 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 a clockwise or counterclockwise direction) and presses (clicks), and then 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 bottom case of the device, and the flex circuit connects directly to the A10 SpO2 Module.

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 bottom case of the device, 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 defibrillator/monitor, 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.

Functional Description *(continued)*

W08 Battery Cable

On the LIFEPAK 20 defibrillator/monitor, the W08 Battery Cable connects the A07 Battery to the A03 Power Module. The cable is hardwired to the A03 Power Module and the other end connects to the A07 Battery at J85.

On the LIFEPAK 20e defibrillator/monitor, the W08 Battery Cable connects the A07 Battery at J85 to the A03 Power Module at J50.

W09/W10 Power to Therapy PCB Cables

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

On the LIFEPAK 20 defibrillator/monitor, W10 is hardwired to the A03 Power Module and connects to the A04 Therapy PCB at J17.

On the LIFEPAK 20e defibrillator/monitor, W10 connects to the A04 Therapy PCB at J17 and to the A03 Power Module at J51.

W11 ECG Sync/System Cables

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

W12 Grounding Cable

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

Functional Description *(continued)*

W13 AC Power Cable	The W13 AC Power Cable connects the A09 AC Power Supply Module at J02 with the A03 Power Module (hard-wired connection) for the LIFEPAK 20 defibrillator/monitor, and at J49 for the LIFEPAK 20e defibrillator/monitor.
W14 Printer Flex Cable	The W14 Printer Flex Cable connects the A05 UI PCB at J34 with the A03 Power Module at J45 and the A12 Printer.
W15 LCD to UI PCB Cable	The W15 LCD to UI PCB Cable connects the A11 LCD Display PCB at CN1 with the A05 UI PCB at J36.
W16 Display Jumper Cable Extender	The W16 Display Jumper Cable Extender connects the A11 LCD Display PCB at P77 to the A08 Backlight Inverter PCB at CN2.
W17 Backlight Inverter Cable	The W17 Backlight Inverter Cable connects the A08 Backlight Inverter PCB at P74 to the A05 UI PCB at J37.
W18 UI Flex Cable	The W18 UI Flex Cable connects the A02 Patient Parameters PCB at J21 and J22 to the A05 UI PCB at J31.

Functional Description *(continued)*

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.

Modes of Operation

When the device is turned on, it operates in one of five modes. Choose from the following links to learn more about a particular operating mode.

Manual Mode

Turning On the Device in Manual Mode

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

To configure the device to turn on in manual mode (the default is AED mode):

1. Display the **SETUP** menu and select MANUAL MODE.
2. Select MANUAL ACCESS in the MANUAL MODE submenu.
3. Select the DIRECT option.

The following table shows all the available power-on options.

Mode/Response	Response Description
Manual/Direct	Turns on in manual mode; direct access between AED and manual modes.
AED/Direct	Turns on in AED mode; direct access between AED and manual modes.
AED/Confirmed	Turns on in AED mode; confirmation required to enter manual mode.
AED/Passcode	Turns on in AED mode; passcode required to enter manual mode.

If the device is placed in manual mode and then reset to AED mode by pressing the ANALYZE button, there are no additional manual mode reprompts or passcode requests until the device power has been cycled.

(Continued on next page)

Manual Mode *(continued)*

Starting Manual Mode from AED Mode

If the AED MODE LED is on when the device is turned on, the device is in **AED Mode**.

To enter manual mode:

- Open the door (if installed) by pressing the MANUAL button on the lower left corner of the door.

  -OR-

- Press one of the following buttons:
  - ENERGY SELECT
  - CHARGE
  - PACER
  - LEAD

To restart AED mode, press the ANALYZE button or cycle the device power.

Note: Closing the door when in manual mode does not restart AED mode operation.

AED Mode

In AED mode (the default setting), the device automatically evaluates the patient rhythm to determine if a shock is needed and prompts the user to press the SHOCK button to deliver a shock.

The device can be reconfigured to turn on in **manual mode**, if desired.

To set options for AED mode, display the **SETUP** menu and select 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 *Defining Setup Options* section in the operating instructions.

Note: If configured to turn on in AED mode, opening the door on the device turns off AED mode and places the device in **manual mode**. Closing the door does not restart AED mode operation. To restart AED mode, press ANALYZE or cycle the device power.

Setup Mode

Introduction

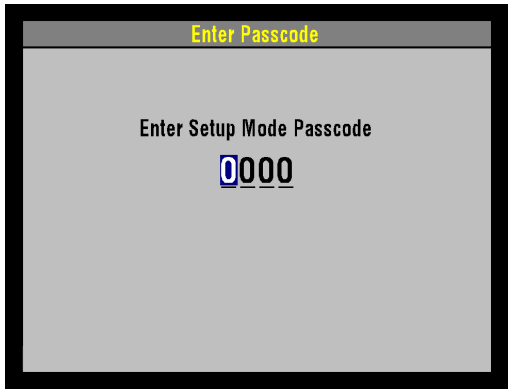
The operating defaults for the device are configured in the SETUP menu. Options include **manual mode** and **AED mode** operating characteristics, alarm setup, time-of-day clock, and others. There is also a factory-reset option that resets the device to the factory default settings, except the maintenance interval, which remains unchanged. 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.

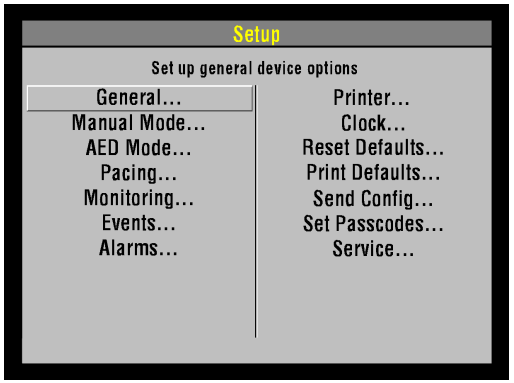
For a complete description of setup options, refer to the *Defining Setup Options* section in the operating instructions.

(Continued on next page)

Setup Mode *(continued)*

Displaying the Setup Menu





To display the SETUP menu:

1. Press and hold the OPTIONS and EVENT buttons, and then press the ON button. When the ENTER PASSCODE overlay appears, release the buttons. The SPEED DIAL LED illuminates, indicating that the SPEED DIAL is active.
2. To enter the passcode, rotate the SPEED DIAL to select a number and then press 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) or the reserved technician passcode (5433 or LIFE) can be used in place of other passcodes to gain access to the SETUP and SERVICE menus.
3. When you have entered the passcode, press the SPEED DIAL. The SETUP menu appears. The PASSCODE INCORRECT-TRY AGAIN message appears if an incorrect passcode is entered.

To exit the SETUP menu, turn the device OFF.

(Continued on next page)

Setup Mode *(continued)*

Setup Menu Options

The following table defines the SETUP menu options.

Note: Refer to the *Defining Setup Options* section in the 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 overlay
ALARMS	Set up alarms defaults
PRINTER	Set up printer defaults
CLOCK	Set up date and time defaults
RESET DEFAULTS	Reset all defaults to factory configuration settings

(Continued on next page)

Setup Mode *(continued)*

Setup Menu Options *(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	Display the SERVICE menu.

Saving the Setup Configuration

If the device owner uses a setup configuration that cannot be disturbed, two choices are available to preserve this setup during repair procedures.

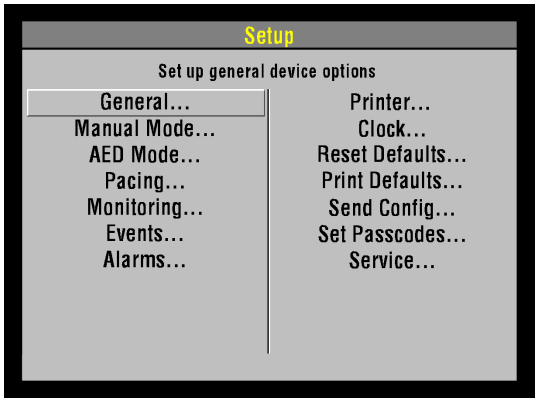
- The first method is to **print the setup configuration**. When service is complete, you can verify the setup and then manually reset the configuration.
- The second method is to **transfer the setup configuration** to another device. After service is complete, transfer the configuration back to the original device.

Note: Saving the configuration by transferring it to another device requires that both devices have the same software version. Otherwise, unexpected results can occur when the configuration is restored to the repaired device.

(Continued on next page)

Setup Mode *(continued)*

Creating a Passcode



To create a passcode, select SET PASSCODES in the SETUP menu.

Select one of the following options in the SET PASSCODES submenu.

Option	Description
SETUP MODE	Set passcode to enter setup mode.
ARCHIVES ACCESS	Select a passcode access protocol for archives mode: 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.

- ARCHIVES ACCESS – Set the device to any of the following protocols (refer to the table above):
  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 *(continued)*

Creating a Passcode *(continued)*

- SETUP MODE – Create a new passcode to access the SETUP menu. The ENTER PASSCODE overlay appears with the first digit highlighted. Rotate the SPEED DIAL to select digits.
- ARCHIVES MODE – Create a passcode to enter archives mode. The ENTER PASSCODE overlay appears with the first digit highlighted. Rotate the SPEED DIAL to select digits.
- DELETE RECORDS – Create a passcode to delete records in archives mode. The ENTER PASSCODE overlay appears with the first digit highlighted. Rotate the SPEED DIAL to select digits.

Service Mode

Introduction

The service mode functions enable qualified service technicians to:

Function	Description
*Perform device calibration routines	■ **Defibrillation Calibration**
*Perform device tests	■ **Keypad Test** ■ **Printer Test** ■ **Pixels Test** ■ **Audio Test**
View the device status registers	■ **Device Log Status** ■ **Counters Status** ■ **Service Log Status** ■ **Clear Memory** ■ **Device Data**
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.

(Continued on next page)

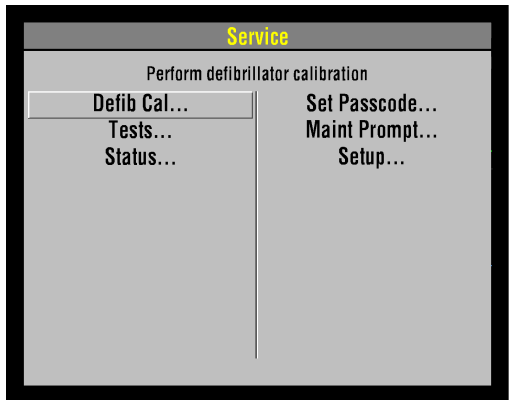
Service Mode *(continued)*

Displaying the Service Menu

To display the SERVICE menu:

1. Display the **SETUP** menu.
2. Select SERVICE from the SETUP menu.
3. Enter the service mode passcode (0000 or 5433).
4. After you enter the passcode, press the SPEED DIAL. The SERVICE menu appears. (If an incorrect passcode is entered, the PASSCODE INCORRECT - TRY AGAIN message appears.)

Service Menu Options



The SERVICE menu options include:

Option	Description
Defib Cal	Perform defibrillator calibration procedure.
Tests	Follow 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 menu.

To exit the SERVICE menu, turn the device OFF.

(Continued on next page)

Service Mode *(continued)*

Setting the Service Mode Passcode

To set a service mode passcode:

1. Select SET PASSCODE in the SERVICE menu. The SERVICE/SET PASSCODE overlay appears.
2. Enter a passcode by rotating the SPEED DIAL to select a number and then pressing the SPEED DIAL.
3. When the last digit is entered, the SERVICE menu appears.

(Continued on next page)

Service Mode *(continued)*

Setting a 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 device 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 a service technician.

To change the scheduled maintenance interval:

1. Display the SERVICE menu.
2. Select MAINT PROMPT. The SERVICE/MAINT PROMPT submenu appears showing the current prompt date for scheduled maintenance (if set).
3. Select INTERVAL. The interval choices are: OFF, 3 MONTHS, 6 MONTHS, and 12 MONTHS.
4. Select the desired interval.
5. Turn the device OFF.

(Continued on next page)

Service Mode *(continued)*

Resetting the Maintenance Prompt

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

To turn off or reset the scheduled maintenance prompt:

1. Display the SERVICE menu.
2. Select MAINT PROMPT. The SERVICE/MAINT PROMPT menu appears, showing the current prompt date for scheduled maintenance.
3. Select RESET. The prompt date is revised to the next scheduled maintenance date.
4. Turn the device OFF.

Inservice Mode

Introduction

Inservice mode enables users to practice or demonstrate the monitoring functions of the device. The functions include:

- Selecting ECG lead selection, size, and 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 device. Inservice mode cannot be entered if cables are attached to the device.
2. While holding down the HOME and EVENT buttons, turn the device ON. Release these buttons when the INSERVICE overlay appears.

To exit inservice mode, turn the device OFF.

Performance Inspection Procedure

The performance inspection procedure (PIP) is a set of manual test procedures used for an operational closed-case evaluation of the device. This section describes the test procedures you will perform to determine if the device 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. Refer to the *Operator Checklist* in the operating instructions for additional items.

PIP – Scope and Applicability

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

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

Refer to **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

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.
Test Equipment Verification	All test equipment used to perform the PIP must have a current calibration label, issued by a certified calibration facility.
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**.
Personnel Requirements	Service technicians who perform the PIP must be properly qualified and thoroughly familiar with the operation of the device, meeting the requirements described in **Service Personnel Qualifications**.

PIP – Test Equipment Requirements

The following table lists the 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: ±1%	Fluke® Biomedical Corp. 215A/217A
Defibrillator analyzer[1]	Energy range: 0 to 450 J Load resistance: 50 Ω ±1% Accuracy: ±2% +2 J Waveforms: NSR, VF, and sine wave	Fluke Biomedical Corp. 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: ±1% (<1 kHz)	Agilent 33120A

1. Some energy meters are not accurate for biphasic waveforms. Contact your defibrillator analyzer's manufacturer for more information.

(Continued on next page)

PIP – Test Equipment Requirements *(continued)*

Equipment	Specifications	Manufacturer
Decade resistance box	0 to 9 MΩ resistance box Resolution: 1 Ω; accuracy: ±1%	IET RS-200 Resistance Substituter
Fixture Assembly, Impedance box to electrode adapter		Medtronic MIN 3205651
Analog ECG output cable (optional)	Connects to the DB-15 connector	Medtronic MIN 3202553
DB15 cable	Connects to the DB-15 connector	N/A
QUIK-COMBO test post adapter	Connects to QUIK-COMBO therapy cable	Medtronic MIN 3005302
3-lead ECG cable		Medtronic MIN 3006218-02
5-lead ECG cable		Medtronic MIN 3200496
General purpose oscilloscope	Bandwidth: dc to 2 MHz Vertical accuracy: ±3% (5 mV – 5 v/div.) Horizontal time base accuracy: ±5%	Tektronix® 2232 or equivalent

(Continued on next page)

PIP – Test Equipment Requirements *(continued)*

Equipment	Specifications	Manufacturer
QUIK-COMBO electrode cable		Medtronic MIN 3006570
QUIK-COMBO test plug accessory		Medtronic MIN 3201673
Standard paddles		Medtronic MIN 3200936
Chassis leakage cable		Dale model 600/100, 2.4 m (8 ft)
LIFEPAK 20/20e SpO2 leakage cable		Medtronic PN 3201832-004, -005, -006

PIP – Instructions

General Instructions

This section lists the general instructions for performing the PIP.

- Troubleshoot and correct all failures and error codes before beginning the 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, and then repeat the PIP.

Exterior Physical Inspection

To perform an exterior physical inspection:

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

(Continued on next page)

PIP – Instructions *(continued)*

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 keypad 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 device is equipped with them).

Cleaning the Paddles

To clean the paddles:

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 *(continued)*

PIP Setup

WARNING!

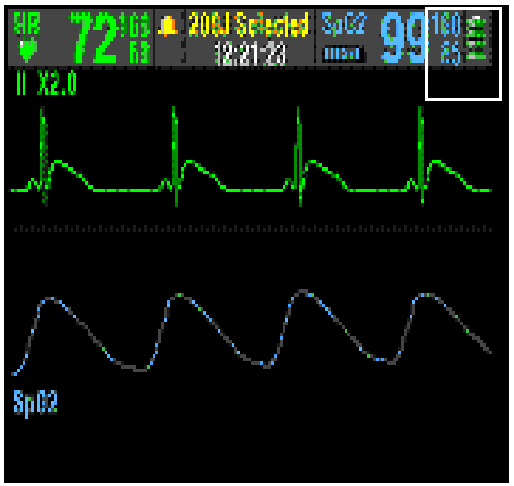
Shock hazard. The device discharges up to 360 joules of electrical energy through the device cable. You must safely discharge this electrical energy as described in this PIP. Do not attempt to perform this procedure unless you are thoroughly familiar with the operation of the device.

To set up the device in preparation for the PIP:

1. Install a roll of paper into the printer.
2. Connect the ac power cord to the device.
3. Connect the QUIK-COMBO electrode cable (or optional standard paddles) to the therapy connector.

PIP – Instructions *(continued)*

Power-On/Self-Test

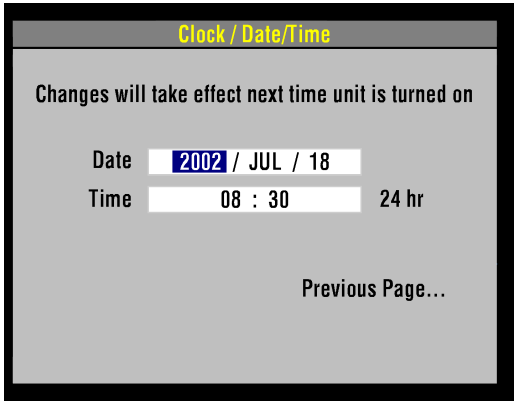


To perform the power-on/self-test:

1. Press ON to initiate the nominal, five-second, power-on, self-test routine.
2. Verify that the device display illuminates and the initial display screen appears, as shown to the upper left.
3. Verify the AC Mains indicator is ON.
4. Verify the Service indicator is off.
5. Turn the device OFF.
6. Continue to the next test.

PIP – Instructions *(continued)*

Date and Time test



To test the device date and time:

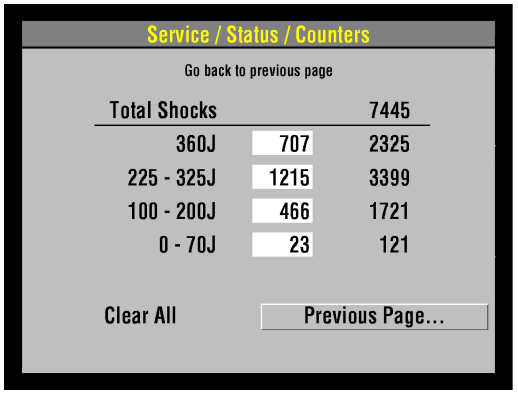
1. Turn the device ON.
2. Press Options key.
3. Select **Date/Time**...from the Options menu.
4. Verify that the correct date and time values are displayed on the LCD.

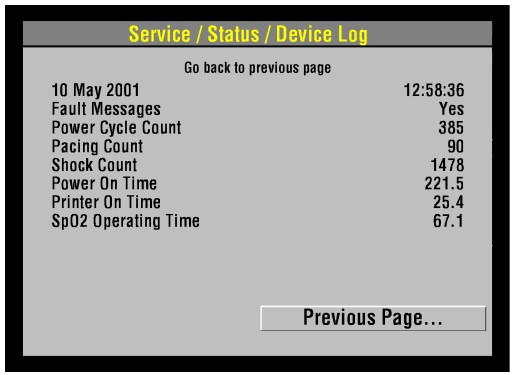
Note: If the date and time are incorrect, set date and time as needed.

5. Turn the device off.
6. Continue to the next test.

PIP – Instructions *(continued)*

Recording Operating Data



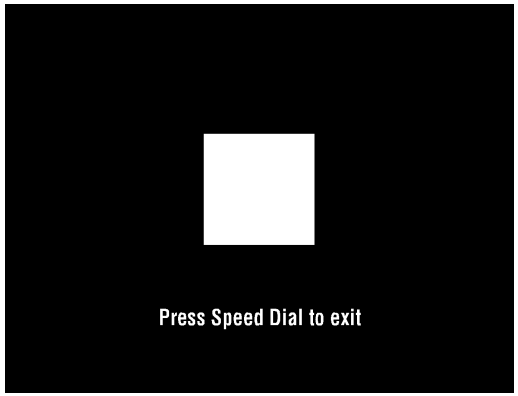


(Optional) To record the operating data onto the **PIP Checklist**, perform the following steps:

1. Display the **SERVICE** menu and select STATUS. (Refer to **Using the Service/ Status Features** for more information.)
2. Select COUNTERS in the SERVICE/STATUS submenu. Record the shocks since last reset (shown in boxes) and total shocks since the device was built. Select CLEAR ALL to reset the counters.
3. Select PREVIOUS PAGE.
4. Select DEVICE LOG in the SERVICE/STATUS submenu. Record the following:
   - Power Cycle Count
   - Pacing Count
   - Shock Count
   - Power On Time
   - Printer On Time
   - SpO2 Operating Time
5. Select PREVIOUS PAGE twice to return to the SERVICE menu.
6. Continue to the next test while still in service mode.

PIP – Instructions *(continued)*

Contrast Test — LCD

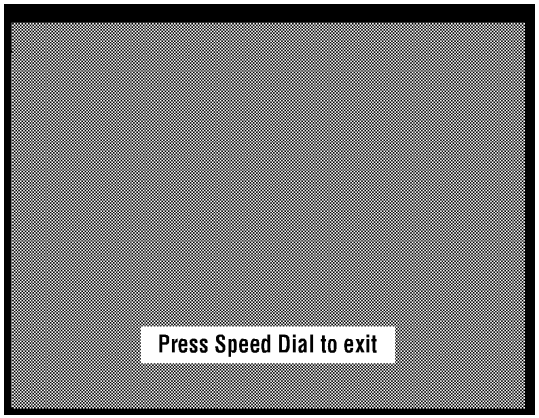


(Optional) To test the screen contrast:

1. Select TESTS in the SERVICE menu, and then select CONTRAST. Verify a square block appears in the center of the screen, as shown to the left.
2. After five seconds, the PRESS SPEED DIAL TO EXIT message appears.
3. Press the SPEED DIAL to return to the SERVICE/TESTS submenu.
4. Continue to the next test.

PIP – Instructions *(continued)*

Pixels Test

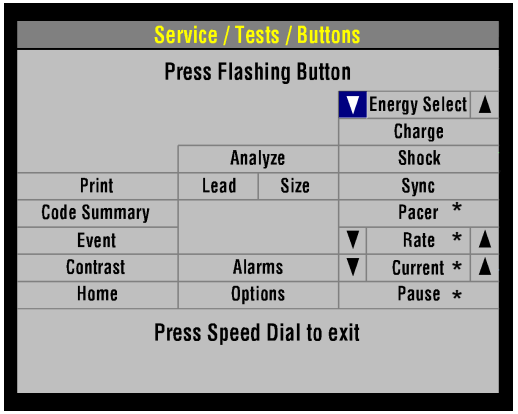


(Optional) To test the display pixels:

1. Select PIXELS in the SERVICE/TESTS submenu. The pixels test screen appears.
2. Carefully examine the screen for any anomalies. Rotate SPEED DIAL to scroll through test screens. The PRESS SPEED DIAL TO EXIT message will appear.
3. Press the SPEED DIAL to return to the SERVICE/TESTS submenu.
4. Continue to the next test.

PIP – Instructions *(continued)*

Keypad Test



* These buttons are not available on nonpacing models. Press the keypad in the button's location to verify the button.

To test the keypad:

1. Select BUTTONS on the SERVICE/TESTS submenu.
2. Press each front panel button when prompted by the flashing control legend (although you can press the buttons in any order).
3. Verify with each button pressed that its associated text box is highlighted. All buttons must be tested regardless of device configuration.

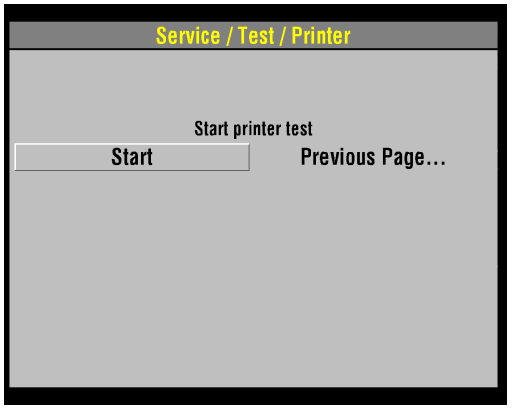
   Note: A failure is indicated by a control text box that is not highlighted. It is normal for the controls with up/down arrows to highlight only the arrows.
4. Press the switch located between the OPTIONS and PAUSE buttons.

   Note: The switch is hidden in the **elastomer keypad**.
5. Verify the key check sound, indicating the button is functioning properly.
6. Press the SPEED DIAL to return to the SERVICE/TESTS submenu.
7. Continue to the next test.

(Continued on next page)

PIP – Instructions *(continued)*

Printer Test

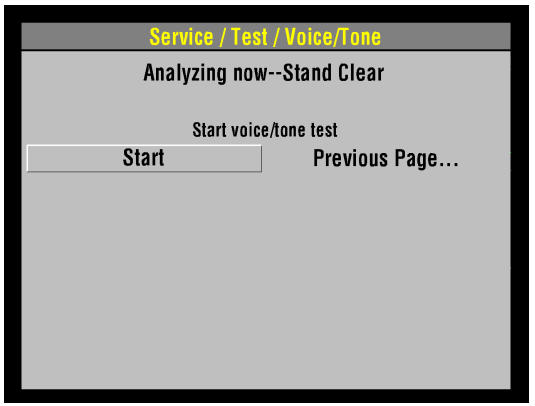


To test the 50 mm printer:

1. Select PRINTER in the SERVICE/TESTS submenu.
2. Select START on the SERVICE/TEST/PRINTER overlay to print a test strip.
3. Inspect the test strip for the following attributes:
   - The large “X” form prints without missing dots.
   - Four horizontal lines (one very close to the upper paper margin).
   - The character set prints clearly without broken characters.
   - Vertical lines spaced 25 mm ±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 submenu.
7. Continue to the next test.

PIP – Instructions *(continued)*

Audio Test



To test the device voice prompts and tones:

1. Select VOICE/TONE from the SERVICE/TESTS submenu.
2. Select START. Voice prompts sound in the speaker.
3. When satisfied that the voice prompts are clearly audible and reproduced without distortion, turn the device OFF.

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

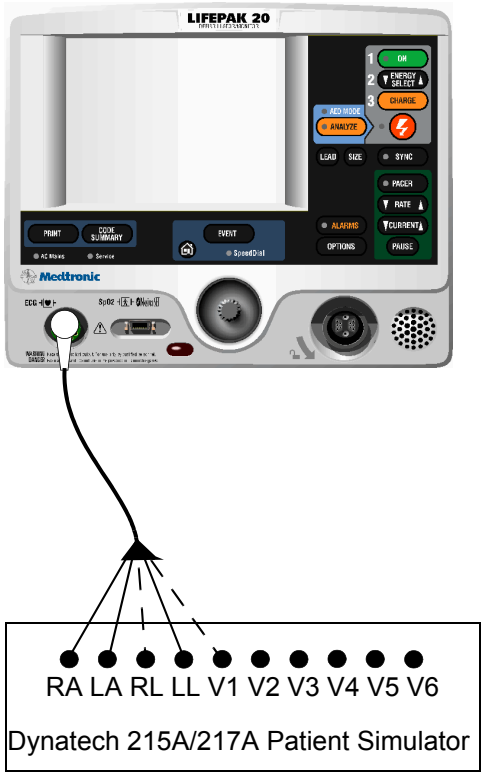
This completes PIP testing using the service mode test feature.

Continue to the next test.

PIP – Instructions *(continued)*

ECG Leads Characteristics setup

For ECG Lead Characteristics test, set up the Patient Simulator and device as shown below. Continue to the ECG Lead Characteristics Procedure on the next page when you complete the setup..



(Continued on next page)

PIP – Instructions *(continued)*

ECG Leads Characteristics test

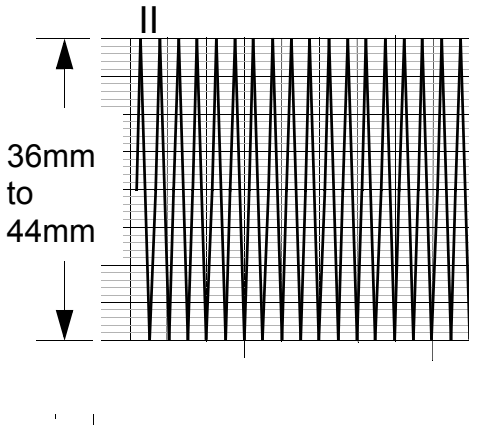
To test ECG Leads Characteristics:

1. Establish the ECG Lead Characteristics setup shown on the previous page.
2. Program the patient simulator output for a 60 BPM, NSR.
3. Turn the device on.
4. Set the device lead selection to LEAD II.
5. Remove the LL lead from the patient simulator.
6. Verify the device displays a LL LEADS OFF screen message.
7. Reconnect the LL lead.
8. Remove the RA lead from the patient simulator.
9. Verify the device displays a RA LEADS OFF screen message.
10. Reconnect the RA lead.
11. Set the device lead selection to LEAD I.
12. Remove the LA lead from the patient simulator.
13. Verify the device displays a LA LEADS OFF screen message.
14. Reconnect the LA lead..

(Continued on next page)

PIP – Instructions *(continued)*

ECG Leads Characteristics test *(continued)*

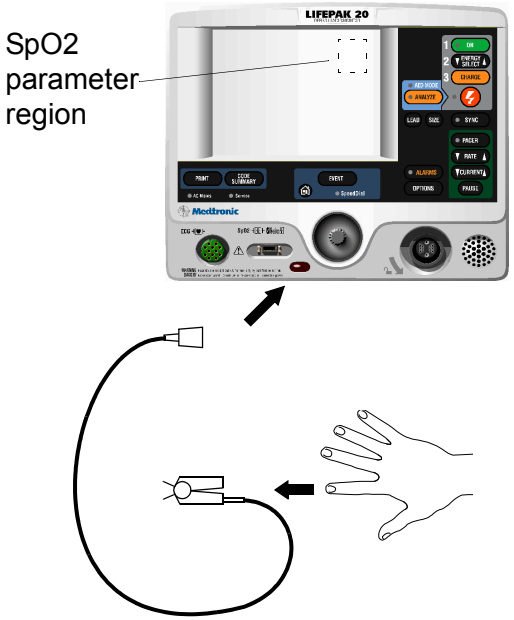


Lead	Printed Peak-to-Peak
I	18 mm to 22 mm
II	36 mm to 44 mm
C	36 mm to 44 mm

15. **For 5 Lead ECG only:** Set the device lead selection to LEAD II.
16. Remove the RL lead from the patient simulator.
17. Verify the device displays a ECG LEADS OFF screen message.
18. **For 5 Lead ECG only:** Set the device lead selection to LEAD C.
19. Remove the **V1**(C) lead from the patient simulator.
20. Verify the device displays a C LEADS OFF screen message.
21. Reconnect the **V1**(C) lead.
22. Program the patient simulator output for a 1 mV, 10 Hz sine wave.
23. Set the ECG size to 4.0 and lead selection to LEAD II.
24. Record five seconds of ECG Lead II and confirm the printed signal amplitude is 36 mm to 44 mm peak-to-peak.
25. Repeat Steps 23 and 24 for Lead I, substituting the signal amplitudes give in the table at the left.
26. **For 5 Lead ECG only:** Repeat Steps 23 and 24 for Lead C, substituting the signal amplitudes give in the table at the left.
27. Remove the ECG cable from the device.

PIP – Instructions *(continued)*

Oximeter Test



To test the SpO2 oximeter:

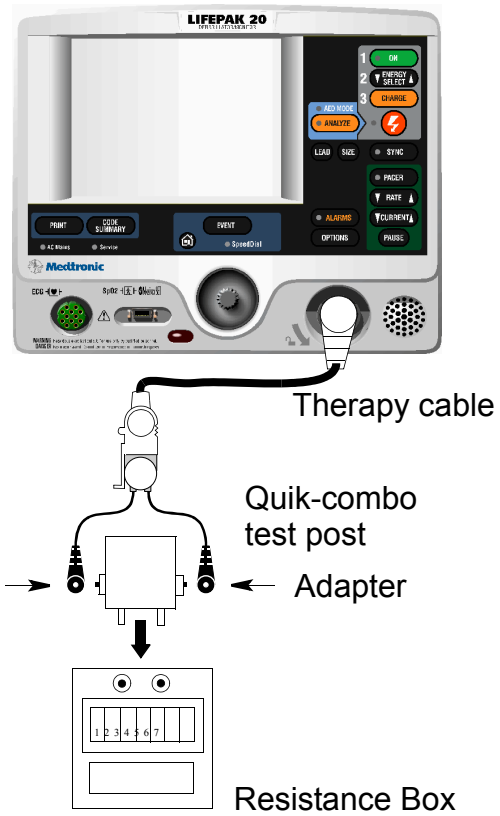
Note: Complete this test only if the device is equipped with the SpO2 option.

1. Connect the oximeter finger probe to the SpO2 connector as shown to 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 the device OFF.

PIP – Instructions *(continued)*

Therapy Impedance Sense Setup

For Therapy Impedance Sense test, set up the Resistance box and device as shown below. Continue to the Therapy Impedance Sense Procedure on the next page when you complete the setup.



PIP – Instructions *(continued)*

Therapy Impedance Sense test

To test Therapy Impedance Sense:

1. Establish the Therapy Impedance Sense setup shown in the figure on the previous page.
2. Set the decade resistance box to 50Ω.
3. Turn on the device.
4. Set the device: manual mode, ECG Size to 1.0, lead selection to PADDLES.
5. Set the decade resistance box to 248 Ω.
6. Verify the device display displays the PADDLES LEADS OFF message.
7. Set the decade resistance box to 182 Ω.
8. Verify the PADDLES LEADS OFF message is removed from the device display.
9. Turn the device off.

PIP – Instructions *(continued)*

Therapy - User Test

To test the Therapy User test:

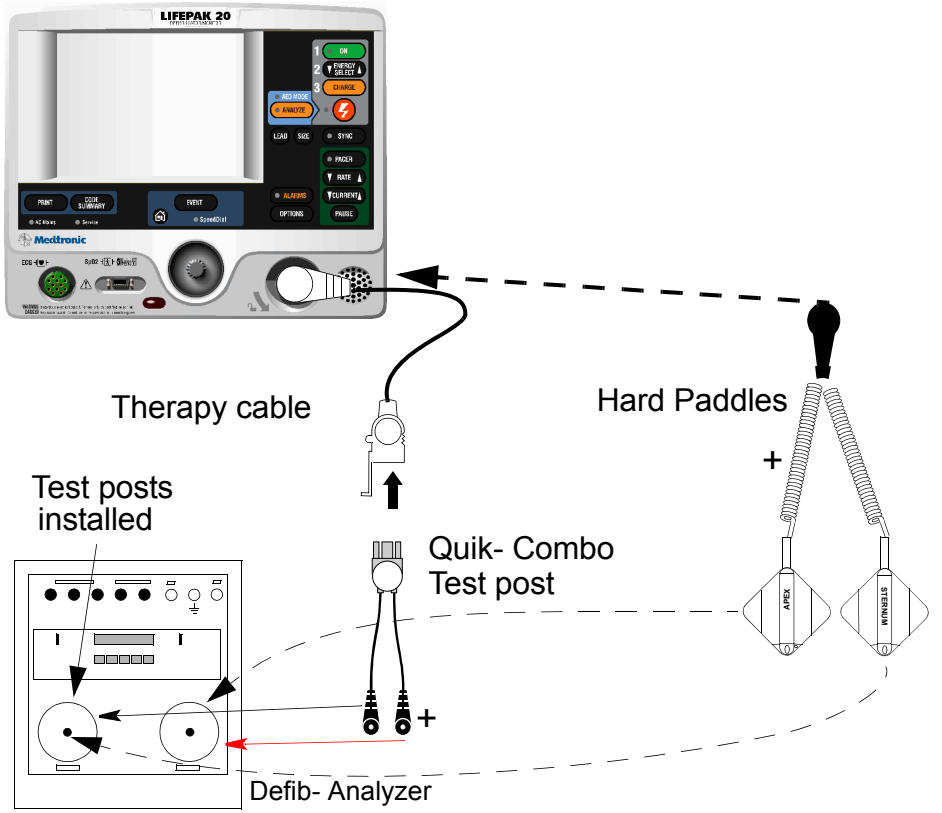
1. **If the unit is equipped with Quik- combo cable:** Connect the Therapy cable between the device and the QUIK-COMBO test plug.
   If the unit is equipped with Hard Paddles: Install a hard paddles into the device and place the device's paddles in the paddle wells.
2. Set the device lead selection to PADDLES.
3. Press the OPTIONS button and select USER TEST from the Options screen.
4. Select YES from the Options/Users Test screen.
5. Push Speed Dial to initiate the self test and the user test. The self test and the user test are performed. The User Test Succeeded report is printed when test is complete.

The unit automatically turns off after successfully completing the test.

PIP – Instructions *(continued)*

Therapy- Delivered Energy and Sync setup

For the Therapy Delivered Energy and Synchoronous cardioversion test, set up the defibrillator analyzer and device as shown below. Continue to the Therapy Delivered Energy and Synchoronous cardioversion Procedure on the next page when you complete the setup.



(Continued on next page)

PIP – Instructions *(continued)*

Therapy - Delivered Energy and Sync test

To test Therapy - delivered energy and Synchoronous cardioversion:

1. Establish the Therapy Delivered Energy and Synchoronous cardioversion setup shown in the figure on the previous page.
2. Turn on the device.
3. Set the device: manual mode, ECG Size to 1.0, lead selection to PADDLES.
4. Set the defibrillator analyzer to measure SYNC.
5. Press the SYNC button ON and select LOCAL, if Remote Sync is set to on.
6. Verify the SYNC LED turns on and R-wave markers appear on the ECG waveform.
7. Press the ENERGY SELECT button to select 2 J.
8. Press the CHARGE button and wait for the device to reach full charge. Then press the SHOCK button to discharge the device.
9. For hard paddles use the APEX PADDLE CHARGE button on Hard paddles
10. Verify the defibrillator analyzer measures a sync R-wave of 60 ms or less.
11. Set the defibrillator analyzer to measure **ENRG** (press ESC, then ENRG)
12. Repeat Steps 7 and 8 for the all energy levels specified in the table.

(Continued on next page)

PIP – Instructions *(continued)*

Therapy- Delivered Energy and Sync test *(continued)*

13. 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

14. Perform the **TCP – Defibrillator Calibration** if the delivered energy falls outside of the acceptable output range.
15. Turn the device off.

PIP – Instructions *(continued)*

Therapy - Paddles ECG Gain and AED mode test

To test Therapy Paddles ECG gain and AED mode test :

1. To test Therapy Paddles ECG gain: Program the defibrillator analyzer output for a 1 mV, 10 Hz sine wave.
2. Set the device ECG Size to 4.0 and Lead selection to PADDLES.
3. 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.

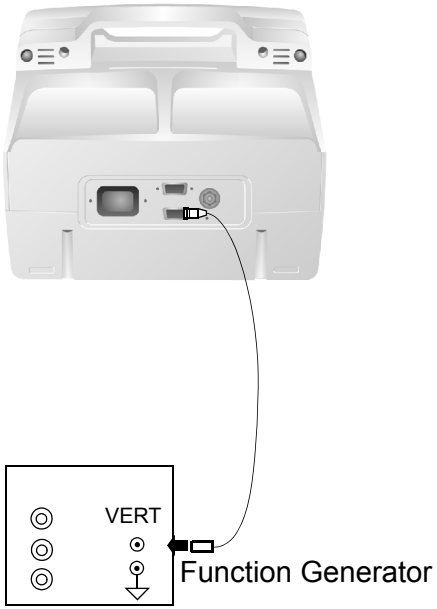
4. To test AED mode test : If the unit is equipped with Hard paddles, remove a hard paddles out of the device's therapy connector and connect the Therapy Quik-combo cable between the device and the Defib analyzer.
5. Press the ANALYZE key to turn the AED mode on. Verify that the AED mode on.
6. Verify that the voice prompts are clearly audible :

   •ANALYZING NOW, STAND CLEAR.

7. Press the ENERGY SELECT key .Verify that the device switches to Manual mode.

PIP – Instructions *(continued)*

Therapy - Remote Sync Test



To test Therapy - Remote Sync:

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: The Agilent 33120A function generator is recommended, set up as follows:
   - Square wave 5 Vp-p, 2.5 Vdc offset, frequency @100 Hz
   - Burst mode (burst count to 1, burst phase to 0, burst rate to 5 Hz)
2. Connect the remote sync cable between the device and the function generator.
3. Activate the remote synchronization feature as follows:
   a. Display the **SETUP** menu and select MANUAL MODE.
   b. Select SYNC from the SETUP/MANUAL MODE submenu.
   c. Select REMOTE SYNC, and then select ON.
4. Turn the device OFF and then ON again.
5. Set the device to **manual mode**, and the lead selection to PADDLES.
6. Press the SYNC button on the device.

(Continued on next page)

PIP – Instructions *(continued)*

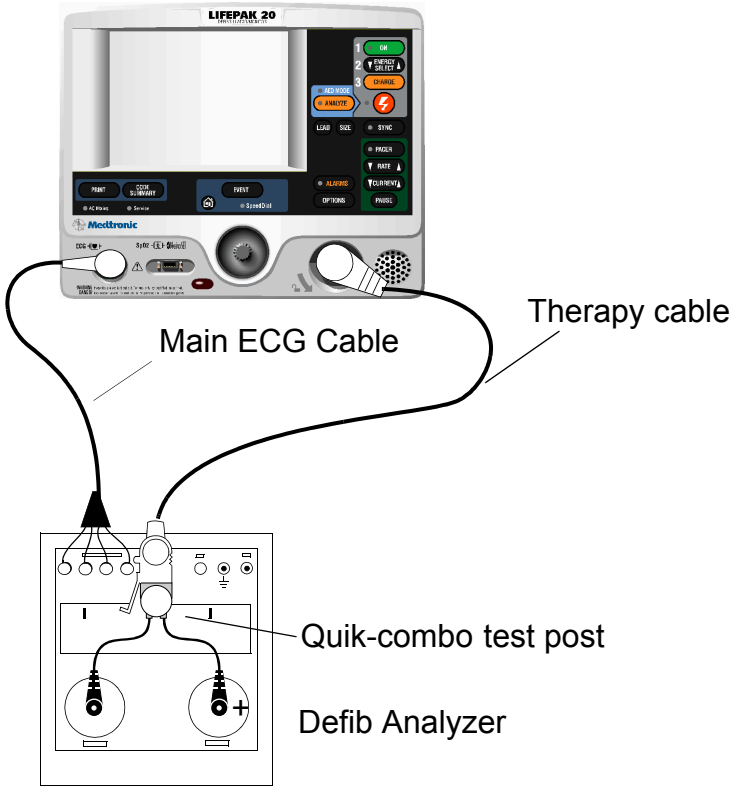
Therapy - Remote Sync Test *(continued)*

7. On the SYNC MODE overlay, select REMOTE. Verify the SYNC LED is flashing.
8. Charge the device to 200 joules. Upon reaching full charge, press SHOCK to discharge the device.
9. Verify the device displays "ENERGY DELIVERED" screen message (for SW-20 version or below) or switches out of remote sync mode (for SW-26 version or above).

PIP – Instructions *(continued)*

Pacer Option Characteristics setup

For the Pacer Option Characteristics test, set up the Defibrillator Analyzer, and device as shown below. Continue to the Pacer Option Characteristics Procedure on the next page when you complete the setup.



(Continued on next page)

PIP – Instructions *(continued)*

Pacer Option Characteristics

To test Pacer Option Characteristics:

Note: Skip this test if using a nonpacing defibrillator.

1. Establish the PIP – Pacer Option Characteristics setup shown in the figure on the previous page.
2. Set the defibrillator analyzer to measure peak current pacing parameters.
3. Press the PACER control on the device.
4. Verify the PACER control LED lights and the PACER overlay appears.
5. Disconnect one of the Test Post Adapter snaps from the defibrillator analyzer.
6. Verify the PACING STOPPED/CONNECT ELECTRODES overlay appears accompanied by an audible alarm.
7. Reconnect the Test Post Adapter snap.
8. Verify the overlay CONNECT ELECTRODES disappears and the alarm stops.
9. Set the defibrillator analyzer to output PACE, MEAS.
10. Press all the keys on Pacer panel, verify that all keys are working properly.

(Continued on next page)

PIP – Instructions *(continued)*

Pacer Option Characteristics *(continued)*

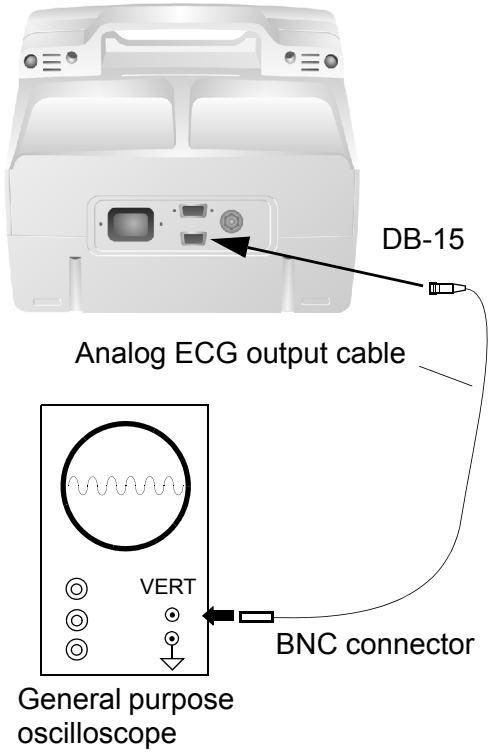
11. At 40 PPM Rate, press the device CURRENT button to select a pacer current of 10ma.
12. Verify the defibrillator analyzer indicates the pacer output current is within the acceptable output limits, shown below:

Peak Current Level (mA)	Acceptable Output (mA)
10	5 to 15
100	95 to 105
200	190 to 210

13. Repeat step 10 and 11 for the remaining peak pacer currents specified in the table.
14. At 40PPM Rate and 200mA, verify the defibrillator analyzer indicates the pacer pulse width is between 19.0 and 21.0 ms .
15. Press the device PACER control to terminate pacing.
16. Turn the device off.

