

AED Pro® Service Manual

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Preface

ZOLL Medical Corporation provides this manual for technicians who service the AED Pro[®] device or diagnose malfunctions. This manual contains the following sections:

Preface — Provides safety warnings and an overview of the manual's contents. Review this section thoroughly before servicing an AED Pro unit.

Chapter 1, "Maintenance Tests" — Provides the recommended procedures for evaluating the condition and performance of an AED Pro unit.

Chapter 2, "Troubleshooting" — Describes possible problems and solutions and lists the error log messages that indicate the unit requires technical service.

Appendix A, "Maintenance Tests Checklist" — Provides a checklist for recording the results of maintenance tests.

Note: The AED Pro contains no user-replaceable parts.

Related Documentation

In addition to this service manual, the following manuals are available for the AED Pro unit:

- *AED Pro Operator's Guide* (9650-0350-01) Describes the device and its controls, the clinical modes of operation, and nonclinical functions.
- AED Pro Simulator Operator's Guide (9651-0801-01) Describes the AED Pro simulator, which you can use to test the AED Pro unit's response to various simulated cardiac rhythms.

Conventions

This manual uses uppercase italics for messages that are voiced or displayed on the screen (for example, *DON'T TOUCH PATIENT, ANALYZING*).

Within text, the names and labels for physical buttons and softkeys appear in **boldface** type (for example, "Press the **Shock** button or the **DISARM** softkey.")

Within test or troubleshooting procedures, this symbol indicates an audible prompt or message; for example:

◀ START CPR

WARNING! Warning statements alert you to conditions or actions that can result in personal injury or death.

Caution Caution statements alert you to conditions or actions that can result in damage to the unit.

Symbols

The following symbols might appear in this document or on the equipment:

Symbol	Description
- ★ -	Defibrillation-proof type BF equipment.
	Attention, consult accompanying documents.
4	Dangerous voltage
CE	Conformité Européenne — Complies with medical device directive 93/42/EEC.
	Keep away from open flame and high heat.
${}^{}$	Do not open, disassemble, or intentionally damage.
\bigotimes	Do not crush.
	Nonrechargeable battery.
RECYCLE Pb	Contains lead. Recycle or dispose of properly.
RECYCLE LI-ION	Contains lithium. Recycle or dispose of properly.
	Do not discard in trash. Recycle or dispose of properly.

	Manufacturer.
EC REP	Authorized representative in the European Community.
SN	Serial Number.
REF	Catalogue number.
i	Consult instructions for use.
	Waste Electrical and Electronic Equipment

Warranty

For warranty information, refer to the AED Pro Operator's Guide.

To maintain the warranty, strictly follow the instructions and procedures in this service manual. Unit failure that is attributable to the use of accessories that are not manufactured by ZOLL might void the ZOLL warranty.

Safety Considerations

Only qualified personnel should service or disassemble an AED Pro unit. Before using, servicing, or disassembling this device, read the *AED Pro Operator's Guide*. Before servicing or disassembling any equipment, review these safety considerations and read this manual carefully.

WARNING! The AED Pro unit can generate as much as 2500 volts with sufficient current to cause lethal shocks.

Before discharging the defibrillator, warn everyone to stand clear of the patient and equipment.

Never discharge the unit with the defibrillation pads shorted together or in open air.

Do not disassemble a battery pack or dispose of it in fire. Do not try to recharge a nonrechargeable battery pack. If mistreated, a battery pack might explode.

This device is protected against interference from radio frequency emissions typical of the two-way radios and cellular telephones used in emergency service or public safety activities. You should assess the device's performance in your typical operating environment to determine the likelihood of radio frequency interference (RFI) from high-power sources.

Technical Service

If the AED Pro unit requires service, contact the ZOLL Technical Service Department.

Telephone:	1-800-348-9011 (U.S.A. customers only)
	1-978-421-9655
Fax:	1-978-421-0010

When requesting service, please provide the following information to the service representative:

- Unit serial number
- Description of the problem
- Department using the equipment and the name of the person to contact
- Purchase order to allow tracking of loan equipment
- Purchase order for a unit with an expired warranty

Returning a Unit for Service

Before sending a unit to the ZOLL Technical Service Department for repair, obtain a service request (SR) number from the service representative.

Remove the battery pack from the unit. Pack the unit with its cables in the original containers (if available) or equivalent packaging. Be sure the assigned service request number appears on each package.

For customers	Return the unit to
In the U.S.A.	ZOLL Medical Corporation 269 Mill Road Chelmsford, MA 01824-4105
	Attention: Technical Service Dept. [SR number]
	Telephone: 1-800-348-9011

(continued)

For customers	Return the unit to
In Canada	ZOLL Medical Canada Inc. 1750 Sismet Road, Unit #1 Mississauga, Ontario L4W 1R6
	Attention: Technical Service Department (SR number)
	Telephone: 1-866-442-1011
In other locations	The nearest authorized ZOLL Medical Corporation representative.
	To locate an authorized service center, contact the International Customer Service at
	ZOLL Medical Corporation 269 Mill Road Chelmsford, MA 01824-4105
	Telephone: 1-978-421-9655

Chapter 1 Maintenance Tests

This chapter describes the procedures for routine testing of the AED Pro[®] unit.

A test typically consists of multiple steps, each of which requires a pass/fail rating. For each step, perform the specified action and then verify that the expected results occur. If all expected results occur, assign a "Pass" rating to the step; otherwise, assign it a "Fail" rating.

