

Acquisition Amplification Anti-vibration Cell Injection Iontophoresis Noise Elimination Manipulation
 Micro-incubation Patch-clamp Perfusion Pipette Manufacture Software Stimulation

Stimulating New Methods in Peripheral Nerve Diagnostics The NEW DS5 Computer Controlled Current Stimulator

We are excited to announce the launch of our NEW DS5 Bipolar Constant Current Stimulator. Unlike traditional stimulators which produce a square output pulse in response to a trigger, the DS5 generates a constant current stimulus which follows the time course and amplitude of an input voltage waveform. As a result, when driven by a computer interface and suitable software, the DS5 is capable of generating a bipolar stimulus of up to $\pm 50\text{mA}$, which can consist of components including sine waves, ramps, square waves or totally arbitrary waveforms.

The DS5 has been developed in collaboration with Professor Hugh Bostock (Institute of Neurology, London) to facilitate "Threshold Tracking" studies of peripheral nerve excitability. Such tests are used routinely in research laboratories to study peripheral nerve physiology, but the lack of a suitable commercially available, medical grade stimulator has meant that they have not been adopted for standard diagnostic purposes.



The DS5 facilitates peripheral nerve diagnostic testing

Instead nerve conduction studies (NCS) are the predominant diagnostic tool for peripheral nerve pathophysiology. Although important, these more traditional tests only provide information on the number of fibres present and the conduction velocity of the fastest ones, shedding more light on the status of axonal myelination than on the biophysical properties of the axons themselves. In contrast to basic conduction studies, nerve excitability testing offers the clinician an insight into the excitability of axons at the point of stimulation and the data collected can indicate disturbances in membrane potential resulting from pathophysiological changes associated with ion channels and/or electrogenic pumps.

Research studies employing pre-production versions of the DS5 have indicated that nerve excitability testing can provide a more rapid and convenient method for diagnostic investigation of various peripheral nerve disorders, such as diabetic neuropathy, carpal tunnel syndrome and amyotrophic lateral sclerosis.

Although the DS5 has been primarily designed for clinical studies of peripheral nerves using threshold tracking techniques, we expect it to prove popular stimulator with any researchers wanting to apply a computer controlled, isolated bipolar constant current stimulus of up to $\pm 50\text{mA}$ to a patient or research volunteer.



The Digitimer DS5 stimulator converts a voltage command waveform into an isolated constant current output

NEW NeuroLog System NL254 Ratemeter



The modular NeuroLog System is a versatile and compact electrophysiology instrument suitable for a wide range of applications, including extracellular and intracellular amplification, pulse generation and electrical stimulation.

The **NL254 Ratemeter** is the latest addition to the range, combining the functions of the NL253 and NL256 Ratemeters into a single module. The NL254 displays instantaneous rate on a 3 digit display and operates over four rate ranges 0-99.9 pulses per second, 0-999 pulses per second, 0-99.9 pulses per minute and 0-999 pulses

per minute. The module allows the user to set a trigger threshold voltage as well as upper and lower rate limits, which give rise to a "frequency window". As well as displaying the calculated rate, the NL254 provides an analogue voltage output proportional to this rate. Further, if the instantaneous rate strays outside the preset limits, a red LED warns the user and the "Limit" output goes TTL high. A green LED illuminates briefly, each time the NL254 detects an event at the input which meets the trigger threshold voltage.



In our 35 year history, Digitimer have designed and manufactured a range of medical stimulators which are used all over the world for research and diagnostic applications. With the introduction of our highly anticipated DS5 Bipolar Constant Current Stimulator, we now manufacture three electrical stimulators approved for use on humans either through CE medical devices certification (DS5, DS7A and D185) or United States FDA clearance (DS7A and D185).

As an established manufacturer of medical devices we are acutely aware of the legal requirements for devices that are used on

humans in either a research or diagnostic setting and because of this we invest considerable development time to obtain regulatory approvals for our clinical stimulators. By obtaining such approval, we not only demonstrate our commitment to high levels of patient and operator safety, but perhaps more importantly for some of our customers, we are also supplying devices that are appropriately certified for use on human subjects.

In this Product Focus, we take a closer look at the three medical stimulators we currently offer and describe some of their unique features and typical applications.

NEW DS5 - Bipolar Computer Controlled Constant Current Stimulator

Primarily designed to aid in peripheral nerve diagnostics by semi-automating nerve excitability tests, the DS5 is likely to be useful for anyone wishing to stimulate human subjects with a computer controlled bipolar stimulus. The DS5 allows for external computer control of the stimulus shape by translating a voltage waveform input into a constant current output of up to $\pm 50\text{mA}$. Within certain safety limits, the DS5 can therefore be used to generate stimulus waveforms which include sine waves, ramps or even totally arbitrary shapes. Stimulus parameters can be continuously monitored via the front panel display or BNC outputs on the rear of the stimulator.