PIP – Instructions *(continued)*

ECG Analog Output



(Optional) To test the ECG analog output using an oscilloscope:

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

1. Establish the test setup as shown to the left, using the ECG cable supplied with the device
2. Input a 1 mV, 10 Hz sine wave from the patient simulator.
3. Set the device 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. Disconnect the analog ECG output cable from the device and the oscilloscope.

PIP – Instructions *(continued)*

Leakage Current Tests

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

Definitions:

Earth Ground: Third wire ground

Normal Condition (N.C.): AC voltage is applied in either normal or reversed polarity i.e. measurements made with the POLARITY switch in both NORMAL and REVERSED positions. The earth ground is intact during these measurements (If LIFT GND switch is not pressed.)

Single Fault Condition (S.F.C.): AC voltage is applied in either normal or reversed polarity i.e. measurements made with the POLARITY switch in both NORMAL and REVERSED positions. The earth ground is **NOT** intact during these measurements (If LIFT GND switch is pressed.)

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.

PIP – Instructions *(continued)*

Leakage Current Tests *(continued)*

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.

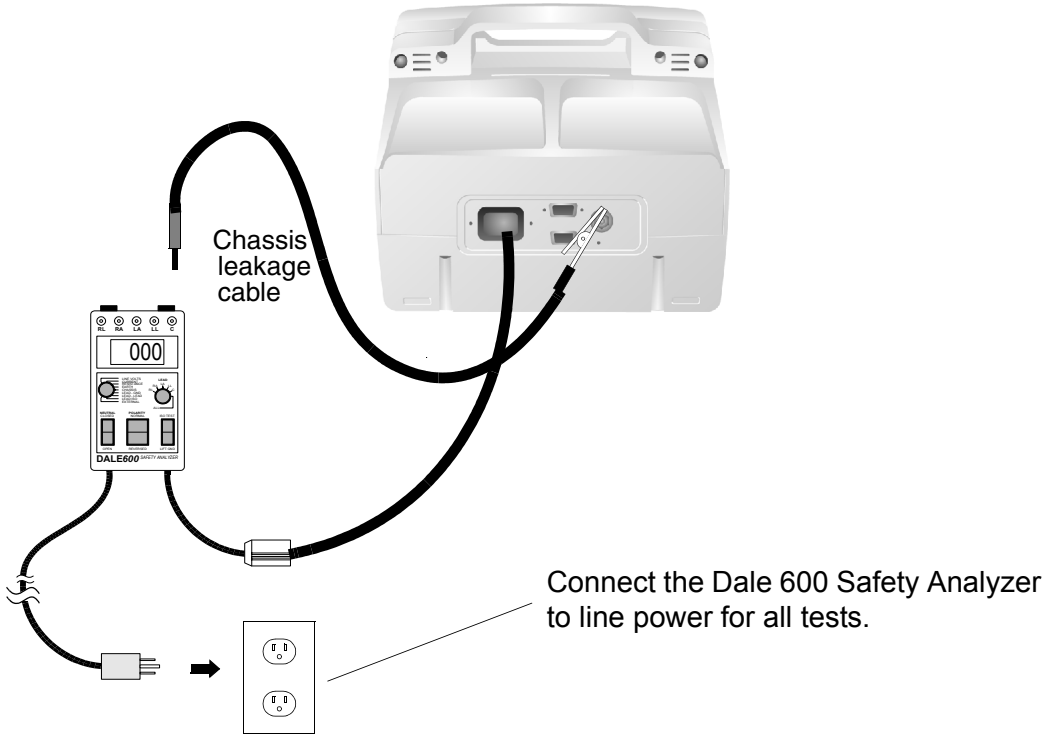
Note: When operating the polarity switch, be sure to pause in the OFF (middle) position when switching between normal and reversed polarities.

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**.

PIP – Instructions *(continued)*

Ground Resistance Test setup

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



(Continued on next page)

PIP – Instructions *(continued)*

Ground Resistance Test

To test Ground Resistance Test:

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

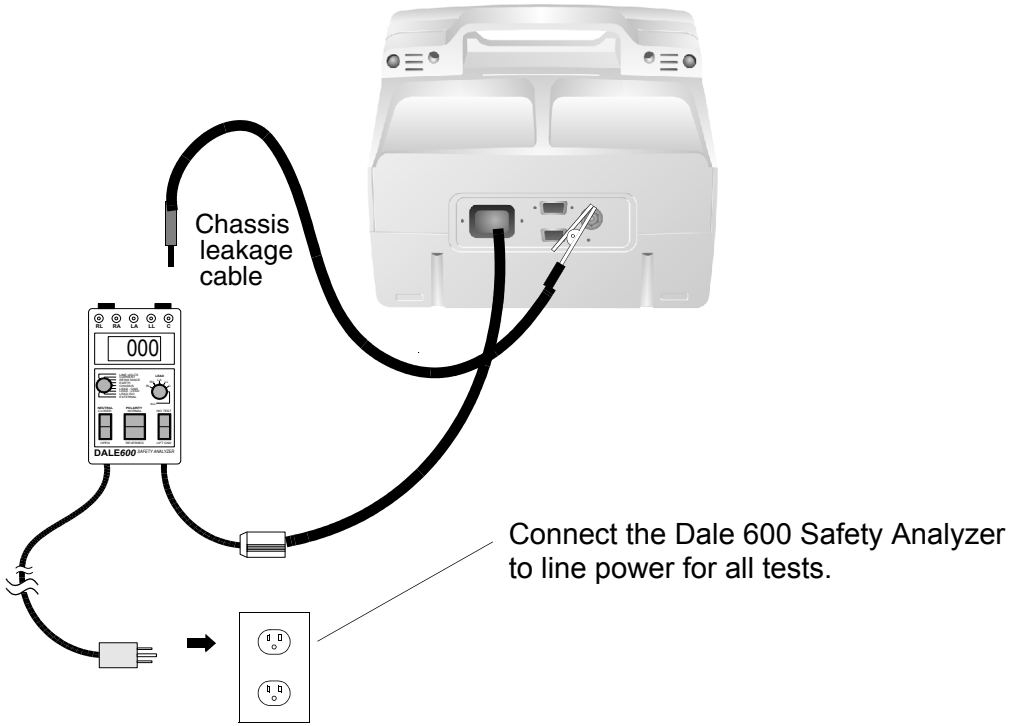
Neutral	Polarity	Mode		Lead
Any	Center	Ohms	Resistance	Any

3. Verify measured ground resistance test is less than 0.5 ohms.
4. Continue to the next leakage current test.

PIP – Instructions *(continued)*

Chassis Leakage Current setup

1. To test chassis leakage current, set up the safety analyzer and device as shown below. Continue to the Chassis Leakage Current Procedure when you complete the setup.



(Continued on next page)

PIP – Instructions *(continued)*

Chassis Leakage Current test

To test Chassis Leakage Current:

1. Establish the 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/Reversed	Leakage µA	Chassis	All

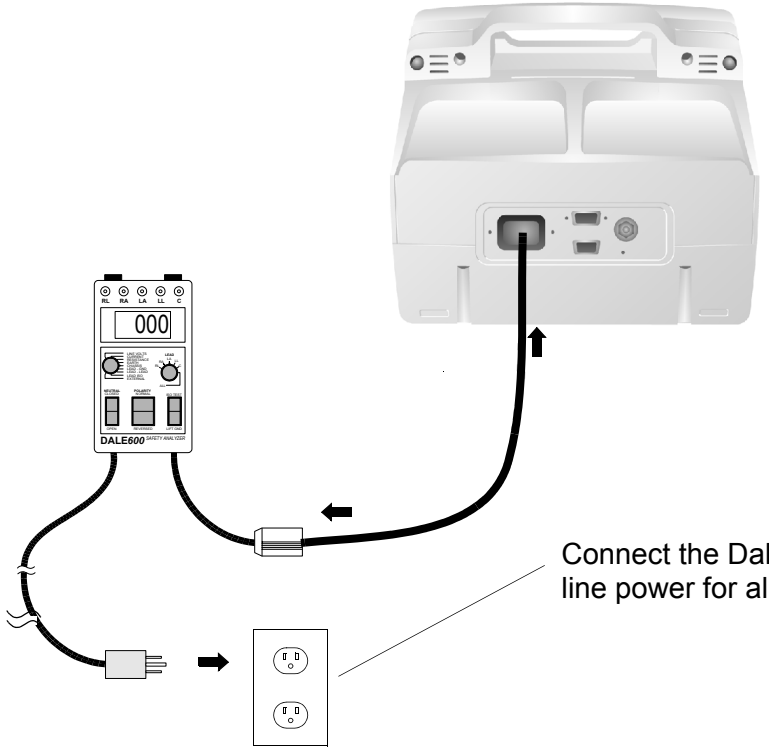
Note: When operating the Polarity Switch, be sure to pause in the Off (middle) position when switching between Normal and Reversed Polarities.

3. Connect the analyzer clip to the Ground stud and turn the device on.
4. Verify measured current is less than 90 µA.
5. Press the LIFT GND button on the safety analyzer.
6. Verify measured current is less than 270 µA (120 VAC) or less than 450 µA (240 VAC).
7. Release the LIFT GND button on the safety analyzer.
8. Continue to the next leakage current test.

PIP – Instructions *(continued)*

Earth Leakage Current setup

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



(Continued on next page)

PIP – Instructions *(continued)*

Earth Leakage Current test

To test Earth Leakage Current:

1. Establish the 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/Reversed	Leakage µA	Earth	Any

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

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

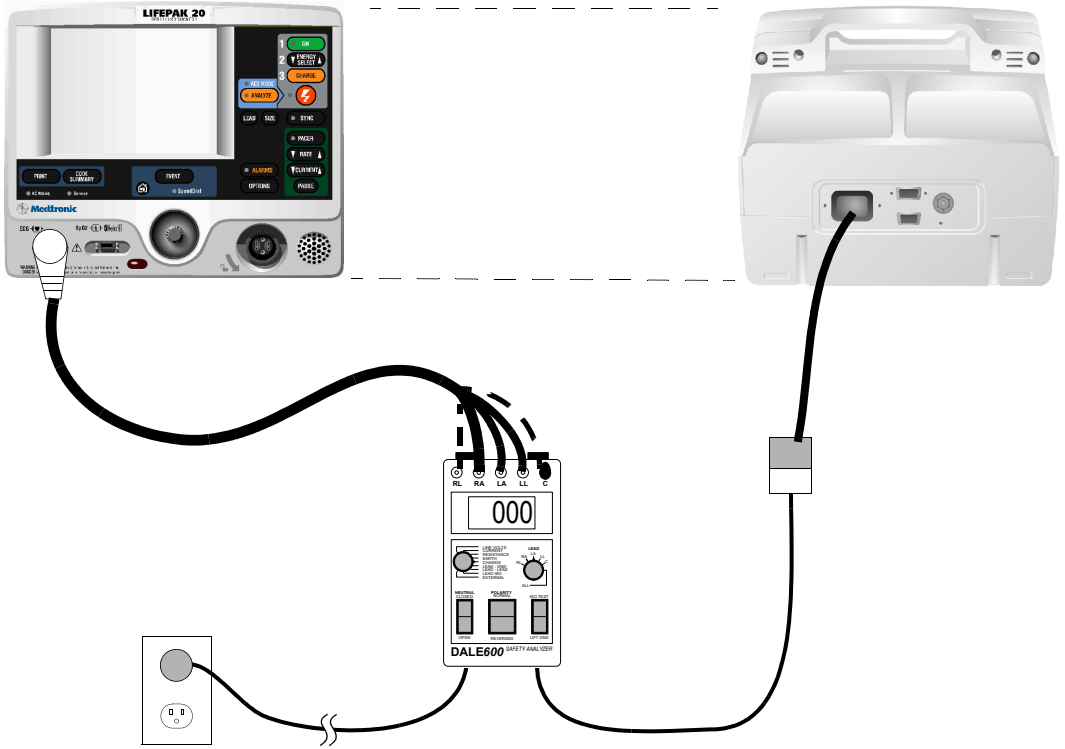
Neutral	Polarity	Mode		Lead
Open	Normal/Reversed	Leakage µA	Earth	Any

5. Verify measured current is less than 900 µA.
6. Continue to the next leakage current test.

PIP – Instructions *(continued)*

ECG Lead Leakage Setup

1. The ECG Lead Leakage Current, set up the safety analyzer and device as shown below. Continue to the ECG Lead Leakage Current Procedure on the next page when you complete the setup.



(Continued on next page)

PIP – Instructions *(continued)*

ECG Lead Leakage Current test

To test ECG Lead Leakage Current :

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

Neutral	Polarity	Mode		Lead
Closed	Normal/ Reversed	Leakage µA	Lead – Gnd	ALL

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

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

Neutral	Polarity	Mode		Lead
Closed	Normal/ Reversed	Leakage µA	Lead – Lead	RA

(Continued on next page)

PIP – Instructions *(continued)*

ECG Lead Leakage Current test *(continued)*

9. Repeat steps 4 through 7 for the remaining (RA and LL).
10. **For 5-Lead ECG**:Repeat steps 4 through 7 for the remaining (RL and C)
11. Turn rhe device off
12. Set the safety analyzer controls to:

Neutral	Polarity	Mode		Lead
Closed	Normal	Leakage µA	Lead Iso	All

WARNING!

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

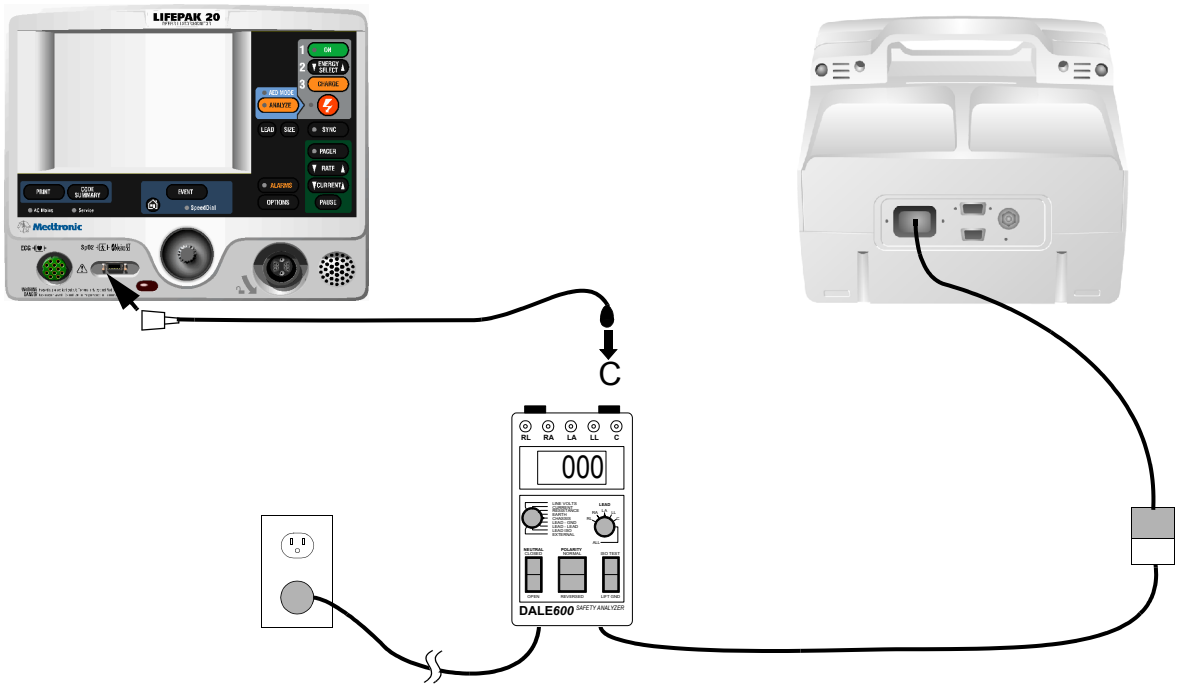
13. Momentarily press the ISO TEST button on the analyzer and observe the current reading.
14. Release the ISO TEST button.
15. Verify the measured current is less than 45 µA.
16. Continue to the next leakage current test.

PIP – Instructions *(continued)*

SpO2 Leakage Current setup

Note: Complete the following only for devices equipped with the SpO2 option.

1. For SpO2 Leakage Current, set up the safety analyzer, and device as shown below. Continue to the SpO2 Leakage Current Procedure when you complete the setup.



(Continued on next page)

PIP – Instructions *(continued)*

SpO2 Leakage Current test

To test SpO2 Leakage Current:

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

Neutral	Polarity	Mode		Lead
Closed	Normal/ Reversed	Leakage µA	Lead – Gnd	C

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

4. Verify the measured current is less than 10 µA (120 Vac) or 100 µA (240 Vac).
5. Press the LIFT GND button on the safety analyzer.
6. Verify the measured current is less than 50 µA (120 Vac) or 500 µA (240 Vac).
7. Release the LIFT GND button.

(Continued on next page)

PIP – Instructions *(continued)*

SpO2 Leakage Current test *(continued)*

8. Set the safety analyzer controls to:

Neutral	Polarity	Mode		Lead
Closed	Normal	Leakage µA	Lead Iso	C

WARNING!

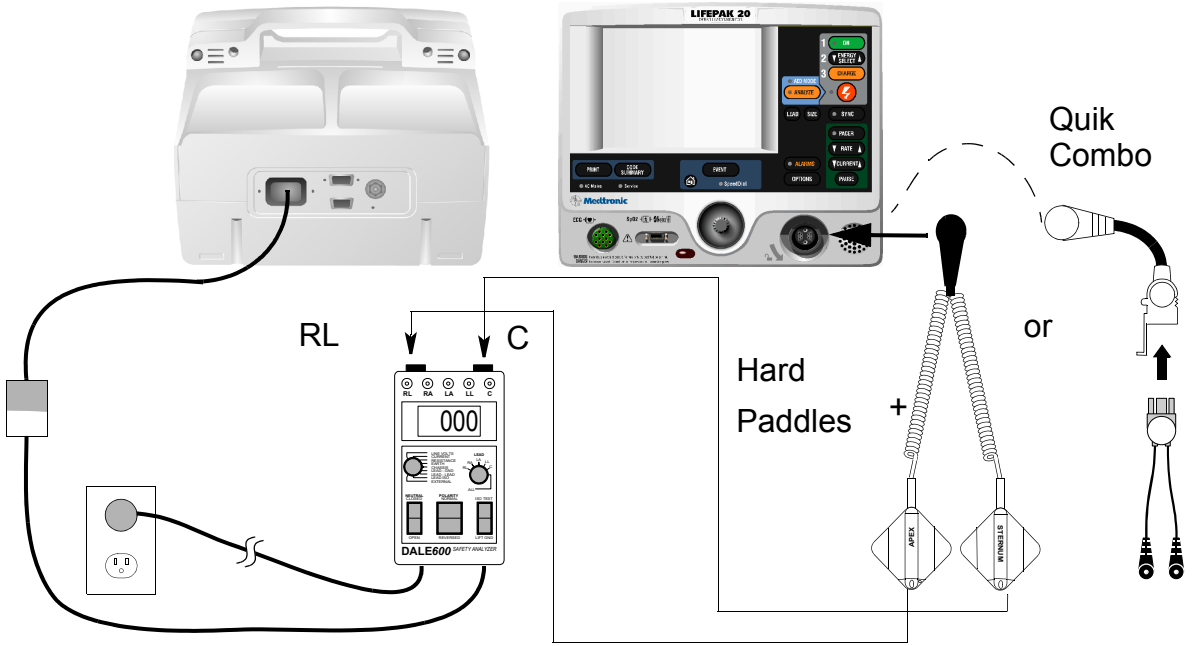
Shock hazard. During sink leakage tests high voltage is present on the safety analyzer electrode snaps. Do not touch the analyzer snaps or device connections during these tests

9. Momentarily press the ISO TEST button on the safety analyzer and observe the measured current reading.
10. Release the ISO TEST button.
11. Verify the measured current is less than 90 µA (120 vac) or 450 µA (240 vac).
12. Continue to the next leakage current test.

PIP – Instructions *(continued)*

Therapy Leakage Current setup

For Therapy leakage current, set up the safety analyzer and device as shown below. Continue to the Therapy Leakage Current Procedure on the next page when you complete the setup.



(Continued on next page)

PIP – Instructions *(continued)*

Therapy Leakage Current test

To test Therapy Leakage Current :

Establish the PIP – Therapy Leakage Current Setup shown in the figure on the previous page

1. Set the safety analyzer controls to:

Neutral	Polarity	Mode		Lead
Closed	Normal/Reversed	Leakage µA	Lead – GND	ALL

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

2. Verify the measured current is less than 10 µA.
3. Press the LIFT GND button on the safety analyzer.
4. Verify the measured current is less than 50 µA.
5. Release the LIFT GND button.
6. Set the safety analyzer controls to:

Neutral	Polarity	Mode		Lead
Closed	Normal/Reversed	Leakage µA	Lead – Lead	RL or C

(Continued on next page)

PIP – Instructions *(continued)*

Therapy Leakage Current test *(continued)*

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

7. Repeat steps 2 through 5.
8. Turn the device off.
9. Set the safety analyzer controls to:

Neutral	Polarity	Mode		Lead
Closed	Normal	Leakage µA	Lead Iso	All

WARNING!

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

10. Momentarily press the ISO TEST button on the safety analyzer and observe the measured current reading.
11. Release the ISO TEST button.
12. Verify the measured current is less than 90 µA (120 vac) or 450 µA (240 vac).

PIP – Summary of Leakage Current Specifications

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 µA	NC: 90 µA
		SFC: 270 µA	SFC: 450 µA
Earth Leakage	Closed Neutral	450 µA	450 µA
	Open Neutral	900 µA	900 µA
ECG Lead Leakage LEAD-GND	ALL	NC: 10 µA	NC: 10 µA
		SFC: 50 µA	SFC: 50 µA
ECG Lead Leakage LEAD-LEAD	RA	NC: 10 µA	NC: 10 µA
		SFC: 50 µA	SFC: 50 µA
	RL (5-Lead)	NC: 10 µA	NC: 10 µA
		SFC: 50 µA	SFC: 50 µA
	LA	NC: 10 µA	NC: 10 µA
		SFC: 50 µA	SFC: 50 µA
	LL	NC: 10 µA	NC: 10 µA
		SFC: 50 µA	SFC: 50 µA

(Continued on next page)

PIP – Summary of Leakage Current Specifications *(continued)*

Leakage Test		Maximum Leakage Current Specifications	
Type of Test	**Lead Test**	**Analyzer @ 120 Vac**	**Analyzer @ 240 Vac**
	C (5-Lead)	NC: 10 µA	NC: 10 µA
		SFC: 50 µA	SFC: 50 µA
ECG Lead Leakage, ISO Test	All	45 µA	45 µA
SpO2 Leakage LEAD-GND	C	NC: 10 µA	NC: 100 µA
		SFC: 50 µA	SFC: 500 µA
SpO2 Leakage ISO test	C	90 µA	450 µA
Therapy Leakage LEAD-GND	All–GND	NC: 10 µA	NC: 10 µA
		SFC: 50 µA	SFC: 50 µA
Therapy Leakage LEAD-LEAD	RL or C	NC: 10 µA	NC: 10 µA
		SFC: 50 µA	SFC: 50 µA
Therapy Leakage ISO Test	All	90 µA	450 µA

Instrument Calibration

This section contains the test and calibration procedures (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 procedures can be performed in any order.

Note: Whenever 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

This TCP applies to the LIFEPAK 20 and 20e defibrillator/monitor exclusively. You can perform the procedures in any order.

Note: Prior to its return to active use, the device must successfully pass all portions of the closed-case performance inspection procedure (PIP) whenever 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

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 device, meeting the requirements described in **Service Personnel Qualifications**.

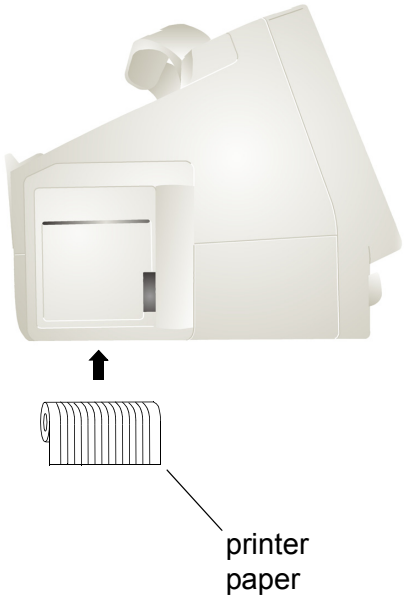
TCP – Test Equipment Requirements

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

Equipment	Specifications	Manufacturer
Defibrillator analyzer[1]	Energy range: 0 to 450 J Load resistance: 50 Ω ±1% Accuracy: ±2% +2 J Waveforms: NSR, VF, and sine wave	Fluke QED 6, with test posts accessory (software version 2.07, or greater)
QUIK-COMBO test post adapter	Connects to QUIK-COMBO therapy cable	Medtronic MIN 3005302
QUIK-COMBO electrode cable		Medtronic MIN 3006570
General purpose oscilloscope	Bandwidth: dc to 2 MHz Vertical accuracy: ±3% (5 mV – 5 v/div.) Horizontal time base accuracy: ±5%	Tektronix 2232 or equivalent

1. Some energy meters are not accurate for biphasic waveforms. Contact your defibrillator analyzer's manufacturer for more information.

TCP – Setup



The following describes the device setup for the TCP.

WARNING!

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

To set up the device for the TCP, install a roll of paper into the printer.

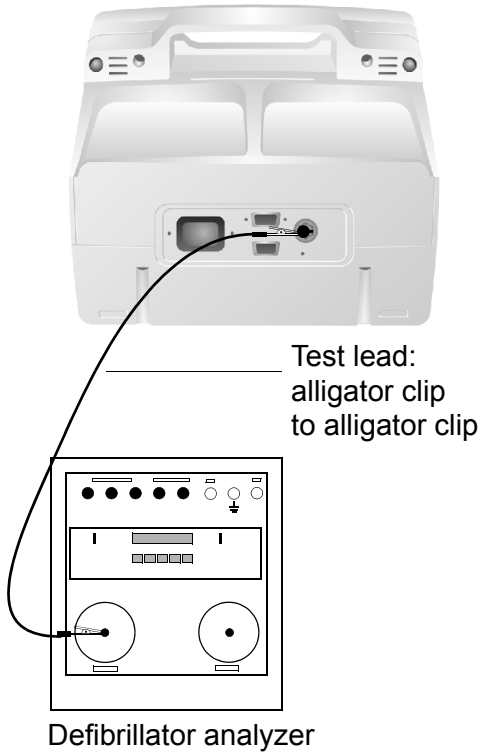
Note: To ensure that the LOW BATTERY message does not appear when the device is turned on or during defibrillator calibration, install a fully functional battery in the device.

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 these procedures.

TCP – Defibrillator Isolation

Standard Paddles Defibrillation Isolation



Perform the Defibrillator Isolation test when any of the high voltage section has been moved or replaced.

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.

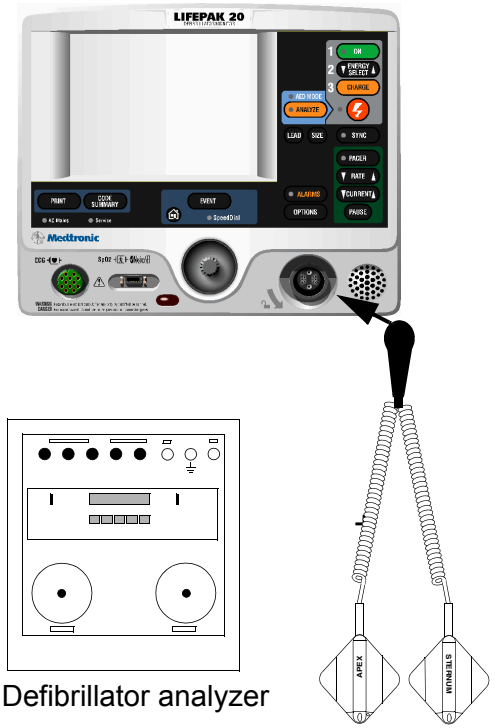
To test defibrillation isolation with standard paddles:

1. Establish the setup shown to the left and on the next page.
2. Turn the device ON.
3. Set the defibrillator analyzer to ENERGY.
4. Select 360J on the device.
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.
7. Press the SHOCK switches on both paddles simultaneously to discharge the device..

(Continued on next page)

TCP – Defibrillator Isolation *(continued)*

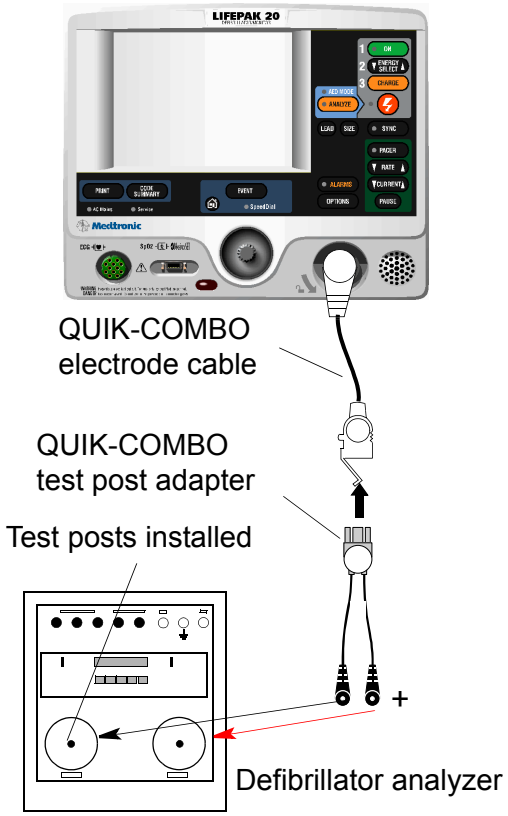
Standard Paddles Defibrillation Isolation *(continued)*



Defibrillator analyzer

8. Verify the defibrillator analyzer indicates a delivered energy of less than 18 joules.
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. Press the SHOCK switches on both paddles simultaneously to discharge the device.
13. Verify the defibrillator analyzer indicates a delivered energy of less than 18 joules.
14. Turn the device OFF.

TCP – Defibrillator Calibration

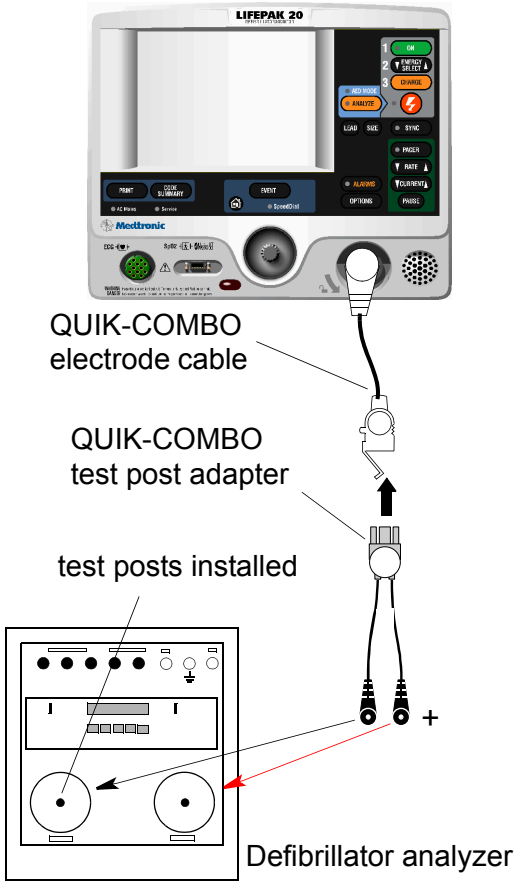


To perform the defibrillator calibration procedure:

1. Connect the device 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. Display the **SERVICE** menu and select DEFIB CAL.
4. Select START to initiate the calibration routine.
5. Follow the instructions on the device screen.
6. When the calibration is complete, turn the device OFF.

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 device delivered energy:

1. Connect the device 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 the device ON. Verify that the AED MODE indicator is off. If not, refer to **Manual Mode**.
4. Press ENERGY SELECT and select 2 J.
5. Press CHARGE and wait for the device to reach full charge. Press SHOCK to discharge the device energy.
6. Verify that the defibrillator analyzer shows an energy level between 1.0 and 3.0 joules.

(Continued on next page)

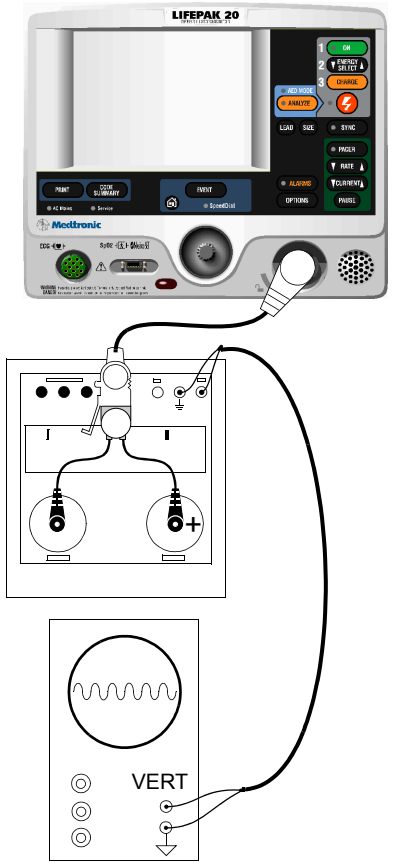
TCP – Delivered Energy Test *(continued)*

Note: Not all energy levels listed in the delivered energy test table below are available on every device.

7. Repeat steps 4 through 6 for the remaining available energy levels specified in the table (10, 15, 50, 70, 100, and 360 joules).

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)



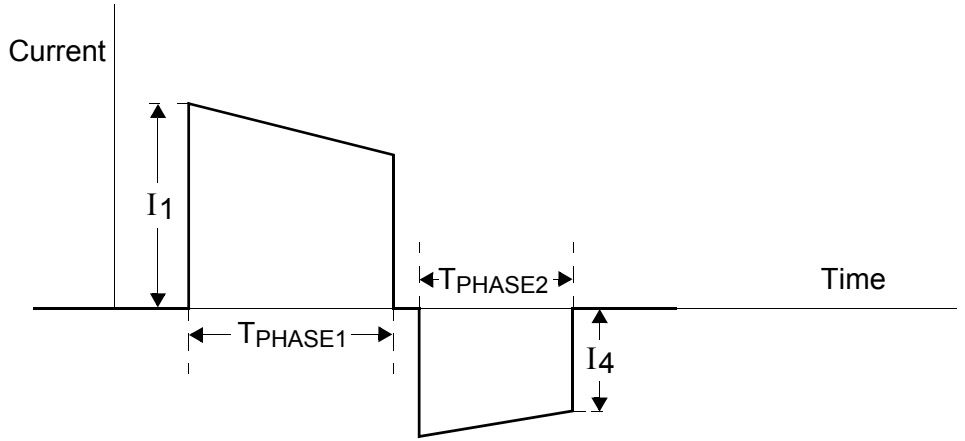
To test the defibrillator output waveform (this test is optional):

1. Connect the device to the 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 Fluke QED 6 defibrillator analyzer. 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 the device ON. Press ENERGY SELECT and select 360 J.
4. Press CHARGE. After the capacitor charges (the SHOCK indicator is blinking), press SHOCK to deliver the energy to the analyzer.
5. Verify that the waveform meets specifications.
6. When testing is complete, turn the device OFF and disconnect the test setup.

(Continued on next page)

TCP – Defibrillator Output Waveform Test *(continued)*



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. $\text{Tilt} = \frac{(I1 - |I4|)}{I1}$

Troubleshooting

This section describes error code usage, interpretation, and corrective action, and provides a separate troubleshooting chart keyed to the **performance inspection procedure (PIP)** and individual troubleshooting tests that require operator interpretation. Choose from the following topics:

Processing Error Codes

Introduction

When an internal program or process fails to execute properly, an error code is logged and the service indicator LED turns on. Errors rarely occur and should be investigated thoroughly by qualified service personnel before the device 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 the error code(s), and cycle the power. If the error code does not reoccur, it may have been the result of EMI or ESD.

Note: Alway reload device software to the current version anytime a circuit board is replaced.

Error Code Processing

To process an error code:

1. Note any problems with the device and consult the **Troubleshooting Chart**.
2. Review error codes in the **Service Log**. Record any errors, including the date, time, error, and error extension.
3. Select CLEAR LOG in the service log, and then turn the device OFF.

(Continued on next page)

Processing Error Codes *(continued)*

Error Code Processing *(continued)*

4. Complete the **performance inspection procedure (PIP)**.
   - If completed successfully, the device may be returned to regular use. (The error code(s) may have been related to EMI or ESD.)
   - If the service LED turns on at any time during the PIP, stop the PIP and continue to the next step in this procedure.
5. Consult the **Troubleshooting Chart** for the suggested corrective action for your PIP failure.
   -OR-
   Review the **Service Log** error codes, and then locate the error code in the **Error Code Table**.

   Note: Use the links in the **Error Code Categories** table to quickly jump to the correct error code in the Error Code Table.
6. Read the corrective action(s). If the corrective action calls for the replacement of a part, click the link in the Troubleshooting Chart or click the appropriate part in the footer at the bottom of the Error Code Table pages to jump to the corrective action process.
7. Service the device based on these inputs, and then repeat the PIP.
8. For persistent error codes, contact your local Medtronic service or sales representative.

Troubleshooting Chart

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 device to ac power source. Disable **AC Loss Alert alarm**.
Power On	No power on	Make sure the device is plugged into ac power. **Replace the A04 Therapy PCB** Check **P21** for 3.3 V to ground. ■ If the A3 pin has 3.3 V to ground – Check or **replace the W18 UI Flex Cable**. – **Replace UI PCB**. ■ If the A3 pin does not have 3.3 V to ground – Check or **replace the A03 Power module**.

(Continued on next page)

Troubleshooting Chart *(continued)*

Area	Observed Symptom	Suggested Corrective Action
Power On *(continued)*	No display (white or blue screen)	1. Check A05 UI PCB for **3.3 V to ground at C96 and 2.5 V to ground at C93**. – If either one is not present, **replace the A05 UI PCB**. 2. Check **P21** for 3.3 V to ground. – 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)	Check **P21** for 2 V to ground. ■ If 12 V is present – **Replace the W18 UI Flex Cable**. – **Replace UI backlight/display assembly**. ■ If 12 V is not present: – Check for 12 V at P17 between pins 1 and 3. – If 12 V is present, **replace A04 Therapy PCB**. – If 12 V is not present, **replace the A03 Power module**.

(Continued on next page)

Troubleshooting Chart *(continued)*

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.
	MAINTENANCE DUE message remains on screen	**Set the Maintenance Prompt interval**. **Reset the Maintenance Prompt interval**.
Keypad	Improper button response	Perform keypad test. Check or **replace the elastomer keypad**. **Replace the A05 UI PCB**.
	Hard paddle buttons	Perform keypad test. Check or replace hard paddles. Check or **replace the W01 Therapy Connector**. **Replace the A04 Therapy PCB**.

(Continued on next page)

Troubleshooting Chart *(continued)*

Area	Observed Symptom	Suggested Corrective Action
Printer	Not printing	Perform 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. ■ If either is higher than 3.3 V, **replace the W14 Printer Flex Cable**. ■ If both are lower than 3.3 V: – Check or **replace the A12 Printer Assembly**. – **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**.

(Continued on next page)

Troubleshooting Chart *(continued)*

Area	Observed Symptom	Suggested Corrective Action
Audio	Inaudible or garbled audio	Perform 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 A03 Power Module**.
QUIK-COMBO or standard paddles delivered energy	Unable to complete auto test	Rerun the 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**.

(Continued on next page)

Troubleshooting Chart *(continued)*

Area	Observed Symptom	Suggested Corrective Action
Patient impedance channel broken *(continued)*	Low patient impedance	If tested into a 50 ohm load during 3:00 AM 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 ECG cable. Check or **replace the W06 ECG connector**. Check or **replace the A02 Patient Parameter PCB**. **Replace the A01 System PCB**.

(Continued on next page)

Troubleshooting Chart *(continued)*

Area	Observed Symptom	Suggested Corrective Action
QUIK-COMBO or standard paddles synchronous cardioversion *(continued)*	Failure to transfer coincident with sync mark	Check sync marker placement on R-wave. Perform the keypad test. ■ If test fails, **replace the A05 UI PCB**. ■ If test passes, run the user test and troubleshoot error code.
Pacer option characteristics	Pacer does not turn on	Verify manufacturer configuration bit setting. Perform keypad test: ■ If test fails, check key tactile feedback. – **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	Check or replace the ECG cable. Check or **replace the W06 ECG Connector**. **Replace the A02 Patient Parameter PCB**.

(Continued on next page)

Troubleshooting Chart *(continued)*

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**.

(Continued on next page)

Troubleshooting Chart *(continued)*

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 A03 Power module**. Check or replace the W09 Power Cable. Check or **replace the A01 System PCB**. Check or **replace the A03 Power module**.

(Continued on next page)

Troubleshooting Chart *(continued)*

Area	Observed Symptom	Suggested Corrective Action
No ac power reminder tone	No alert	Check configuration setting. **Replace the A03 Power module**.
Leakage current	Fails chassis leakage test	**Replace the A03 Power module**.
Grounding resistance	Fails ground resistance test	Check or replace the power cord. **Replace the A03 Power module**.

Error Code Categories

Error codes are organized into the following categories, in four-digit hexadecimal format:

Initial Digit	Category	Description	Associated PCBs and Assemblies
axxx	PR	Printer	A12 Printer
bxxx	BM	Behavior Manager	A01 System
0xxx	UT	Utilities	A01 System
1xxx	UI	User Interface	A01 System, A04 Therapy, A05 UI, A12 Printer, W14 Printer Flex Cable, W18 UI Flex Cable
2xxx	DC	Data Communications	A01 System
3xxx	DM	Data Management	A01 System
4xxx	SM	System Monitor	A01 System, A04 Therapy, A05 UI , W18 UI Flex Cable
50xx	PC	Processor Control	A01 System, A02 PP PCB, A04 Therapy, A05 UI, W18 UI Flex Cable
51xx	PM	Power Management	A03 Power Module, A04 Therapy, A07 Battery, W08 Battery Cable
6xxx	PP	Patient Parameter – SpO2	A02 PP PCB, A06 OEM PCB, A10 SpO2 Module
8xxx	DSP	Digital Signal Processor	A01 System, A02 PP PCB
9xxx	TH	Therapy	A01 System, A03 Power Module, A04 Therapy, A07 Battery

Error Code Table

Error	Error Description	Corrective Action
a00b	Printer communication lost	Reload the device software.
a00e	Printer initialization error	Reload the device software.
b001	Invalid state request	1. Clear error and perform PIP. 2. Replace A01 System PCB.
b011	System behavior manager error	Reload the device software.
b012	Energy cap charging time out	Reload the device software.
b013	Shock advisory system error	Reload the device software.
b014	Shock advisory system time out	Reload the device software.
b016	Motion detect timer error	Reload the device software.
b017	Shock result time out	Reload the device software.
b018	USB interrupt error	1. Clear error and perform PIP. 2. Replace A01 System PCB.

(Continued on next page)

Error Code Table *(continued)*

Error	Error Description	Corrective Action Code
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 ID unknown	Replace the A01 System PCB.
000d	System hardware/software configuration lost	Replace the A01 System PCB.
0002	System Flash memory voltage error	Replace the A01 System PCB.
0003	Cannot erase system Flash memory	Replace the A01 System PCB.
0004	Cannot 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	1. Replace the W18 UI Flex Cable. 2. Replace the A05 UI PCB. 3. Replace the A01 System PCB.
100f	Display update timer error	1. Reload the device software. 2. Replace the A01 System PCB.

(Continued on next page)

Error Code Table *(continued)*

Error	Error Description	Corrective Action Code
1010	Display update queue error	1. Reload the device software. 2. Replace the A01 System PCB.
1013	System detected unexpected UI reset	1. Replace the W18 UI Flex Cable. 2. Replace the A05 UI PCB.
1014	Voice prompt/audio watchdog failure	1. Reload the device software. 2. Replace the A01 System PCB.
1015	USB data time-out error	Replace the W18 UI Flex Cable.
1016	UI USB data error	Replace the A05 UI 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	1. Reload the device software. 2. Replace the A05 UI PCB.
1c04	UI ADC not functioning	Replace the A05 UI PCB.

(Continued on next page)

Error Code Table *(continued)*

Error	Error Description	Corrective Action
1c05	Printer ADC out of tolerance (temperature)	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)	1. Check the W14 Printer Flex Cable. 2. Replace the A12 Printer. 3. Replace the A05 UI PCB.
1c07	UI voltage out of tolerance (5 V)	Replace the A05 UI PCB.
1c08	UI voltage out of tolerance (3.3 V)	Replace the A05 UI PCB.
1c09	UI voltage out of tolerance (2.5 V)	Replace the A05 UI PCB.
1c0a	UI voltage out of tolerance (35 V)	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.

(Continued on next page)

Error Code Table *(continued)*

Error	Error Description	Corrective Action
1c11	UI application Flash memory corrupted	1. Reload the device software. 2. Replace the A05 UI PCB.
1c12	UI font Flash memory corrupted	1. Reload the device software. 2. Replace the A05 UI PCB.
1c13	UI FPGA Flash memory corrupted	1. Reload the device 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.
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)	1. Reload the device software. 2. Replace the A01 System PCB.

