User Manual

DA-2003
Defibrillator Analyzer

CONTENTS

I.   MANUAL REVISION RECORD

This record page is for recording revisions to your *DA-2003 User Manual* that have been published by BC Biomedical or its authorized representatives. We recommend that only the management or facility representative authorized to process changes and revisions to publications:

- Make the pen changes or insert the revised pages;
- Ensure that obsolete pages are withdrawn and either disposed of immediately, or marked as superseded and placed in a superseded document file, and;
- Enter the information below reflecting that the revisions have been entered.

Rev No	Date Entered	Reason	Signature of Person Entering Change
0	-	Initial Release	
1	11/12/04	Part Number Changes	KLB

II. INTRODUCTION

2.1 Features

The DA-2003 Defibrillator Analyzer is a precision instrument for testing defibrillators, and is designed to be used by trained service technicians. It measures the energy output, and ensures that the defibrillator complies with specified requirements. DA-2003 has a built-in load resistance of 50 ohm, which roughly corresponds to the impedance of the human body. The defibrillator pads are placed on the DA-2003 contact plates. Thus, the defibrillator is connected through the load resistance. When the defibrillator is discharged, DA-2003 calculates and displays the energy delivered.

2.2 General Information

Temperature Requirements +15°C to +35°C when operating
0°C to +50°C in storage

Display
Type LCD graphic display
Alphanumeric format 6 lines, 40 characters

Data Input/ Output (2) Parallel printer port (1); Bi-directional RS -232C (1) for Computer control

Power 2 x 9 volt alkaline Battery Duracell® MN1604 (or equivalent) for 20 -25 operational hours, or 240 VAC (Battery Eliminator), 115 VAC for US.

Mechanical Specifications
Housing High impact plastic case
Height 9.8 cm 3.9 in.
Width 24.8 cm 9.8 in.
Depth 28.0 cm 11.0 in.
Weight 1.85 kg (with battery) 4.1 lbs.

Printer Port Centronics Interface

Standard Accessories
110 V or 220 V AC Adapter (P/N BC20-00429)
Internal paddle-contact adapter (P/N BC20-00430)
Snap-to-banana adapters (10 pk) (P/N BC20-17024)
DA-2003 User Manual
Protective Cover (P/N BC20-00427)

Additional Accessories
Defib. paddle adapter
(specify defibrillator type)
Soft Carrying Case (P/N BC20-30108)

Storage
Store in the carrying case in dry surroundings within the temperature range specified, without battery. There are no other storage requirements.

Periodic Inspection
The unit should be calibrated every 12 months.

III.   SPECIFICATIONS

1. Energy Output Measurement

High Range

Voltage	<5000 volts
Maximum current	120 amperes
Maximum energy	1000 Joules
Accuracy	$\pm$ 2 % of reading for >100 Joules
	$\pm$ 2 Joule of reading for <100 Joules
Trigger level	100 volts
Playback amplitude	1 mV/1000 V Lead I
Test pulse	100 + 4 Joules

Low Range

Voltage	<1000 volts
Maximum current	24 amperes
Maximum energy	50 Joules
Accuracy	$\pm$ 2% of reading for >20 Joules
	$\pm$ 2 Joule of reading for <20 Joules
Trigger level	20 volts
Playback amplitude	1 mV/200 V Lead I
Test pulse	Approx. 4 Joules
Load Resistance	50 ohms $\pm$ 1%, non-inductive (<1 μH)
Display Resolution	0.1 Joules
Measurement Time Window	100 ms
Abs. Max. Peak Voltage	6000 volts
Pulse Width	100 ms
Cardioversion	Measured time delay $\pm$ 2 ms

Oscilloscope Output

High measure range	1000:1 amplitude-attenuated
Low measure range	200:1 amplitude-attenuated

Waveform Storage And Playback
Discharge can be viewed via ECG outputs and paddles.
Output: 200:1 Time Base expansion.

Sync Time Measurements

Timing window	Starts - 40 ms at each R-wave peak.
Test waveforms	All waveform simulations available.
Delay time accuracy	$\pm$ 1 ms

Charge Time Measurement
From 0.1 seconds to 99.9 seconds.

2. ECG Wave

ECG General

Lead configuration	12-lead simulation. RL, RA, LA, LL, V1-6	
Output impedance	Limb leads	1000 ohms to RL
	V Leads	1000 ohms to RL

All other signals are in relative proportion to Lead amplitude as follows:
The amplitudes are shown for a Lead I amplitude by 1 mV:

Lead I	1.0 mV (LA - RA)
Lead II	1.5 mV (LL - RA)
Lead III	0.5 mV (LL - LA)
V Lead	1.5 mV (V - 1/3 (LL+LA+RA))

High Level Output (ECG Jack)
1/4" standard phone-jack with an amplitude of 1V/mV of low level Lead II signal

Defibrillator Contact Plates
Same amplitude as Lead I low level ECG.
1 mV between contact surfaces.

