NOTE: Biopac Science Lab for Mac OS was discontinued in 2012. This platform is no longer supported.

SETUP UIDE

BIOPAC SCIENCE LAB

This Setup Guide covers the following topics:

A. Components
B. Hardware Connections
C. Computer Connections
D. Software Installation
E. System Check
F. Headphone Connections
G. Stimulus/Response Set
H. Running a Lesson
I. Analyzing Data
J. Support Materials
K. Technical Support

Setup, support, and training videos at **.biopac.com**

A. Biopac Science Lab Components

Introductory System

- installation CD
- MP40 control unit
- 40EL lead set
- 9V battery
- 40PAD adhesive base pads

Optional

Stimulus-Response Set

- 40CBLFB1 feedback cable
- 40HP headphones
- 40CBLEXT audio extension

B. MP40 Hardware Connections

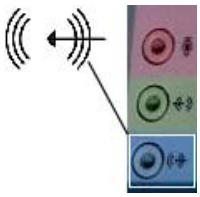
1. Insert the 9V battery into the MP40 unit.
   - Slide cover off, insert battery (note +/- polarity), replace cover.
2. Plug the 40EL into the top of the MP40 and tighten the screws.
3. *Optional:* For improved tabletop stability when the belt clip is attached, apply the self-adhesive 40PAD to the MP40 (attach one on each flat corner of the back of the unit).
   - Be careful not to place the self-adhesive base on the battery component area.

C. Computer Line In Connections

Requires Line In and working sound card

PC i i

Common
"**Li l** "
icon



ac i i

PC

Port is usually **b u** .

Mac models with line in:

Core Duo, eMac, G5, iMac lamp/swing arm with 17" or 19" monitor; Mac mini - Core Duo; PowerBook with aluminum case; Power Mac (tower) G5.

Mac models without line in:

G3 iMac (candy color/flower power/Dalmation with CRT monitor); G4 iMac lamp/swing arm with 15' monitor; iBook; PowerBook with titanium case, Mac mini - PowerPC; Power Mac G4.

Important - Audio line in is *not* the same as headphones.

- If the computer does not have built-in audio line in, an external line in is required.
  - USB-Sound adapter from BIOPAC, or
  - Audio adapter (Griffin iMic, USB*Gear*, etc.), or
  - PCI sound card
  - See *Audio Adapter Compatibility* reviews at Biopac Science Lab online support www.biopac.com.

1. Plug the MP40 cord into the computer's Line In port (blue on most Windows computers).
2. If you are running Biopac Science Lab on a laptop and you have it plugged in (as opposed to running on battery power), you need to use a three-prong (grounded) plug to prevent excess "noise."

3. If running under Windows Vista® you must adjust the audio setting *prior to initial audio capture setup*. Lesson 11 requires 2-channel audio and the default under Vista is 1-channel audio.
   a. Go to Start > Control Panel > Sound.
   b. Click the 'Recording' tab and then double-click 'Microphone' to open 'Microphone Properties'.
   c. Click the 'Advanced' tab.
   d. From the 'Default Format' menu, select “2 channel, 16-bit, 44100 Hz”. (48000 Hz will also work.)
   e. Click 'Apply' and then click 'OK'.
   f. In the 'Sound' dialog, click the 'Playback' tab.
   g. Double-click 'Speakers' to open 'Speaker Properties'.
   h. Click the 'Advanced' tab.
   i. From the 'Default Format' menu, select “16-bit, 44100 Hz”. (48000 Hz will also work)
   j. Restart the computer.

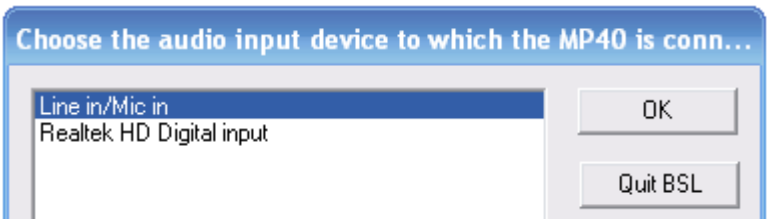
D. Software Installation

1. Insert the Biopac Science Lab installation CD.
2. The installer should launch automatically.
   - If the installer does not launch automatically, open the CD and double-click either “BScLSetup.exe” (Windows®) or “Install Biopac Science Lab” (VISE icon in Mac OS™).
3. Follow screen prompts to complete software installation. Make sure to accept the terms in the License Agreement before clicking Next in the License Agreement dialog.

   Note You will be prompted to select an audio card.

   - If there is more than one option (if you have more than one audio card installed), choose the one with the MP40 connected.
   - The options for selection will vary with each computer, but should resemble the “Sound card selection” dialog above.

4. When you click Finish in the final installation prompt, the Biopac Science Lab registration Web page will open (if your computer is connected to the Internet). **Comp t t r istratio to acc ss T c ica Support a r c i up at s.** If your computer is not currently connected to the Internet, you can register online later.



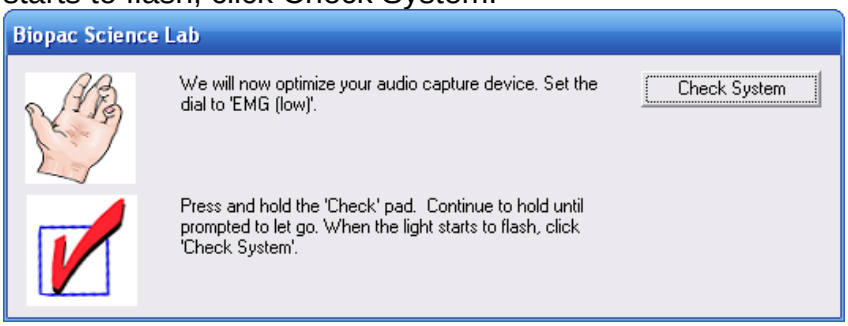
5. When you click Finish, Biopac Science Lab will automatically launch. Choose the audio input device to which the MP40 is connected and click OK.
6. When you click OK, a Check System prompt will display. Continue to section E for System Check direction.

E. System Check

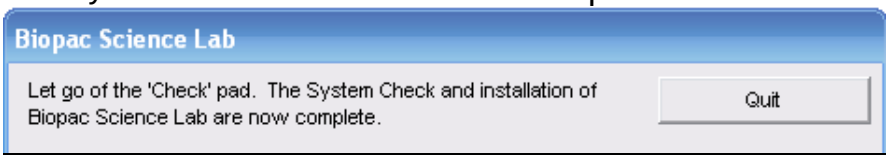
Installation requires a System Check (audio system check).

- If you skip the System Check, you will only be able to use the program for analysis (review of saved data files).
- Students can install the program without running the System Check to allow for analysis outside of the classroom.

1. Set the MP40 to EMG (low) as prompted. Hold down the Check pad. When the light starts to flash, click Check System.



2. **Co ti u to o o t C c pa u ti prompt to t o.**
   The System Check will last approximately 15 seconds.
   - If you receive an error message, see Technical Support at the end of this guide for troubleshooting tips.
3. When prompted, let go of the Check pad and then click Quit.
   - The System Check and Installation of Biopac Science Lab are now complete.

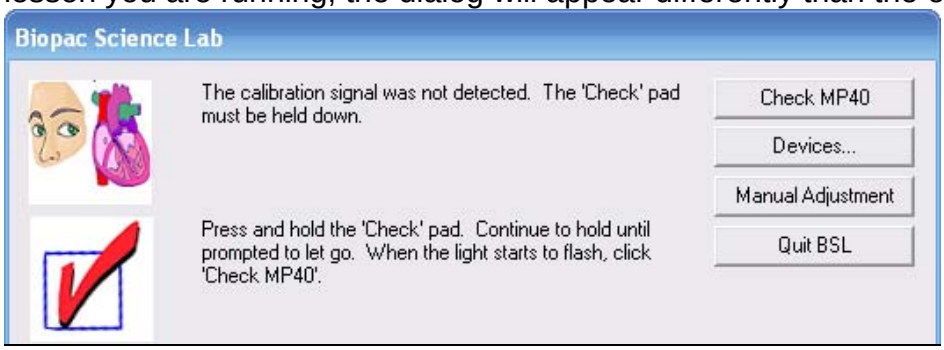


Note To repeat a System Check *after* installation:

a. Launch any lesson and <u>do not set</u> the MP40 as prompted.

b. Click Check MP40.

   - The MP40 Check will fail and a dialog will be generated (depending on the lesson you are running, the dialog will appear differently than the one below).



c. Click Devices. In the dialog that opens, choose the appropriate audio input device (if necessary), and click Check System. Follow System Check directions.

F. Headphone Connections

Some lessons feature optional listening segments. To run these segments, connect stereo headphones (40HP) to the computer.

- If you have the optional extension (40CBLEXT, included with the Stimulus/Response Kit), you can connect it to extend the reach of the headphone jack. Plug the 40CBLEXT into the computer and then plug the headphones into the extension cable.

Note Lesson 11 requires Stimulus/Response set in addition to headphones (see next segment).

G. Stimulus/Response Set

Optional The Stimulus/Response Set includes a feedback cable (40CBLFB1), headphones (40HP), and an extension cable (40CBLEXT) and is used for Lesson 11 Reaction Time.

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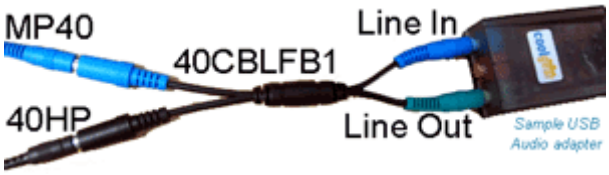
bui t i Li l



A variety of USB audio adapters can be used; yours may not match the sample shown.

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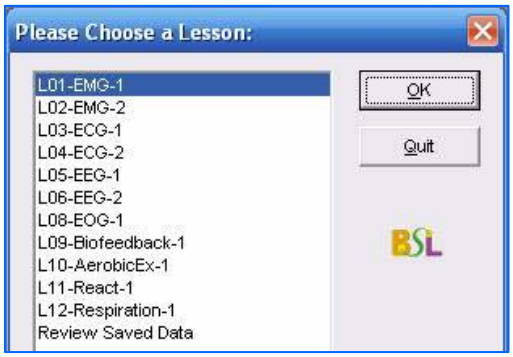
1. Connect the feedback cable to the computer (or Line In adapter)

   40CBLFB1 connections should always be: blue to Line In and green to Line Out.

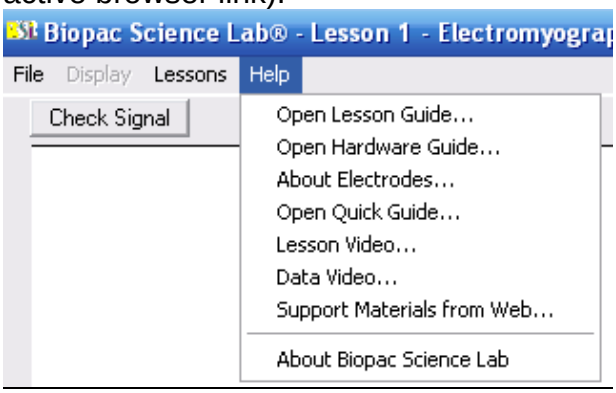
2. Connect the MP40 to the feedback cable (blue to blue).
3. Connect the headphones to the feedback cable (black to black).
   - If needed, use the extension cable (40CBLEXT) from the Line Out to the feedback cable (40CBLFB1); connect the extension cable to Line Out (green to green), and then connect the headphones to the extension (black to black).
4. Run a system check to confirm the feedback cable is working. See Section E for details.