(Continued on next page)

Error Code Table *(continued)*

Error	Error Description	Corrective Action
3001	System cannot use data management (DM) Flash memory	1. Reload the device software. 2. Replace the A01 System PCB.
3002	System data management Flash memory corrupted	1. Clear memory (service mode). 2. Reload the device software. 3. Replace the A01 System PCB.
3005	System cannot delete DM record	1. Clear memory (service mode). 2. Reload the device software. 3. Replace the A01 System PCB.
3007	System cannot create new DM record	1. Clear memory (service mode). 2. Reload the device software. 3. Replace the A01 System PCB.
3008	System could not store DM record	1. Clear memory (service mode). 2. Reload the device software. 3. Replace the A01 System PCB.

(Continued on next page)

Error Code Table *(continued)*

Error	Error Description	Corrective Action
3009	System could not erase oldest DM record	1. Clear memory (service mode). 2. Reload the device software. 3. Replace the A01 System PCB.
300a	System cannot clear DM memory	1. Reload the device software. 2. Replace the A01 System PCB.
300b	System error writing DM record	1. Clear memory (service mode). 2. Reload the device software. 3. Replace the A01 System PCB.
300c	System cannot read archived DM record	1. Clear memory (service mode). 2. Reload the device software. 3. Replace the A01 System PCB.
3010	System error DM memory corrupt	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.

(Continued on next page)

Error Code Table *(continued)*

Error	Error Description	Corrective Action
4005	System NVRAM error log	1. Replace the coin cell battery. 2. Reload the device software. 3. Replace the A01 System PCB.
4006	Error log queue not functioning	1. Reload the device software. 2. Replace the A01 System PCB.
4008	Error log count corrupted	1. Reload the device software. 2. Replace the A01 System PCB.
4009	System RAM test failed	1. Reload the device software. 2. Replace the A01 System PCB.
400a	System program Flash memory corrupted	1. Reload the device software. 2. Replace the A01 System PCB.
400b	Program contents failure	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.

(Continued on next page)

Error Code Table *(continued)*

Error	Error Description	Corrective Action
4010	Service LED failed	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 device software.
4013	Voice/font Flash memory invalid	Reload the device software.
4fff	Additional information related to error code that is logged before 4fff	No action required for 4fff; refer to error code logged before 4fff.
5003	System watchdog failed	Replace the A01 System PCB.
5004	System watchdog reset	1. Reload the device 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 device software. 2. Replace the A01 System PCB.
5008	System boot program failure	Replace the A01 System PCB.

(Continued on next page)

Error Code Table *(continued)*

Error	Error Description	Corrective Action
5009	Real-time clock (RTC) access failed	1. Reload the device software. 2. Replace the A01 System PCB.
500a	Coin cell battery not detected	1. Replace the coin cell battery. 2. Replace the A01 System PCB.
500b	Cannot use system NVRAM	1. Reload the device software. 2. Replace the A01 System PCB.
500c	System application start error	1. Reload the device software. 2. Replace the A01 System PCB.
500d	System software initialization time out	1. Reload the device software. 2. Replace the A01 System PCB.
500e	System application start error	1. Reload the device software. 2. Replace the A01 System PCB.
5010	Configuration mismatch	Replace the coin cell battery.

(Continued on next page)

Error Code Table *(continued)*

Error	Error Description	Corrective Action
5011	NVRAM configuration data error	1. Replace the coin cell battery. 2. Reload the device software.
5012	Configuration data error	Replace the coin cell battery.
5013	System meter initialization error	Reload the device software.
5014	System meter mismatch	Replace the coin cell battery.
5015	NVRAM error	Replace the A01 System PCB.
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.
501a	NVRAM corrupted	Replace the coin cell battery.
501c	RTC not running	1. Replace the coin cell battery. 2. Replace the A01 System PCB.

(Continued on next page)

Error Code Table *(continued)*

Error	Error Description	Corrective Action
501d	RTC out of sync	1. Replace the coin cell battery. 2. Replace the A01 System PCB.
501e	System software execution error	Reload the device software.
501f	System software read error	Reload the device software.
5020	System software write error	Reload the device software.
5021	System software error	Reload the device software.
5022	System software exception code	Reload the device software.
5023	System software exception code	Reload the device software.
5024	System software exception code	Reload the device 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.

(Continued on next page)

Error Code Table *(continued)*

Error	Error Description	Corrective Action
5029	Therapy USB did not initialize	Replace the A04 Therapy PCB.
502a	UI USB did not initialize	1. Replace the W18 UI Flex Cable. 2. Replace the A05 UI PCB.
502b	USB system failed	Replace the A01 System PCB.
502f	Device type invalid	1. Check configuration code. 2. Set device type. 3. Replace the A01 System PCB.
5030	PP USB disconnect	Replace the A02 PP PCB.
5031	UI USB disconnect	1. Replace the W18 UI Flex Cable. 2. Replace the A05 UI PCB.
5032	Therapy USB disconnect	Replace the A04 Therapy PCB.
5033	PP USB download time out	Reload the device software.
5036	USB initialization failed	1. Reload the device software. 2. Replace the A01 System PCB.

(Continued on next page)

Error Code Table *(continued)*

Error	Error Description	Corrective Action
5037	USB unitization error	1. Reload the device software. 2. Replace the A01 System PCB.
5038	Cannot clear interrupt source	Replace the A01 System PCB.
5039	Bus error reported by USB PP channel	1. Clear error and perform PIP. 2. Replace the A02 PP PCB. 3. Replace the A01 System PCB.
503a	Bus error reported by USB UI channel	1. Clear error and perform PIP. 2. Replace the A05 UI PCB. 3. Replace the A01 System PCB.
503b	Bus error reported by USB therapy channel	1. Clear error and perform PIP. 2. Replace the A04 Therapy PCB. 3. Replace the A01 System PCB.
503c	USB host driver cannot create transfer descriptor	1. Clear error and perform PIP. 2. Replace the A01 System PCB.

(Continued on next page)

Error Code Table *(continued)*

Error	Error Description	Corrective Action
503d	USB host driver received message larger than maximum allowed	1. Clear error and perform PIP. 2. Replace the A01 System PCB.
5040	Inconsistent RTC time	Replace the A01 System PCB.
5105	Battery failed to reach charge in 2.5 hours	1. Replace the A07 Battery. 2. Replace the A03 Power module.
5106	Power supply out of tolerance	1. If power supply voltage is <14 Vdc, replace ac power supply. 2. If >14 Vdc, clear error and perform PIP.
5107	Power module RAM error	Replace the A03 Power module.
5108	Power module self-test diagnostic error	Replace the A03 Power module.
510a	Battery <10 V after 20 minutes of charging	1. Replace the A07 Battery. 2. Replace the A03 Power module.
510b	Does not switch to battery power	Replace the A03 Power module.
510c	Does not detect ac disconnect	Replace the A03 Power module.

(Continued on next page)

Error Code Table *(continued)*

Error	Error Description	Corrective Action
510d	Battery powered when connected to ac power	Replace the A03 Power module.
510e	Battery <10 V after charge cycle	Replace the A07 Battery.
510f	Battery charge cycle stopped	1. Check battery connection. 2. Replace the A07 Battery. 3. Replace the A03 Power module.
5110	AC isolation diode shorted	Replace the A03 Power module.
5112	Battery not detected	1. Check the A07 Battery connection. 2. Check W08 Battery Cable. 3. Check for valid power hardware ID in SERVICE/STATUS/DEVICE DATA overlay. 4. Replace the A07 Battery. 5. Invalid power hardware ID; replace the A03 Power module. 6. Valid power hardware ID; replace the A04 Therapy PCB.

(Continued on next page)

Error Code Table *(continued)*

Error	Error Description	Corrective Action
5115	Battery thermistor <400 Ohms	Replace A07 Battery (LIFEPAK 20e) Check battery thermistor. (LIFEPAK 20) ■ Replace the A07 Battery if <400 Ohms. ■ Replace the A03 Power module if >400 Ohms.
5116	Charger reporting zero during battery charging	Replace the A03 Power module.
5117	No 12C connection detected (LIFEPAK 20e only)	1. Replace the A07 Battery. 2. Replace the A03 Power module.
5118	Power module connected to NiMH battery (LIFEPAK 20 only)	Replace the A07 Battery.
511a	Battery failure	Replace the A07 Battery.
5fff	Additional information related to error code that is logged before 5fff	No action required for 5fff; refer to error code logged before 5fff.
6002	PP program corrupted	Reload the device software.
6003	PP program not found	Reload the device software.

(Continued on next page)

Error Code Table *(continued)*

Error	Error Description	Corrective Action
6004	PP boot-up error	Reload the device software.
6009	No PP data	Reload the device software.
600c	SpO2 misconfigured	1. Check configuration. 2. Reload the device software.
600e	PP reset	1. Reload the device software. 2. Replace the A02 PP PCB.
600f	OEM configuration error	1. Check configuration. 2. Reload the device software.
6010	PP initialization error	Reload the device software.
6018	Incorrect updated SpO2 image	Replace the A06 OEM PCB.
6019	Incorrect updated SpO2 image CRC	Replace the A06 OEM PCB.
6801	PP power supply out of tolerance	Replace the A02 PP PCB.
6802	PP pre-amp data invalid	1. Clear error and perform PIP. 2. Replace the A02 PP PCB

(Continued on next page)

Error Code Table *(continued)*

Error	Error Description	Corrective Action
6804	PP data RAM test error	1. Clear error and perform PIP. 2. Replace the A02 PP PCB.
6805	PP RAM test error	1. Clear error and perform PIP. 2. Replace the A02 PP PCB.
6806	PP CRC test error	1. Clear error and perform PIP. 2. Replace the A02 PP PCB.
6807	PP ECG test error	1. Clear error and perform PIP. 2. Replace the A02 PP PCB.
680b	SpO2 board error	Replace the A10 SpO2 Module.
6fff	Additional information related to error code that is logged before 6fff	No action required for 6fff; refer to error logged before 6fff.
800a	System DSP error	Reload the device software.
8013	Voice format error	Reload the device software.

(Continued on next page)

Error Code Table *(continued)*

Error	Error Description	Corrective Action
8014	No paddles data	1. Reload the device software. 2. Replace the A01 System PCB.
801b	DSP did not receive USB SOF (start of frame) interrupt	1. Clear error and perform PIP. 2. Replace the A01 System PCB.
8105	Impedance channel out of calibration	Replace the A01 System PCB.
8108	Paddles data out of sync	1. Reload the device software. 2. Replace the A01 System PCB.
8109	Paddles pre-amp user test failed	1. Rerun the user test. 2. Replace the A01 System PCB.
810b	Real impedance <-30 ohms for one second	1. Perform TCP - defibrillator calibration. 2. Replace the A01 System PCB.
8fff	Additional information related to error code that is logged before 8fff	No action required for 8fff; refer to error logged before 8fff.

(Continued on next page)

Error Code Table *(continued)*

Error	Error Description	Corrective Action
9004	Unable to initialize therapy control	Replace the A01 System PCB.
9005	Defib disabled	Replace the A01 System PCB.
9007	Shock not delivered	Reload the device software.
9009	Defib charge time expired	Replace the A07 Battery.
900b	Pacing rate out of tolerance	Replace the A01 System PCB.
900f	Unable to initialize therapy control	1. Check the stack connector. 2. Replace the A04 Therapy PCB.
9011	Pacer fault	1. Reload the device software. 2. Replace the A04 Therapy PCB.
9017	Pacer disabled	Reload the device software.
901a	Pacer rate storage corrupted	Reload the device software.
901b	Therapy PCB communication lost	1. Check the stack connector. 2. Replace the A04 Therapy PCB.

(Continued on next page)

Error Code Table *(continued)*

Error	Error Description	Corrective Action
901d	Testing purpose only	Replace the A01 System PCB.
9021	Impedance value indicates regulator in System PCB pre-amp failed	1. Clear error and perform PIP. 2. Replace the A01 System PCB.
9c03	Therapy processor, unplanned reset	Replace the A04 Therapy PCB.
9c04	Therapy/system controller communication watchdog	Replace the A01 System PCB.
9c05	CRC error	1. Clear error and perform PIP. 2. Replace the A04 Therapy PCB.
9c06	Calibration constant A out of range	1. Perform TCP - defibrillator calibration. 2. Clear Service Log.
9c07	Calibration constant B out of range	1. Perform TCP - defibrillator calibration. 2. Clear Service Log.
9c08	Therapy ROM cyclic redundancy check (CRC) failed	1. Reload the device software. 2. Replace the A04 Therapy PCB.
9c09	Therapy RAM pattern write test failed	Replace the A04 Therapy PCB.

(Continued on next page)

Error Code Table *(continued)*

Error	Error Description	Corrective Action
9c0a	Therapy relay idle coil voltage out of range	Replace the A04 Therapy PCB.
9c0b	Therapy relay enabled coil voltage out of range (5 ms)	Replace the A04 Therapy PCB.
9c0c	Therapy relay enabled coil voltage out of range (100 ms)	Replace the A04 Therapy PCB.
9c0d	Therapy relay drive enabled coil voltage out of range	Replace the A04 Therapy PCB.
9c0f	Therapy/power assembly communication error	1. Check power module 26-pin ribbon cable to J16 or A04 Therapy PCB. 2. Replace the A03 Power module. 3. Replace the A04 Therapy PCB.
9c11	Capacitor Dump failed	Replace the A04 Therapy PCB.
9c12	Therapy PCB 5 V out of range	Replace the A04 Therapy PCB.
9c13	Therapy PCB 15 V out of range	Replace the A04 Therapy PCB.
9c14	Therapy PCB -15 V out of range	Replace the A04 Therapy PCB.

(Continued on next page)

Error Code Table *(continued)*

Error	Error Description	Corrective Action
9c15	Therapy ADC time out error	Replace the A04 Therapy PCB.
9c18	3:00 AM H bridge test: NE leg shorted	Replace the A04 Therapy PCB.
9c19	3:00 AM H bridge test: SE leg shorted	Replace the A04 Therapy PCB.
9c1a	3:00 AM H bridge test: NW leg shorted	Replace the A04 Therapy PCB.
9c1b	3:00 AM H bridge test: SW leg shorted	Replace the A04 Therapy PCB.
9c1c	3:00 AM H bridge test: east side stuck open	Replace the A04 Therapy PCB.
9c1d	3:00 AM H bridge test: west side stuck open	Replace the A04 Therapy PCB.
9c1e	3:00 AM H bridge test: charge time out of range	1. Perform TCP - defibrillator calibration. 2. Clear Service Log.
9c1f	3:00 AM shorted paddles relay contact test: relay shorted	1. Inductive resister is not connected or is open. 2. Replace the A04 Therapy PCB. 3. Replace the A01 System PCB.

(Continued on next page)

Error Code Table *(continued)*

Error	Error Description	Corrective Action
9c20	3:00 AM shorted paddles relay contact test: relay shorted	Replace the A04 Therapy PCB.
9c21	3:00 AM pace drive test: pace power supply stuck on	Replace the A04 Therapy PCB.
9c22	3:00 AM pace drive test: pace power supply inoperable	Replace the A04 Therapy PCB.
9c23	3:00 AM pace drive test: relay contacts shorted	Replace the A04 Therapy PCB.
9c24	3:00 AM pace drive test: relay drive low side shorted	Replace the A04 Therapy PCB.
9c25	3:00 AM pace drive test: relay drive high side shorted	Replace the A04 Therapy PCB.
9c26	3:00 AM pace drive test: pace FET shorted	Replace the A04 Therapy PCB.
9c27	3:00 AM pace drive test: pace current path open	Replace the A04 Therapy PCB.
9c28	3:00 AM pace drive test: pace set point error	Replace the A04 Therapy PCB.
9c29	3:00 AM redundant controls test: redundant controls stuck on	Replace the A04 Therapy PCB.

(Continued on next page)

Error Code Table *(continued)*

Error	Error Description	Corrective Action
9c2a	3:00 AM redundant controls test: enable 2 stuck on	Replace the A04 Therapy PCB.
9c2b	3:00 AM 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.
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 is not connected or is open. 2. Replace the A04 Therapy PCB.
9c35	Therapy CPU instruction test failed	Replace the A04 Therapy PCB.
9c36	Therapy software stack overflow	Reload the device software.

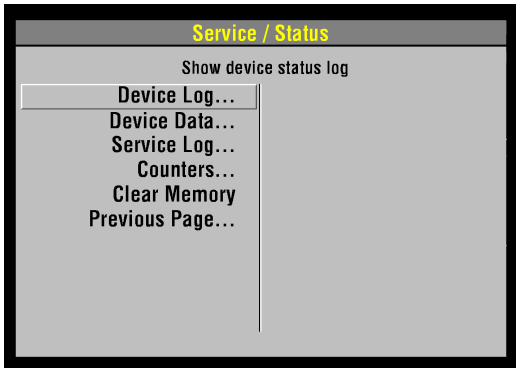
(Continued on next page)

Error Code Table *(continued)*

Error	Error Description	Corrective Action
9c3a	Energy capacitor overvoltage error	Replace the A04 Therapy PCB.
9c3b	3:00 AM redundant controls 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.

Using the Service/Status Features

Accessing the Service/ Status Features



The SERVICE/STATUS submenu includes options that provide information such as stored manufacturing data, recorded errors, and counters for shock and pacing operation.

To display the SERVICE/STATUS submenu, access the **SERVICE** menu and select STATUS.

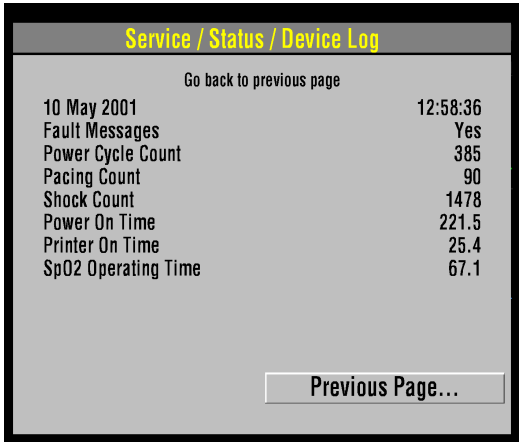
The SERVICE/STATUS options include:

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

(Continued on next page)

Using the Service/Status Features *(continued)*

Device Log



Select DEVICE LOG on the SERVICE/STATUS submenu to view essential device characteristics, such as when the operating software was installed, and accumulative device operations, such as the shock count.

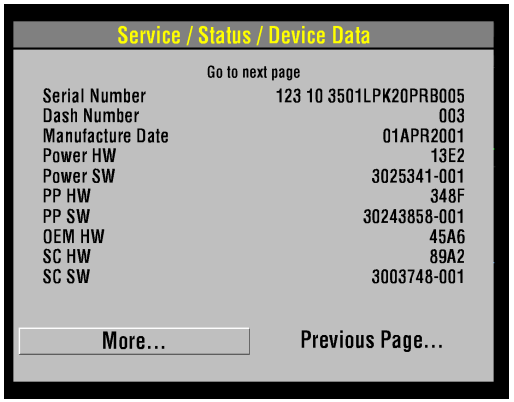
The device log data includes the following information:

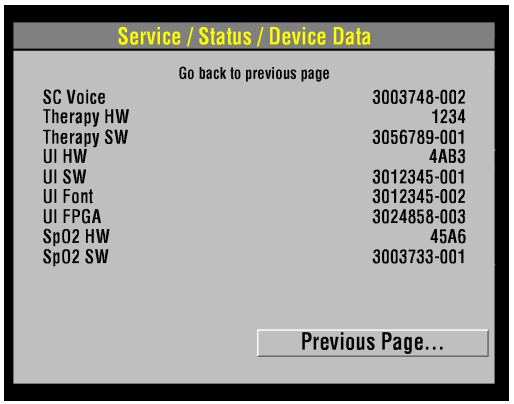
Data	Description
Manufacturing date	The date when the device was manufactured, specifically, when the operating software was loaded.
Fault Messages	Indicates whether there are any error codes stored in the Service Log (refer to **Processing Error Codes**).
Power Cycle Count	The number of times the device has been powered on.
Pacing Count	Total pacing pulses delivered by the device.
Shock Count	Total times the device defibrillation capacitor has been charged.
Power On Time	Total device power-on time.
Printer On Time	Total printer running time.
SpO2 Operating Time	Total SpO2 running time.

(Continued on next page)

Using the Service/Status Features *(continued)*

Device Data





Select DEVICE DATA on the SERVICE/STATUS submenu to view essential device characteristics, such as the serial number, and accumulative device operations, such as the shock count.

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
OEM HW	OEM PCB hardware serial number
SC HW	System controller hardware serial number

(Continued on next page)

Using the Service/Status Features *(continued)*

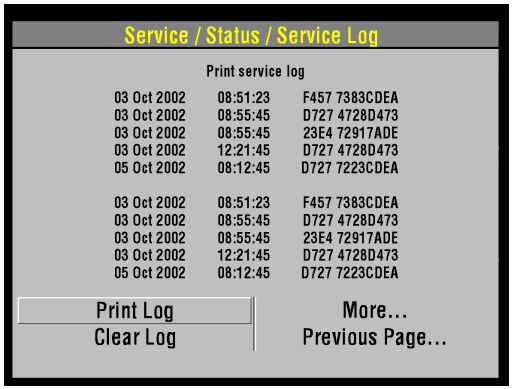
Device Data *(continued)*

Data	Description
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

(Continued on next page)

Using the Service/Status Features *(continued)*

Service Log



Select SERVICE LOG on the SERVICE/STATUS submenu to view the device service record.

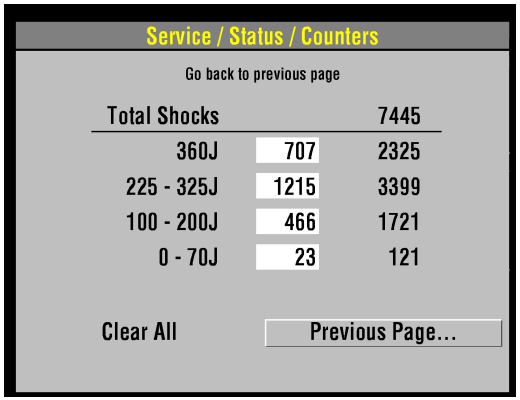
The service log includes the following information:

Data	Description
Service dates	Service log entries (error codes)
PRINT LOG button	Prints the service log
CLEAR LOG button	Clears the service log

(Continued on next page)

Using the Service/Status Features *(continued)*

Counters



Select COUNTERS on the SERVICE/STATUS submenu to view the joule settings, the total number of shocks delivered since the last reset, and the total number of shocks delivered since the device went into operation.

To reset the counters, select CLEAR ALL. This resets the boxed subtotal counters but not the running-total counters. You can also reset the counters using the CLEAR MEMORY feature discussed on the next page.

(Continued on next page)

Using the Service/Status Features *(continued)*

Clear Memory

Select CLEAR MEMORY on the SERVICE/STATUS submenu to clear the flash data management memory on the A02 Memory PCB. A count-down timer appears to indicate the clearing process, which requires approximately 30 seconds.

Specifically, it clears the following:

- ECG data — All stored ECG data (up to 45 minutes of first-in-first-out continuous ECG waveforms) are permanently deleted.
- Patient reports — All stored patient reports are permanently deleted.

Clear the data management memory when 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: Clearing the data management memory is permanent; there is no undo. To save important patient data before clearing the memory, print the individual patient data (refer to the *Data Management* section in the operating instructions.

Service Indicator

The service indicator LED does not indicate the presence of errors in the Service Log. The service indicator LED illuminates when an error code is written to the Service Log. Refer to **Processing Error Codes** to resolve the problem.

For example, if the service indicator illuminates when you turn on the device, an error code has been written to the Service Log. If you cycle the power, and the service indicator does not illuminate again, it does not mean that there are no error codes in the Service Log. You must review the Service Log and resolve the error code that was written there in the first instance.

Device User Test

When you turn on the device, a series of self-tests occur. If errors are detected, the service indicator LED illuminates. Self-testing does not occur only at power-on; it is continuous while the device is turned on.

Pressing the OPTIONS button and selecting USER TEST does not initiate a self-test cycle; rather, it monitors self-test status and produces reports. The device waits until the next self-test cycle is complete and then reports USER TEST PASSES.

One operation is specific to the OPTIONS/USER TEST feature. This operation consists of one cycle of charging the defibrillator capacitor to 10 joules and then dumping the charge. If this operation does not pass, the service indicator LED illuminates and an error is written to the Service Log (refer to **Processing Error Codes**).

Preventive Maintenance

Periodic maintenance, inspection, and testing of the device helps detect and prevent possible electrical and mechanical problems. When scheduled maintenance is due for the device, the MAINTENANCE DUE message displays for approximately 10 minutes each time the device is turned on (if a maintenance interval is set). To set and reset the maintenance interval, refer to **Setting a Maintenance Prompt Interval** and **Resetting the Maintenance Prompt**.

For information about battery-related topics, refer to **Battery Maintenance**. The information in this section includes the following:

Maintenance and Testing Guidelines

Periodic maintenance, inspection, and testing of the device will help prevent possible electrical and mechanical problems. Refer to the *Operator Checklist* in the operating instructions for additional items.

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 procedure (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		4 years

Cleaning

Cleaning Tools and Materials

The tools and materials that you will need to perform an external and internal cleaning of the device are listed 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, maximum)

Cleaning *(continued)*

External Cleaning Procedure

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 the accessory operating instructions.

Clean the exterior of the device by wiping the surface with any of the following solutions:

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

Cleaning *(continued)*

SpO2 Cleaning Procedure

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 allowing it to dry. Do not soak or immerse the cable in any liquid solution. Do not attempt to sterilize.

Cleaning *(continued)*

Internal Cleaning Procedure

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 device 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.

Device Useful Life

During product development, the device and subassemblies are subjected to rigorous life testing. This testing and the routine testing and maintenance program recommended in this service manual will help 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*).

Storing the Device

When not in use, or during long periods of storage, connect the device 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.

Note: Do not store or ship the device without turning off the AC Loss Alert alarm.

AC Loss Alert Alarm

The device is equipped with an alarm that beeps when the device 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. The default setting is 15 minutes.

To set or disable the alarm:

1. Display the **SETUP** menu.
2. Select GENERAL from the SETUP menu.
3. Select AC LOSS ALERT from the SETUP/GENERAL submenu.
4. Select 5 MINUTES, 15 MINUTES, 30 MINUTES, or NEVER ALERT to set or turn off the alarm.

Recycling

Recycle the device at the end of its useful life.

- Recycling assistance — Recycle the device 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 disposable electrodes — After using disposable electrodes, follow your local clinical procedures for recycling.
- Recycling batteries — Refer to **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

AC power is the main power source for the device.

There is one backup battery located in the bottom case.

- The LIFEPAK 20 defibrillator/monitor uses a 10-cell, nickel metal hydride (NiMH) battery.
- The LIFEPAK 20e defibrillator/monitor uses a 9-cell, lithium-ion (Li-ion) battery.

WARNING!

The LIFEPAK 20e defibrillator/monitor battery will not be charged or may be charged incorrectly if a battery other than a Physio-Control battery is used.

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 device for at least two hours.

The device also has a coin cell 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 should be replaced at the end of its life.

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 when ac power is connected to the device. The charger does not recharge the battery until one week has passed since the battery's last full recharge or until the battery has been disconnected and then reconnected.

The LIFEPAK 20e defibrillator/monitor has a built-in, constant, current-constant voltage charger that recharges a completely discharged backup battery in approximately four hours when ac power is connected to the device. The charger does not recharge the battery until the Li-ion battery's state-of-charge drops below 85%.

Note: The LIFEPAK 20e defibrillator/monitor will only initiate battery charging if the battery pack is below 40° C. If extensive defibrillator shocks have been applied to a device in a high ambient temperature, the battery will not immediately start charging.

Storing the Battery

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's initial charge.

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, or refer to http://recycling.medtronic.com for disposal instructions.

WARNING!

Risk of fire, explosion, and burns. Do not recharge, disassemble, crush, heat above 100° C (212° F), incinerate, or mistreat batteries.

Replacement Procedures

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

Perform an interior inspection whenever the device 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.). See the **Interconnect Diagram** for additional information.

(Continued on next page)

Replacement Procedures
(continued)

Repair Procedures Index

Choose from the following replacement procedures (procedures are listed in device disassembly order from left to right):

Battery Replacement

Top Case

Parts List	Top Case Removal	Top Case Installation

Front Case

Assembly Diagram (Front View)	Assembly Diagram (Rear View)	Parts List
Front Case Disassembly	Front Case Reassembly	Front Case Removal
Front Case Installation	Grounding Harness Orientation	AED Door Replacement
W18 UI Flex Cable Removal	W18 UI Flex Cable Installation	A15 Elastomer Keypad Removal
A15 Elastomer Keypad Installation	A11 Active Display Removal	A11 Active Display Installation
A08 Backlight Inverter PCB Diagram	A11 Active Display Diagram	W17 Backlight Inverter Cable Diagrams
A05 User Interface (UI) PCB Removal	A05 User Interface (UI) PCB Installation	A05 User Interface PCB Diagram
W18 UI Flex Cable Diagrams	W04 Speed Dial Assembly Removal	W04 Speed Dial Assembly Installation
W02 Speaker Assembly Removal	W02 Speaker Assembly Installation	W04 Speed Dial Assembly Diagrams
W02 Speaker Assembly and W25 Speaker Harness Extension Cable Diagrams		

(Continued on next page)

Repair Procedures Index *(continued)*

Boardstack

(Continued on next page)

Repair Procedures Index *(continued)*

Bottom Case

(Continued on next page)

Repair Procedures Index *(continued)*

Final Assembly

Warnings and Cautions

The following general warnings and cautions apply to all actions you may perform during maintenance of the device.

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 under Static-Sensitive Devices (SSD).

Static-Sensitive Devices (SSD)

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.

(Continued on next page)

Static-Sensitive Devices *(continued)*

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.

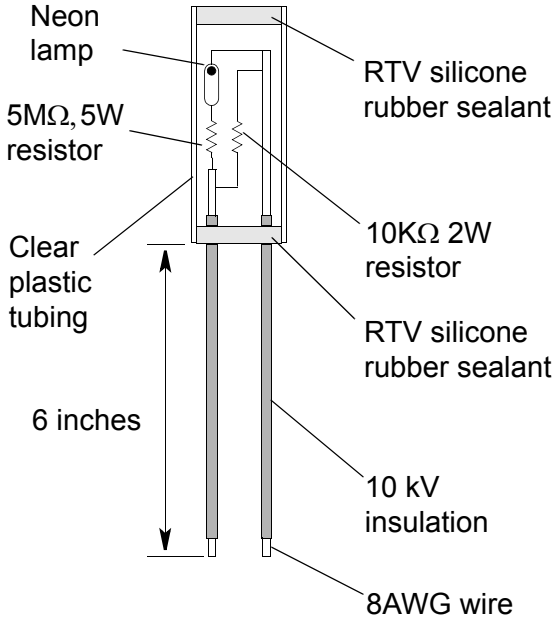
Keep Work Area Static-Free

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

Capacitor Discharge Tool



WARNING!

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

Third party biphasic capacitor discharge tools are available for purchase. Contact a Technical Support Representative for more information.

Shown is an example of how the biphasic capacitor discharge tool is constructed for discharging the A13 Energy Storage Capacitor. The materials used in this example are:

- 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

For instructions on discharging the energy storage capacitor, continue to the next page.

Using the Capacitor Discharge Tool

WARNING!

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

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

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 (see the illustration on the next page).
4. Place the other probe in the connection point of the capacitor wire. 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.

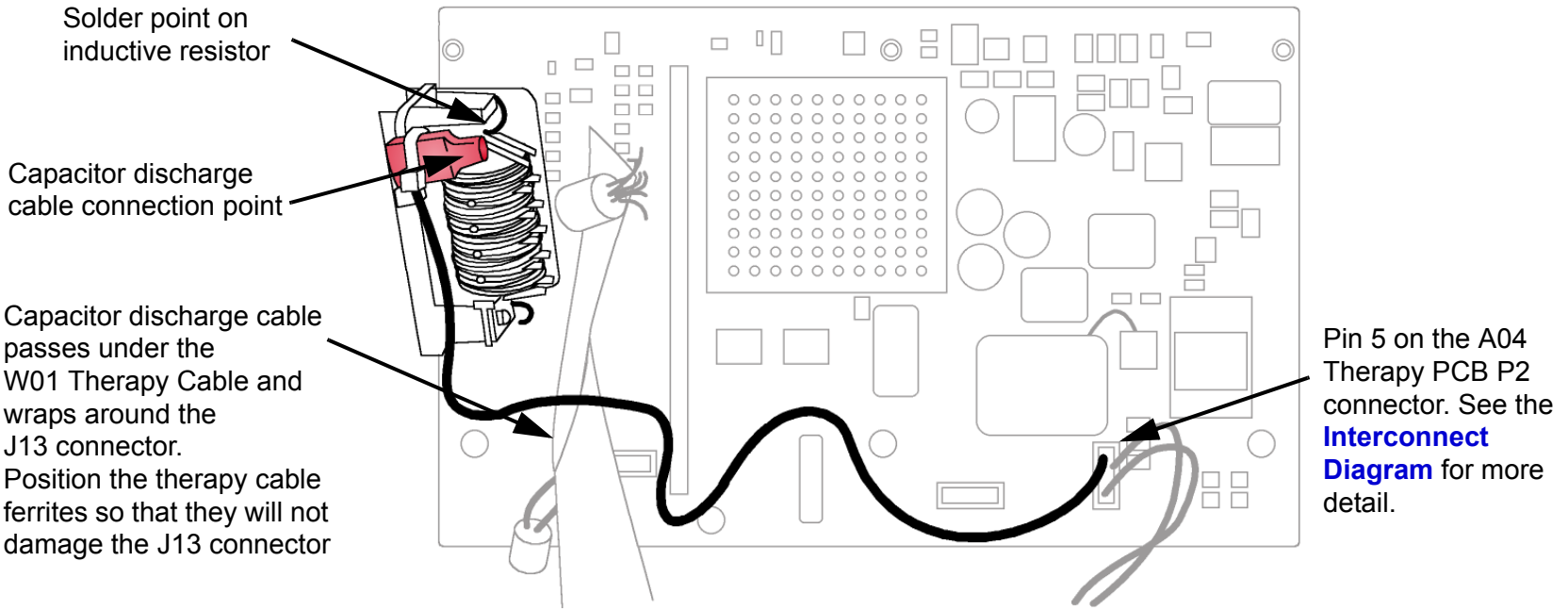
(Continued on next page)

Using the Capacitor Discharge Tool *(continued)*

WARNING!

Shock hazard. Do not assume the capacitor is discharged 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 the Setup Configuration

The following procedures describe 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.
- The second method is to print the setup configuration, complete repairs, and then manually reconfigure the device.

Note: Saving the configuration by transferring it to a spare device requires that both devices have the same software version. Otherwise, potentially unexpected results may occur when the configuration is restored to the repaired device. Verify that copyright dates are the same on the introduction page of both devices.

Transferring the Setup Configuration

To transfer the setup configuration to a spare device:

1. With the power OFF on both devices, connect the two devices using a configuration transfer cable (MIN 3202447) between the device system connectors.
2. Display the **SETUP** menu on both devices.
3. Select SEND CONFIG in the SETUP menu on the device to be repaired. The SEND CONFIG overlay appears.

(Continued on next page)

Saving the Setup Configuration *(continued)*

4. Select SEND and press the SPEED DIAL. The setup configuration transfers to the spare device.
5. Select PRINT DEFAULTS in the SETUP menu on the device to be repaired. The printer prints the device setup configuration. Save this backup printout for possible future reference.
6. Turn both devices OFF.

Restoring the Setup Configuration

To restore the setup configuration by transferring it back to the repaired device:

1. Connect the spare device (with the saved setup configuration) to the repaired device using a configuration transfer cable (MIN 3202447) between the device system connectors.
2. Display the **SETUP** menu on both devices.
3. Click SEND CONFIG in the SETUP menu on the spare device. The SEND CONFIG overlay appears.
4. Select SEND and press the SPEED DIAL. The setup configuration transfers back to the repaired device.
5. Turn both devices OFF.

(Continued on next page)

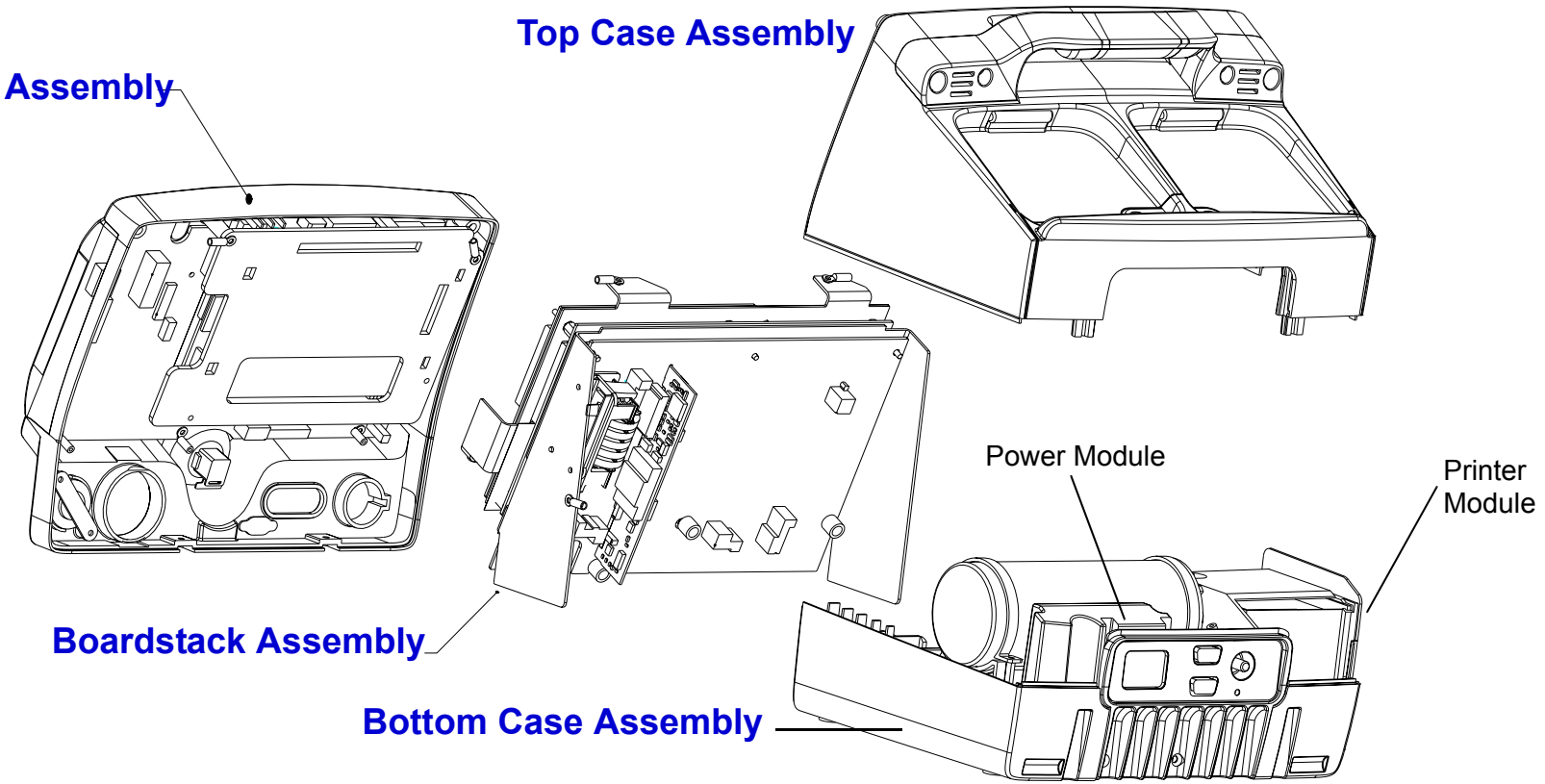
Saving the Setup Configuration *(continued)*

Printing the Setup Configuration

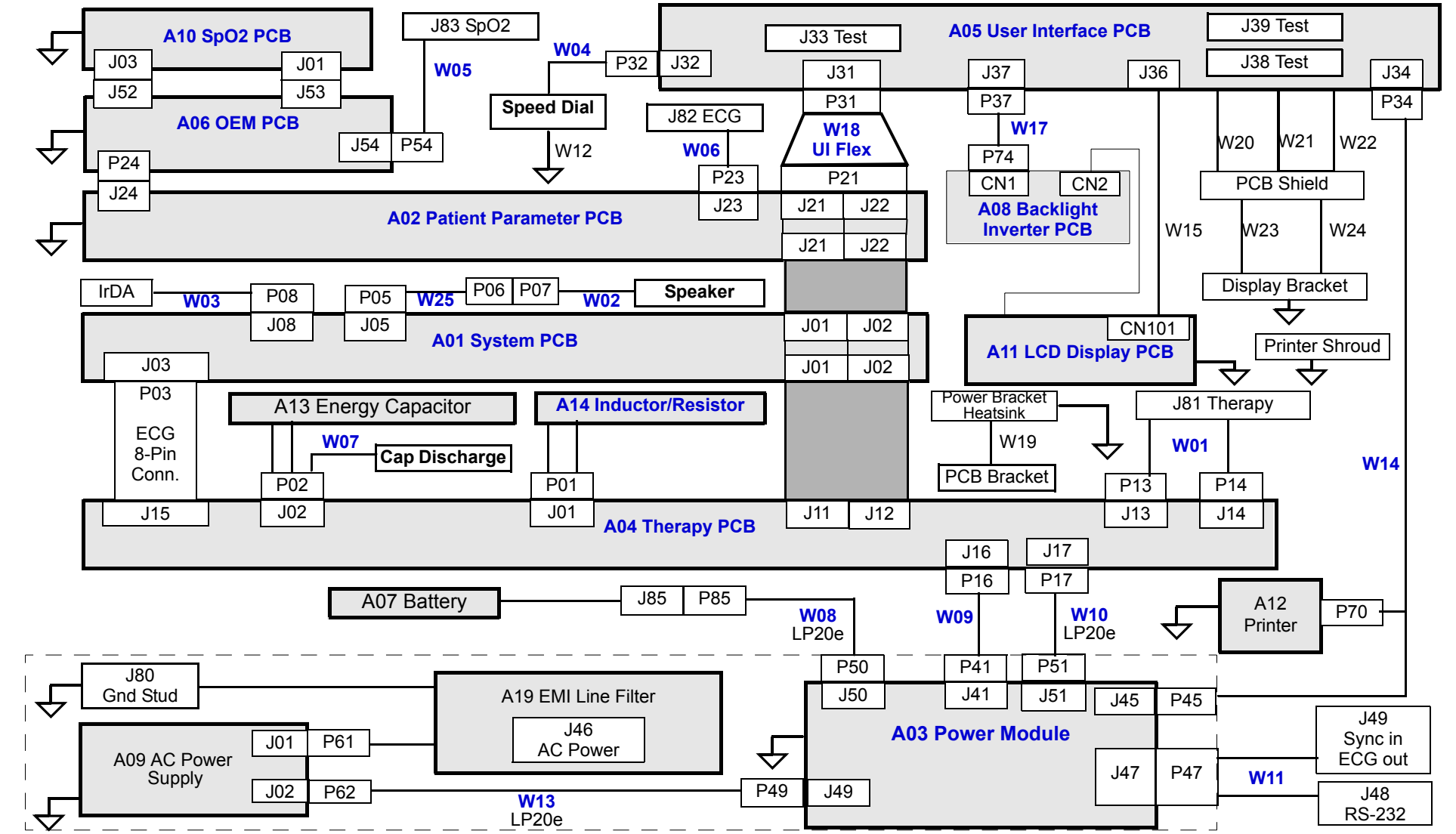
To print the setup configuration:

1. Display the **SETUP** menu.
2. Select PRINT DEFAULTS. The printer prints the device setup configuration. Save this printout for future reference.
3. Turn the device OFF.
4. Make the necessary repairs.
5. Turn the device ON and display the SETUP menu.
6. Using the printout, check the settings in each menu and revise as necessary to match the printout.
7. Turn the device OFF.

Main Assemblies

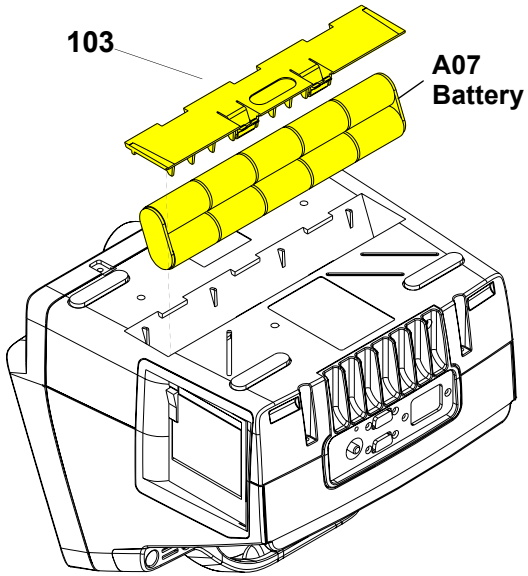


Interconnect Diagram



Battery Replacement

A07 Battery Replacement



Note: There are two different types for the A07 Batteries. The LIFEPAK 20e defibrillator/monitor uses the A07 Battery with the 6-pin connector, and the LIFEPAK 20 defibrillator/monitor uses the battery with the 4-pin connector. To remove the A07 Battery from the device:

1. Disconnect the device from ac power.
2. Place the device top down.
3. Insert two, small, flat-bladed screwdrivers into the door taps and pinch the tabs to remove the battery door (103).
4. Remove and disconnect the A07 Battery.

