



ELECTRICAL SAFETY ANALYZER



SA-2000

USER MANUAL

**BC BIOMEDICAL
SA-2000
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WARNING

All connections to patients must be removed before connecting the Device Under Test (DUT) to the Analyzer. A serious hazard may occur if the patient is connected when testing with the Analyzer.

Do not connect any leads from the patient directly to the Analyzer or DUT.

CAUTION

The Analyzer is not a continuous duty device. Do not leave the device under test (DUT) connected to this unit for extended periods. It is intended for short duration testing within the current limits and duty cycles specified.

<p style="text-align: center;">BC GROUP SA-2000 ELECTRICAL SAFETY ANALYZER</p>

The Model SA-2000 is a Microprocessor based Electrical Safety Analyzer. The following are highlights of some of the main features:

GENERAL

- DEVICE UNDER TEST CURRENT MEASUREMENT
- EARTH / GROUND LEAD RESISTANCE
- EARTH / GROUND LEAKAGE CURRENT
- CHASSIS LEAKAGE CURRENT
- TRUE RMS MEASUREMENTS
- 85 TO 265 VAC OPERATION
- FULL 20 AMP RATING
- TOUCH CONTROL KEYS – NO KNOBS
- LED STATUS INDICATORS
- AUDIO FEEDBACK
- EXTERNALLY REPLACEABLE GROUND FUSE
- AUTOMATIC LOAD REVERSAL DELAY

ACCESSORIES

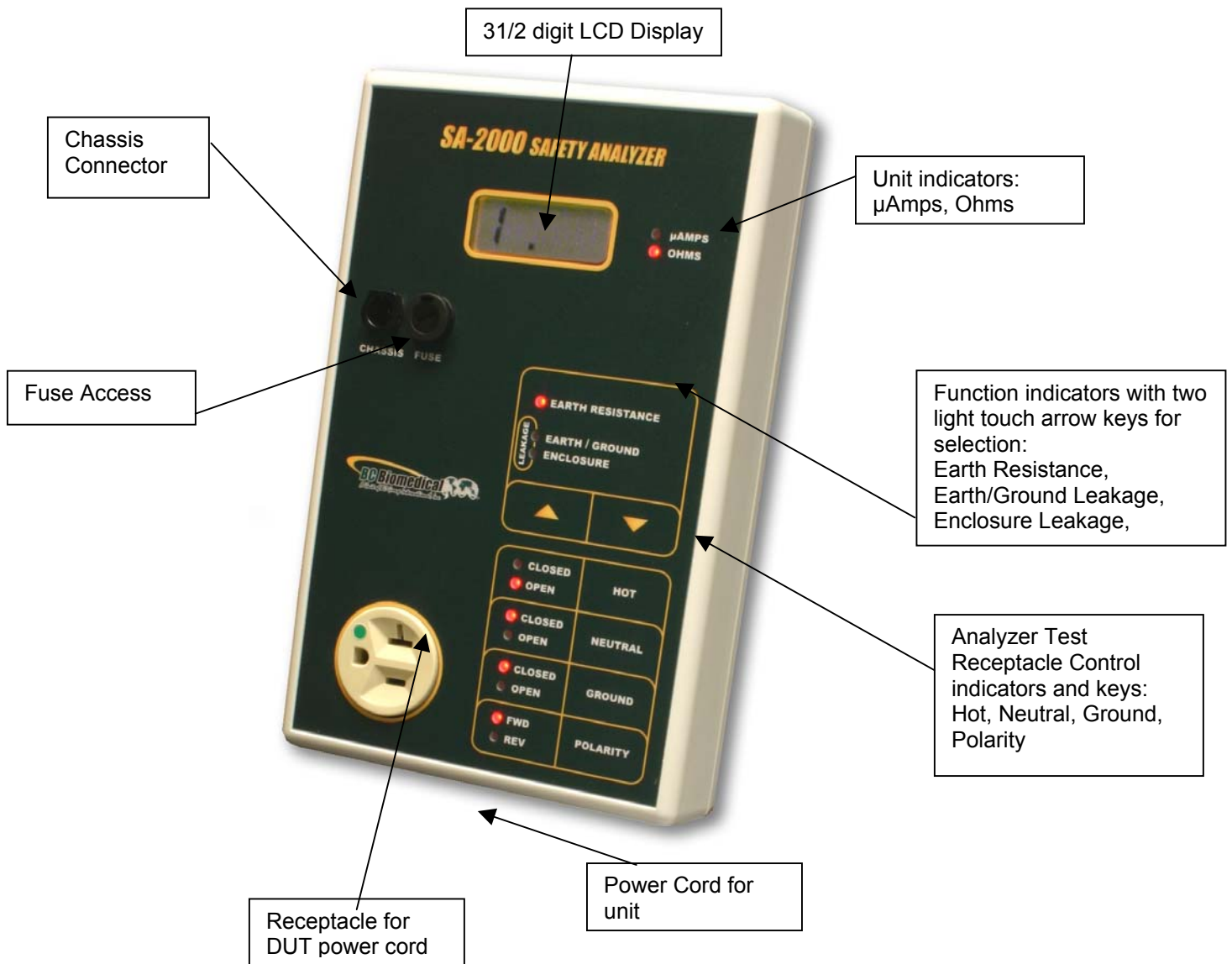
BC20 - 20110	CHASSIS CABLE (BLACK) 8 FT
BC20 - 30107	BC BIOMEDICAL MEDIUM SOFT SIDED CARRYING CASE

