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STM200 CONSTANT VOLTAGE STIMULATOR – UNIPOLAR PULSE

The STM200 can be used to stimulate any preparation or subject*, including:

- Pain and stress studies that require lower voltages and wider pulse widths.

- Tissue baths (range 0-100 V at 0.1-200 ms pulse width).

- Nerve or muscle stimulation that requires higher energy than a STMISOC/D/E can deliver.

*IMPORTANT:

- For MRI Applications, when possibly considering the use of the STM200 for associated electrical stimulation of human subjects, please refer to BIOPAC Application Note 257 for context, warnings and details.

- **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.

Controls & Connections

Front Panel

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

- 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.

If the Range is changed before recording begins, the scaling must also be changed (MP menu > Set Up Channels) to maintain direct Level recordings.

If the Range is changed during recording, the user should manually enter a software marker to note the change (Esc). 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   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.

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Level   Level is used in conjunction with Range to set the stimulus pulse output level. Turn the Level control (right to increase, left to decrease) to establish the desired Level, as indicated on the digital display.

Output   Standard BNC connector to output the stimulus pulse to external electrodes or other devices.

LCD light   The red LCD is activated when the DC adapter is plugged in and the power switch on the back panel is turned ON, and flashes when the stimulus pulse is active.

Back Panel
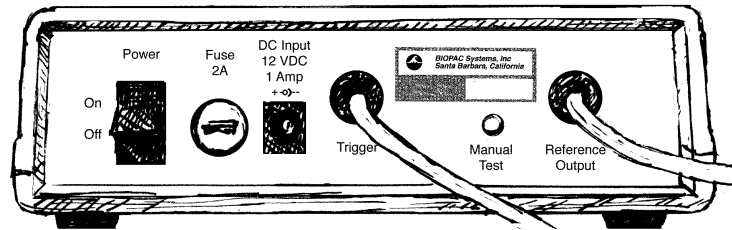
Power   Rocker switch for turning the STM200 power ON and OFF.

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

DC Input   Socket for DC adapter (AC300A or equivalent).

Trigger   This cable terminates in a 3.5 mm mono plug for connection to the UIM100C Analog Output 0 or the STM100C 50 ohm output.

Manual Test   Used to diagnose problems with the STM200 stimulator unit. With Trigger cable disconnected, press the Manual Test button to initiate a stimulus with a fixed pulse width of 1 millisecond.

Reference Out This output cable terminates in an RJ-11 plug for connection to the AMI100D/HLT100C. The cable reports the stimulator marker pulse to the MP System, via the channel it is connected to. A marker pulse will be generated each time the stimulator generates a pulse. The front panel Reference switch determines the marker amplitude:

- Actual varies between 0-1 V and maps to 0-100 V or 0-10 V

- Fixed is 15 ms

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Software Setup

The stimulation waveform may be created using stimulator setup (MP menu > Set Up Stimulator or MP Menu > Set Up Data Acquisition > Stimulator). The output waveform should be designed so that it has

- One or more pulses

- Baseline of 0 V

- Pulse amplitude of 5 V

- Pulse length from 0.1 ms to 200 ms

- Related pulse duty cycle should not normally exceed 10%; higher duty cycles are supportable in certain circumstances.
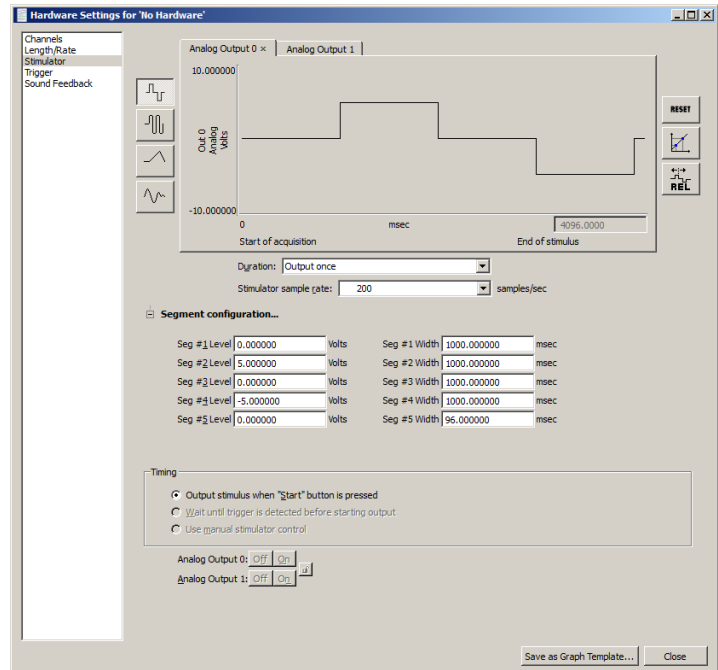

Calibration

The "Reference Output" signal should be calibrated to optimize results.