This chapter includes the following inspection and test procedures:

- "1.0 Physical Inspection" on page 1-3
- "2.0 Power Supply Test/Current" on page 1-4
- "3.0 Power ON Test" on page 1-5
- "4.0 Pediatric Mode/Electrode Connector Type Test" on page 1-6
- "5.0 Defibrillator Energy Test" on page 1-7
- "6.0 Battery Type Test" on page 1-9
- "7.0 Establish Communication" on page 1-10
- "8.0 Internal Discharge Test" on page 1-11
- "9.0 Patient Impedance Calibration" on page 1-13
- "10.0 ECG Lead-Off Detection" on page 1-15
- "11.0 ECG Offset Calibration" on page 1-16
- "12.0 Real Time Clock Test" on page 1-18
- "13.0 Write Calibration to Flash" on page 1-20
- "14.0 Audio Recording Test (if option installed)" on page 1-21
- "15.0 Read Error Log Final" on page 1-22

Preparations for Testing

- Gather the required equipment listed in the next section.
- Perform all the steps within each test procedure in the order specified.

If testing results indicate that the battery pack must be replaced, you will need a fully charged spare battery pack.

Test Equipment

For some tests, you need one or more of these items:

- ZOLL defibrillation analyzer (universal) adapter cable (8000-0804-01)
- Defibrillator Analyzer (e.g. QED 6) or Fluke Impulse 4000 Defibrillator/Pacer Performance Analyzer (Fluke Biomedical/ DNI Nevada) with 1.06 software or higher
- Battery Current Test Fixture (P/N 9100-0690-TF),
- Power Supply 12V 10A,
- AED Plus[®], Quick-Test, Test Fixture (P/N 9100-0567-TF)
- DMM (e.g. Agilent 34401A Digital Multimeter) or equivalent.
- AED Pro Disposable Battery (P/N 1008-002003-01)
- SurePower[®] Rechargeable Li-Ion Battery (P?N 1009-001535-03)
- PC with ZOLL RescueNet[®] Code Review and ZAS (ZOLL Administration Software, P/N 7771-000012-01),
- ZOLL USB IrDA port (P/N 9355-0807).
- PC with AED Plus/PRO DCI Panel software (P/N 9103-0815-SW),
- AED Pro Resistance, Decade Box (P/N 9100-000957-TF) or equivalent (e.g.RS-200 Resistance Substituter).
- ZOLL 3-lead ECG cable (8000-0838 or 9500-001802)
- USB Flash Drive (P/N 8000-000474),

For ZOLL part numbers, refer to the accessories list in the AED Pro Operator's Guide.

1.0 Physical Inspection

Use this procedure to ensure that the unit shows no signs of damage or excessive wear.

Tools Needed

None.

Test Setup

None.

Test Procedure

Observ	e the following:	Pass	Fail
1.1	Is the unit clean and undamaged?		
1.2	Are all signs of wear reasonable and not excessive?		
1.3	Are the front panel and housing undamaged and free of cracks?		
1.4	Are input connectors clean and undamaged?		
1.5	Are all cables free of cracks, cuts, exposed or broken wires? Are the pads sealed within the packaging? If you are using an AED Pro 3-lead cable, is it free of cuts or other?		
1.6	Verify that the electrodes have not expired?		
1.7	Is battery housing free of cracks and damage?		

2.0 Power Supply Test/Current

Equipment Needed

- Battery Current Test Fixture (P/N 9100-0690-TF),
- Power Supply 12V 10A,
- DMM (e.g. Agilent 34401A Digital Multimeter) or equivalent,
- AED PLUS, Quick-Test, Test Fixture (P/N 9100-0567-TF).

- Install the Battery Current Test Fixture (P/N 9100-0690-TF) into the battery well.
- On the DMM, set Function to DC Amps by pressing *Shift* button then the *DC I* button.
- Connect the RED lead from the *I* jack of the DMM to one of the Meter Leads on the Battery Current Test Fixture (P/N 9100-0690-TF).
- Connect the BLACK lead from the *LO* jack (located above the *I* jack) of the DMM to the other Meter Leads on the Battery Current Test Fixture (P/N 9100-0690-TF).
- Connect the power supply RED and BLACK leads, respectively into the Power Supply posts on the Battery Current Test Fixture (P/N 9100-0690-TF).
- Connect AED PLUS Quick-Test Test Fixture (P/N 9100-0567-TF) to the unit.
- Set the Power Supply to 12.00V.

Test	Action	Expected Result(s)	Pass	Fail
2.1	Turn the Power Supply on.	Verify the unit issues a voice and text prompt UNIT OK , and the unit is turned off.		
2.2	Press the I Measure switch on the Battery Current Test Fixture.	Observe the current measurement on the Digital Multimeter is between 10uA to 70uA.		
2.3	Press and release the On/Off button.	Verify that the unit powers on in rescue mode. Wait for the following prompts are given: ADULT PADS, DONT'T TOUCH PATIENT ANALYZING before taking measurement.		
2.4	Press the I Measure switch on the Battery Current Test Fixture.	Observe the current measurement on the Digital Multimeter is between 0.1A to 0.4A.		
2.5	Press and hold the On/Off button to power off the unit.	Verify unit displays UNIT POWERING OFF message.		

3.0 Power ON Test

Equipment Needed

- Power Supply 12V 10A,
- AED PLUS, Quick-Test, Test Fixture (P/N 9100-0567-TF),
- Battery Current Test Fixture (P/N 9100-0690-TF) or AED Pro Disposable Battery (P/N 1008-002003-01).

Setup

• Connect AED PLUS Quick-Test Test Fixture (P/N 9100-0567-TF) to the unit.

Test	Action	Expected Result(s)	Pass	Fail
3.1	Place the AED Pro Battery in the battery well (then turn on the Power Supply if Battery Current Test Fixture is used)	Initial Power up. Unit will turn off by itself after UNIT OK prompt.		
3.2	Press and hold the On/Off button for at least 7 seconds, then release it.	Within 10 seconds after the unit is turned on, the Ready For Us indicator displays a green Check. Indicating the unit is ready for use. A red "X" indicates the unit is not ready for use.		