Playback
200 to 1 time-base expansion of defibrillator pulse by playback to ECG Leads

Manual ECG Performance Test

DC Pulse	4 seconds 1.0 mV
Square wave	2 Hz 1.0 mV p-p biphasic
Triangular wave	2 Hz 1.0 mV
Sine	0.1, 0.2, 0.5, 10, 40, 50, 60, and 100 Hz
Amplitude	0.5, 1.0, 1.5, 2.0 mV (Lead II)
Accuracy	$\pm$ 5 % (Lead II 1.0 mV)

ECG Performance Test

Gain/Damping	2 Hz square wave
Frequency Response	
Low Frequency	4 second DC pulse
Band Pass	10 Hz sine
Monitor	-3dB point: 40 Hz sine
Power Line Notch	50 Hz sine
Filter	
Linearity	2 Hz triangle wave

Normal Sinus

Rates	30, 60, 80, 120, 180, 240 and 300 BPM.
Accuracy	$\pm$ 1% of selection
Amplitudes	0.5, 1.0, 1.5 and 2.0 mV (Lead II)
Accuracy	$\pm$ 5 % (Lead II 1.0 mV)

Automatic ECG Rate Test

Arrhythmia Selections

vfib	Ventricular Fibrillation
afib	Atrial Fibrillation
blk II	Second degree A-V block
RBBB	Right Bundle Branch Block
PAC	Premature Atrial Contraction
PVC_E	Early PVC

PVC_STD   PVC
PVCRonT   R on T PVC
mfPVC   Multifocal PVC
bigeminy   Bigeminy
run5PVC   Bigeminy Run of 5 PVCs
vtach   Ventricular Tachycardia

Shock Advisory Test Algorithms
ASYS   Asystole
SVTa_90   Supraventricular Tachycardia
PVT_140
PVT_ 160
MVT_140
MVT_160
CVF   Course Ventricular Fibrillation
FVF   Fine Ventricular Fibrillation

IV. INSTALLATION

4.1 Receipt, Inspection and Return

1. Inspect the outer box for damage.

2. Carefully unpack all items from the box and check to see that you have the following items:

    - DA-2003 Defibrillator Analyzer
    - 110 V or 220 V AC Adapter
    - Internal paddle-contact adapter
    - Ground contact adapter
    - 10 pack, Snap-to-banana adapter
    - DA-2003 User Manual

3. If you note physical damage, or if the unit fails to function according to specification, inform the supplier immediately. When BC Biomedical or the company's representative, is informed, measures will be taken to either repair the unit or dispatch a replacement. The customer will not have to wait for a claim to be investigated by the supplier. The customer should place a new purchase order to ensure delivery.

4. When returning an instrument to BC Biomedical, or the company representative, fill out the address label, describe what is wrong with the instrument, and provide the model and serial numbers. If possible, use the original packaging material for return shipping. Otherwise, repack the unit using:

    - A reinforced cardboard box, strong enough to carry the weight of the unit.
    - At least 5 cm of shock-absorbing material around the unit.
    - Nonabrasive dust-free material for the other parts.

    Repack the unit in a manner to ensure that it cannot shift in the box during shipment.

BC Biomedical's product warranty is on page 26 of this manual. The warranty does not cover freight charges. C.O.D. will not be accepted without authorization from BC Biomedical or its representative.

4.2 Set-up

1. Equipment connection is as shown in the typical setup below. For direct communication to printer attach the printer cable to the 25-pin outlet port on the DA-2003.

BC Biomedical DA-2003 User Manual 11/04
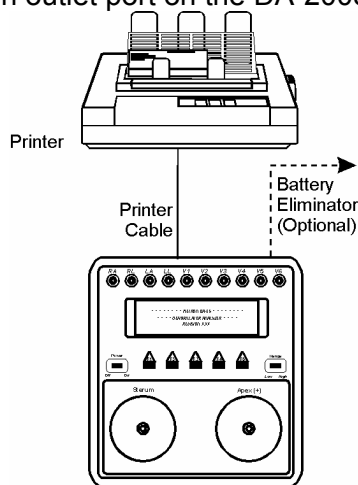
4.3   Power

1.   **Main On/Off Switch.** DA-2003 should remain off for at least 5 seconds before switching on again, in order to allow the test circuits to discharge fully.

2.   **Low Battery Power.** If battery power falls below 6.9 volts ($\pm$ 0.3 volts), the display will show 'Change battery, and reset system'. This means that the battery should either be replaced or the instrument should be connected to a battery eliminator. The main switch has to be switched off and then on again in order to use the instrument.

