# Warner Instruments
# Stimulus Isolation Unit
# Model SIU-202


Warner Instruments
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CE

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The **SIU-202** is an isolated stimulator primarily designed for use with imaging chambers having field stimulation electrodes. Output is easily switched between positive and negative unipolar stimulus pulses. Stimulus intensity is easily programmed using the front panel controls.

The **SIU-202** features optional optical isolation at the input and is battery-powered for complete isolation at the output terminals. Timing pulses can be controlled by any device capable of generating a TTL level positive pulse (e.g., a computer with data acquisition).

Output amplitude is set using a ten-turn potentiometer in conjunction with a range mode switch and duration is set using an external TTL signal.

Features include:

- ✓ Low-noise device for sensitive electrophysiological applications
- ✓ Constant-current output
- ✓ Battery-powered high voltage delivery circuit for complete DC isolation
- ✓ Optical coupling isolates the stimulator from pulse source input
- ✓ Current output range up to 10 mA
- ✓ Variable compliance voltage for low-current applications

**THIS EQUIPMENT IS NOT DESIGNED NOR INTENDED FOR USE ON HUMAN SUBJECTS**

## NOMENCLATURE

### Text conventions

This manual refers to amplifier controls at three functional levels; control blocks, specific controls within a block, and settings of specific controls. To minimize the potential for confusion, we have employed several text conventions which are specified below. Since our goal is to provide clarity rather than complexity, we welcome any feedback you may wish to provide.

- Warner Instrument product numbers are presented using **bold type**.
- References to specific controls are specified using NON-UNDERLINED SMALL CAPS.
- References to individual control settings are specified in *italic type*.
- Special comments and warnings are presented in highlighted text.

Any other formatting should be apparent from context.

## CONTROL DESCRIPTION

The instrument front panel contains all the controls for selecting stimulus polarity and amplitude of the pulse. Pulse timing is driven from an external source.

### Output Polarity Switch

The OUTPUT POLARITY TOGGLE SWITCH is used to set the desired pulse shape. Options include *off* (center), *positive (+) pulse* and *negative (-) pulse.* The pulse amplitude is set by the controls in the next section (*see below*), while pulse duration and timing is set by the TTL signal applied to the PULSE IN BNC. Setting the POLARITY switch to the center position disconnects the output current, but the battery power is still being used. It is normal for the COMPLIANCE LED to light while the output is off.

### Output Control Switches

Two controls are used to select the constant current output range and to set the pulse amplitude. These controls are the 10-turn OUTPUT SET potentiometer and the OUTPUT RANGE switch.

Constant current modes are *0–0.1 mA*, *0-1.0 mA* and *0-10 mA*. The desired current is set using the lockable 10-turn OUTPUT SET potentiometer. A red COMPLIANCE LED indicates when the external resistance is too high, preventing the instrument from maintaining the set current value. If the resistance of the load is too high for the current selected, the COMPLIANCE LED will light to indicate that the output current is below the setting on the RANGE switch and the Dial (the POWER LED will also get brighter).


### Pulse Out

**CAUTION: Dangerous voltages and currents are presented at the PULSE OUT connections. Extreme care must be taken to avoid serious personal injury.**

Output signals are delivered to the sample or chamber via the RED and BLACK PULSE OUT banana jacks. The RED and BLACK BANANA JACKS connect to the *positive and negative* side of the preparation, respectively.

An OUTPUT POLARITY TOGGLE SWITCH is provided to turn the pulse output on or off without need to access user settings. In the center *off* position, the RED and BLACK OUTPUT JACKS are

disconnected from the constant current source. For personal safety, the output should always be set to the *off* position before handling the device or connecting cables.

### Pulse In

The PULSE IN BNC is used in conjunction with the OUTPUT CONTROL switches and is used to define the duration and timing of the applied pulse.

In *positive (+) pulse* or *negative (-) pulse* modes, the length of a TTL *high* signal (3-5 V), applied to the PULSE IN BNC, will specify the duration of output pulse.

### Connecting Cable

A special cable (*not supplied*), the **CC-102,** is available to facilitate connection from the PULSE OUT banana jacks and Warner's field stimulation chambers.


