FLUKE®

Biomedical

Impulse 6000D

Defibrillator Analyzer

Impulse 7000DP

Defibrillator/Transcutaneous Pacer Analyzer

Getting Started Manual

PN 3028662
August 2007

Warranty and Product Support

Fluke Biomedical warrants this instrument against defects in materials and workmanship for one year from the date of original purchase OR two years if at the end of your first year you send the instrument to a Fluke Biomedical service center for calibration. You will be charged our customary fee for such calibration. During the warranty period, we will repair or at our option replace, at no charge, a product that proves to be defective, provided you return the product, shipping prepaid, to Fluke Biomedical. This warranty covers the original purchaser only and is not transferable. The warranty does not apply if the product has been damaged by accident or misuse or has been serviced or modified by anyone other than an authorized Fluke Biomedical service facility. NO OTHER WARRANTIES, SUCH AS FITNESS FOR A PARTICULAR PURPOSE, ARE EXPRESSED OR IMPLIED. FLUKE SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSSES, INCLUDING LOSS OF DATA, ARISING FROM ANY CAUSE OR THEORY.

This warranty covers only serialized products and their accessory items that bear a distinct serial number tag. Recalibration of instruments is not covered under the warranty.

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Notices

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Unpacking and Inspection

Follow standard receiving practices upon receipt of the instrument. Check the shipping carton for damage. If damage is found, stop unpacking the instrument. Notify the carrier and ask for an agent to be present while the instrument is unpacked. There are no special unpacking instructions, but be careful not to damage the instrument when unpacking it. Inspect the instrument for physical damage such as bent or broken parts, dents, or scratches.

Technical Support

For application support or answers to technical questions, either email techservices@flukebiomedical.com or call 1-800- 648-7952 or 1-425-446-6945.

Claims

Our routine method of shipment is via common carrier, FOB origin. Upon delivery, if physical damage is found, retain all packing materials in their original condition and contact the carrier immediately to file a claim. If the instrument is delivered in good physical condition but does not operate within specifications, or if there are any other problems not caused by shipping damage, please contact Fluke Biomedical or your local sales representative.

Standard Terms and Conditions

Refunds and Credits

Please note that only serialized products and their accessory items (i.e., products and items bearing a distinct serial number tag) are eligible for partial refund and/or credit. Nonserialized parts and accessory items (e.g., cables, carrying cases, auxiliary modules, etc.) are not eligible for return or refund. Only products returned within 90 days from the date of original purchase are eligible for refund/credit. In order to receive a partial refund/credit of a product purchase price on a serialized product, the product must not have been damaged by the customer or by the carrier chosen by the customer to return the goods, and the product must be returned complete (meaning with all manuals, cables, accessories, etc.) and in "as new" and resalable condition. Products not returned within 90 days of purchase, or products which are not in "as new" and resalable condition, are not eligible for credit return and will be returned to the customer. The Return Procedure (see below) must be followed to assure prompt refund/credit.

Restocking Charges

Products returned within 30 days of original purchase are subject to a minimum restocking fee of 15 %. Products returned in excess of 30 days after purchase, but prior to 90 days, are subject to a minimum restocking fee of 20 %. Additional charges for damage and/or missing parts and accessories will be applied to all returns.

Return Procedure

All items being returned (including all warranty-claim shipments) must be sent freight-prepaid to our factory location. When you return an instrument to Fluke Biomedical, we recommend using United Parcel Service, Federal Express, or Air Parcel Post. We also recommend that you insure your shipment for its actual replacement cost. Fluke Biomedical will not be responsible for lost shipments or instruments that are received in damaged condition due to improper packaging or handling.

Use the original carton and packaging material for shipment. If they are not available, we recommend the following guide for repackaging:

- Use a double–walled carton of sufficient strength for the weight being shipped.
- Use heavy paper or cardboard to protect all instrument surfaces. Use nonabrasive material around all projecting parts.
- Use at least four inches of tightly packed, industry-approved, shock-absorbent material around the instrument.

Returns for partial refund/credit:

Every product returned for refund/credit must be accompanied by a Return Material Authorization (RMA) number, obtained from our Order Entry Group at 1-800-648-7952 or 1-425-446-6945.

Repair and calibration:

To find the nearest service center, go to www.flukebiomedical.com/service or

In the U.S.A.:
Cleveland Calibration Lab
Tel: 1-800-850-4606
Email: globalcal@flukebiomedical.com

Everett Calibration Lab
Tel: 1-888-99 FLUKE (1-888-993-5853)
Email: service.status@fluke.com

In Europe, Middle East, and Africa:
Eindhoven Calibration Lab
Tel: +31-402-675300
Email: ServiceDesk@fluke.com

In Asia:
Everett Calibration Lab
Tel: +425-446-6945
Email: service.international@fluke.com

Certification

This instrument was thoroughly tested and inspected. It was found to meet Fluke Biomedical's manufacturing specifications when it was shipped from the factory. Calibration measurements are traceable to the National Institute of Standards and Technology (NIST). Devices for which there are no NIST calibration standards are measured against in-house performance standards using accepted test procedures.