To install the A07 Battery:

1. Place the device top down.
2. Connect the W08 Battery Cable to the A07 Battery.
3. Insert the A07 Battery into the battery compartment. (For the LIFEPAK 20 battery, ensure the fuse is facing toward the rear of the device.)

   Note: Install the A07 Battery in the compartment with the wire harness facing toward the front of the device.
4. Close the battery door (103).
5. **Complete the PIP**.

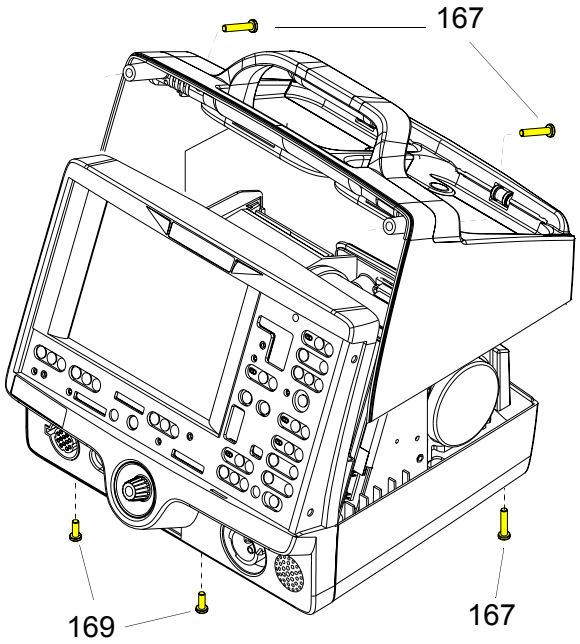
Top Case

Parts List

Item	Quantity	MIN	CAT.	Part Description	Note
167	4	202253-592	21300-005334	Machine screws 6-32 × 1.75L	
169	2	202253-570	21300-001032	Machine screw, 6-32 × 0.375L	
242	1	3202497-002	21330-001036	Top case assembly	

Top Case *(continued)*

Top Case Removal

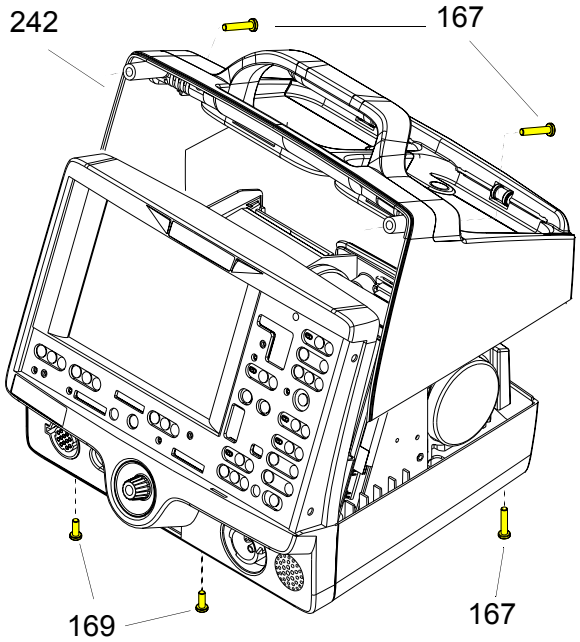


To remove the top case:

1. Disconnect the device from ac power.
2. **Remove the A07 Battery** from the device.
3. Place the device face down.
4. Remove and discard the two 6-32 × 0.375 screws (169) securing the bottom case to the front case.
5. Remove and discard the 6-32 × 1.75 screws (167) securing the bottom case to the top case.
6. Place the device on its bottom.
7. Remove and discard the two 6-32 × 1.75 screws (167) 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 device.
9. **Discharge the A13 Capacitor**.

Top Case *(continued)*

Top Case Installation



To install the top case:

1. Align the front case to the bottom case.
2. Align the top case (242) to the bottom case.
3. Align the front case to the top case.
4. Secure the top case to the front case with two new 6-32 × 1.75 screws (167).
5. Turn the device face down and secure the front case to the bottom case with two new 6-32 × 0.375 screws (169).
6. Secure the top case onto the bottom case with two new 6-32 × 1.75 screws (167).
7. **Install the A07 Battery** into the device.
8. Review the **labels parts list** and install new labels.
9. **Complete the PIP**.

Front Case

Assembly Diagram (Front View)

Front Case Removal (9)

Front Case Installation (9)

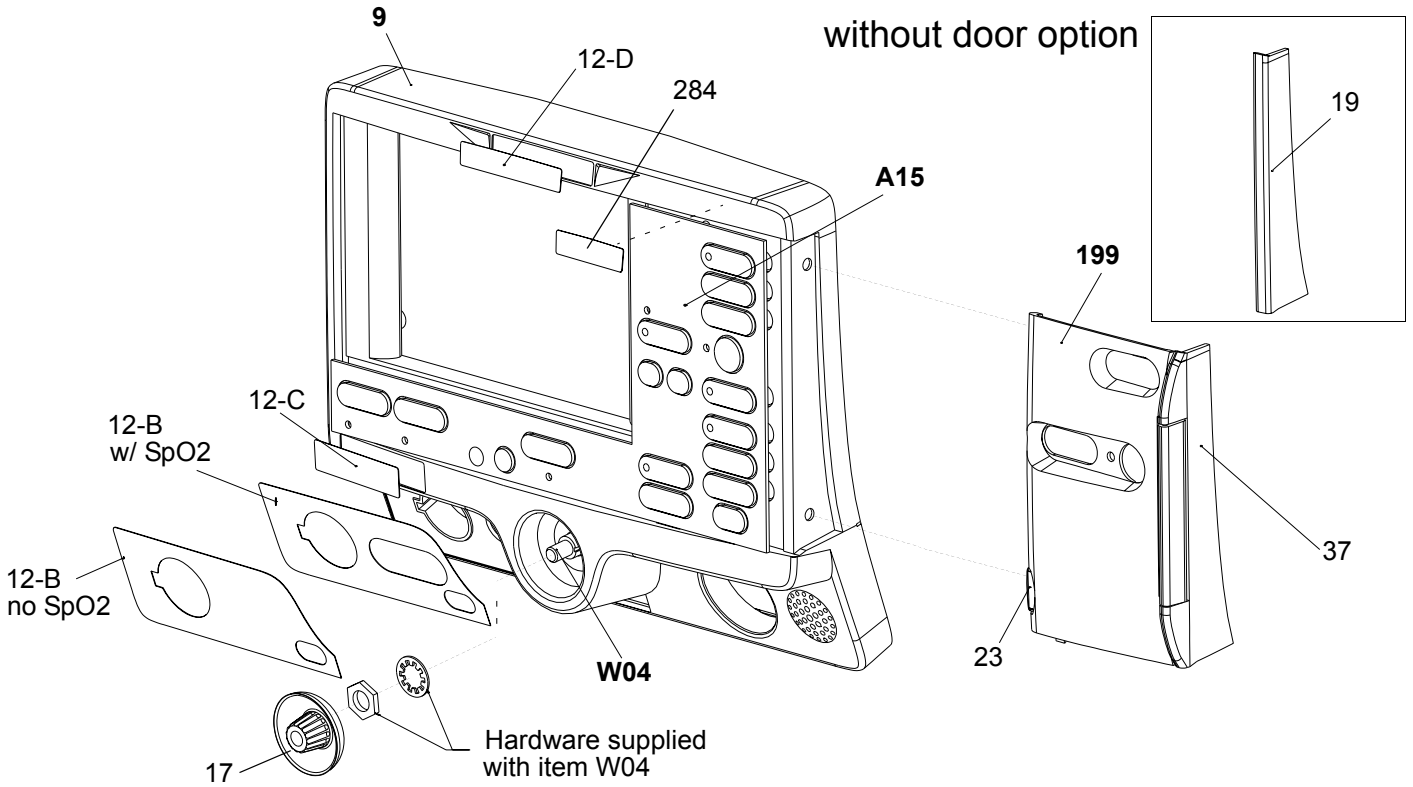
AED Door Replacement (199)

W04 Speed Dial Assembly Removal

W04 Speed Dial Assembly Installation

A15 Elastomer Keypad Removal

A15 Elastomer Keypad Installation



Front Case *(continued)*

Assembly Diagram (Rear View)

A11 Active Display Removal

A11 Active Display Installation

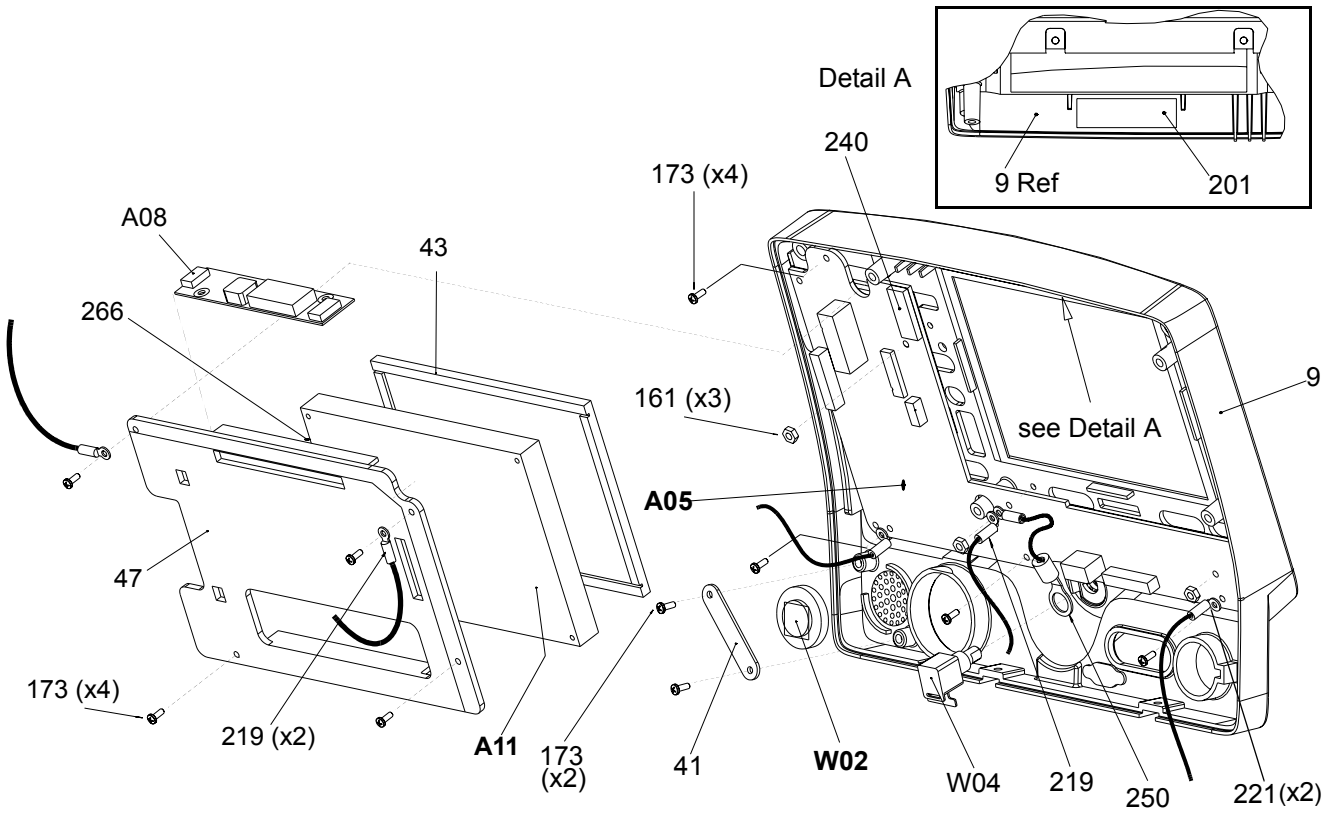
A05 User Interface (UI) PCB Removal

A05 User Interface (UI) PCB Installation

W02 Speaker Assembly Removal

W02 Speaker Assembly Installation

Grounding Harness Orientation



Front Case *(continued)*

Parts List

Item	Quantity	MIN	CAT.	Part Description	Note
A05	1	3201966-005	21330-001034	User Interface PCB	**Part of kit MIN 3202718-007**
A08	1	3202033-000	21300-004213	Active Backlight Inverter	**Part of kit MIN 3202718-009**
A11	1	3205278-001	21300-007363	Active Color LCD Display	**Part of kit MIN 3202718-008**
A15	1	3200642-031	21300-004231	Elastomer Keypad (all options)	**Select other language**
A15	1	3200642-061	21300-004598	Elastomer Keypad (no pacing)	**Select other language**
W02	1	3201593-004	21300-004247	Speaker Assembly	
W04	1	3201145-000	21300-004264	Speed Dial Assembly	
W15	1	3200995-000	21300-004805	Active Color Display Cable	**Part of various kits**
W17	1	3200996-002	21300-004237	Active Backlight Inverter Cable	**Part of kit MIN 3202718-009**
W18	1	3201000-003	21330-001006	UI to Stack Flex Assembly	

(Continued on next page)

Front Case *(continued)*

Parts List *(continued)*

Item	Quantity	MIN	CAT.	Part Description	Note
9	1	3200624-006	21300-004223	Front case	**Part of kit MIN 3202718-001**
12		various	various	Label set (6 labels)	**Refer to Labels Assembly**
17	1	3200633-000	21300-004620	Speed Dial knob	
19	1	3200638-001	21300-004837	Cover plate, door	**Part of kit MIN 3202718-001**
23	1	3201499-009	21501-000767	Manual latch label (**Part of door kit**)	**Select other language**
37	1	3200637-001	21300-004836	Door hinge plate	**Part of kit MIN 3202718-001**
41	1	3201610-000	21300-004649	Bracket, speaker mounting	
43	1	3200913-002	21300-004233	Display lens	**Part of various kits**
47	1	3200640-015	21300-004838	Active display bracket	**Part of kit MIN 3202718-009**

(Continued on next page)

Front Case *(continued)*

Parts List *(continued)*

Item	Quantity	MIN	CAT.	Part Description	Note
161	3	200805-000	21300-000584	Locking hex nut, 4-40	
173	10	202253-761	21300-001038	Machine screw, 4-40 × .312L	**Part of kit MIN 3202718-024**
199	1	3202056-004	21300-004252	AED door assembly	**Part of door kit**
201	1	3201111-003	21300-004241	Thermally conductive backlight inverter pad	**Part of kit MIN 3202718-001**
219	3	3202246-000	21300-004254	Grounding strap harness	Active Display
221	2	3202246-001	21300-004255	Grounding strap harness	User Interface PCB
240	1	804447-041	21300-004807	Foam spacer	**Part of kit MIN 3202718-025**
250	1	3202246-002	21300-004884	Grounding strap harness, Speed Dial	
266	1	3205497-308	21300-006141	Nylon snap rivet	**Part of kit MIN 3202718-008**
284	1	3206926-001	21501-001935	Label - Adult VF Dose	**Refer to Labels Assembly**

Front Case *(continued)*

Front Case Disassembly

To disassemble the front case:

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

Front Case *(continued)*

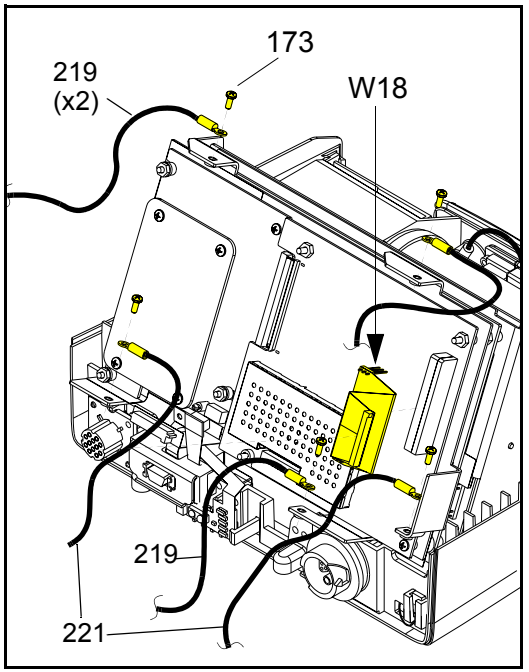
Front Case Reassembly

To reassemble the front case:

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

Front Case *(continued)*

Front Case Removal



WARNING!

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

To disassemble the front case:

1. **Remove the A07 Battery**.
2. **Remove the top case**.
3. **Discharge the A13 Energy Capacitor**.
4. Disconnect the two grounding harnesses (219) that connect the A11 Active Display to the top of the PCB support bracket by removing and discarding the two screws (173).

   Note: Replace any broken or frayed grounding straps.
5. 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.

(Continued on next page)

Front Case *(continued)*

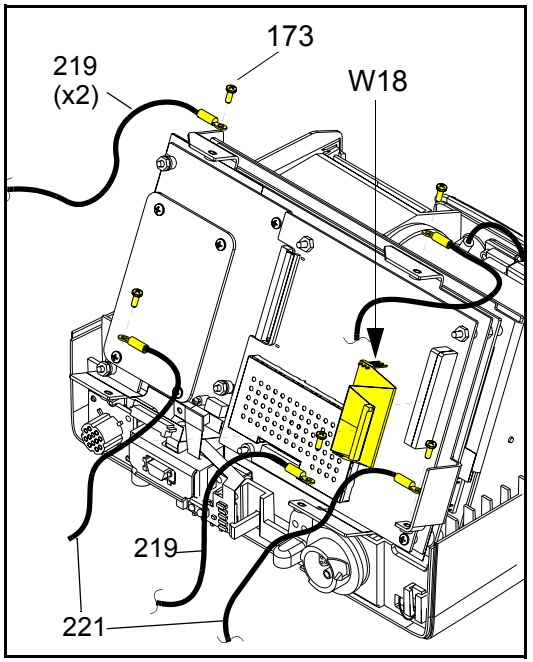
Front Case Removal *(continued)*

6. Disconnect the two grounding harnesses (221) that connect the bottom left and right corners of the A05 User Interface (UI) PCB to the PCB support bracket by removing and discarding the two screws (173).
7. Disconnect the grounding harness (219) that connects the bottom center of the A05 UI PCB to the PCB support bracket by removing and discarding the screw (173).
8. Disconnect the W25 Speaker Harness Extension Cable from the W02 Speaker Assembly.
9. Disconnect the W14 Printer Flex Cable from the A05 UI PCB at J34.

   Note: Disconnect the Speed Dial connector to access the printer connector.
10. Pull the front case away from the device.

Front Case *(continued)*

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.

Note: Reconnect the SPEED DIAL cable if it was disconnected during the disassembly process.

CAUTION!

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

3. Install the two grounding harnesses (221) by connecting the bottom left and right corners of the A05 UI PCB to the PCB support bracket, using two new screws (173). Refer to **Grounding Harness Orientation** for grounding harness placement.
4. Install the grounding harness (219) by connecting the bottom center of the A05 UI PCB to the boardstack system shield, using a new screw (173).

(Continued on next page)

Front Case *(continued)*

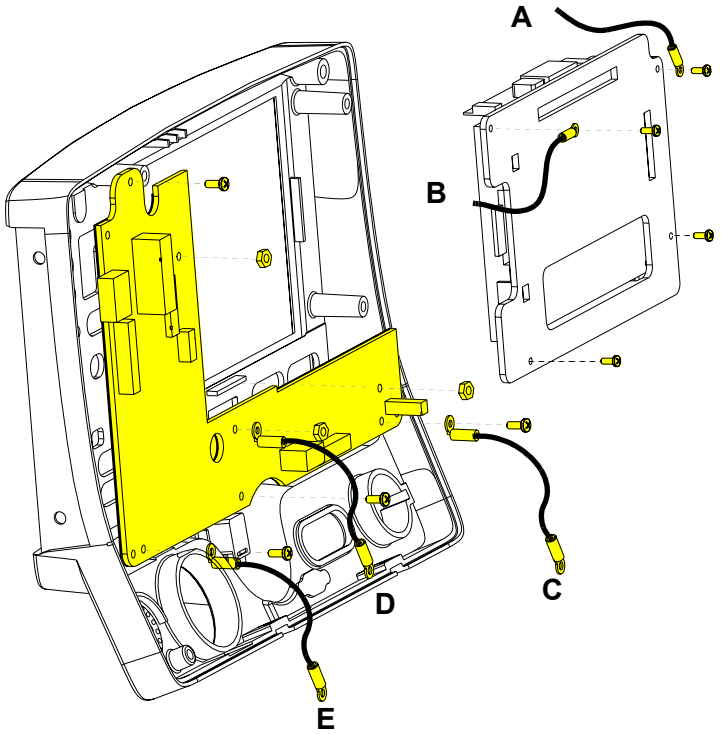
Front Case Installation *(continued)*

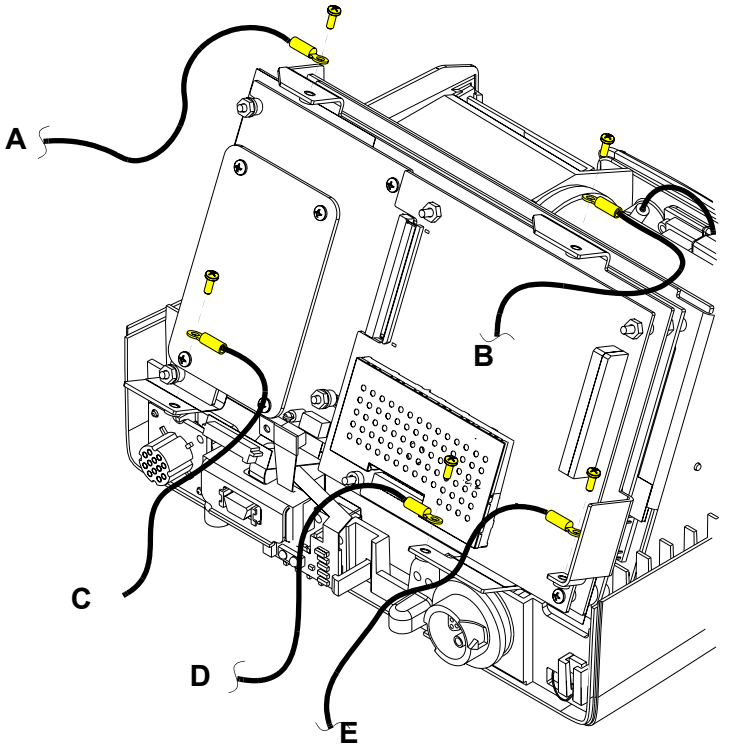
5. Connect the W18 UI Flex Cable to the A02 PP PCB at J21 and J22 and then to the A05 UI PCB at J31.
6. Connect the two grounding harnesses (219) by connecting the top of the front case to the system shield, using two new screws. Refer to **Grounding Harness Orientation** for grounding harness placement.
7. **Reassemble the top case**.

Front Case *(continued)*

Grounding Harness Orientation

To ensure that the top case, front case, and bottom case join correctly, align the grounding harnesses as shown below and on the next page.



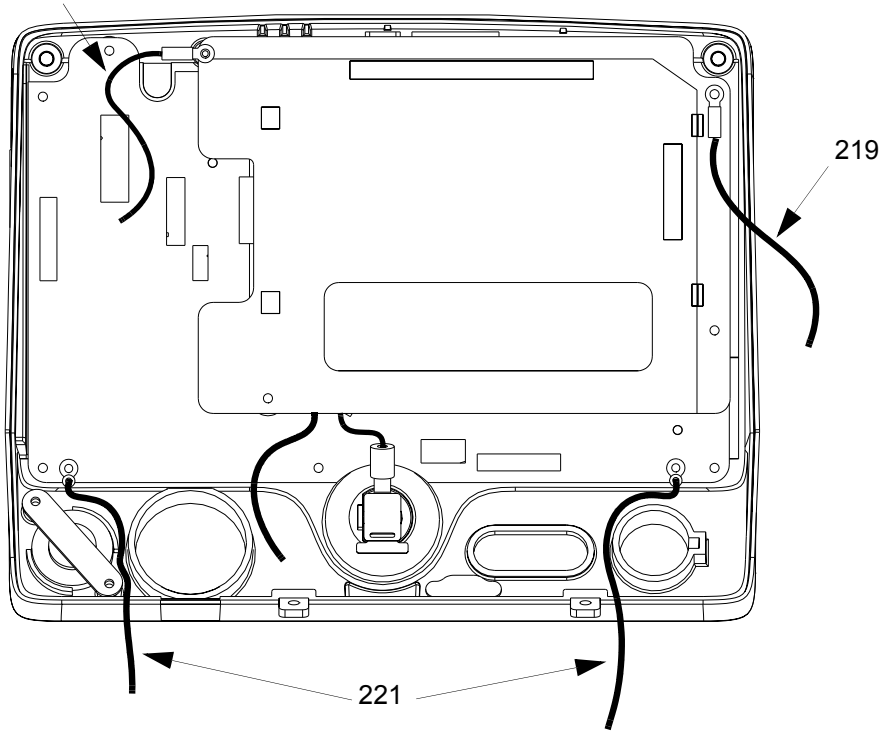


(Continued on next page)

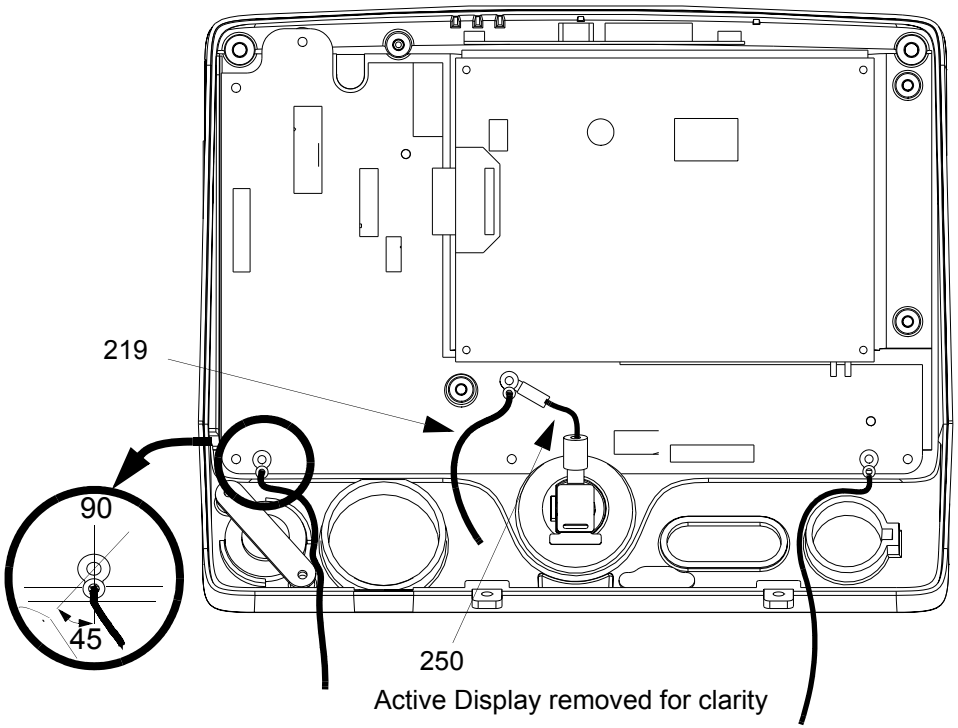
Front Case *(continued)*

Grounding Harness Orientation *(continued)*

Grounding Harness lug orientation



Grounding Harness lug orientation



Active Display removed for clarity

Front Case *(continued)*

AED Door Replacement

The AED door assembly is designed to be an easily replaceable, breakaway assembly. If the door assembly accidently comes off during use, follow step 3 of the AED door installation procedure below.

To remove the entire AED door assembly:

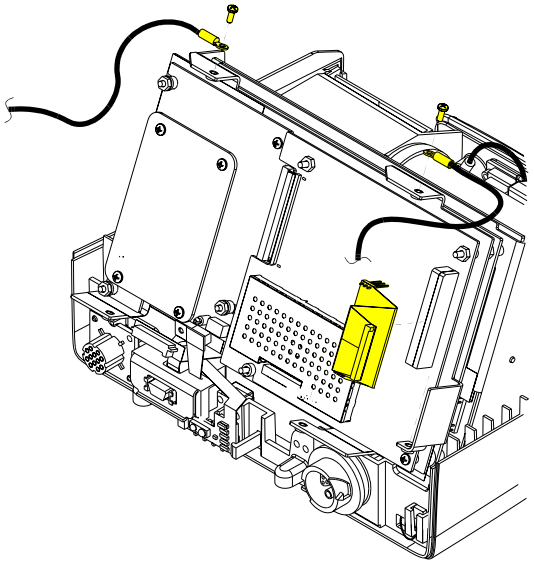
1. Open the AED door.
2. Use a small screwdriver to pry the hinge pin center slightly away from the door assembly until the door slides free of the hinge.
3. Peel the hinge off the front case.
4. Clean the front case to remove old adhesive.

To install a new AED door assembly:

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

Front Case *(continued)*

W18 UI Flex Cable Removal



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

To remove the W18 UI Flex Cable:

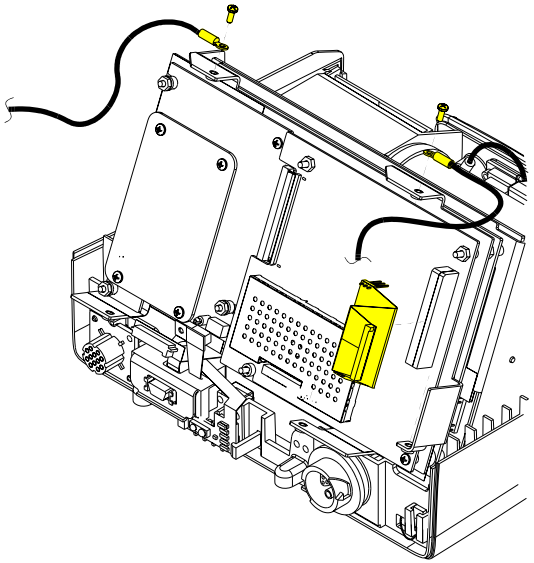
1. From the system shield, disconnect the two grounding straps (219) that connect the top of the front case to the system shield, by removing the two screws.

   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 device correctly.

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 device.

Front Case *(continued)*

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.

   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 to avoid possible pin damage.

3. Connect the two grounding straps (219) by connecting the top of the front case to the system shield, using 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 device correctly.

4. **Reassemble the top case**.

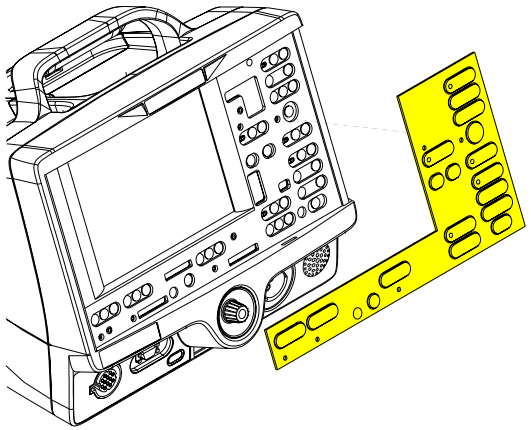
Front Case *(continued)*

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

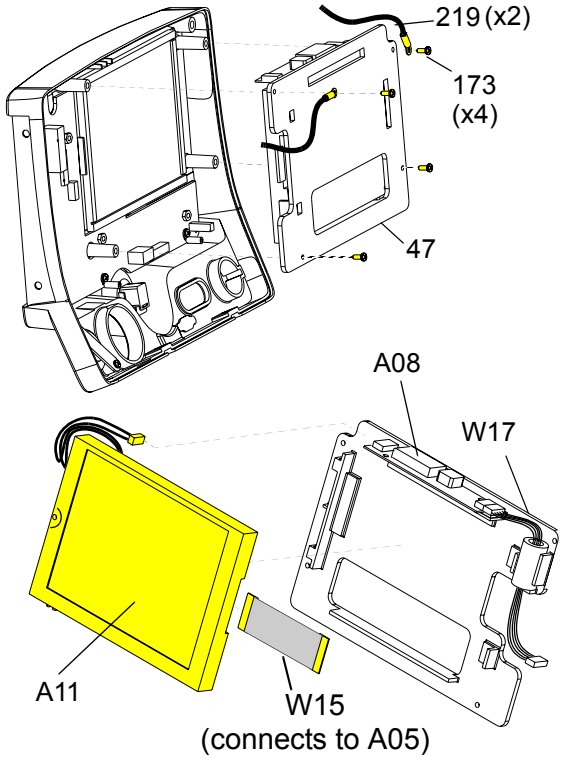


To install the A15 Elastomer Keypad:

1. Select one of the following device configurations to find the MIN (part number) for the correct keypad for your device:
   - **Keypad View**
   - **Keypad Parts List**
2. After thoroughly cleaning the front case, position the left and right bottom edges of the A15 Elastomer Keypad flush against the bottom corners of the front case.
3. 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 *(continued)*

A11 Active Display Removal



Note: Remove the following assemblies before beginning this disassembly:

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

To remove the A11 Active Display:

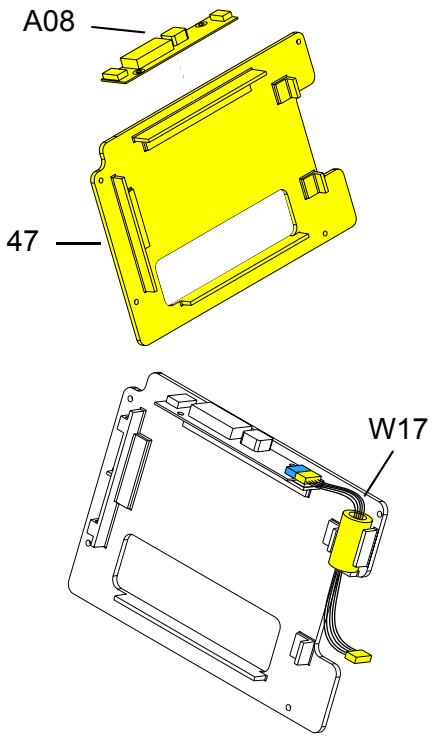
1. Disconnect the W15 Active Display Cable (see illustration) from the A11 Active Display, as follows:
   - Gently pull both sides of the locking tab away from the connector.
   - Pull the cable out of the socket (leave the cable connected to the UI PCB).
2. Disconnect the W17 Backlight Inverter Cable from the A05 UI PCB at J37.
3. Remove and discard the four 4-40 × 0.312 screws (173) from the display assembly cover.

   Note: **Remove the 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 from the front case.

(Continued on next page)

Front Case *(continued)*

A11 Active Display Removal *(continued)*



5. Check the condition of the following parts. Remove and replace any part that has cracks, broken wires, or damaged connectors.

   A08 Backlight Inverter — To remove, disconnect the Active Display wires at CN2. Disconnect the W17 Backlight Inverter Cable at CN1. Pull the backlight inverter away from the display bracket. A new display bracket is required because the adhesive and foam are pre-attached.

   W15 Active Display Cable — To remove, disconnect it from the A05 UI PCB at J36 (cable was previously disconnected from the Active Display in step 1).

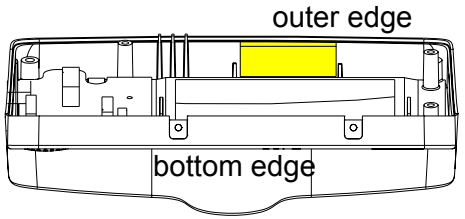
   W17 Backlight Inverter Cable — To remove, disconnect it from the A05 UI PCB at J37. Disconnect it from the A08 Backlight Inverter (if not previously removed) at CN1. Pull the ferrite bead out of the molded notches on the display bracket.

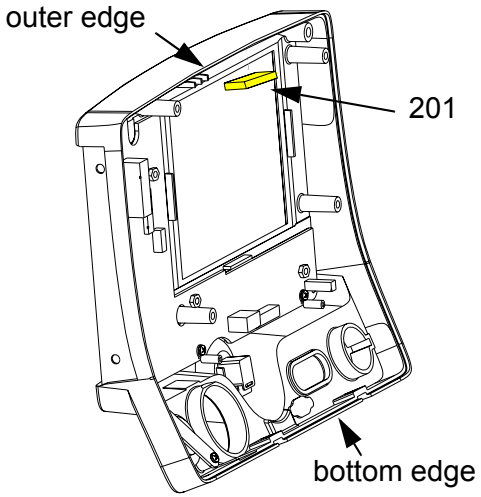
   Display bracket (47) — After removing above parts, replace if necessary. The display bracket has the Backlight Inverter PCB adhesive and the Active Display foam preattached.

   Thermal conductive pad (201) — To remove, peel away the old pad located on the top inside edge of the top case (**see illustration**).

Front Case *(continued)*

A11 Active Display Installation





To install the A11 Active Display:

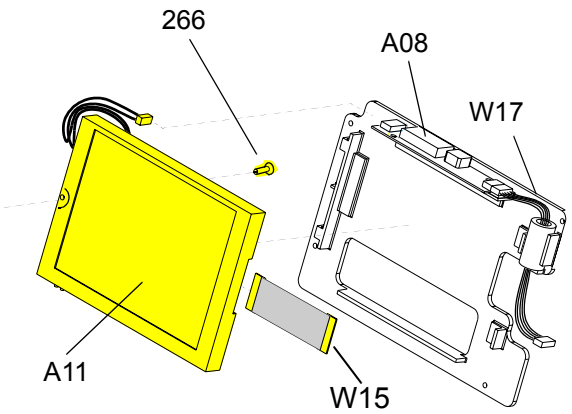
1. Verify the condition of the following parts and replace if necessary:
   - A08 Backlight Inverter (**see illustration**)
   - W15 Active Display Cable (**see illustration**)
   - W17 Backlight Inverter Cable (**see illustration**)
   - Display bracket (47) (**see illustration**)
   - Thermal conductive pad (201), located on the top inside edge of the top case
2. Replace the thermal conductive pad (201), if necessary, 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 must be positioned flush against the outer edge of the front case (past the ends of the locator notches in the front case).
3. Insert the snap rivet (266) (**see illustration**) through the hole from the back of the display and ensure the rivet expands on the front side.

(Continued on next page)

Front Case *(continued)*

A11 Active Display Installation *(continued)*



4. If replacing the A08 Backlight Inverter, a new display bracket (47) is required. The display bracket has the adhesive and display foam piece preinstalled.
5. Position the A11 Active Display inside the display bracket.
6. Connect the A11 Active Display wires to the A08 Backlight Inverter at CN2. Loop the wires under the molded hook in the display bracket.
7. Connect the W17 Backlight Inverter Cable to the A08 Backlight Inverter at CN1 and seat the ferrite bead into the molded notches of the display bracket. Connect P37 of the inverter cable (if disconnected previously) to the A05 UI PCB at J37.
8. Place the active display bracket assembly in position in the front case. (If replacing the Active Display, remove the clear protective cover prior to installing it into the front case.)

   Note: The A08 Backlight PCB must make contact with the thermal conductive pad (201) on the front case.
9. Place the two grounding harnesses (219) onto the top two screws (173). Refer to **Grounding Harnesses Orientation** for grounding harness placement.

(Continued on next page)

Front Case *(continued)*

A11 Active Display Installation *(continued)*

CAUTION!

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

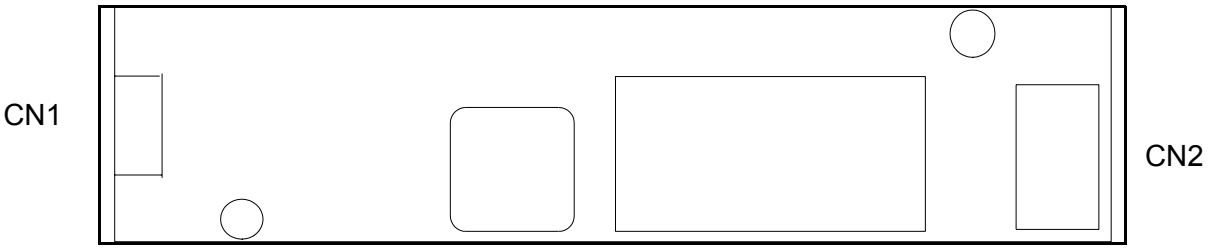
10. Install four new 4-40 × 0.312 screws (173) to secure the display assembly to the front case.
11. Connect the W15 Active Display Cable to the A05 UI PCB at J36 (if removed previously), as follows.
    - Open the J36 connector lock.
    - Insert the W15 Display Cable (metal contacts down) into the connector lock.
    - Close the connector lock to secure the cable.

    Note: The cable connector must be square with the connector lock.
12. Complete the process by **Installing the front case**.

Front Case *(continued)*

A08 Backlight Inverter PCB Diagram

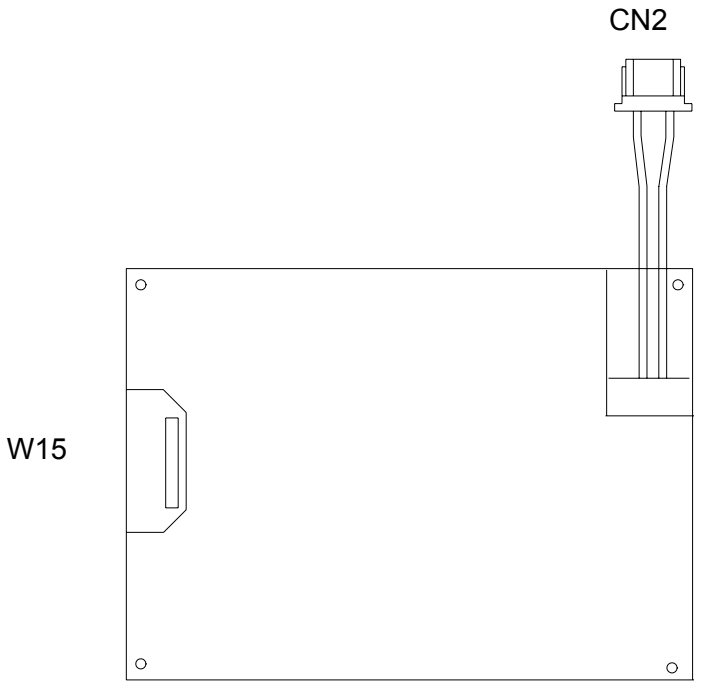
MIN **3202033**



Front Case *(continued)*

A11 Active Display Diagram

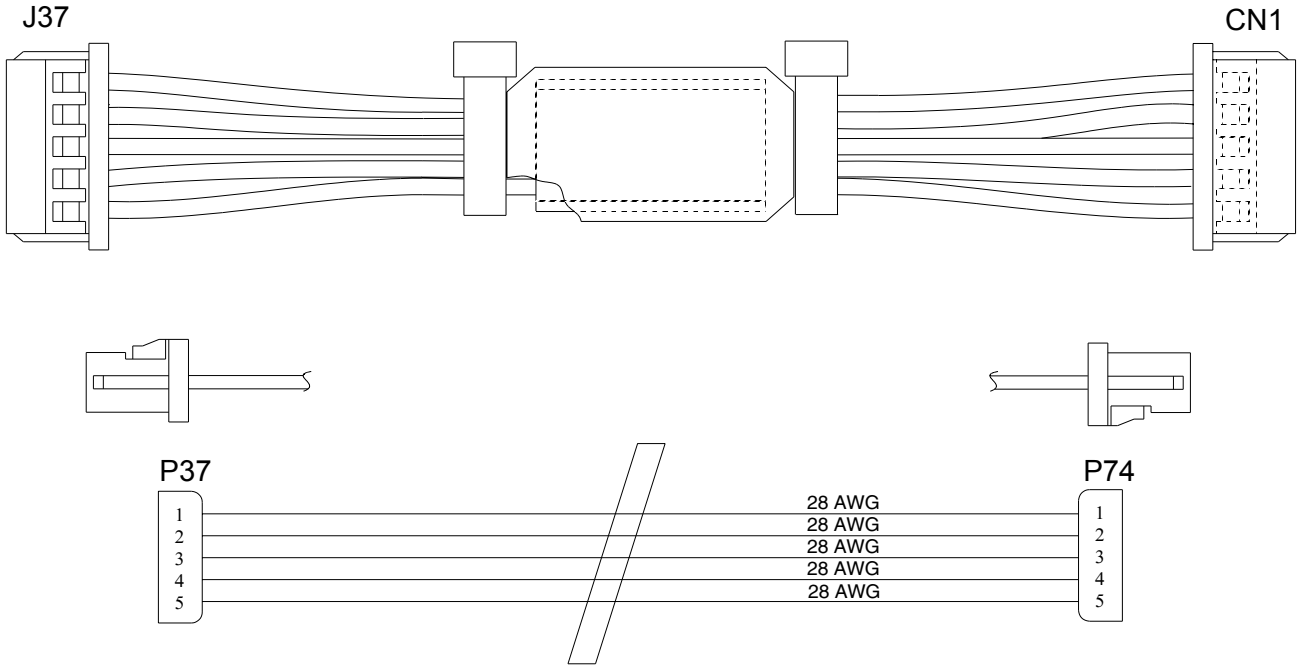
MIN **3205278**



Front Case *(continued)*

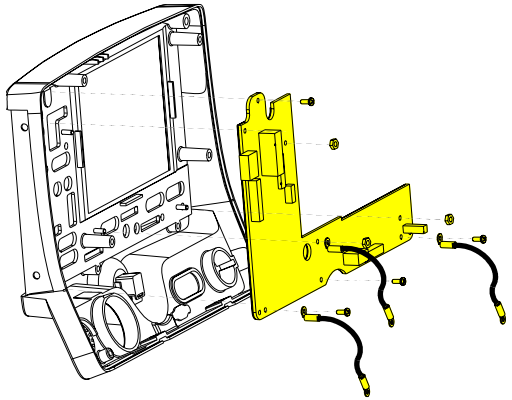
W17 Backlight Inverter Cable Diagrams

MIN **3200996**



Front Case *(continued)*

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 and discard the three 4-40 × 0.312 screws (173) from the bottom edge of the A05 UI PCB. **Remove the two grounding harnesses** (221) attached to the left and right corner screws.