H. Running a Lesson

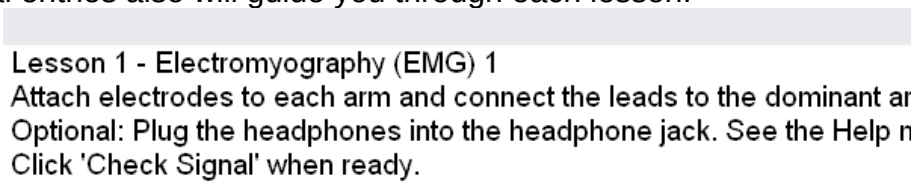


1. Launch the Biopac Science Lab software.
   - Double-click the shortcut that the installer automatically created on your desktop, or open the file by selecting it from the Start menu (Windows) or from the Finder in the Applications folder (Mac).
2. Choose a lesson to run. Click OK.
   - Select Review Saved Data to analyze stored data files or Sample Data; see Section I Analyze for details.

3. Type in a unique file name when prompted.
   - No two people can have the same file name, so use a unique identifier, such as the Subject's nickname or student ID#.
4. At the beginning of each lesson, you will be prompted to run an MP40 Check. Follow the on-screen directions, making sure to press and hold the **C c** pad for the entire five-second check.
5. After running the MP40 Check, the Help menu will be accessible. The Help menu for each lesson contains a Lesson Guide, video clips of sample data and the lesson procedure, a hardware overview, electrode overview, and a link to the BIOPAC Support page (requires active browser link).

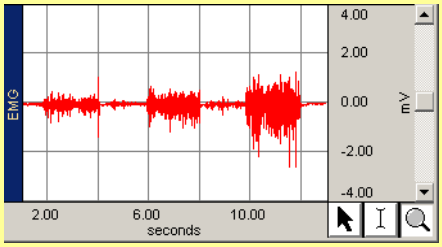


   - Each Lesson Guide offers detailed, step-by-step lesson instructions.
   - Journal entries also will guide you through each lesson.



   - Buttons in the lesson also provide video access.
6. After the MP40 Check in each lesson, a Signal Check is required. Follow on-screen prompts to check the signal, and continue with lesson.

REAL TI E DATA DISPLA



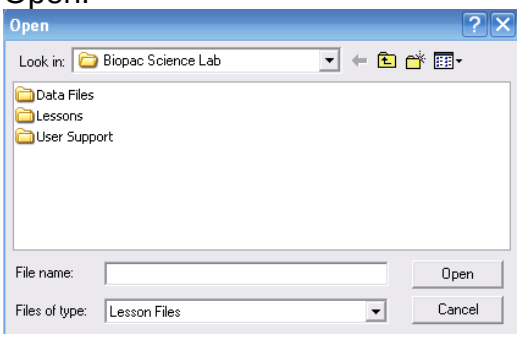
The intro system is ideal for life science labs and includes tutorial-style lesson experiments for

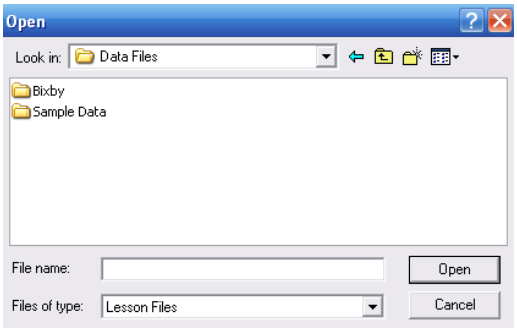
- Biology - Physiology - Exercise Physiology - Psychology

Plus **it s r a to r cor stu t si protoco s**

I. Analyzing Data

1. To review saved data, choose Analyze current data file" from the Done dialog after recording data, or choose "Review Saved Data" from the Lessons menu and browse to the required file.
2. You will be prompted to open a saved data file. Open the Data Files folder and select either a lesson that you previously stored or a Sample Data File from the Sample Data folder. Click Open.





J. Support Materials

A. Help Menu

B. Video Buttons

C. Sample data files

D. Files on the installation CD

E. **.biopac.com** Support > Biopac Science Lab

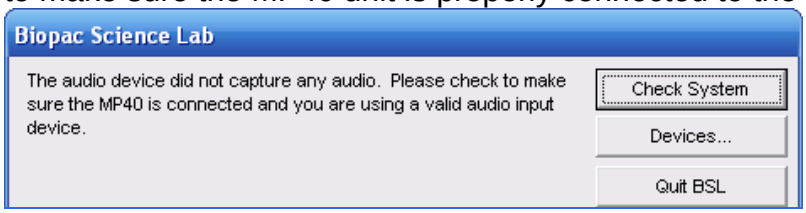
K. Technical Support

ra Troub s ooti

- Check MP40 battery (see Hardware Guide under the Help menu).
- Check Line In status.
- Restart computer.
- Relaunch the software and repeat the System Check.

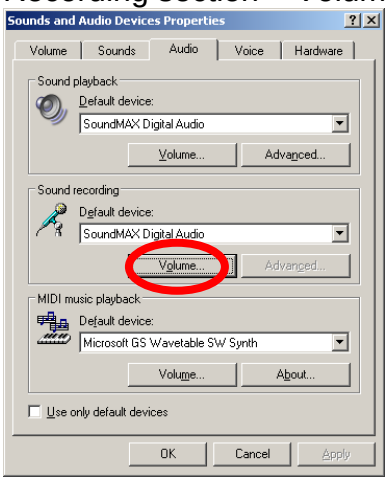
S st m C c Troub s ooti

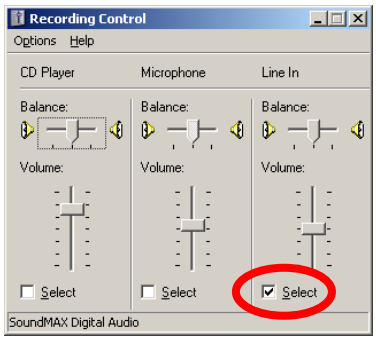
- Clipping: If the system check does not work the first time (and a prompt indicates that the MP40 is clipping), click Check System and try to run the system check again. Repeat if necessary.
- Audio input device error: If the System Check generates an audio input device error, check to make sure the MP40 unit is properly connected to the Line In port.

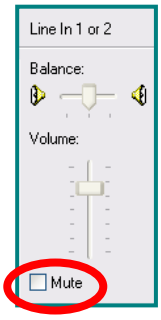


Li l Issu s

- Line In status
  - Line In must be active for Sound Recording Volume. Check the select box or uncheck the Mute box per your system OS.
  - The path to this setting may vary based on your OS but should be similar to: Start > Settings > Control panel > Sounds and Audio Devices > Audio tab > Sound Recording section > Volume







Windows OS Settings

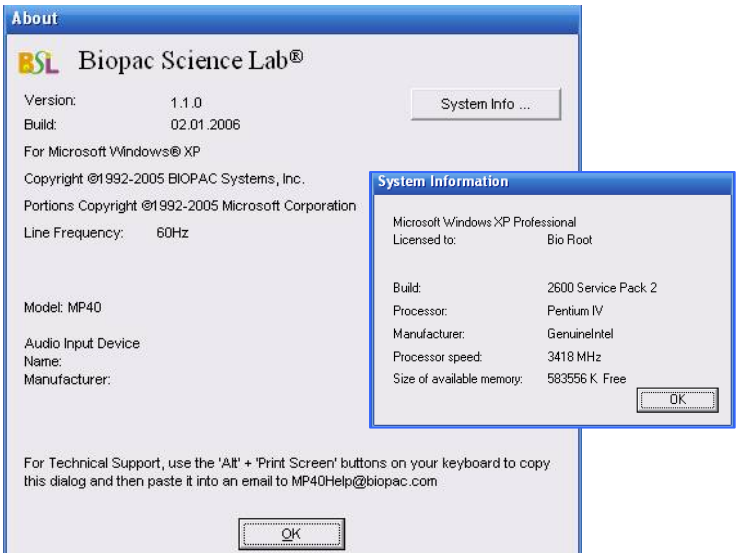
- Line In Tolerance
  - The Line In must tolerate a 1 V RMS signal.
    - Check the manufacturer's web site to see if the tolerance is provided.
    - If you cannot determine the tolerance, email support@biopac.com with the sound card name and computer operating system information (i.e., Windows XP Service Pack 2).
  - If the sound card will not tolerate 1 V RMS
    - Use a different built-in sound card.
    - Use a USB Line In/Out audio adapter (Griffin, USBGear, etc.).
    - Use a PCI sound card.

A apt r Issu s

- If using a Griffin iMic under Vista, set the Sound > Microphone Properties default format to "2 channel, 16-bit, 44100 Hz" (or 48000 Hz) and restart the computer.

Co tacti BIOPAC

If you need to send a support email to BIOPAC, please include the information from the About dialog and System Info dialog, accessed under the Help menu.



info@biopac.com
support@biopac.com
www.biopac.com

ST EP PRO RA ABLE STI ULATOR OR E PRI E

The STMEPM Programmable Stimulation System for E-Prime allows a user to interface the STMISOLA Stimulator with E-Prime to control the stimulus frequency and stimulus intensity for real-time stimulus delivery changes based on a subject's responses.

The system includes

- STMISOLA Constant Current and Constant Voltage Linear Isolated Stimulator
- USB 4-ch D/A Unit
- Software Utility (STMISOLA<--> E-Prime) with sample E-Prime experiment
- Interface cables

The sample E-Prime experiment provides the necessary interface commands to communicate with the D/A unit. The D/A unit provides the STMISOLA with the appropriate voltage levels to stimulate a subject. The system supports up to four STMISOLA (and includes one).

IMPORTANT: The Current Feedback Monitor Cable (CBLCFMA) is recommended for use with any voltage stimulator; to isolate CBLCFMA output, use INISOA and AMI100D/HLT100C. Always make sure to place the electrodes on the participant at least 10 minutes before starting any electrical stimulation. Use a CBLCFMA to monitor and record the actual current delivered to the participant at ALL times. A large enough change in current delivered to the participant will alter the subjective perception of the stimulation. Thus, an unpleasant shock may become painful if more current starts being delivered or become ineffectual if less current is being delivered than during threshold identification. Changes in the levels of delivered current are due to changes in impedance. Changes in impedance could be due to a number of factors: gel saturating the skin over time; gel drying up – over longer period of times; hydration level of participant; sweating; decoupling of electrodes and skin due to motion artifacts; etc. Read Safe Use of Electrical Stimulators – Application Note 257 for Comprehensive Safety Guidelines for Performing Electrical Stimulation on Subjects

SPECI ICATIO S

STMISOLA: see Constant Current and Constant Voltage Linear Isolated Stimulator specs

CBLEPM connection cable x 4: 3.5 mm to 2 x tinned wire (STMISOLA to D/A card)

D/A Unit: High-speed multifunction module with eight 13-bit, 1 MS/s analog inputs and four 12-bit, 1 MS/s analog outputs

Four 12-bit, ±10 V analog outputs with 1 MS/s update rate
USB-bus powered (type: 2.0 high speed; compatibility: 1.1 or 2.0)
8 single-ended/4 differential analog inputs
13-bit resolution
1 MS/s sample rate
Single-ended ranges: ±10 V, ±5 V, ±2.5 V or 0 to10 V
Differential ranges: ±20 V, ±10 V, or ±5 V
16 digital I/O lines
Two 32-bit counters
One 32-bit PWM timer output

RI CO PATIBILIT

The STMEPM should **not** be used in an MRI and should not be used in stimulating subjects who are to be placed in an MRI. For electrical stimulation requirements in MRI or fMRI, use STMEPM-MRI.

