Digitimes

www.digitimer.com

2008/9

NeuroLog SYSTEM

Stimulating Solutions

NEW Digitimer DS4 Biphasic Constant Current Stimulus Isolator

The DS4 has been developed to meet the needs of scientists who require a stimulus isolator that can output a bi-phasic isolated constant current stimulus in response to an external voltage waveform, provided by a computer DAC via software. Such a requirement is already met by our NeuroLog System in the form of the NL512 Biphasic Buffer & NL800A Stimulus Isolators, but the DS4 is our first standalone device to meet this need.

The DS4 accepts a variety of voltage input ranges (±1V, ±2.5V, ±5V and ±10V) and produces a constant current stimulus output in 4 overlapping ranges (±10µA, ±100µA, ±1mA and ±10mA) from a compliance voltage of ±48V. In addition, the DS4 has a GATE input which allows multiple DS4's to be connected to a single analogue voltage source, with each DS4 being digitally enabled, separately.

One of the problems with stimulators that make use of an external voltage source to define a stimulus waveform is that small offsets or noisy baseline signals from the DAC's used to drive them can result in unwanted battery drain or perhaps worse, low amplitude stimulation. The DS4 uses a special "inactivity sensor" to monitor the input voltage and disable the DS4 output if this voltage falls below 0.15% of the full scale value (in +ve or -ve directions) for a user selectable time period of 100ms, 200ms, 1s or 2s. Unlike other devices which only produce an output when the input voltage exceeds a threshold value, this "inactivity sensor" reduces battery usage and damaging "leak currents" during infrequent stimulation, while at the same time maintaining low levels of zero crossing distortion for repetitive waveforms.

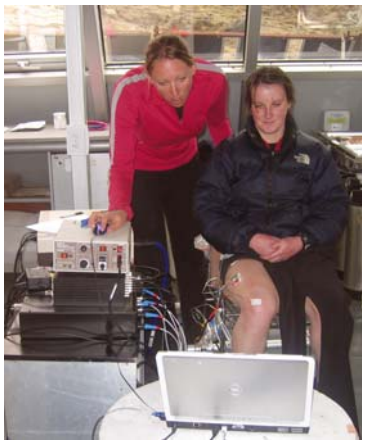
The DS4 uses an external power supply for the control circuitry and readily available/inexpensive batteries to provide the opto-isolated stimulus voltage source.

High Voltage Stimulation at High Altitude - Everest Revisited

Emma Ross in front of Mount Everest

In 1994 a specially modified version of our NeuroLog System was taken on the British Mount Everest Medical Expedition. Research conducted at Everest base camp (5,340m) included studies on hearing and balance by a team directed by Martin Rosenberg (Queen Mary and Westfield College, University of London). The modified NeuroLog system featured a fully fledged data acquisition system, called DigiStore which enabled data to be acquired and stored in a device that was both rugged and portable.

Earlier this year, Brunel University lecturer Emma Ross joined an expedition from the University of Otago, New Zealand which based itself at the high altitude Pyramid Research Laboratory (5,050m) in Nepal. Emma's research looked at how the brain, muscles and the respiratory system coped with the decreased oxygen levels at altitude and how acclimatisation to low oxygen levels occurs. As part of her research Emma made use of her **Digitimer DS7A High Voltage Constant Current Stimulator** which she already employs in her own UK-based lab.



Emma (left) and Becky Lucas (University of Otago) conducting tests with the Digitimer DS7A Stimulator at the Pyramid Research Laboratory

NeuroLog SYSTEM

PRODUCT FOCUS

The NeuroLog System allows you to perform intracellular, extracellular or transducer-based recordings, signal conditioning, pulse generation or electrical stimulation, within one modular unit.
The NL900D Case & Power Supply Unit (pictured) 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, as well as simultaneously provide outgoing trigger pulses to other devices or electrically stimulate the preparation of interest. We also offer the compact NL905 Case (shown below) which holds up to four modules for less demanding applications. Here, we present some of the roles NeuroLog System modules can play in various amplification and signal conditioning tasks.