WARNING

Unauthorized user modifications or application beyond the published specifications may result in electrical shock hazards or improper operation. Fluke Biomedical will not be responsible for any injuries sustained due to unauthorized equipment modifications.

Restrictions and Liabilities

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Manufacturing Location

The Impulse 6000D and 7000DP Defibrillator/Transcutaneous Pacer Analyzers are manufactured at Fluke Biomedical, 6920 Seaway Blvd., Everett, WA, U.S.A.

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Introduction

The Impulse 6000D and 7000DP (hereafter the Analyzer) are portable, battery-powered precision instruments for testing external defibrillators. The 7000DP has the added capability of testing trancutaneous pacemakers. Where the additional pacemaker testing capability is applicable, this manual qualifies the description with “7000DP only.” The model 7000DP appears in all product illustrations.

Intended Use

The Analyzer is intended for use by trained service technicians to perform periodic inspections on a wide range of cardiac resuscitation equipment. The testing procedures are menu-driven, and simple to operate.

Unpacking the Analyzer

Carefully unpack all items from the box and check that you have the following items:

- Impulse 6000D or 7000DP
- Battery charger
- Getting Started Manual
- Users Manual CD
- Defib paddle contact plates
- Impulse 6000D 7000DP Ansur Software CD (demo)

Table 1. Symbols

Symbol	Description
⚠	Important information; refer to manual.
	Do not dispose of this product as unsorted municipal waste. Go to Fluke's website for recycling information.
	Conforms to relevant Australian EMC requirements
	Conforms to relevant Canadian and US standards
⚠	Hazardous voltage
CE	Conforms to European Union directives
CAT I	IEC Measurement Category I – CAT I equipment designed to protect against transients in equipment on circuits not directly connected to MAINS. Under no circumstances should the terminals of the Analyzer be connected to any MAINS voltage.

Safety Information

In this manual, a **Warning** identifies hazardous conditions and actions that could cause bodily harm or death. A **Caution** identifies conditions and actions that could damage the Analyzer, the equipment under test, or cause permanent loss of data.

⚠⚠ Warning

To avoid possible electrical shock or personal injury, follow these guidelines:

- **Use this Analyzer only in the manner specified by the manufacturer or the protection provided may be impaired.**
- **Read the Users Manual before operating the Analyzer.**
- **Do not use the product if it operates abnormaly.**
- **Do not use the product in wet locations, around explosive gases or dust.**
- **Use extreme caution when working with voltages above 30 volts.**
- **Use the proper terminals, functions and ranges for the test being performed.**

- **Do not operate the Analyzer with the battery eliminator connected, unless connected directly to mains power. During battery operation, completely remove the battery eliminator/charger from both the Analyzer and wall socket.**
- **Observe all precautions noted by the Device Under Test (DUT) equipment manufacturer when analyzing the DUT.**

Instrument Familiarization

Figure 1 and Table 2 describes the top-panel controls and connections of the Analyzer .

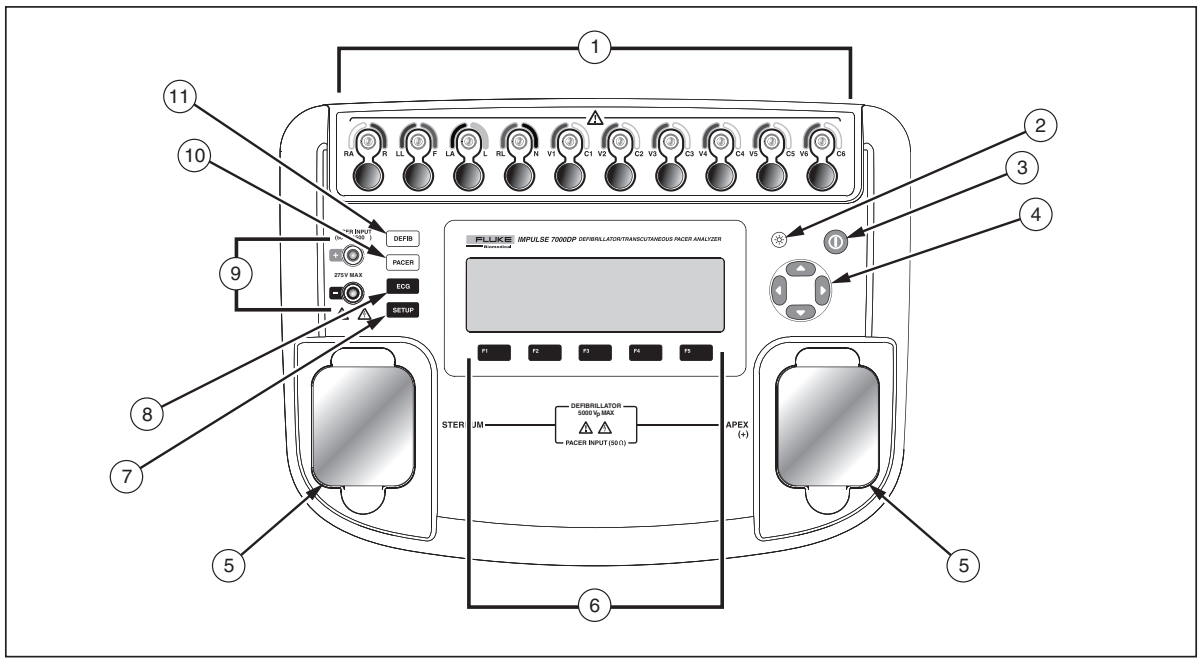

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Figure 1. Top-Panel Controls and Connections

