BIO-SYSTEM CALIBRATOR

MODEL B68-02 - OPERATION and APPLICATIONS

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COULBOURN INSTRUMENTS

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B68-02 BIO-SYSTEM CALIBRATOR

The Bio-System Calibrator provides precision waveforms for the calibration of physiological research equipment. The unit is capable of providing signals on two channels simultaneously for complete system calibration from electrodes through amplifiers, couplers, signal processors and A/D converters to a computer. Signals from microvolt levels to IRIG standard 1.4 Volt levels are available for all of the 16 digitally stored waveforms. For your convenience, diagrams of the waveforms are provided on adhesive labels which you may affix to the top of the instrument case, on a wall or other place. (These diagrams are also shown on page 6.)

Signals such as ECG, blood pressure, and blood flow are synchronized. Any two signals may be run together on the two channels, permitting the calibration of components or computer programs which process complex mathematical functions representing the interrelationships between signals.

In addition to actual biological waveforms and standard calibration signals, geometric functions and sine signals are available to calibrate differentiators, integrators, filters, analog-to-digital converters and other signal conditioning and processing circuits.

APPLICATIONS

Since the unit may be either battery or line-power operated, applications include mobile and field equipment checks, as well as bench and laboratory use. The unit is also useful as a simulator for demonstration of equipment function in the classroom. Researchers, educators, medical personnel, design and sales engineers, as well as technicians will find the Bio-System Calibrator indispensable.

OPERATION

Each of the two channels may independently access, via the rotary switches, any one of the 16 waveforms stored in memory. The “RATE” rotary switch control in the center of the panel determines the sweep rate of the memory. The two channels of the memory are stepped by a single control to maintain synchronization between the two signals. Outputs of the two channels are independent and all output levels within each channel are independent and available simultaneously.

Output levels of 10 microvolts, 100 microvolts, 1 millivolt and 1 volt of the same waveform are available on four jacks. The low-level signals are available on .080 pin jacks for convenience in attaching electrode cables using standard .080 leads to test bioamplifiers. The 1-volt signal is brought out via two phone jacks (mini and ultra mini) for testing a system's high-level-input signal processors and, via A/D converters, computer signal processing functions.

An output multiplier permits the signal to be at the nominal value in a positive mode, at nominal value at +/- .5 volts, and at IRIG standard value of +/- 1.4volt nominal value.

Differential amplifiers may be checked by connecting one of the active electrode leads while grounding the other active lead and the ground (common) lead to the ground jack. If the negative lead is connected to ground and the positive lead to one of the signal jacks, the signal will be in a positive-going reference mode. For example, an ECG "R" wave will be "up". If the positive lead is grounded, and the negative connected to a signal jack, the "R" wave will travel in a negative direction or "down". (See page 5.)

The vernier control allows the user to switch out of the calibrated mode and set the signal level at any value between zero and nominal. This may be useful for simulations and demonstrations. The vernier can be set to change a trace level (excursion) on the screen.

To set up a signal of any desired value, e.g. a 3-microvolt sine wave, connect a meter to the 1-volt output and set the vernier for 300 millivolts. The signal at the 100-microvolt output will then be 30 microvolts.

The sweep rate may be set to retrace the waveform at 1, 2, 5, 10, or 100 times per second using the rate control at the center of the panel. Integration has been provided internally to "smooth" the digitally stored

waveforms so that small "staircase" increments will not affect the calibration of high-resolution signal processors. The integrator time constant is "tuned" to each sweep rate for the particular requirements of the waveforms for minimum distortion.

Operation is generally straightforward and almost self-explanatory when one observes the front and rear panels. There are, however, a few items that need further explanation in order to realize the full capabilities of the calibrator.

FRONT PANEL CONTROLS AND INDICATORS

RATE SWITCH - Used to retrace the waveform at 1, 2, 5, 10, or 100 times per second.

"MON" INDICATOR - This indicator flashes at an interval determined by the rate switch.

"BAT" INDICATOR - Illuminated when the battery voltage drops indicating that battery replacement or battery recharge is necessary.