NOTE
Do not use mercury, air or carbon-zinc batteries.

3.   **Changing Batteries.** Open the compartments in the base of the instrument, replace the old batteries with new ones, and close the compartment covers. Use 9-volt alkaline batteries (Duracell® MN1604 or similar).

NOTE
Remove the batteries and disconnect the AC Adapter if you do not intend to use the DA-2003 for an extended period of time.

4.   **Battery Eliminator.** BC Biomedical's AC Adapter plug-in power supply transformer allows you to use the DA-2003 anywhere a standard electrical outlet is available. To attach the AC Adapter insert the adapter's small connector into the micro jack labeled "Batt. Elim. 9V DC" on the right rear of the unit. Plug the large connector into the nearest standard electrical outlet.

4.4 Internal Paddles

To be able to test defibrillators with internal paddles, an internal paddle adapter has to be used. These contacts have a banana plug that is attached to the standard paddle contact, and which is protected by a plastic insulation washer.
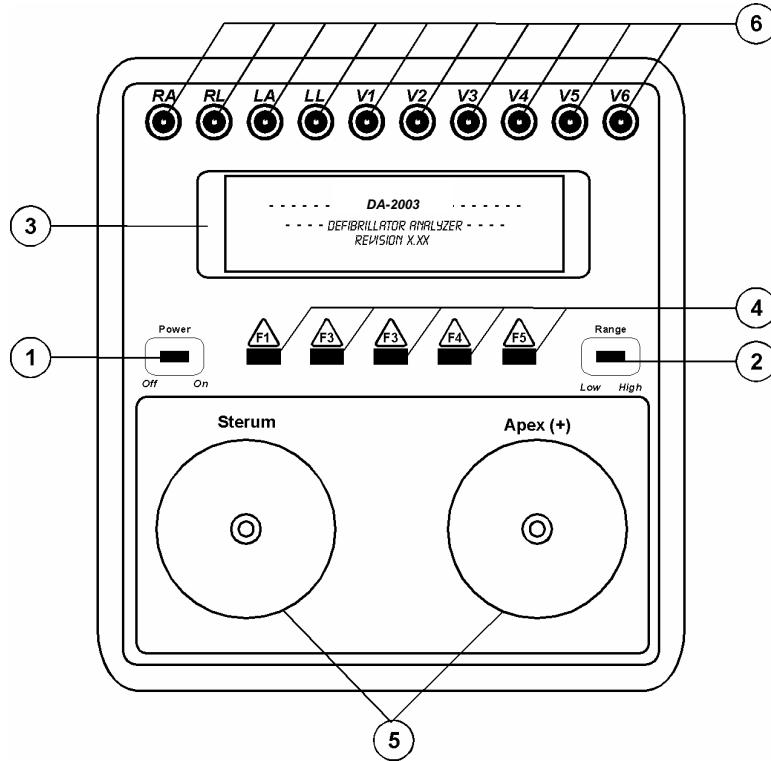
4.5 Special Contacts

Certain defibrillators (automatic models and those with pacer options) have special contacts that are fastened to the electrodes attached to the patient. BC Biomedical has special adapters to suit the majority of these defibrillators. These are available as accessories. They are more or less the same as the internal pad adapter except that they have a special adapter on the top, which matches the contact on the defibrillator. Defibrillator paddle adapter (specify defibrillator type)

V.   OPERATING

5.1 Control Switches and Connections

Front Panel

1. Power Switch	Turns the power on and off.
2. Range Switch	Switches between Low and High ranges of defibrillator energy.
3. LCD Display	Shows messages, test results and function menus.
4. Function Keys	FI - F5 are used to select the functions shown on the bottom line of the LCD display, i.e., for selecting the function that is directly above the key.
5. Contact Surfaces	The defibrillator's paddles are placed on these so that the discharged energy passes through the instrument in defib. mode and that the pacer signal passes through the instrument with a fixed 50 ohm load in the PACE mode.
6. Low Level ECG Connectors	10 color-coded 4 mm safety terminals with snap-to-banana adapters.