### Fiber Optic Converter

An optional fiber optic converter box is available for use with the **SIU-202**. The TTL outputs of the external stimulus timing device can be delivered to the fiber optic converter, completely eliminating all grounded connections to the stimulus isolator.

### Battery Replacement

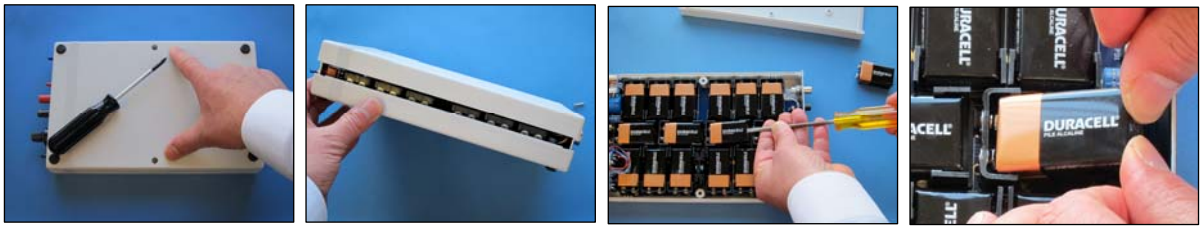
The **SIU-202** is powered by 16 9V batteries to achieve total isolation from line-powered operation and 60Hz interference. This is optimal for sensitive electrophysiological applications that require a low-noise recording environment. The ultralow power requirements of the control electronics allow for approximately 250 hours of operation at 2mA output level. A low battery LED provides advance notice of battery failure. The LOW-BATTERY LED lights when the low-voltage battery goes below 7.1 Volts. It is assumed that, under most conditions, the low-voltage battery will get low before the high-voltage batteries. If the COMPLIANCE LED goes on before it is expected, then this could indicate that the high-voltage batteries are low before the low-voltage battery. In any case, it is best to change them all. Check the condition of the batteries removed, since some of them may still be usable for other applications.

Step 1. Remove the two Phillips head retaining screws from the bottom of the enclosure.

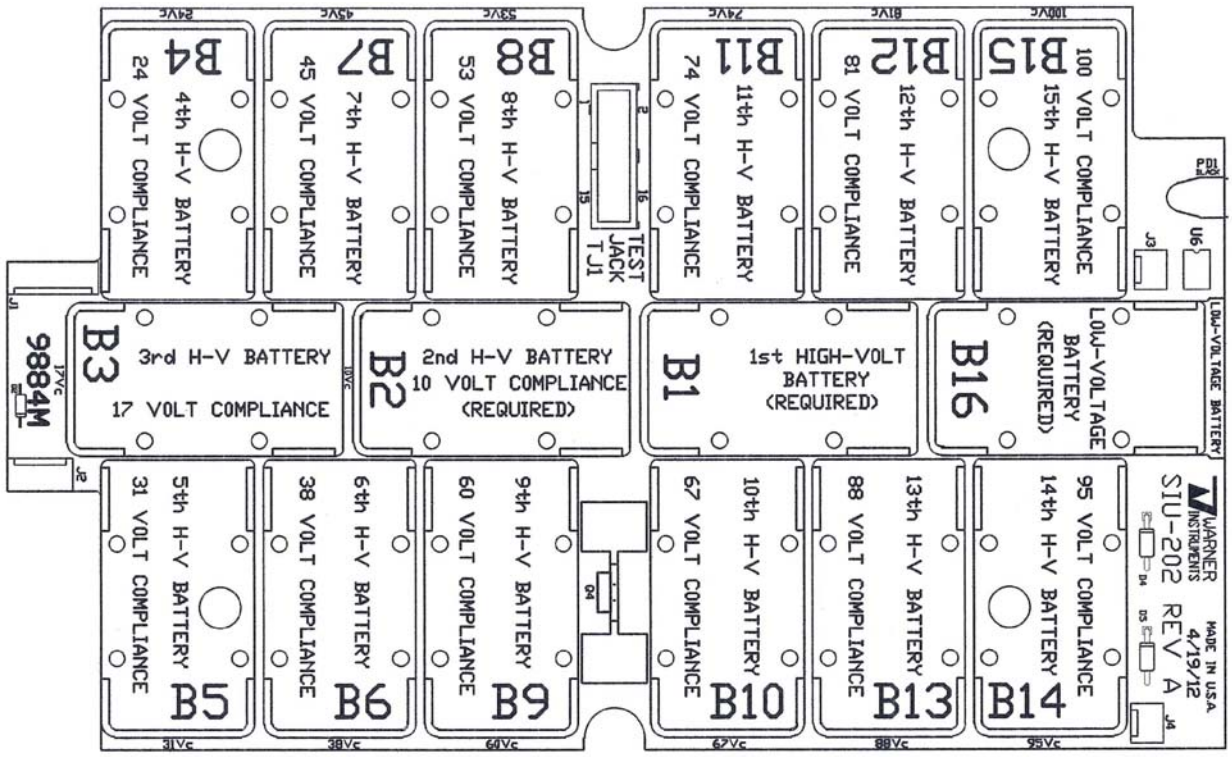
Step 2. Flip the device over and remove the top cover.