Table 2. Top-Panel Controls and Connections

Item	Name	Description
1	ECG lead connectors	Outputs of low-level ECG signals (RA/R, LL/F, LA/L, RL/N, V1/C1, V2/C2, V3/C3, V4/C4, V5/C5, and V6/C6).
2	Backlight button	Turns the LCD display backlight on and off.
3	Power button	Turns the Analyzer on and off.
4	Navigation buttons	Cursor control buttons for navigating menus and lists.
5	Defib connectors	Defibrillator connections (Shown with removable defib paddle contact plates installed).
6	Function softkeys	Keys F1 through F5 are used to select from a number of selections that appear in the LCD display above each function softkey.
7	Setup button	Opens the setup menu.
8	ECG button	Opens the main menu for ECG test functions.
9	Pacemaker inputs	Input for low-level Pacer signal (7000DP only).
10	Pacer button	Opens the main menu for pacer test functions (7000DP only).
11	Defibrillator button	Opens the main menu for defibrillator test functions.

Figure 2 and Table 3 describes the rear-panel connections of the Analyzer.

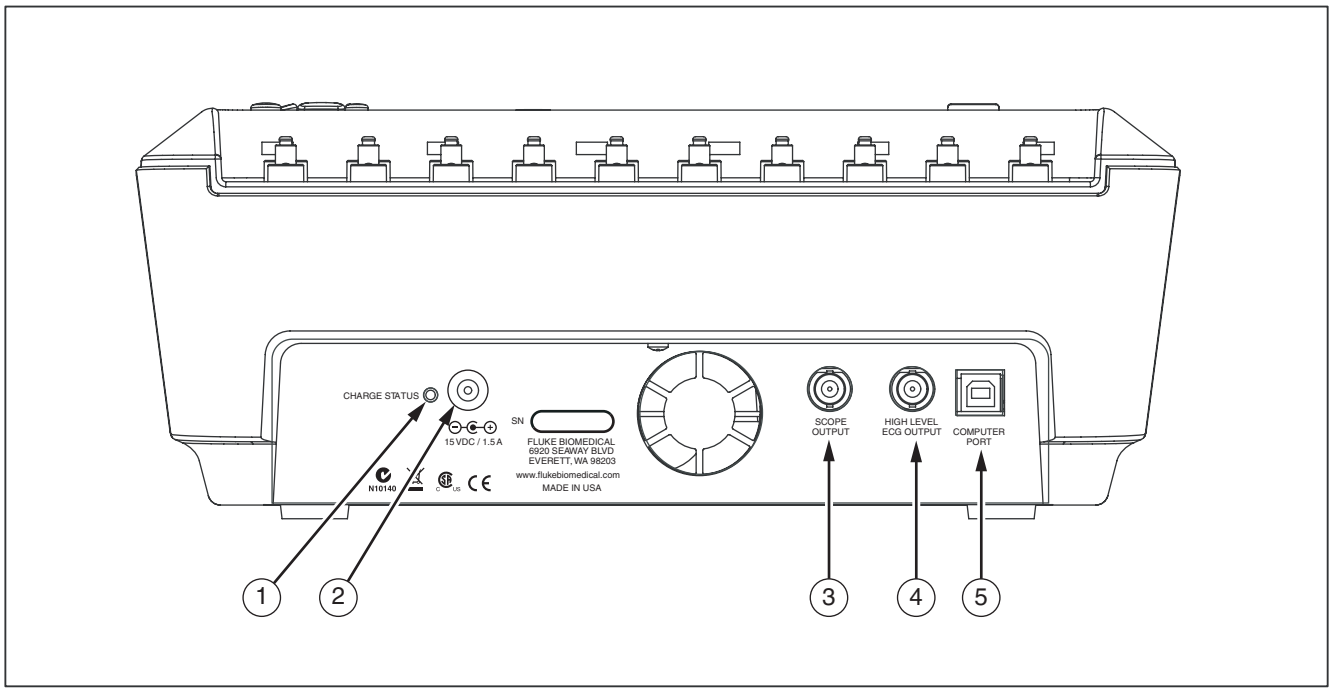

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Figure 2. Rear-Panel Connections

Table 3. Rear-Panel Connections

Item	Name	Description
1	Charge Status LED	Indicates RED while battery is charging. Indicates GREEN when the battery is fully charged and the charger is still connected.
2	Battery Charger connector	Input connector for attaching the battery charger to the Analyzer.
3	Scope output	Output signal jack for displaying the defib playback wave on an oscilloscope.
4	Hi-level ECG output	High-level ECG signal output jack for oscilloscope viewing.
5	Computer Port	Device Port (B-style USB) for controlling the Analyzer from a PC or instrument controller.