BSL STI ULATORS

o u ar Stimu ators
BSLSTMB for MP36/36R/35
BSLSTMA for MP30

Lo o ta Stimu ator A apt r
OUT3 Output Adapter for built-in Stimulator (MP36 only)
SS58L Low Voltage Stimulator (MP35 only)

See also: **HSTM01**, **ELSTM1**, **ELSTM2**, **EL300S** and **EL400** electrodes.

BSLSTMB

BSLSTMA

Lab set up note
Placing the BSLSTMA/B unit too close to MP3X hardware can result in data distortion of the BSLSTMA/B pulse width signal; the distortion is more apparent at higher sampling rates.

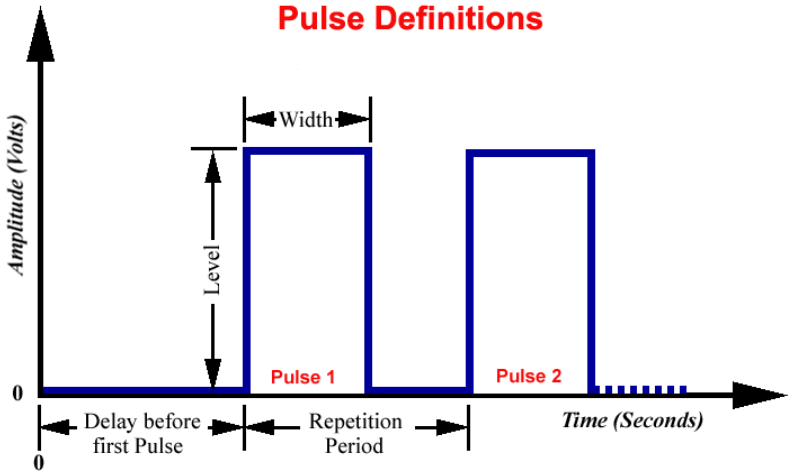
- NEVER set the BSLSTMA/B atop an MP3X
- Position the BSLSTMA/B away from the MP3X to reduce the signal distortion

Note The older "BSLSTM" uses dial reading and a flip range switch. The same guidelines and cautions described here apply, except when noted.

The BSLSTM Stimulator works in conjunction with the Biopac Student Lab System to allow precise stimulus pulse outputting. Use the BSLSTM and the BSL *PRO* to perform a wide array of measurements, such as:

- Twitch sub-threshold & threshold
- Maximum twitch responses
- Single twitch, summation
- Muscle tension/length vs. force
- Tetanic contraction
- Nerve conduction
- Fatigue
- Velocity

STI ULATOR PULSE DE I ITIO S



Pulse width	The time that the pulse is in the non-zero or active state.
Delay before first pulse	The initial delay from the start of acquisition to the start of the first pulse.
Repetition period	The time between pulses, as measured from the start of one pulse to the start of the next pulse. This is the inverse of the Pulse rate.
Pulse rate	The number of pulses that occur in a one-second interval, expressed in Hz. The **Pulse rate** relates to the **Pulse period** as follows:

Also called —
Pulse frequency
Repetition rate
Events per second

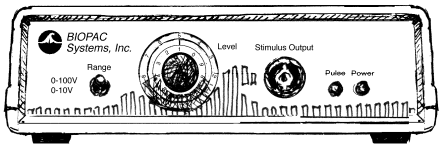
Pulse rate (Hz) = 1000 / Repetition period (milliseconds)

Pulse Repetition	Use when referring to either Pulse rate or Pulse period.
Pulse level	The amplitude of the pulse, expressed in Volts. The output of the BSLSTM is 0 Volts when the pulse is not active.
Number of pulses	The number of successive pulses that will be sent out at the selected Pulse Width, Pulse Rate, or Pulse Period, and Pulse Level.

RO T PA EL TER I OLO

BSLSTMA/B — Digital Display & Keyed Switch

BSLSTM — Dial Reading & Flip Switch



Range control

Establishes the stimulus pulse output level range in Volts (0-10 Volts or 0-100 Volts).

BSLSTMA/B key control: Turn right to select a range of 0-10 Volts.
Turn left to select a range of 0-100 Volts.
Remove the key for added safety and control.

BSLSTM switch control: Flip down to select a range of 0-10 Volts.
Flip up to select a range of 0-100 Volts.

- If the **Range** is changed <u>before</u> recording begins, the **Preset** must also be changed (under the "Setup channels" option of the **MP3X** menu) in order to maintain direct Level recordings.
- If the **Range** is changed <u>during</u> recording, the user should manually enter a software marker to note the change (by holding down F9 on a PC or Esc key on a Mac). The pulse Level could then be determined by (mentally) moving the decimal place to the right or left, depending on how the **Range** was changed.

Reference

BSLSTMA/B only: Refers to the pulse width of the signal on the Reference Output (on the back panel).

- **Actual** reflects the actual output width.
- **Fixed (15 ms)** establishes a pulse width of 15 ms, regardless of the actual pulse width.

The Reference control only affects the pulse width; in either case, the pulse level reflects the actual output level.

Level

Level is used in conjunction with **Range** to set the stimulus pulse output level.

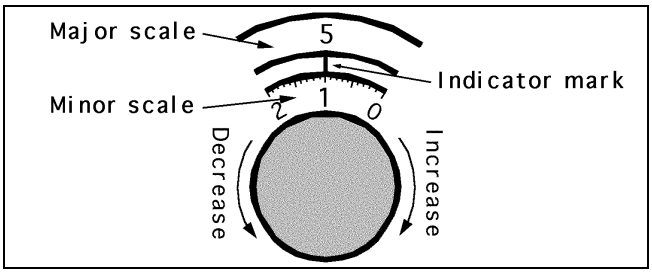
BSLSTMA/B digital display: Turn the Level control (right to increase, left to decrease) to establish the desired Level, as indicated on the digital display.

BSLSTM knob dial: The **Level** knob has a "Major scale" and a "Minor scale" which indicate the voltage level as shown below:

Range switch	**Major scale**	**Minor scale**
0-10 V	Volts	Volt / 10
0-100 V	Volts x 10	Volts

Turning the **Level** knob clockwise increases the voltage level, and turning it counterclockwise decreases the voltage. In the following close-up of the **Level** knob, the

level reads 5.1 Volts (Range 0-10 V) or 51 Volts (Range 0-100 V).
As shown in the following diagram, the indicator mark is between the two dials.



Close-up of "Level" adjustment knob

Stimulus output — Stimulus pulse output for connection to external electrodes or other devices. This is a standard BNC style connector.

Pulse indicator — LED flashes when the stimulus pulse is active: BSLSTMA/B = red. BSLSTM = green.

Power indicator — Activated when the DC adapter is plugged in and the power switch on the back panel is turned ON.
BSLSTMA/B: The LCD display is activated.
BSLSTM: LED indicator lights green

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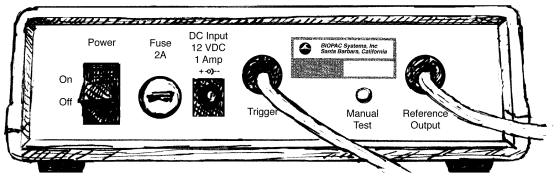


Power switch — Rocker switch for turning the BSLSTM power ON and OFF.

Fuse holder — If the fuse blows and must be replaced, use a screwdriver to open (counterclockwise) and close (clockwise) the fuse cap.

DC Input — Socket for BIOPAC DC adapter.

Trigger cable — Connects to the Analog Out connector on the back of the MP3X acquisition unit. The MP3X sends the Pulse width and Pulse rate information via this cable.

Manual Test button — Used to diagnose problems with the BSLSTM stimulator unit.

When the **Trigger** and **Reference Output** cables are **disconnected** from the MP3X , the **Manual Test** button can be used to initiate a stimulus with a fixed pulse width of 2.5 milliseconds.

Reference Output Cable — The stimulus marker output is labeled **Reference Output** on the back panel of the BSLSTM. This output cable connects to any of the four channel inputs (CH1, CH 2, CH 3, or CH 4) on the front of the MP3X acquisition unit. The output cable carries the stimulator marker pulse to the MP3X. The marker pulse has a fixed pulse width 15 ms and is generated each time the stimulator generates a pulse.

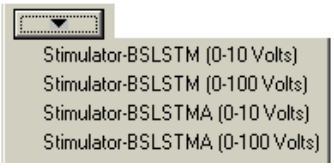
- BSLSTMA/B: Use the front panel Reference switch to select Actual or Fixed.
- BSLSTM has a fixed pulse width of 15 ms, selected so that the MP30 can capture the pulse with a sample rate as low as 100 samples per second.

If the BSL *PRO* software has been setup correctly, the amplitude of this marker will reflect the **Level** knob setting on the BSLSTM. See the **Range switch** section for information on how this reading can be affected.

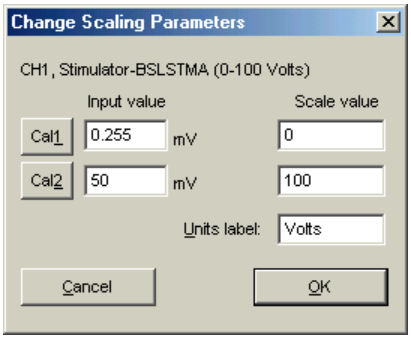
Calibration

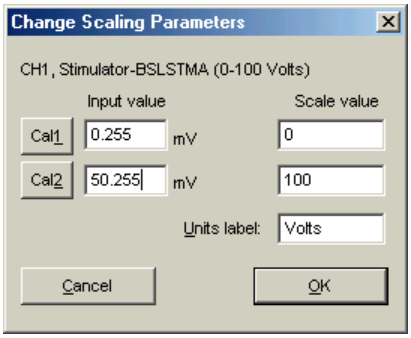
The "Reference Output" signal from the BSLSTM must be calibrated to ensure accurate results.

1. Choose the correct **Preset** (via MP3X menu > Setup Channels).



   - For example, if using the BSLSTMA/B, don't choose a "BSLSTM..." Preset. Also, make sure the Preset matches the Voltage Range that will be used (0-10 V, or 0-100 V).
2. With stimulator connected and ON, turn the **Level** control counter-clockwise until the display reads 0 (or as close to 0 as possible).
3. Get into the **Scaling** window for the Reference Output channel (via MP3X menu > Setup Channels > > Scaling...).
4. Press the **Cal1** button to get the signal representing 0 V out of the stimulator.