   Note: Replace any broken or frayed grounding harnesses.

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

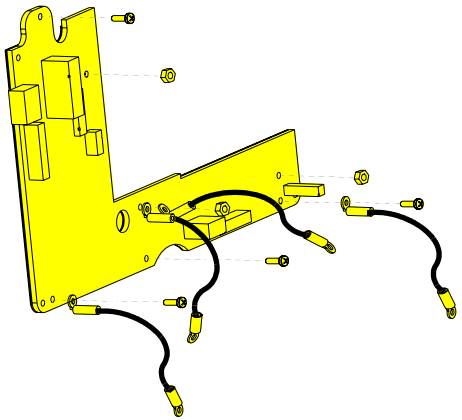
(Continued on next page)

Front Case *(continued)*

A05 User Interface (UI) PCB Removal *(continued)*

4. Remove and discard the 4-40 × 0.312 screw (173) from the top left corner of the A05 UI PCB.
5. Remove the three 4-40 nuts (161) from the A05 UI PCB. Remove the 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 device 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 the 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 *(continued)*

A05 User Interface (UI) PCB Installation *(continued)*

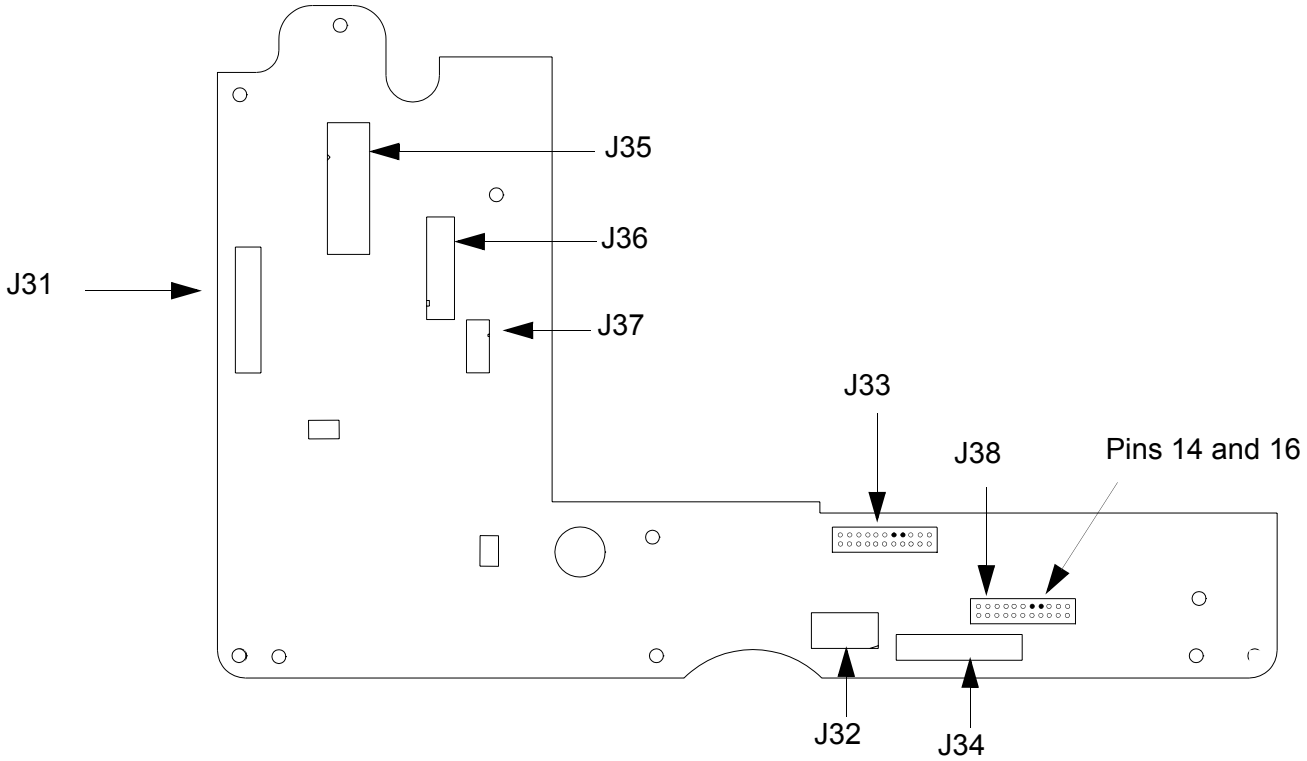
3. Place the two grounding harnesses (221) onto the new lower left and right 4-40 × 0.312 screws (173).
4. Install four new 4-40 × 0.312 screws (173) onto the A05 UI PCB. Refer to **Grounding Harness Orientation** for grounding harness placement.

   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. Complete the process by **Installing the active display** assembly.

Front Case *(continued)*

A05 User Interface PCB Diagram

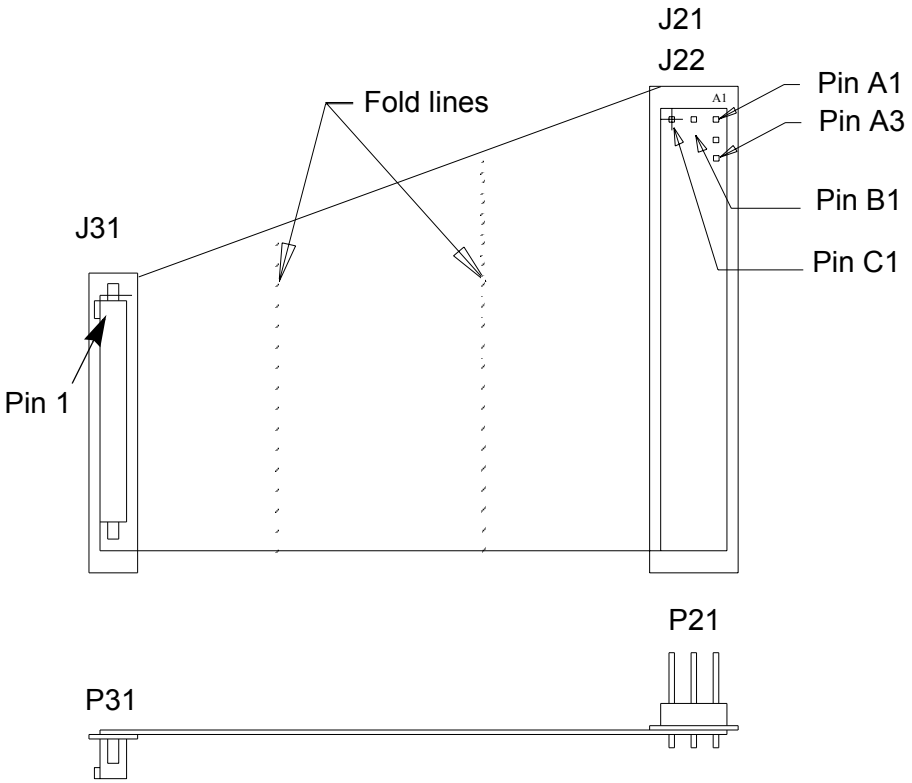
MIN **3201996**

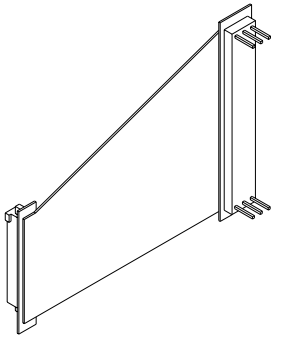


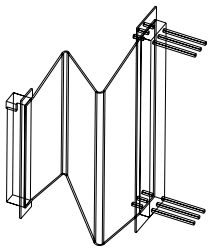
Front Case *(continued)*

W18 UI Flex Cable Diagrams

MIN **3201000**



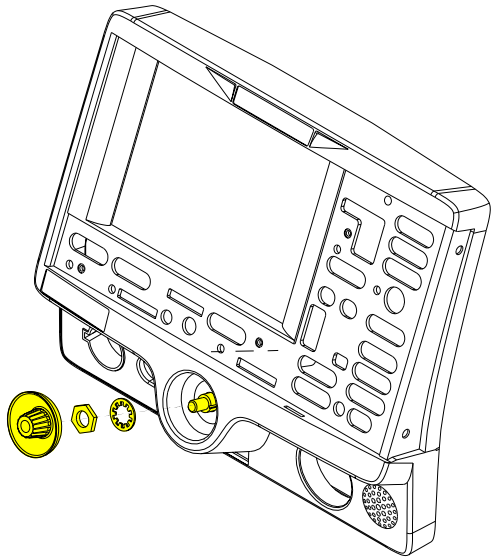




Folded view

Front Case *(continued)*

W04 Speed Dial Assembly Removal



Note: Remove the following assemblies before beginning this disassembly:

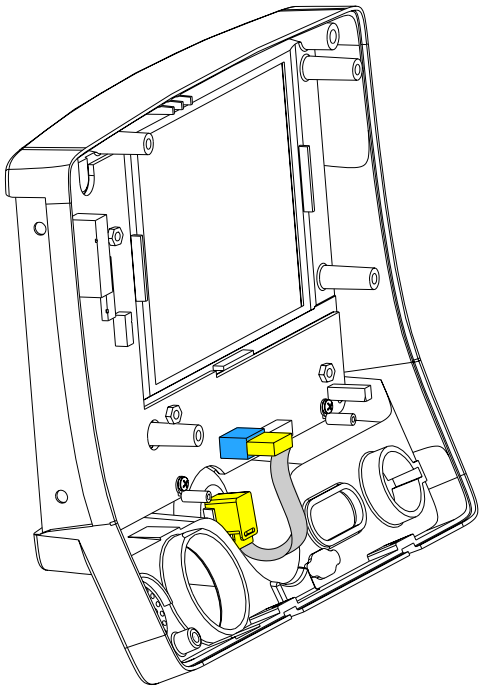
- **Top case**
- **Front case**

To remove the W04 Speed Dial Assembly:

1. Disconnect the W04 Speed Dial connector from the A05 UI PCB at J32.
2. Turn the 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.

Front Case *(continued)*

W04 Speed Dial Assembly Installation

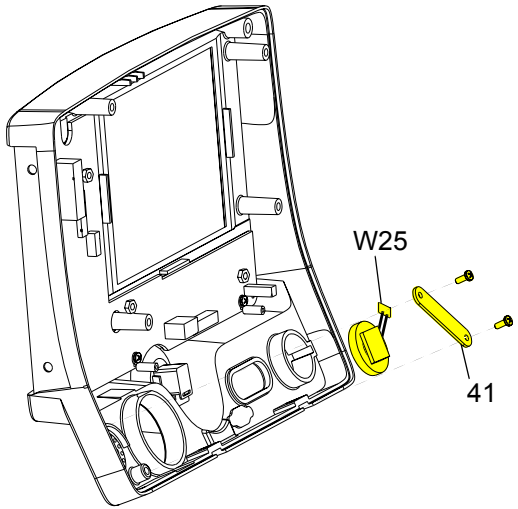


To install the W04 Speed Dial Assembly:

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 onto the Speed Dial axle.
4. Install and tighten the nut onto 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. Complete the process by **Installing the front case**.

Front Case *(continued)*

W02 Speaker Assembly Removal



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

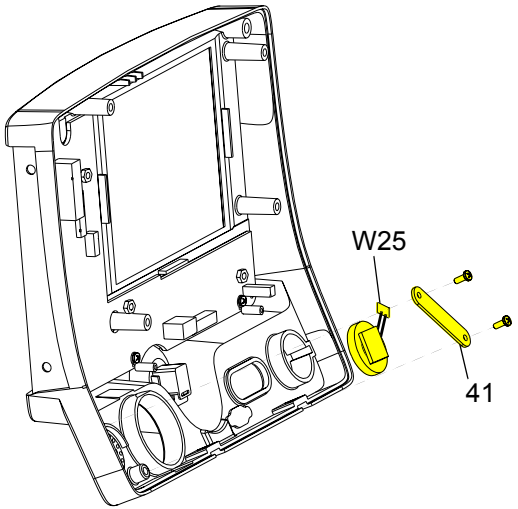
- **Top case**
- **Front case**

To remove the W02 Speaker Assembly:

1. Disconnect the speaker cable from the W25 Speaker Harness Extension Cable connector. Refer to the **W25 Speaker Harness Extension Cable** removal and installation instructions for more information.
2. Remove and discard the two 4-40 × 0.312 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 *(continued)*

W02 Speaker Assembly Installation



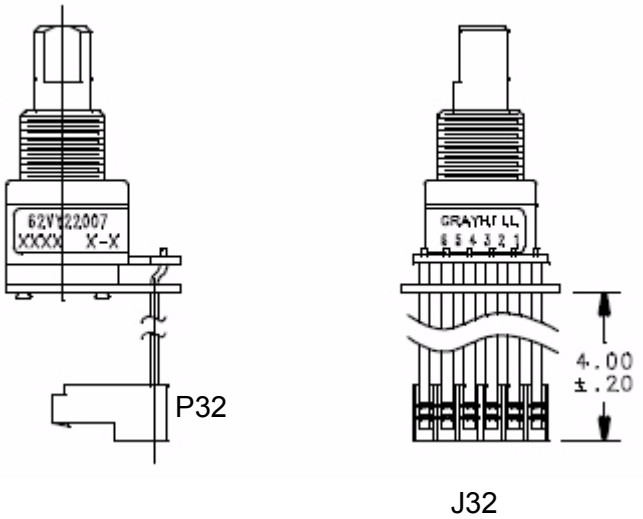
To install the W02 Speaker Assembly:

1. Fit the W02 Speaker Assembly into the front case and position the cable at the 2:00 position.
2. Place the speaker mounting bracket (41) over the foam spacer and install two new 4-40 × 0.312 screws (173).
3. Connect the speaker cable to the W25 Speaker Harness Extension Cable connector.
4. Complete the process by **Installing the front case**.

Front Case *(continued)*

W04 Speed Dial Assembly Diagrams

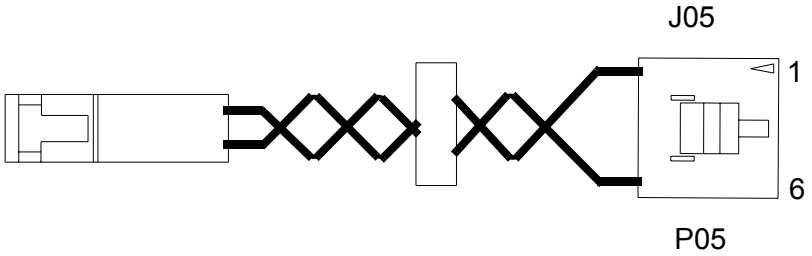
MIN **3201145**



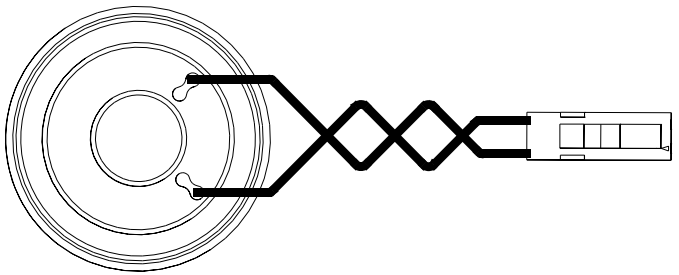
Front Case *(continued)*

W02 Speaker Assembly and W25 Speaker Harness Extension Cable Diagrams

W25 Speaker Harness Extension Cable (bottom case)
MIN **3201593-003**

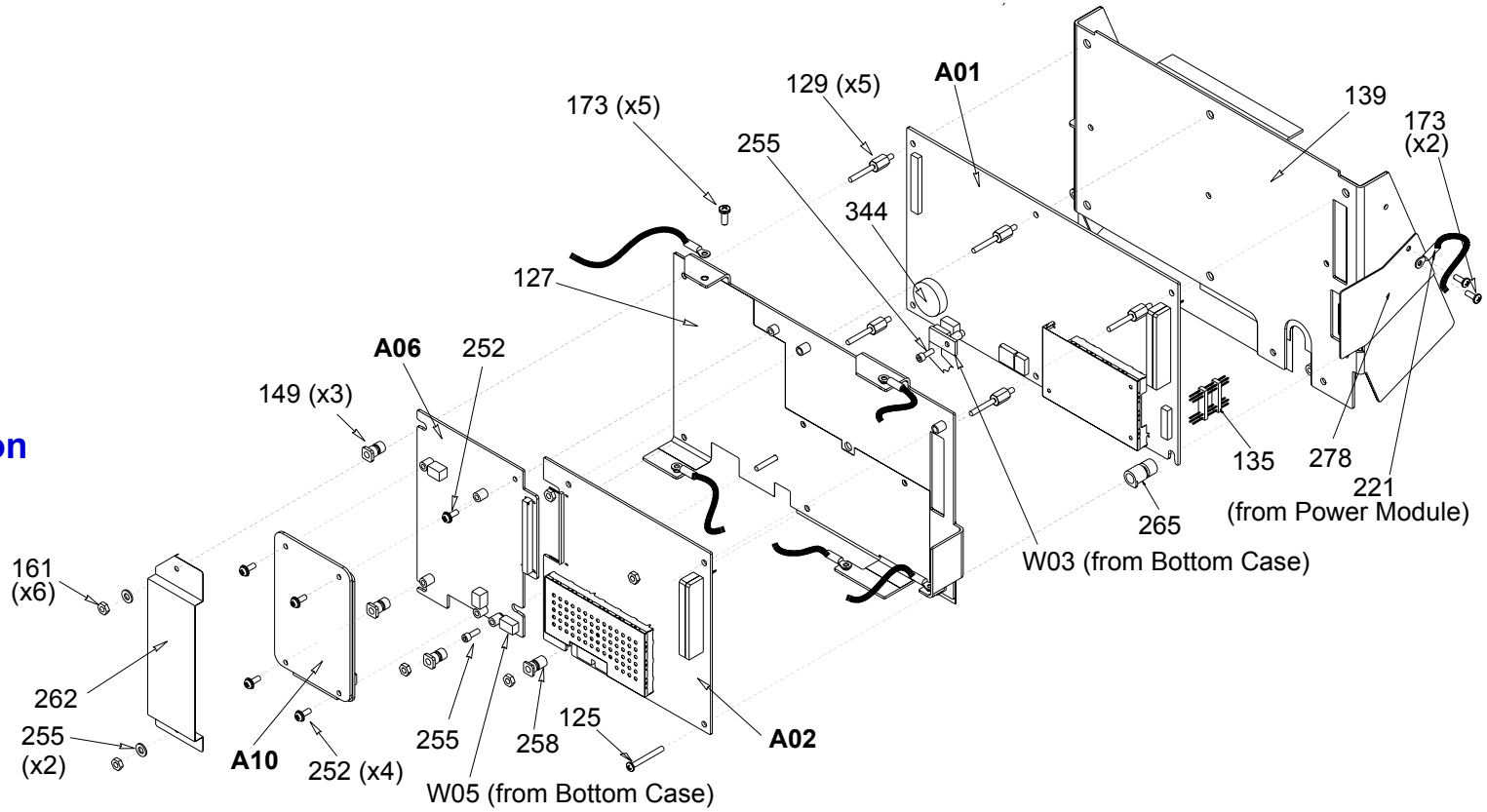


W02 Speaker Assembly (front case)
MIN **3201593-004**



Boardstack

Assembly Diagram



Boardstack *(continued)*

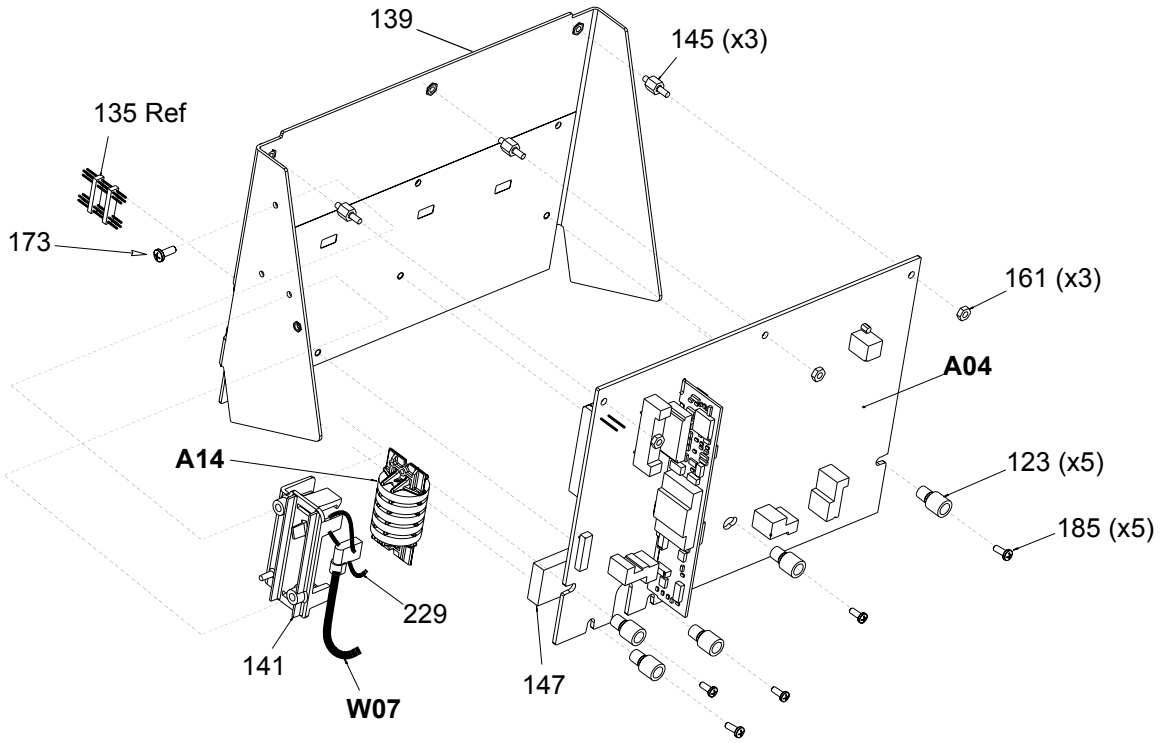
A04 Therapy PCB Assembly Diagram

MIN **3202259**

A04 Therapy PCB Removal

- Inductive Resistor

A04 Therapy PCB Installation



Boardstack *(continued)*

Parts List

Item	Quantity	MIN	CAT.	Part Description	Note
A01	1	3201964-010	21330-001033	System Controller PCB	**Part of kit MIN 3202718-018**
A02	1	3202680-000	21330-001055	Patient Parameter PCB	**Part of kit MIN 3202718-020**
A04	1	3202259-002	21330-001021	Therapy PCB (with pacing)	**Part of kit MIN 3202718-016**
A04	1	3202259-003	21330-001022	Therapy PCB (without pacing)	**Part of kit MIN 3202718-017**
A06	1	3201950-003	21330-001037	OEM Interface PCB (SpO2 models only)	**Part of kit MIN 3202718-019**
A10	1	3200928-001	21300-004885	SpO2 Module (LIFEPAK 20 defibrillator/monitor)	Masimo MS-5 Rev E
A10	1	3206274-002	21300-007444	SpO2 Module (LIFEPAK 20e defibrillator/monitor)	Masimo MS-11 (with Nellcor compatibility, **order kit MIN 3202719-023**)
A14	1	3010212-007	21300-003970	Inductive Resistor	
W07	1	3202383-001	21300-004307	Capacitor Discharge Cable	

(Continued on next page)

Boardstack *(continued)*

Parts List *(continued)*

Item	Quantity	MIN	CAT.	Part Description	Note
123	5	3201374-010	21300-004242	ISO mount, Therapy	**Part of kit MIN 3202718-016**
125	1	202253-772	21300-006430	Screw 4-40 × 1.000L	**Part of kit MIN 3202718-018**
127	1	3200927-006	21300-004236	Boardstack shield	**Part of kit MIN 3202718-021**
129	5	3201375-006	21300-004815	Standoff-M/M .250 hex, .375	**Part of kit MIN 3202718-021**
135	1	3201007-002	21300-004704	Boardstack connector	**Part of kit MIN 3202718-018**
139	1	3200639-007	21300-004228	PCB support bracket	
141	1	3201415-004	21300-004245	Inductive resistor bracket	
145	3	3201375-005	21300-004816	Standoff-M/M .250 hex, .250L	
147	1	3201111-000	21300-007457	Thermally conductive pad	**Part of various kits**
149	3	3201374-011	21300-004243	ISO mount, OEM	**Part of kit MIN 3202718-021**
161	9	200805-000	21300-000584	Locking hex nut, 4-40	
173	3	202253-761	21300-001038	Machine screw, 4-40, .312L	**Part of kit MIN 3202718-024**

(Continued on next page)

Boardstack *(continued)*

Parts List *(continued)*

Item	Quantity	MIN	CAT.	Part Description	Note
185	5	202253-764	21300-004599	Machine screw, 4-40, .500L	
229	2	200536-001	21300-000499	Cable tie retainer	**Part of kit MIN 3202718-025**
252	5	201874-270	21300-000926	Machine screw SEMS 4-40 x .312L	**Part of kit MIN 3202718-021**
255	2	3202489-031	21300-005120	Screw-Cap, Hex,4-40 x .312 Nylon	**Part of kit MIN 3202718-019**
258	1	3201374-012	21300-005187	ISO mount, Parameter	**Part of kit MIN 3202718-021**
262	1	3203897-000	21300-006038	Nomex shield	**Part of kit MIN 3202718-021**
264	2	200804-102	21300-000580	Washer, .125ID, .312D	**Part of kit MIN 3202718-021**
265	1	3201374-009	21300-005578	ISO mount, System Controller (standoff)	**Part of kit MIN 3202718-018**
278	1	3206405-000	21300-006593	Shield - EMI, PCB Stack	**Part of kit MIN 3202718-021**
344	1	202305-000	21300-001052	Coin battery, 3 V	

Boardstack *(continued)*

Boardstack Disassembly

To disassemble the boardstack:

1. **Remove the A07 Battery**.
2. **Remove the top case**.
3. **Remove the front case**.
4. **Remove the boardstack assembly**.
5. **Remove the A10 SpO2 Module** (only if 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 *(continued)*

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 Module**, if removed.
5. **Install the boardstack assembly**.
6. **Install the front case**.
7. **Install the top case**.
8. **Install the A07 Battery**.
9. Review the **labels parts list** and install new labels.
10. **Complete the PIP**.

Boardstack *(continued)*

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 device so the ECG and therapy connectors are in view, and then set the device on its left side.
2. Disconnect the grounding harness (219) that connects 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 device so the ac power connector is in view.
4. Disconnect the 4-pin W10 Power/Therapy Cable connector from the A04 Therapy PCB at J17.

(Continued on next page)

Boardstack *(continued)*

Boardstack Removal *(continued)*

5. Lift the boardstack assembly out of its track and tilt it 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 Connector Assembly from the A04 Therapy PCB at J14.
8. Disconnect the W07 Capacitor Discharge Cable from the A04 Therapy PCB at J2.
9. Disconnect the therapy connector 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 the screw (255) using a 3/32 allen driver.

(Continued on next page)

Boardstack *(continued)*

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 Assembly at J54 by first removing the screw (255) using a 3/32 allen driver.
13. Disconnect the W06 ECG wire harness 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's cable from the A04 Therapy PCB at J1.
17. Remove and discard the two 4-40 × 0.312 screws (173) that connect the A14 Inductive Resistor to the PCB support bracket (139).
18. Remove the boardstack assembly from the bottom case.

Boardstack *(continued)*

Boardstack Installation

To install the boardstack assembly:

1. Turn the device 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 new 4-40 × 0.312 screws (173).
4. Connect the A14 Inductive Resistor's cable to the A04 Therapy PCB at J1. Route the cable under the W01 Therapy Cable as shown on the next page.
5. Tie wrap (229) the W07 Capacitor Discharge Cable to the inductive resistor bracket (141).
6. Connect the A13 Energy Capacitor's cable to the A04 Therapy PCB at J2.
7. Route the W07 Capacitor Discharge Cable with the A14 Inductive Resistor's cable as shown on the next page.

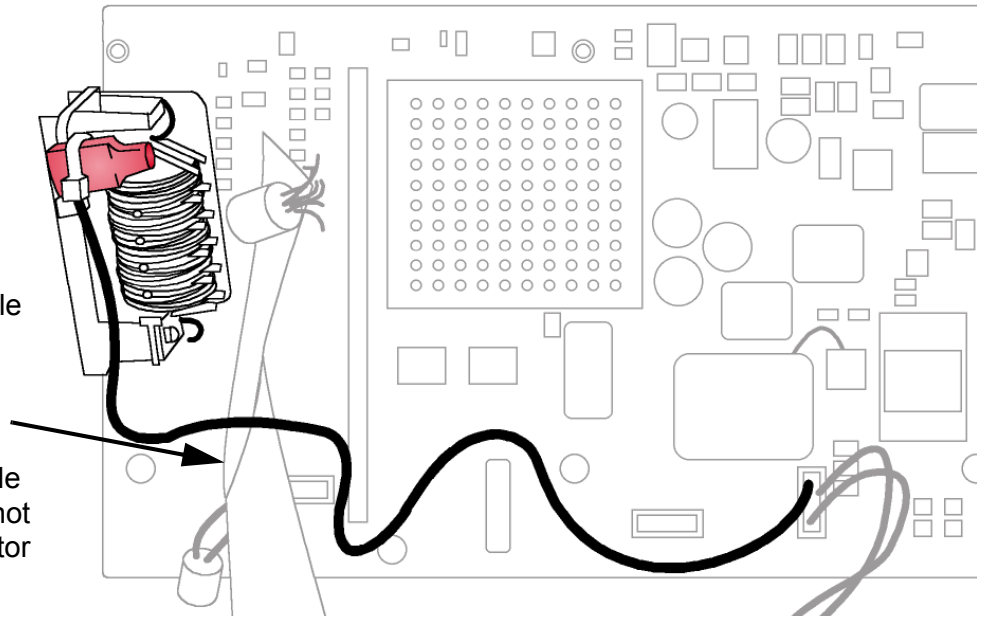
(Continued on next page)

Boardstack *(continued)*

Boardstack Installation *(continued)*

8. Connect the 5-pin therapy connector to the A04 Therapy PCB at J13. Route three ferrite beads of the 5-pin therapy connector cable into the lower left corner of the A04 therapy PCB.

   Note: If the 5-pin therapy connector cable has a fourth ferrite bead, (MIN 3200474-008 or greater), route this bead above the battery well, prior to connecting to J13.



(Continued on next page)

Boardstack *(continued)*

Boardstack Installation *(continued)*

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 W01 Therapy Connector Assembly slides into the slot in the A04 Therapy PCB.
12. Connect the 4-pin W10 Power/Therapy Cable 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.
16. Connect the W05 SpO2 Cable (if included) to the OEM PCB at J54 and fasten with a screw (255) using a 3/32 allen driver.

    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 the connector pins.

(Continued on next page)

Boardstack *(continued)*

Boardstack Installation *(continued)*

17. Connect the W03 IrDA Flex Cable to the A01 System PCB at J08 and fasten with a screw (255) using a 3/32 allen driver.
18. Install the grounding harness (219) from the power module to the support bracket (139) using new 4-40 × 0.312 screws (173).
19. Complete the process by **Installing the front case**.

Boardstack *(continued)*

W07 Capacitor Discharge Cable Replacement

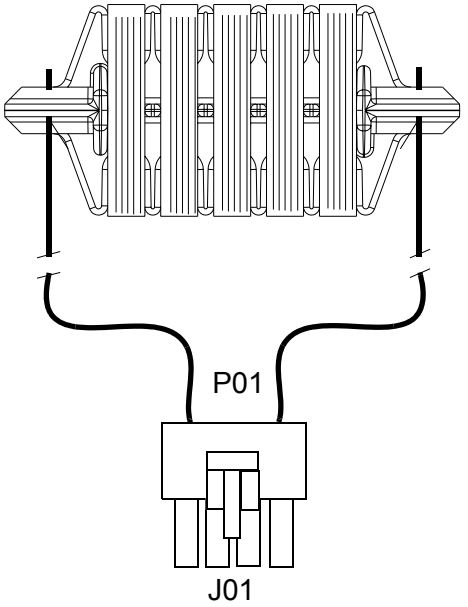
The W07 Capacitor Discharge Cable is part of the capacitor replacement kit. Complete the **A13 Energy Capacitor Removal procedure** to remove the cable.

Complete the **A13 Energy Capacitor Installation procedure** to install the cable.

Boardstack *(continued)*

A14 Inductive Resistor Diagram

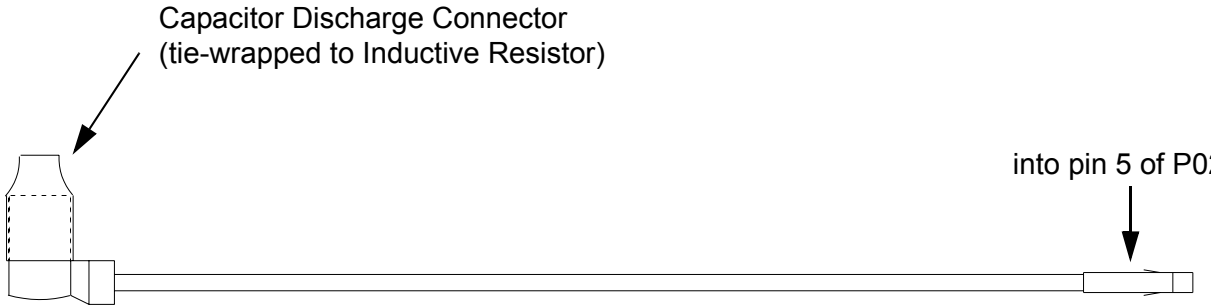
MIN **3010212**



Boardstack *(continued)*

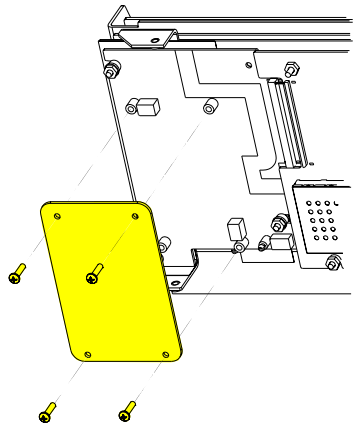
W07 Capacitor Discharge Cable Diagram

MIN **3202383**



Boardstack *(continued)*

A10 SpO2 Module Removal



Note: Remove the following assemblies before beginning this disassembly:

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

To remove the SpO2 Module:

1. Remove the Nomex shield (262) by removing the two nuts (161) and washers (264).
2. Remove and discard the four 4-40 × 0.312 screws (252) from the A10 SpO2 Module.
3. Lift the A10 SpO2 Module away from the boardstack assembly.

A10 SpO2 Module Installation

To Install the A10 SpO2 Module:

Note: Select the correct module for the LIFEPAK 20 or LIFEPAK 20e defibrillator/monitor.

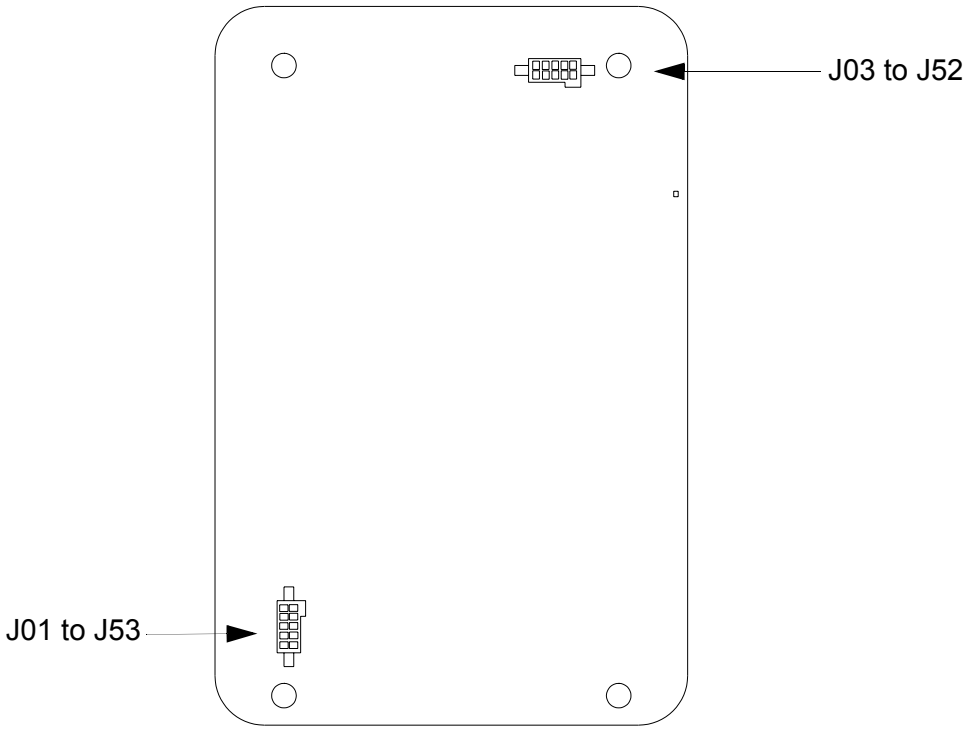
1. Position the A10 SpO2 Module into position over the A06 OEM PCB.
2. Install four new 4-40 × 0.312 screws (252) into the A10 SpO2 Module.
3. Install the Nomex shield (262) by securing it to the A06 OEM PCB with the two washers (264) and nuts (161).
4. Complete the process by **Installing the front case**.

Boardstack *(continued)*

A10 SpO2 Module Diagram

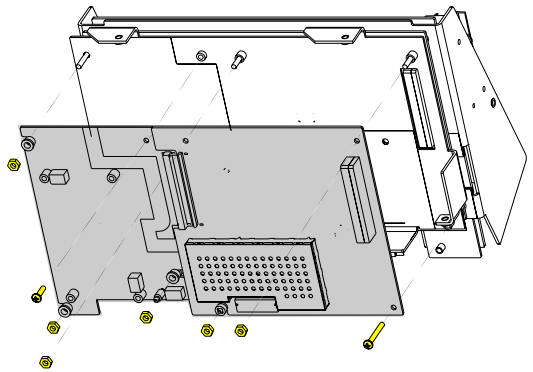
MIN **3200928**
(LIFEPAK 20 defibrillator)

MIN **3206274**
(LIFEPAK 20e defibrillator)



Boardstack *(continued)*

A02 Patient Parameter and A06 OEM/SpO2 Assembly Removal



Note: Remove the following assemblies before beginning this disassembly:

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

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

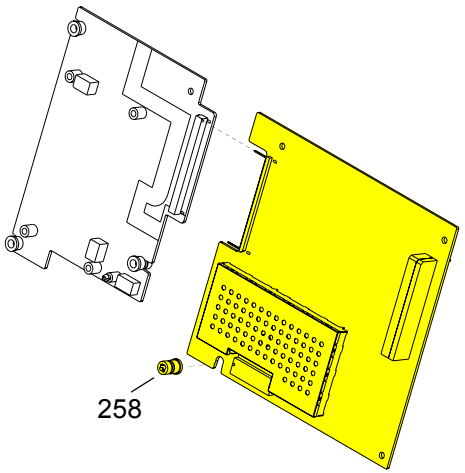
1. Disconnect the W05 SpO2 Flex Cable from the A06 OEM/SpO2 Assembly at J54 by removing the screw (255).
2. Disconnect the W06 ECG wire harness from the A02 PP PCB at J23.
3. Remove and discard the 4-40 × 0.937 screw (125). Remove the three 4-40 nuts (161) from the A02 Patient Parameter PCB.
4. If the device is equipped with the A06 OEM/SpO2 option, remove the Nomex shield (262) by removing the two washers (264) and nuts (161).

   Note: **Remove the A10 SpO2 module** if replacing the A06 OEM PCB.
5. Lift the A02 Patient Parameter PCB (OEM/SpO2) assembly away from the boardstack assembly. Ensure that the PCB clears the lip on the frame in the lower right corner.

(Continued on next page)

Boardstack *(continued)*

A02 Patient Parameter and A06 OEM/SpO2 Assembly Removal *(continued)*



6. Inspect the orange parameter ISO mount (258) installed in the A02 Patient Parameter PCB. Verify the mount is in good condition.
7. If the device is equipped with the A06 OEM/SpO2 option:
   a. Inspect the three, white, OEM ISO mounts (149) installed in the A06 OEM PCB. Verify the mounts are in good condition.
   b. Separate the A02 Patient Parameter PCB from the A06 OEM/SpO2 assembly at J24.

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

Boardstack *(continued)*

A02 Patient Parameter and A06 OEM/SpO2 Assembly Installation

To install the A02 Patient Parameter and optional A06 OEM/SpO2 assembly:

1. Make sure the orange parameter ISO mount (258) is installed on the A02 Patient Parameter PCB with the square end facing out.
2. If the device is equipped with the A06 OEM/SpO2 option:
   a. Make sure the three, white, OEM ISO mounts (149) are installed on the A06 OEM PCB with the square ends facing out.
   b. Connect the A02 Patient Parameter to the A06 OEM/SpO2 assembly at J24.
3. Install the A02 Patient Parameter (OEM/SpO2) PCB onto the five standoffs (129) on the boardstack shield (ensure the standoffs are tight and in good condition). Make sure the PCB clears the lip in the lower right corner and the 60-pin connector seats correctly.
4. If the device is equipped with the A06 OEM/SpO2 option:
   a. **Install the A10 SpO2 module**, if previously removed.

(Continued on next page)

Boardstack *(continued)*

A02 Patient Parameter and A06 OEM/SpO2 Assembly Installation *(continued)*

b. Install the Nomex shield (262) onto the OEM PCB by securing it with two washers (264) and nuts (161). Make sure the fold on the Nomex shield is in the upper left corner of the OEM PCB.

c. Install the one remaining nut (161) and new 4-40 × 0.312 screw (252) onto the OEM PCB.

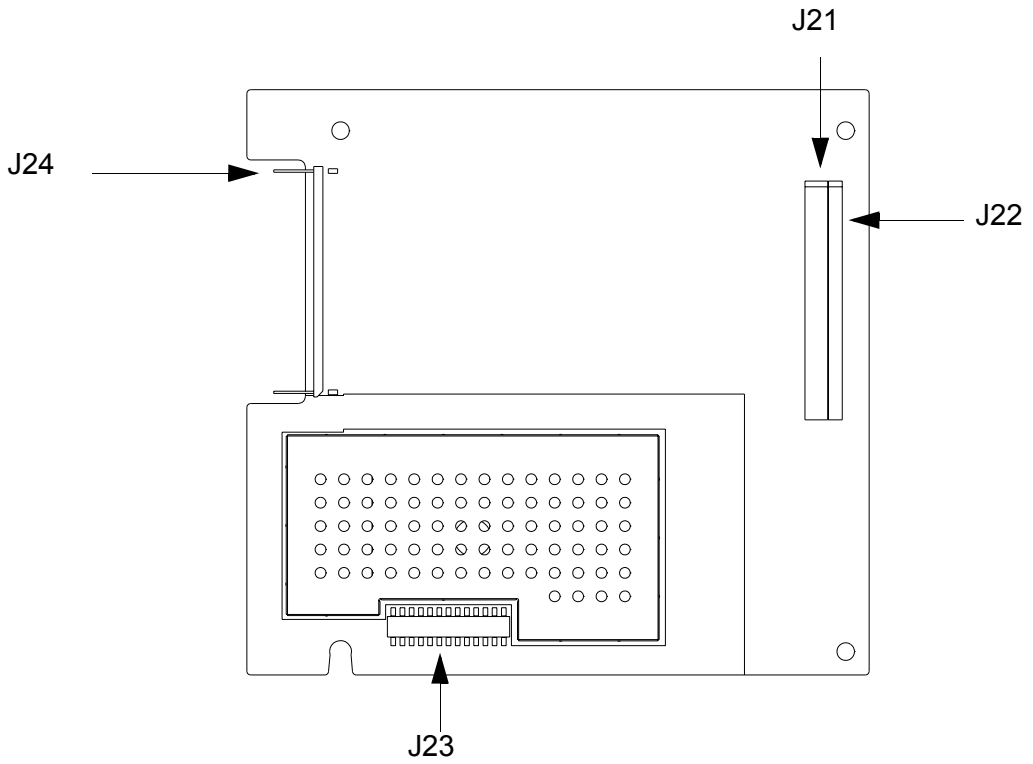
5. If the device is NOT equipped with the A06 OEM/SpO2 option, make sure the boardstack shield is secured with two nuts (161) along the left side only.
6. Install the three remaining 4-40 nuts (161) and new 4-40 × 0.937 screw (125) onto the A02 Patient Parameter PCB.
7. Connect the W05 SpO2 Cable (if included) to the OEM PCB at J54 and fasten with a screw (255).

   Note: Carefully align the SpO2 connector to the sockets, and gently press the connectors into the sockets using steady pressure to avoid damage to connector pins.
8. Connect the ECG cable to the A02 PP PCB at J23.
9. Complete the process by **Installing the front case**.

