

# Deliver precise constant voltage or current stimuli.



## DS2A Constant Voltage, DS3 Constant Current, DS4 Bi-phasic Stimulus Isolators

Brief pulses of electricity are used in various biomedical research applications as a stimulus to excite nerve or muscle fibers. Several factors need to be considered when choosing the right stimulator.

- In order to minimize artifacts introduced into electrophysiological data, it is desirable to electrically isolate the stimulator from both ground and the trigger device.
- The voltage required to send current through tissues can vary greatly, making it important to have control over the stimulus driving force.
- Large impedance variations during an experiment can result in loss of the stimulus. In this event, a constant current stimulator may be more suitable.

Our three isolated stimulators either provide constant voltage (DS2A), constant current (DS3), or bi-phasic output (DS4) giving you the ability to choose the stimulator which best suits your experimental needs.

## DS2A Constant Voltage Stimulator

- External control of pulse duration.
- Overload protection circuit preventing current in excess of 50 mA being delivered.

## DS3 Constant Current Stimulator

- Four current ranges allow precise control of output between 2 µA and 32 mA.
- Output discharge (Clamp) circuit prevents capacitance build-up during stimulus trains, which is important to prevent stimulus loss.
- 90 V compliance provided.

## DS2A & DS3 Features:

- Accurate and reproducible stimulus characteristics.
- Switchable polarity, variable output and duration ranges (20 µs to 2 sec).
- External pulse duration control through the BNC trigger input.
- A single-shot button, which operates irrespective of trigger inputs.
- Cases manufactured from insulating material may be rack mounted using an optional mounting frame (Model D121-11) available from AutoMate Scientific.
- Power provided by standard batteries. Note that current is only drawn during pulse delivery.

## DS4 Bi-phasic Stimulator

- Voltage input ranges of ±1V, ±2.5V, ±5V and ±10V.
- Output in 4 overlapping ranges of ±10µA, ±100µA, ±1mA & ±10mA)
- ±48 V compliance provided.
- GATE input allows multiple DS4's connected to one DAC out.



## Additional Specifications

### DS2A & DS3 Trigger

A positive pulse between 3 V and 20 V is required to trigger these stimulators. The trigger input current varies from 6 mA to 62 mA over the above voltage range. Trigger pulse duration should not normally be less than 4  $\mu$ s.

### DS2A & DS3 Pulse Duration

**Range:** 20  $\mu$ s to 2 sec. One dial allows continuous adjustment from 2 to 20, while another is used to select the range (from 10  $\mu$ s, 100  $\mu$ s, 1 ms, 10 ms, 100 ms or external source) with  $\pm$ 10% accuracy.

### Trigger Isolation

Optical coupling is employed between the trigger source and the stimulator circuitry. The capacity coupling is less than 3 pF.

### Batteries (DS2a & DS3)

11 x PP3 9V, IEC-6R61 style batteries. Current is only drawn when delivering a pulse. Note that battery test sockets are built-in.

### Batteries (DS4)

The DS4 includes a  $\pm$ 15V external power supply or accepts 10x 12V GP23A batteries.

### Mounting

One or two stimulators may be mounted in a 19" rack using a specially fabricated frame (model D121-11) available from AutoMate Scientific.

### Dimensions

Panel size: 190 mm x 110 mm.

### Weight

800 g complete with batteries

### Output terminals

A pair of 2 mm touch-proof sockets on the front panel spaced at 0.75".

### Indicator

An LED operates for the duration of each output pulse.

## Technical Specifications

- Output:**

DS2A-Mk.II (Constant voltage): Two ranges provide 99 V (high) and 9 V (low) maximum output. A multi-turn dial allows output to be selected as a percentage of maximum. Square wave pulse profile with typical rise time <1  $\mu$ s and fall time <3  $\mu$ s into resistive load.

DS3 (Constant current): Output between 2  $\mu$ A and 32 mA. Control is achieved by a variable range switch with four selections (10  $\mu$ A, 100  $\mu$ A, 1mA, 10 mA) and a three-turn dial. Pulses from high impedance stimulators (constant current units) can result in cells "charging-up" between stimuli, leading to stimulus loss. This problem has been overcome in the DS3, which has an Output Discharge (Clamp) Circuit that operates for 20  $\mu$ s after each stimulus pulse. This will discharge cells with capacitances as high as 1000 pF.

DS4 (Bi-phasic): Bi-phasic constant current proportional to the input voltage up to 5 kHz signals.  $\pm$ 10 $\mu$ A;  $\pm$ 100 $\mu$ A;  $\pm$ 1mA;  $\pm$ 10mA for a full scale input. >2 $\mu$ s duration. An "inactivity sensor" reduces battery usage and damaging "leak currents" during infrequent stimulation, while maintaining low levels of zero crossing distortion for repetitive waveforms.



## Isolated Stimulators Ordering Information

Part No.	Product Description	Price
DS2A	Constant voltage stimulator	\$ 1,124
DS3	Constant current stimulator	\$ 1,291
DS4	Bi-phasic stimulator	\$ 2,268
D121-11	19" rack frame for two stimulators or DG2A	\$ 101

U.S./Canada prices shown. International prices add 20%. Email or visit web store for latest prices.

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