1. With the STM200 connected and ON, turn the Level control counter-clockwise until the display reads 0 (or as close to 0 as possible).

2. MP > Set Up Data Acquisition > Channels > View by Channels and click the Setup button for the stimulator channel.
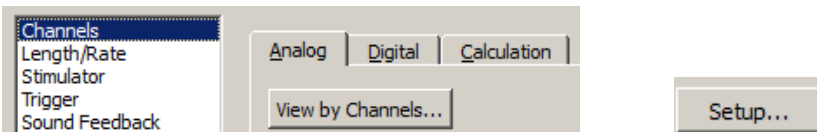
3. Press **Cal 1** to get the signal representing 0 V out of the stimulator.
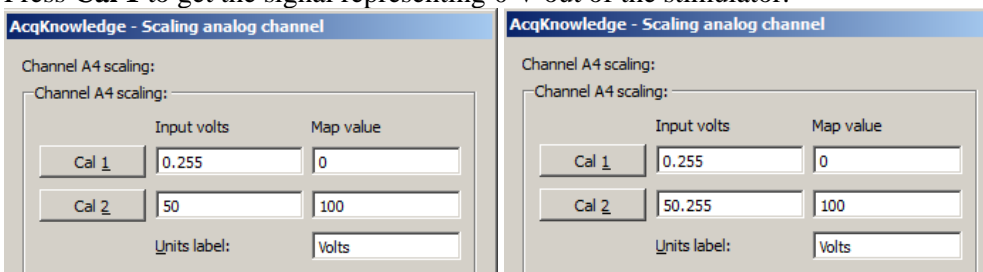
4. Add the Input value found with Cal 1 to the Input Value displayed for **Cal 2**.

   - For example, if "Cal 1" is pressed and returns an Input Value of .255 V, .255 V should be added to the existing 50 V and manually entered as the total value of 50.255 V for Cal 2 Input Value.

   Note   Even if the Cal 1 Input Value is negative, it must still be "added" to the number for Cal 2 (which essentially subtracts it) to arrive at the proper value.

5. Click **OK** to close out of the Scaling window.

Optional: Click **Save as Graph Template** to save these new scale settings. As long as neither the MP unit nor stimulator changes, the calibration should not need to be repeated.

6. Close out of the Setup window.

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STM200 SPECIFICATIONS   (This new unit has digital display and a keyed range switch)

Pulse width	
Controlled by:	Computer software (Acq*Knowledge*)
Range:	0.01 – 200 milliseconds
Range output*:	0.03 – 200 milliseconds
	*Note: Rise/fall times of output pulses vary from 10 to 25 microseconds each depending upon pulse height. Specified output pulse range indicates typical full width at half maximum.
Resolution:	10 µsec (minimum) based on waveform output rate of 100 kHz**
Pulse Repetition	
Controlled by:	Computer software (Acq*Knowledge*)
Pattern:	Fully arbitrary pulse sequence
Resolution:	10 µsec (minimum) based on waveform output rate of 100 kHz
Pulse level	
Control:	Manual (10 turn potentiometer)
Range (selectable with *Key Switch*)	*Range 1*: .025 - 10 Volts
	Range 2: .12 - 100 Volts
	Infinite (potentiometer adjustable) range
Current Output:	1 ms pulse: 500 ma
	100 µs pulse: 1000 ma
Accuracy:	5% accuracy to digital readout
Reference Output	Corresponds 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 MP System.
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

IMPORTANT NOTE! To set pulse width on STM200, assume that STM200 adds 40 µsec to the pulse width signal from Acq*Knowledge*. Example: For 100 µsec pulse width at output of STM200, set output pulse width to 60 µsec.

Read Safe Use of Electrical Stimulators – Application Note 257 for Comprehensive Safety Guidelines for Performing Electrical Stimulation on Subjects.