Boardstack *(continued)*

A02 Patient Parameter PCB Diagram

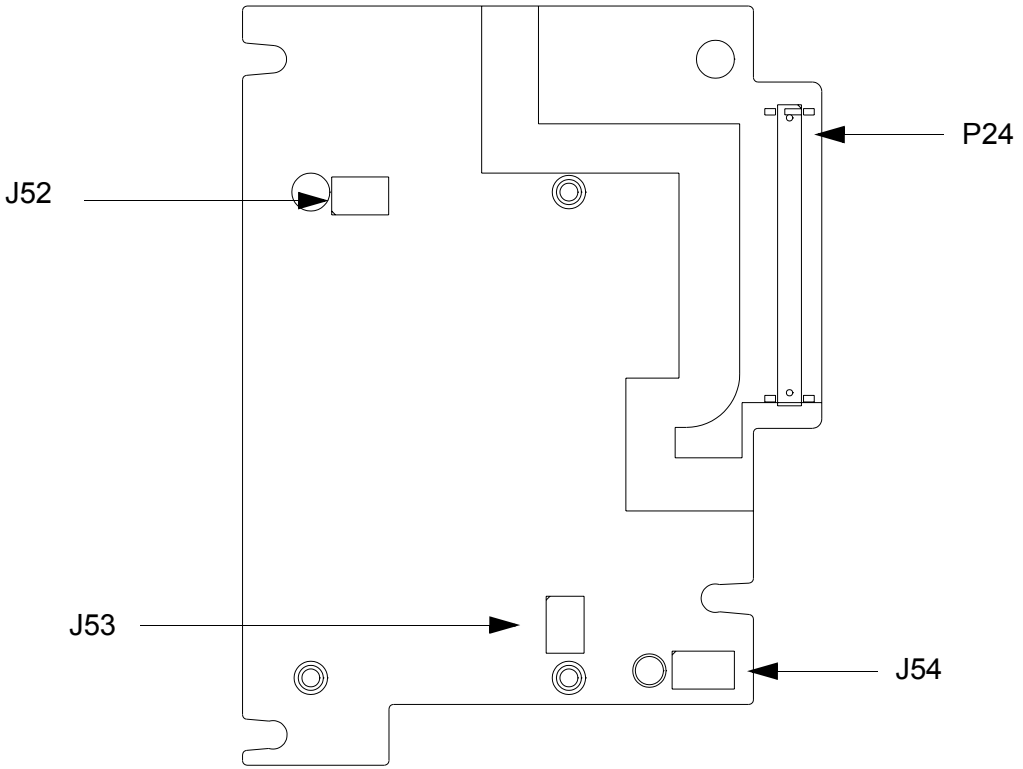
MIN **3202680**



Boardstack *(continued)*

A06 OEM Interface PCB Diagram

MIN **3201950**



Boardstack *(continued)*

Coin Cell Battery Replacement

Note: Remove the following assemblies before beginning this disassembly:

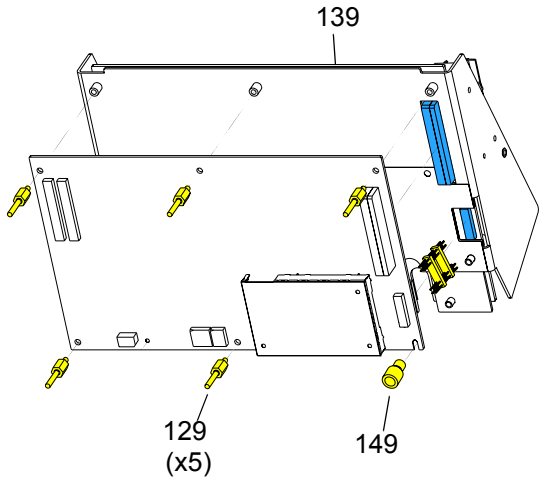
- **Top case**
- **Front case**
- **Boardstack assembly** (optional removal)
- **A02 Patient Parameter PCB** (OEM/SpO2 assembly, if applicable)

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 from the housing.
3. Install the new coin battery (344).
4. Replace the PCB shield (127).
5. **Install the A02 Patient Parameter PCB and A06 OEM PCB**.
6. **Install the A10 SpO2 Module** (if previously removed).
7. Complete the process by **Installing the front case**.

Boardstack *(continued)*

A01 System PCB Removal



Note: Remove the following assemblies before beginning this disassembly:

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

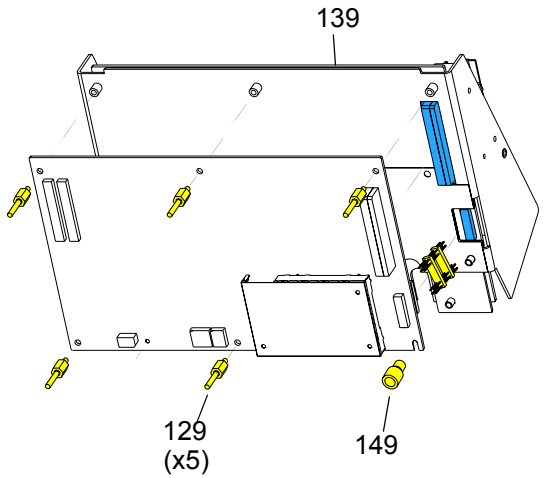
To remove the A01 System PCB:

1. Remove the PCB shield (127).
2. Remove and discard the five threaded standoffs (129) from the A01 System PCB.
3. Remove the round, snap-in standoff (265) 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) (connects the A01 System PCB J03 with the A04 Therapy PCB at J15), and safeguard it for reuse.

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

Boardstack *(continued)*

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. As the A01 System PCB slides down, ensure that the support bracket standoffs and the pins on the 8-pin and 60-pin stack connectors seat with their connectors evenly.
4. Install five new 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 *(continued)*

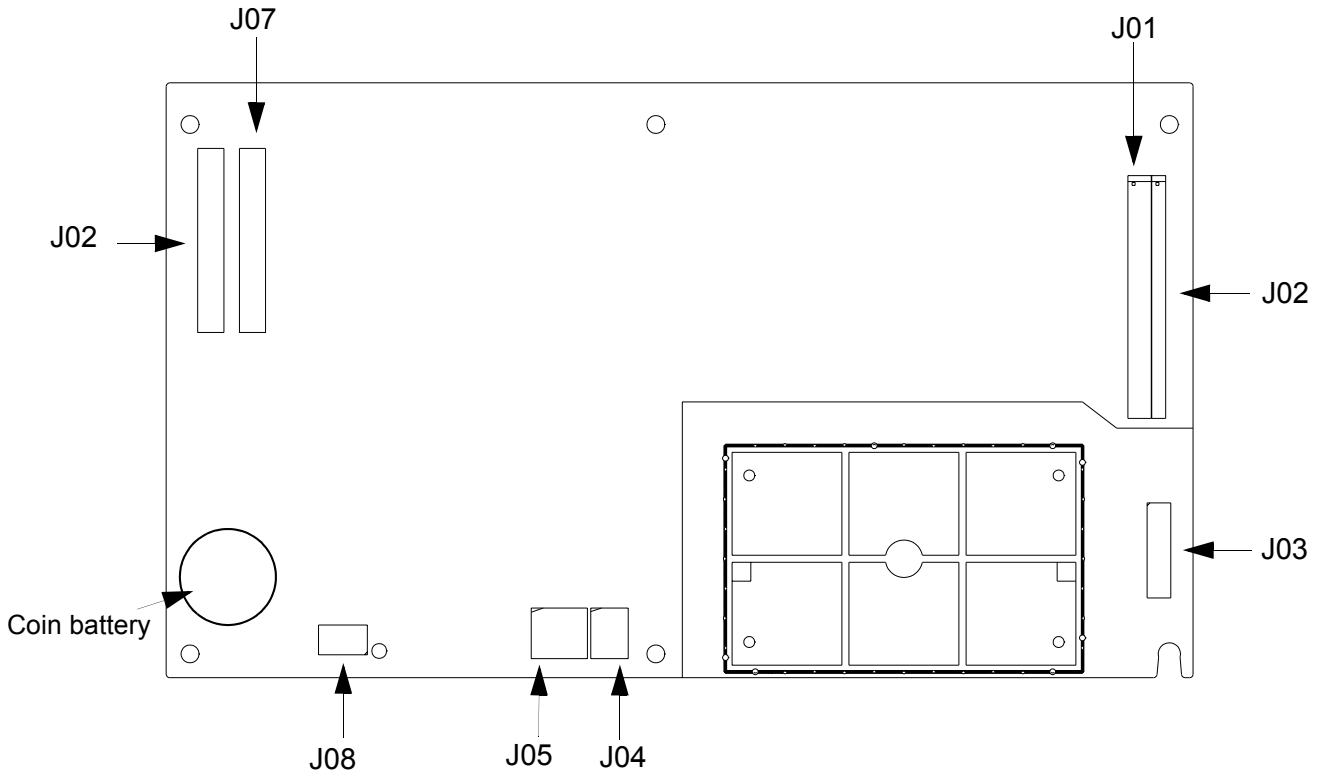
A01 System PCB Installation *(continued)*

7. **Install the A02 Patient Parameter PCB** and A06 OEM PCB assembly.
8. **Install the A10 SpO2 Module** (if previously removed).
9. **Install the Boardstack Assembly**.
10. Complete the process by **Installing the front case**.

Boardstack *(continued)*

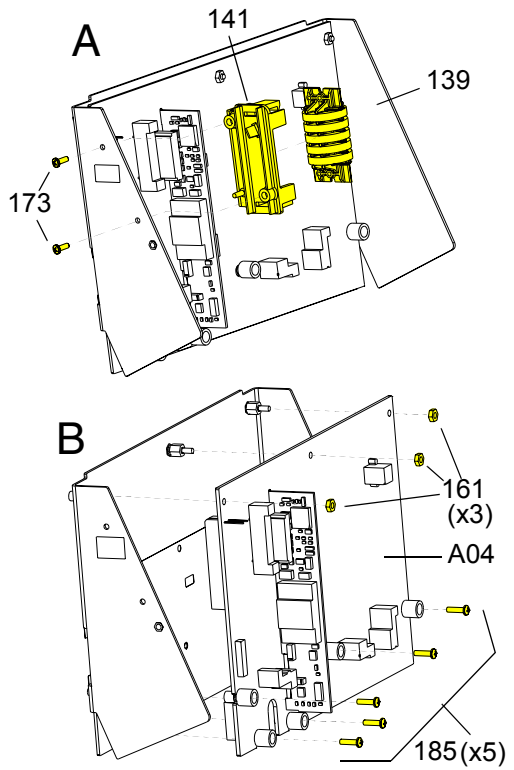
A01 System PCB Diagram

MIN **3201964**



Boardstack *(continued)*

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 and discard the two 4-40 × 0.312 screws (173) connecting the inductive resistor bracket (141) to the PCB support bracket (139).
2. Remove the inductive resistor bracket (141).
3. Remove and discard the five 4-40 × 0.500 screws (185) located inside the five insulated standoffs.

   Note: The standoffs should remain with the A04 Therapy PCB.
4. Remove the three 4-40 nuts (161) from the metal standoffs along the top edge of the A04 Therapy PCB (see illustration B at left).
5. Remove the A04 Therapy PCB from the PCB support bracket (139).
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.

(Continued on next page)

Boardstack *(continued)*

A04 Therapy PCB Removal *(continued)*

Note: The 8-pin stack connector may remain connected to the A04 Therapy PCB or the A01 System PCB, or it may 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 PCB support bracket (139), install three new standoffs (145), short side down, onto the bracket.
2. If you are replacing the Therapy PCB, ensure that the five plastic standoffs (149) are correctly positioned, large end up, on the PCB.

   Note: 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.

(Continued on next page)

Boardstack *(continued)*

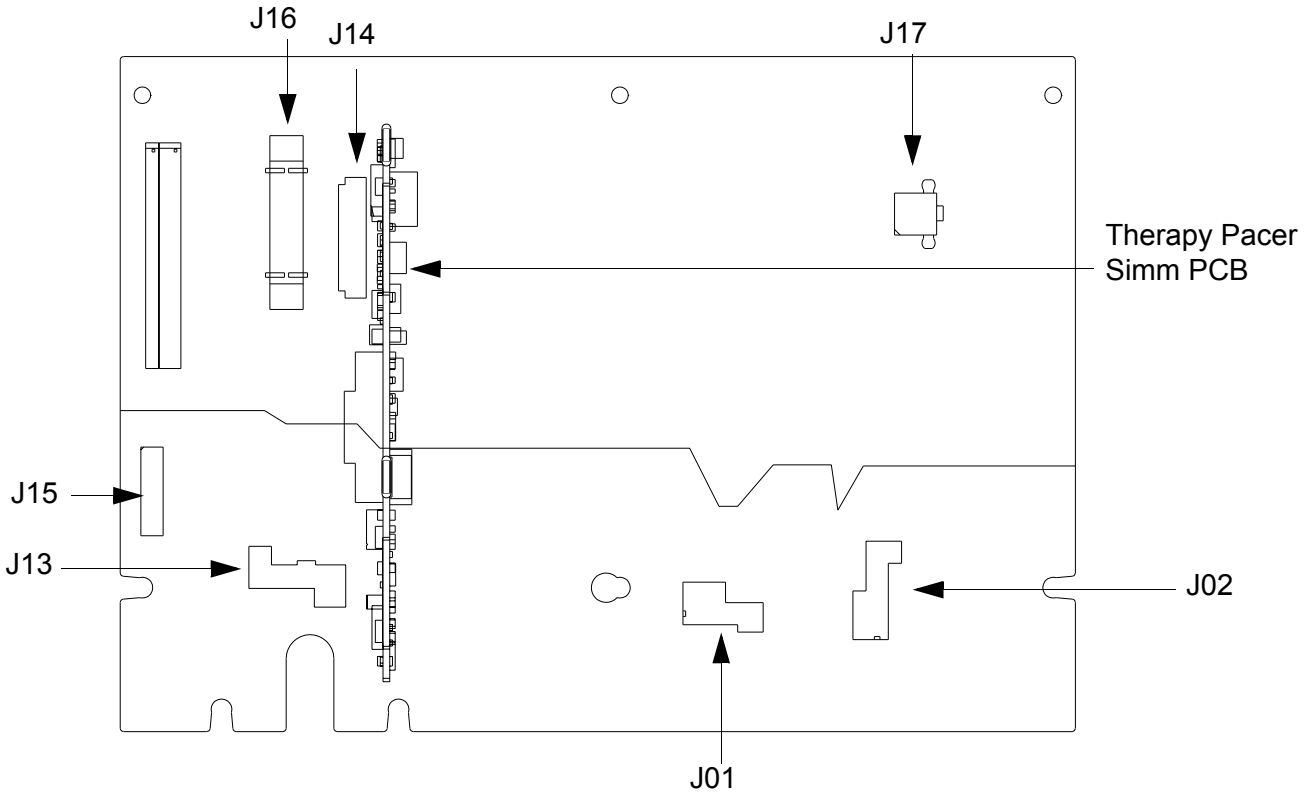
A04 Therapy PCB Installation *(continued)*

3. Carefully align the A04 Therapy PCB with the PCB support bracket (139) and press it into position. As the A04 Therapy PCB slides down the support bracket standoffs, ensure that the pins on the 8-pin and 60-pin stack connectors seat with their connectors evenly.
4. Install five new 4-40 × 0.500 screws (185) in the five insulated standoffs (149).
5. Install the three 4-40 nuts (161) onto the metal standoffs along the top edge of the A04 Therapy PCB.
6. Secure the A14 Inductive Resistor's cable to the PCB support bracket (139) with two new 4-40 × 0.312 screws (173).
7. Route the A14 Inductive Resistor's cable under the W01 Therapy Cable, the same way as the W07 Capacitor Discharge Cable (**see illustration**).
8. **Install the Boardstack Assembly**.
9. Complete the process by **Installing the front case**.

Boardstack *(continued)*

A04 Therapy PCB Diagram (With Pacing)

MIN **3202259-002**

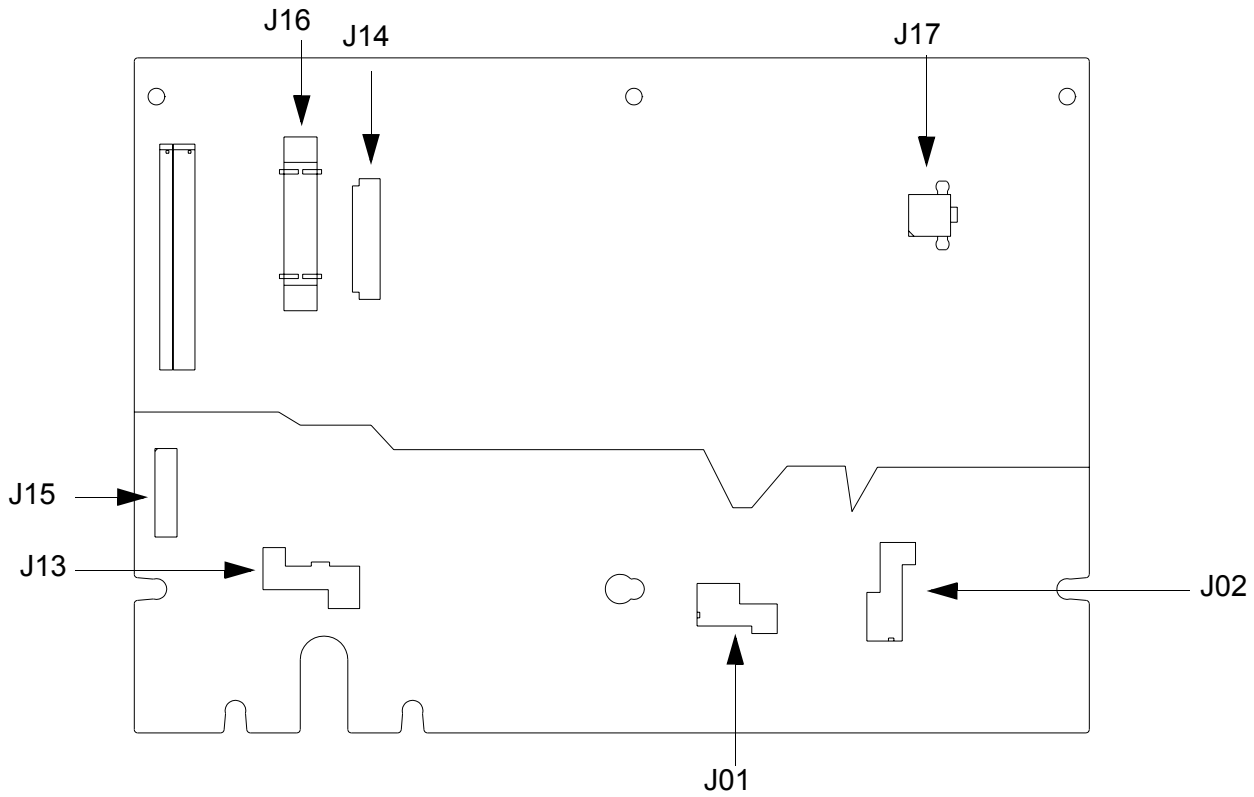


(Continued on next page)

Boardstack *(continued)*

A04 Therapy PCB Diagram (Without Pacing)

MIN **3202259-003**



Bottom Case

Assembly Diagram (Modules)

Bottom Case Disassembly

Bottom Case Reassembly

A12 Printer Module Removal

A12 Printer Module Installation

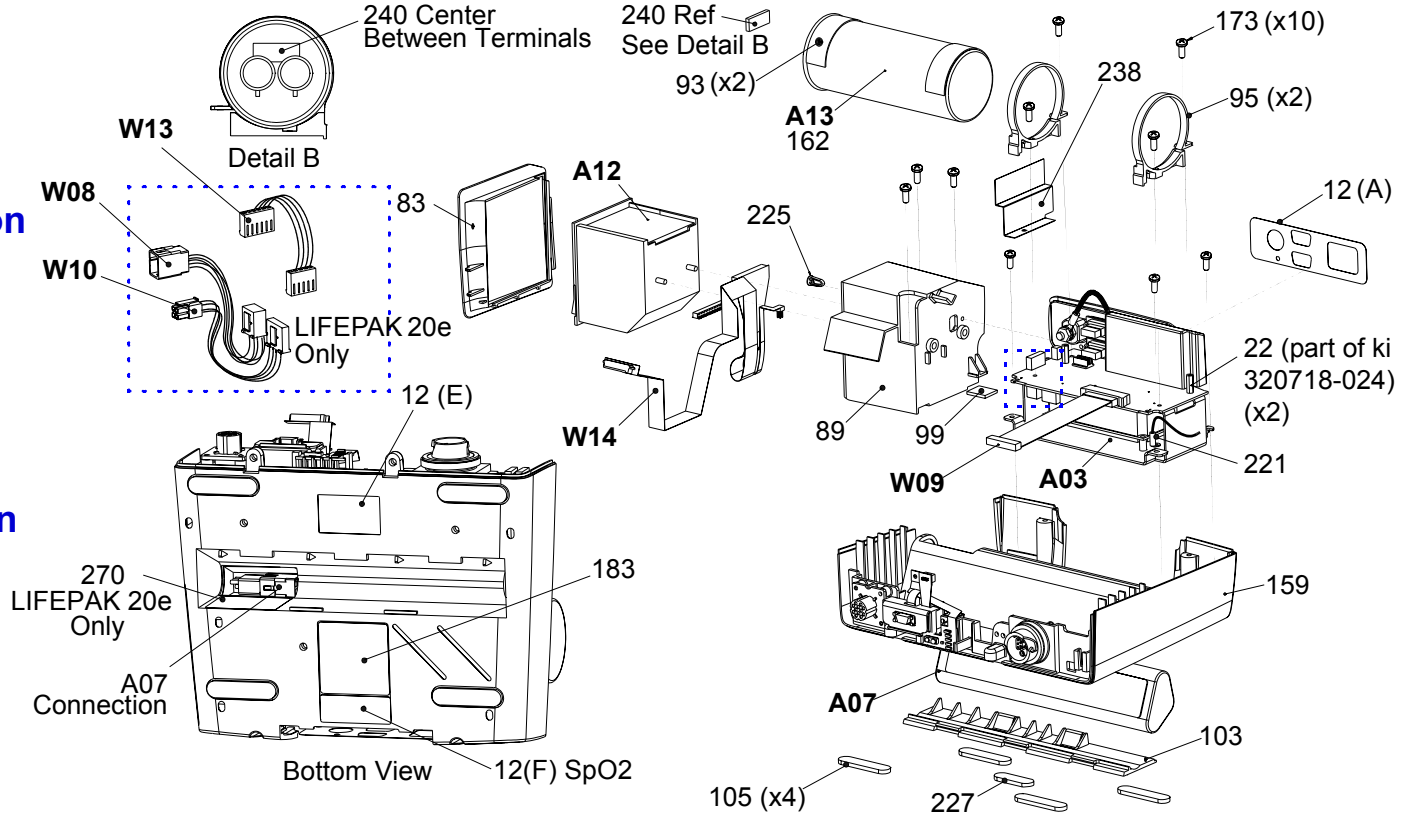
- Printer
- Printer flex cable
- Printer bezel
- Printer shroud

A03 Power Module Removal

A03 Power Module Installation

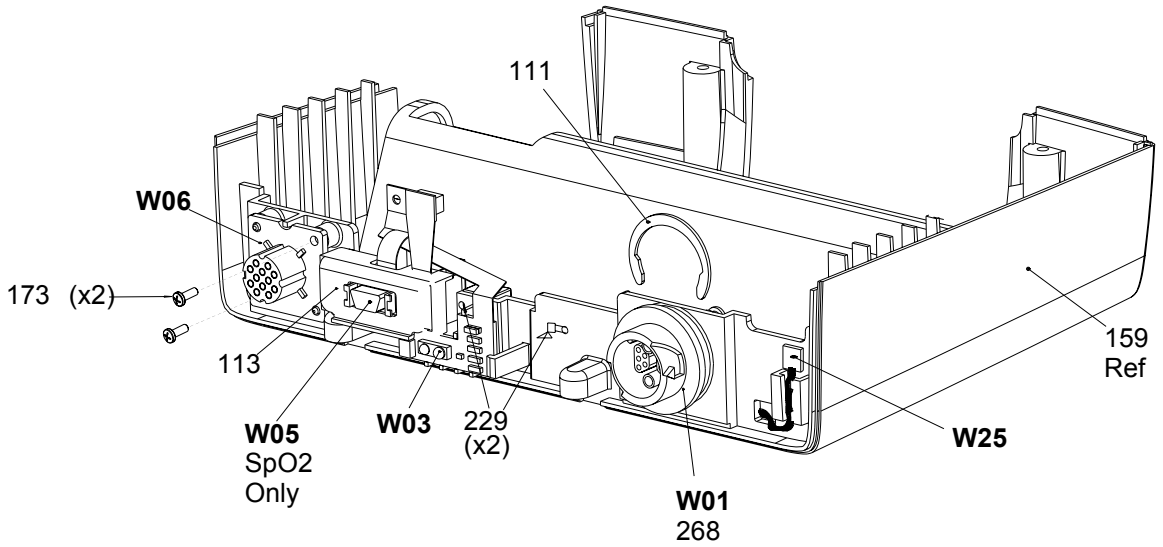
A13 Energy Capacitor Removal

A13 Energy Capacitor Installation



Bottom Case *(continued)*

Assembly Diagram (Connectors)



Bottom Case *(continued)*

Parts List

Item	Quantity	MIN	CAT.	Part Description	Note
A03	1	3202131-004	21330-001040	Power Module Assy, LIFEPAK 20	**Part of kit MIN 3202718-010**
A03	1	3202131-006	21330-001186	Power Module Assy, LIFEPAK 20e	**Part of kit MIN 3202718-022**
A07	1	3200497-000	11141-000068	12V, 3Ah, NiMH battery pack, LIFEPAK 20	
A07	1	3205296-002	21300-007374	Battery Pack – Li-ion, LIFEPAK 20e	
A12	1	3200920-000	21240-000001	Printer, Chart Recorder Xena2	White 38-pin IC
A13	1	3200846-002	21300-004232	Energy Storage Capacitor	**Part of kit MIN 3202718-025**
W01	1	3200474-008	21300-004222	Therapy Connector Assembly	**Part of kit MIN 3202718-026**
W03	1	3200926-005	21300-004235	IrDA Flex Assembly	
W05	1	3200925-005	21300-004234	SpO2 Flex Assembly	**Part of kit MIN 3202718-013**
W06	1	3201010-008	21300-004239	ECG 7-Contact Receptacle	
W08	1	3206579-001	21330-001166	Battery Cable, LIFEPAK 20e	**Part of kit MIN 3202718-022**
W09	1	3201241-000	21300-004669	Power to Therapy 26-pin Cable	

(Continued on next page)

Bottom Case *(continued)*

Parts List *(continued)*

Item	Quantity	MIN	CAT.	Part Description	Note
W10	1	3206857-000	21330-001165	Power/Therapy Cable, LIFEPAK 20e	**Part of kit MIN 3202718-022**
W11	1	3201997-506	21330-007072	ECG Sync/System Cables	**Part of kit MIN 3202718-022**
W13	1	3206469-003	21330-001164	AC Power Cable, LIFEPAK 20e	**Part of kit MIN 3202718-022**
W14	1	3201001-005	21300-004238	Printer Flex Cable Assembly	
W25	1	3201593-003	21300-004246	Speaker Assembly Harness Ext.	
12	sheet	3201640	21501-various	Label Set (6 labels), LIFEPAK 20	**Refer to Labels Assembly**
12	sheet	3206034	21501-various	Label Set (6 labels), LIFEPAK 20e	**Refer to Labels Assembly**
22	2	3202228-562	21300-003883	Standoff-Hex,M/F,4-40,0.188	**Part of kit MIN 3202718-024**
83	1	3201408-000	21300-004621	Printer Bezel	
89	1	3200626-004	21300-004306	Printer Shroud	
93	2	804447-36	21300-007458	Foam Spacer (part of A13 assy)	**Part of kit MIN 3202718-025**
95	2	3200922-000	21300-004619	Capacitor Support Bracket	**Part of kit MIN 3202718-024**

(Continued on next page)

Bottom Case *(continued)*

Parts List *(continued)*

Item	Quantity	MIN	CAT.	Part Description	Note
99	1	3201597-000	21300-004653	EMI Foam Core Gasket	
103	1	3200628-002	21300-004835	Battery Door, LIFEPAK 20	
103	1	3200628-004	21300-006412	Battery Door, LIFEPAK 20e	
105	4	802885-00	21300-002137	Mounting Foot	Part of bottom case assembly
111	1	200040-001	21300-000149	Therapy Retaining Ring	**Part of kit MIN 3202718-026**
113	1	3200921-000	21300-004602	SpO2 Connector Mounting Clip	**Part of kit MIN 3202718-013**
159	1	3200625-005	21300-004889	Bottom case assembly	
162	1	3009787-003	21300-004110	Capacitor shield (part of A13 assembly)	**Part of kit MIN 3202718-025**
173	12	202253-761	21300-001038	Machine screw 4-40 × .312L	**Part of kit MIN 3202718-024**
183	1	3201643-007	21501-000923	Serial number label, LIFEPAK 20	**Refer to Labels Assembly**
183	1	3201643-010	21501-001793	Serial number label, LIFEPAK 20e	**Refer to Labels Assembly**

(Continued on next page)

Bottom Case *(continued)*

Parts List *(continued)*

Item	Quantity	MIN	CAT.	Part Description	Note
221	1	3202246-001	21300-004255	Grounding strap harness	
225	1	3202377-010	21300-004400	Fastener	
227	1	802885-01	21300-002138	Mounting foot	Attached to battery door (103)
229	2	200536-001	21300-000499	Cable tie retainer	**Part of kit MIN 3202718-025**
238	1	3206900-001	21300-006962	Dielectric shield	**Part of kit MIN 3202718-024**
240	1	804447-041	21300-004807	Foam Spacer	**Part of kit MIN 3202718-025**
268	1	3203445-001	21300-005784	Seal, Therapy Connector Mount	**Part of kit MIN 3202718-026**
270	1	3206152-000	21501-001625	Label, NIMH Battery Warning	LIFEPAK 20e only

Bottom Case *(continued)*

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 12 Printer Module**.
6. **Remove the A13 Energy Capacitor**.
7. **Remove the A03 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**.

Bottom Case *(continued)*

Bottom Case Reassembly

To reassemble the bottom case:

1. Obtain 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 A03 Power Module**.
10. **Install the A13 Energy Capacitor**.
11. **Install the A12 Printer Module**.
12. **Install the boardstack assembly**.

(Continued on next page)

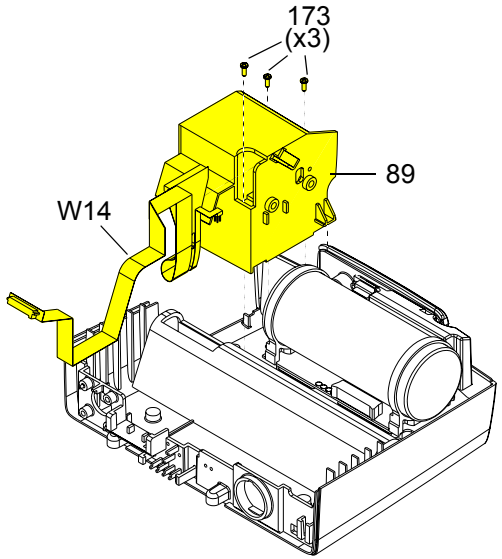
Bottom Case *(continued)*

Bottom Case Reassembly *(continued)*

13. **Install the front case**.
14. **Install the top case**.
15. **Install the A07 Battery**.
16. Review the **labels parts list** and install new labels.
17. **Complete the PIP**.

Bottom Case *(continued)*

A12 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 A12 Printer Module:

Note: Remove the following assemblies before beginning this disassembly:

- **A07 Battery**
- **Top case**
- **Front case**
- **Boardstack**

1. Open the printer door and remove the printer paper roll.
2. Loosen the two captured screws located inside the printer on the rear wall.
3. Carefully pull the A12 Printer out of the printer shroud (89).
4. Disconnect the W14 Printer Flex Cable from the printer at printer connection J1.

(Continued on next page)

Bottom Case *(continued)*

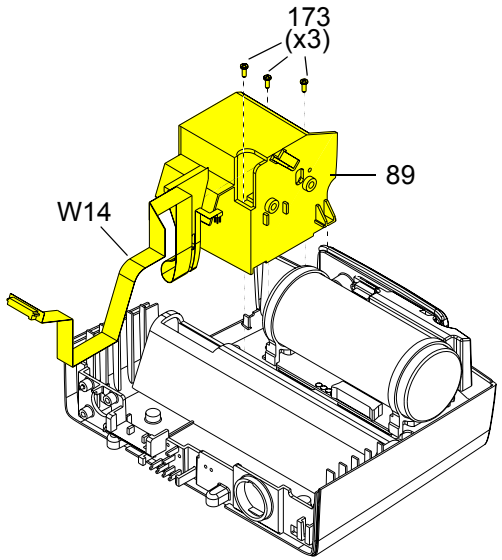
A12 Printer Module Removal *(continued)*

Note: If removing the A12 Printer, the removal process is complete. If removing the printer shroud 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 and discard the three 4-40 × 0.312 screws (173) from the bottom of the printer shroud (89).
7. Carefully lift the shroud to access the 4-pin power cable.
8. Disconnect the 4-pin power cable from the A03 Power Module at J45, and feed it 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 *(continued)*

A12 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 only, start at step 9.

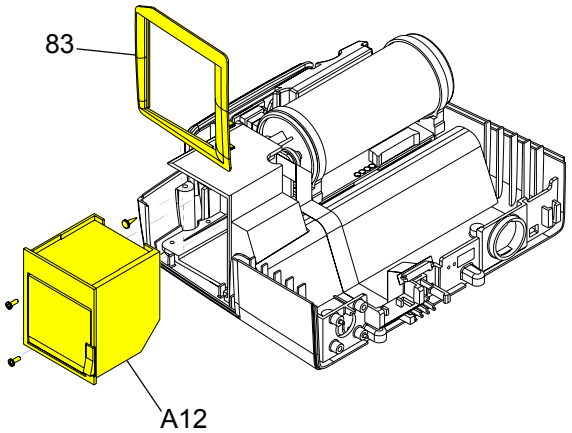
To install the printer module:

1. Slide the W14 Printer Flex Cable under the W06 ECG Cable and position the printer cable along the right side of the guide on the bottom case.
2. Insert the printer cable connector and the 4-pin power cable connector through the large slot in the shroud.
3. Insert the 4-pin power connector through the small slot in the shroud.
4. Connect the 4-pin power connector to the A03 Power Module at J45, ensuring that the connector is positioned correctly.
5. Position the printer shroud (89) in the bottom case.
6. Install three new 4-40 × 0.312 screws (173) into the bottom of the printer shroud.

(Continued on next page)

Bottom Case *(continued)*

A12 Printer Module Installation *(continued)*

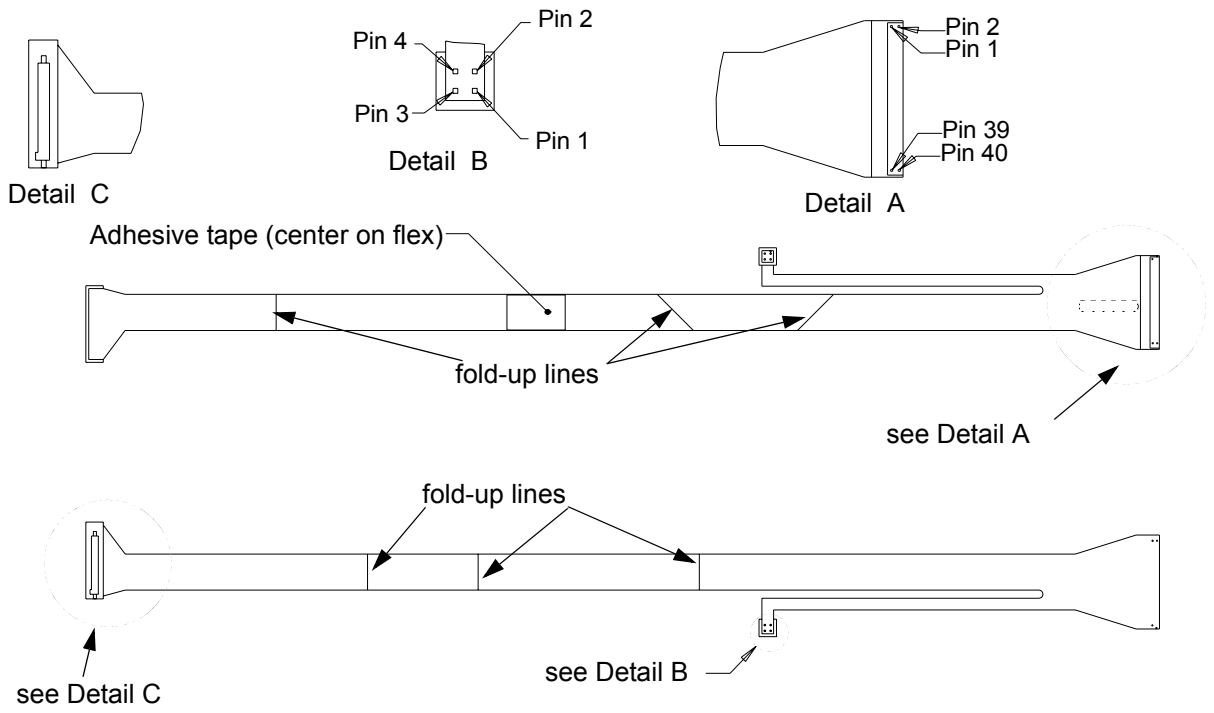


7. If removed, press the fastener (225) into the printer shroud to secure the J45 flex connector.
8. Insert the printer bezel (83) ensuring that it is flush with the bottom case.
9. Connect the W14 Printer Flex Cable to the J1 connector on the printer. The cable should lay flat against the rear of the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

Bottom Case *(continued)*

W14 Printer Flex Cable Diagrams

MIN **3201001**



Bottom Case *(continued)*

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:

- **A07 Battery**
- **Top case**
- **Front case**

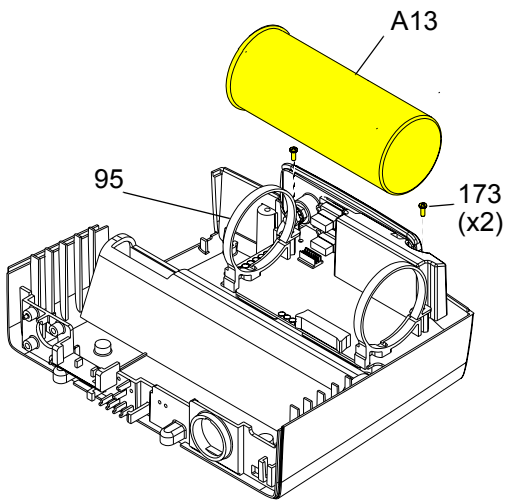
To remove the A13 Energy Capacitor:

1. If the boardstack assembly was not removed, remove and discard the screw and ground cable (221).
2. Disconnect the W10 Power/Therapy Cable from the A04 Therapy PCB at J17.
3. Pull the boardstack assembly away from the printer shroud (89) and the power module.
4. Disconnect the W07/A13 Capacitor Discharge Cable from the A04 Therapy PCB at J2.

(Continued on next page)

Bottom Case *(continued)*

A13 Energy Capacitor Removal *(continued)*

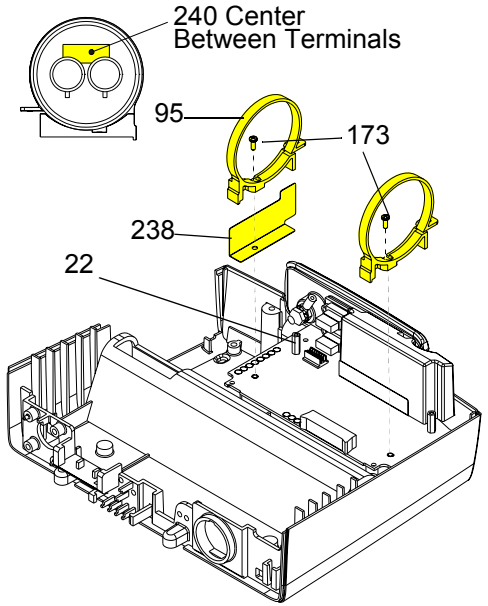


Note: Take care not to damage the adjacent hardware or wires when removing the W07 Capacitor Discharge Cable.

5. Remove the cable tie retainer (229) securing the W07 Capacitor Discharge Cable to the inductive resistor bracket (141).
6. Remove and discard the two 4-40 × 0.312 screws (173) from the rear of the capacitor brackets (95).
7. Lift the capacitor (A13) out of the capacitor brackets.
8. Remove the capacitor sleeve with foam tape (162 and 93) from the capacitor.
9. If removing the capacitor brackets (95), remove and discard the two 4-40 × 0.312 screws (173) from the front of the capacitor brackets (95) and remove the capacitor brackets (95) and the capacitor shield (238) (see illustration on next page).

Bottom Case *(continued)*

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 the two capacitor brackets (95) onto the standoffs using two new 4-40 × 0.312 screws (173) (if the brackets were removed).
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 joint at the top of the capacitor. Poron tape must secure the sleeve at both ends of the capacitor.
4. Inspect the A13 Energy Capacitor to ensure that foam tape (240) in present (optional on LIFEPAK 20).
5. 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.
6. Install two new 4-40 × 0.312 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 *(continued)*

A13 Energy Capacitor Installation *(continued)*

7. Connect the capacitor cable to the A04 Therapy PCB at J2. The W07 Capacitor Discharge Cable is attached at pin 4 of this connector.
8. 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 (**see illustration**) as the inductive resistor cables.
9. **Install the power module**, if not installed.
10. **Install the boardstack**, if not installed.
11. Reconnect the 4-pin W10 Power/Therapy Cable connector to the A04 Therapy PCB at J17. Reseat the boardstack assembly.
12. Install a new 4-40 × 0.312 screw (173) and fasten the ground cable (221) to the boardstack.
13. **Install the front case**.
14. **Install the top case**.
15. **Install the A07 Battery**.
16. **Complete the PIP**.

Bottom Case *(continued)*

A03 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:

- **A07 Battery**
- **Top case**
- **Printer module**
- **Capacitor (optional removal)**
- **Boardstack (optional removal)**

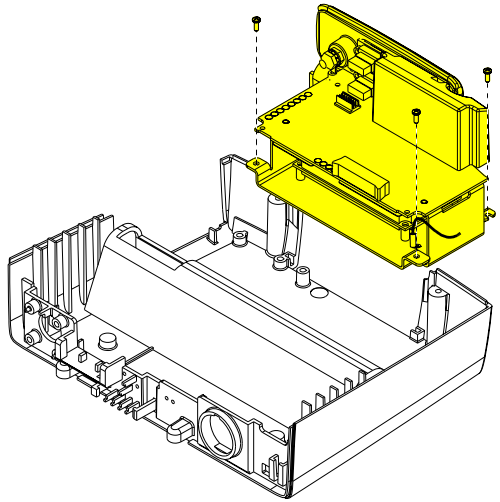
To remove the power module assembly:

1. If the boardstack assembly is installed in the bottom case, continue with step 2. If the boardstack assembly has been removed, proceed to step 5.
2. Disconnect the W10 Power/Therapy 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 *(continued)*

A03 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** (complete steps 6 through 9).
6. Remove and discard the forward right 4-40 × 0.312 screw (173) that secures the right side of the power module and grounding harness (221).

   Note: Remove the grounding harness (221) as you remove the right forward screw. Replace the grounding harness if broken or frayed.
7. Remove and discard the forward left 4-40 × 0.312 screw (173) that secures the left side of the power module.
8. Loosen the rear 4-40 × 0.312 screw (173) that secures the right rear corner of the power bracket three turns.
9. Tilt the left side of the power module up, clearing the loosened screw, and remove it from the bottom case.

Bottom Case *(continued)*

A03 Power Module Installation

To install the power module assembly:

1. Ensure that the right rear corner 4-40 × 0.312 screw (173) is loosely installed (back off 3 to 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 a new 4-40 × 0.312 screw (173) in the power bracket's left forward corner.
4. Insert a 4-40 × 0.312 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 × 0.312 screw (173) in the rear right corner.
6. **Install the A13 Energy Capacitor**, if it was removed.
7. **Install the boardstack**, if it was removed.
8. Connect the W09 26-Pin Cable between the A03 Power Module at J41 and the A04 Therapy PCB at J16.

(Continued on next page)

Bottom Case *(continued)*

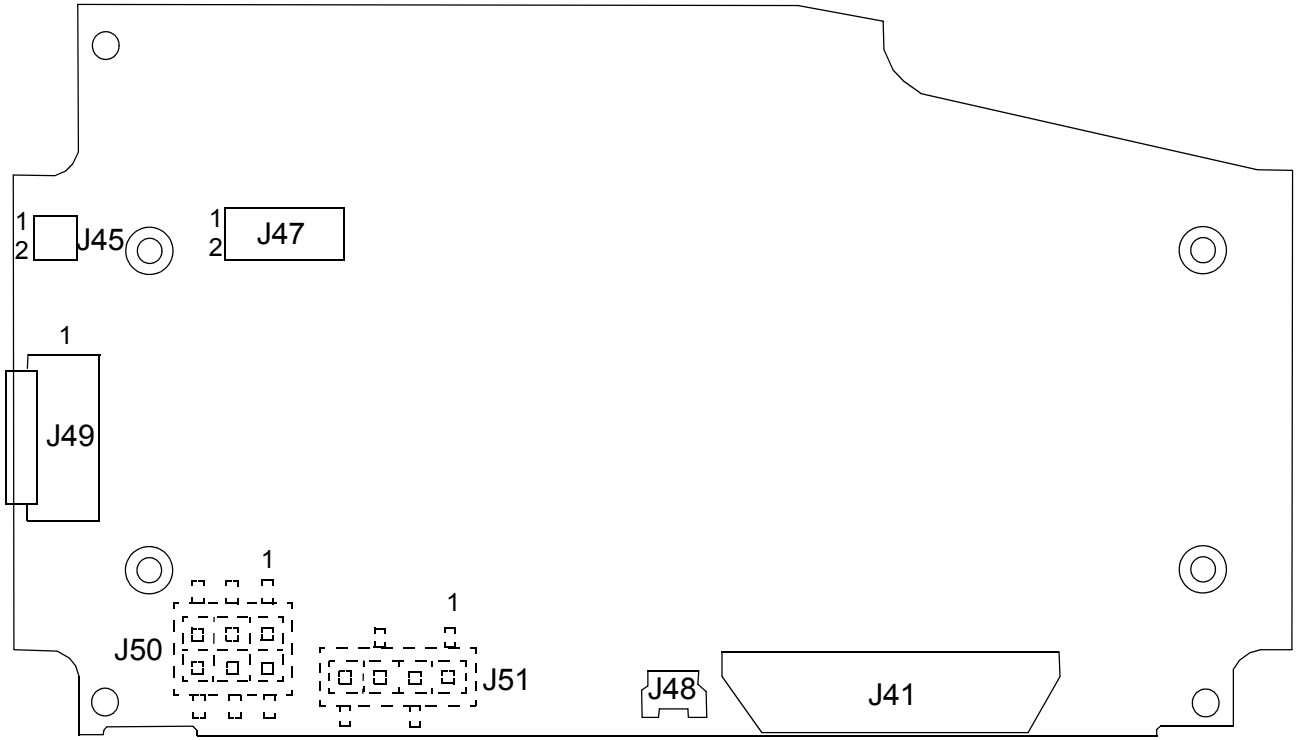
A03 Power Module Installation *(continued)*

9. Connect the 4-pin W10 Power/Therapy Cable connector to the A04 Therapy PCB at J17.
10. **Install the A12 Printer Module**.
11. **Install the front case**.
12. **Install the top case**.
13. **Install the A07 Battery**.
14. **Complete the PIP**.