Rear Panel
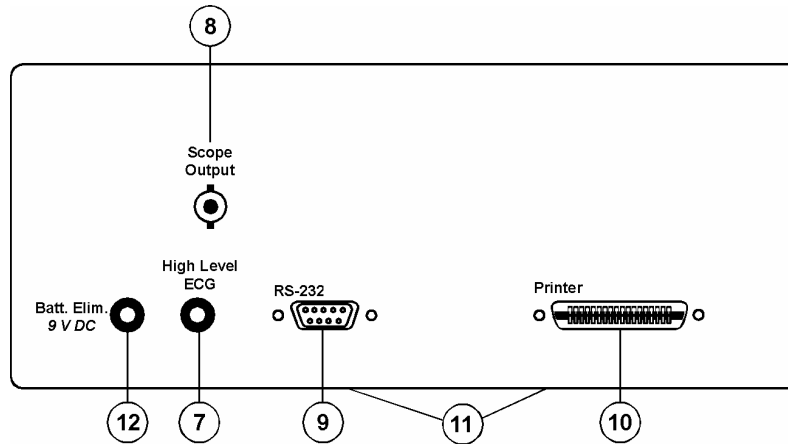
|		
7.	**High Level ECG Jack**	1/4" standard phone-jack for amplitude of 1 V/mV of low level Lead 1 signal.
8.	**Oscilloscope Output**	BNC-contact for attenuated signal in real time.
9.	**RS-232 Serial Port**	9-pin D-sub
10.	**Printer Outlet Port**	14-25 pin D-sub
11.	**Location of Batteries**	2 compartments in the base of the instrument can be opened to replace the batteries.
12.	**Battery Eliminator Socket**	Battery contact for connecting 9V 30 mA battery eliminator.

5.2 Menu and Function Keys

The DA-2003 uses display and programmable function keys to provide flexibility and control over the operations. The upper part of the screen displays messages, status and results. The menu bar is at the bottom of the display. The function keys are numbered from FI to F5.

A function is selected by pressing the key located directly under the Menu Item displayed in the menu bar. A menu unit is written in capital letters. The menu has two pages. The next pages of the menu are selected by pressing **more-2**, or **more-1**.

5.3 Menu and Messages

1. **Startup Screen**. The following screen will be displayed for 2 seconds after the DA-2003 has been switched on.
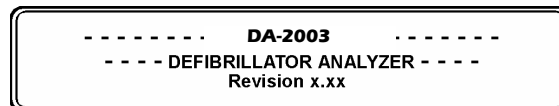
2. **Main Menu**

   a. Main Menu Bar (Page 1) - Mode switch in Low or High position.

```
- - - - - STATUS - - - -        - - - - - RESULT - - - -
Wave    :     off          Energy   :   0.0 JOULES
Ampl.   :                   Peak U   :   0.0 VOLTS
Load    :     50 OHMS       Peak I   :   0.0 AMPS
Oper.   :     LOCAL         Charge T :   MS

ECG          PERF.      CHARGE     PRINT
WAVE         WAVE       TIME       HEADER      more-2
```
F1   F2   F3   F4   F5

   b. Second Menu Bar (Page 2)

```
WAVE       PLAY       SYSTEM     REMOTE
AMPL.      PULSE      TEST       CONTR.      more-1
```
F1   F2   F3   F4   F5

3. **ECG WAVES (F1).**

```
→   off          180 BPM      PAC          run5PVC
    vfib         240 BPM      PVC_E        vtach
    30 BPM       300 BPM      PVC_STD
    60 BPM 80    afib         PVCRonT
    BPM          blk II       mfPVC
    120 BPM      RBBB         bigeminy

                 UP           DOWN        SELECT      CANCEL
```
F1   F2   F3   F4   F5

Choose desired wave by pressing **UP (F2)** or **DOWN (F3)**. Save this under 'Wave" in the STATUS field by pressing **SELECT (F4)**. Press **CANCEL (F5)** to cancel selection.

4. **PERF. WAVE (Performance ECG) (F2)**.

```
→   off          Sine 0.5
    Pulse        Sine 10
    Square       Sine 40
    Triang.      Sine 50
    Sine 0.1     Sine 60
    Sine 0.2     Sine 100

                 UP           DOWN        SELECT      CANCEL
```
F1   F2   F3   F4   F5

Choose desired selection by pressing **UP (F2)** or **DOWN (F3)**. Save this under 'Wave" in the STATUS field by pressing **SELECT (F-4)**. Press **CANCEL (F5)** to cancel selection.

5. **CHARGE TIME (F3).** Used to test the battery and charging capacitor in the defibrillator. It changes the text 'Delay' to 'Chrg T : xx.x S' in the RESULT field in the main menu.