Intracellular & Extracellular Recording

Our **NL102G DC PRE-AMPLIFIER** is ideal for intracellular DC recordings from fluid filled high impedance electrodes. This double-width module features capacity neutralization, impedance checking, current injection, low leakage current and minimal DC drift. It is supplied with a compact headstage and a remote "buzz" box to aid electrode penetration. For extracellular, differential DC recordings we recommend our **NEW** **NL109 BRIDGE AMPLIFIER** and **NL100AK HEADSTAGE**.
For AC coupled extracellular recordings, the **NL100AK HEADSTAGE** and **NL104A AC PRE-AMPLIFIER** provide an excellent combination. 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 0.5Hz to >50kHz is available through the **NL125/6 FILTER**. In addition, the **NL201 SPIKE TRIGGER** can be used to convert spikes into uniform TTL pulses which can then be counted, converted to frequency (using our **NEW** **NL254 RATEMATER)** or further analysed using other modules. The **NL120S AUDIO AMPLIFIER** and **NL985S LOUDSPEAKER** would allow the spikes to be monitored audibly.

Isolated Multi-channel 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**, where further amplification of the signals can be selected on a channel by channel basis. Further filtering is provided by the various **NL134/5/6** or **NL144 FILTERS**, while the signal can be conditioned for ADC input using the **NL530 CONDITIONER**.

Pulse Generation & Stimulation

The NeuroLog System range includes a number of timing modules designed to permit flexible pulse generating protocols. Whether you want to deliver a regular burst of pulses, a preset number of pulses or continuous stimulation for a set duration, it is likely that the Neurolog System can be configured to accomplish your needs. Output from our **NL301 PULSE GENERATOR** and **NL304 PERIOD GENERATOR** is based on standard TTL, so the system can be interfaced with other devices. For electrical stimulation requirements, our compact, battery powered **NL800A STIMULUS ISOLATOR** produces monophasic or biphasic electrical stimuli and can be driven by the **NL510A PULSE BUFFER** (square pulses) or **NL512 BIPHASIC BUFFER** (abitrary waveform shapes).

Pressure & Force Transducer-based Recording

Our **NEW** **NL109 BRIDGE AMPLIFIER** can be used with a selection of force transducers that we offer, allowing you to measure forces up to 250kgf.
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 pressure amplifier, 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.

Digitimer Clinical News

Audio Interface Adds Sound Output to the D360

The **D360 8-Channel Isolated Amplifier** can be used for multi-channel AC amplification of electro-encephalography (EEG), evoked potential (EP), electro-cardiography (ECG) or electro-myography (EMG) signals. The control software provides gain, filter, impedance checking and deblock functions. Analogue output to your acquisition interface is via connectors on the rear of the unit or from 8 BNC sockets on the front. The D360 has been designed within the requirements of the medical devices directive through implementation of the EN60601 Standard.

D360-AIS Audio Interface

It is often useful to be able to listen to the signal being recorded and in response to this requirement, Digitimer has introduced the **D360-AIS Audio Interface**. This small device can be connected to the D360 via one of the rear output "D" connectors and the LINE-IN of a PC soundcard allowing the D360 operator to listen to each of the 8 channels individually. As well as a rotary switch which selects the channel of interest, the D360-AIS also features a volume knob.

It is becoming increasingly popular for D360 amplifiers to be used with laptop computers which lack the serial port required for connection to the amplifier. We offer a specific USB adaptor (**D360-USB-TO-SERIAL**) which is compatible with the D360, making it possible to control the D360 via a USB port. Please be aware that not all commercially available USB/Serial adaptors are compatible with the D360.

Amplifier Checker & Impedance Meter for Clinical Neurophysiology

D179 Performance Checker

The **Digitimer D179 Performance Checker** is used by Clinical Neurophysiology departments to provide an independent check of their EEG, EMG or EP amplifier systems. Designed for use with a calibrated Signal Generator (also available from us), the D179 attenuates the output signal so that it can be fed into the amplifier inputs. The amplified voltages can then be compared with those expected.

While the D179 allows users to confirm that their amplifiers are working correctly, our **NEW Electrode Impedance Checker** gives you the ability to check the quality of your electrode placements and identify faults in your lead wires. This small handheld unit is battery powered and features a user set LED display of good/poor impedance levels.

Impedance Meter

DS5 Control Software & Updated Firmware Now Available

The first DS5 Bipolar Constant Current Stimulators were delivered to Digitimer customers about a year ago and interest in this unique device has been tremendous.