Step 3. Removing batteries: Use a flat blade screwdriver to gently lift the battery out of its holder as shown. Then grasp the battery and pull it away from and off of its holder terminals.

Step 4. Install fresh batteries: Align the battery snaps as shown and gently push the battery forward and down.




Step 5. Location of control battery: The control battery is labeled as B16 in the drawing below. The Low Battery LED is monitoring the voltage of the control battery; this battery may need to be replaced before the stack of 15 batteries that supplies the 100 volts for driving the constant current output.



As a guide, if the installed batteries are more than 2 years old, then the entire set of 16 batteries should be replaced at once. If the low battery indicator comes on and the batteries are less than 2 years old, it is possible that just the control battery needs to be replaced. To quickly test the condition of the high voltage battery stack, apply a DC command to the input, turn the $I_{set}$ current command dial to 10 mA or fully clock wise, set output to POSITIVE , and monitor the output terminals of the SIU-202 with a DC voltmeter set to measure 200VDC. If the DVM measures greater than 105 VDC than the 15 batteries that make up the high voltage output do not need to be replaced.

## Variable Compliance Voltage Feature

In applications where the compliance voltage requirement is below 100 volts, the SIU-202 can be used with fewer batteries. The low-voltage battery that powers the circuitry (B16) is always required. This battery is located near the center of the rear panel. The two batteries in front of the low-voltage battery (B1 and B2) are also required. If these are the only three batteries installed, then the SIU-202 will operate with a compliance voltage of 10 volts. Adding additional batteries according to the chart will increase the compliance voltage. Any number of batteries, from 3 to 16, can be used, provided that they are installed according to the chart and diagram.

| Batteries Installed | Compliance Voltage |
|---|---|
| Low-Voltage + 1st-2nd | 10 Volts |
| Low-Voltage + 1st-3rd | 17 Volts |
| Low-Voltage + 1st-4th | 24 Volts |
| Low-Voltage + 1st-5th | 31 Volts |
| Low-Voltage + 1st-6th | 38 Volts |
| Low-Voltage + 1st-7th | 45 Volts |
| Low-Voltage + 1st-8th | 53 Volts |
| Low-Voltage + 1st-9th | 60 Volts |
| Low-Voltage + 1st-10th | 67 Volts |
| Low-Voltage + 1st-11th | 74 Volts |
| Low-Voltage + 1st-12th | 81 Volts |
| Low-Voltage + 1st-13th | 88 Volts |
| Low-Voltage + 1st-14th | 95 Volts |
| Low-Voltage + 1st-15th | 100 Volts |

