



### STM100C STIMULATOR MODULE

The STM100C is a single channel stimulation amplifier that was designed for use in the following applications:

#### Stimulus and Response Testing

- Auditory brainstem response testing
- Visual evoked response testing
- Somatosensory response testing
- Nerve conduction velocity and latency recording

#### Biofeedback Procedures

Auditory, visual or mechanical feedback from biophysical signals

The STM100C incorporates manual and automatic attenuation and polarity controls. Automatic attenuation can be effected in 1-dB steps over a 128-dB range. The STM100C has dual stimulus outputs. The **50 Ω Output** can be AC or DC coupled. The **Ext Stim** output is a very low-impedance, high-power, AC coupled output that can be used to drive headphones, speakers and other low impedance devices like lights and solenoids.

The STM100C can amplify and condition signals from four possible sources:

- |                       |                        |
|-----------------------|------------------------|
| Analog (D/A) Output 0 | Pulse (Digital I/O 15) |
| Analog (D/A) Output 1 | Analog Input CH 16     |

#### IMPORTANT!

- A) STM100C is connected to the **left side** of the AMI100D, HLT100C, or UIM100C (compared to other 100C-series amplifier modules, which are connected to the right side of the UIM100C).
- B) Check the “**Stim 100**” option in the Manual Control dialog box (accessed via the MP menu). See the *AcqKnowledge* Software Guide for Manual Control details
- C) After connecting the STM100C to the AMI100D, HLT100C, or UIM100C, other amplifier modules (such as the ERS100C,) snap onto right side of the AMI100D, HLT100C, or UIM100C.



See diagram on the following page for an example connection of the STM100C to the MP unit and other modules.

**See also:** Application Note [AH162](#)—Using the Stimulation Features of the MP System

## STIMULUS RESPONSE TESTING

In stimulus response testing, the **STM100C** is commonly used with the **ERS100C** and the **MP System**. (In the case of the **STMEPM-MRI** Programmable Stimulation System for E-Prime, the **STM100C** is paired with the **IPS100C** in place of the MP System). The **ERS100C** is a very low noise biopotential amplifier, with sufficient bandwidth ranges to accommodate the variety of evoked potential testing.

For most types of evoked response testing, the MP unit will be operating in averaging mode. Typically, the stimulus output waveform is generated in the stimulator setup window and ported through either analog output 0 or analog output 1, and the output device (such as the **OUT101** Tubeophone) is connected to the external stimulus jack on the **STM100C**. This allows for complex pulses, tones, ramp waves and arbitrary shaped analog waveforms to be used as stimulus signals.



*STM100C connection to MP device, UIM100C and ERS100C*

See the *AcqKnowledge* Software Guide for stimulator setup window details.

### 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.
- Make sure that the settings on the **STM100C** match those in the stimulator setup windows (i.e., the output channel in the stimulator window matches the output channel selected on the **STM100C**).

## AUDITORY EVOKED POTENTIALS

Auditory evoked potentials, like the **ABR** can be implemented using the **STM100C**. The **STM100C** is used to present the auditory pulse or “click” to an auditory stimulator, like the *Tubeophone* (**OUT101**). The **OUT101** or headphones (**OUT100**) plug directly into the **EXT STIM** jack on the **STM100C**. “Clicks” can be either rarefaction or condensation (positive or negative pulses). “Click” attenuation can be controlled manually or via the computer in 1-dB steps over a 128-dB range.

## SOMATOSENSORY RESPONSE TESTS

These tests are very similar to **ABR** and **VEP** tests, except the stimulation source is usually an electrical pulse or mechanical impulse applied at some point along the leg or arm. Somatosensory tests are used to characterize the perception of touch. By connecting a solenoid to the **EXT STIM** output of the **STM100C**, a mechanical pulse can be generated for peripheral nervous system stimulation.

## GENERAL NERVE CONDUCTION VELOCITY TESTS

General nerve conduction velocity tests are evoked potential tests, but they generally do not require extensive signal averaging like the ABR or EP tests. The STM100C can perform this type of test, however the STM100C output is limited to a 20-Volt pk-pk signal. In the case of *in vitro* or *in vivo* experimentation, the 20-Volt range of the STM100C is typically adequate. For surface electrode stimulators, higher voltage is often required.

→ For higher voltage outputs, use the STMISOD or STMISOE (with the STM100C) to boost the voltage stimulus signal to 100 V or 200 V, respectively.

## BIOFEEDBACK PROCEDURES

The STM100C can be used to condition and amplify the signals coming from any biopotential or transducer amplifier. The source amplifier must have its output switched to CH 16 (last channel), and the STM100C SOURCE switch needs to be placed on CH 16 as well. With the headphones or speaker plugged into the EXT STIM jack, biopotential signals like EMG can be heard directly. The EXT STIM output can also be used to drive visual indicators directly, so rhythmic or pulsatile signals (like ECG or respiration) can be easily observed. Mechanical actuators like relays and solenoids can be directly connected to the STM100C.

**CALIBRATION:** None required

## STM100C SPECIFICATIONS

Stimulus Output Voltage:	20 Volts (p-p) maximum.
Voltages of up to 200 V are possible by connecting STMISO Series to the <b>Ext Stim</b> output on the STM100C.	
Current Output Drives:	
50 Ω Output:	±200 mA (3.5 mm phone jack)
Ext. Stim. Output:	±1.0 amp (6.35 mm [¼"] phono jack)
Ext. Stim Z (out):	Less than 0.1 Ω
Input Sources:	D/A0, D/A1, PULSE (DIG I/O 15), CH 16 (Analog)
Polarity Control:	Manual or digital control (DIG I/O 7, H-POS, L-NEG)
Attenuation Control:	Manual or digital control
Attenuation Control Range:	128 dB (Digital I/O 0-6, LSB-MSB)
Attenuation Step Resolution:	1 dB
LED Indicators:	Limit*, Pulse*
Uniphasic Pulse Width:	10 μs (min) with 5 μs resolution
Biphasic Pulse Width:	MP160/150: 20 μs (min)
Biphasic Pulse Resolution:	MP160/150: 10 μs
Arbitrary Wave Resolution:	MP160/150: 10 μs
Weight:	380 grams
Dimensions:	4 cm (wide) x 11 cm (deep) x 19 cm (high)

\*The LIMIT LED is primarily for troubleshooting. Under normal operation, this LED should never illuminate. If the LIMIT LED shines red, too much current is flowing TO system ground via the 50 ohm output. If green, too much current is flowing FROM system ground. Generally, observation of green/red LED LIMIT activity indicates a failure to drive the device connected to the 50 ohm output.

The PULSE LED indicates the state of digital channel 15 in the MP150/MP160 system. The LED is illuminated (red) when D15 is in the low (0) state and is off when D15 is in the high (5) state. Note that the state of D15 is only relevant to STM100C operation when "SOURCE" switch is set to "PULSE".

Users of MP160 with Smart Amplifiers should be aware that Digital channel 15 must be high or floating when *AcqKnowledge* is launched and when data acquisition begins. To combine Smart Amplifiers with STM100C using "PULSE" as SOURCE, hardware should hold D15 high with LEVEL control knob set to 0% until data are being acquired. Then D15 may be set low to prepare for pulses that will control stimulator, and LEVEL control knob may be adjusted to desired position.