4.0 Pediatric Mode/Electrode Connector Type Test

Equipment Needed:

- Power Supply 12V 10A,
- Battery Current Test Fixture (P/N 9100-0690-TF) or AED PRO Disposable Battery (P/N 1008-002003-01) or SurePower Rechargeable Li-Ion Battery (P/N 1009-001535-03),
- AED PLUS, Quick-Test, Test Fixture (P/N 9100-0567-TF),
- Defibrillator Analyzer (e.g. QED-6 or Impulse 4000) or equivalent.

- Connect the HV Connector Cable of the AED PLUS Quick-Test Test Fixture (P/N 9100-0567-TF) to the Defibrillator Analyzer and set waveform to VFIB.
- Set the AED PLUS Quick-Test Test Fixture (P/N 9100-0567-TF) to Pediatric Mode.
- Set the Power Supply to 12.00V then turn it off.
- **Note:** *Test values below are based on the default pediatric energy settings (50, 70, and 85 Joules) into a 50 ohm load.*

Test	Action	Expected Result(s)	Pass	Fail
4.1	Connect the Simulator Cable to the device, and then turn the Power Supply on.	Verify the unit issues a voice and text prompt UNIT OK,		
4.2	Press the On/Off button and release it.	Verify that the following prompts are given: PEDIATRIC PADS, DON'T TOUCH PATIENT ANALYZING, followed by SHOCK ADVISED, DON'T TOUCH PATIENT, and PRESS FLASHING SHOCK BUTTON.		
4.3	Press Flashing Shock button.	Verify that unit prompts SHOCK DELIVERED .		
4.4	1 st shock energy test (default value 50 joules).	Verify the Energy delivered into analyzer is 43 joules to 59 joules.		
4.5	Press and hold the On/Off button to power off the unit.	Verify unit displays <i>UNIT</i> <i>POWERING OFF</i> message.		

5.0 Defibrillator Energy Test

Equipment Needed:

- Power Supply 12V 10A, Battery Current Test Fixture (P/N 9100-0690-TF) or AED PRO Disposable Battery (P/N 1008-002003-01),
- AED PLUS Quick-Test Test Fixture (P/N 9100-0567-TF),
- Defibrillator Analyzer (e.g. QED-6 or Impulse 4000) or equivalent.

- Connect the HV Connector Cable of the AED PLUS Quick-Test Test Fixture (P/N 9100-0567-TF) to the Defibrillator Analyzer.
- Set the AED PLUS Quick-Test Test Fixture (P/N 9100-0567-TF) to Defib Mode.
- Set the Power Supply to 12.00V.
- **Note:** Test values below are based of the default adult energy settings (120, 150, and 200 Joules) into a 50 ohm load.

Test	Action	Expected Result(s)	Pass	Fail
5.1	Disconnect the Simulator Cable from the device, and then turn the Power Supply on.	Verify that the following prompts are given: PLUG IN CABLE, PLUG IN CABLE.		
5.2	Re-connect the Simulator Cable to the device.	Verify that unit voice prompts ADULT PAD followed by UNIT OK before unit shuts off by itself.		
5.3	Press the On/Off button and release it.	Verify that the following prompts are given: ADULT PADS, DON'T TOUCH PATIENT ANALYZING, followed by "SHOCK ADVISED, "DON'T TOUCH PATIENT, PRESS FLASHING SHOCK BUTTON.		
5.4	Press Flashing Shock button	Verify that unit prompts SHOCK DELIVERED.		
5.5	1 st shock energy test (default value 120 joules)	Verify the Energy delivered into analyzer is 105 joules to 143 joules.		
5.6		Verify the unit prompts START CPR followed by CONTINUE CPR.		

5.7	Press VFIB on the Defibrillator Analyzer.	After 2 minutes (default setting), Verify the unit prompts STOP CPR , followed by DON'T TOUCH PATIENT ANALYZING twice, followed by SHOCK ADVISED, DON'T TOUCH PATIENT, PRESS FLASHING SHOCK BUTTON.	
5.8	Press Flashing Shock button	Verify that unit prompts SHOCK DELIVERED.	
5.9	2 nd shock energy test (default value 150 joules)	Verify the Energy delivered into analyzer is 122 joules to 166 joules.	
5.10		Verify the unit prompts START CPR , followed by CONTINUE CPR .	
5.11	Press VFIB on the Defibrillator Analyzer.	After 2 minutes (default setting), Verify the unit prompts STOP CPR, followed by DON'T TOUCH PATIENT ANALYZING twice, followed by SHOCK ADVISED, DON'T TOUCH PATIENT, PRESS FLASHING SHOCK BUTTON.	
5.12	Press Flashing Shock button	Verify that unit prompts SHOCK DELIVERED.	
5.13	3 rd shock energy test (default value 200 joules)	Verify the Energy delivered into analyzer is 155 joules to 211 joules.	
5.14	Press and hold the On/Off button to power off the unit.	Verify unit displays <i>UNIT</i> <i>POWERING OFF</i> message.	

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6.0 Battery Type Test

Equipment Needed:

- SurePower Rechargeable Li-Ion Battery (P/N 1009-001535-03),
- AED PRO Disposable Battery (P/N 1008-002003-01),
- AED PLUS, Quick-Test, Test Fixture (P/N 9100-0567-TF),
- Defibrillator Analyzer (e.g. QED-6 or Impulse 4000) or equivalent.

- Connect the HV Connector Cable of the AED PLUS Quick-Test Test Fixture (P/N 9100-0567-TF) to the Defibrillator Analyzer.
- Connect AED PLUS Quick-Test Test Fixture (P/N 9100-0567-TF) to the unit.

