

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

Digitimer Stimulator Gets FDA Clearance

Major surgical procedures are always associated with a small risk to the patient, however, surgery to the spine, spinal cord or blood vessels supplying the spinal cord can result in post-operative neurological deficits ranging from a slight loss of sensation to complete paraplegia in one or more limbs. The Digitimer D185 MultiPulse Stimulator was developed in close collaboration with leading clinical neurophysiologists to provide an effective means of monitoring the viability of the spinal cord during surgery. This gives surgical teams the ability to operate with unprecedented confidence when carrying out procedures such as scoliosis correction, tumour re-section or repair of thoraco-abdominal aortic aneurysms.



The D185 produces a short burst of high voltage pulses which, when applied transcranially, stimulate descending motor pathways and produce motor evoked potentials (MEPs) which can be monitored in the extremities of the upper and lower limbs. Any changes in the latency or amplitude of these MEPs

can be used as an indication of whether there is a threat to the health of the spinal cord, either from direct mechanical trauma or from an impaired blood supply.



Evidence from a five year long, one thousand patient, two centre study in the USA was recently presented to the US Food & Drug Administration (FDA), who decided to allow the D185 to be cleared for marketing within the USA. FDA clearance means that the D185 is now the only stimulator which can be legally used in the USA for transcranial electrical stimulation during intraoperative MEP monitoring. It is hoped that with this news, the technique of intra-operative MEP monitoring will become more widely accepted by cardiovascular and neurosurgeons worldwide. Digitimer now offer the D185 stimulator to hospitals and neurophysiological monitoring organizations throughout the world. You can read more about recent changes to the D185 inside this issue of Digitimes.

Some more Stimulating Solutions from Digitimer



D330 MultiStim System - The Multi-channel Stimulation Solution

The D330 MultiStim System is a modular and highly versatile multi-channel stimulator for biomedical scientists who require accurate *in vitro* stimulation of a number of low impedance tissue

preparations with different stimulating voltages or currents.

The system provides a choice of modules for either constant voltage stimulation or constant current stimulation. A meter can be fitted into the system to allow precise voltage or current monitoring.

A selection of 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. For ease of use, most modules have an error indicator to warn of incompatible settings or an overload condition. 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 and Gating modules. In order to help with module selection we have compiled a number of application diagrams which are downloadable from the Support section of our website.

DS2A & DS3 Isolated Stimulators - A Constant Source of Stimulation

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, one of which operates the control circuitry.

One or two stimulators can be 19" rack mounted using our D121-11 mounting frame. In addition, the mounting frame also accepts our DG2 Trigger Generator, a device which provides a simple method of repetitively triggering the DS2A or DS3.



Amplification & Signal Conditioning using the NeuroLog System



The NeuroLog System lets you perform intracellular, extracellular or transducer-based recordings, signal conditioning, pulse generation or electrical stimulation, within one modular unit.

The NL900D Case & Power Supply Unit allows up to 13 modules to be installed. This means that a single NeuroLog System can be configured to amplify several different parameters, such as extracellular spikes, intracellular potentials or even blood pressure, and simultaneously provide outgoing trigger pulses to other devices or electrically stimulate the preparation of interest. Here we present some of the roles NeuroLog System modules can play in various amplification and signal conditioning applications.

Extracellular AC Recording

The NL100AK head-stage and NL104A AC PRE-AMPLIFIER provide an excellent combination suitable for extracellular recordings from neuronal preparations with sharp electrodes. They can be used in single-sided or differential modes, provide impedance matching for micro-electrode recording and feature low noise amplification. Continuously adjustable bandpass filtering from 0.1Hz to >50kHz is available through the NL125/6 FILTERS. In addition, the NL201 SPIKE TRIGGER can be used to convert spikes into uniform TTL pulses which can then be counted, converted to frequency or further analysed using other modules. Use of the NL120S AUDIO AMPLIFIER and NL985S LOUDSPEAKER would allow the spikes to be monitored audibly.



Extracellular DC Recording

As an alternative, an NL100A head-stage can be coupled to the NL107 RECORDER AMPLIFIER, providing a DC coupled amplification system. This particular configuration would be suited to grease-gap recording in neuronal preparations. Under these conditions, pharmacological studies of drug-induced DC shifts could be measured.