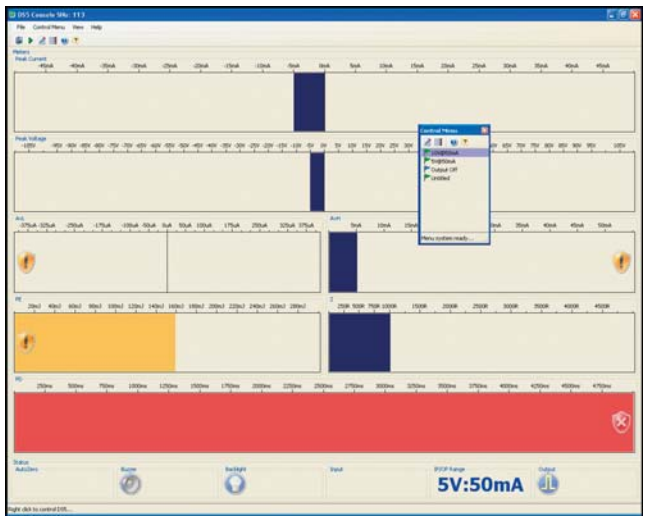
Digitimer DS5 Stimulator

Digitimer has now released Control Software to allow the DS5 Settings to be modified from a Windows PC rather than through the front panel buttons on the stimulator. This software will make it easier for you to set up the stimulator prior to the start of stimulation, as particular settings relating to the output limits and the input/output ranges can be stored for subsequent recall. In addition the software will graphically display the same stimulus parameter information as the front panel of the DS5.

Within the Control Software are components that will allow programmers to use their own software to send settings commands to the DS5 via a COM interface. This means that users who are writing programs to generate the necessary analogue input voltage for the DS5 will also be able to adjust stimulator settings such as the input and output ranges within their own software, without having to manually access the DS5 front panel menu.

DS5 stimulators already in use will require a firmware upgrade to allow the software above to recognize the DS5 and this can be carried out over the internet following installation of the software.

If you have not done so already, please register your DS5 purchase at **www.digitimer.com/register** so that we can keep you informed of further developments.



The DS5 Control Software gives users external control of DS5 settings

DS5 User Interface Software can now be downloaded FREE from our website:- http://update.digitimer.com/DS5/software/latest

Got an Idea for a NEW or Modified Device?

Let us help you develop it

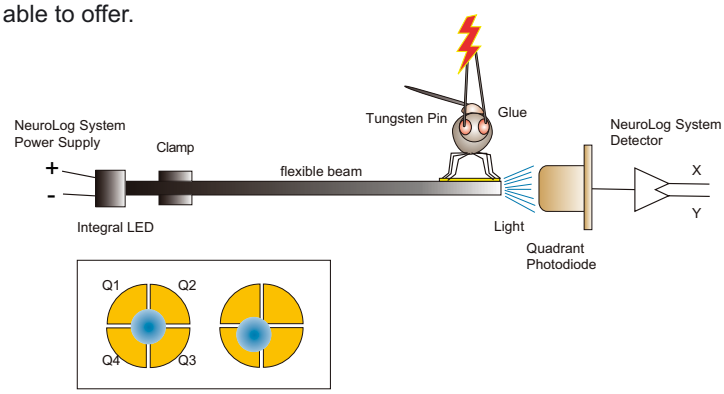
For over thirty years Digitimer has provided life scientists and clinicians with tools designed for medical and research applications. Many of our products started life as ideas suggested to Digitimer by existing customers who were unable to find the device they needed or the function they required within the existing range of available instrumentation.

Using our design and production expertise as well as our detailed knowledge of the requirements of the medical device directive and CE certification procedures, we are often able to provide a solution for our customers. This can be in the form of either modifications to existing products or the development of new ones. The three "Case Studies" presented below are typical examples of the sorts of projects Digitimer have become involved with. If you are a scientist, clinician or engineer working in the academic or private sector, please feel free to contact us in order to discuss how we can help with any product ideas you might have.

Case Study 1 NeuroLog System NL280 XY Ergometer

Dr Chris Elliott (University of York, UK) carries out research on neuromuscular mechanisms in drosophila and as part of his research, Chris has constructed a "fly ergometer" which uses a flexible light pipe and a photodiode array to detect the small forces generated when a fruit fly jumps in response to an electrical stimulus. Using this apparatus Chris has been able to examine the jumping reflex in wildtype flies of various ages as well as mutants with neuromuscular defects.