Turning the Analyzer On

Note

When using the Analyzer for the first time, plug the battery charger into the Analyzer and a power outlet and charge the Analyzer for at least 4 hours. The Analyzer is still usable during this period with the battery charger connected.

Press the power button (⏻) on the top panel to turn the Analyzer on. After a short self-test period, the Analyzer will display the screen shown in Figure 3 to indicate it is ready for operation.

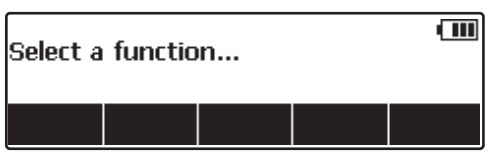

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Figure 3. Analyzer Ready Display

Connecting a Defibrillator and Pacer to the Analyzer

Figure 6 shows the two methods of connecting a defibrillator to the Analyzer. The Defib Paddle Contact

plates are inserted into the defibrillator jacks when external defibrillator paddles are used on the defibrillator.

⚠ Caution

To avoid damage to the Analyzer or defibrillator, do not apply defibrillator pulses to the pacer inputs.

Figure 7 shows the pacer connected to either the pacer input jacks or the defibrillator jacks. While the pacer input jacks have a selectable load from 50 to 1500 Ω, the defibrillator input jacks have a fixed load of 50 Ω.

Figure 8 shows how to connect the ECG leads to the Analyzer.

Accessing the Analyzer Tests

The Analyzer uses a series of menus to access various Analyzer functions and setup variables. As shown in Figure 4, the Analyzer indicates three different defibrillator tests (Energy, Sync, and Charge Time) along the bottom of the display. An Exit selection is also indicated as a way of backing out of the defibrillator tests. Pressing a softkey (F1 through F5) under a specific test will cause that test to be selected.

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Figure 4. Defib Function Menu

Some menu selections reveal a list of selectable items by displaying ⬍ to the right of the presently selected item. See Figure 5. To change the selection, press either ⏶ or ⏷ to scroll through the possible selections. Once the desired selection appears, press the function softkey and ⬍ disappears from the display.

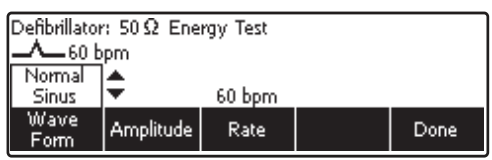

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Figure 5. Cursor Navigation Example

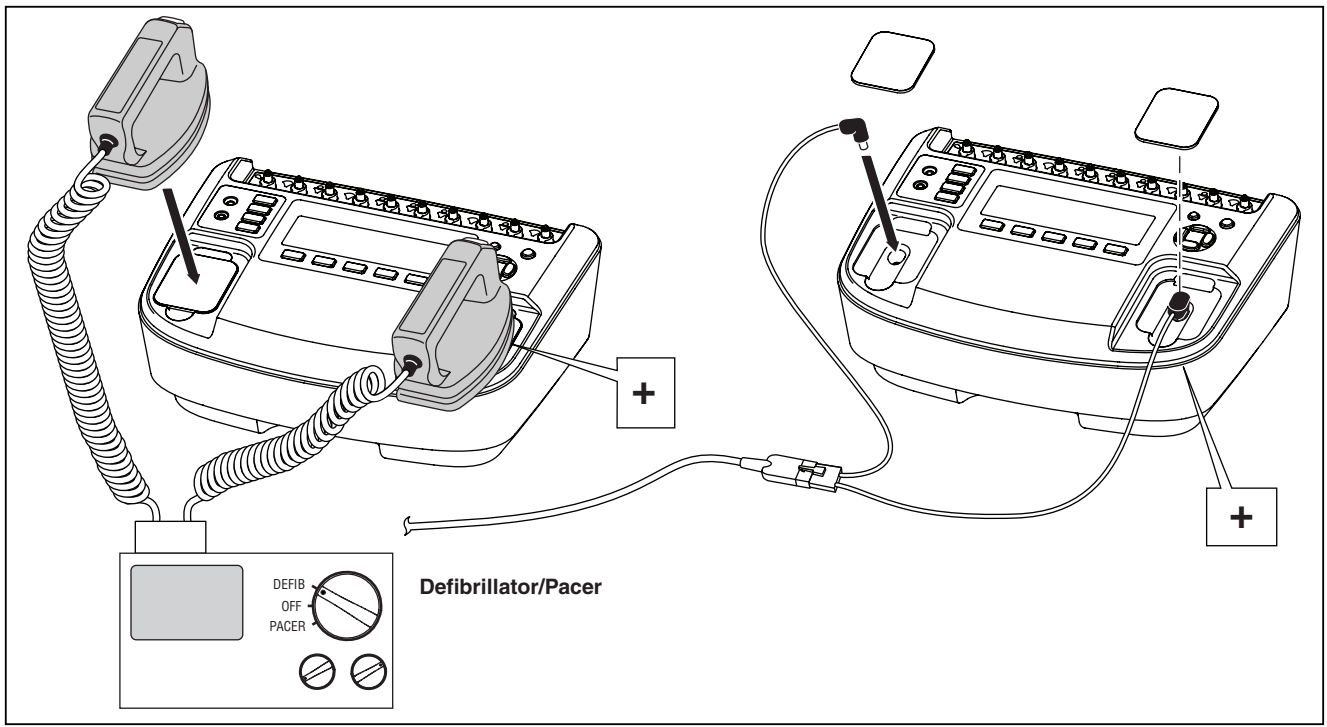

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Figure 6. Defibrillator Connections