DS7A & DS7AH - General Purpose Muscle/Nerve Electrical Stimulators



The DS7A provides up to 100mA constant current, high voltage pulses of brief duration (up to 2ms) for percutaneous stimulation during investigation of the electrical activity of nerve and muscle tissue. The output current is continuously variable over the range 0 to 100mA. The DS7AH version, allowing currents up to 1A with a maximum pulse duration limit of 200 μs , is also available. This model is offered to overcome the difficulties of stimulating deep peripheral nerves, or large muscles such as the quadriceps with large area electrodes. Appropriate output plugs (D185-OC1) or adaptor cables (D185-HB4) and re-useable electrodes are not supplied with the unit, but are available separately. The DS7A or DS7AH can be triggered by an external device such as our DG2A Train/Delay Generator. For applications that require a higher output, we recommend our D185 MultiPulse (see below). The DS7A & DS7AH have been cleared by the FDA for marketing within the USA and comply with the CE medical devices directive.

D185 - MultiPulse Cortical Stimulator

Now used worldwide as a highly effective tool for **Intraoperative Monitoring of the Spinal Cord**, the D185 MultiPulse is the ONLY standalone stimulator with FDA clearance for this application. The D185 allows transcranial motor evoked potentials (MEPs) to be used in surgical procedures such as scoliosis correction, spinal tumour resection and thoraco-abdominal aortic aneurysm (TAAA) repair. With a voltage source of 1000V, the D185 can often elicit MEPs in patients with pre-existing neuropathologies.

The brief high voltage output also makes the D185 suitable for **Nerve Root Stimulation** during differential diagnosis of peripheral nerve disorders such as multifocal motor neuropathy and motor neuron disease. The high voltage allows you to effectively stimulate deep nerve roots as they exit the spinal column, while the very short pulse duration minimizes patient discomfort. Digitimer manufactures a range of electrode handles specifically designed for this type of application.



Bought a Digitimer Product in the Last Month?

Register it with us at www.digitimer.com/register and Receive a FREE Extended Warranty

NEW Digitimer Electrodes & Recording/Stimulating Accessories



Needle Electrodes

In recent years, more and more of our customers have asked us if we can supply electrodes for use with our instrumentation and in response to this increase in demand, we have recently launched an extended range of Neurodiagnostic Accessories. We hope these products will be of interest to many of our customers seeking suitable electrodes to use with our clinical stimulators and amplifiers.

This new range includes disposable and re-useable needle electrodes; cup, ring and felt pad electrodes; as well as various specialist electrode types. We can also offer accessories such as adaptors, electrode linkers, Collodion and conductive paste.

If you are looking for a particular type or size of electrode that we don't yet stock, just let us know and we will see if we can source it for you.



Bipolar Felt Pad Electrode



Bipolar Electrode



EEG Cup Electrodes

Enhanced Client Software for the D360 8-Channel Amplifier

The D360 8-channel Patient Amplifier System is a computer controlled isolated amplifier. It can be used for multi-channel AC coupled amplification of electro-encephalography (EEG), evoked potential (EP) or electro-myography (EMG) signals. The system comprises a main amplifier unit with a remote active headbox and dedicated Microsoft Windows compatible control software. The recently enhanced **D360 Client Software** now allows for different users to setup and save amplifier settings for particular protocols, so that you can quickly reconfigure the D360 for your studies. It is also possible to rename channels and individual amplifiers so as to improve identification of electrode location when adjusting amplifier settings. The software is compatible with D360 serial numbers 51 and higher and can be provided upon request.

Multiple D360 amplifiers can be "daisy-chained" to produce a system capable of amplifying a greater number of channels (in

multiples of 8). Grouping allows several channels to be configured with the same gain and filter settings, with the result that altering the settings for one of the channels leads to the same change across the group. The control software also provides impedance checking of the electrodes and deblock functions. Analogue output to your chosen acquisition interface is via a "D" connector on the rear of the main unit or 8 BNC sockets on the front panel. The D360 has been designed according to the medical devices directive through implementation of the EN60601 Standard.



NEW EPTA 1179A Performance Checker - Now Manufactured by Digitimer



The EPTA Performance Checker is now manufactured by Digitimer

The EPTA (Electro-Physiological Technicians Association) have transferred the manufacture of their model 1179 Performance Checker to Digitimer Ltd. As a result, we are now able to offer the updated 1179A unit (model D179) with or without the required function generator (see below).