Chris was keen to make this apparatus more accessible to other researchers in the field and asked Digitimer if we could manufacture a version which could be offered commercially. After successful prototype evaluation we can now offer the **NL280 XY ERGOMETER** as part of our NeuroLog System range. The NL280 comprises the flexible light pipe, photodiode detector and a NeuroLog System module which provies powers the emitter/detector and outputs the voltage signals which correlate with the force generated. The light pipe and detector are designed to be mounted on Narishige magnetic stands which we are also able to offer.



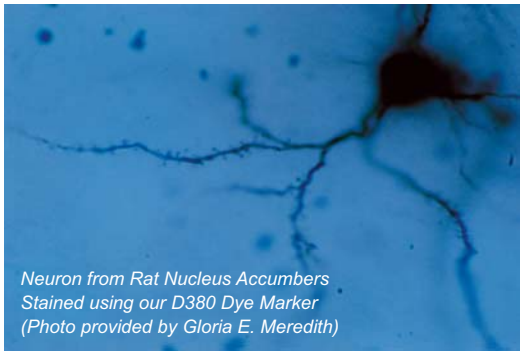
Case Study 2 Stimulator for Surgical Correction of Anorectal Malformation

Earlier this year we were approached by staff at Great Ormond Street Hospital (GOSH, London, UK) who were looking for a suitable stimulator to use as a muscle locator during surgery, as the device they had previously used was not CE compliant. In a technique pioneered by Alberto Peña, a surgeon uses a handheld bipolar stimulating probe to map the location of striated muscle, which is ultimately used to surgically construct an anus in very young children born with anorectal malformation.

While our DS7A stimulator was able to produce the necessary output current for their needs, it requires a trigger from another device in order to produce an output and this made it unsuitable in its standard form. In collaboration with the team at GOSH, we were able to design a modified DS7A which had a built in frequency generator (oscillator). This meant that when switched on and enabled, the unit delivered stimuli at a set frequency so that the surgeon could stimulate repetitively while he moved the probe over the area of interest. At the time of writing, the GOSH team had used the modified stimulator for the first surgical cases and the unit had performed very well.

Case Study 3 Brain Slice Recording - All Day & Most of the Night

At the Centre for Cognitive and Neural Systems (University of Edinburgh), Roger Redondo, Patrick Spooner and Prof. Richard Morris have devised a novel method of maintaining the temperature of brain slices during long term recordings. This new approach, presented at the FENS 2008 meeting in Geneva, makes it possible to record from acute slices for extended periods. So how does it work? Traditional methods of heating slices during recording rely on heating a fluid filled chamber immediately under the slices. This form of heating results in droplets of condensation forming on the cooler recording electrode and subsequent mechanical disturbance of the recording site, due to electrode "droop". Further, if these pure water droplets are not regularly removed by the electrophysiologist, they can fall back into the recording chamber thereby drastically changing the osmotic environment of the slice and causing it to lose viability sooner.



Neuron from Rat Nucleus Accumbers Stained using our D380 Dye Marker (Photo provided by Gloria E. Meredith)

In Edinburgh they decided that rather than heating the slice chamber, it would make sense to maintain the temperature of everything within the Faraday cage. The equipment required to convert a rig to this type of temperature control is already commercially available and specialist Edinburgh Temperature Controller Software written by Patrick Spooner will be available from Digitimer in the near future.

Bilayer Recording System for Use with EPC10 Patch Clamp

Bilayer recording is a well established technique for studying pore forming proteins in artificial membranes. Here, we introduce the **Ionovation Compact** from HEKA – a highly flexible bench top system based on this technique. The bilayer forms a gigaohm resistance between two saline-buffer filled chambers. After incorporation of pore forming proteins (ion channels, solute channels, carriers or pumps), protein mediated currents or membrane potentials can be recorded at high resolution. Stable, low noise, Ag/AgCl electrodes with salt bridges allow recordings in a wide current and salt concentration range. The readily mounted bilayer chamber consists of a 25 µm thick Teflon foil with an aperture of about 50 µm diameter separating two polycarbonate compartments of about 3 ml volume each.

The Ionovation Compact system is integrated with the well-known **EPC 10 Patch Clamp Amplifier** for low noise recording and data acquisition. The Ionovation Compact is controlled by user-friendly **PATCHMASTER** software providing fully automated operations e.g. bilayer production & validation, capacitance control of bilayer integrity and perfusion of both membrane sides. A user defined experimental workflow with pre-defined protocols allows the system to be run in an automated manner.