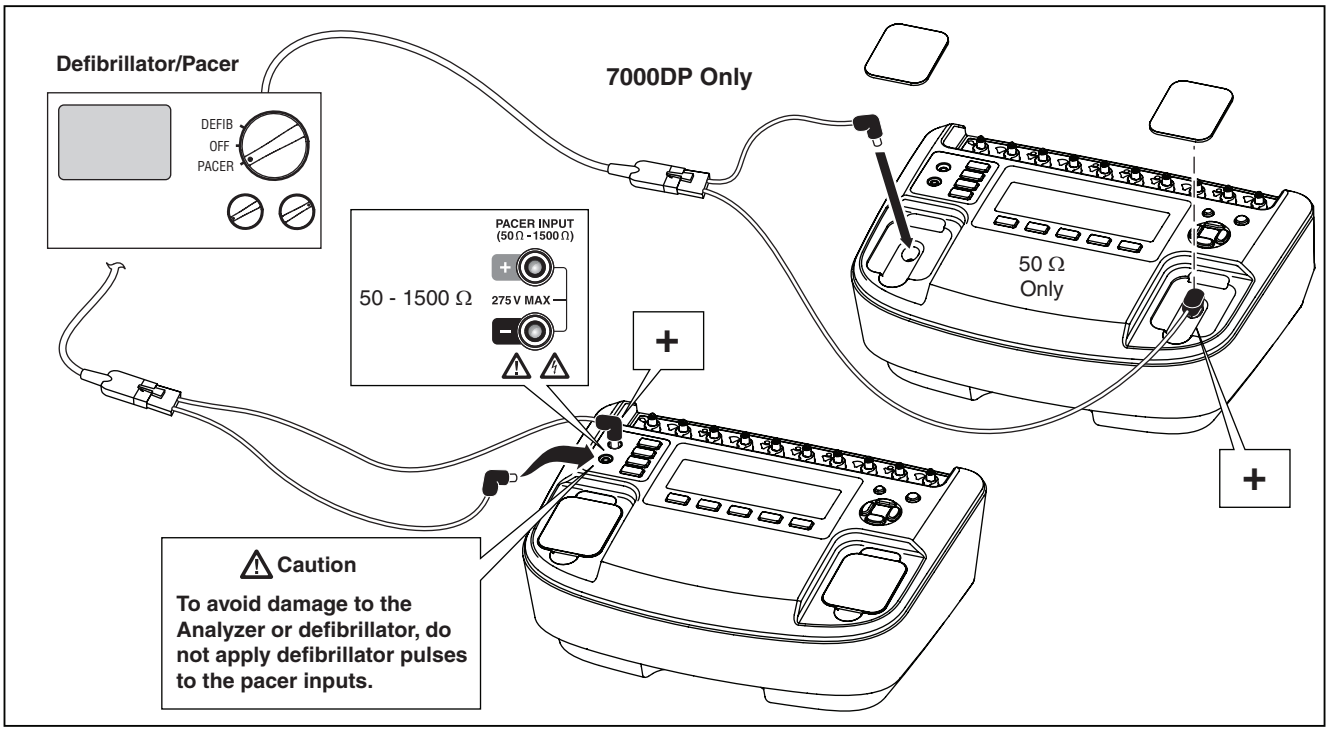

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Figure 7. Pacer Connections

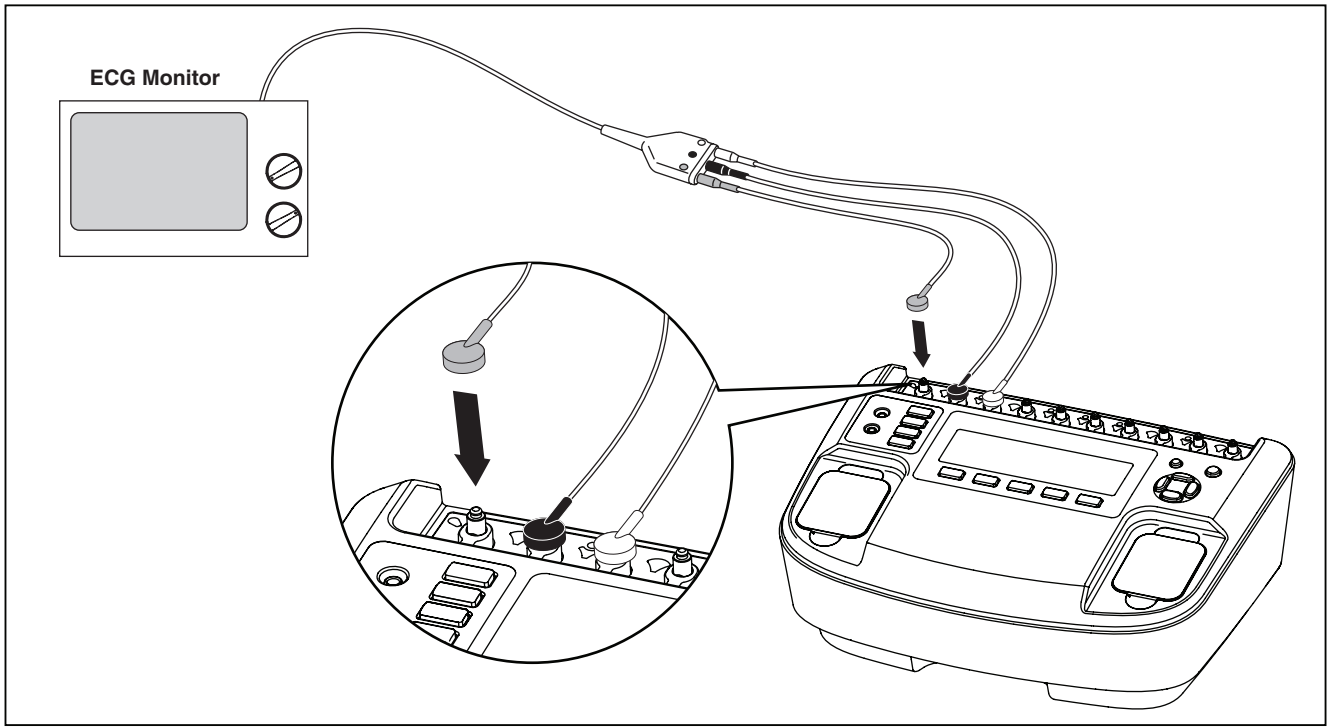

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Figure 8. ECG Connections

What to Do Next

For more information on how to use the Analyzer, refer to the *Impulse 6000D, 7000DP Users Manual* contained on the accompanying CD.

Maintenance

The Analyzer needs little maintenance or special care. However, treat it as a calibrated measuring instrument. Avoid dropping or other mechanical abuse that could cause a shift in the calibrated settings. The Analyzer has no internal user serviceable parts.

Cleaning the Analyzer

⚠ Caution

Do not pour fluid onto the Analyzer surface; fluid seepage into the electrical circuitry may cause the Analyzer to fail.

⚠ Caution

Do not use spray cleaners on the Analyzer; such action may force cleaning fluid into the Analyzer and damage electronic components.

Clean the Analyzer occasionally utilizing a damp cloth and mild detergent. Take care to prevent the entrance of liquids.

Wipe down the adapter cables with the same care. Inspect them for damage to and deterioration of the insulation. Check the connections for integrity before each use.

Maintaining Peak Battery Condition

To maintain peak battery capacity, the Analyzer should be charged completely at least once a month. If the Analyzer is to be left idle for more than a month and it is inconvenient to periodically connect to the battery charger, keep it connected to the charger while idle.