Guidelines drawn up by EPTA urge clinical neurophysiology departments to carry out certain routine checks on their equipment to ensure that it is operating within specified standards. While many instruments offer internal calibration functions, these checks do not of course provide any independent verification that the equipment is functioning correctly. Only by use of an independent external device can such checks be carried out with complete confidence.

The 1179A Performance Checker is designed to be used in conjunction with a suitable signal source. The recommended signal source for those departments wishing to check EEG's only is the TG315 Function Generator, available from Thurlby-Thandar, or their distributors. For those departments needing to check Evoked Potential and EMG/Nerve Conduction systems as well as EEG, a signal source with a trigger input is needed. Here, the Thurlby-Thandar TG1010A is suggested, which is a digital function generator.

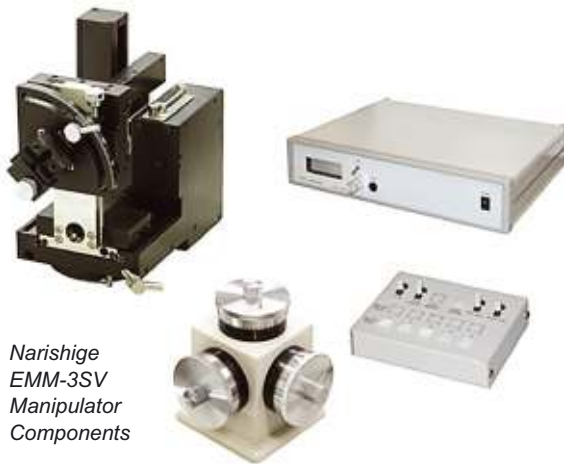
The 1179A Performance Checker accepts the output from either of the above sources, attenuates it by 100,000:1 (100dB) and presents it simultaneously to 32 outputs via standard 1.5mm touch-proof sockets on the top of the box. There is in addition a GROUND/COMMON socket and two REFERENCE/NEUTRAL sockets. Whilst it is possible for departments to buy the signal source from either the manufacturer or a distributor, it may be more convenient to purchase the Thurlby-Thandar Function Generators direct from Digitimer at the same price.

NEW EMM-3SV Three-axis Motorized Micromanipulator from Narishige

The new EMM-3SV motorized micromanipulator from Narishige has been developed to meet the demanding requirements of patch clampers who need a more precise and natural control method than that provided by other motorized manipulators. Years of experience and technical expertise in precision control technology have been combined to create a motorized manipulator with the smooth, accurate positioning and superb operability of a hydraulic manipulator. Having addressed the key problem of vibration suppression, the EMM-3SV offers exceptional smoothness, pin point precision and dramatically improved operating stability.

The EMM-3SV gives 40mm of fine or coarse movement in the XYZ axes, digitally displays distances on the power unit and can be mounted in left handed or right handed configurations. The control box allows for toggling between fine and coarse movement as well as the ability to memorize electrode positions for easy return to a recording site after pipette replacement. Further, the EMM-3SV also enables a fourth axis of movement along the pipette axis. Smooth movement is achieved through the use of a control unit familiar to anyone who has ever used a Narishige hydraulic manipulator.

If you are interested in the EMM-3SV manipulator or any other products from the Narishige range of manipulators, injectors and pipette fabrication instruments, please let us know.



Narishige
EMM-3SV
Manipulator
Components

Flip the Tip Technology - Automated Patch Clamp

flyion GmbH have developed a system for obtaining automatic and reliable whole cell recordings from ion channels expressed in mammalian cells. Using "Flip the Tip" technology, a specially fabricated glass microelectrode is filled with a cell suspension and giga-ohm seals are made between a cell flushed towards the tip. By applying suction from the outside of the tip, a stable whole cell recording can be achieved with extremely low access resistance (approx. 3Mohm). Alternatively, the system is also capable of making perforated patch recordings. Through Digitimer, flyion currently offer the **Flyscreen 8500 Patch Clamp Robot**, the more compact **PatchBox** and a **Feedback Microforge** for the production of specially shaped pipettes.

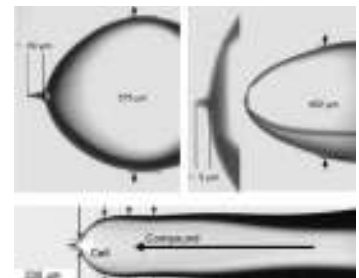


Close-up of a flyion "Flip Tip"

The Flyscreen 8500 uses racks of these specially mounted FlipTips in combination with a totally automated liquid and cell handling robot to make recordings from up to 6 cells in parallel. The Flyscreen 8500 makes use of **HEKA EPC10 Patch Clamp Amplifiers** (a six channel system requiring two EPC10 Triple amplifiers). The FlyScreen Suite software provides the control interface although HEKA's PatchMaster Software operates in the background and can be accessed directly at any time.