Injection, Incubation & Iontophoresis Solutions from Digitimer

The Medical Systems range of products includes the PLI-100 and PLI-90 Picoliter Injectors which have gained renown through their use at the Cold Spring Harbor Laboratory Workshops. These injectors are able to deliver volumes in the femto litre range, using precise timing and pressure controls. The PLI-100 includes a vacuum facility for cell holding or pipette filling.

For incubation, the Medical Systems range includes a selection of Peltier controlled chambers for patch-clamp recording in isolated cells and slices (PDMI-2 and PSMI) as well as a chamber slide incubator (CSMI) and the small open and closed Leiden chambers. Digitimer also offer high quality brain slice and tissue chambers from Scientific Systems Design.

For pressure or iontophoretic drug delivery you need look no further than the BH-2 NeuroPhore System. This modular device is able to be configured with up to 5 channels of pressure or current ejection. The NeuroPhore incorporates digitally controlled ejection and pause timing, as well as out of compliance/unbalance warnings and impedance checking.

InstruTECH Products Now Manufactured by HEKA

In late 2007 an agreement was reached between InstruTECH and HEKA which saw the German manufacturer of patch clamp equipment purchasing a selection of the assets of InstruTECH. This purchase allowed HEKA to continue manufacturing and supporting the following InstruTECH Data Acquisition products: ITC-18, PCI-18, PCI-18V3, USB-18, ITC-1600, PCI-1600, PCI-1600e, PCI-16, PCI-16V3 and USB-16.

Following the closure of InstruTECH's offices earlier in 2007 there was a short period of uncertainty, however, this welcome news meant that Digitimer could continue to offer their products as part of the HEKA range. In honour of Milan Kesler, the company founder, HEKA will continue to brand all current Data Acquisition Interfaces with the InstruTECH name.

Is 50/60Hz Mains Noise Still Bugging You?

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 just what you need.

Can We Help With Anything Else?

Don't forget that Digitimer also represents the companies below, which also manufacture equipment for life science research. If you are looking for a product from their ranges or something else that you cannot find, please get in touch with us and we will try and help.

AutoMate Scientific
READY FOR RESEARCH

Bruxton

flyion
ion channel solutions

NARISHIGE

Scientific Systems Design Inc.

TMC

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 below) can be 19" rack mounted using our D121-11 mounting frame which will support one or two of these instruments.

DG2A - A Simple, Battery Powered Trigger Generator

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.

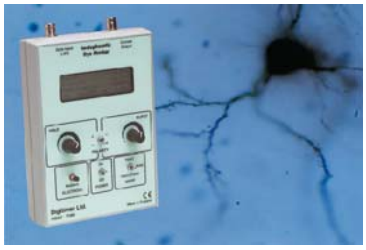
D330 MultiStim
Multi-channel Tissue Bath Stimulation System

The **D330 MultiStim System** is a modular and versatile multi-channel stimulator for biomedical scientists requiring accurate *in vitro* field 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 (www.digitimer.com/support).

Register Your Product With Us & Extend Your Warranty for FREE!

All products manufactured by Digitimer include a standard 12 month warranty against defects in materials or workmanship, however, by registering your purchase with us, you can extend this warranty to two years, **free of charge**. Currently, you can register your purchase online at www.digitimer.com/support or complete and return the Product Registration Leaflets included with despatched orders of Digitimer and NeuroLog products. This offer is only available for purchases of products manufactured by Digitimer and your registration details MUST reach us within 28 days of purchase in order to qualify.



The Digitimer D380 Dye Marker

In addition, and as part of our ongoing commitment to the ISO 9001:2000 quality standard, we are actively seeking feedback from our customers relating to customer satisfaction. A brief customer satisfaction questionnaire is included on the Product Registration Forms and we would appreciate your comments and suggestions.

Get Your News Faster - Register for the Digitimes E-mail Newsletter

Would you be interested in reading about the latest developments and product news from Digitimer in an E-mail format or online? E-mail newsletters are becoming more popular for many reasons, including their obvious environmental benefits and Digitimer would like to E-mail registered customers every couple of months to keep them updated with our products, as well as provide application notes and trouble-shooting information. If you would like to join this mailing list, just drop us an E-mail asking to be added (you will of course be able to remove yourself at any time).

For more information please contact us or visit our website

Digitimer Ltd, 37 Hydeway, Welwyn Garden City, AL7 3BE, UK

Tel: +44 (0)1707 328347 **Fax:** +44 (0)1707 373153

E-mail: sales@digitimer.com **Web:** www.digitimer.com/digitimes08