6. **PRINT HEADER (F4).** Automatically writes a heading for the new test protocol.
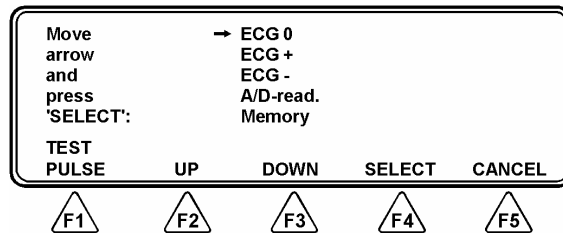
7.   **WAVE AMPL. (Wave Amplitude) (F1)**.

```
┌─────────────────────────────────────┐
│                                      │
│   To change ECG        2.0 mV        │
│   amplitude,           1.5 mV        │
│   move arrow and   →   1.0 mV        │
│   press 'SELECT':      0.5 mV        │
│                                      │
│                                      │
│           UP      DOWN    SELECT   CANCEL │
└─────────────────────────────────────┘
      /F1\    /F2\    /F3\    /F4\    /F5\
```
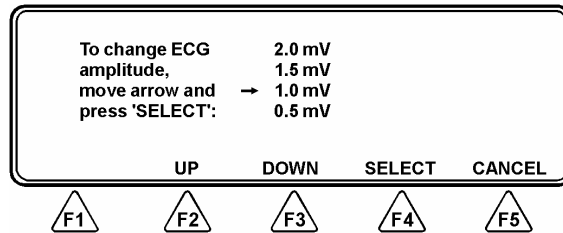
Choose desired amplitude by pressing **UP (F2)** or **DOWN (F3)**. Save this under 'Ampl" in the STATUS field by pressing **SELECT (F-4)**. Press **CANCEL (F5)** to cancel selection.

8.   **PLAY PULSE (F2)** enables playback of the last discharge. See the discussion on playback of energy wave on page 4-3.

9.   **SYSTEM TEST (F1)**

```
┌─────────────────────────────────────┐
│   Move           →  ECG 0            │
│   arrow             ECG +            │
│   and               ECG -            │
│   press             A/D-read.        │
│   'SELECT':         Memory           │
│                                      │
│   TEST                               │
│   PULSE     UP      DOWN    SELECT   CANCEL │
└─────────────────────────────────────┘
      /F1\    /F2\    /F3\    /F4\    /F5\
```

Choose a test variant by pressing **UP (F2)** or **DOWN (F3) or TEST PULSE (F1)**. Press **CANCEL (F5)** to cancel selection. Also, Chapter 5, Control and Calibration, for additional information on 'ECG0', 'ECG+' and 'ECG-' (paragraphs 5.4.10-12) and 'A/D-read' (paragraph 5.4.20). 'Memory' is for factory testing.

10.   **REMOTE CONTR. (Remote Control) (F4)** enables communication with a PC with test automation software.

┌─────────────────────────────────────┐
Note
DA-2003 has an internally generated test pulse. The control pulse is set at 1.2 Joules in the Low range and 28.5 Joules in the High range. The test pulse is not a calibration pulse, and should not be used as an indication of the general accuracy of the instrument. The test pulse is a good control for testing functions.

5.4 Test Result Printouts

DA-2003 automatically prints out the test results, via the printer output, after each discharge generated. Select **PRINT HEADER (F4)** if you want to print out a page with a new header.

VI. TESTING

6.1 Introduction

DA-2003 measures the energy output, and ensures that the defibrillator complies with specified requirements. It has a built-in load resistance of 50 ohms, which roughly corresponds to the impedance of the human body. The defibrillator pads are placed on the DA-2003 contact plates. Thus, the defibrillator is connected through the load resistance. When the defibrillator is discharged, DA-2003 will calculate and display the energy delivered.

Defibrillator energy is defined as an integral of the moment of the discharged energy from the defibrillator. The energy is equal to the square of the voltage, divided by the load resistance.

$$E = \int p\, dt = \int V^2 / R\, dt = \int V^2\, dt / R$$

DA-2003 measures and records the voltage pulse every 100 μs, 1000 times, for a total time of 100 ms. The squares of the voltages are then summed, multiplied by 100 μs, and divided by the load resistance, 50 ohms.

$$E = \sum_{0}^{1000} (V^2) \bullet dt / R = \sum_{0}^{1000} (V^2) \bullet 100\ \mu s / 50\ ohms$$

The unit for energy is 'joule', which is equal to Ws (Watt second).

6.2 Test Preparation

1.   If checking ECG monitoring, prompting, or triggering from the ECG, connect the low level or high level ECG connectors to the ten 4 mm AHA color-coded safety terminals or standard phone jack, as appropriate.

2.   Switch the DA-2003 on. The following will be displayed in the LCD display for about two seconds:

```
- - - - - - -      DA-2003        - - - - - - -
         - - - - DEFIBRILLATOR ANALYZER - - - -
                   Revision x.xx
```

3.   The following main menu will then appear. It will show LOCAL.

```
- - - - - STATUS - - - -        - - - - - RESULT - - - -
Wave    :     off           Energy    :   0.0 JOULES
Ampl.   :                   Peak U    :   0.0 VOLTS
Load    :   50 OHMS         Peak I    :   0.0 AMPS
Oper.   :   LOCAL           Charge T  :   MS

ECG          PERF.      CHARGE     PRINT
WAVE         WAVE       TIME       HEADER      more-2
```

/F1\   /F2\   /F3\   /F4\   /F5\

6.3 Energy Test

1. Select a suitable energy range using the mode switch.
   - Use the HIGH range for normal adult testing.
   - Use the LOW range for low energy testing, where the energy does not exceed 50 Joule and the peak voltage does not exceed 1200 volts.