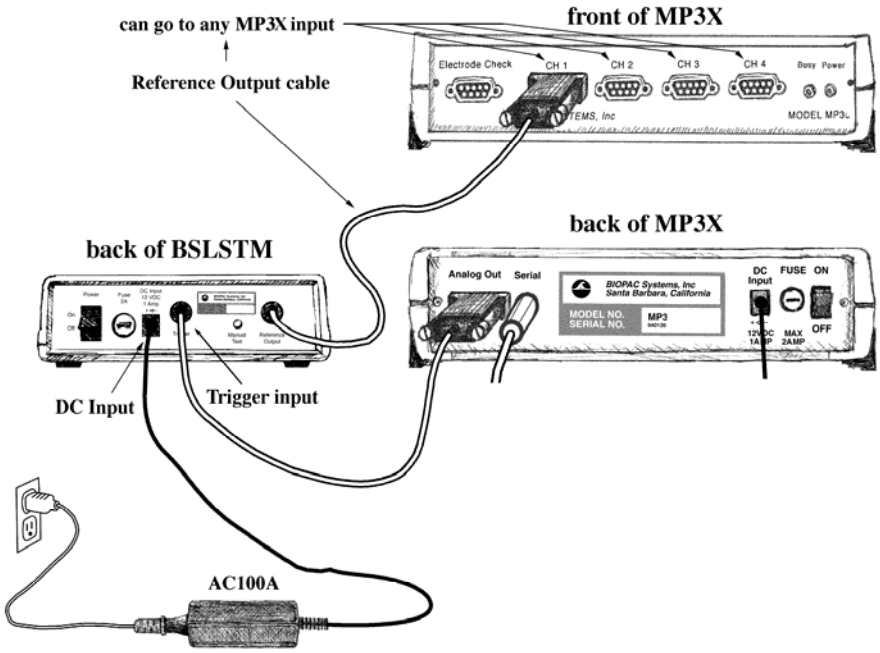




5. **Add** the Input value found with Cal1 to the Input Value displayed for Cal2.
   - For example, if "Cal1" is pressed and provides an Input Value of .255 mV, add the number .255 mV to the existing 50 mV and manually enter the total value of 50.255 mV for Cal2 Input Value.
   - *Note*: Even if the Cal1 Input Value is negative, it must still be "added" to the number for Cal2 (which essentially subtracts it) to arrive at the proper value.
6. Click **OK** to close out of the Scaling window and then close out of the Setup Channel window. The system is now ready to record.
7. *Optional*: Save the setup as a Graph Template to save these new scale settings. As long as neither the MP3X nor stimulator changes, the calibration should not need to be repeated.

CO ECTI THE BSLST TO THE P

1) Turn the **MP3X** unit **OFF**.
2) Confirm that **Power** switch on the back of the **BSLSTM** is in the **OFF** position.
3) Set the **Range** on the front of the **BSLSTM** to **0-10 V**.
4) Set the **Level** to 1 Volt.
   - BSLSTM: 1 Volt is set when the Major Scale (top number) is 1 and the Minor Scale (lower number) is 0.
5) Plug the **Trigger** cable (female DB9 connector) from the back of the **BSLSTM** into the **Analog Out** port (DB9 Male connector) on the back of the **MP3X**.



6) Plug the **Reference Output** cable (Male DB9 connector) from the back of the **BSLSTM** into an open channel input port (DB9 female connectors: CH 1, CH 2, CH 3, or CH 4) on the front of the **MP3X**.
7) Plug the 12 Volt **DC adapter** into the wall.
8) Mate the **DC output** connector on the end of the adapter cable to the **DC Input** socket on the back of the **BSLSTM**.
   - Make sure the connector is pressed in completely.
9) Plug the stimulator electrode assembly into the BNC connector on the front of the stimulator, labeled Output on the BSLSTMA/B and Stimulus Output on the BSLSTM.
10) Place the BSLSTMA/B unit away from the MP3X. Placing the BSLSTMA/B too close to MP3X hardware can result in data distortion of the BSLSTMA/B pulse width signal; the distortion is more apparent at higher sampling rates.
    - NEVER set the BSLSTMA/B atop an MP3X.
    - Position the BSLSTMA/B away from the MP3X to reduce the signal distortion.

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BSLST A B SPECI ICATIO S

(This new unit uses digital display and a keyed range switch)

Pulse width

Controlled by:	Computer, with lockable width limit
Range:	.049 – 100 milliseconds
Resolution:	2 microseconds
Accuracy:	5% (Can be improved to better than 2% using the "Correction factor" in the "Stimulator Preferences' window.)
Correction factor	Range: 0 - 150 microseconds Average value: 60 microseconds

Pulse Repetition

Controlled by:	Computer
Pattern:	Selectable (1-254 pulses) or continuous
Range—No Load:	5 seconds - .499 milliseconds Period (.2 - 3,333 Hz Rate)
Range—Load:	2 K Ohm load

0 - 10 Volt Range: 5 seconds to the following minimum repetition period:

100 ms P.W.	300 ms
10 ms P.W.	30 ms
1 ms P.W.	3 ms

0 - 100 Volt Range: 5 seconds to the following minimum repetition period:

100 ms P.W.	100 Volts:	1 second
	50 Volts:	300 ms
10 ms P.W.	100 Volts:	400 ms
	50 Volts:	30 ms
1 ms P.W.	100 Volts:	4 ms
	50 Volts:	3 ms

Limits:	User adjustable lower and upper rate limits
Resolution:	2 microseconds
Accuracy:	Better than 2%

Initial Pulse Delay

Time range:	None or .5 - 100 milliseconds
Resolution:	2 microseconds

Pulse level

Control:	Manual (10 turn potentiometer)
Range (selectable with *K Switch*):	*Range 1*: .025 - 10 Volts *Range 2*: .12 - 100 Volts Infinite (potentiometer adjustable) range
Accuracy:	5% accuracy to digital readout

Reference Output

Correlates to actual pulse output (Requires Calibration)

Pulse width:	Fixed (15 millisecond) or Direct (follows actual pulse output)
Amplitude:	0 - 50 mV correlates to 0 – 10 V actual output or 0 – 100 V actual output.

Manual Test Pulse

(Button on back panel)

Note: Will only function when "Trigger" cable is <u>not</u> connected to the MP3X.

Pulse Width:	1 millisecond

Stimulator isolation

Volts:	2,000 Volts DC (HI POT test)
Capacitance coupling:	60 pF

Power requirements

12 Volts DC adapter (included), 1 Amp

Fuse

250 V, 2 A, fast blow

Fuse Dimensions:	1.25" length × .25" diameter

Module Weight

610 grams

Module Dimensions

16 cm x 16 cm x 5 cm

BSLST SPECI ICATIO S

(This older unit uses dial reading and a flip range switch)

Pulse width

Controlled by:	Computer, with lockable width limit
Range:	.2 – 100 milliseconds
Resolution:	2 microseconds
Accuracy:	5% (Can be improved to better than 2% using the "Correction factor" in the "Stimulator Preferences' window.)
Correction factor	Range: 0 - 150 microseconds Average value: 110 microseconds

Pulse Repetition

Controlled by:	Computer
Pattern:	Selectable (1-254 pulses) or continuous
Range—No Load:	5 seconds - .3 milliseconds Period (.2 - 3,333 Hz Rate)
Range—Load:	2 K Ohm load

0 - 10 Volt Range: 5 seconds to the following minimum repetition period:

100 ms P.W.	150 ms
10 ms P.W.	10.1 ms
1 ms P.W.	1.1 ms

0 - 100 Volt Range: 5 seconds to the following minimum repetition period:

100 ms P.W.	100 Volts:	beyond functional limits
	50 Volts:	250 ms
10 ms P.W.	100 Volts:	200 ms
	50 Volts:	150 ms
1 ms P.W.	100 Volts:	20 ms
	50 Volts:	2.5 ms

Limits:	User adjustable lower and upper rate limits
Resolution:	2 microseconds
Accuracy:	Better than 2%

Initial Pulse Delay

Time range:	None or .5 - 100 milliseconds
Resolution:	2 microseconds

Pulse level

Controlled by:	Manually (10 turn potentiometer)
Range (switchable):	*Range 1*: .025 - 10 Volts *Range 2*: .15 - 100 Volts Infinite (potentiometer adjustable) range
Accuracy:	5% accuracy to dial indicator

Reference Output

Correlates to actual pulse output (Requires Calibration)

Pulse width:	15 millisecond fixed pulse width
Amplitude:	0 - 10 mV correlates to 0 – 10 V actual output or 0 – 100 V actual output

Manual Test Pulse

(Button on back panel)
Note: Will only function when "Trigger" cable is <u>not</u> connected to the MP3X.

Pulse Width:	2.5 - 3 milliseconds

Stimulator isolation

Volts:	2,000 Volts DC (HI POT test)

Capacitance coupling:

60 pF

Power requirements

12 Volts DC adapter (included), 1 Amp

Fuse

250 V, 2 A, fast blow

Dimensions:	1.25" length × .25" diameter

Module Weight

610 grams

Module Dimensions

16 cm x 16 cm x 5 cm

LO OLTA E STI ULATOR

OUT3

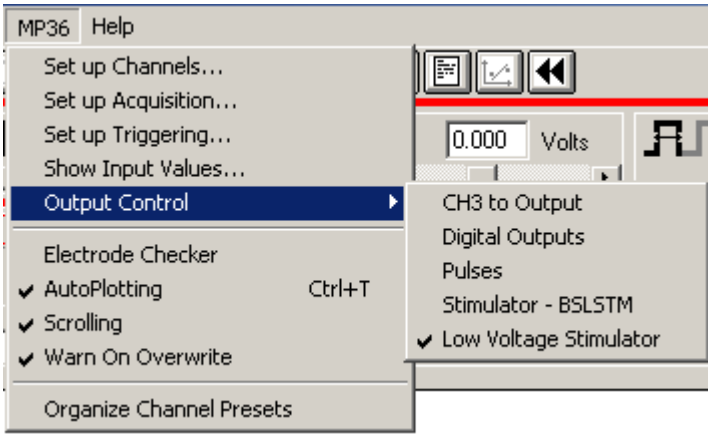
The **MP36** includes a built-in low voltage stimulator—just use the Analog Out port.

- For connection to BIOPAC electrodes, add the **OUT3 BNC Adapter.**

SS58L

The **MP35** uses the **SS58L Low Voltage Stimulator** to the Analog Out port.

Connect any electrode or lead with a BNC connector (such as needle electrodes or clip leads) for direct stimulation of animal or tissue preps. Control the stimulus with the Output Control option of the BSL *PRO* software. Output can be monitored directly on the computer without any external cable.



Interface options:	Nerve chambers — use BSLCBL3A or BSLCBL4B
	Stimulation electrodes — use ELSTM2
	Clip leads — use BSLCBL7, BSLCBL11, or BSLCBL12
Pulse level:	-10 V to + 10 V, software adjustable in 5 mV increments
Pulse width:	0.05-100 milliseconds
Pulse repetition:	5 seconds-0.1 millisecond (0.2-10,000 Hz)
Power:	No additional power required

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STIMULATOR ELECTRODE GUIDELINES

— *PLEASE READ* —

It is very important to follow the electrode placement guidelines when connecting stimulator electrodes from the BSLSTM to a subject.

