

DS5 - Isolated Bipolar Constant Current Stimulator

The DS5 has been developed for the new and increasingly important field of Clinical Nerve Excitability Studies. These studies, including electrotonus and threshold electrotonus, are giving us added understanding of human nerve excitability and the pathophysiology of diseases such as diabetic neuropathy, carpal tunnel syndrome (CTS), amyotrophic lateral sclerosis (ALS), multifocal motor neuropathy (MMN), motor neurone disease (MND) taxolcisplatin neuropathy and neuromyotonia.

Multiple Applications

Although the DS5 has been primarily designed for clinical studies of peripheral nerves using threshold tracking techniques, because the unit provides a current output proportional to the voltage input and can deliver up to $\pm 50\text{mA}$ (from a compliance voltage of greater than $\pm 100\text{V}$), it should appeal to any researchers wishing to safely apply a computer controlled constant current stimulus to a patient or research volunteer.

Unlimited Stimulus Profile Possibilities

Unlike other clinical stimulators, the DS5 is not a traditional "square wave pulse stimulator". Instead, the DS5 will produce an isolated constant current stimulus proportional to a voltage applied at its input, with the shape of the input waveform describing the shape of the stimulus. As a result, when driven by a computer running appropriate software, the DS5 is capable of generating a stimulus consisting of multiple components including sine waves, ramps, square waves or totally arbitrary waveforms. Patient safety is assured at all times by the implementation of safety features which, amongst other things, also limit the amount of energy passed to the subject.

Stimulus Control via Commercial or Specialist Hardware/Software

The DS5 has been developed in collaboration with Professor Hugh Bostock at the Institute of Neurology in London, who uses the stimulator to facilitate the threshold tracking measurements alluded to above. Briefly, muscle action potentials evoked by a test stimulus from the DS5 are amplified and compared with a desired "target response". The resultant "error signal" is used to modulate the amplitude of the test stimulus. Once a baseline level of excitability is established, conditioning pulses can be applied to examine their effect on the excitability of the nerve being studied. By carrying out this procedure using his own specialist software, diagnostic tests can be partially automated and completed more rapidly.

The Complete Stimulating Solution

The DS5 stimulator has four input voltage ranges: $\pm 1\text{V}$, $\pm 2.5\text{V}$, $\pm 5\text{V}$ and $\pm 10\text{V}$ making it widely compatible with other hardware. There are three output ranges: $\pm 10\text{mA}$, $\pm 25\text{mA}$ and $\pm 50\text{mA}$, with selection either by front panel controls or Windows PC Control Software. On the rear of the device are two BNC sockets, one accepting the voltage input waveform, the other providing a Monitor Output, allowing the stimulus waveform to be fed into a data acquisition system so it can be recorded alongside your EMG data.



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Technical Specifications

Output:	Bipolar constant current proportional to the input voltage
Output Ranges:	± 10 ; ± 25 ; ± 50 mA for a full scale input
Input Ranges:	± 1 ; ± 2.5 ; ± 5 ; ± 10 V full scale
Connections:	Output - 4mm shrouded, touch-proof sockets (red and black) on 3/4" centres Monitors - Rear panel BNC sockets for "delivered current" and "applied voltage" Input - Rear panel BNC socket Firmware Update - USB socket on rear panel
Controls:	Four front panel push buttons labelled on LCD Output - On/Off-Reset
Safety Limits:	50mJ/300mJ pulse energy 50 μ A average "idle" current 10mA average pulse current 50mA peak current 1s/5s maximum pulse duration
Indicators:	Power ON LED Green Warning LED Amber LCD Display for setting up and checking: - Peak current delivered * - Input voltage range - Output current range - Peak Voltage* - Error warnings - Out of compliance - Pulse energy (PE) - Pulse duration (PD) - Average idle current (AvL) - Average pulse current (AvH)
Software:	Microsoft Windows™ compatible USB Software (WinXP onwards)
Power:	100V, 120V, 200V or 240V (externally selected), 47-63Hz, 35VA
Classification:	Class I with Type BF applied part
Safety:	EN(IEC) 60601
Dimensions:	225 x 100 x 255 (w x h x d)
Weight:	4kg (approx.)

* These values are displayed graphically NOT numerically

Suggested Further Reading:

Hugh Bostock, Katia Cikurel & David Burke (1998) Threshold tracking techniques in the study of human peripheral nerve. *Muscle & Nerve*, **21**: 137 - 158.

Matthew C. Kiernan, David Burke, Kjeld V. Andersen & Hugh Bostock (2000) Multiple measures of excitability: A new approach in clinical testing. *Muscle & Nerve*, **23**: 399 - 409.

Cindy S.-Y. Lin, Jane H. L. Chan, Emmanuel Pierrot-Deseilligny & David Burke (2002) Excitability of human muscle afferents studied using threshold tracking of the H reflex. *J. Physiol.*, **545**: 661 - 669.

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