OPTIONAL ACCESSORIES

BC20 - 20112	CHASSIS CABLE (BLACK) 16 FT
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LAYOUT

This section looks at a SA-2000 layout, with the elements that are present labeled.



The unit is controlled by 6 light touch keys. They allow the user to perform all the functions available in the system. There is an audio click when a key is depressed. Note that some keys are locked out based on the current function setting. If an invalid key is depressed, a Razz tone is sounded.

There are 13 LEDs to provide the user with full information about the test that is being performed and the current setup. This section will review the layout and operation of each of the elements.

Display

The main information in the system is presented in the 3½ digit LCD display. This data is provided as simple meter readings with the units indicated by one of the two LEDs on the right of the display. The units LEDs will automatically change to the necessary range based on the function selected.

Function Selection

Three LEDs and two keys make up the Function Selection Section. The keys are up and down arrows. When depressed, they step the Analyzer through the available options. The LED next to the currently selected option is illuminated.

Analyzer Test Receptacle Control

There are four keys and 8 LEDs in the Analyzer Test Receptacle Control Section. They allow the manual control of the power connections that are made to the DUT. Internally, a series of relays are switched by the microprocessor based on the keys that are depressed. The LEDs indicate the current state of the power connections to the Receptacle.

Note: The Forward/Reverse keys have an internal switching delay feature that first turns off the power to the DUT, delays for a short period, reverses the lines and then turns the unit back on. This eliminates the need for the user to remember to delay at this point or risk damage to the Analyzer.

Connectors

There is a connector for the Chassis lead into which the test cable simply plugs. There is a release pin on the cable plug that must be depressed to remove the cable.

Fuse

There is a fuse in the ground leg of the Analyzer Test Receptacle. This is to help prevent damage from excess ground current. It is located on the face for ease of replacement.

Test Receptacle

This receptacle is for the connection of the Device Under Test (DUT). It is Hospital Grade, rated 20 A. An external patch cord is necessary to connect devices utilizing different types of plugs.

Power Cord

The unit uses a standard Hospital Grade power cord. This cord provides power to both the Safety Analyzer and the DUT. The connector is designed to plug into a 15A, 125 VAC, Receptacle. For higher voltage and current applications, an external patch cord is required.

TESTING

WARNING

All connections to patients must be removed before connecting the Device Under Test (DUT) to the Analyzer. A serious hazard may occur if the patient is connected when testing with the Analyzer.

Do not connect any leads from the patient directly to the Analyzer or DUT.

The SA-2000 Safety Analyzer allows the user flexibility in testing. Several basic tests can be run and in almost any sequence. The information in this section presents a systematic approach that is just one way to proceed. It is only presented as a guide and it is the responsibility of the user to establish which tests are required based on local codes, facilities practices and equipment manufacturer's recommendations.

