SI-200 Isolated Stimulator

Technical Note

SI-200

Overview

The SI-200 is an isolated constant current generator with 100-volt compliance. It is specifically designed for safe transcutaneous stimulation of muscles and nerves.

Front Panel

The amplitude of the stimulating pulse from the SI-200 is controlled by a single knob on the front of the unit. This control is a ten-turn potentiometer which is attached to a dial counter (with integral lock) that shows the number of turns from 0.0 to 10.0. When turned fully clockwise, this Amplitude control can command a current output of 20 milliamps. The current applied is thus twice the value on the dial indicator.

The front panel of the SI-200 also contains two Pulse Status lights. A glowing Power light indicates that the SI-200 unit is properly powered up, and the H.V. Ready light indicates that the high voltage power supply is ready to deliver a stimulus. The last items on the front panel of the SI-200 are the positive and

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negative jacks of the H.V. (high voltage) Output. The stimulus electrodes are connected to these outputs.

Rear Panel

The rear panel of the SI-200 contains the Power on/off switch, the power receptacle, and the BNC connector of the Trigger input. The Trigger input is connected to a stimulator or a digital-to-analog converter (DAC), which can provide TTL level trigger pulses that drive the SI-200.

Control of the SI-200

The SI-200 is controlled by any stimulator or DAC that is capable of delivering TTL input pulses. TTL input pulses are nominally 5V in amplitude and at least 100 microseconds (µs) in duration. The frequency and duration of the stimulus pulses from the SI-200 are determined by programming the TTL level pulses of the stimulator or DAC. When the output of the stimulator or DAC is connected to the Trigger input of the SI-200 and activated, the SI-200 will generate stimulus pulses of the same frequency and duration as the TTL level pulses from the stimulator or DAC. The amplitude of the stimulus pulses from the SI-200 is still under the control of the single knob on the front of the SI-200.

Power Setup

The SI-200 can draw power from either an AC or a DC output wall transformer with an output greater than 9 volts and less than 15 volts, at 1000mA. A wall transformer with an output of 12VAC and 1000ma is supplied with the SI-200.

Stimulation

Electrical stimuli are delivered by the SI-200 to the preparation through a set of included leads with either snaps or alligator clips. Each lead set connects to the SI-200 through high voltage safety connectors. The safety connectors on each lead are plugged into H.V. Output jacks on the front panel of the SI-200, so that the red lead is plugged into the red high voltage safety jack labeled Positive and the black lead is plugged into the black high voltage safety jack labeled Negative.

The stimulator or DAC driving the SI-200 determines the durations and the frequencies of the stimuli delivered to the preparation. However, the SI-200 limits

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the duration of its stimulus output pulses to a maximum of 10 ms and their frequency to a maximum of 50 Hz.

The SI-200 is a constant current device, which means it will develop whatever voltage is necessary to maintain the current flow set from the knob on the front of the SI-200. The high voltage power supply in the SI-200 has a 100-volt compliance. This means that 100 volts is the maximum voltage that the SI-200 can develop while delivering the set current. In constant current devices like the SI-200, more voltage is required to deliver the set current to the subject if the electrical resistance increases where the stimulating electrodes connect to the subject.

Constant current devices differ from constant voltage devices. When presented with an increase in resistance, like dehydration of the gel under the electrodes, a constant current device increases its output voltage to maintain delivery of the set current to the subject. On the other hand, a constant voltage device still delivers the set voltage to the subject with an increase in the resistance at the electrodes, but the current delivered to the subject decreases if it is limited by the power supply of the constant voltage device.

Although the high voltage supply can deliver up to 100 volts, it is at very low current and then only for very brief periods (fixed maximum of 10 milliseconds). The amount of power delivered to the subject is not sufficient to cause injury or tissue damage, but experimental precautions should be followed at all times.

Experiments

LabScribe experiments using the SI-200 include:

- **Experiment HM-4: Stimulus Response, Work, Summation, and Tetanus in Human Muscle** (found in the **Human Muscle** category of the LabScribe **Settings** menu as **HumanMuscleTwitch**)
- **Experiment HM-6: Stimulation of Antagonistic Muscles** (found in the **Human Muscle** category of the LabScribe **Settings** menu as **Stimulation-OpposingMuscles**)
- **Experiment HN-3: Human Nerve Conduction** (found in the **Human Nerve** category of the LabScribe **Settings** menu as **HumanNerveConduction**)

Technical Data and Specifications

SPECIFICATIONS	
Output Current	0-20 mA
Compliance Voltage	100V
Isolation	Rated to 5300V RMS
Power	9-15VAC/VDC 1000mA
Trigger Input:	External TTL signal

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SPECIFICATIONS	
Frequency Range	Externally Driven 0.1-50 Hz
Pulse Width Minimum	100µS
Pulse Width Maximum	100mS
Coupling Capacitance	≤5pF

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