2. Securely place the defibrillator paddles on the DA-2003 contact plates, and discharge the defibrillator. The APEX (+) pad should be connected to the right-hand plate, and the STERNUM pad to the left plate. This ensures correct signal polarity for the oscilloscope output. A reversal of this configuration will not damage the DA-2003, nor will it give incorrect energy readings. However, the polarity of the oscilloscope output will simply be reversed. The discharge from the defibrillator is transferred to the DA-2003's load resistance.

3. DA-2003 calculates the energy delivered over the load resistance and displays the result in joules under RESULT.

Note
If the maximum voltage for a selected range is exceeded, the LCD display will show 'WARNING! Overload'

```
- - - - - STATUS - - - -        - - - - - RESULT - - - -
Wave    :     off            Energy   :   0.0 JOULES
Ampl.   :                    Peak U   :   0.0 VOLTS
Load    :    50 OHMS         Peak I   :   0.0 AMPS
Oper.   :    LOCAL           Charge T :   MS

ECG        PERF.      CHARGE    PRINT
WAVE       WAVE       TIME      HEADER     more-2

 /F1\      /F2\       /F3\      /F4\      /F5\
```

APEX (+) pad → right plate
STERNUM pad → left plate

DA-2003 also shows the energy measured, the maximum voltage and the maximum current in the energy wave. Following the discharge from the defibrillator, DA-2003 shows a playback of the wave from the ECG output. A new pulse can be generated when the LCD display shows 'LOCAL'.

4. Following a discharge from the defibrillator, the instrument shows a playback of the wave from the ECG output. The display will thus be in playback mode. When this is shown in one line, DA-2003 automatically prints out the result.

5. The discharged pulse can be repeated. To do this press **more-2 (F5)** to advance to page 2 of the main menu.

```
WAVE      PLAY      SYSTEM   REMOTE
AMPL.     PULSE     TEST     CONTR.     more-1

 /F1\     /F2\      /F3\     /F4\      /F5\
```

Press **PLAY PULSE (F2)**. The display will show 'Oper: Playback,' and displays the result in joules under RESULT.

```
- - - - - STATUS - - - -        - - - - - RESULT - - - -
Wave    :     off            Energy   :   0.0 JOULES
Ampl.   :                    Peak U   :   0.0 VOLTS
Load    :    50 OHMS         Peak I   :   0.0 AMPS
Oper.   :    LOCAL           Charge T :   MS

ECG        PERF.      CHARGE    PRINT
WAVE       WAVE       TIME      HEADER     more-2

 /F1\      /F2\       /F3\      /F4\      /F5\
```

Following playback, the apparatus is ready to receive a new discharge from the defibrillator. The display will show 'LOCAL'.

6. When testing automatic defibrillators, it is quite common to have to select 'vfib' from the ECG menu 'ECG WAVE' for the 'ventricular fibrillation' wave. Automatic defibrillators typically do not fire without seeing 'v-fib'.

6.4 Cardioversion Test

1. Select **ECG WAVE (F1)** from the main menu.

```
- - - - - STATUS - - - -        - - - - - RESULT - - - -
Wave    :      off           Energy    :   0.0 JOULES
Ampl.   :                     Peak U    :   0.0 VOLTS
Load    :    50 OHMS          Peak I    :   0.0 AMPS
Oper.   :    LOCAL            Charge T  :   MS

ECG          PERF.        CHARGE     PRINT
WAVE         WAVE         TIME       HEADER      more-2
```
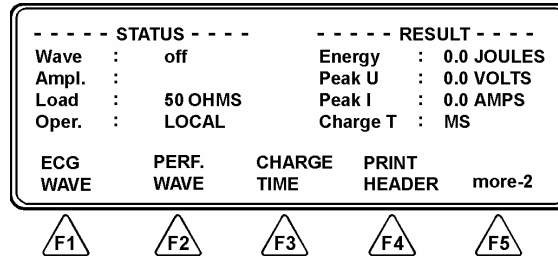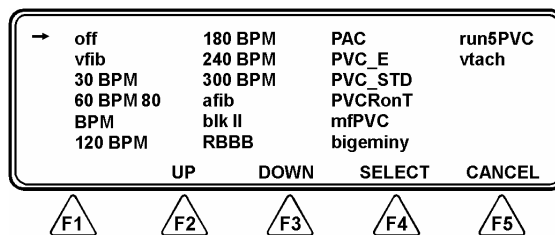/F1\   /F2\   /F3\   /F4\   /F5\