The BSLSTM can output lethal levels of energy!

- Always set the **Level** to "0" Volts prior to connecting the stimulator electrodes to the subject.
- Increase the **Level** adjustment slowly until a response is noted.
- Never increase the **Level** more than necessary to obtain the desired response.
- The **BSLSTM** should only be used under direct supervision of an Instructor.
- Never place any stimulator leads in the mouth or any other body orifice.
- To prevent a "Ground loop," the **Ground** of the stimulator electrode and the **Ground** of the measuring electrode(s) must always be connected to the same location.
- Use the **HSTM01 Human Stimulation Electrode** for human stimulation.
- To prevent a current path that goes across or through the heart, the stimulator electrodes and the measuring electrodes should always be in close proximity.

  For example, if making measurements on an arm, the stimulator electrodes and measuring electrodes — including the ground electrodes — must be on the same arm. Any other electrodes or transducers that make electrical contact with the body should not be connected while the stimulator is connected.

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STP SUPERLAB S STE OR P R P P

STP35W Components

SuperLab Software

STM-C-POD-IO marking unit for MP3x

STP35B Interface Cable

Six-button Response Box

Pushbutton Keycap Color Kit

The STP35W is a stand-alone system that measures subject responses to visual or auditory stimuli. It can present visual stimuli on a computer screen, or auditory stimuli via headphones or speakers, and simultaneously (1ms resolution) send trigger signals to an MP36R/MP36/MP35 System for data synchronization and collection purposes. The STP35W system includes:

- **SuperLab** – present visual stimuli on a computer screen, or auditory stimuli via headphones or speakers, and simultaneously (1 ms resolution) send trigger signals for data synchronization and collection purposes to an MP36/35 BSL System or MP36R Research System.
- **c-pod marking unit** – for measuring physiological responses to stimuli, the c-pod marking unit synchronizes multiple signals (input) between the STP35W and the MP36/36R/35 System. The c-pod will send event markers via USB with high precision. Features include Asynchronous Output; Scheduler; Pattern Generation; Mixed output, 32-bit microprocessor. c-pods simplify connection & timing details and deliver guaranteed jitter-free performance.
- **Interface** – use the included STP35B for MP36/36R/35 to parallel port connections
- **Response Box** – Use the six-pushbutton response box for performing accurate (1 ms resolution) reaction time measurements.

NOTE: Second PC required. The synchronization signal(s) coming from the **STP35W** can be directed to a BIOPAC System running on a PC or a Mac, but it's not possible to run the **STP35W** on the same computer as the BSL MP36/35 System or MP36R Research System. The **STP35W**requires that the SuperLab software and c-pod be placed on a PC running Windows 7/Vista/XP; Mac OS X setups require a StimTracker (STK100).

See BSL *PRO* Lesson H30 Stroop Effect for details of the classic psychology experiment and a sample of how SuperLab works with the BSL System.

STP35 MP36R/MP36/MP35 TO SUPERLAB

For users who already have SuperLab and an MP3X unit, the STP35 Interface Cable can be used to connect the two systems. The STP35 cable interfaces with the I/O port of the rear of the MP36R/MP36/MP35 unit.

STP35B MP36R/MP36/MP35 TO PARALLEL

MP36R/MP36 or MP35 to E-Prime, Direct RT, MediaLab, Inquisit, and other systems that connect via the parallel port.

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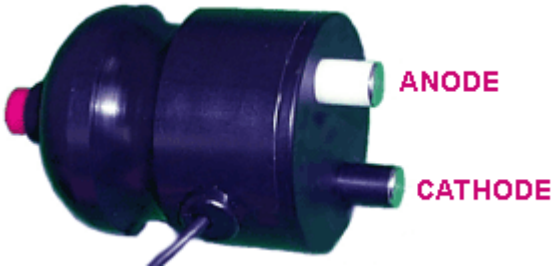


Human stimulation with a superior degree of safety and comfort

The STMHUM is a direct, human-safe stimulator that provides pulse output in the range of 0-100 V. The maximum width pulse that can be generated is limited to 1 msec by hardware, ensuring the STMHUM meets all stimulator safety standards.

The ergonomic design allows the user to focus on the electrode placement instead of worrying about holding the electrode.

- Subjects depress the red safety switch to allow the software-controlled stimulus presentation through
- To stop the stimulus, Subjects simply remove their thumb from the switch and the electrode shuts off.

Cable terminates in a DB9 connector to interface the "Analog out" port on MP36 and MP36R units; not compatible with MP35 or MP30 units. Requires software versions BSL 4.1.1 or Acq*Knowledge* 4.4.1 or higher.

The STMHUM eliminates the need for an external stimulator—use as a cost-effective alternative for the HSTM01+BSLSTMB/A hardware combination.

BIOPAC software provides an output control panel that allows for the voltage to be specified directly along with pulse frequencies. Set parameters using MP Menu > Output Control > Human Stimulator – STMHUM:

I PORTA T Refer to the Stimulation Safety Notes beginning on the next page.

ST HU SPECI ICATIO S

Stimulus Type:	Voltage
Stimulus Pulse Width:	50 µsec to 1 msec
Step Up Voltage Ratio:	1:10
Maximum output voltage:	100 V
Safety Switch:	Yes (pushbutton)
Isolation Capacitance:	100 pF
Isolation Voltage:	1500 V
Power output:	Watt (instantaneous max.) = (100 V x 100 V)/500 Ohms = 20 Watts
	Joules (Watts x Seconds) = 20 Watts x 0.001 seconds = 0.020 Joules = 20 mJ
Stimulating Electrodes:	*Material*: Stainless steel; *Diameter*: 8 mm; *Spacing*: 2.54 cm
Dimensions:	*Height* (electrode bottom to button top): 7.7 cm; *Diameter*: 4.5 cm; *Weight:* 170 G
Cable:	*Length*: 3 m (10'); *Connector*: DB9 male
Interface:	MP36 or MP36R Analog Out port (DB9 female)

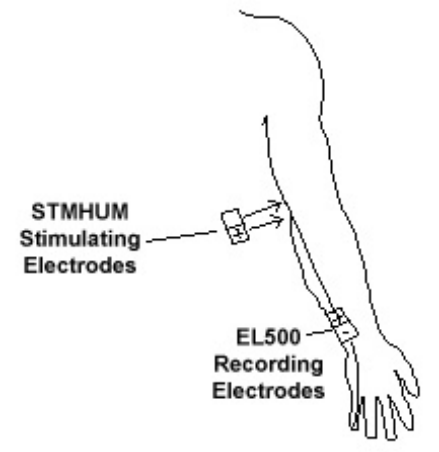
IMPORTANT SAFETY NOTES!

When using the STMHUM, it is possible to generate voltages as high as 100 V p-p. These voltages are potentially dangerous, especially if the stimulator's high voltage outputs are connected across the subject's heart. Across the heart means that the heart is potentially in the electrical path from lead to lead. This situation occurs when the stimulation electrodes are placed on opposite sides of the subject's body.

NEVER PLACE STIMULATION ELECTRODES ON OPPPOSITE SIDES OF THE SUBJECT'S BODY!

Always use the stimulator with the leads placed in relatively close proximity to each other and relatively far from the heart, and with the leads placed only on the **SAME** side of the body. The figure to the right illustrates correct connection techniques when using the STMHUM.

Example of correct stimulation electrode placement:



STIMULATION SAFETY

The harmonized, international regulatory standard relating to the safety of nerve and muscle stimulators is **IEC 60601-2-10:2015**. Certain stimulation equipment is excluded from this standard, such as stimulators intended for cardiac defibrillation; however, for the purposes of defining relevant safety metrics for the STMHUM stimulation unit, this standard is quite relevant.

STMHUM stimulation units are designed in such a manner that the power available to stimulate the subject is limited. This limitation of power is achieved through the use of stimulus isolation transformers which have physical constraints (due to their size and construction) which absolutely —in accordance to known physical laws — constrain the maximum transferable power to be no more than a specific level.

The IEC 60601-2-10:2015 standard clearly specifies the **limitation of output power** for a variety of wave types.

* For stimulus pulse outputs, the maximum energy per pulse shall not exceed 300mJ, when applied to a load resistance of 500 ohms,
* For stimulus pulse outputs, the maximum output voltage shall not exceed a peak value of 500 V, when measured under open circuit conditions.

STMHUM units employ stimulus isolation transformers that limit the output pulse width to 1 ms maximum, under 500 ohm load conditions. In addition, the highest available output voltage is 100 V pk-pk under open circuit conditions.

For the pulse energy calculation for STMHUM:

Joules = Watts x Seconds
Watt (instantaneous max.) = (100 V x 100 V)/500 Ohms = 20 Watts
Joules (Watts x Seconds) = 20 Watts x 0.001 seconds = 0.020 Joules = 20 mJ

Accordingly, the highest possible energy output using the STMHUM is **20 mJ**, considerably **less than the 300 mJ maximum** as specified by IEC 60601-2-10:2015.

CAUTIONS FOR USE!

Even the safest stimulation units, if used incorrectly, can cause serious harm. The following points illustrate fundamental rules for using stimulus isolation units to stimulate subjects.

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1) **NEVER APPLY THE STIMULUS SIGNAL IN SUCH A MANNER AS TO CAUSE CURRENT TO FLOW THROUGH THE HEART**.

   Primarily considered, this rule implies that stimulation leads should never be split apart so as to be able to touch opposing sides of the body surrounding the heart.

   For example: NEVER CONNECT THE STIMULUS ISOLATION UNIT SO THAT ONE LEAD TOUCHES THE LEFT ARM AND THE OTHER LEAD TOUCHES THE RIGHT ARM.

   Both stimulus leads [(+) and (-)], should be applied to the SAME side (left or right) of the subject's body. Furthermore, always stimulate AWAY from the heart. Stimulation probes (such as BIOPAC's EL350 or the EL351), which constrain the distance from the positive stimulation output to the negative stimulation output, should always be used for skin surface stimulation of nerve or muscle.

   The EL350 or the EL351 stimulation probes fix the distance between stimulation outputs to 35 mm. It is not recommended that this distance be increased for skin surface stimulation of nerve or muscle. An increase in this distance simply allows stimulation currents to circulate over a larger area, which is usually not necessary for nerve or muscle stimulation scenarios.

2) **Always start the stimulation process with the stimulator control set the LOWEST possible level**. The “Pulses” output control panel in the BIOPAC software is used to control the STMHUM. Set to the 0% level, prior to the onset of the stimulation protocol. During the protocol, increase the stimulus intensity by increasing the Level in small increments Stop increasing the intensity at the first sign of subject discomfort.

IMPORTANT NOTES!

A) It takes as little as **15 micro-amps** directed across the heart to instigate ventricular fibrillation. This situation can be readily achieved by using sub-surface stimulation needle electrodes that insert directly into the heart. It is considerably more difficult to achieve ventricular fibrillation on the same heart using surface electrodes, but it is possible to do so, evidenced by the performance of cardiac defibrillation units used in hospitals or by paramedics.

B) **Qualified experienced professionals** should supervise any protocols where electrical stimulation is applied to human subjects. Electrical stimulation protocols are not simple. Please contact BIOPAC Systems for any questions regarding the use of BIOPAC’s stimulation units or accessories.

