

User Manual

MAXISIM 2000 Patient Simulator



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II. INTRODUCTION

BC Biomedical's MaxiSim 2000 is a high performance simulator designed to simplify patient monitor testing, and is designed to be used by trained service technicians. It simulates electrocardiogram, respiration, dynamic blood pressure and static temperature.

It offers three preprogrammed automatic test modes (ECG rate, ECG performance rate, and BP level), plus a built-in ECG lead continuity test. Arrhythmia selection includes two supraventricular, two-conduction; eight ventricular, one paced; and one fetal/maternal ECG simulation.

General MaxiSim 2000 Information:

| | |
|------------------------------|--|
| Display/Control: | 2-digit numeric display keys 5 switches for BP, respiration, temperature and Power On/Off |
| ECG Output Connectors | |
| High Level: | Standard phone jack |
| Low level: | 10 AHA color-coded standard safety banana connectors with detachable banana to snap adapter. |
| Power: | 9 V Alkaline battery or battery eliminator |
| Case: | High impact plastic |
| Weight: | 0.5 kg / 1.1 lbs. |
| Dimensions: | Height: 47 mm / 1.8 in. Width: 138 mm / 5.4 in. Length: 190 mm / 7.5 in. |
| Standard Accessories: | MaxiSim 2000 Patient Simulator Carrying Case User Manual MaxiSim 2000 |
| Optional Accessories: | Unterminated or prewired BP Cable Unterminated or prewired 400/700 YSI-series Temperature Cable 110 V or 220 V AC Adapter |

III. SPECIFICATIONS

ECG General

| | |
|---------------------|--|
| Lead Configuration: | 12-lead simulation derived from one resistively divided analog signal. RL, RA, LA, LL, V1-6 |
| Output Impedance | |
| Limb leads: | 500 or 1000 ohms to RL |
| V Leads: | 1000 ohms to RL |
| High Level Output: | 0.5 V/mV of low level (Lead II) |

Normal Sinus

| | |
|---------------------|--|
| Rates: | 30, 60, 80, 120, 180, and 300 BPM |
| Rate Accuracy: | ± 1% of selection |
| Amplitudes: | 0.5mV, 1.0mV, 1.5mV and 2.0mV (Lead II) |
| Amplitude Accuracy: | ± 5%. (Lead II 1.0mV) Automatic ECG Rate Test |

Manual ECG Performance Test

| | |
|---------------------|---|
| Square Wave: | 2.0Hz 1.0 V p-p biphasic |
| DC pulse: | 4.0 sec. 1.0 mV |
| Sine Waves: | 0.1, 0.5, 10, 40, 50, 60 and 100 Hz |
| Triangle Wave: | 2.0 Hz |
| Amplitude: | 0.5mV, 1.0mV, 1.5mV and 2.0mV (Lead II) |
| Amplitude Accuracy: | ± 5%. (Lead II 1.0mV) |

Automatic 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 Filter: | 50 Hz sine |
| Linearity: | 2 Hz triangle wave |

ECG Lead Test

Display flashes if lead resistance is <3 kOhms (DC lead wire only)

Blood Pressure General

| | |
|--------------------------|--------------------------|
| Input/Output Impedance: | 300 Ohms |
| Exciter Voltage Range: | 2 to 16 volts |
| Exciter Frequency Range: | DC to 4000 Hz |
| Output Sensitivity: | 5 or 40 μ V/V/mmHg |
| Accuracy: | ± 1% full scale ± 1 mmHg |
| Calibrated Rate: | 80 BPM |

Dynamic Blood Pressure Selections

| | |
|--------------------------------|--|
| Arterial: | 120/80 mmHg |
| Left Ventricle: | 20/0 mmHg |
| Right Ventricle: | 25/0 mmHg |
| Pulmonary Artery: | 25/10 mmHg |
| CVP (Central Venous Pressure): | 15/10 mmHg |
| PAW (Pulmonary Wedge): | 10/2 mmHg |
| Static Levels: | 0, 20, 40, 80, 100, 200, 250, 300 mmHg |

Arrhythmia Selections

- Atrial Fibrillation 1 & 2
- Premature Atrial Contraction
- Premature Ventricular Contraction (PVC)
- Early PVC
- R on T PVC
- Multifocal PVCs
- Bigeminy
- Bigeminy Run of 5 PVCs
- Ventricular Tachycardia
- Ventricular Fibrillation
- Second Degree Type 2
- Right Bundle Branch Block
- Asynchronous Pacemaker
- Fetal/Maternal ECG

Respiration

Normal Physiological Simulation

Baseline Impedances:

500 to 1000 Ohms

Impedance Variations:

0.1, 0.2, 0.5, 1.0, and 3.0 Ohms

Rates:

0 (Apnea), 15, 20, 30, 40, 60, 120 BPM

Output Configuration:

Lead 1, 11, RL-LL

Temperature

30°C / 86°F, 37°C / 98.6°F, 40°C / 104°F

Compatible with YSI 400/700 series

Accuracy: $\pm 0.25^{\circ}\text{C}$

IV. RECEIPT, INSPECTION & 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:
 - MaxiSim 2000 Patient Simulator
 - Carrying Case

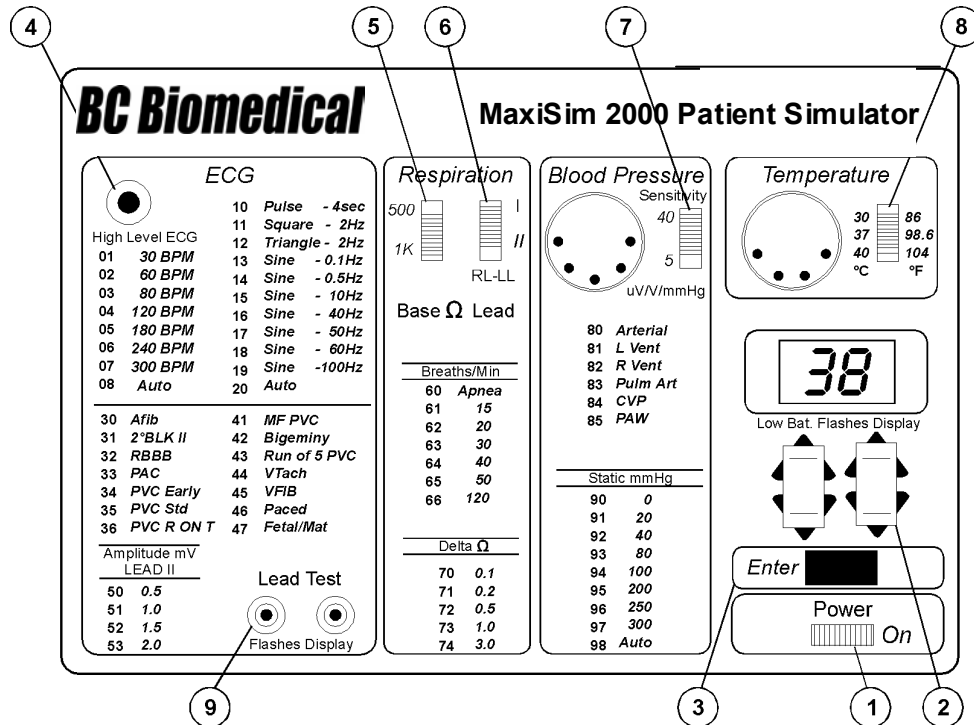
 - MaxiSim 2000 User Manual
3. If you note physical damage, or if the unit fails to function according to specification, inform the supplier immediately. When BC Biomedical or the company's representative, is informed, measures will be taken to either repair the unit or dispatch a replacement. The customer 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 8 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.

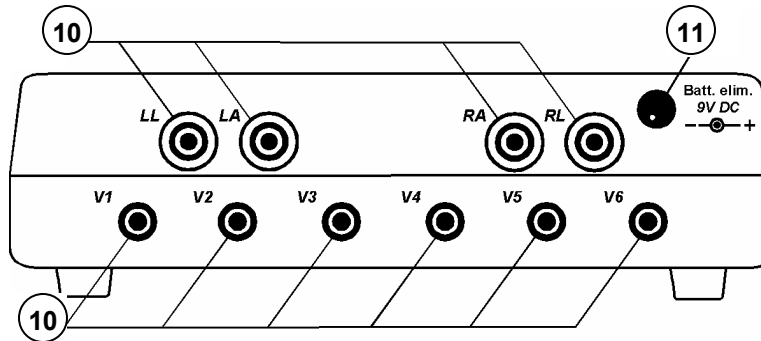
V. CONTROL SWITCHES AND TERMINALS

Front Panel



1. **Power Switch** Turns the power on and off.
2. **LCD Display** Sets LCD display waveform values. Use the right key to enter units, and the left key to enter tens. Press the top of the key to increase the value. Press the bottom of the key to decrease the value.
3. **Enter** Pressing this stores newly specified waveform value set by the keys.
4. **High Level ECG Connector** Standard phone jack connecting the high level ECG output signal.
5. **BASE (Baseline Impedance) Slide Switch** Sets the impedance between each lead. The respiration parameter (breathing rate/min) is selected and stored in the display.
6. **LEAD Slide Switch** Determines which lead is in use. The position of the switch must correspond to the type of patient monitor in use.
7. **Blood Pressure Slide Switch ($\mu\text{V}/\text{V}/\text{mmHg}$)** Sets the sensitivity to match the input sensitivity of the patient monitor (either 5 or 40 $\text{FV}/\text{V}/\text{mmHg}$). The waveform is selected and stored in the display.
8. **Temperature Slide Switch** Sets the temperature to be used.
9. **Lead Test Terminals** For testing ECG leads. Connect each end of the lead to one of the two Lead Test Terminals. The LCD display will flash if the lead is OK.