Note

To obtain the specified performance, use the battery charger specified in this manual.

Accessories

Table 4 lists the accessories for the Analyzer. Contact your local Fluke Biomedical sales representative or go to www.flukebiomedical.com for an up-to-date accessories list.

Table 4. Accessories

Item	Fluke Biomedical Model Number
GE Medical RESPONDER1500/1700 4mm	3065423
Internal Defib Pdl Contacts 2/set 4mm	3065438
R2 Darox MRL/MDE/NK/Kimberly Clark 4mm	3065450
Med ERS /PhysioControl QUIK COMBO 4mm	3065461
Med ERS/PhysioControl QUIK PACE 4mm	3065477
Med ERS/PhysioControl FAST PATCH 4mm	3065489
Philips/HP/Agilent CODEMASTER 4mm	3065492
Philips/Agilent HEARTSTART FR2/MRX 4mm	3065509
ZOLL Medical PD-2200 MULTIFUNCTION 4mm	3065511
ZOLL Medical NTP/PD1400 4mm	3065527

Specifications

General Specifications

Temperature

Operating	10 °C to 40 °C (50 °F to 104 °F)
Storage	-20 °C to +60 °C (-4 °F to +140 °F)
Humidity	10 % to 90 % non-condensing
Display	LCD display
Communications	USB device port for computer control
Modes of Operation	Manual and remote
Power	Internal rechargeable NiMH battery pack for nine hours (typical) operation after full charge, or the battery charger can operate the Analyzer and charge the battery simultaneously.
Battery Charger	100 to 240 V input, 15 V/1.5 A output. For best performance, the battery charger should be connected to a properly grounded ac receptacle.