OUT SERIES

Headphones

- OUT1 High Fidelity Headphones
- OUT1A Ultra-Wide Frequency Response Headphones
- OUT100 Monaural Headphone
- 40HP Monaural Headphones

LED

- OUT4 Visual Stimulus: Controllable LED
- OUT103 LED Cable

- OUT2 BNC Output Adapter
- OUT3 *see Stimulators*
- OUT5 *see STMISOLA*
- OUT101 Tubephone
- OUT01E Foam Ear Inserts:
- OUT101R Plastic Tubes
- OUT102 Piezo Audio Transducer
- OUT6 DSUB9 to RJ11 Output Adapter

OUT HI H IDELIT HEADPHO ES

These wide response high-fidelity headphones are used for auditory stimulus (short tones or clicks) or to listen to physiological signals (like EMG) directly. The Headphones are comfortable and lightweight (3 ounces) and include a 2 meter cable so the Subject can be seated a comfortable distance from the acquisition unit.

Unlike other Smart Sensors that connect to the MP3X, the OUT1 connects to the "Analog out" port on the back panel of the MP3X.

OUT1 SPECIFICATIONS

Cable Length:	2 meters
Connector Type:	9 Pin DIN (female)

OUT A IDE RE UE C RESPO SE HEADPHO ES

These ultra-wide frequency response headphones connect directly to the headphone port on the MP36 or MP36R data acquisition unit.

Features of these multi-purpose headphones include:

- High dynamic range
- High-resolution capsule
- 1/8" connector plus 1/4" adapter included
- Single-sided cord
- Oval-shaped ear cups
- Comfortable headband
- High-quality components and exceptionally rugged construction

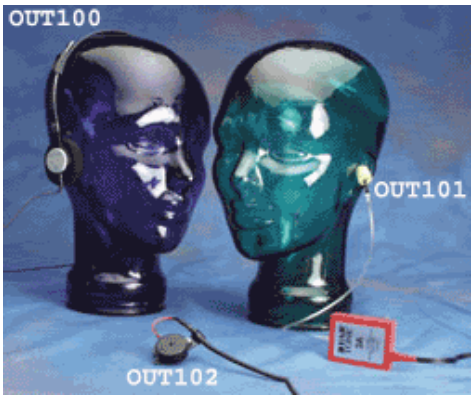
OUT1A SPECIFICATIONS

Connector: 1/8" TRS connector plus 1/4" TRS adapter
Interface: MP36 or MP36R (not compatible with other MP units)
Frequency response: 20 Hz - 20 kHz

Max. power handling: 100 mW
Impedance: 32 Ohm
Sensitivity: 105 dB @ 1 kHz
Cord length: 2 meters
Dimensions: 11-3/4" x 9-3/4" x 8-1/4"

OUT O AURAL HEADPHO ES

These monaural headphones can be used with the STM100C stimulator module to deliver a tone signal while recording data for startle response or other stimulus-response studies. The headphones can also be used to listen to raw signals (such as EMG), piped through the STM100C from an amplifier output. The OUT100 is a wide response, high efficiency headphone, weighing 85 grams and is equipped with a 1.8 meter cord terminated in a 6.3 mm (1/4") phone plug.



OUT100 SPECIFICATIONS

Weight:	85 grams
Connector Type:	6.3 mm (1/4")
Cable length:	1.8 meters
Speaker:	28 mm dia 32 ohm dynamic Mylaar
Impedance:	16 Ohm @ 1.0 kHz
Power Handling:	100 mW max
Frequency response:	20 Hz - 20 kHz
Average SPL:	108 dB ± 4 dB
Adapter (included):	1/4" mono adapter plug

HP O AURAL HEADPHO ES

These monaural headphones are used with Biopac Science Lab MP40 and Biopac Student Lab MP45 for stimulus response experiments and to listen to EMG signals. The 40HP is a wide-response, high-efficiency headphone.

40HP SPECIFICATIONS

Cable Length:	5 meters
Connector Type:	3.5 mm phone plug

OUT B C OUTPUT ADAPTER

This BNC adapter is designed to output signals from the MP3X unit to other devices (such as external amplified speakers and scopes). This 2-meter adapter cable terminates in a male BNC for easy connections.

See also: **SS9LA** BNC Input Adapter

OUT2 SPECIFICATIONS

Cable Length:	2 meters
Connector Type:	BNC (male)

OUT ISUAL STI ULUS CO TROLLABLE LED

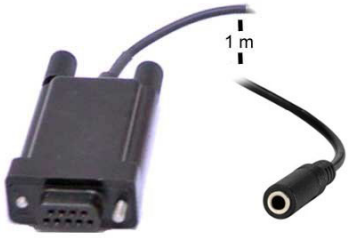
The OUT4 is a controllable high-brightness LED output device mounted on an angled stand intended to provide a good viewing angle for subjects. Use OUT4 for visual stimulus presentation in Biopac Student Lab Lesson 11A Reaction Time - Visual Stimulus, Visual Evoked Potential experiments, and more. Set LED intensity via Use MP Menu > Output Control > Visual Stim Controllable LED - OUT4; set flash rate/sequence via MP Menu > Output Control > Pulse Sequence.

OUT4 SPECIFICATIONS

LED:	White, Relative Luminous Intensity up to ~5000 mcd, adjustable
Interface:	MP36 or MP35 “Analog Out” port* (Pulse Out 0-5 V)
Cable:	2 meters

* OUT4 is not compatible with a) Research System MP36R at this time because Acq*Knowledge* 4.4 and below does not include the required output control, b) with MP45, c) with MP30 except if used in place of SS10L in BSL Lesson 11.

OUT ST ISOLA I TER ACE OR P R



This DSUB9 to 3.5 mm mono jack interface allows the MP36/36R to be used with the STMISOLA isolated linear stimulator for arbitrary stimulus output (range -10 V to +10 V). The 1 m interface connects the MP36/36R Analog Out and the STMISOLA 3.5 mm mono plug/cable.

Compatible with:

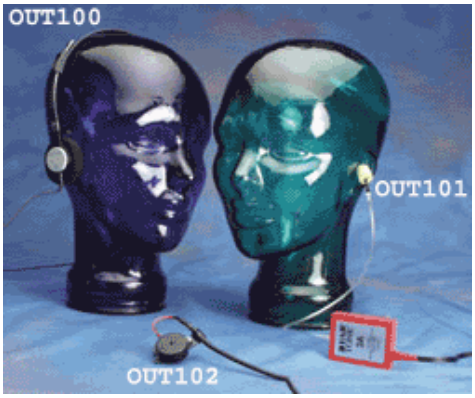
- MP36 with BSL 4.1.2 and above
- MP36R with Acq*Knowledge* 4.4.2 and above

OUT DSUB TO R OUTPUT ADAPTER

Use this DSUB9 to RJ11 jack Output Adapter to map the analog output of an MP36 or MP36R to an RJ jack; allows stimulators designed with AMI/HLT-compatible connections to be connected to MP36/36R units. Control the STMTHERM, or other stimulators that have RJ11 input cables.

OUT TUBEPHO E

- **OUT101E** Replacement Foam Ear Inserts: pkg. of 50
- **OUT101T** Replacement Plastic Tubes: pkg. of 4



OUT101 Components: one Tubephone, plastic tube and 50 foam ear inserts

Use the OUT101 tubephone to deliver clicks and tones in auditory evoked response applications (i.e. ABR).

The tubephone design consists of a monaural acoustic transducer attached to a short, flexible, plastic tube, which fits into the subject's ear with the aid of a foam tip.

Use of the tubephone reduces ambient noise and bone conduction problems, which can interfere with auditory response recordings. Furthermore, because the Tubephone provides a 1 msec acoustic signal delay (due to plastic tube), it automatically separates true response from electromagnetic artifact resulting from speaker activation.

MP36 and MP36R interface options:

- BSL System stimulator (model BSLSTM): use BSLCBL6 and Radio Shack P/N 274-047 ¼" to 1/8" phono adapter
- BSL MP36 data acquisition unit Analog Out port: use OUT3 plus BSLCBL6 and Radio Shack P/N 274-047 ¼" to 1/8" phono adapter
- MP36 headphone port: use Radio Shack P/N 274-047 ¼" to 1/8" phono adapter; note—volume may not reach the same levels as the Analog Out port

Calibration for Auditory Brainstem Response Studies

To calibrate the OUT101 Tubephone, use an Etymotic ER-7C Probe Microphone—this microphone provides a calibrated output voltage which is a function of applied Sound Pressure Level (SPL). The sensitivity is 50 mV/Pascal (-46 dB re: 1 V/uBar): 0 dB SPL = 0 dBuV. Place the Probe Microphone insert tube in the auditory canal prior to the insertion of the OUT101 foam tip.

The OUT101 Tubephone sound delivery tube and the Probe Microphone sound input tube will then be exposed to the same auditory chamber. Accordingly, the SPL is recorded, via the Probe Microphone, simultaneously with applied auditory stimulus from the OUT101 Tubephone.

OUT101 SPECIFICATIONS

Response:	Compares to TDH-39, 49 or 50 audiometric headphones
Acoustic signal delay:	1 msec
Dimensions:	3.8 cm (wide) x 5 cm (high) x 1 cm (thick)
Cable termination:	6.3 mm (1/4") phone plug
Cable length:	1.8 meters
Cable clip:	Yes; clip attaches to fabric or fixtures

OUT PIE O AUDIO TRA SDUCER

The OUT102 Piezo transducer may be connected directly to the STM100C stimulator module 50 ohm output. When the stimulator module output rises above 1.5 volts, the Piezo indicator will emit a constant audible signal (3.0 kHz @ 80 dB). Accordingly, the device is very useful for providing an audible stimulus, or alarm, when a physiological signal passes a certain threshold. As such, the OUT102 makes an excellent audible BPM indicator for ECG, blood pressure or respiration signals. The device can also be used to indicate when temperature or other slowly moving variable (e.g. electrodermal response) passes a certain threshold. The threshold for the OUT102 is determined by adjusting the amplitude control on the STM100C module. The specific Biopotential or Transducer amplifier signal monitored can be recorded while simultaneously directed through the STM100C module. To operate as described here, the source amplifier needs to be set to CH16, STM100C is set to CH16 input, and source signal must be able to reach at least +1.5v of amplitude. Source signal gain can typically be sufficiently adjusted by using the gain switch on the source amplifier module. STM100C amplitude control can be used to attenuate the source signal, as required, to help activate the Piezo transducer on only the desired source signal portions.

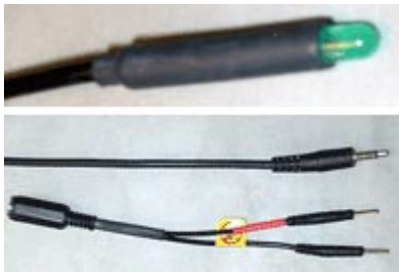
The OUT102 also connects directly to the UIM100C digital I/O ports for operation with Control Channel outputs. The OUT102 measures 2.5 cm (dia) x 1 cm (high) and comes equipped with a 1.8 m cable terminated in a 3.5 mm phone plug. An adapter is included for connecting the OUT102 to the UIM100C digital I/O ports.