Intracellular DC Recording

The NL102G DC PREAMPLIFIER is a suitable amplifier for intracellular recording (it can also be used for extracellular micro-electrode recordings). Used with the NL106 AC/DC AMPLIFIER it provides a total gain up to x1,000, while the NL125/6 FILTERS give continuously adjustable bandpass (and notch) filtering from DC to >50kHz. The NL102G features capacitance neutralization, current injection (up to 100nA) and impedance checking. Internally generated current injection and impedance checking can both be controlled by other devices or NeuroLog modules. The NL102G now includes the NL412 PULSE box, which allows remote and full activation of the capacitance compensation circuitry. This "buzz" process can aid penetration during electrode impalement.

Four Channel Isolated Amplification for EMG, EEG or ECG Recording

An ideal system for multi-channel AC recording of physiological signals such as EEG, EMG or ECG in the research environment. The system provides a wide range of amplification and filter settings. The NL824 4-CHANNEL PREAMPLIFIER can be positioned near the recording site, so reducing the length of the electrode cables and minimising interference. The outputs are connected to the NL820A ISOLATOR (housed in the NeuroLog case), where further amplification of the signals can be selected on a channel by channel basis. Further filtering can be carried out by the various NL134/5/6 or NL144 FILTERS, while the signal can be conditioned for ADC input using the NL530 CONDITIONER.



Transducer-based Measurements

The NL108A PRESSURE AMPLIFIER provides an easy method of monitoring physiological pressure changes and can be used in combination with your own or our disposable (NL108T2) / reusable (NL108T4) pressure transducers. A pressure transducer and appropriate lead can be connected to the NL108A module, allowing continuous monitoring of parameters such as blood or intra-tracheal pressures. The output of the NL108A can be fed directly to a chart recorder or ADC interface for PC-based acquisition.

Visit www.digitimer.com for detailed information on the NeuroLog System, including Application Notes & FAQ's

NEW Products from Digitimer

The NEW NL405 - Giving the NeuroLog Range more "Width"

The new NL405 Width/Delay module has been introduced to replace the NL401 Digital Width and NL403 Delay Width modules and combines features from both into a single unit. Improving on the ranges available on the NL401/403 (1µs to 999s as opposed to 1µs to 10s), this module can either be used to give width to an incoming trigger pulse (triggering on either the +ve or -ve edges) or be used to introduce a delay followed by an output pulse. The NL405 also features a push button start on the front panel as well as an LED indicator, which allows easy monitoring of output pulses. In most applications, the NL405 will be a suitable replacement for the NL401 and NL403 which are no longer available.



Stimulate, Record, Stimulate, Record, Stimulate....

The NL100RK consists of a new headstage (NL100AKS) and NL100C Stimulus Control module designed for use with the NL104A AC Preamplifier and allowing stimulation and recording through the same electrode. The NL100C allows a voltage stimulus of up to 100V (e.g from our own DS2A stimulator) to pass through the NL100AKS headstage and recording electrode under the control of a three position switch on the NL100C front panel. The switch has "On", "Off" and "Ext" positions, allowing presentation of the stimulus to be controlled manually or via a gating pulse from an external device.

A Module with a Difference

The NL143 Difference Amplifier allows the difference between two signals to be continuously monitored during the course of an experiment. The module has four inputs and three outputs, allowing three alternative "differences" to be recorded simultaneously from each module. Internal settings define the channels to be subtracted. The module also features a post-subtraction offset control which allows the output to be offset to a desired level e.g. for zeroing at the start of an experiment.