Mechanical

Housing	ABS Plastic
Size (H x W x L)	13 cm x 32 cm x 24 cm (5 in x 13 in x 9.5 in)
Weight	3.0 kg (6.6 lb)

Safety Standards

CE	IEC/EN61010-1 2nd Edition; Pollution degree 2
CSA	CAN/CSA- C22.2 No. 61010-1; UL61010-1

Electromagnetic Compatibility Standards (EMC)

European EMC	EN61326-1

Defibrillator Analyzer Specifications

Energy Output Measurement

Compatible Defibrillator Waveshapes.....Lown, Edmark, Trapezoidal, DC Bi-phasic, and AC Pulsed Bi-phasic

Autoranged Measurement.....0.1 to 600 J

Accuracy

0.1 to 360 J .....±(1 % of reading + 0.1 J)

360 to 600 J .....±(1 % of reading + 0.1 J), typical

Note

For Pulsed Bi-Phasic defibrillator, specified accuracy is ±(1.5 % of reading + 0.3 J) on both ranges.

Load resistance

Resistance.....50 Ω

Accuracy.....±1 %, non-inductive (<2 µH)

Variable external load resistance (optional).....25, 75,100, 125, 150, or 175 Ω, All values ±1 %, non-inductive (<2 µH)

Pulse trigger level .....20 V

Pulse width

Range.....1.0 to 50.0 ms

Accuracy.....±0.1 ms

Voltage

Range.....20 to 5000 V

Accuracy.....±(1 % of reading + 2 V)

Current

Range.....0.4 to 100.0 A

Accuracy.....±(1 % of reading + 0.1 A)

Sample rate ..... 250 kHz (4 µs sample)
Maximum Average Power ..... 12 W, equivalent to 10 defib pulses of 360 J every 5 minutes
Oscilloscope Output
Autorange ..... 2000:1, 400:1 and 80:1: dependant on the range
Waveform Playback
Output ..... BNC
Output impedance ..... 50 Ω (nominal)
Delay ..... 50 ms (nominal)
Accuracy ..... ±5 % of nominal
Charge Time Measurement
Range ..... 0.1 to 100.0 s
Accuracy ..... ±0.05 s, typical
Synchronization Test (Elective Cardioversion)
Delay Time Measurement
Timing window ..... ECG R-wave peak to the defib pulse peak
Range ..... -120 to +380 ms; measures timing from 120 ms prior to the R-wave peak to up to 380 ms following the R-wave peak.
Resolution ..... 1 ms
Accuracy ..... ±1 ms
ECG waves
Normal Sinus Rhythm (NSR) ..... 30 to 180 (by 1) BPM
Atrial fibrillation ..... Coarse and fine
Monomorphic Ventricular Tachycardia ..... 120 to 240 (by 5) BPM
Asystole ..... Flat line

Automated Defibrillator Test ECG Waves

Normal Sinus	30 to 300 (by 1) BPM
Ventricular Fibrillation	Coarse and fine
Monomorphic Ventricular Tachycardia	120 to 300 (by 5) BPM
Polymorphic Ventricular Tachycardia	5 types
Asystole	Flat line

ECG Waves

ECG General

Lead configuration	12-lead simulation. RA, LL, LA, RL, V1-6 with independent outputs
Lead to lead impedance	1000 Ω (nominal)
Rate accuracy	±1 % of nominal

ECG Amplitudes

Reference lead	Lead 1
Settings	0.05 to 0.45 (by 0.05) mV 0.5 to 5.0 (by 0.5) mV
Accuracy	±2 % of setting, lead I and 2 Hz square wave

For performance waves and R-wave detection, other leads are proportional to Lead I in percentage per:

Lead I	100
Lead II	150
Lead III	50
Leads V1 through V6	100

For normal sinus waves, other leads are proportional to Lead I in percentage per:

Lead I	100
Lead II	150
Lead III	50

Lead V1	24
Lead V2	48
Lead V3	100
Lead V4	120
Lead V5	112
Lead V6	80

ECG Normal Sinus

Rates	30 to 360 (by 1) BPM

ECG High Level Output (BNC Jack)

Amplitude	0.2 V/mV of Lead I amplitude
Accuracy	±5 %. 2 Hz Square Wave
Output Impedance	50 Ω output impedance

ECG on Defibrillator Input Load

Same as Lead II amplitude

ECG Performance Waves

Square wave	2.0 and 0.125 Hz
Triangular wave	2.0 and 2.5 Hz
Sine waves	0.05, 0.5, 5, 10, 40, 50, 60, 100, 150, and 200 Hz
Pulse	30 and 60 BPM, 60 ms pulse width

R-Wave Detection

Waveform	Haver-triangle
Amplitude	0.05 to 0.45 (by 0.05) V 0.5 to 5.0 (by 0.5) V
Rate	30, 60, 80, 120, 200, and 250 BPM
Widths	8, 10, 12 ms, and 20 to 200 (by 10) ms
Accuracy	±(1 % setting + 0.2 mV)

Noise Immunity

Wave ..... Sine
Line Frequency.....50 or 60 Hz (± 0.5 Hz)
Amplitude .....0.0 to 10.0 (by 0.5) mV
Accuracy.....± 5%

Transvenous Pacer Pulse Simulation

Widths
Range.....0.1, 0.2, 0.5, 1.0, and 2.0 ms
Accuracy.....±5 % of setting
Amplitudes.....0 (off) and ±2, ±4, ±6, ±8, ±10, ±12, ±14, ±16, ±18, ±20, ±50, ±100, ±200, ±500, and ±700 mV
Accuracy.....± (10 % of setting + 0.2 mV)