The included 3.5 mm mono splitter (3.5 mm male mono phone plug to two 3.5 mm female mono sockets) and one CBL100 (3.5 mm mono male to 3.5 mm mono male cable) permit the analog drive signal to be directed to two locations. The drive signal – usually from DA0 or DA1 – is typically directed to the splitter cable. One socket output of the splitter cable is directed to the OUT102 input. The other socket output of the splitter cable is looped back to drive an available MP input, via CBL100, through the UIM100C. In this manner, during acquisition, the stimulus level and timing will be indicated on the recording.

OUT102 SPECIFICATIONS

Dimensions:	2.5 cm (dia) x 1 cm (high)
Cable Length:	1.8 meters
Connector Type:	3.5 mm phone plug + adapter for the UIM100C digital I/O ports

OUT LED CABLE



Use this LED cable to synchronize a light flash. The 3 meter cable makes it easy to use the LED for a variety of protocols. Terminates for connection to Analog OUT 0/1 and includes adapter for connection to Digital I/O. **Media synchronization** - Windows only - Acq*Knowledge* 4.1 and above.

The included 3.5 mm mono splitter (3.5 mm male mono phone plug to two 3.5 mm female mono sockets) and one CBL100 (3.5 mm mono male to 3.5 mm mono male cable) permit the analog drive signal to be directed to two locations. The drive signal – usually from DA0 or DA1 – is typically directed to the splitter cable. One socket output of the splitter cable is directed to the OUT103 input. The other socket output of the splitter cable is looped back to drive an available MP input, via CBL100, through the UIM100C. In this manner, during acquisition, the stimulus level and timing will be indicated on the recording.

Option 1: MP150 and UIM100C setup using an Analog Output

a. Connect the OUT103's 3.5 mm phone plug from the LED to one of the arms of the included Y-cable.

b. Connect the included CBL100 to the other arm of the Y-cable.

c. Connect the stem of the Y-cable to one of the two Analog Output connections near the bottom of the front face of the UIM100C.

d. Connect the other end of the CBL100 to an otherwise unused Analog Channel also on the front face of the UIM100C.

e. Use "MP160/150 > Set Up Channels..." (in Acq*Knowledge* 4.4, choose "Channels" in the left pane after choosing "MP160/150 > Set Up Data Acquisition...") and acquire and plot the analog channel to which the CBL100 is connected.

f. Use "MP160/150 > Set Up Stimulator..." (in Acq*Knowledge* 4.4, choose "Stimulator" in the left pane after choosing "MP160/150 > Set Up Data Acquisition...") to send 5 volt pulses through the Analog Output.

Option 1: MP160 and AMI100D/HLT100C setup using an Analog Output

a. Connect the OUT103's 3.5 mm phone plug from the LED to one of the arms of the included Y-cable.

b. Connect the included CBL100 to the other arm of the Y-cable.

c. Connect the stem of the Y-cable to a CBL122 connected to one of the two Analog Output connections near the bottom of the front face of the AMI100D/HLT100C.

d. Connect the other end of the CBL100 to a CBL122 connected to an otherwise unused Analog Channel also on the front face of the AMI100D/HLT100C.

e. Use "MP160 > Set Up Channels..." (in Acq*Knowledge* 5, choose "Channels" in the left pane after choosing "MP160 > Set Up Data Acquisition...") and acquire and plot the analog channel to which the CBL100 is connected.

f. Use "MP160 > Set Up Stimulator..." (in Acq*Knowledge* 5, choose "Stimulator" in the left pane after choosing "MP160 > Set Up Data Acquisition...") to send 5 volt pulses through the Analog Output.

Option 2: MP150 and UIM100C setup using a Digital I/O Channel

a. Connect the OUT103 2 mm pin adapter to the 3.5 mm plug on the OUT103 cable.

b. Connect the red OUT103 2 mm pin to a Digital I/O channel on the rear of the UIM100C and the black pin to GND D on the rear of the UIM100C.

c. Use MP150 > Set Up Channels to acquire and plot the Digital I/O channel the OUT103 is connected to.

d. Set MP150 > Show Manual Control

- Set for ‘Output.’
- Enable the 'Set immediately' option.
- Click the Digital I/O channel the OUT103 was connected to toggle between 0 and 1.

If necessary, click the 'Set' button to update the manual control and output a digital pulse.

MP36R setup - additional items required

a. Connect an OUT3 (BNC adapter) to the 'Analog Out' port on the rear of the MP36R.

b. Connect a BSLCBL6 (interface cable: BNC to 3.5 mm) to the OUT3.

c. Connect the OUT103 3.5 mm plug to the BSLCBL6 3.5 mm socket.

d. Set MP36 > Output Control 'Low Voltage Stim' option

- Set Pulse width to 100 msec.
- Set Pulse level to 5 volts – set Reference Channel to any digital channel.
- Click the D’ON’ button to output a digital pulse.

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PODS A D C PODS

Map any Input Signal to any Output Pin—Event Markers sent USB

STM-M-POD-IO for MP36/36R Systems

STM-M-POD-STP for STP100C and MP160 Systems

STM-M-POD-IO

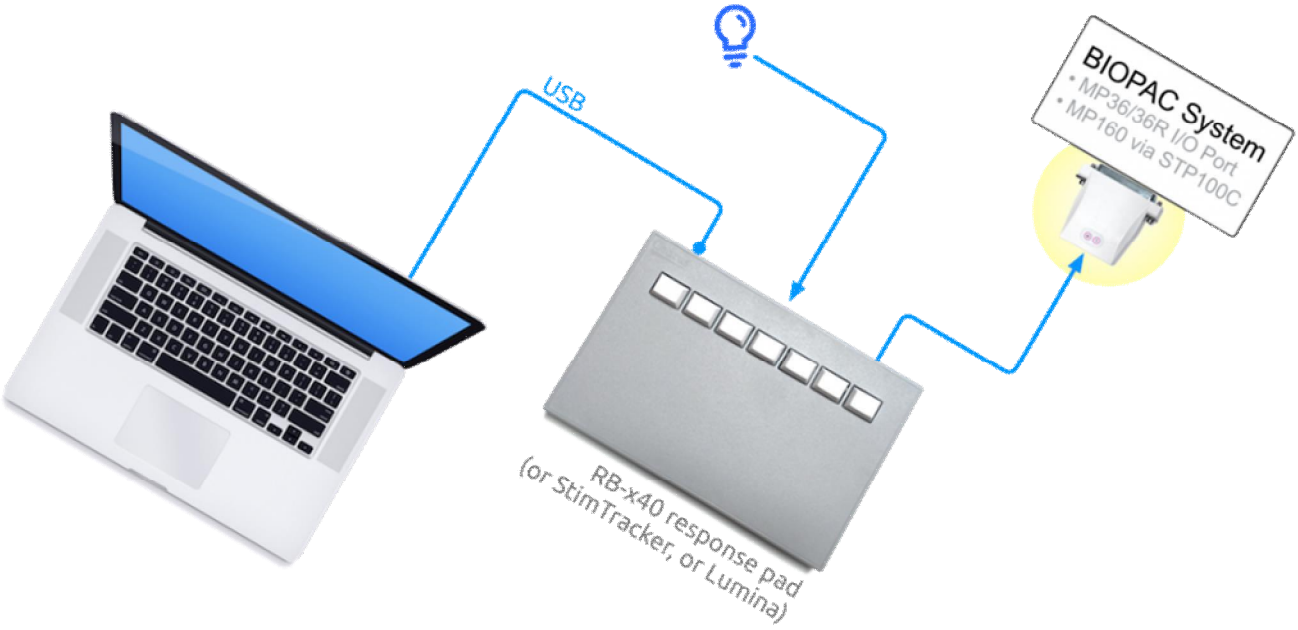
STM-M-POD-STP

Use mï pod to map any input signal to any output pin, or combine any number of input signals to a single output pin and build your very own custom output table. With its speedy microprocessor, this translation power adds a minuscule 50 µs delay.

Use m-pods to get all, or only, the desired signals. In some experiments, it may be appropriate to mark the onset of participantsô key presses. In others, these markers get in the way and it may be preferable to have more data bits available for markers sent via USB. Or even a mix of both.

No more fussing over the right connector size, gender, and pin assignmentsð just choose the m-pod for the specific interface and enjoy instant compatibility:

- interface directly to the I/O port on MP36 and MP36R units, or
- interface to an STP100C for MP160 Systems



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Easily Send Event Markers from Computer to Recording Devices—Affordable Jitter-Free Precision

STM-C-POD-IO for MP36/36R Systems

STM-C-POD-STP for STP100C and MP160 Systems

STM-C-POD-IO

STM-C-POD-STP

Send event markers via USB with high precision. c-pods simplify connection & timing details and deliver guaranteed jitter-free performance.

- Asynchronous Output
- Scheduler
- Pattern Generation
- Mixed output
- 32-bit microprocessor
- Interface directly to I/O port on MP36 and MP36R units, or to an STP100C for MP160 Systems.

Asynchronous Output

With traditional I/O cards, software programs used for sending pulses need to wait for the duration of the pulse before work can resume. Imagine sending a postcard to a friend and then not being able to do anything else until that postcard is delivered. Itôs a lot of wasted time. This is synchronous delivery.

cï pod can deliver signals asynchronouslyð an application sends a command that includes the pulse duration and then resumes working, e.g. to present a stimulus or look for participant response. cï pod takes care of completing the pulse delivery.

Scheduler

cï pod takes the idea of asynchronous output a step further. Instead of delivering a pulse now, why not deliver it later? Better yet, why not deliver multiple pulses later?

This is a useful feature that answers the following question: when presenting a movie or sound, how can I mark certain points precisely during playback?

With the scheduling feature, itôs possible to preload cï pod with a list of times for pulse delivery, the length of the pulse, and the output line(s) that it should be delivered on. A subsequent command can be sent at the onset of the movie or sound to start executing the schedule.

Pattern Generation

cï pod can function as a pattern generator as well, sending periodic pulses out on a user-defined output line, or even pulses of different periods on multiple output lines. This is useful for applications requiring strobing, or where the intensity of light or a motor is controlled using pulse width modulation (PWM).

Mixed Output

And more: the features described above are not mutually exclusive. For example, while a schedule is being executed on output lines 1, 2, and 3, an async pulse command can be sent at any time on the remaining lines 4 through 8.

Similarly, while a pattern is being generated on some lines, an asynchronous pulse command can be sent on the remaining lines. cï pod will not skip a beat.

32-Bit Microprocessor

Inside the c-pod is a computer with a speedy 32-bit engine, humming with useful, well-polished software.

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	c–pod	m–pod + using an existing response pad	StimTracker
Send Pulses Asynchronously	✓	✓	✓
Signal / Pattern Generator	✓	✓	No
Pulse Scheduler Feature	✓	✓	No
Marks Onset of Participant Key Presses	No	✓	No
Marks Onset of Visual Stimuli	No	✓	✓
Marks Onset Of Auditory Stimuli	No	No	✓
Marks Onset of External TTL Input	No	No	✓
Voice Key	No	No	✓
Number of Simultaneous Outputs	1	1	2

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EP STI ULUS PRESE TATIO S STE S ITH E PRI E

These stimulus presentation packages include E-Prime experiment generator and an isolated digital interface (STP100C) with parallel port cable (CBL110C).