Test	Action	Expected Result(s)	Pass	Fail
6.1	Insert the SurePower Rechargeable Li-Ion Battery into the device (battery well).	Verify BATTERY INSERTION TEST appears on the display screen of the device.		
6.2		Verify the unit issues a voice and text prompt UNIT OK and the Green Check symbol is displayed in the Ready Indicator before unit shuts off by itself.		
6.3	Remove Battery.	Verify the Green Check switches to a Red X symbol in the Ready Indicator.		
6.4	Insert the AED PRO Disposable Battery into the device (well).	Verify BATTERY INSERTION TEST appears on the display screen of the device.		
6.5		Verify the unit issues a voice and text prompt: IF NEW BATTERY PRESS LEFT SOFT KEY and the Green Check symbol is displayed in the Ready Indicator, followed by UNIT OK after 20 seconds before unit shuts off by itself.		
6.6	Remove Battery.	Verify the Green Check switches to a Red X symbol in the Ready Indicator.		

7.0 Establish Communication

Equipment Needed:

- Power Supply 12V 10A,
- Battery Current Test Fixture (P/N 9100-0690-TF) or AED PRO Disposable Battery (P/N 1008-002003-01),
- AED PLUS Quick-Test Test Fixture (P/N 9100-0567-TF),
- Defibrillator Analyzer (e.g. QED-6 or Impulse 4000) or equivalent,
- PC with ZOLL RescueNet Code Review and ZAS (ZOLL Administration Software, P/N 7771-000012-01),
- ZOLL USB IrDA port (P/N 9355-0807).

- Start the ZAS on the computer; make sure the connection is established before starting the AED Pro unit.
- Note: For best transmission results, the ZOLL USB IrDA port (P/N 9355-0807) must be facing the IrDA port of the unit with a clear 10 to 18-inch line-of-sight.
- Connect AED PLUS Quick-Test Test Fixture (P/N 9100-0567-TF) to the unit.

Test	Action	Expected Result(s)	Pass	Fail
7.1	If the unit is on, press the On/Of button for 1 second to turn off the unit.	Unit powers off.		
7.2	Press and hold the On/Off button for at least 7 seconds, then release it.	The AED Pro unit establishes contact with the Computer within 5 seconds and the unit issues the voice and text prompt message NON RESCUE MODE, COMMUNICATION ESTABLISHED.		

8.0 Internal Discharge Test

Equipment Needed

- Power Supply 12V 10A,
- Battery Current Test Fixture (P/N 9100-0690-TF) or AED PRO Disposable Battery (P/N 1008-002003-01),
- AED PLUS Quick-Test Test Fixture (P/N 9100-0567-TF),
- Defibrillator Analyzer (e.g. QED-6 or Impulse 4000) or equivalent.

- Connect the HV Connector Cable of the AED PLUS Quick-Test Test Fixture (P/N 9100-0567-TF) to the Defibrillator Analyzer and set waveform to VFIB.
- Connect AED PLUS Quick-Test Test Fixture (P/N 9100-0567-TF) to the unit.

Test	Action	Expected Result(s)	Pass	Fail
8.1	Disconnect the Simulator Cable from the device, and then turn the Power Supply on.	Verify that the following prompt is given: PLUG IN CABLE.		
8.2	Re-connect the Simulator Cable to the device.	Verify that unit voice prompts, ADULT PADS, followed by UNIT OK before unit shuts off by itself.		
8.3	Press the On/Off button and release it.	Verify that the following prompts are given: ADULT PADS, DON'T TOUCH PATIENT ANALYZING, followed by SHOCK ADVISED, DON'T TOUCH PATIENT, PRESS FLASHING SHOCK BUTTON		
8.4	DO NOT press Flashing Shock button.	Verify the ready beep stays steady for 3 seconds approximately and voice prompts again DON'T TOUCH PATIENT, PRESS FLASHING SHOCK BUTTON		
8.5		Verify the ready beep stays steady for 3 seconds approximately and voice prompts again DON'T TOUCH PATIENT, PRESS FLASHING SHOCK BUTTON, followed by 2 beeps		

8.6		Verify the ready beep stays steady for 3 seconds approximately and voice prompts again DON'T TOUCH PATIENT, PRESS FLASHING SHOCK BUTTON, followed by 3 beeps, and then NO SHOCK DELIVERED prompt.	
8.7	Press and hold the On/Off button to power off the unit.	Unit powers off.	

9.0 Patient Impedance Calibration

Equipment Needed

- Power Supply 12V 10A,
- Battery Current Test Fixture (P/N 9100-0690-TF) or AED PRO Disposable Battery (P/N 1008-002003-01),
- AED PLUS Quick-Test Test Fixture (P/N 9100-0567-TF),
- PC with AED PLUS/PRO DCI Panel software (P/N 9103-0815-SW),
- AED PRO Resistance, Decade Box (P/N 9100-000957-TF) or equivalent (e.g.RS-200 Resistance Substituter).

- Power up with IrDA Mode (communication mode).
- Note: For best transmission results, the ZOLL USB IrDA port (P/N 9355-0807) must be facing the IrDa port of the unit with a clear 10 to 18-inch line-of-sight.
- Note: Patient Impedance and ECG Calibration are saved together. To test calibration of both Impedance and ECG offset, select DCI commands: GICAL; GEVOL, 2000; GECAL.
- Connect AED PLUS Quick-Test Test Fixture (P/N 9100-0567-TF) to the unit.
- Connect the Decade Box to the HV Connector Cable of the AED PLUS Quick-Test Test Fixture (P/N 9100-0567-TF) to set the appropriate resistance for Impedance calibration. The decade box can only handle ¹/₄ watt, DO NOT discharge into the box.