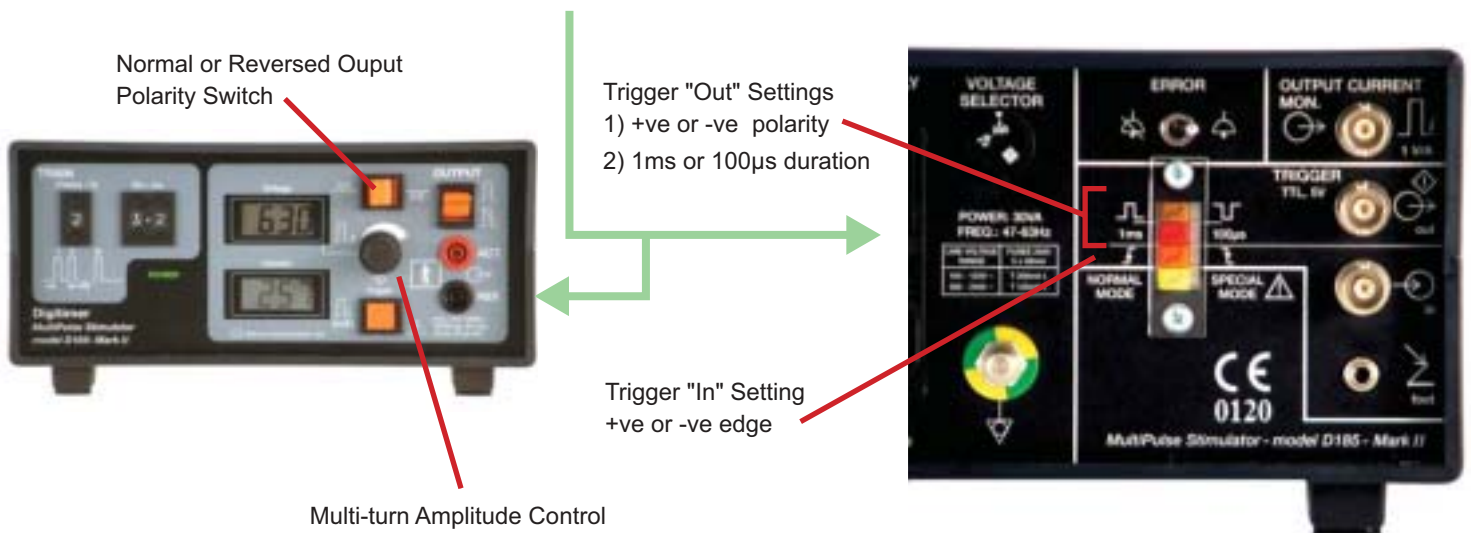
While this module was originally designed to allow the differences between two biological parameters to be continuously monitored, it could also be used to remove unwanted offsets introduced into analogue signals originating from computer DAC interface cards.



The D185 Stimulator Gets A Face Lift

At Digitimer we listen to feedback from all our customers and nowhere is this better demonstrated than in the case of the D185, which now incorporates some significant enhancements.

All D185 Stimulators now feature a polarity reversal switch which allows the user to reverse electrode polarity without having to remove and replace electrode leads. Output amplitude selection is now facilitated by a multi-turn dial on the front panel. The trigger settings of the instrument have now been incorporated into the back panel, allowing the D185 to be configured for use with several different clinical monitoring systems rapidly and easily without the need to remove the case and adjust internal settings. Finally, special circuitry has been added to reduce stray mains frequency pickup below perceptible levels.



News from our Partners

Perfusion Systems & Recording Chambers



AutoMate Scientific provide a range of high quality, pressure regulated perfusion systems offering manual or automatic control. With ValveBank, manual control is achieved through a handheld valve controller unit, which also offers a high level of automation. The unit can be programmed by hand or with EasyCode software for Windows or Macintosh. Alternatively, the ValveLink system allows perfusion to be controlled manually or directly by your acquisition software, using appropriate cables between your data acquisition interface and valve controller.

Perfusion systems of 4, 8 and 16 channels are available; all featuring rapid solution exchange (10ms), 360µm, 250µm or 100µm perfusion tips and micro-litre dead volume. Additional use of a pressure manifold allows for constant and increased flow rates, ideal when using the perfusion tips mentioned above.