The Analyzer requires a good Earth/Ground connection for operation. It should be plugged into a "Hospital Grade" receptacle. This is necessary for both good test results and personal safety.

The unit will power up with the Neutral and Ground Closed, in Forward Polarity and with the Hot Open. It is recommended that the unit be returned to this condition when plugging and unplugging the Device Under Test (DUT).

Earth Resistance

With the Earth Resistance function selected, the display will show the resistance between the Chassis Test lead and the Earth/Ground Pin on the Analyzer Test Receptacle. This resistance is a combination of the resistance within the DUT enclosure and the resistance in the Earth/Ground Lead in the DUT power cord.

NOTE: This test has no meaning for equipment that does not use a three-wire (Earth/Grounded) power cord.

The test requires that the Black (Kelvin) test cable be plugged into the Chassis Socket. The other end should be connected to a solid ground point on the DUT. Consult the equipment manufacturer's documentation for the recommended connection point.

Since the Black (Kelvin) cable removes any error from the test lead and the internal circuitry uses a similar connection at the Analyzer Test Receptacle ground pin (providing a true 4 wire reading), the value displayed is the actual resistance of interest, without any compensation. The display is in hundredths of Ohms and will read to 19.99 Ohms. Overrange shows as 1_ _ _.

Earth/Ground Leakage Current

With the Earth/Ground function selected and the Ground-Open, the display will show the leakage current in the ground wire of the DUT. The display is in μ Amps and will read from 0 to 1999.

Selecting this function automatically opens the connection to Earth/Ground and passes any leakage current through a 1000 Ohms load with either AAMI ES1-1993 frequency compensation as selected by the Load key.

The test should be performed for all receptacle switch combinations as called out in the Test Matrix, or a subset of these based on the manufacturer's specifications or local codes and protocols.

NOTE: This test has no meaning for equipment that does not use a three-wire (Earth/Grounded) power cord.

Enclosure Leakage

With the Enclosure function selected, the display will show the leakage current between the Enclosure (Chassis) and Earth/Ground. The display is in μAmps and will read from 0 to 1999.

The test requires that the Black (Kelvin) test cable be plugged into the Chassis Socket. The other end should be connected to a solid ground point on the DUT. Consult the equipment manufacturer's documentation for the recommended connection point.

NOTE: If a non-conductive enclosure is used, a 200 cm^2 conductive foil pad should be used. This foil is to be placed in close contact with the enclosure and connected to the Black lead.

Any leakage current will flow through the Black lead and then through a 1000 Ohms load with either AAMI ES1-1993 frequency compensation as selected by the Load key.

The test should be performed for all receptacle switch combinations as called out in the Test Matrix, or a subset of these based on local codes, facilities practices and equipment manufacturers recommendations.

Test Matrix

DUT POWER	GROUND	POLARITY	HOT	NEUTRAL
On	Closed	Forward	Closed	Closed
On	Closed	Forward	Closed	Open
On	Closed	Forward	Open	Closed
On	Closed	Forward	Open	Open
On	Closed	Reverse	Closed	Closed
On	Closed	Reverse	Closed	Open
On	Closed	Reverse	Open	Closed
On	Closed	Reverse	Open	Open
On	Open	Forward	Closed	Closed
On	Open	Forward	Closed	Open
On	Open	Forward	Open	Closed
On	Open	Forward	Open	Open
On	Open	Reverse	Closed	Closed
On	Open	Reverse	Closed	Open
On	Open	Reverse	Open	Closed
On	Open	Reverse	Open	Open
Off	Closed	Forward	Closed	Closed
Off	Closed	Forward	Closed	Open
Off	Closed	Forward	Open	Closed
Off	Closed	Forward	Open	Open
Off	Closed	Reverse	Closed	Closed
Off	Closed	Reverse	Closed	Open
Off	Closed	Reverse	Open	Closed
Off	Closed	Reverse	Open	Open
Off	Open	Forward	Closed	Closed
Off	Open	Forward	Closed	Open
Off	Open	Forward	Open	Closed
Off	Open	Forward	Open	Open
Off	Open	Reverse	Closed	Closed
Off	Open	Reverse	Closed	Open
Off	Open	Reverse	Open	Closed
Off	Open	Reverse	Open	Open