Bottom Case *(continued)*

A03 Power Module Diagram

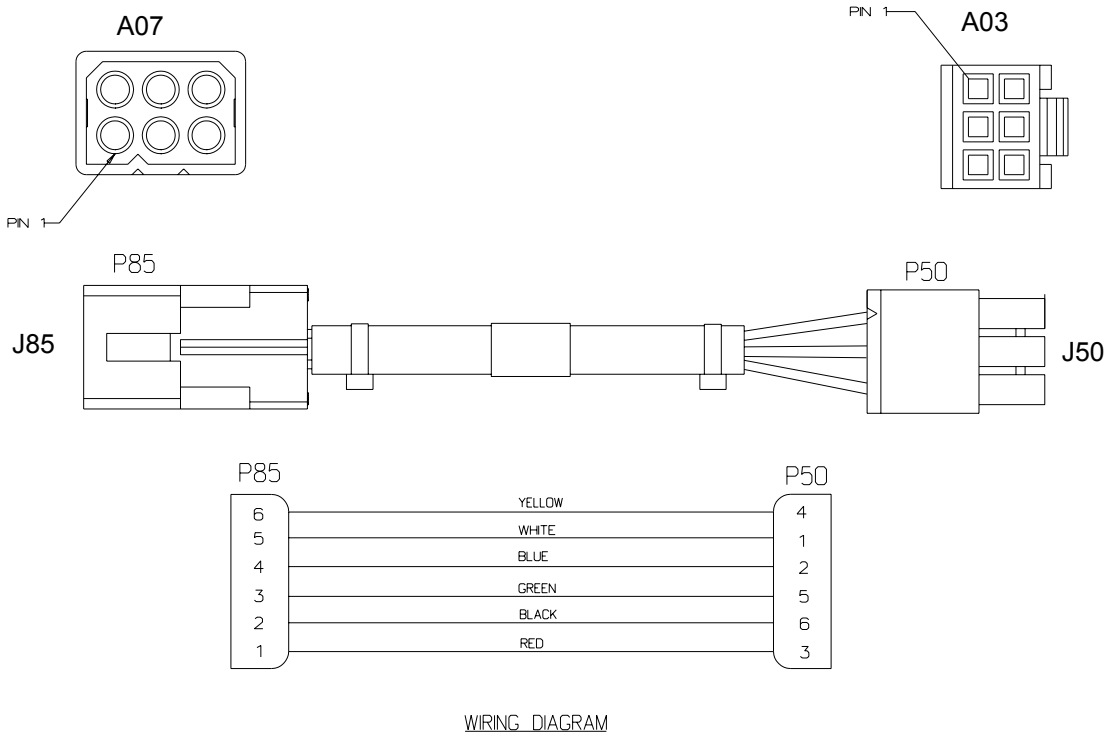
MIN **3202131**



Bottom Case *(continued)*

W08 Battery Cable Diagrams (LIFEPAK 20e Only)

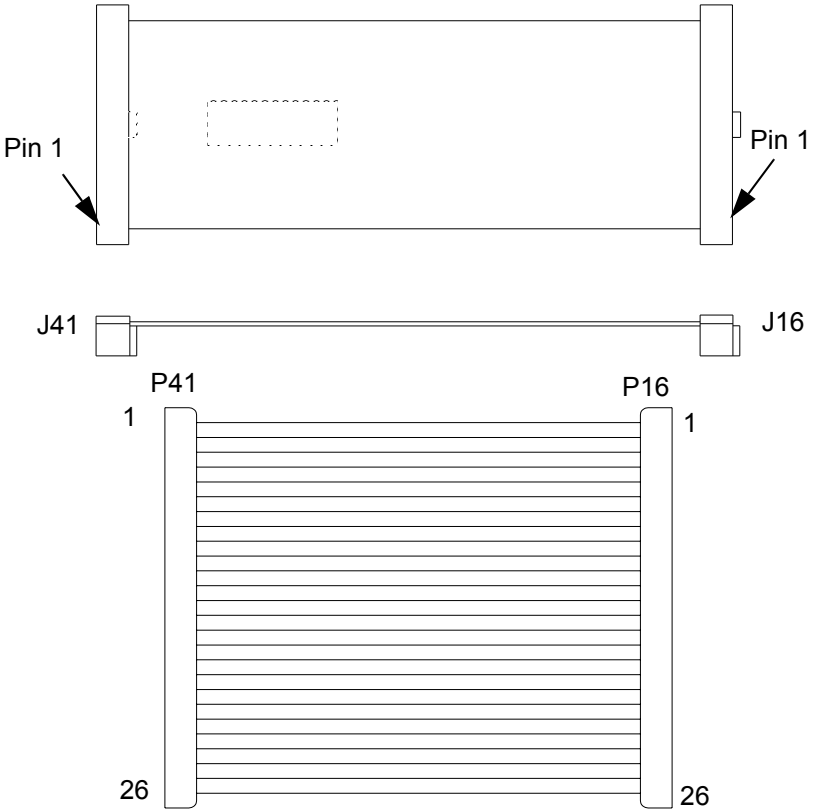
MIN **3206579**



Bottom Case *(continued)*

W09 26-Pin Cable Diagrams

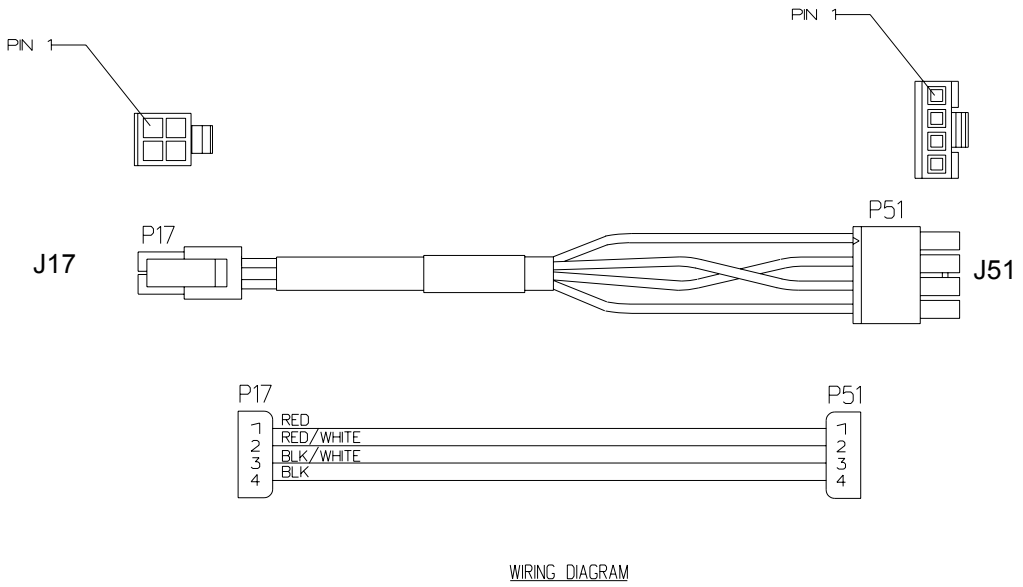
MIN **3201241**



Bottom Case *(continued)*

W10 Power/Therapy Cable Diagrams (LIFEPAK 20e Only)

MIN **3206857**

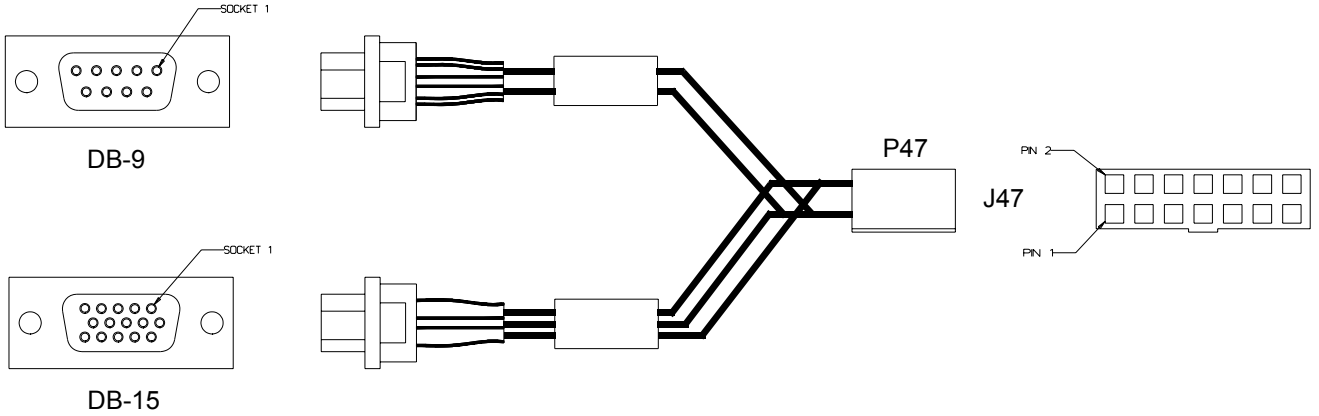


WIRING DIAGRAM

Bottom Case *(continued)*

W11 ECG Sync/System Cables Diagrams

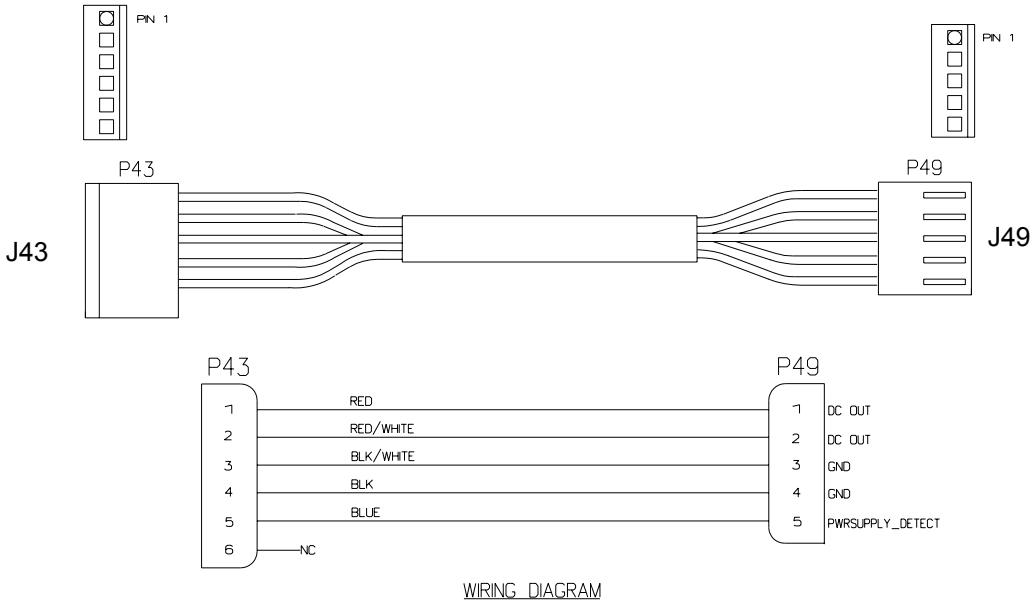
MIN **3201997**



Bottom Case *(continued)*

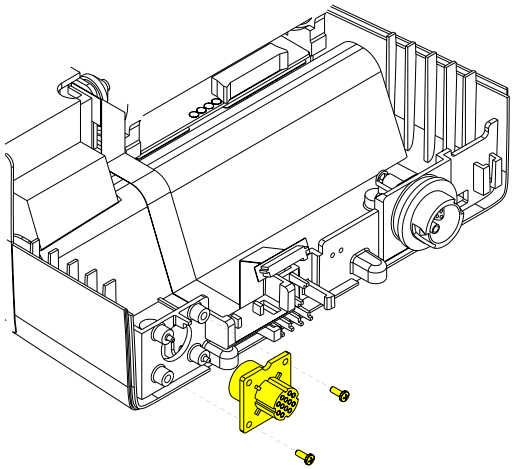
W13 AC Power Cable Diagrams (LIFEPAK 20e Only)

MIN **3206469**



Bottom Case *(continued)*

W06 ECG Connector Removal



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

- **A07 Battery**
- **Top case**
- **Front case**
- **Boardstack**

To remove the W06 ECG Connector:

1. Remove and discard the two 4-40 × 0.312 screws (173) from the 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 *(continued)*

W06 ECG Connector Installation

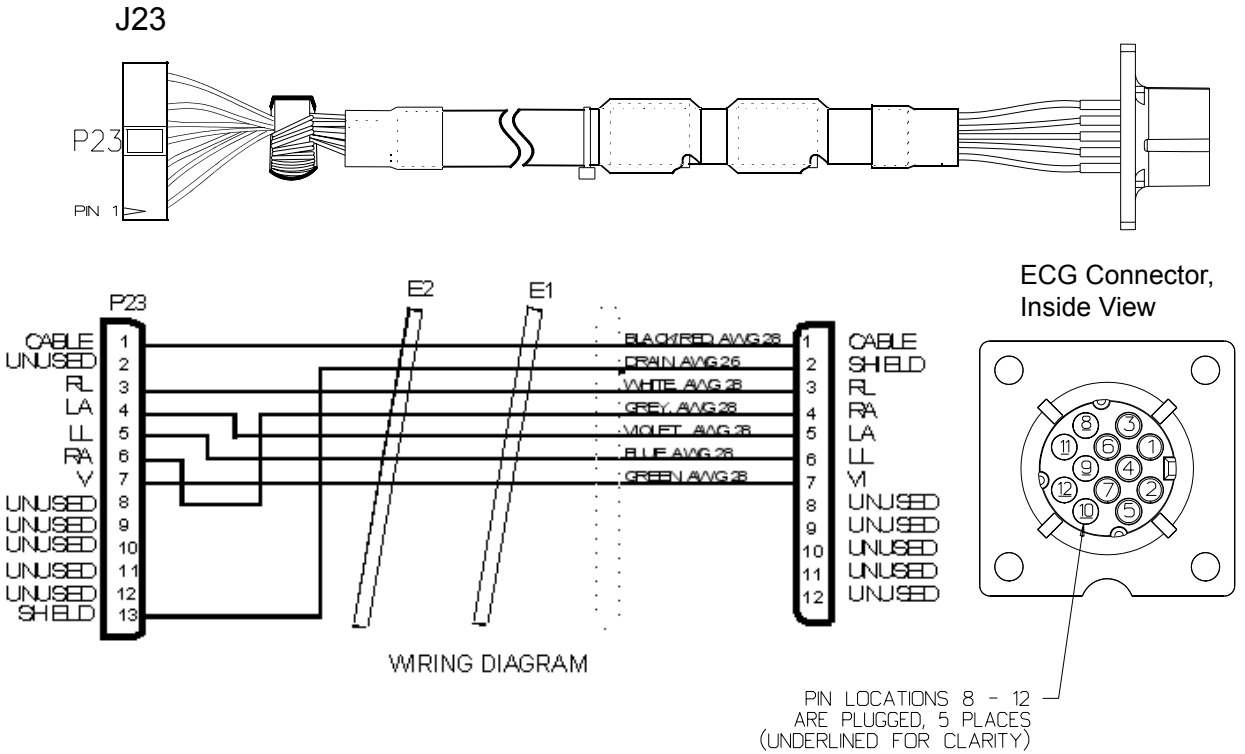
To Install the W06 ECG Connector:

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 new 4-40 × 0.312 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**.
6. **Install the front case**.
7. **Install the top case**.
8. **Install the A07 Battery**.
9. **Complete the PIP**.

Bottom Case *(continued)*

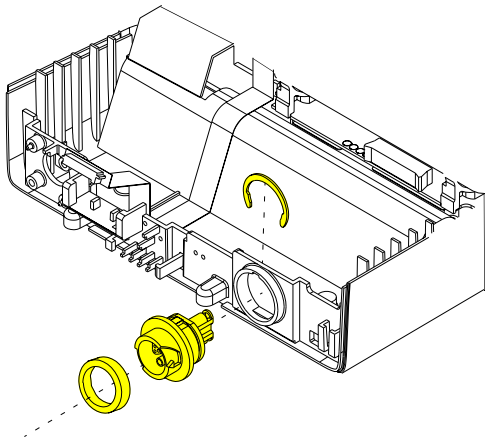
W06 ECG Connector Assembly Diagrams

MIN **3201010**



Bottom Case *(continued)*

W01 Therapy Connector Removal



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

- **A07 Battery**
- **Top case**
- **Front case**
- **Boardstack**

To remove the W01 Therapy Connector Assembly:

1. Remove the Therapy Connector Seal (268) from the W01 Therapy Connector.
2. Remove the retaining ring (111) from the back of the W01 Therapy Connector.
3. From outside the case, remove the therapy connector from the bottom case and feed the therapy cable through the connector hole.

Bottom Case *(continued)*

W01 Therapy Connector Installation

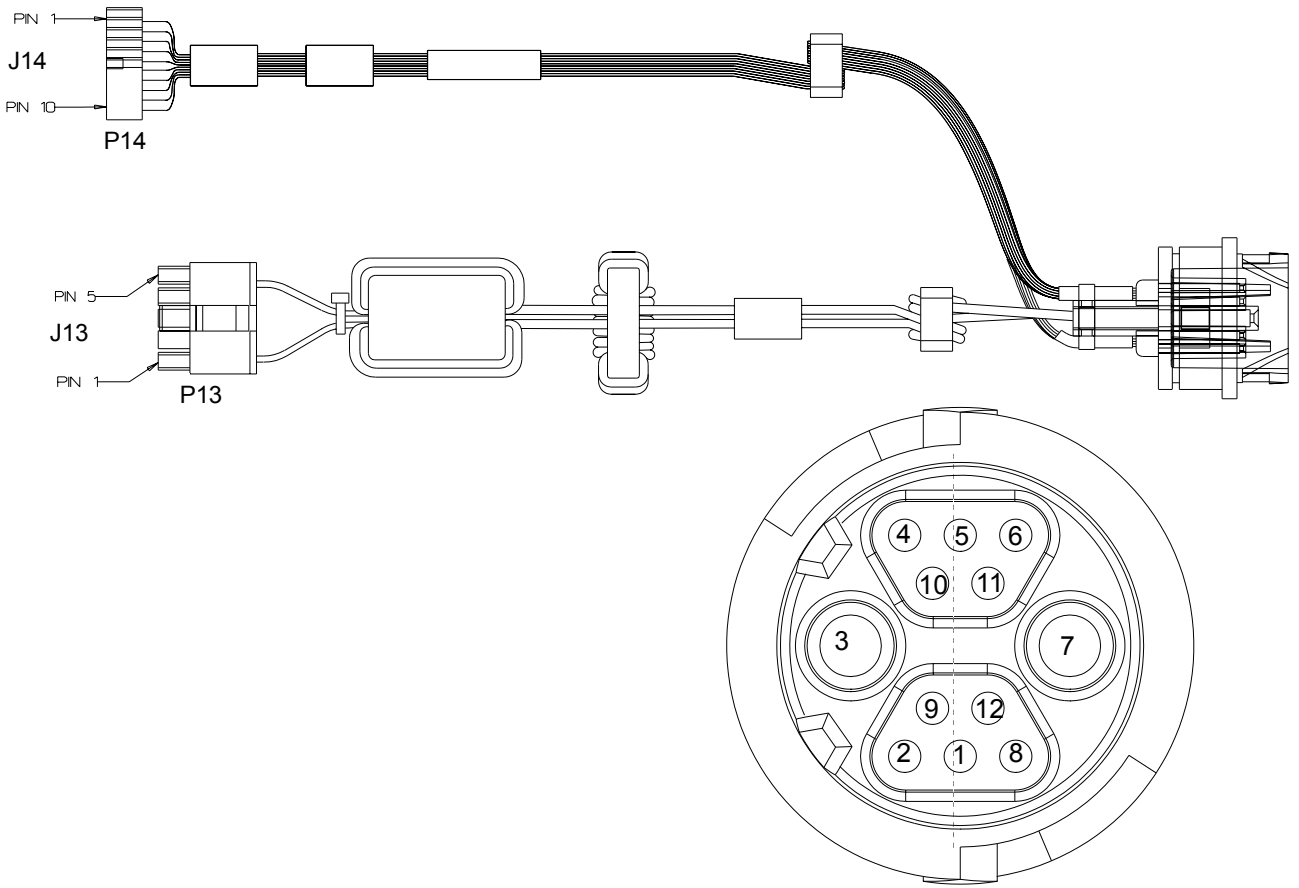
To install the W01 Therapy Connector Assembly:

1. From outside the case, align the key on the connector with the notch in the bottom case and slide the W01 Therapy Connector Assembly into the bottom case.
2. Install the retaining ring (111) onto the back of the W01 Therapy Connector Assembly, and rotate the clip so that the open end is visible.
3. Install the Therapy Connector Seal (268) onto the W01 Therapy Connector.
4. **Install the boardstack**.
5. **Install the front case**.
6. **Install the top case**.
7. **Install the A07 Battery**.
8. **Complete the PIP**.

Bottom Case *(continued)*

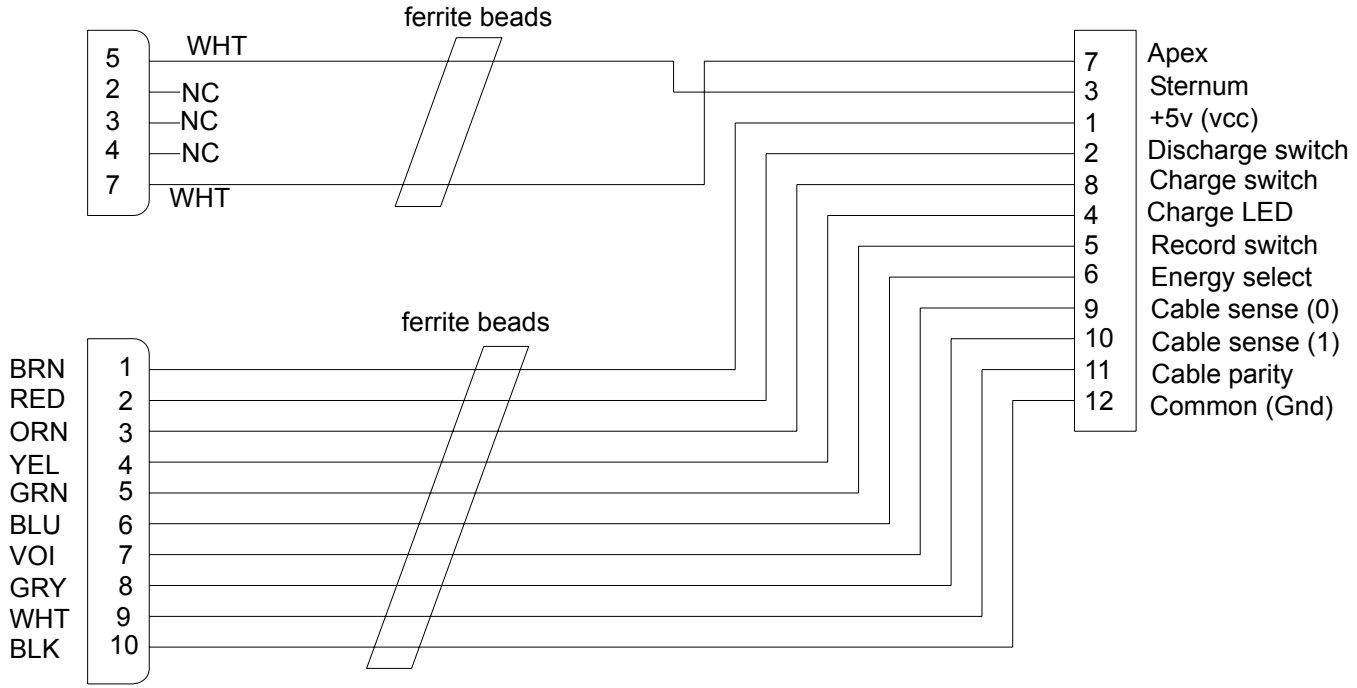
W01 Therapy Connector Assembly Diagrams

MIN **3200474**



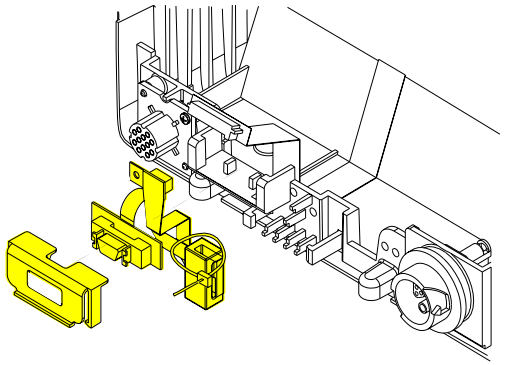
Bottom Case *(continued)*

W01 Therapy Connector Assembly Wiring Diagram



Bottom Case *(continued)*

W05 SpO2 Connector Removal



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

- **A07 Battery**
- **Top case**
- **Front case**
- **Boardstack**
- **W03 IrDA Port**

To remove the W05 SpO2 Connector 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 clip (113), away from the bottom case.
3. Lift the mounting clip away from the bottom case.
4. Lift the W05 SpO2 connector assembly away from the bottom case.

Bottom Case *(continued)*

W05 SpO2 Connector Installation

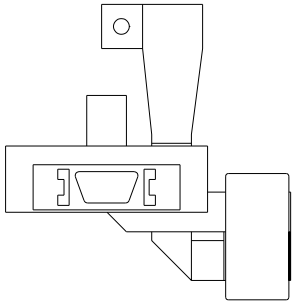
To install the W05 SpO2 Connector Assembly:

1. Place the W05 SpO2 input connector into the locating detail in the bottom case.
2. Position the SpO2 connector mounting clip (113) in front of the mounting block detail on the bottom case.
3. Press the SpO2 connector mounting clip in and down onto the bottom case mounting block detail 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**.
6. **Install the boardstack**.
7. **Install the front case**.
8. **Install the top case**.
9. **Install the A07 Battery**.
10. **Complete the PIP**.

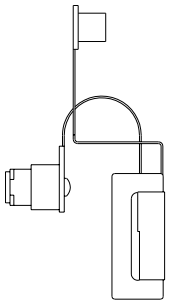
(Continued on next page)

Bottom Case *(continued)*

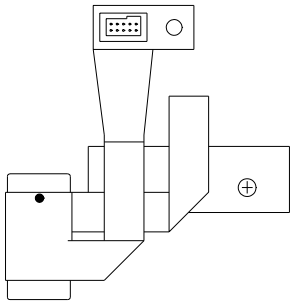
W05 SpO2 Assembly Diagrams MIN **3200925**



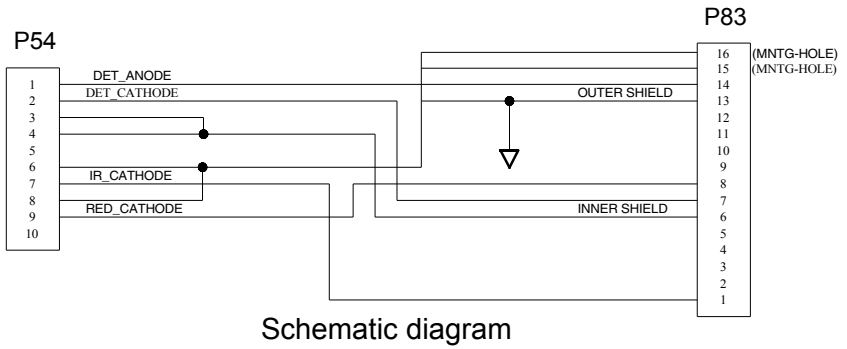
Front view



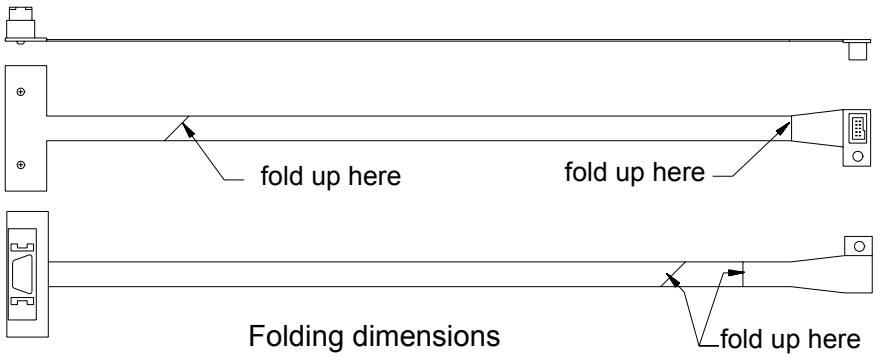
Side view



Back view



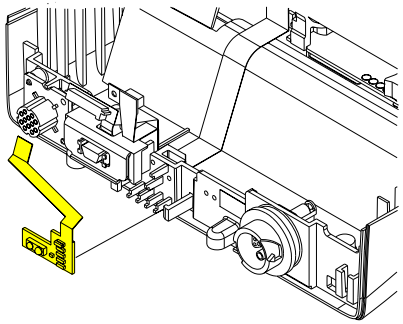
Schematic diagram

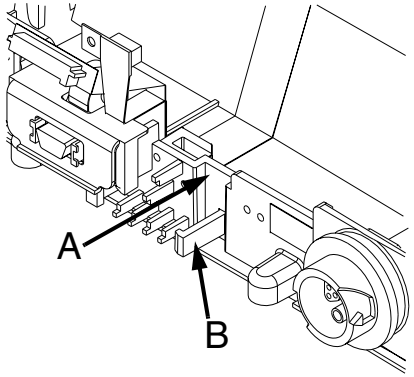


Folding dimensions

Bottom Case *(continued)*

W03 IrDA Assembly Removal





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

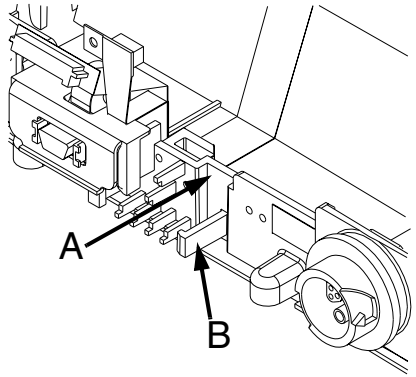
- **A07 Battery**
- **Top case**
- **Front case**
- **Boardstack (optional removal)**

To remove the W03 IrDA Assembly:

1. If the boardstack is not removed, disconnect the W03 IrDA flex cable from the A01 System PCB at J8 by first removing the screw (255) using a 3/32 allen driver.
2. Insert a slotted 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, freeing the right edge of the W03 IrDA Assembly.
4. Remove the W03 IrDA Assembly from the bottom case.
5. If the boardstack is still installed in the bottom case, disconnect the IrDA connector from the A01 System PCB at J8.

Bottom Case *(continued)*

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 front panel on the bottom case.)
2. Insert a large slotted 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) slightly outward,
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 W03 IrDA Assembly to the A01 System PCB at J08 and fasten with a screw (255) using a 3/32 allen driver, if the boardstack is still installed in the bottom case. Otherwise, **Install the boardstack**. The IrDA flex cable is connected during the boardstack installation.

(Continued on next page)

Bottom Case *(continued)*

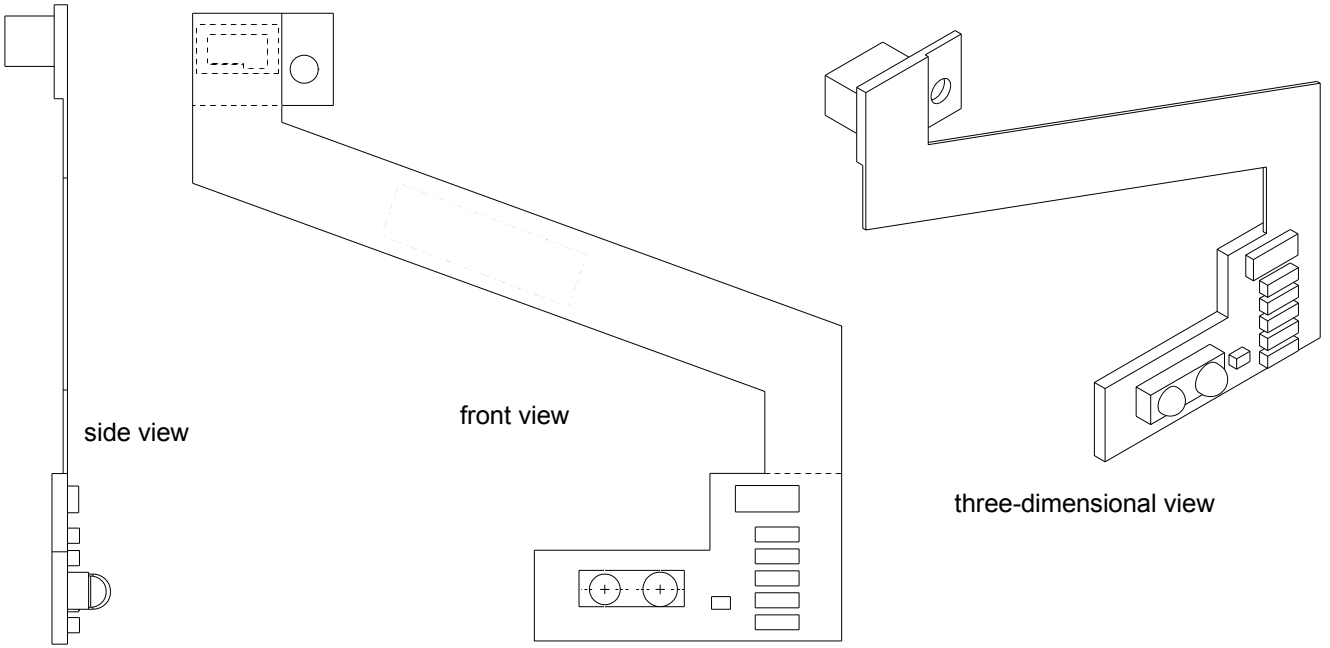
W03 IrDA Assembly Installation *(continued)*

7. **Install the front case**.
8. **Install the top case**.
9. **Install the A07 Battery**.
10. **Complete the PIP**.

Bottom Case *(continued)*

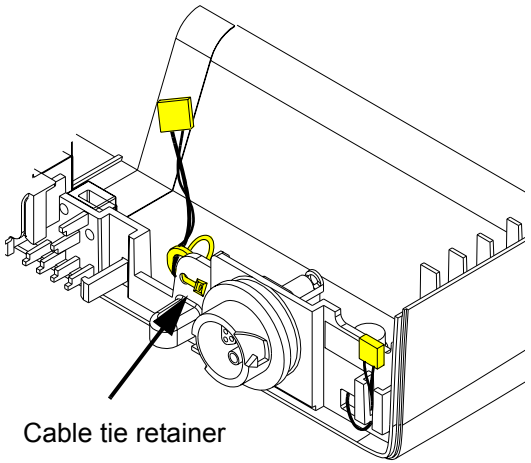
W03 IrDA Assembly Diagrams

MIN **3200926**



Bottom Case *(continued)*

W25 Speaker Harness Extension Cable Removal



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

- **A07 Battery**
- **Top case**
- **Front case**
- **Boardstack**

Note: To remove the W25 Speaker Harness Extension Cable:

1. Disconnect the W25 Speaker Harness Extension Cable from the W02 Speaker Assembly (part of front case removal).
2. Disconnect the other end of the W25 Speaker Harness Extension Cable from the A01 System PCB at J5 (part of boardstack removal).
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 Assembly. Remove the cable from the bottom case.

Bottom Case *(continued)*

W25 Speaker Harness Extension Cable Installation

To Install the W25 Speaker Harness Extension Cable:

1. Feed the W25 Speaker Harness Extension Cable under the W01 Therapy Connector Assembly.
2. Insert the W25 Speaker Harness Extension Cable into the holder in the bottom case.
3. Install the cable tie retainer (229) in the set of holes .5 inches to the left of the W01 Therapy Connector Assembly, and secure the extension cable's ferrite ring to the bottom case.
4. **Install the boardstack**.
5. **Install the front case**.
6. **Install the top case**.
7. **Install the A07 Battery**.
8. **Complete the PIP**.

Final Assembly

Device Labeling Including Label Set (12) 3201640 - LIFEPAK 20 3206034 - LIFEPAK 20e

To apply the labels to the device:

1. Remove the old labels and clean the device with isopropyl alcohol.
2. Select the correct label set (**language**).
3. Apply the labels (refer to the next page for placement):

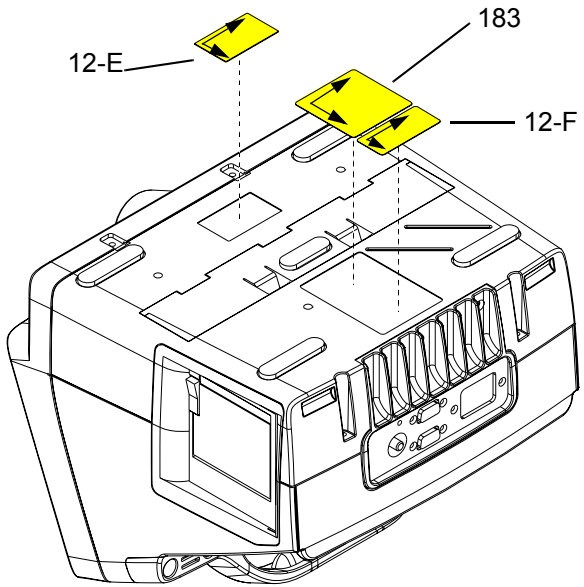
Item	MIN (ref)	Part Description	Note
12 - Label set	3201290	Rear connector label	A in **Labels Assembly diagram**
12 - Label set	3201274-030	Front connector label, ENG (SpO2)	B in **Labels Assembly diagram**
12 - Label set	3201274-015	Front connector label, ENG (no SpO2)	B in **Labels Assembly diagram**
12 - Label set	3201275	Medtronic logo label	C in **Labels Assembly diagram**
12 - Label set	3201273	Product ID label	D in **Labels Assembly diagram**
12 - Label set	3009060	FDA label	E in **Labels Assembly diagram**
12 - Label set	3202375	Masimo patent label	F in **Labels Assembly diagram**
23	3201499	Manual latch label	**Select language**
183	3201643	Serial number label	**SN label illustration**
284	3206926	Label - Adult VF Dose	**Labels Assembly diagram**

Final Assembly *(continued)*

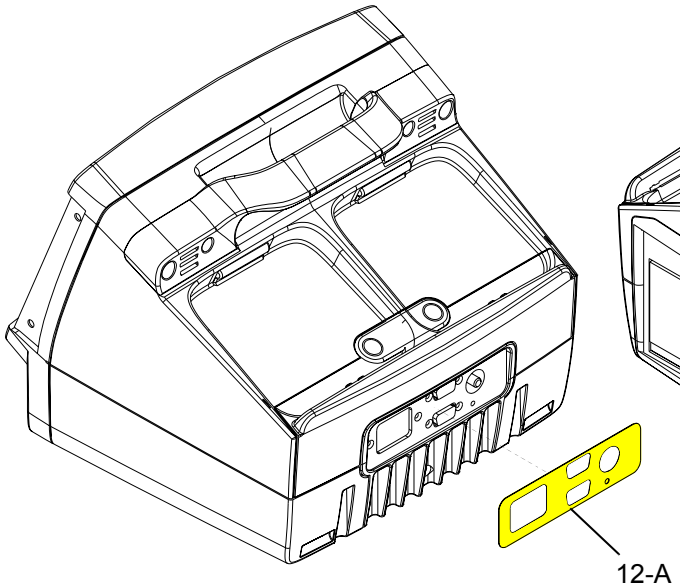
Label Placement Diagrams

Refer to the **parts list** for label description.

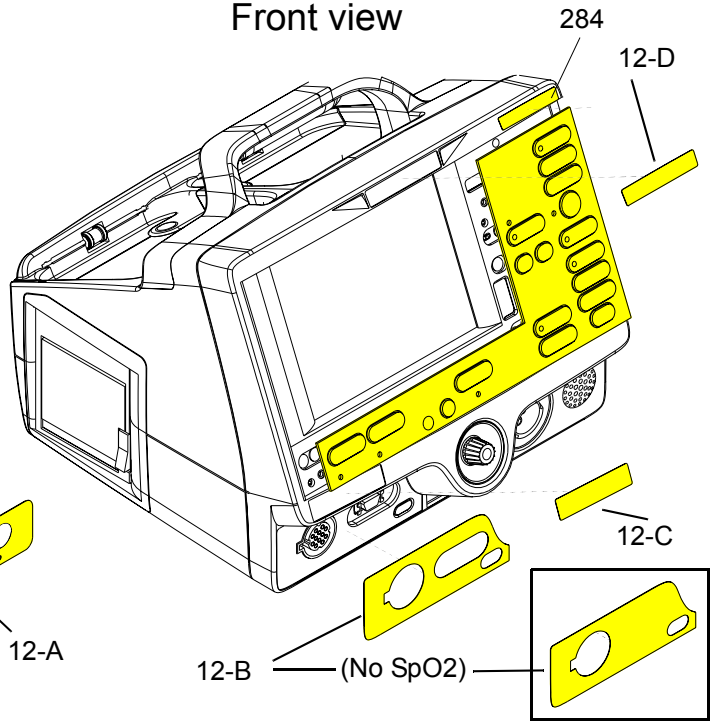
Bottom view



Rear view



Front view



Final Assembly *(continued)*

LIFEPAK 20/20e Label Set Languages

Language	MIN	CAT.	Part Description
English	3201640-152	21501-001804	LIFEPAK 20 label set (no SpO2)
English	3201640-166	21501-001818	LIFEPAK 20 label set (with SpO2)
English	**3206034-004**	**21501-001754**	**LIFEPAK 20e label set (no SpO2)**
English	**3206034-005**	**21501-001755**	**LIFEPAK 20e label set (with SpO2)**
French	3201640-153	21501-001805	LIFEPAK 20 label set (no SpO2)
French	3201640-167	21501-001819	LIFEPAK 20 label set (with SpO2)
French	**3206034-082**	**21501-001765**	**LIFEPAK 20e label set (no SpO2)**
French	**3206034-083**	**21501-001766**	**LIFEPAK 20e label set (with SpO2)**
German	3201640-154	21501-001806	LIFEPAK 20 label set (no SpO2)
German	3201640-168	21501-001820	LIFEPAK 20 label set (with SpO2)
German	**3206034-042**	**21501-001761**	**LIFEPAK 20e label set (no SpO2)**
German	**3206034-043**	**21501-001762**	**LIFEPAK 20e label set (with SpO2)**
Spanish	3201640-155	21501-001807	LIFEPAK 20 label set (no SpO2)
Spanish	3201640-169	21501-001821	LIFEPAK 20 label set (with SpO2)

(Continued on next page)

Final Assembly *(continued)*

LIFEPAK 20/20e Label Set Languages *(continued)*

Language	MIN	CAT.	Part Description
Spanish	**3206034-122**	**21501-001769**	**LIFEPAK 20e label set (no SpO2)**
Spanish	**3206034-123**	**21501-001770**	**LIFEPAK 20e label set (with SpO2)**
Italian	3201640-156	21501-001808	LIFEPAK 20 label set (no SpO2)
Italian	3201640-170	21501-001822	LIFEPAK 20 label set (with SpO2)
Italian	**3206034-062**	**21501-001763**	**LIFEPAK 20e label set (no SpO2)**
Italian	**3206034-063**	**21501-001764**	**LIFEPAK 20e label set (with SpO2)**
Swedish	3201640-157	21501-001809	LIFEPAK 20 label set (with SpO2)
Swedish	3201640-171	21501-001823	LIFEPAK 20 label set (no SpO2)
Swedish	**3206034-182**	**21501-001776**	**LIFEPAK 20e label set (with SpO2)**
Swedish	**3206034-183**	**21501-001777**	**LIFEPAK 20e label set (no SpO2)**
Danish	3201640-158	21501-001810	LIFEPAK 20 label set (with SpO2)
Danish	3201640-172	21501-001824	LIFEPAK 20 label set (with SpO2)
Danish	**3206034-202**	**21501-001778**	**LIFEPAK 20e label set (no SpO2)**
Danish	**3206034-203**	**21501-001779**	**LIFEPAK 20e label set (with SpO2)**

(Continued on next page)

Final Assembly *(continued)*

LIFEPAK 20/20e Label Set Languages *(continued)*

Language	MIN	CAT.	Part Description
Dutch	3201640-159	21501-001811	LIFEPAK 20 label set (no SpO2)
Dutch	3201640-173	21501-001825	LIFEPAK 20 label set (with SpO2)
Dutch	**3206034-102**	**21501-001767**	**LIFEPAK 20e label set (no SpO2)**
Dutch	**3206034-103**	**21501-001768**	**LIFEPAK 20e label set (with SpO2)**
Finnish	3201640-160	21501-001812	LIFEPAK 20 label set (no SpO2)
Finnish	3201640-174	21501-001826	LIFEPAK 20 label set (with SpO2)
Finnish	**3206034-222**	**21501-001780**	**LIFEPAK 20e label set (no SpO2)**
Finnish	**3206034-223**	**21501-001781**	**LIFEPAK 20e label set (with SpO2)**
Norwegian	3201640-161	21501-001813	LIFEPAK 20 label set (no SpO2)
Norwegian	3201640-175	21501-001827	LIFEPAK 20 label set (with SpO2)
Norwegian	**3206034-242**	**21501-001795**	**LIFEPAK 20e label set (no SpO2)**
Norwegian	**3206034-243**	**21501-001782**	**LIFEPAK 20e label set (with SpO2)**
Polish	3201640-162	21501-001814	LIFEPAK 20 label set (no SpO2)
Polish	3201640-176	21501-001828	LIFEPAK 20 label set (with SpO2)

(Continued on next page)

Final Assembly *(continued)*

LIFEPAK 20/20e Label Set Languages *(continued)*

Language	MIN	CAT.	Part Description
Polish	**3206034-262**	**21501-001783**	**LIFEPAK 20e label set (no SpO2)**
Polish	**3206034-263**	**21501-001794**	**LIFEPAK 20e label set (with SpO2)**
Portuguese	3201640-163	21501-001815	LIFEPAK 20 label set (no SpO2)
Portuguese	3201640-177	21501-001829	LIFEPAK 20 label set (with SpO2)
Portuguese	**3206034-142**	**21501-001771**	**LIFEPAK 20e label set (no SpO2)**
Portuguese	**3206034-143**	**21501-001773**	**LIFEPAK 20e label set (with SpO2)**
Brazilian	3201640-164	21501-001816	LIFEPAK 20 label set (no SpO2)
Brazilian	3201640-178	21501-001830	LIFEPAK 20 label set (with SpO2)
Brazilian	**3206034-162**	**21501-001774**	**LIFEPAK 20e label set (no SpO2)**
Brazilian	**3206034-163**	**21501-001775**	**LIFEPAK 20e label set (with SpO2)**
Japanese	3201640-135	21501-000943	LIFEPAK 20 label set (no SpO2)
Japanese	3201640-150	21501-000956	LIFEPAK 20 label set (with SpO2)
Japanese	**3206034-402**	**21501-001791**	**LIFEPAK 20e label set (no SpO2)**
Japanese	**3206034-403**	**21501-001792**	**LIFEPAK 20e label set (with SpO2)**

(Continued on next page)

Final Assembly *(continued)*

LIFEPAK 20/20e Label Set Languages *(continued)*

Language	MIN	CAT.	Part Description
Chinese	3201640-165	21501-001817	LIFEPAK 20 label set (no SpO2)
Chinese	3201640-179	21501-001831	LIFEPAK 20 label set (with SpO2)
Chinese	**3206034-342**	**21501-001539**	**LIFEPAK 20e label set (no SpO2)**
Chinese	**3206034-343**	**21501-001540**	**LIFEPAK 20e label set (with SpO2)**
Hungarian	3201640-282	21501-001832	LIFEPAK 20 label set (no SpO2)
Hungarian	3201640-283	21501-001833	LIFEPAK 20 label set (with SpO2)
Hungarian	**3206034-282**	**21501-001785**	**LIFEPAK 20e label set (no SpO2)**
Hungarian	**3206034-283**	**21501-001786**	**LIFEPAK 20e label set (with SpO2)**
Czech	3201640-302	21501-001834	LIFEPAK 20 label set (no SpO2)
Czech	3201640-303	21501-001835	LIFEPAK 20 label set (with SpO2)
Czech	**3206034-302**	**21501-001787**	**LIFEPAK 20e label set (no SpO2)**
Czech	**3206034-303**	**21501-001788**	**LIFEPAK 20e label set (with SpO2)**
Russian	3201640-322	21501-001836	LIFEPAK 20 label set (no SpO2)
Russian	3201640-323	21501-001837	LIFEPAK 20 label set (with SpO2)

(Continued on next page)

Final Assembly *(continued)*

LIFEPAK 20/20e Label Set Languages *(continued)*

Language	MIN	CAT.	Part Description
Russian	**3206034-322**	**21501-001789**	**LIFEPAK 20e label set (no SpO2)**
Russian	**3206034-323**	**21501-001790**	**LIFEPAK 20e label set (with SpO2)**
Korean	3201640-382	21501-001838	LIFEPAK 20 label set (no SpO2)
Korean	3201640-383	21501-001839	LIFEPAK 20 label set (with SpO2)
Korean	**3206034-382**	**21501-001541**	**LIFEPAK 20e label set (no SpO2)**
Korean	**3206034-383**	**21501-001542**	**LIFEPAK 20e label set (with SpO2)**

Final Assembly *(continued)*

Manual Latch Label Languages

Note: To order the MANUAL latch label and the AED door together as a kit refer to **AED Door/Latch Label Kits**.