AutoMate manufacture the PCP-1 Petri Dish Perfusion Chamber Insert which facilitates integration of their perfusion systems with chambers based around

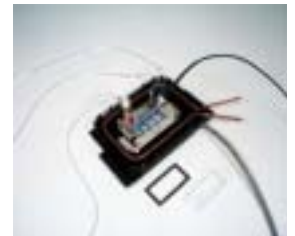
disposable 35mm petri dishes as well as the OPC-1 which is a low volume *Xenopus* oocyte perfusion chamber, designed for use during two electrode voltage clamp recording.

Temperature Controlled Micro-incubators, Cell Injectors & Drug Application Systems **Medical Systems**

Temperature Controlled Micro-incubators

Digitimer supply & support the full range of Medical Systems, temperature controlled micro-incubators. Whether you are working on brain or other tissue slices, cultured or acutely dissociated cells, require static or perfused conditions, there is likely to be an incubator to meet your requirements. The Open Perfusion (PDMI-2, top left), Patch Slice (PSMI) and Chamber Slide (CSMI, top right) incubators feature Peltier controlled heating and cooling via the TC202A bipolar temperature controller unit, allowing temperatures to be maintained between 0°C and 50°C (with optional water jacket). The PSMI has a low profile design specifically for use with upright microscopes when patch clamp recording from brain slices. The PDMI-2 is designed for use with inverted microscopes and is more suitable for imaging & patch-clamp applications using isolated cells in disposable 35mm petri dishes or the MSC-TD coverslip dish.

As well as the Peltier driven chambers, there are a number of heated incubators, including the Leiden micro-incubator (LU-CB-1, bottom right) and Brain Slice Chamber (BSC, bottom left). For further details on the incubators and accessories available, please request our detailed product information sheets or download them from our website.



PLI-100 Pico-litre Cell Injectors



The PLI-100 picolitre injector is a sophisticated device for intracellular or intranuclear injection of precise volumes in the femtolitre to microlitre range. The unit features channels for injection and holding pipettes and can be supplied with a range of accessories.

NeuroPhore Drug Application System

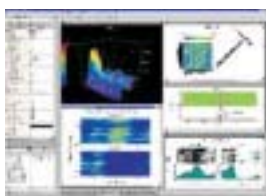


The NeuroPhore System is the gold standard in modular drug application devices and can be user configured to eject drugs by iontophoretic or pneumatic means. Each rack supports up to five pump modules which can be programmed to pump sequentially or in parallel in response to internal/external timing or manual triggering.



ALPHA OMEGA

Multi-channel Extracellular Recording & Signal Processing



EPS - Electrode Positioning System (4 channel, modular)

MT - Microdriving Terminal (up to 32 electrodes)

MCP - Multi-channel (4 - 250) Amplifiers

MSD - Online Spike Processing (1 - 8 channels)

Alpha-MAP - Acquisition Interface

And Complementary Acquisition & Analysis Software

Partial or Complete Solutions for Multi-channel Recording, Data Acquisition & Analysis

Taking the features of PULSE software and extending them further, PATCHMASTER provides advanced control over multi-channel EPC9/10 double or triple patch clamp amplifiers. Further, because a single InstruTECH PCI-1600 card can be used to connect two EPC10 amplifiers to a computer, PATCHMASTER can control two EPC10 Triple amplifiers, allowing parallel recording from up to 6 cells simultaneously.

Main Features & Improvements over Pulse:

- 2 A/D data acquisition channels of PULSE extended to 16 input channels with variable sampling rates.
- 1 D/A channel of PULSE increased to 8 stimulation channels.
- Enhanced Protocol Editor, includes repeat loops, macros and conditional statements.
- Includes an I/O Control Monitor to easily assess the status of external hardware.
- Enhanced online analysis functions allow integration of the Pulse Generator and Online Analysis procedures.
- Improved automatic leak subtraction compensation.
- Data acquired in PULSE can be automatically converted to PATCHMASTER format.
- PATCHMASTER licence includes a copy of PULSE.

Other Products from HEKA, Bruxton & InstruTECH

PATCH-CLAMP AMPLIFIERS

Don't worry, the world hasn't gone completely "multi-channel", as the well known EPC7, EPC8 and single channel version of the computer controlled EPC10 are still available to those who still find recording from one cell rewarding (and challenging) enough.