MANUAL REVISIONS

<u>Revision #</u>	<u>Program #</u>	<u>Revisions Made</u>
Rev 01	DT7335B	Preliminary Manual
Rev 02	DT7335B	Table of Contents Updated
Rev 03	DT7335B	Color Overlays
Rev 04	DT7335CD	Accessories Added

LIMITED WARRANTY

WARRANTY: BC GROUP INTERNATIONAL, INC. WARRANTS ITS NEW PRODUCTS TO BE FREE FROM DEFECTS IN MATERIALS AND WORKMANSHIP UNDER THE SERVICE FOR WHICH THEY ARE INTENDED. THIS WARRANTY IS EFFECTIVE FOR TWELVE MONTHS FROM THE DATE OF SHIPMENT.

EXCLUSIONS: THIS WARRANTY IS **IN LIEU OF** ANY OTHER WARRANTY EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF **MERCHANTABILITY** OR FITNESS FOR A PARTICULAR PURPOSE.

BC GROUP INTERNATIONAL, INC. IS NOT LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES.

NO PERSON OTHER THAN AN OFFICER IS AUTHORIZED TO GIVE ANY OTHER WARRANTY OR ASSUME ANY LIABILITY.

REMEDIES: THE PURCHASER'S SOLE AND EXCLUSIVE REMEDY SHALL BE: (1) THE REPAIR OR REPLACEMENT OF DEFECTIVE PARTS OR PRODUCTS, WITHOUT CHARGE. (2) AT THE OPTION OF **BC GROUP INTERNATIONAL, INC.**, THE REFUND OF THE PURCHASE PRICE.

SPECIFICATIONS


SCALES & RANGES	
EARTH/GROUND RESISTANCE	0-19.99 Ohms +/- 1% of reading, +/- 1 digit
LEAKAGE CURRENT	0-1999 μ Amps, RMS
DC and 25 to 1KHz	+/- 1.0% of reading, +/- 1 digit
1.00 KHz – 100 KHz	+/- 2.5% of reading, +/- 1 digit
100 KHz – 1.00 MHz	+/- 5.0% of reading, +/- 1 digit
CAPACITY	15 Amps, 30 Minutes 20 Amps, 5 Minutes

PHYSICAL	
ENCLOSURE	8.625 x 5.5 x 1.625 Inches (219 x 140 x 41 mm) ABS Plastic
WEIGHT	<2.5 Lbs (<1.1 Kg)
DISPLAY	.5 inch, 3 ½ digit LCD
FACE PLATE	Lexan, Back printed
OPERATING RANGE	15 to 40 C
STORAGE RANGE	-20 to 65 C


ELECTRICAL	
POWER	85 to 265 VAC, 50/60 Hz 5 VA
FUSE	250 mA, 250 V 5X20 mm, Fast Acting Receptacle Ground Leg

APPENDIX A -- LABEL

The following is a representation of the label found on the back of the SA-2000:

WARNING 

***All Connections to Patients Must be Removed Before Connecting the Analyzer to the Device Under Test (DUT).**
***The Analyzer Is Not a Continuous Duty Device.**
Do Not Leave DUT Connected For Extended Periods.


QUICK REFERENCE GUIDE 
(See User Manual For Details)

Earth Resistance: Connect Black Cable from Chassis Socket to Solid Ground Point on DUT. Read Ground Lead Resistance.

Earth/Ground Leakage Current: Read Leakage. Repeat for All Receptacle Switch Combinations.

Enclosure Leakage: Connect Black Cable from Chassis Socket to Solid Ground Point on DUT. Read Leakage. Repeat for All Receptacle Switch Combinations.

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85-265 VAC, 50/60 Hz, 5 VA
15 Amps, 30 Minutes / 20 Amps, 5 Minutes
Ground Fuse - 250 mA, 250 V,
5X20 mm, Fast Acting

Made in the USA (FD-7334B-01)

NOTES