## SPECIFICATIONS

| | |
|---|---|
| Output Waveform | Current Pulse |
| Output Current Ranges | 0.1, 1.0, and 10 mA |
| Output Compliance | Up to 100 V |
| Output Polarity | Selected by Mode Switch<br>Red connector is positive in positive mode<br>Red connector is negative in negative mode |
| Amplitude Control | Multi-turn dial |
| Input Pulse Requirements | TTL level, positive pulse 3 volt, 1 mA minimum<br>Minimum Pulse Width: 100µs |
| Input Connector | BNC; optional fiber optic |
| Output Connector | 5-way binding posts (Banana Jacks, 4mm ID) |
| Power Requirements | 3-16 9-volt alkaline batteries |
| Physical Size, H x W x D | 4.5 x 15.9 x 27.9 cm |
| Shipping Weight | 3 kg |
| Operating conditions | Equipment is intended to be operated in a controlled laboratory environment.<br>Temperature: 0-40 °C<br>Altitude: sea level to 2000 m<br>Relative humidity: 0-95% |

## WARRANTY

The **SIU-202** is warranted to be free from defects for a period of one year from date of shipment. Warner Instruments will repair or replace at its option any parts that fail under normal use with the exception of the electrodes and 9V batteries.

**NOTE:** Repairs are performed at the factory. Shipping charges for the return to the factory are the responsibility of the customer. Warner will return the repaired item FOB destination.

## CERTIFICATIONS

# *Declaration of Conformity*

*CE MARKING (EMC)*

## Application of Council Directive: 89/336/EEC

| | |
|---|---|
| Standards To Which Conformity Is Declared: | EN55022 Class A<br>EN61000-3-2<br>EN61000-3-3<br>EN50082-1:1992<br>EN61000-4-2<br>EN61000-4-3<br>ENV50204<br>EN610000-4-4<br>EN610000-4-8<br>EN610000-4-11 |
| Manufacturer's Name: | Warner Instruments, LLC |
| Manufacturer's Address: | 1125 Dixwell Avenue<br>Hamden, CT 06514<br>Tel: (203) 776-0664 |
| Equipment Description: | Power Controller |
| Equipment Class: | ITE-Class A |
| Model Numbers: | SIU-202 |

***I the undersigned, hereby declare that the equipment specified above, conforms to the above Directive(s) and Standard(s).***

Place: Hamden, Connecticut USA

Signature:

Full Name: Burton J. Warner

Position: President

# *Declaration of Conformity*

*CE MARKING (LVD)*

## Application of Council Directive: 73/23/EEC

| | |
|---|---|
| Standards To Which Conformity Is Declared: | EN61010-1:1993 |
| Manufacturer's Name: | Warner Instruments, LLC |
| Manufacturer's Address: | 1125 Dixwell Avenue<br>Hamden, CT 06514<br>Tel: (203) 776-0664 |
| Equipment Description: | Power Controller<br>Safety requirements for electrical equipment for measurement and laboratory use |
| Equipment Class: | Class I |
| Model Numbers: | SIU-202 |

***I the undersigned, hereby declare that the equipment specified above, conforms to the above Directive(s) and Standard(s).***

Place: Hamden, Connecticut USA

Signature:

Full Name: Burton J. Warner

Position: President

# WEEE/RoHS Compliance Statement

**EU Directives WEEE and RoHS**

To Our Valued Customers:

Harvard Apparatus is committed to being a good corporate citizen. As part of that commitment, we strive to maintain an environmentally conscious manufacturing operation. The European Union (EU) has enacted two Directives, the first on product recycling (Waste Electrical and Electronic Equipment, WEEE) and the second limiting the use of certain substances (Restriction on the use of Hazardous Substances, RoHS). Over time, these Directives will be implemented in the national laws of each EU Member State.

Once the final national regulations have been put into place, recycling will be offered for those Harvard Apparatus products which are within the scope of the WEEE Directive. Products falling under the scope of the WEEE Directive available for sale after August 13, 2005 will be identified with a "wheelie bin" symbol.

Two Categories of products covered by the WEEE Directive are currently exempt from the RoHS Directive – Category 8, medical devices (with the exception of implanted or infected products) and Category 9, monitoring and control instruments. Most of Harvard Apparatus' products fall into either Category 8 or 9 and are currently exempt from the RoHS Directive. Harvard Apparatus will continue to monitor the application of the RoHS Directive to its products and will comply with any changes as they apply.

- **Do Not Dispose Product with Municipal Waste.**
- **Special Collection/Disposal Required.**