SOFTWARE

HEKA continue to provide a comprehensive selection of software to complement their range of amplifiers. PULSE and TIDA remain the most popular acquisition packages while X-CHART and FURA provide support for continuous recording and Calcium imaging. Data acquired within PULSE can be further analysed using PULSEFIT or exported to Igor Pro, Origin or Sigmaplot. Single channel recordings can be made and analysed using the Bruxton ACQUIRE and TAC software, which are available in Windows and MacOS versions.



ACQUISITION INTERFACES

ITC-1600 - The HEKA EPC10 series of amplifiers incorporate the new ITC-1600 interface manufactured by InstruTECH. The I-1600 rack communicates with the host computer through a fibre optic cable and PCI card. A single PCI card can control a single or dual I-1600 rack allowing 8 or 16 channel acquisition.

ITC-18 - The ITC-18 is the second generation low-noise 16 bit computer interface from Instrutech. The ITC-18 offers unsurpassed capability while retaining all of the exceptional features of its predecessor, the ITC-16. The ITC-18 provides a major improvement in the quality of acquired data, making measurements that would otherwise not be possible.

VR10B - The VR-10B in conjunction with a video cassette recorder becomes a high performance digital recording system. A unique digital PCM tape encoding technique, together with state of the art microprocessor and digital signal processing technology provides for stable low noise recordings.



50Hz/60Hz Mains Noise Removal without Filtering



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.

NARISHIGE



Celebrating 50 Years of Manufacturing Precision Tools for Electrophysiology

Fine & Coarse Manipulators, Cell Injectors, Anti-vibration Plates & Pipette Fabrication Instruments

Other Digitimer Products

Isolated Constant Current Stimulator for Human Use

The DS7A High Voltage Constant Current Stimulator is a very popular product for percutaneous stimulation within clinical or research environments. The stimulator uses mains power to provide a variable compliance of up to 400V, allowing a maximum stimulation current of 100mA, or 1A with the DS7AH variant. The stimulator has a built in "single-shot" trigger button, but also accepts TTL trigger input via a BNC socket on the rear of the unit or triggering from a contact closure footswitch. In addition, a TTL output, also on the rear, allows triggering of recording equipment. The DS7A has 6

selectable stimulus durations of between 50 μ s and 2000 μ s (restricted to 50-200 μ s with the DS7AH). Electrodes (not supplied) are connected to the stimulator via touch-proof safety sockets. Electrode extension cables or plugs are available from Digitimer.



8-Channel Patient Amplification & Filtering System



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. 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 from 8 individual BNC sockets on the front panel. The D360 has been designed according to the medical devices directive through implementation of the EN60601 Standard.



D380 Dye Marker

A simple iontophoretic device for dye labelling of cells. Battery powered, adjustable constant current output with Hold (6nA), Inject (12nA) and unblocking modes.



D130 Spike Processor

Single channel spike processing for the less demanding user. Features window discrimination, audio monitoring and spike logging capabilities (with optional software).



Coming Soon! A New Website for Digitimer

- Research, Clinical & NeuroLog System product zones.
- Individual product or price list request service.
- Dropdown menus to improve site navigation.
- Product overviews as well as detailed information in PDF format.
- Enhanced product support pages including updated FAQs and application notes.
- Links to publications where Digitimer products have been used.

As this issue of Digitimes goes to print, the new look Digitimer website is near completion and should be online very soon. The new site divides the Digitimer product range into three zones, Clinical Instruments, Research Instruments and The NeuroLog System, in order to better reflect the interests of our customers.

The new site will continue to provide an online price request service, which we know many of our customers find increasingly useful, as well as detailed product information relating to our range of equipment. We have also decided to place a greater emphasis on the provision of detailed product

information in PDF format which is of obvious benefit to our international customers. Enhancements of our product support pages are aimed to provide more technical help through the use of regularly updated FAQs and Application Notes. If you are a frequent visitor to **Digitimer.com**, then we hope you will appreciate the changes and continue to visit us. If you have never visited our website before, then please take a look. We are grateful for any feedback relating to your experience of the Digitimer website, as a means to make further improvements in the future.

Please use the enclosed Faxback form or contact us directly for further product & pricing information

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