Test	Action	Expected Result(s)	Pass	Fail
9.1	Double click on DCI_Panel icon on Desktop. Select AED Pro mode.	Verify the DCI Panel.vi appear screen is displayed.		
9.2	Set Decade Box to 10 Ohms. Select SIL (hi, lo, md) from the 'Command 1' window, enter LO in 'Parm 1 (val)' window and click SEND .	The response will be OK.		
9.3	Set Decade Box to 35 Ohms. Select SIL (hi, lo, md) from the 'Command 1' window, enter MD in 'Parm 1 (val)' window and click SEND .	The response will be OK.		
9.4	Set Decade Box to 300 Ohms. Select SIL (hi, lo, md) from the 'Command 1' window, enter HI in 'Parm 1 (val)' window and click SEND .	The response will be OK.		

9.5	Remove the Decade Box. Select GICAL from 'Command 1' window and click SEND .	The response will be SILLO, SILMED, SILHI. Compare as followed:	
		56 < SILLO< 176 counts (10 Ohms), 134 < SILMD< 321 counts (35 Ohms), 972 < SILHI< 2129 counts (300 Ohms).	
9.6	Select SFCAL from 'Command 1' window and click SEND.	The response will be SFCAL, OK. Note: the Calibration values will go back to default conditions if not saved. Save calibration values. both ECG offset and Impedance must be calibrated.	

10.0 ECG Lead-Off Detection

Equipment Needed

- Power Supply 12V 10A,
- Battery Current Test Fixture (P/N 9100-0690-TF) or AED PRO Disposable Battery (P/N 1008-002003-01),
- Defibrillator Analyzer (e.g. QED-6 or Impulse 4000) or equivalent,
- AED PRO 3-Lead ECG Cable (PN 9500-001802) or (8000-0838).

- Insert the AED PRO 3-Lead ECG Cable into the connector on the AED Pro unit and connect the leads to the Defibrillator Analyzer.
- Set the Defibrillator Analyzer to NSR (normal sinus rhythm).
- Place the Battery Current Test Fixture in the battery well.
- Set the Power Supply to 12.00V.

Test	Action	Expected Result(s)	Pass	Fail
10.1	Turn on the Power Supply.	Verify the unit issues a voice and text prompt UNIT OK before unit shuts off by itself.		
10.2	Turn on the AED Pro unit.	Verify the rhythm is displayed and the unit issues a voice and text prompt ECG MONITORING CABLE.		
10.3	Pull any of the ECG leads from the Analyzer.	Verify that the signal disappears and the unit issues a voice and text prompt CHECK ECG ELECTRODES		
10.4	Press and hold the On/Off button to power off the unit.	Unit powers off.		

11.0 ECG Offset Calibration

Equipment Needed

- Power Supply 12V 10A.
- Battery Current Test Fixture (PN 9100-0690-TF) or Disposable Battery (PN 1008-002003-01),
- AED PLUS Quick-Test Fixture (PN 9100-0567-TF),
- Defibrillator Analyzer(e.g QED-6 or Impulse 4000) or equivalent,
- PC with AED PLUS/PRO DCI Panel software (PN 9103-0815-SW).

- Power up with IrDA Mode (communication mode).
- Note: For best transmission results, the ZOLL USB IrDA port (P/N 9355-0807) must be facing the IrDa port of the unit with a clear 10 to 18-inch line-of-sight.
- Connect AED PLUS Quick-Test Test Fixture (P/N 9100-0567-TF) to the unit.
- Connect AED PLUS Quick-Test Test Fixture (P/N 9100-0567-TF) to the Defibrillator Analyzer.

Test	Action	Expected Result(s)	Pass	Fail
11.1	Set the QED 6 as follow: Select: WAVE , select PERF Select "+" sign 2 times.	The QED 6 will display the following: Performance 10Hz Sin		
11.2	Select from the DCI commander 1: GEVOL Enter 2000 in 'Parm 1 (val)' window, Select from the DCI Commander 2: GECAL (Get ECG Voltage offset level for 2000mS) Click on "Send"	The response will be: GEVOL,XX(VOL) GECAL, XX. This is the current setting of the offset		

11.3	Select from the DCI commander:	The response will be: SECAL, OK	
	SECAL, Enter 0 in 'Parm 1 (val)' window to remove the old offset and resets to zero offset. Click on "Send"		
	Select from the DCI commander 1:		
	GEVOL , Enter 2000 in 'Parm 1 (val)' window. Select from the DCl commander 2: GECAL again to get the new offset value (VOL). Click on "Send"		
	Select from the DCI commander:		
	SECAL, - (VOL) [SECAL, minus (VOL)] to set new ECG offset calibration. ENTER. Click on "Send"		
11.4	Select from the DCI commander 1:	The response will be: GEVOL,0 +/-2.5 counts;	
	GEVOL Enter 2000 in 'Parm 1 (val)' window; Select from the DCI commander 2: GECAL and click on "Send".	GECAL, (new offset #)	
11.5	To save Calibration, Select from the DCI commander: SFCAL	The response will be SFCAL, OK	

12.0 Real Time Clock Test

Equipment Needed

- Power Supply 12V 10A,
- Battery Current Test Fixture (P/N 9100-0690-TF) or AED PRO Disposable Battery (P/N 1008-002003-01),
- AED PLUS Quick-Test Test Fixture (P/N 9100-0567-TF).

- Connect AED PLUS Quick-Test Test Fixture (P/N 9100-0567-TF) to the unit.
- Place the Battery Current Test Fixture (P/N 9100-0690-TF) in the battery well.
- Set the Power Supply to 12.00V.
- Turn on the Power Supply and turn the unit off.
- **Note:** To set the current date and time in the AED pro, make sure you are in Non-Rescue Mode.