BLACK .080" JACKS AND PHONE JACKS - Ranging in output from 10 microvolts to 1 volt, these output jacks vary directly with the VERNIER and output controls.

VERNIER CONTROL - Used to switch out of the calibrated mode and set the signal level at any value between zero and nominal.

GAIN AND OFFSET CONTROL - Permits the signal to be set at the nominal value in a positive mode, at nominal value at ± .5 volt, and at IRIG standard value of ±1.4 volt nominal value.

CHANNEL SELECT - Selects waveform. See the chart on page 6.

The combination of output jacks and controls enables the user to obtain multiple combinations of output levels from microvolts to volts on each channel independently.

NOTE: *When setting AC levels, be sure the meter being used can resolve low frequency signals such as 1, 2, 5, or 10 Hz. Most meters are unable to resolve below 40 Hz. It is advisable to read the levels with the rate switch at the X100 position and the waveform selector at position 10 (sine wave), then switch to the lower sweep rate and appropriate channel.*

REAR PANEL INPUTS AND OUTPUTS

GATE INPUT - Used to hold the output off and start waveforms at the beginning of a cycle. Correct polarity must be observed for proper operation. Used with the “AUX” outputs of the Habitest Lincs to calibrate serial-pulse A/D device protocols. Input Voltage Range: 5 to 30 Volts.

SYNC OUTPUT - Provides a pulse at the end of each waveform cycle to permit synchronization with another B68-02 or other equipment. An external pull-up resistor is required. Voltage Range: 5 to 30 Volts

CHARGER INPUT - Accepts a standard "barrel" type plug with an outside diameter of .216" (5.5 mm) and an inside diameter of .082" (2.1 mm). Maximum input is 12 volts DC. It is possible to operate the Bio-System Calibrator with the charger only and without the battery.

CAUTION: The polarity of the center pin on the charger input connector is negative. If you do not use a standard charger, and polarity is reversed, no damage to the calibrator unit will result; however **a severe current overload might be placed on your power supply.**

CONNECTIONS

S-SERIES MODULES AND OTHER SYSTEMS USING .080 ELECTRODE LEADS

To make the electrode-to-cable and differential-shorting connections using S-series modules and old electrode cables that use .080 electrode leads, use the standard stackable programming leads you already have (or the six supplied with the unit). Follow the connections for the V-series shown on the next page but *without* using the adapters.

Two Mini Phone leads (below) are provided. These are the standard “analog leads” for our old S-series system, which were supplied with all S-series analog modules. You can use these, or the leads you already have to connect the high-level signals to modules or the Linc interface module.

If you have a different (from our S-series) system that uses .080 electrode connections, use the (6) - .080 stackable leads (below) to make connections to your electrode cable. If your system uses inputs other than .125 Mini Phone jacks for high level signals, you will have to cut one of the leads provided in half and fit the cut ends with the proper connectors (BNC etc.) for your system.

.080 STACKABLE LEAD. Standard programming lead used with S-series modules. Use these to connect old-style electrode cables formerly supplied with S-series modules. Six supplied

MINI PHONE LEAD - Standard analog lead supplied with S-series modules. Use these to connect high-level signals to S-series modules or cut and fit with the proper connectors for your system. Two supplied.

V-SERIES MODULES AND OTHER SYSTEMS USING SAFETY ELECTRODE LEADS

Six .080 lead to safety-electrode-lead adapters are also provided with the unit to connect low-level signals to bioamplifiers using safety-lead connections. Two Ultramini-phone leads are provided with the unit for connection from the calibrator high-level outputs to our current LabLinc V-series module inputs. Both are shown below.