2. The ECG Wave menu opens. DA-2003 includes the following ECG wave selection for cardioversion tests, or for the testing of electrocardiograph monitors.
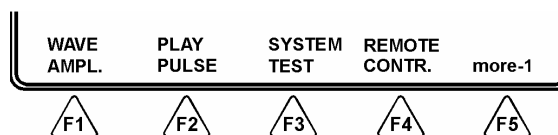
Normal Sine Rates: 30, 60, 80, 120, 180, 240 and 300
ECG Arrhythmia types as follows:

vfib	Ventricular Fibrillation
afib	Atrial Fibrillation
blk II	Second degree A-V block
RBBB	Right Bundle Branch Block
PAC	Premature Atrial Contraction
PVC_E	Early PVC
PVC_STD	PVC
PVCRonT	R on T PVC
mfPVC	Multifocal PVC
bigeminy	Bigeminy
run5PVC	Bigeminy Run of 5 PVCs
vtach	Ventricular Tachycardia

```
→    off          180 BPM      PAC         run5PVC
     vfib         240 BPM      PVC_E       vtach
     30 BPM       300 BPM      PVC_STD
     60 BPM 80    afib         PVCRonT
     BPM          blk II       mfPVC
     120 BPM      RBBB         bigeminy

              UP         DOWN      SELECT     CANCEL
```
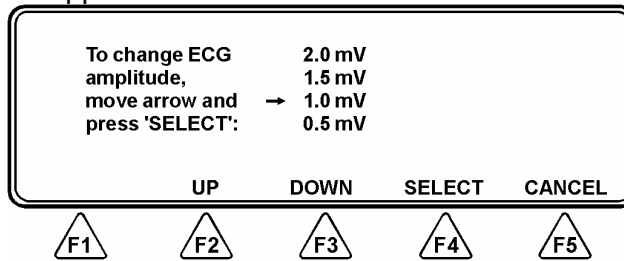/F1\   /F2\   /F3\   /F4\   /F5\

Select a desired wave by pressing **UP (F2)** or **DOWN (F3)**. Save this under 'Wave" in the STATUS field by pressing **SELECT (F4)**. Press **CANCEL (F5)** to cancel selection.

3. DA-2003 includes the following ECG wave amplitude options:
0.5 mV, 1.0 mV, 1.5 mV and 2.0 mV. To change wave amplitude select **more-2** on the main menu to advance to page 2. Select **WAVE AMPL. (F1)**.

```
WAVE        PLAY       SYSTEM     REMOTE
AMPL.       PULSE      TEST       CONTR.      more-1
```
/F1\   /F2\   /F3\   /F4\   /F5\

15

The Wave Amplitude Menu appears:

```
┌─────────────────────────────────────────┐
│                                         │
│   To change ECG        2.0 mV           │
│   amplitude,           1.5 mV           │
│   move arrow and    →  1.0 mV           │
│   press 'SELECT':      0.5 mV           │
│                                         │
│                                         │
│              UP      DOWN    SELECT   CANCEL │
└─────────────────────────────────────────┘
     /F1\    /F2\    /F3\    /F4\    /F5\
```

Select the desired amplitude by pressing **UP (F2) or DOWN (F3)**. Save this under 'Ampl" in the STATUS field by pressing **SELECT (F4)**. Press **CANCEL (F5)** to cancel selection.

4. Set the defibrillator to synchronized cardioversion mode. Discharge the defibrillator over the instrument's load resistance.

5. DA-2003 measures the time delay in milliseconds (ms) between the top of the 'R' wave and the discharging of the defibrillator pulse. This delay will be shown in the LCD display as: 'Delay: xxx ms'. DA-2003 also shows the energy measured, the maximum voltage and the maximum current in the energy wave. Following the discharge from the defibrillator, DA-2003 shows a playback of the wave from the ECG output. A new pulse can be generated when the LCD display shows 'LOCAL'.
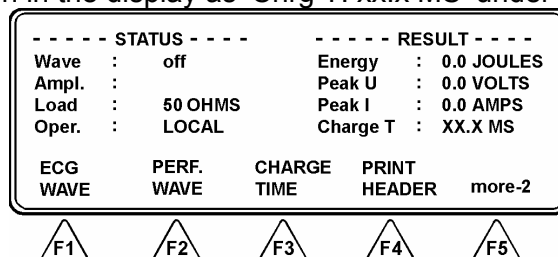
6.5 Maximum Energy Charging Time Test

1. The charge time function is used to test the battery and the charging capacitor in the defibrillator.

2. Set the defibrillator to maximum energy.

3. Securely place the defibrillator paddles on the DA-2003 contact plates, and discharge the defibrillator. The APEX (+) pad should be connected to the right-hand plate, and the STERNUM pad to the left plate. This ensures correct signal polarity for the oscilloscope output. A reversal of this configuration will not damage the DA-2003, nor will it give incorrect energy readings. However, the polarity of the oscilloscope output will simply be reversed. The discharge from the defibrillator is transferred to the DA-2003's load resistance.