The PatchBox is a plug & play patch-clamp setup for your desktop. The PatchBox forms Giga-seals and whole-cell break-ins automatically inside regular patch pipettes. Just fill with cells and let the box patch! It is an affordable automated patch clamp workstation, costing less than a manual setup which makes use of your existing puller, patch clamp amplifier and software.

The Feedback Microforge from flyion is a fully automated feedback controlled pressure polishing microforge, designed for the manufacture of highly specific glass electrodes or chips. You merely select your required geometry with the software and the pipette tip is automatically shaped while you watch on screen.



Examples of electrode tips made with the Feedback Microforge

Please contact Digitimer for full details on the full range of patch-clamp hardware and software available from flyion and HEKA, as well as data acquisition hardware and software products from InstruTECH and Bruxton Scientific.



Feedback Microforge - for manufacture of custom electrode shapes



flyion PatchBox - compact desktop patch clamp solution



The Flyscreen 8500 Patch Clamp Robot - available in three or six channel versions

Design Changes Cut the Cost of the BSC1 Slice Chamber



BSC1 Brain Slice Chamber

The BSC1 Brain Slice Chamber from Scientific Systems Design allows users to make electrophysiological recordings from brain slices in either the submerged or interface modes. A sloped insert was previously supplied with the BSC1 to reduce dead volume during interface recording, however, SSD have now withdrawn this accessory, and lowered the cost of the BSC1.

The BSC1 chamber still allows for submerged or interface recording using the net insert, but if a researcher wishes to make interface recordings with a low dead volume, we would now recommend the BSC2 chamber which is specifically designed for this purpose.

Multiple Valve Options Now Available for AutoMate Perfusion Systems



AutoMate Scientific ValveBank Perfusion System

Enhancing their position as a leading manufacturer of perfusion systems, AutoMate Scientific now offer complete systems based around Lee Mini Valves, in order to enhance liquid switching times. Here we take a look at the three types of valve now on offer:-

Pinch Valves for Reduced Maintenance - Easiest valves to clean and switch tubing. Liquids never touch the valves. Switches in 30-50 ms. 1/32" i.d. silicone tube passes through, and is pinched closed by solenoid activation. All AutoMate Scientific valves include an individual indicator LED. The new aluminum enclosure keeps the valves dry from spills and offers luer lock ports for syringe reservoirs.



*Miniature
Lee Valves*

Teflon™ Valves for Fast Switching - Required for fast kinetics applications.

Excellent chemical and corrosion resistance. Non-stick surface resists particles and chemical deposits. Switches in less than 10 ms, with 20 µl of dead volume from port to port. Threaded female inlet and outlet ports accept Hose Barb, Luer Lock and Nut & Ferrule fittings.

NEW Lee™ Mini Valves for Extremely Fast Switching and Minimal Pressure Pulse - For the most demanding applications AutoMate Scientific offers tiny valves from the Lee Company. Enclosed in the new aluminum box with luer locks for syringe reservoirs, these valves can open and close in 1.5-4.0 ms with a ValveLink8.2 controller.

NEW Compact Tabletop Anti-vibration System from TMC



*TableTop CSP
Antivibration Solution*

It isn't always convenient or necessary to build a rig around a standard anti-vibration table, so the engineers at TMC have developed a novel solution. TMC now offer the 66 Series TableTop Compact Sub-Hertz Pendulum (CSP) High Performance Vibration Isolation System. This compact (18" x 20" x 3") platform can be placed on a bench top and after connection to a gas or air supply is ready to use. At 22kg it is also easy to transport for relocation purposes and

will support loads of up to 67kg. The CSP features an electropolished stainless steel chassis with a powder coat finish steel top plate. If necessary it can be supplied with a suitable bench top Faraday cage. Of course, Digitimer continue to supply the TMC range of standard anti-vibration tables, Faraday cages and associated accessories. If you are setting up an electrophysiology rig that uses other equipment from Digitimer, why don't you ask us for a quote? We can arrange for an experienced installation engineer to deliver and setup tables at your convenience.

Standard tables are available in sizes from 25" x 36" to 36" x 60" with stainless steel laminate, plastic laminate or drilled top plates designed to suit your particular applications. The variety of optional accessories includes casters, arm rests and sliding shelves. Changes to the design of the Type II Faraday cages include the provision of an optional hanging shelf, rubber lined holes for cable passage in and out of the screened environment and a "roller blind style" front panel which is more convenient to operate than hinged doors.