Test	Action	Expected Result(s)	Pass	Fail
12.1	Press and hold the On/Off button for at least 7 seconds, then release it.	Verify the unit issues a voice and text prompt UNIT OK,		
12.2	Press SET TIME softkey.	Verify the unit prompts you to set the Year, Month, Day Hour, Minute, and Second. To advance to each subsequent screen, press \rightarrow softkey.		

12.3	SET YEAR: Press the + Softkey to the desired year, using numbers 2000 through 2037. Press the \rightarrow softkey to advance to the next screen. SET MONTH: Press the + Softkey to the desired month, using numbers 01 through 12. SET DAY: Press the + Softkey to the desired day, using numbers 01 through 31. SET HOUR: The AED Pro has a 24-hour clock. Press the + Softkey to the desired hour, using numbers 01 through 24. SET MINUTE: Press the + Softkey to the desired minute, using numbers 00 through 59. SET SECOND: Press the + Softkey to the desired second, using numbers 00 through 59. Press the \rightarrow softkey one more time. Note: You cannot go backwards when scrolling through the numbers.	The unit then displays the selected date and time.	
12.4	Press the left softkey (Enter).	The Text message SAVING DATA appears.	

13.0 Write Calibration to Flash

Equipment Needed

- Power Supply 12V 10A,
- Battery Current Test Fixture (P/N 9100-0690-TF) or AED PRO Disposable Battery (P/N 1008-002003-01),
- USB Flash Drive (P/N 8000-000474),
- AED PLUS, Quick-Test, Test Fixture (P/N 9100-0567-TF).

- Connect AED PLUS Quick-Test Test Fixture (P/N 9100-0567-TF) to the unit.
- Place the in the battery well.
- Set the Power Supply to 12.00V.
- Turn on the Power Supply and turn the unit off.
- **Note:** To download data to a USB device in the AED pro, make sure you are in Non-Rescue Mode.

Test	Action	Expected Result(s)	Pass	Fail
13.1	Press and hold the On/Off button for at least 7 seconds, then release it.	Verify the unit issues a voice and text prompt UNIT OK,		
13.2	Attach a USB device to the port inside the battery compartment, and then press the USB softkey.			
13.3	Press the ALL softkey to download all patient data on the unit.	Verify the unit issues a voice and text prompt USB DEVICE CONNECTED, followed by DOWNLOADING DATA and DATA DOWNLOAD COMPLETE		
13.4		If there is no USB device attached or if the unit fails to establish a connection with the device, the unit issues command INSERT USB DEVICE.		

14.0 Audio Recording Test (if option installed)

Equipment Needed

- Power Supply 12V 10A,
- AED PLUS, Quick-Test, Test Fixture (P/N 9100-0567-TF),
- USB Flash Drive (Clinical Files from previous step),
- PC with RescueNet Code Review.

Setup:

- Connect AED PLUS Quick-Test Test Fixture (P/N 9100-0567-TF) to the unit.
- Place the in the battery well.
- Set the Power Supply to 12.00V.
- Turn on the Power Supply and turn the unit off.

Note: *The AED Pro is capable of recording up to 20 minutes of continuous ECG/Audio recording if Audio Recording is enabled during a rescue.*

Test	Action	Expected Result(s)	Pass	Fail	N/A
14.1	Insert USB Flash Drive containing clinical event data (imported from the AED in USB Test Step) in computer USB Slot. Open file explorer, and select USB Drive	Verify files are present			
14.2	Double-click on desired file and then click Yes on the messaging box	Verify a RecueNet Code Review , Standard Edition screen pops up			
14.3	Select "3-Magnified ECG" from the top of the screen and click on the Play button	Verify that all voice prompts and events from the device itself recorded in the environment can be heard from the PC speaker.			

15.0 Read Error Log - Final

Equipment Needed

- Power Supply 12V 10A,
- Battery Current Test Fixture (P/N 9100-0690-TF) or AED PRO Disposable Battery (P/N 1008-002003-01),
- AED PLUS Quick-Test Test Fixture (P/N 9100-0567-TF),

- Start the ZAS on the computer; make sure the connection is established before starting the AED Pro unit.
- Note: For best transmission results, the ZOLL USB IrDA port (P/N 9355-0807) must be facing the IrDa port of the unit with a clear 10 to 18-inch line-of-sight.
- Connect AED PLUS Quick-Test Test Fixture (P/N 9100-0567-TF) to the unit.

Test	Action	Expected Result(s)	Pass	Fail
15.1	If the unit is on, press the On/Of button for 1 second to turn off the unit	Unit powers off.		
15.2	Press and hold the On/Off button for at least 7 seconds, then release it.	The AED Pro unit establishes contact with the Computer within 5 seconds and the unit issues the voice and text prompt message UNIT OK , followed by NONRESCUE MODE and COMMUNICATION ESTABLISHED		
15.3	Double click on the latest ZAS AED Pro version software icon on Desktop. Click on History and select "upload and display history data from device". Click NEXT and notice "*.CEH	Verify ERROR ID codes and ERROR DESCRIPTIONS.		
	" in the filename box and click SAVE. Click on the ERROR LOG box.			
15.4	Clear Log and Close the AED Pro Error Log box.			

Chapter 2 Troubleshooting

This chapter describes technical issues commonly encountered during routine maintenance or after a malfunction of the AED Pro unit and recommends steps to solve the problem. This chapter also lists AED Pro error log messages that indicate the unit requires technical service.

This chapter contains the following:

- "Troubleshooting the AED Pro Unit" on page 2-2
- "AED Pro Error Log Messages" on page 2-6

If this chapter does not help you resolve the problem, call the ZOLL Technical Service Department for assistance. For contact information, refer to "Technical Service" on page vii.