4. Select **CHARGE TIME (F3)** from the main menu and the charge button on the defibrillator simultaneously.

```
┌─────────────────────────────────────────┐
│  - - - - - STATUS - - - -   - - - - - RESULT - - - - │
│  Wave   :    off          Energy   :  0.0 JOULES │
│  Ampl.  :                 Peak U   :  0.0 VOLTS  │
│  Load   :  50 OHMS        Peak I   :  0.0 AMPS   │
│  Oper.  :  LOCAL          Charge T :  MS         │
│                                                 │
│  ECG     PERF.    CHARGE    PRINT               │
│  WAVE    WAVE     TIME      HEADER    more-2     │
└─────────────────────────────────────────┘
     /F1\    /F2\    /F3\    /F4\    /F5\
```

```
┌────────────────────────────────┐
│ APEX (+) pad   → right plate   │
│ STERNUM pad  → left plate      │
└────────────────────────────────┘
```
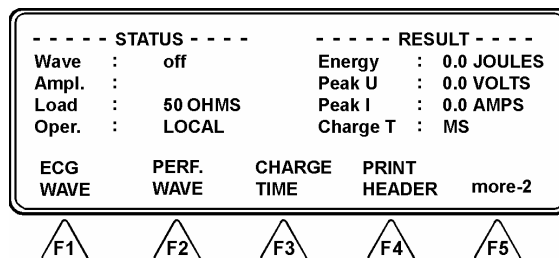
When the defibrillator is charged, discharge it through the instrument.

5. Charging time will be shown in the display as 'Chrg T: xx.x MS' under RESULT.

```
┌─────────────────────────────────────────┐
│  - - - - - STATUS - - - -   - - - - - RESULT - - - - │
│  Wave   :    off          Energy   :  0.0 JOULES │
│  Ampl.  :                 Peak U   :  0.0 VOLTS  │
│  Load   :  50 OHMS        Peak I   :  0.0 AMPS   │
│  Oper.  :  LOCAL          Charge T :  XX.X MS    │
│                                                 │
│  ECG     PERF.    CHARGE    PRINT               │
│  WAVE    WAVE     TIME      HEADER    more-2     │
└─────────────────────────────────────────┘
     /F1\    /F2\    /F3\    /F4\    /F5\
```

IX.   WARRANTY

BC Biomedical warrants that the DA-2003 Defibrillator Analyzer will substantially conform to published specifications and to the documentation, provided that it is used for the purpose for which it was designed. BC Biomedical will, for a period of twelve (12) months from date of purchase, replace or repair any defective analyzer, if the fault is due to a manufacturing defect. In no event will BC Biomedical or its local representatives be liable for direct, indirect, special, incidental, or consequential damages arising out of the use of or inability to use the DA-2003 Defibrillator Analyzer, even if advised of the possibility of such damages. BC Biomedical or its local representat ives are not responsible for any costs, loss of profits, loss of data, or claims by third parties due to use of, or inability to use the DA-2003 Defibrillator Analyzer. Neither BC Biomedical nor its local representatives will accept, nor be bound by any other form of guarantee concerning the DA-2003 Defibrillator Analyzer other than this guarantee. Some jurisdictions do not allow disclaimers of expressed or implied warranties in certain transactions; therefore, this statement may not apply to you.

X.   TECHNICAL SUPPORT

BC Biomedical's DA-2003 Defibrillator Analyzer is backed by a superior support staff. If the DA-2003 ever fails to work perfectly, please contact the Technical Support Staff.

Written Communications
You may write a letter with your comments and send it to:

BC Biomedical
BC Group International, Inc.

3081 Elm Point Industrial Dr
St. Charles MO   USA   63301
OR
E-mail: sales@bcgroupintl.com

Phone Support
You can telephone the Technical Assistance Center at 314-638-3800 or 1-800-242-8428 between 8:00 AM and 4:30 PM Central Standard Time (CST) Monday through Friday, except holidays.

Whichever method of contact you choose, please provide the following information:

- Product name and serial number

- Revision level of your software

- The specific steps which reproduce your problem

- Any error codes displayed on screen

- A daytime phone number, fax number, and/or email address (if available)

- Your name / company