*TMC Antivibration Table
and Faraday Cage*

It's Not a Filter! Remove Mains Interference (50/60Hz) without Filtering



Quest Scientific HumBug Noise Eliminator

A remarkable device from Quest Scientific, the HumBug removes unwanted mains noise from an analogue signal without any of the "side effects" of filtering. The HumBug continuously monitors the mains noise and subtracts it from the signal in real time, without any waveform distortion, frequency loss, DC shift, signal attenuation or phase errors.

If you have a problem with excessive mains interference and you haven't been able to remove it effectively by conventional means, then perhaps the HumBug is for you. Please contact Digitimer to arrange a no obligation loan.

MultiStim - Multi-channel Tissue Bath Stimulation System

The **D330 MultiStim System** is a modular and versatile multi-channel stimulator for biomedical scientists requiring accurate *in vitro* stimulation of multiple low impedance tissue preparations with different stimulating voltages or currents. Timing modules are available to generate pulses, variable in frequency and duration, which can be controlled as trains using a gating waveform, variable in repetition rate and duration or pulse count. Sockets are fitted to allow full external control and synchronisation if required. The D330 MultiStim System comes as a 19" rack-mountable unit that can house up to ten stimulation channels - along with the pulse train generator, gating and meter modules. In order to help with module selection, a number of application diagrams are downloadable from the Support section of our website.



D330 MultiStim System

DG2A - A Simple, Battery Powered Trigger Generator



DG2A - A simple trigger source for our range of stimulators

The **DG2A Trigger Generator** is a compact, free-standing, battery powered device which can be used to generate trigger pulses necessary for repetitive stimulation. Also featuring DELAY controls, it can be used for determining nerve or axonal Effective Refractory Period (ERP) through the production of a delayed second pulse.

Various modes allow output pulses to be produced singularly, continuously or in a burst, with the burst/train duration and pulse frequency determined by the front panel controls. In each of the modes (except FREE-RUN), outputs can be initiated either by the front panel push button, a TTL compatible trigger/gating pulse or a suitable foot switch. The unit is especially suitable for use with our range of isolated stimulators.

Low Cost Dye Marking Tool for Anatomical Visualisation

The **D380 Iontophoretic Marker** provides a compact and easy to use solution for dye labelling of cells or injection of pharmacological agents. Electrophysiologists often use an existing patch clamp amplifier to provide current to carry out such tasks, however, if these techniques are not already being used in the laboratory, alternative iontophoretic devices are often prohibitively expensive. The D380 provides a cost effective answer, delivering currents of up to $\pm 12\text{nA}$, with a holding current of up to $\pm 6\text{nA}$. A deblock button provides a means of removing blockages from the end of electrodes and an LCD display allows continuous monitoring of several parameters.



D380 Dye Marker - Dye Injection of cells for neuroanatomical visualisation

Compact Source of Constant Current or Voltage Stimulation



Our Compact, Low Noise DS2A & DS3 Stimulators

The **Digitimer DS2A (constant voltage) and DS3 (constant current) Isolated Stimulators** are popular in electrophysiology laboratories all over the world. Their compact and user friendly design has generated a loyal following amongst researchers wishing to precisely stimulate nerve or muscle from an isolated power source.

Both units can be triggered manually using the front panel single-shot button or automatically in response to TTL compatible trigger pulses. In addition, pulse duration can be defined by (i) the settings of the front panel control dials (ii) the duration of the incoming trigger pulse or (iii) the length of time that the single-shot button is held down. Power for both stimulators is derived from eleven standard 9V batteries, which offer low

noise and long life. Power is only drawn from the batteries when a stimulation pulse is given. The DS2A, DS3 or DG2A Trigger Generator (see above) can be 19" rack mounted using our D121-11 mounting frame which will support one or two of these instruments.

Want to Find Out More About Our Products?

If this newsletter was mailed to you, then just complete and return (by fax or mail) the enclosed faxback form, alternatively, you can complete a feedback form on our website at www.digitimer.com/digitimes. A Digitimer representative will send you the requested information and provide any further assistance you might require. We look forward to hearing from you.

Win an Amazon Gift Voucher in Our Monthly Competition!

Just visit www.digitimer.com/prize07, correctly answer a few simple multiple choice questions which relate to our product range and you will be entered into our Monthly Prize Draw for a **£50, €75 or \$100 Amazon Gift Voucher**. A new set of questions will be posted each month, from now until December 2007, so come back and try again if you don't win the first time.

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