Troubleshooting the AED Pro Unit

Table 2-1 lists general issues with the unit and their associated corrective action.

First, try the recommendations given under "Operator Action." If these steps do not remedy the problem, follow the suggestions under "Technical Action."

For information on contacting ZOLL Technical Service, refer to page vii.

Table 2-1. General Issues

Symptom	Operator Action	Technical Action
Unit beeps or displays a red "X" while turned off.	— Turn the unit on. Follow the prompts to resolve the problem.	If the beeping continues, take the unit out of service.
		Contact ZOLL Technical Service.
Ready indicator shows a red "X" while the device is	— Turn the unit off and then on again. Follow the prompts to resolve the	If the red "X" remains, take the unit out of service.
powered on.	problem.	Contact ZOLL Technical Service.
Power-on self-test failed.	— Follow the prompts to resolve the problem.	If the unit continues to fail, take it out of service.
		Contact ZOLL Technical Service.
Unexpected shutdown in clinical mode.	Note: In clinical mode, the unit automatically powers off if it does not detect a patient connection within 10 minutes (configurable).	If the unit continues to fail, take it out of service. Contact ZOLL Technical Service.
	— Turn the unit on. Follow the prompts to resolve the problem.	
Unexpected shutdown in nonrescue mode.	Note: The unit automatically powers off if an established IrDA connection is lost.	If the unit still is not ready for use, take it out of service. Contact ZOLL Technical
	 Press and hold the On/Off button for at least 5 seconds. Follow the prompts to resolve the problem. 	Service.
CHANGE BATTERY	— Replace the battery pack with a fully charged battery pack as soon as possible.	None.
	— Ensure that the electrode cable is properly connected to the unit.	None.
	 Remove the cable and check for bent or broken pins. 	
	— Replace the electrode cable.	
ANALYSIS HALTED KEEP PATIENT STILL	— Keep the patient still during ECG analysis. If transporting the patient by stretcher or vehicle, stop all patient movement during ECG analysis.	None.

Symptom	Operator Action	Technical Action
◀ RELEASE SHOCK BUTTON	— Release the Shock button. Wait until the unit issues the prompt <i>PRESS FLASHING SHOCK BUTTON</i> before pressing the button.	None.
◀ PLUG IN DEFIB CABLE	 Note: This prompt appears if an ECG cable is connected, but the unit is not configured for ECG monitoring. — Check the cable and replace if necessary. 	None.
RELEASE LEFT SOFTKEY	— Release the softkey.	None.
or		
RELEASE RIGHT SOFTKEY		

 Table 2-1.
 General Issues (continued)

ECG Monitoring Troubleshooting

Table 2-2 lists common issues with ECG monitoring and their associated corrective action.

 Table 2-2.
 ECG Monitoring Issues

Symptom	Corrective Action
CHECK ECG ELECTRODES	Ensure that the ECG cable is connected to each electrode and to the unit.
ATTACH ECG ELECTRODES	Ensure that the ECG electrodes are making good contact with the patient and are not dried out.
	Replace the ECG electrodes.
	Replace the ECG cable.
Noisy ECG, artifact, or wandering	Turn off nearby two-way radios and cell phones.
baseline.	Before attaching electrodes, properly prepare the patient's skin (refer to the AED Pro Operator's Guide).
	Ensure proper adhesion of the electrodes to the patient.
	Arrange the ECG cable so that it does not pull on any of the electrodes.
Poor ECG signal level.	Replace the ECG electrodes and change their position on the patient.
Irregular heart rate.	Observe the patient's ECG. Verify that the irregular heart rate is not caused by noise, low amplitude R waves, extra-systoles, or arrhythmia.
	Replace the ECG electrodes and change their position on the patient.
	ECG analysis detected a shockable rhythm.
	Replace the ECG electrodes and cable with defibrillation pads to deliver therapy.

Defibrillator Troubleshooting

Table 2-3 lists common issues with defibrillation and their associated corrective action.

Symptom	Corrective Action
Defibrillator does not charge.	(Semiautomatic mode only) The patient's ECG rhythm is not shockable because it is not either ventricular fibrillation (VF) or wide-complex ventricular tachycardia (VT), or is VF with amplitude less than 100 μ V.
	Confirm that the defibrillation cable is plugged in and the pads are attached to the patient.
	Install a fully charged battery pack.
Defibrillator takes more than 15 seconds to charge.	Install a fully charged battery pack.
Energy does not discharge when the Shock button is pressed.	A fully charged defibrillator automatically disarms itself after 60 seconds in manual mode or 30 seconds in semiautomatic mode. Charge the defibrillator again and deliver the shock while the charge-ready tone sounds.
	The Shock button was pressed before the unit was fully charged. Wait for the charge-ready tone and a flashing Shock button before pressing and holding the Shock button.
No apparent energy delivery to patient.	Under certain circumstances, a patient might not display a physical reaction when energy is delivered.
	Replace the electrodes if they are dried out or expired.
	Ensure that the electrodes are making proper contact with the patient's skin.
	Test the defibrillator.
	If the prompt CHECK DEFIB PADS appears, check and correct the attachment or position of the electrodes.
CHECK DEFIB PADS	Ensure that the defibrillation electrode pads are making proper skin contact and that the patient does not have excessive hair beneath electrodes.
	If message persists, change the defibrillation cable.
▲ ANALYSIS HALTED KEEP PATIENT STILL	Check for proper application and adhesion of the defibrillation electrode pads.
	Ensure that no one is touching the patient and that the patient is motionless during ECG analysis.
◀ DEFIB MAINTENANCE REQUIRED	Contact ZOLL Technical Service.

Table 2-3.Defibrillator Issues

AED Pro Error Log Messages

The AED Pro unit records internal errors in an error log, which you can retrieve by using a Windows-based personal computer with ZOLL Administration Software (ZAS).