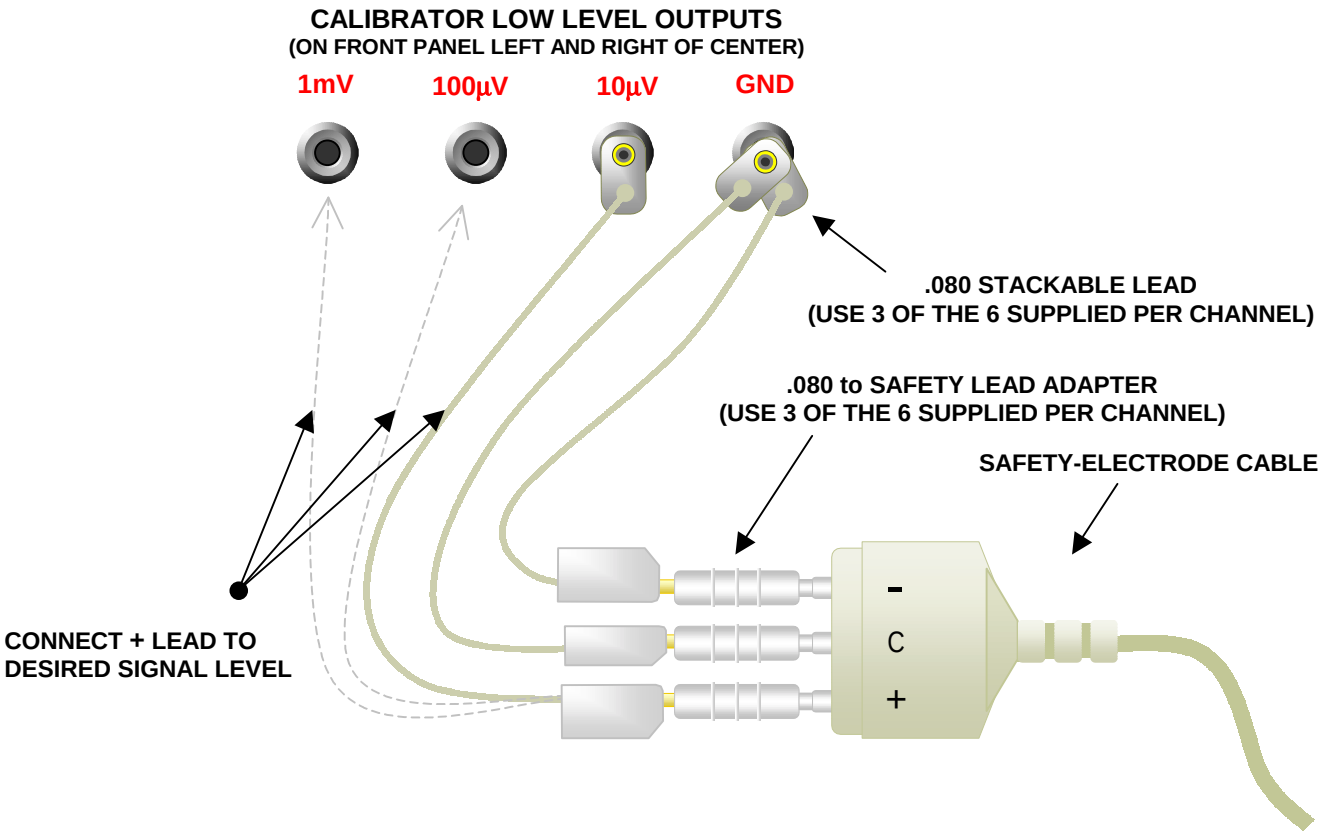
When using our V-series modules and an electrode cable with the safety input terminations on the cable end, use 3 of the 6 - .080 lead to safety-electrode adapters to connect the low-level outputs of the calibrator to the electrode inputs on the cable for each channel. Short either the "+" or "-" lead of a differential amplifier to ground by stacking the .080 lead to the ground (common) jack on the front panel of the calibrator as shown in the diagram on the next page.

.080 LEAD to SAFETY ELECTRODE adapter.
For electrode cables supplied with V-series modules. Six supplied.

ULTRAMINI-PHONE lead. To connect calibrator outputs to V-series high-level signal module inputs. Two supplied.

CONNECTIONS for LOW-LEVEL SIGNAL INPUTS to BIOAMPLIFIER INPUTS

(These are the connections from the calibrator to bioamplifiers using Safety-electrode leads for CI V-series modules and other systems.)



SPECIFICATIONS

2 Channels

Waveforms

Number of Waveforms: 16 (See chart on the next page.)

