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STMEPM-MRI – ELECTRICAL STIMULATION SYSTEM DESIGNED FOR MRI OR FMRI

The STMEPM-MRI Programmable Stimulation System for E-Prime allows a user to interface the STM100C Stimulator with E-Prime to control the stimulus frequency and stimulus intensity for real-time stimulus delivery changes based on a subject's responses. It is also possible to hardcode the stimulus intensity levels in the presentation so that predefined stimulus levels are delivered during the E-Prime presentation. This MRI system is like the standard STMEPM but adds requisite elements to make it fully functional for stimulation requirements in fMRI and MRI.

Items for Standalone system shown

All **STMEPM-MRI System options** include the following:

- STM100C Stimulator Module
- STMISOC Stimulus Isolation Adapter
- Measurement Computing USB 4-ch D/A Unit
- Software Utility (STM100C<--> E-Prime) with sample E-Prime experiment
- MECMRI-STMISO MRI Filter/Cable Set
- Interface Cables: CBLEPM for E-Prime; CBL100 3.5 mm
- LEAD108C Electrode Leads (2)
- EL509 Disposable Dry Electrodes
- GEL104 Salt-free, Chloride-free Electrically Conductive Gel

In addition to the items listed above, available configuration options include the following:

Standalone system:

- IPS100D Isolated Power Supply
- CBL122 Interface Cable

Add to MP-connected system:

- CBLCFMA Current Feedback Monitor Cable
- INISOA Signal Isolation Adapter (x2)
- Additional CBL100 interface cable

HARDWARE SETUP

Standalone stimulator (STMEPM-MRI_STANDALONE)

1. Connect the CBLEPM to Measurement Computing device and Analog Channel 16 of the IPS100D using a CBL100 and CBL122. For older systems that shipped with IPS100C, the CBL122 is not necessary for this connection as CBL100 connects directly to that hardware.
2. Connect the STM100C to the IPS100D or IPS100C. In both configurations the STM100C connects directly without cables. Match the 25 and 37 pin connectors on the left side of the IPS to those on the right side of the STM100C.
3. Connect the STMISOC to the STM100C (6.25 mm phone plug to EXT STIM).
4. Set the SOURCE selector switch near the top of the front face of the STM100C to A16 (older labeling: CH 15).

Combined with MP system (STMEPM-MRI_ADD-TO-MP-SYS)

1. Connect the CBLEPM to Measurement Computing device and Analog Channel 16 of AMI100D using a CBL100 and INISOA to for MP160 system. MP150 systems require HLT100C using INISO or INISOA to connect CBL100 to Channel 16. Connect STM100C between MP device and AMI100D (or HLT100C for MP150).

NOTE: No other hardware should be configured to send signals through Analog channel 16 of the MP system.

2. To monitor current supplied by stimulator to participant, connect CBLCFMA to negative high-voltage output of STMISOC, and then to MECMRI-4 and to another INISOA (INISO is also acceptable if using MP150 system).

3. Connect INISOA to an unused channel of the AMI100D (unused means no other piece of equipment is connected to the MP system and configured to send its signal through the given channel; most amplifiers are configured via a white switch on the top of the amplifier).
4. The 6.25 mm phone plug for the STMISOC should be connected to EXT STIM of the STM100C, and the SOURCE selector switch of STM100C should be set to A16 (older labeling: CH 15).

   For additional Recording and Calibration information, see the STMEPM Instructions.

Sample Experiment

The sample E-Prime experiment provides the necessary interface commands to communicate with the D/A unit. The D/A unit provides the STM100C with the appropriate voltage levels to stimulate a subject. The system supports up to four STM100C (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 several 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.

SPECIFICATIONS

STM100C Stimulator Module: see specs here

STMISOC Stimulus Isolation Adapter: see specs here

IPS100D Isolated Power Supply: see specs here

MECMRI-STMISO MRI Filter/Cable Set: see specs here

CBLCFMA Current Feedback Cable: see specs here

LEAD108C Electrode Lead: see specs here

EL509 Disposable Electrode: see specs here

GEL104 Conductive Gel: see specs here

CBL100 and CBL122: see specs here

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

STMEPM-MRI is not subject to the same possible errant stimulation issues as the standard STMEPM might be if suitable patch panel filtering is not constructed. STMEPM-MRI setup is restricted in terms of pulse width (2 ms max) and only voltage-controlled voltage stimulation is possible; stimulation of differing intensity can be generated under E-Prime control.

For implementation of subject electrical stimulation in the fMRI and MRI for the purposes of psychophysiological research, see Application Note 282.

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