To retrieve the error log, follow these steps:

Step	Action
1	Turn off the AED Pro unit.
2	Start the ZOLL Administration Software (ZAS) on the computer.
3	Position the AED Pro unit so that its IrDA port has a clear line-of-sight with the computer's IrDA port and the ports are about 10 to 18 inches (25 to 45 cm) apart.
4	Press and hold the unit's On/Off button for at least 5 seconds to start the unit in nonrescue mode.
5	After the unit issues the message <i>COMMUNICATIONS ESTABLISHED</i> , refer to the ZAS help for instructions on saving the unit's history file and viewing the included error log.

After saving the error log file on the computer, you can use ZAS to clear the error log on the AED Pro unit.

Table 2-4 lists critical error log messages.

Important: If any of these messages appears in the error log, contact ZOLL Technical Service as described on page vii.

Table 2-4. AED Pro Error Log Messages

Error No.	Error Message
1	The patient relay is not working properly
2	Attempting to charge the capacitor while the SAFELINE in the CPLD is set - should not charge
3	The capacitor takes too long to charge
4	The H-bridge test failed while the bridge was disabled. There should have been 0 current measured.
5	VCAP1 and VCAP2 are not within a defined range of each other
6	The H-bridge test failed while the bridge was enabled - an invalid current reading was taken during the positive test on the H-bridge
7	The H-bridge test failed while the bridge was enabled - an invalid current reading was taken during the negative test on the H-bridge
8	Defib did not charge during the power-on charge test
9	The Defib task is not receiving A2D vCap1 event samples - needed for charging
10	FnSafety has determined that the charge has dropped below a specified value during the holding of charge.
11	The capacitor failed to charge
12	The capacitor over-charged
13	The capacitor contained an unsafe voltage in an idle state

Error No.	Error Message
14	Patient impedance experienced a short
15	The A2D is getting non-accurate readings during its test
17	The message queue overflowed
18	PowerOn task has timed out while waiting for a self test result to come back.
19	Calibration faults that occur during a clinical event.
20	An unexpected error has occurred when calling a Nucleus operation.
21	An unexpected error has occurred when calling a Rhapsody operation.
22	An unexpected coding error has occurred.
23	No Language installed - corrupt language.
24	The shock button is pressed/stuck.
25	The ECG Calibration data is invalid
26	The Patient Impedance Calibration data is invalid
27	A critical flash error has occurred
28	The WatchDog is not enabled during clinical event
29	The clock test failed
Note:	Error numbers 256 and greater indicate noncritical conditions.

Table 2-4.	AED Pro	Error L	og Messages	(continued)
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Appendix A Maintenance Tests Checklist

This appendix provides a sample maintenance checklist for the AED Pro unit. To ensure that the equipment is functioning properly and ready for emergency use, complete the checklist periodically according to local protocols.

Your organization can create custom checklists for your specific requirements.

Instructions

To maintain records for maintenance testing, photocopy the checklist shown on the following pages. The checklist includes an entry for each test described in this manual. Use these copies to record the results of your testing and then retain the copies for your records.

ZOLL AED Pro Maintenance Tests Checklist

Use this checklist to record the results of AED Pro maintenance tests and keep it for your records. For a description of each numbered test, refer to Chapter 1, "Maintenance Tests" in the AED Pro Service Manual.

Result of Check:	1.0	Physical Inspection	5.0 Defibrillator Energyf-Test	8.	0 Internal Discharge-Te
No action required		Pass Fail	Pass Fall		Pass Fail
☐ Minor problems	1.1		5.1	8.	
corrected	1.2		5.2	8.	
replaced	1.3		5.3	8.	з П П
Major problems identified (unit out of service)	1.4		5.4 🔲 🗖	8.	4 П П
(1.5		5.5	8.	5 0 0
Additional Remarks	1.6		5.6	8.	
	1.7		5.7	8.	
	2.0	Power Supply	5.8		
			5.9	9.	0 Patient
	2.1		5.10		Impedance Calibration
	2.2		5.11 🔲 🔲		Pass Fail
	2.3		5.12	9.	1 🗆 🗆
	2.4		5.13	9.	2
	2.5		5.14	9.	3 🔲 🗖
	3.0	Power On		9.	4 🗆 🗖
		PASS FAIL N/A	6.0 Battory Test	9.	5 🔲 🗖
	3.1		Type	9.	6
	3.2		Pass Fail		
	4.0	ECG Monitoring	6.1	10	0.0 ECG Lead Of
		(Optional) Pass Fail N/A	6.2		Pass Fail
	4.1		6.3	1().1
	4.2		6.4	1().2
	4.3		6.5	10).3 🔲 🔲
	4.4		6.6	10	0.4
	4.5				
			7.0 Establish	11	.0 ECG Offset
			Pass Fail		
			7.1	11	FASS FAIL
			7.2	11	
				11	

11	.4			
				_
				_
		 11.4	11.4	11.4

	11.4					
ge-Test	11.5					
-	12.0 Real Time Clock					
1		Test	_			
]	10.1	Pass				
]	12.1					
]	12.2	Ш				
]	12.3					
]	12.4					
	13.0	Writa	Calibration			
nce	13.0	to Fla	sh			
ion		Pass	FAIL			
AIL	13.1					
]	13.2					
]	13.3					
3	13.4					
]						
3	14.0	Audio	Recording			
]		Test (Optional)			
	1/1 1	Pass				
ad Off	44.0					
on	14.2					
AIL	14.3					
_						
]	15.0	Real E	Error Log			
]	15 1					
]	15.1					
	15.2					
fset	15.3					
ion	154	п				
	10.4		—			
	10.4	-	_			
	10.4		_			