Arrhythmia Selections

Pacer Interactive (Transcutaneous pacer, Impulse 7000DP only)
Demand.....30 to 360 (by 1) BPM
Asynchronous
Non-Capture
Non-Function
Threshold (Interactive pacing simulation only) 10 to 250 (by 10) mA
Supraventricular
Atrial Fibrillation Coarse
Atrial Fibrillation fine
Atrial Flutter
Sinus Arrhythmia
Missed Beat
Atrial Tachycardia

- Paroxysmal Atrial Tachycardia (PAT)
- Nodal Rhythm
- Supraventricular Tachycardia

Premature

- Atrial PAC
- Nodal PNC
- PVC1 Left Ventricle
- PVC1 LV Early
- PVC1 LV R on T
- PVC2 Right Ventricle
- PVC2 RV Early
- PVC2 RV R on T
- Multifocal PVCs

Ventricular

- PVCs 6/min
- PVCs 12/min
- PVCs 24/min
- Freq Multifocal
- Trigeminy
- Bigeminy
- Pair PVCs
- Run 5 PVCs
- Run 11 PVCs
- Monomorphic Ventricular Tachycardia .....120 to 300 (by 5) BPM
- Polymorphic Ventricular Tachycardia .....1 to 5
- Ventricular Fibrillation: Coarse and Fine

- Asystole
- Conduction
  - 1° Block
  - 2° Block Type I
  - 2° Block Type II
  - 3° Block
  - Right Bundle Branch Block RBBB
  - Left Bundle Branch Block LBBB
- Transvenous Paced with selectable pacer spike amplitudes and widths
  - Atrial 80 BPM
  - Async 75 BPM
  - Demand with frequent sinus beats
  - Demand with occasional sinus beats
  - AV Sequential
  - Non-Capture
  - Non-Function
  - Selectable pacer pulse parameters for transvenous simulation. (Atrial and Ventricular channels are independently selectable):
    - Atrial Pacer Pulse
      - Width .....0.1, 0.2, 0.5, 1.0, 2.0 ms
      - Polarity .....+ or -
      - Amplitude .....0 (off), 2 to 20 (by 2), 50, 100, 200, 500, 700 mV
    - Ventricular Pacer Pulse
      - Width .....0.1, 0.2, 0.5, 1.0, 2.0 ms
      - Polarity .....+ or -
      - Amplitude .....0 (off), 2 to 20 (by 2), 50, 100, 200, 500, 700 mV

Transcutaneous Pacemaker Analyzer Specifications (Impulse 7000DP only)

Test Load Selections

Defibrillator Input

Fixed Load ..... 50 Ω
Accuracy ..... ±1 %, non-inductive (<2 µH)
Power Rating..... 10 defib pulses of 360 J every 5 minutes

Pacemaker Input

Variable Load ..... 50 to 1500 Ω in 50 Ω steps
Accuracy ..... ±1 %, non-inductive (<2 µH)
Power Rating..... 5 W (average), 40 W (peak) @ 1000 Ω

Measurements

Manufacturer Specific Algorithms

GE Responder (1500 & 1700)
MDE 300 (Medical Data Electronics)
Medtronic ERS/Physio Control LIFEPAK
MRL (Medical Research Laboratory/Welch Allyn)
Philips/Agilent/HP
Schiller Medical
ZOLL Medical
(plus a general purpose default algorithm selection)

Current

Range..... 4.00 to 250 mA
Accuracy ..... ±(1% of reading + 0.02 mA)

Pulse Rate

Range.....5.0 to 800 PPM

Accuracy.....±(0.5% of reading + 0.1 PPM)

Pulse Width

Range.....1.00 to 100.0 ms

Accuracy.....±(0.5% of reading + 0.01 ms)

Energy

Range.....1 µJ to 2.00 J

Accuracy.....±(4% of reading + 10 µJ)

Demand and Asynchronous Mode Test

Input Pacer pulse rates.....30 to 200 PPM

ECG NSR wave

Rate.....10 to 300 (by 1) BPM

Amplitude .....1 mV

Underdrive rate.....10 BPM minimum

Overdrive rate.....300 BPM maximum

Sensitivity Test

Automatic Interactive Threshold Detection

Compatible pacer rates	30 to 120 PPM

ECG R wave:

Waveforms	Square, Triangle, Sine
Width	1 to 19 (by 1) ms 20 to 95 (by 5) ms 100 to 300 (by 25) ms
Accuracy	± 5% of setting
Amplitude	0.05 to 0.95 (by 0.05) mV 1.0 to 5.0 (by 0.5) mV
Accuracy	± 5% of setting

Refractory Period Tests

Paced Refractory Period	20 to 500 ms
Sensed Refractory Period	15 to 500 ms
Accuracy	±1 ms
Pacer pulse rate	20 to 200 PPM

ECG

Waveform	Triangle wave
Pulse width	40 ms
Amplitude	1.0 mV