E-Prime provides experiment generation and millisecond precision data collection through data handling and processing. E-Prime is a powerful suite of applications combining precise millisecond timing, a user-friendly environment, and the flexibility to create simple to complex experiments for both advanced and novice users.

- EPM100W includes E-Prime 3.0
- EPM100 – E-Prime 3.0 software only

Use the Acq*Knowledge* Digital inputs to stim events tool to automatically score and label digital event marks from the E-Prime presentation. The digital channels are interpreted as a binary number. Each stimulus event placed into the graph has the corresponding number included with its label. This allows further analysis to distinguish between different types of stimulus events for automated event related analysis.

E ITH E PRI E .

- Support for tablets and touchscreens
- SlideButton sub-object for an area of response collection without using script
- SlideChoice sub-object to design multiple choice surveys, recognitions, recalls
- SlideSlider sub-object to design scales and sliders
- Slide Layout Templates for quick design
- Improved interface with tabbed workspace and easier access to windows
- Find and replace properties in an experiment
- Run an experiment in a floating window for quicker inspection and debugging
- Run desired List rows at runtime with Interactive order selection
- Interactively run List rows for debugging purposes
- Create conditional Task Events using subroutines in User Script
- Improved Audio/Video playback and load times
- Start an experiment from any List object
- Play movie and audio files in additional formats
- Online Experiment Library
- E-Prime Command Reference and online documentation
- New experiment design templates
- Access Full and User Script in the Structure window
- Automatically generate text data files upon completion of experiment
- Save a definition of columns of interest in E-DataAid
- Correct, Incorrect, Omission Task Events
- Check for Update checks web and prompts when updates are available

The E-Prime suite of applications includes:

- E-Studio – Drag and drop graphical interface for experiment design.
- E-Basic – Underlying scripting language of E-Prime (nearly identical to Visual Basic for Applications™).
- E-Run – Once experiment design is complete, a single mouse click generates it into an E-Basic script. E-Run then affords you the millisecond precision of stimulus presentation, synchronizations, and data collection.
- E-Merge – Quickly and easily combines your single session data files for group analysis.
- E-DataAid – Data management utility that allows you to filter, edit, analyze, and export your data.
- E-Recovery – Recovers data files in the event of early terminated experiments, or lost or corrupted files.

I TER ACE TO BIOPAC

Research Systems: MP160 or MP150 System—Use the Isolated Digital Interface (STP100C) to safely isolate digital inputs (in the range of 0-3.3 V or 0-5.0 V) and outputs; STP100C includes CBL110C, a 3-meter DB25 M/F ribbon cable to interface with E-Prime via the printer port.

Education Systems: MP36 or MP35 System—Use the STP35A DB25 M/F 3-meter ribbon cable to interface the computer printer port to the I/O Port on the back panel of the MP unit.

S STE RE UIRE E TS

For E-Prime system requirements see:

- Current release E-Prime 3
- Legacy versions E-Prime 1 and E-Prime 2

See also: STP100C, STMEPM

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BSLCBL CABLE SERIES

BSLCBL1A: Stimulator to Nerve Chamber ï Standard Banana Plug
BSLCBL2A: Stimulator to Nerve Chamber ï 2 mm Pin (Mini-Banana) Plugs
BSLCBL3A: Nerve Chamber to BSL ï Standard Banana Plugs
BSLCBL4B: Nerve Chamber to BSL ï 2 mm Pin (Mini-Banana) Plugs
BSLCBL5: 3.5 mm Phone Plug
BSLCBL6: Stimulator to Output ï 3.5 mm Mono Male Phone Plug
BSLCBL7: Stimulator to Electrode ï BNC to 2x Alligator Clip
BSLCBL11: Stimulator to Electrode ï BNC to 2x Electronic Test Clip (spring-loaded)
BSLCBL12: Stimulator to Electrode ï BNC to 2x Toothless Alligator Clip
BSLCBL8/9: High Impedance ï 1.5 mm Touchproof
BSLCBL14A: MP36/35 Input Adapter for Research Amplifiers

Interface Cables

Stimulator to Nerve Chamber

Interface the BSL Stimulator with nerve conduction chambers. A BNC connector interfaces with the stimulator and two plugs attach to the nerve chamber.

Gold-plated

Stackable ground

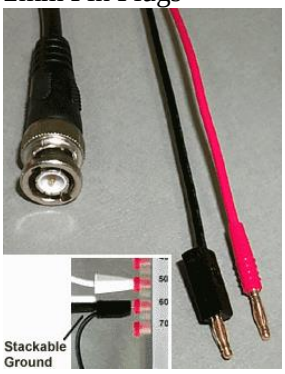
Length: 1.2 meters

Pin Plugs: 2 mm (OD)

Standard Banana Plugs: 4 mm (OD)

BSLCBL1A
Banana Plugs

BSLCBL2A
2mm Pin Plugs



Nerve Chamber to Biopac Student Lab

Interface nerve conduction chambers with the Biopac Student Lab System; use to record the signals coming from the nerve. A BSL DSUB 9 connector interfaces with the Biopac Student Lab MP3X unit and two plugs attach to the nerve chamber.

Length: 1.2 meters

BSLCBL3A
Banana Plugs

BSLCBL4B
2mm Pin Plugs

BSLCBL3A/4B Specs

Gain: 1/10 (divide by 10)

Input Impedance (single-ended and common-mode): 5e11 Ohms (500 GigaOhms)

Common-Mode Rejection: 90 dB Typical

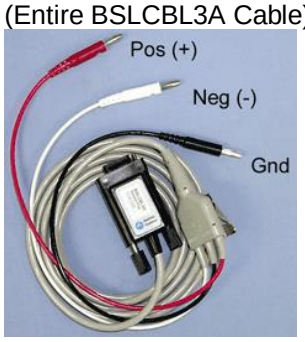
Input Bias Current: 3 pA Typical, 100 pA

Maximum Voltage Noise: 1.3 µV p-p (0.1-10 Hz)

Voltage Noise Density: 36 nV /SQRT(Hz)

Current Noise Density: 0.01 pA /SQRT(Hz)

(Entire BSLCBL3A Cable)



(Entire BSLCBL4B Cable)

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3.5 mm Phone Plug Adapter

Use BSLSBL5, 1.7 meters (included with TSD122). The cable has a built-in attenuation of 1/200, which translates 10 V to 50 mV.

Stimulator to Output

Use BSLCBL6 to interface the BSL Stimulator with 3.5 mm Mono Phone Jack outputs, like the OUT100 Headphones or the OUT101 Tubephone set for auditory stimulation. Required for Auditory Evoked Response experiments. Use with OUT3 for MP36 built-in low voltage stim.

Length: 1.3 meters

BSLCBL5

3.5 mm Phone Plug

BSLCBL6

3.5 mm Mono Phone Jack

Stimulator to Electrode

BSLCBL7,

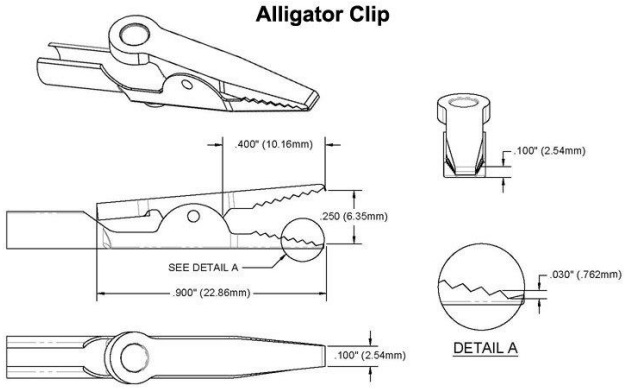
BSLCBL11, and

BSLCBL12

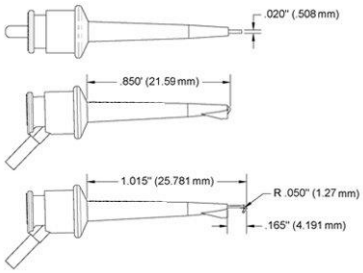
BSLCBL7 - BNC to 2x Alligator Clip
BSLCBL11 - BNC to 2x Electronic Test Clip (spring-loaded)
BSLCBL12 - BNC to 2x Toothless Alligator Clip

Use these special electrode lead clips to interface stimulating electrodes, or to connect directly with animal preparations. Each 1-meter cable has two clips And terminates with one BNC connector to interface with BSLSTM, SS58L Stimulator, or OUT3 for MP36 low volt stimulator and silver or platinum wire electrodes.

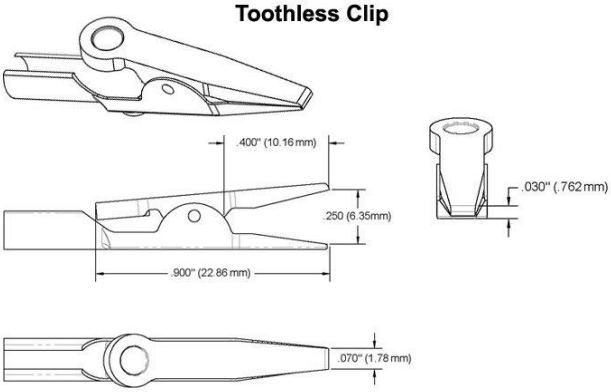
Alligator Clip



Retractable Clip



Toothless Clip



High-impedance cables **BSLCBL8 and** **BSLCBL9** 	These fully-shielded, high-impedance electrode interface cables permit high resolution recording of biopotential signals using reusable electrodes. The adapter terminates with standard 1.5 mm Touchproof electrode connectors to interface reusable electrodes (EL250, EL350, and EL450 series). **IMPORTANT:** A ground connection, to the measurement point, is required when using BSLCBL8 or BSLCBL9. This connection is mandatory to allow the internal cable amplifiers to receive the required bias current. The ground connection is made from the center pin of the electrode lead attachment junction at the end of the cable to the preparation/animal/nerve under study. Typically, a LEAD140 series lead, EL450 series needle electrode or LEAD110 series clip lead is used to establish this ground connection. BSLCBL8/9 Specifications Input Range: BSLCBL8: MP36/36R: ±2 V, MP35: ±1 V, MP30: ±70 mV, MP45: ±2 V BSLCBL9: MP36/36R: ±3.8 V, MP35: ±3.8 V, MP30: ±700 mV, MP45: ±3.8 V Input Impedance: 500 GigaOhm (Single-ended & Common-Mode) Input Bias Current: 3 pA Typical, 100 pA Maximum Maximum Voltage Noise: 1.3 µV p-p (0.1-10 Hz) Voltage Noise Density: 36 nV /SQRT(Hz) Current Noise Density: 0.01 pA /SQRT(Hz) Cable length: 2 meters Interface: MP3X (DSUB 9) Gain: BSLCBL8 (Gain = 1), BSLCBL9 (Gain = 1/10)
MP36/35 Input Adapter for Research Amplifiers **BSLCBL14A** 	3.5 mm male phone plug adapter with built-in attenuation. Provides a divide by 10 attenuation to scale the ±10 V signal range of BIOPACôs 100 series modules to the ±2 V (MP36) or ±1 V (MP35) device input ranges. Interface with MP3X, MP45 or BIOPAC 100 series amplifiers through a connection to either the UIM100 or the IPS100C Isolated Power Supply. (Not compatible with MP30.)