Controls

Waveform Output Select: 2 Independently selectable channels, 2 - 16 position switches. Output Level Accuracy is +/- 1% of Full Scale

Waveform Repetition Rate Select: 1, 2, 5, 10, and 100 per second. Repetition Rate Accuracy **-** Crystal controlled, less than .001% error.

Polarity control: Unipolar and Bipolar - 10 microvolts, 100 microvolts, 1.0 millivolts, and 1 volt peak-to-peak. Bipolar - 10 microvolts, 100 microvolts, 1.0 millivolts, and 1 volts RMS (sine wave), +/- 1.4 volts peak-to-peak. NOTE: All waveform outputs are single-ended. For differential inputs, ground one active lead (as shown on top of page).

Vernier: Permits setting of output level from 0 to 1.1 times the selected level.

Indicators

Monitor Indicator: Pulses on at the completion of each waveform cycle.

Battery Indicator: Indicates low battery voltage condition when illuminated.

Power

Line (110/ 220 VAC, 50, 60 Hz – Specify on order) or battery powered. Standard 9-Volt Alkaline or NiCad battery. Use of a charger permits line operation and/or battery charging capability (requires NiCad battery). The B68-02 Bio-System Calibrator requires a fully charged NiCad or an Alkaline 9-Volt battery.

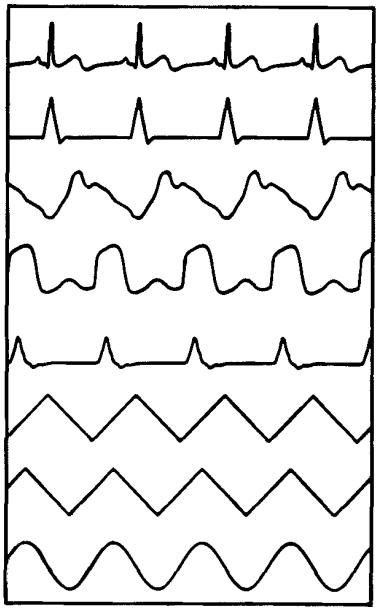
Changing Battery: The battery compartment is located on the left side of the rear panel. Release the battery compartment's snap cover and install battery keeping battery terminals to the right side of the compartment. Close the snap cover.

Battery Service Life: Alkaline - approx. 100 hours, NiCad - approx. 24 hours per charge
Recharge time - approx. 8 hours. NOTE: The calibrator may be used during a recharge cycle.

Physical Dimensions

Size: 10.8 x 4.5 x 9.8 inches, 27.4 x 11.4 x 24.9 cm.
Weight: 3.4 lbs., 1.54 kg.

CHART of STORED WAVEFORMS for the B68-02



0 – ECG Waveform

1 – AAMI Standard ECG Waveform

2 – Blood Pressure Waveform

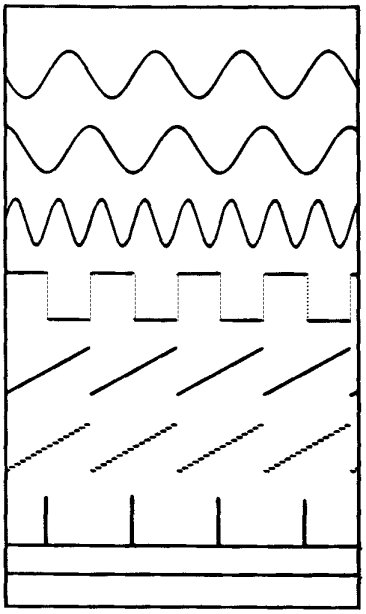
3 – Blood Flow Waveform

4 – Fast Depolarization Action Potential

5 – Saw Tooth 0° Phase

6 – Saw Tooth 9 0° Phase

7 – Sine θ - 0° Phase



8 – Sine θ - 180° Phase

9 – Sine θ - 90° Phase (Cosine)

10 – Sine 2xθ - 0° Phase

11 – Half Cycle "Square"

12 – 1-Cycle Ramp

13 – 16-Step Staircase

14 – 1% of Cycle Spike

15 – Precision DC Ref. At Nominal Value