Rear Panel



10. Low level ECG Connectors

10 AHA color-coded 4mm safety terminals. Snap-to-banana adapters for the terminals are optional with the MaxiSim 2000.

11. Battery Eliminator

Micro jack for connecting the 9V plug-in power supply transformer for use in operating the unit from any standard electrical outlet.

NOTE

Use only BC Biomedical AC Adapter plug-in power supply transformer supplied with the unit.

USE

1. Power

The power switch is the slide-switch situated at the bottom right-hand corner of the panel. The instrument should be switched off when not in use, to save the battery. A flashing display indicates low battery power.

2. Battery Replacement

The battery is situated in the base of the instrument. Use a 9 volt alkaline battery.

3. Top Panel Controls and Connectors Display and Keyboard

The MaxiSim 2000 has a two-digit display. To the left of the LCD display is a listing of available waveforms and two-digit codes. Access a waveform by displaying its corresponding two-digit code. Use the two keys below the LCD display to enter units and tens (the right key is for units; the left is for tens). Pressing the top of the keys increases the values, while pressing the bottom of the keys decreases the values. The selected waveform is stored by pressing **Enter**. Repeat the above procedure if you desire to store several waveforms. By using the left-hand key (tens), you can switch between waveforms stored in the instrument.

NOTE

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

When the apparatus is switched on, the display will show the program version for a short period before switching into standard mode.

Manual ECG, High Level Output

The high level ECG output signal is a Lead II waveform with 0.5V/mV of low level Lead II. The high level ECG connection (standard phone jack) is situated in the upper left-hand corner of the instrument.

NOTE

When the instrument is switched off, all stored information will be canceled.

Respiration

The respiration signal is transferred via ECG connections. The position of the LEAD switch determines which lead is in use. The position of the switch must correspond to the type of patient monitor being used. The BASE (baseline impedance) switch sets the impedance between each lead. The respiration parameter (breathing rate/min.) is selected and stored in the display.

Blood Pressure

The sensitivity switch (pVN/mmHg) must be set to match the input sensitivity of the patient monitor (either 5 or 40 pVN/ mmHg). The waveform is selected and stored in the display. Prewired cables and diagrams for connecting various types of monitors are available from BC Biomedical. Unterminated cables are also available.

**CABLE CONNECTION MATRIX
BLOOD PRESSURE CABLE**

| DIN Plug | Pin No. | Color | Function |
|----------|---------|-------|-------------|
| | 4 | Black | Output (+) |
| | 1 | Red | Output (-) |
| | 3 | White | Exciter (+) |
| | 5 | Green | Exciter (-) |
| | 2 | Blue | ECG ref |

Temperature

(See below). The type of cable used determines the type of probe simulated, either 400 or 700 series YSI probes. Temperature is selected by a slide switch. Prewired 400/700 YSI-series temperature cables to connect to the temperature connector are available from BC. Unterminated cables are also available.

**CABLE CONNECTION MATRIX
UNIVERSAL TEMPERATURE CABLES**

| DIN Plug | Pin No. | Color | OUTPUT 1 | OUTPUT 2 |
|----------|---------|-------|------------|------------|
| | | | 400 Series | 700 Series |
| | 1 | Green | Tip | No conn. |
| | 2 | Red | No conn. | Tip |
| | 3 | White | No conn. | Ring |
| | 4 | Black | Barrel | Barrel |

Lead Testing

ECG leads should be tested regularly. Connect each end of a lead to one of the two Lead Test terminals. The display will flash if the lead is OK.

4. Rear Panel Connectors

Low-Level ECG Leads

There are ten AHA color-coded 4mm safety terminals located on the rear panel. Snap-to-banana adapters for the terminals are optional with the MaxiSim 2000

Battery Eliminator

BC Biomedical's AC Adapter plug-in power supply transformer allows you to use the MaxiSim 2000 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.

NOTE

Remove the batteries and disconnect the AC Adapter if you do not intend to use the MaxiSim 2000 for an extended period of time.

VI. WARRANTY

BC Biomedical warrants that the MaxiSim 2000 Patient Simulator 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 MaxiSim 2000 Patient Simulator, even if advised of the possibility of such damages. BC Biomedical or its local representatives 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 MaxiSim 2000 Patient Simulator. Neither BC Biomedical nor its local representatives will accept, nor be bound by any other form of guarantee concerning the MaxiSim 2000 Patient Simulator 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.

VII. TECHNICAL SUPPORT

BC Biomedical's MaxiSim 2000 Patient Simulator is backed by a superior support staff. If the *MaxiSim* 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 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