Language	MIN	CAT.	Part Description
English	3201499-900	21501-000767	AED door latch label
French	3201499-902	21501-000924	AED door latch label
German	3201499-901	21501-000925	AED door latch label
Spanish	3201499-900	21501-000767	AED door latch label
Italian	3201499-060	21501-000932	AED door latch label
Swedish	3201499-901	21501-000925	AED door latch label
Danish	3201499-902	21501-000924	AED door latch label
Dutch	3201499-100	21501-000930	AED door latch label
Finnish	3201499-220	21501-000929	AED door latch label
Norwegian	3201499-901	21501-000925	AED door latch label
Polish	3201499-260	21501-000928	AED door latch label

(Continued on next page)

Final Assembly *(continued)*

Manual Latch Label Languages *(continued)*

Note: To order the MANUAL latch label and the AED door together as a kit refer to **Manual Latch Label Kits**.

Language	MIN	CAT.	Part Description
Portuguese	3201499-900	21501-000767	AED door latch label
Brazilian	3201499-900	21501-000767	AED door latch label
Japanese	3201499-400	21501-000926	AED door latch label
Chinese	3201499-340	21501-000927	AED door latch label
Hungarian	3201499-280	21501-001349	AED door latch label
Czech	3201499-300	21501-001350	AED door latch label
Russian	3201499-320	21501-001351	AED door latch label
Korean	3201499-380	21501-001352	AED door latch label

Final Assembly *(continued)*

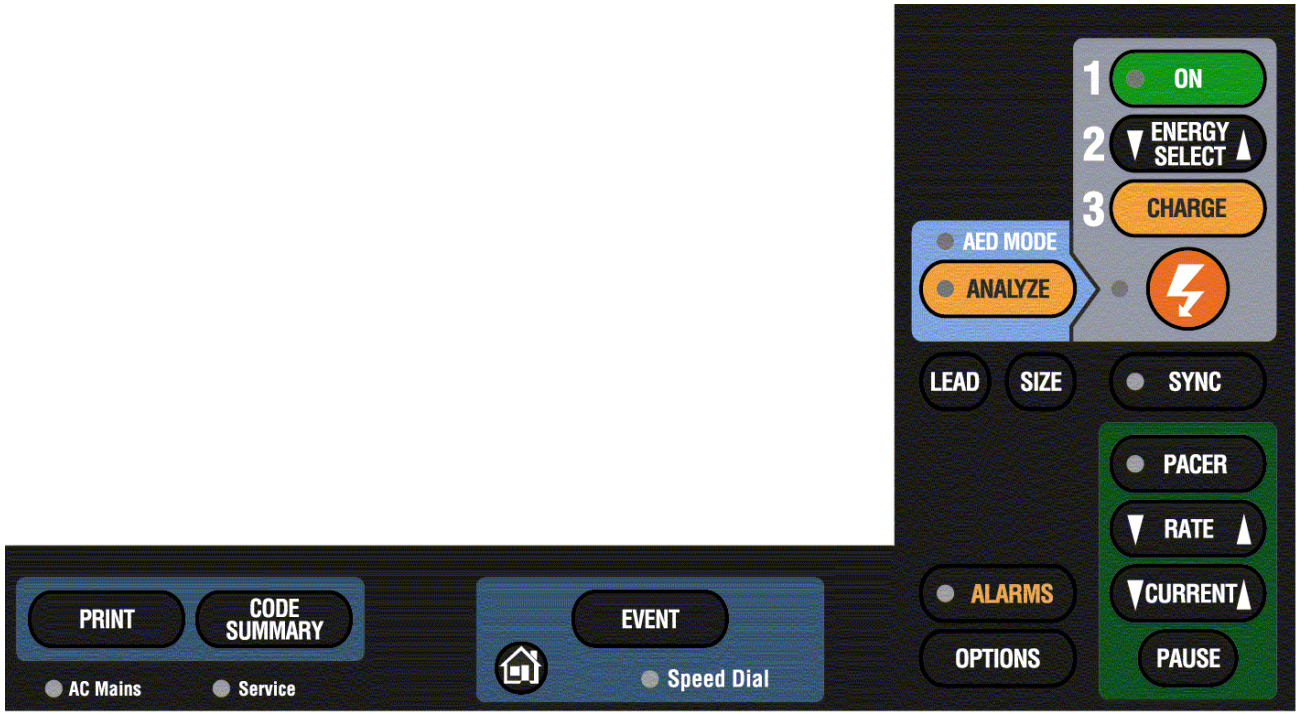
AED Door/Latch Label Kits

Kit MIN	CAT.	Languages	Part Description
3202360-027	21330-001007	English, Spanish, Portuguese, Brazilian	AED door (3202056) and Latch label (3201499)
3202360-028	21330-001008	German, Swedish, Norwegian	AED door (3202056) and Latch label (3201499)
3202360-029	21330-001009	Italian	AED door (3202056) and Latch label (3201499)
3202360-030	21330-001010	French, Danish	AED door (3202056) and Latch label (3201499)
3202360-031	21330-001011	Dutch	AED door (3202056) and Latch label (3201499)
3202360-032	21330-001012	Finnish	AED door (3202056) and Latch label (3201499)
3202360-033	21330-001013	Polish	AED door (3202056) and Latch label (3201499)
3202360-034	21330-001014	Chinese	AED door (3202056) and Latch label (3201499)
3202360-035	21330-001015	Japanese	AED door (3202056) and Latch label (3201499)

Final Assembly *(continued)*

A15 Elastomer Keypad – All Options

(Refer to the parts list on the next page for language MINs.)



(Continued on next page)

Final Assembly *(continued)*

A15 Elastomer Keypad - Languages

Language	MIN	CAT.	Part Description
English	3200642-106	21300-004598	Keypad (no Pacing)
English	3200642-091	21300-004231	Keypad (with Pacing)
French	3200642-107	21300-004740	Keypad (no Pacing)
French	3200642-092	21300-004755	Keypad (with Pacing)
German	3200642-108	21300-004741	Keypad (no Pacing)
German	3200642-093	21300-004712	Keypad (with Pacing)
Spanish	3200642-109	21300-004744	Keypad (no Pacing)
Spanish	3200642-094	21300-004713	Keypad (with Pacing)
Italian	3200642-110	21300-004743	Keypad (no Pacing)
Italian	3200642-095	21300-004714	Keypad (with Pacing)
Swedish	3200642-111	21300-004742	Keypad (no Pacing)
Swedish	3200642-096	21300-004715	Keypad (with Pacing)

(Continued on next page)

Final Assembly *(continued)*

A15 Elastomer Keypad - Languages *(continued)*

Language	MIN	CAT.	Part Description
Danish	3200642-112	21300-004748	Keypad (no Pacing)
Danish	3200642-097	21300-004716	Keypad (with Pacing)
Dutch	3200642-113	21300-004747	Keypad (no Pacing)
Dutch	3200642-098	21300-004717	Keypad (with Pacing)
Finnish	3200642-114	21300-004746	Keypad (no Pacing)
Finnish	3200642-099	21300-004718	Keypad (with Pacing)
Norwegian	3200642-115	21300-004749	Keypad (no Pacing)
Norwegian	3200642-100	21300-004719	Keypad (with Pacing)
Polish	3200642-116	21300-004750	Keypad (no Pacing)
Polish	3200642-101	21300-004729	Keypad (with Pacing)
Portuguese	3200642-117	21300-004751	Keypad (no Pacing)
Portuguese	3200642-102	21300-004720	Keypad (with Pacing)

(Continued on next page)

Final Assembly *(continued)*

A15 Elastomer Keypad - Languages *(continued)*

Language	MIN	CAT.	Part Description
Brazilian	3200642-118	21300-004752	Keypad (no Pacing)
Brazilian	3200642-103	21300-004721	Keypad (with Pacing)
Japanese	3200642-119	21300-004753	Keypad (no Pacing)
Japanese	3200642-104	21300-004722	Keypad (with Pacing)
Chinese	3200642-123	21300-004754	Keypad (no Pacing)
Chinese	3200642-122	21300-004723	Keypad (with Pacing)
Hungarian	3200642-126	21300-006164	Keypad (no Pacing)
Hungarian	3200642-125	21300-006163	Keypad (with Pacing)
Czech	3200642-129	21300-006167	Keypad (no Pacing)
Czech	3200642-128	21300-006166	Keypad (with Pacing)
Russian	3200642-132	21300-006170	Keypad (no Pacing)
Russian	3200642-131	21300-006169	Keypad (with Pacing)
Korean	3200642-135	21300-006173	Keypad (no Pacing)
Korean	3200642-134	21300-006172	Keypad (with Pacing)

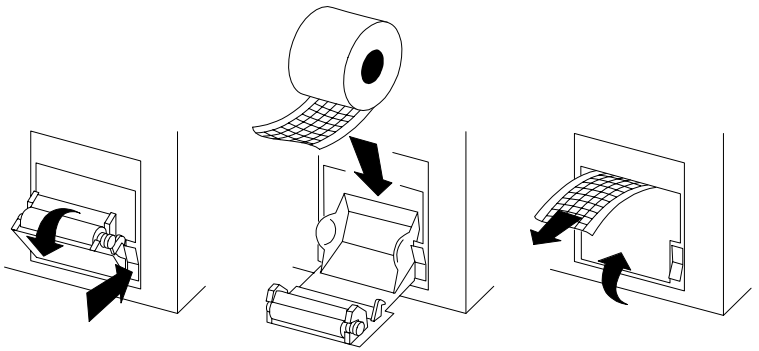
Final Assembly *(continued)*

Installing Printer Paper

To install a new roll of printer paper into the printer:

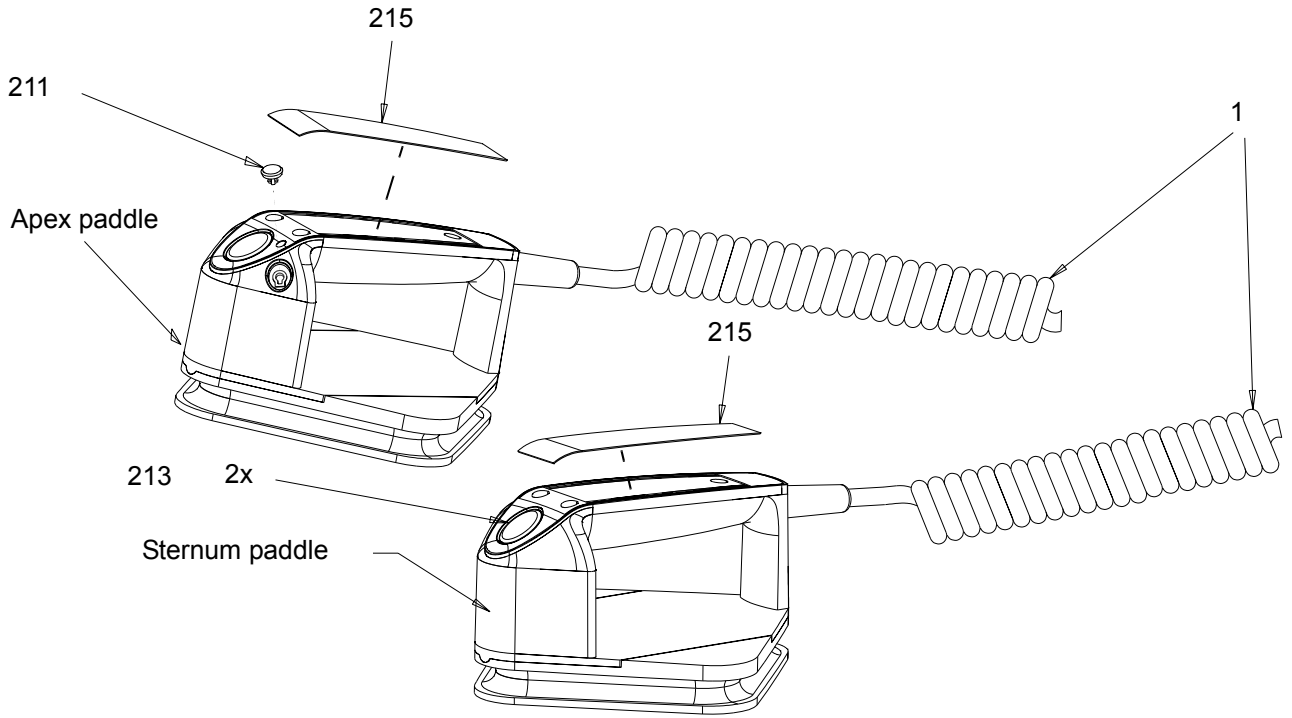
1. Press the printer button located on the left side of the device to open the printer door.
2. Remove the old roll of paper.
3. Insert the new paper roll into the paper chamber, with the end coming from under the roll.

   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.



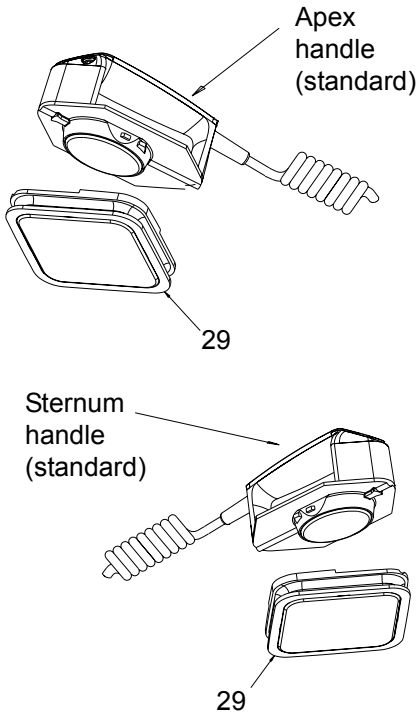
Final Assembly *(continued)*

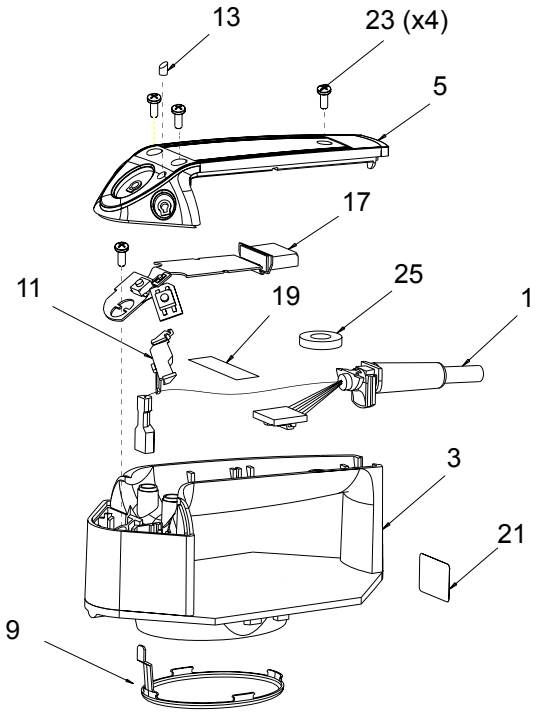
Standard Paddles Labels and Buttons



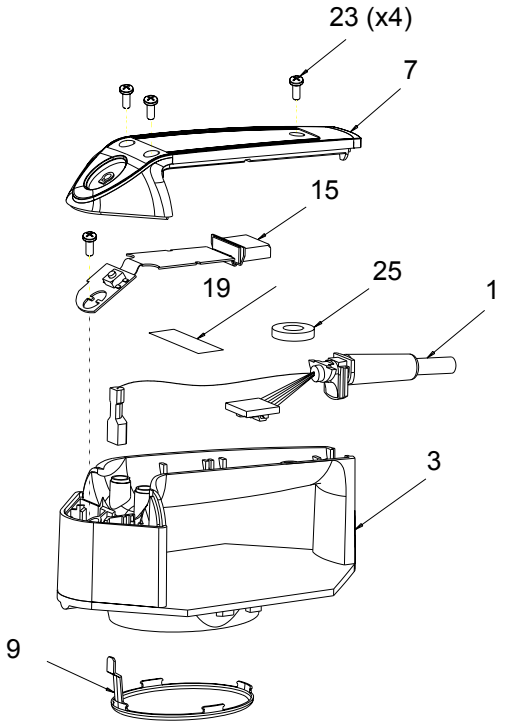
Final Assembly *(continued)*

Standard Paddles Assembly Diagrams





Apex handle



Sternum handle

Final Assembly *(continued)*

Standard Paddles
Parts List

Item	Quantity	MIN	CAT.	Part Description	Note
1	1	3202665-000	21300-004877	Cable assembly	
3	2	3200644-004	21300-004770	Paddle handle	
5	1	3200645-003	21300-004771	Apex paddle cover	
7	1	3201248-003	21300-004773	Sternum paddle cover	
9	2	3200939-00	21300-004772	Pediatric electrode	Part of the paddle handle (3)
11	1	3201675-000	21300-004774	Apex support bracket	
13	1	3202172-000	21300-004775	Apex light pipe	Part of Apex paddle cover (5)
15	1	3201225-004	21330-001018	Sternum paddle flex PCB assembly	
17	1	3201244-052	21330-001020	Apex paddle flex PCB assembly	

(Continued on next page)

Final Assembly *(continued)*

Standard Paddles
Parts List *(continued)*

Item	Quantity	MIN	CAT.	Part Description	Note
19		253-0038-00	21300-001224	Kapton tape	
23	8	202253-761	21300-001038	Machine screw 4.40 x .312L	
25	2	804447-038	21300-004543	Poron spacer	
29	2	3200941-003	21330-001024	Hard paddle adapter assembly	
211	1	3200648	various	Charge button	Refer to **Charge Button Languages**
213	2	3200943-000	21300-004710	Shock button	
215	2	3202523	21501-000997	Paddle label	Refer to **Standard Paddles Label Languages**

Final Assembly *(continued)*

Standard Paddles Label Languages

Language	MIN	CAT.	Part Description
English	3202533-000	21501-000823	Paddle labels
French	3202533-000	21501-000823	Paddle labels
German	3202533-000	21501-000823	Paddle labels
Spanish	3202533-001	21501-000824	Paddle labels
Italian	3202533-002	21501-000827	Paddle labels
Swedish	3202533-000	21501-000823	Paddle labels
Danish	3202533-000	21501-000823	Paddle labels
Dutch	3202533-000	21501-000823	Paddle labels
Finnish	3202533-003	21501-000828	Paddle labels
Norwegian	3202533-000	21501-000823	Paddle labels
Polish	3202533-004	21501-000829	Paddle labels

(Continued on next page)

Final Assembly *(continued)*

Standard Paddles Label Languages *(continued)*

Language	MIN	CAT.	Part Description
Portuguese	3202533-005	21501-000809	Paddle labels
Brazilian	3202533-005	21501-000809	Paddle labels
Japanese	3202533-000	21501-000823	Paddle labels
Chinese	3202533-006	21501-000807	Paddle labels
Hungarian	3202533-280	21501-001428	Paddle labels
Czech	3202533-300	21501-001429	Paddle labels
Russian	3202533-320	21501-001430	Paddle labels
Korean	3202533-380	21501-001431	Paddle labels

Final Assembly *(continued)*

Charge Button Languages

Language	MIN	CAT.	Part Description
English	3200648-015	21300-004886	Charge button
French	3200648-016	21300-004756	Charge button
German	3200648-902	21300-004766	Charge button
Spanish	3200648-017	21300-004757	Charge button
Italian	3200648-018	21300-004758	Charge button
Swedish	3200648-019	21300-004759	Charge button
Danish	3200648-020	21300-004760	Charge button
Dutch	3200648-902	21300-004766	Charge button
Finnish	3200648-021	21300-004761	Charge button
Norwegian	3200648-022	21300-004762	Charge button
Polish	3200648-023	21300-004763	Charge button

(Continued on next page)

Final Assembly *(continued)*

Charge Button Languages *(continued)*

Language	MIN	CAT.	Part Description
Portuguese	3200648-903	21300-004767	Charge button
Brazilian	3200648-903	21300-004767	Charge button
Japanese	3200648-024	21300-004764	Charge button
Chinese	3200648-025	21300-004765	Charge button
Hungarian	3200648-280	21300-006328	Charge button
Czech	3200648-300	21300-006329	Charge button
Russian	3200648-320	21300-006330	Charge button
Korean	3200648-380	21300-006331	Charge button

Final Assembly *(continued)*

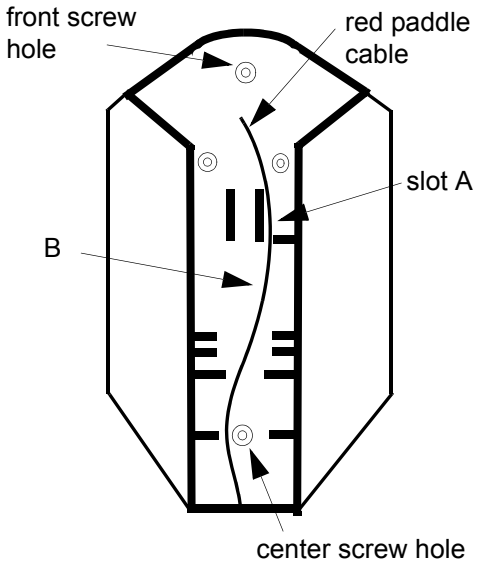
Standard Paddles Disassembly

To disassemble the paddles:

1. Remove the 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 the 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 *(continued)*

Standard Paddles Assembly



To assemble the paddles:

1. Position the paddle cable (1) in the paddle handle (3), and use needle-nosed 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 illustration 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 next to the front screw hole.
8. Install the screw (23) into the front screw hole.
9. Install the paddle cover (5 or 7) and secure it with three screws (23).

Service Replacement Kits

The service replacement kits include components that support a particular replacement activity.

Kit MIN	CAT.	Part Description
3202718-000	40402-000001	Top Case Handle kit
3202718-001	40402-000002	Front Case kit
3202718-007	40402-000008	User Interface PCB kit
3202718-008	40402-000009	Active Display kit
3202718-009	40402-000010	Active Display Bracket/Backlight Inverter kit
3202718-010	40402-000011	Power Module kit, **LIFEPAK 20**
3202718-013	40402-000014	Masimo SpO2 Connector kit
3202718-016	40402-000003	Therapy PCB (with pacing) kit
3202718-017	40402-000004	Therapy PCB (without pacing) kit
3202718-018	40402-000005	System PCB kit
3202718-019	40402-000006	OEM PCB kit

(Continued on next page)

Service Replacement Kits *(continued)*

Kit MIN	CAT.	Part Description
3202718-020	40402-000007	Patient Parameter PCB kit
3202718-021	40402-000017	Boardstack kit
3202718-022	40402-000018	Power Module kit, **LIFEPAK 20e**
3202718-023	40402-000019	SpO2 Module, w/Nellcor S/W kit, **LIFEPAK 20e**
3202718-024	40402-000020	Capacitor Bracket kit
3202718-025	40402-000021	HV Capacitor kit
3202718-026	40402-000022	Therapy Connector kit

Service Replacement Kits *(continued)*

Top Case Handle Kit
MIN **3202718-000**

Item	Quantity	MIN	CAT.	Part Description
2	1	3200631-000	21300-004611	Top case handle
167	2	202253-592	21300-005334	Machine screw 6-32 x 1.75L
169	2	202253-570	21300-001032	Machine screw 6-32 x .375L

Front Case Kit
MIN **3202718-001**

Item	Quantity	MIN	CAT.	Part Description
9	1	3200624-008	21300-004223	Front case
19	1	3200638-001	21300-004837	Cover plate, door
37	1	3200637-001	21300-004836	Door hinge plate
43	1	3200913-002	21300-004233	Display Lens
167	4	202253-592	21300-005334	Machine screw 6-32 x 1.75L
169	2	202253-570	21300-001032	Machine screw 6-32 x .375L
201	1	3201111-003	21300-004241	Thermally conductive backlight inverter pad

(Continued on next page)

Service Replacement Kits *(continued)*

User Interface PCB Kit
MIN **3202718-007**

Item	Quantity	MIN	CAT.	Part Description
A05	1	3201966-005	21330-001034	User Interface PCB
W15	1	3200995-000	21300-004805	Active Display Cable
240	1	804447-041	21300-004807	Foam spacer

Active Display/Lens Kit
MIN **3202718-008**

Item	Quantity	MIN	CAT.	Part Description
A11	1	3205278-001	21300-006174	Active Color LCD Display
W15	1	3200995-000	21300-004805	Active Display Cable
43	1	3200913-002	21300-004233	Display lens
173	4	202253-761	21300-001038	Screws 4-40 x 0.312
266	1	3205497-308	21300-006141	Nylon snap rivet

(Continued on next page)

Service Replacement Kits *(continued)*

Active Display Bracket/ Backlight Inverter Kit MIN **3202718-009**

Item	Quantity	MIN	CAT.	Part Description
A08	1	3202033-500	21300-004213	Backlight Inverter
W17	1	3200996-002	21300-004237	Active Backlight Inverter Cable
47	1	3200640-015	21300-004838	Active Display Bracket
203	1	3202018-000	21300-004250	Extender cable (for Sanyo display devices)

Power Module Kit, LIFEPAK 20 MIN **3202718-010**

Item	Quantity	MIN	CAT.	Part Description
A03	1	3202131-004	21330-001040	Power Supply module

(Continued on next page)

Service Replacement Kits *(continued)*

Masimo SpO2 Connector Kit
MIN **3202718-013**

Item	Quantity	MIN	CAT.	Part Description
W05	1	3200925-005	21300-004234	SpO2 Flex Assembly
113	1	3200921-000	21300-004602	SpO2 connector mounting clip

Therapy PCB (with Pacing) Kit
MIN **3202718-016**

Item	Quantity	MIN	CAT.	Part Description
A04	1	3202611-000	21330-001042	Therapy PCB with pacing, Programmed
123	5	3201374-010	21300-004242	ISO mount, Therapy
147	1	3201111-000	21300-007457	Thermally conductive pad

(Continued on next page)

Service Replacement Kits *(continued)*

Therapy PCB (without Pacing) Kit
MIN **3202718-017**

Item	Quantity	MIN	CAT.	Part Description
A04	1	3202611-001	21330-001041	Therapy PCB without pacing, Programmed
123	5	3201374-010	21300-004242	ISO mount, Therapy
147	1	3201111-000	21300-007457	Thermally conductive pad

System PCB Kit
MIN **3202718-018**

Item	Quantity	MIN	CAT.	Part Description
A01	1	3201964-010	21330-001033	System Controller PCB
265	1	3201374-009	21300-005578	ISO mount, System Controller
125	1	202253-772	21300-006430	Screw 4-40 × 1.000L
135	1	3201007-002	21300-004704	Boardstack connector

(Continued on next page)

Service Replacement Kits *(continued)*

OEM PCB Kit
MIN **3202718-019**

Item	Quantity	MIN	CAT.	Part Description
A06	1	3202622-000	21330-001044	OEM PCB
252	1	201874-270	21300-000926	Machine screw SEMS 4-40 x .312L
255	1	3202489-031	21300-005120	Screw-Cap, Hex,4-40 x .312 Nylon

Patient Parameter PCB Kit MIN **3202718-020**

Item	Quantity	MIN	CAT.	Part Description
A02	1	3202680-000	21330-001055	Patient Parameter PCB
125	1	202253-772	21300-006430	Screw 4-40 × 1.000L

(Continued on next page)

Service Replacement Kits *(continued)*

Boardstack Kit
MIN **3202718-021**

Item	Quantity	MIN	CAT.	Part Description
125	1	202253-772	21300-006430	Screw 4-40 × 1.000L
127	1	3200927-006	21300-004236	Boardstack shield
129	5	3201375-006	21300-004815	Standoff-M/M .250 hex, .375
149	3	3201374-011	21300-004243	ISO mount, OEM
173	2	202253-761	21300-001038	Screw, 4-40 x 0.312L
252	5	201874-270	21300-000926	Machine screw SEMS 4-40 x .312L
258	1	3201374-012	21300-005187	ISO mount, Parameter
262	1	3203897-000	21300-006038	Nomex shield
264	2	200804-102	21300-000580	Washer, .125ID, .312D
278	1	3206405-000	21300-006593	Shield - EMI, PCB Stack

(Continued on next page)

Service Replacement Kits *(continued)*

Power Module Kit, LIFEPAK 20e
MIN **3202718-022**

Item	Quantity	MIN	CAT.	Part Description
A03	1	3202131-006	21330-001186	Power Supply module
W08	1	3206579-001	21330-001166	Battery Cable
W10	1	3206857-000	21330-001165	Power/Therapy Cable
W11	1	3201997-506	21330-007072	ECG Sync/System Cables
W13	1	3206469-003	21330-001164	AC Power Cable

SpO2 Module, w/ Nellcor S/W kit, LIFEPAK 20e
MIN **3202718-023**

Item	Quantity	MIN	CAT.	Part Description
A10	1	3206274-002	21300-007444	Masimo MS-11 SpO2 module
286	N/A	3207319-000	N/A	Software load, Dual-flash

(Continued on next page)

Service Replacement Kits *(continued)*

Capacitor Bracket Kit
MIN **3202718-024**

Item	Quantity	MIN	CAT.	Part Description
95	2	3200922-000	21300-004619	Capacitor Support Bracket
173	4	202253-761	21300-001038	Screw, 4-40 x 0.312L
238	1	3206900-001	21300-006962	Dielectric shield
22	2	3202228-562	21300-003883	Standoff, .188 hex, .562L

Capacitor Kit
MIN **3202718-025**

Item	Quantity	MIN	CAT.	Part Description
A13	1	3200846-002	21300-004232	Energy Storage Capacitor
W07	1	3202383-001	21300-004307	Capacitor Discharge Cable
93	2	804447-36	21300-007458	Foam spacer
162	1	3009787-003	21300-004110	Capacitor dielectric shield
229	1	200536-001	21300-000499	Cable tie retainer
240	1	804447-041	21300-004807	Foam, Capacitor end
260	1	3202773-000	21300-005068	Inductive Resistor Assy.
kit	1	3202718-011	40402-000012	Capacitor bracket kit

(Continued on next page)

Service Replacement Kits *(continued)*

Therapy Connector Kit
MIN **3202718-026**

Item	Quantity	MIN	CAT.	Part Description
W01	1	3200474-008	21300-007366	Therapy Connector Assembly
111	1	200040-001	21300-000149	Therapy retaining ring
268	1	3203445-001	21300-005784	Seal, therapy connector

Software Replacement and Device Upgrades

The device 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

CAUTION!

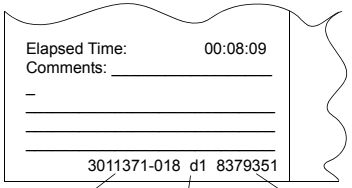
Possible inoperable device. The configuration data is critical for proper operation of the device. If the device configuration data is lost, the device CANNOT BE USED. Contact factory support if you lose this data.

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 component that is powered by a coin cell battery located on the A01 System PCB. If this coin cell battery is improperly replaced or is dead, the device configuration data will be lost.

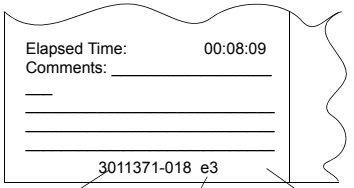
To check if your device has lost the configuration data information, turn on the device and press CODE SUMMARY. A device that has lost configuration data will not display a serial number on the CODE SUMMARY report printout and may also list an incorrect device profile.

Verifying the Device Configuration Data *(continued)*

Device with correct configuration data



Device with incorrect configuration data

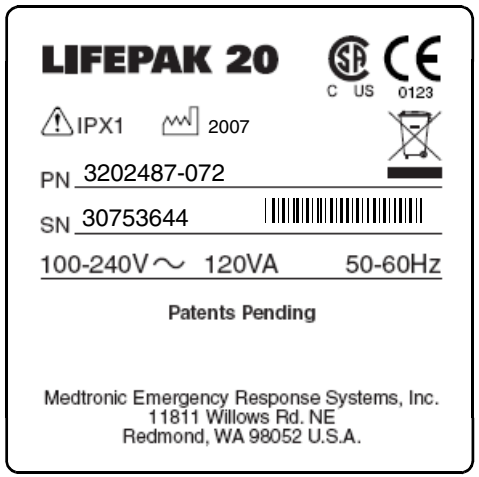


The device configuration data may be loaded only by authorized Medtronic personnel. Contact your local Medtronic representative for assistance.

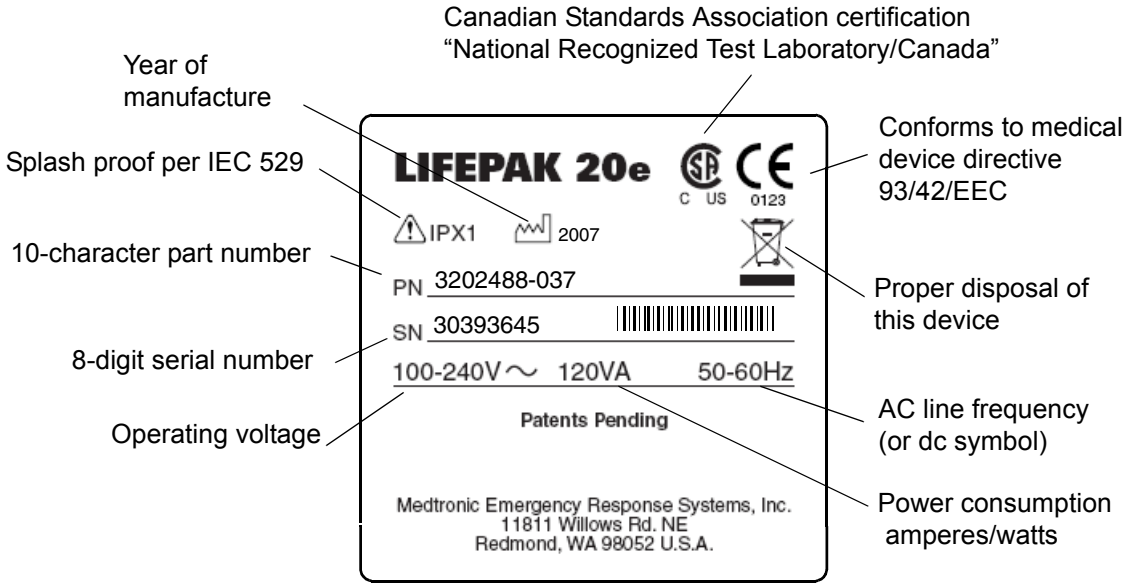
Device Part Number and Serial Number

PN and SN Label

The device serial number (SN) and part number (PN) are noted on a label on the bottom of the device.



3201643-007



3201643-010

Device Part Number and Serial Number *(continued)*

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 device is related to the sales order created during device manufacturing and appears on the serial number label on the bottom of the device. Use this number when calling to order parts.

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, MINs (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 manufacturing date is available for viewing by accessing the **Device Log**.

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 device.

Index

A

B

C

D

E

Q

R

S

T

LIFEPAK 20/20e 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	❒	❒	❒	

Testing		Pass	Fail	NA	Comments
1	Power On				
	a. Confirm the Service indicator is off.	❒	❒	❒	
	b. Confirm the device completes the Power On sequence.	❒	❒	❒	
2	Date and Time				
	Check/set date and time	❒	❒	❒	
3	Record Operating Data [optional]				

360J shocks		Power Cycle Count	
225 – 325J shocks		Pacing Count (if installed)	
100 – 200J shocks		Shock Count	
0 – 70J shocks		Power On Time	
		Printer On Time	
		SpO2 Operating Time (if installed)	
Total Shocks			

4	Contrast Test [optional test]	❒	❒	❒	
5	Pixel Test [optional test]	❒	❒	❒	
6	Keypads Confirm all control text boxes are highlighted.	❒	❒	❒	
7	Printer Confirm printed test strip and CHECK PRINTER message.	❒	❒	❒	
8	Audio Confirm voice messages and tones are clear and not distorted.	❒	❒	❒	
9	ECG Lead Characteristics				
	a. Confirm leads off screen messages.	❒	❒	❒	
	b. Record 5-lead ECG gain (tolerance 36 to 44 mm).	Amplitude: _____ mm			
		Amplitude: _____ mm			
		Amplitude: _____ mm			
		Amplitude: _____ mm			5-Lead only
		Amplitude: _____ mm			5-Lead only
10	Oximeter [if SpO2 option is installed] Confirm SpO2 reading is between 90% and 100%.	❒	❒	❒	
11	Therapy Impedance Sense				
	a. Confirm display of PADDLES LEADS OFF message. [248 ohms]	❒	❒	❒	
	b. Confirm no display of PADDLES LEADS OFF message. [182 ohms]	❒	❒	❒	

Testing *(continued)*		Pass	Fail	NA	Comments
12	Therapy User Test Confirm Device passes User Test	❒	❒	❒	
13	Therapy Delivered Energy Record Sync Rwave (maximum 60 ms):	Sync: _____ ms			
	2 J – Record delivered energy (tolerance 1.0 to 3.0 J).	Energy Level: _____ J			
	70 J – Record delivered energy (tolerance 65.1 to 74.9 J).	Energy Level: _____ J			
	360 J– Record delivered energy (tolerance 334.8 to 385.2 J).	Energy Level: _____ J			
14	Therapy ECG Characteristics Record ECG gain (tolerance 36 to 44 mm; 38 to 50 mm with QED 6).	Amplitude: _____ mm			
	AED / Manual modes	❒	❒	❒	
15	Therapy Remote Sync Test Remote Sync: .Sync LED is flashing	❒	❒	❒	
	Correct response to energy transfer	❒	❒	❒	
16	Pacer Option Characteristics [If Pacer option is installed]				
	a. Confirm leads off detection.	❒	❒	❒	
	b. 10 ma – Record current (tolerance 5 to 15 ma).	Current Level: ____ ma			
	100 ma – Record current (tolerance 95 to 105 ma).	Current Level: ____ ma			
	200 ma – Record current (tolerance 190 to 210 ma).	Current Level: ____ ma			
	c. Record pulse width (tolerance 19.0 to 21.0 ms).	Pulse Width: _____ ms			
17	ECG Analog Output [opional test] Record signal amplitude (tolerance 0.85 to 1.15 Vp-p).	Amplitude: _____ Vp-p			
18	Ground Resistance Test	❒	❒	❒	
19	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.	❒	❒	❒	
20	Earth Leakage Current				
	a. Neutral Closed, Polarity Normal, Earth.	❒	❒	❒	
	b. Neutral Closed, Polarity Reversed , Earth.	❒	❒	❒	
	c. Neutral Open, Polarity Normal, Earth.	❒	❒	❒	
	d. Neutral Open, Polarity Reversed, Earth.	❒	❒	❒	
21	ECG Lead Leakage Current				
	a. Neutral Closed, Polarity Normal, Lead-Gnd, Normal.	❒	❒	❒	
	b. Neutral Closed, Polarity Normal, Lead-Gnd, Fault.	❒	❒	❒	
	c. Neutral Closed, Polarity Reversed, Lead-Gnd, Normal.	❒	❒	❒	
	d. Neutral Closed, Polarity Reversed, Lead-Gnd, Fault.	❒	❒	❒	
	e. Neutral Closed, Polarity Normal, Lead-Lead, Normal.	❒	❒	❒	
	f. Neutral Closed, Polarity Normal, Lead-Lead, Fault.	❒	❒	❒	
	g. Neutral Closed, Polarity Reversed, Lead-Lead, Normal.	❒	❒	❒	
	h. Neutral Closed, Polarity Reversed, Lead-Lead, Fault.	❒	❒	❒	
	i. Neutral Closed, Polarity Normal, Lead Iso.	❒	❒	❒	

Testing *(continued)*	**Pass**	**Fail**	**NA**	**Comments**
22 SpO2 Leakage Current [If SpO2 option is installed]				
a. Neutral Closed, Polarity Normal, Lead-Gnd, Normal.	❒	❒	❒	
b. Neutral Closed, Polarity Normal, Lead-Gnd, Fault.	❒	❒	❒	
c. Neutral Closed, Polarity Reversed, Lead-Gnd, Normal.	❒	❒	❒	
d. Neutral Closed, Polarity Reversed, Lead-Gnd, Fault.	❒	❒	❒	
e. Neutral Closed, Polarity Normal, Lead Iso.	❒	❒	❒	
23 Therapy Leakage Current				
a. Neutral Closed, Polarity Normal, Lead-Gnd, Normal.	❒	❒	❒	
b. Neutral Closed, Polarity Normal, Lead-Gnd, Fault.	❒	❒	❒	
c. Neutral Closed, Polarity Reversed, Lead-Gnd, Normal.	❒	❒	❒	
d. Neutral Closed, Polarity Reversed, Lead-Gnd, Fault.	❒	❒	❒	
e. Neutral Closed, Polarity Normal, Lead-Lead, Normal.	❒	❒	❒	
f. Neutral Closed, Polarity Normal, Lead-Lead, Fault.	❒	❒	❒	
g. Neutral Closed, Polarity Reversed, Lead-Lead, Normal.	❒	❒	❒	
h. Neutral Closed, Polarity Reversed, Lead-Lead, Fault.	❒	❒	❒	
i. Neutral Closed, Polarity Normal, Lead Iso.	❒	❒	❒	