DS8000

8-Channel Digital Stimulator

- Built-In Single Board Computer
- LCD with Touch Screen Input
- Excel input with custom or a real biopotential waveform
- Scope Mode Displays Waveforms
- Up to 8 External Trigger Inputs
- Three High Precision Event Timers, Synchronous or Asynchronous
- Synchronize Perfusion System with Stimulus Delivery
- Software Fully Upgradeable via Remote Serial or Ethernet Access
- Biphasic/Monophasic/Rectangular/Sine/ User Defined Waveforms
- Variable Interpulse Intervals
- Channel Outputs Individually Switchable
- 8 Separate Analog, Digital and Combined D or A Outputs
- GLP /GCP Compliant with Password Protection
- User-Defined Protocols with Memory Storage
- FTP File Upload/Download and Screen Dump

The DS8000 represents a quantum leap in the performance of the research stimulator. Using a powerful single board computer, DS8000 is the most advanced stimulator on the market. With a built-in computer, all of the waveform is generated digitally with precision timing. It can generate more complex stimulating wave patterns than any other instrument on the market. The LCD touch screen display/input makes a vast improvement and ease of operation for the user interface. A built in digital oscilloscope will allow the user to check the waveform instantly on the screen. The instrument can be rack mounted with all of the frequently used connectors on the front panel. An Ethernet connection allows the user to transfer custom waveforms and upgrade the software using TCP/IP protocol via remote Ethernet access.

The DS8000 has 8 analog outputs, 8 TTL outputs and 8 combined analog or TTL outputs. Each combined output can be comprised of a combination of any 1 to 8 channels. Three independent internal timers and three independent external triggers are offered. The output waveforms offered include unipolar pulse, bipolar pulse, rectangular pulse, step, sine and ramp. In addition, researchers can design their own waveforms. An external trigger, internal analog channel, internal TTL channel, or any of the three built-in timers can be used to control each output channel. All of the three built-in timers can be programmed and linked to perform complicated timing schemes.

A unique feature of the DS8000 is stimulation with a waveform that is identical or similar to a real biopotential waveform, such as ECG, EEG or action potential, providing the scientist with much more information than would a simple square waveform (see Figures 1, 2 and 3).

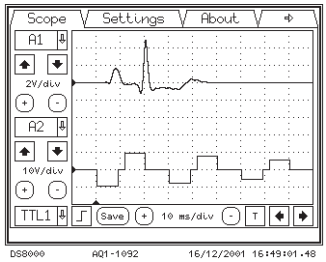

Fig. 1

DS8000

DS8000 SPECIFICATIONS

TIMING PARAMETERS	
PERIOD (TOTAL SIGNAL WIDTH)	0.04 ms to 10,737,418.24 ms
PULSE WIDTH	0.02 ms to 10,737,418.24 ms
BIPOLAR GAP WIDTH	0.00 ms to 10,737,418.24 ms
OPERATING MODES	Free run, triggered, gated, Train, DC
TRIGGERS	8 External, manual, TTL 1-8, combined TTL 1-8, timer start or stop
TRAIN EVENTS	1-50
TRAIN PULSE WIDTH	0.02 ms to 10,737,418.24 ms (3 hours)
TRAIN PULSE DELAY	0.04 ms to 10,737,418.24 ms
TRAIN PERIOD	0.06 ms to 10,737,418.24 ms
BNC OUTPUT CONNECTORS	Analog, combined analog, combined digital (TTL)
WAVEFORMS	Unipolar, bipolar, rectangular, sine, ramp, step, custom defined
CUSTOM WAVEFORM	12 steps/ voltage point (1025 if remote controlled)
VARIABLE STEP WAVEFORM	100 points (1025 if remote controlled)
OUTPUT NOISE	< 5 mV rms
TIMING ACCURACY	< 100 ppm
OUTPUT VOLTAGE RESOLUTION	5 mV
MAX. OUTPUT VOLTAGE	+/-10V @ +/- 10 mA @ 0.005 V/step
OUTPUT IMPEDANCE	50 Ω Combined Analog, < 10 Ω (for < 10 mA load)
EXTERNAL TRIGGER SYNC	40 µs minimum pulse TTL, CMOS 20 µs glitch and spike protection
DIGITAL I/O	5V max 10 mA (input); 25V @ 500 mA (open collector output)
MAINS VOLTAGE	85-260 V AC, 45-65 Hz 50W
EMC	CE approval pending
DIMENSIONS	13.3 cm x 42.5 cm x 25.4 cm 5.25" x 16.73" (19" rack) x 10"
WEIGHT	Approximately 4.0 kg (9 lb)
AMBIENT TEMPERATURE	-10 to +40 °C; -20 to +50 °C (Internal)
HUMIDITY	Max. 95% relative humidity, non-condensing

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

Screen dumps of actual patterns

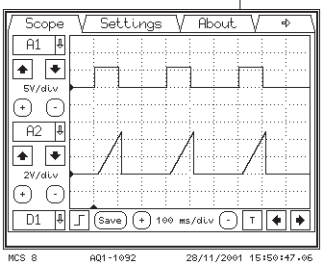

Fig. 2

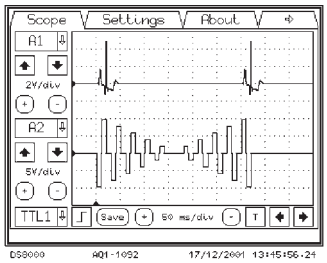

Fig. 3

A biopotential waveform captured by a data acquisition system may be transferred to an Excel spreadsheet for editing or modification, then sent to the DS8000.

One of the main problems of designing a stimulator is that a user might want very different stimulating patterns for different research applications. In order to satisfy all of these needs, traditional logical circuit based stimulators have control panels that use buttons and knobs to give the user as much control options as possible. However, even with a full panel of buttons, the selection of the stimulating pattern is still very limited. These types of stimulators can not generate complicated waveforms, such as combination pulses at varying interpulse intervals and amplitudes. Although microprocessor-based stimulators have made a significant step in solving these problems, some complicated waveforms are still impossible to generate. In fact, this decade old technology has serious limitations since each control button has been programmed to perform multiple functions. Moreover, it can only display limited lines of scrolled text—no graphics! To complicate matters, it is almost impossible to upgrade the software with new functions once the instrument has been manufactured; even the programming is awkward.

The DS8000 overcomes the hardware limitations of other types of stimulators by being reliant on a flexible software-timing interface. The user can then apply this flexibly to almost any kind of stimulation protocol without being restricted by the hardware limitations of the traditional logical circuit based stimulators. In order to suit complex custom protocols, the DS8000 is designed to offer a unique flexibility by simply reprogramming the pattern output using a few keystrokes under pull-down menus.

Although personal computer (PC)-based stimulators have the potential to give the user many of these options, they have major limitations that are inherent to the nature of PCs. Fundamentally, the timing on PCs is not accurate because computers have higher priorities to do other operations first. As a result of these other priorities, the important timing required for research stimulation becomes unstable. Despite the fact that PCs are very economical, they are not specifically designed to give accurate timing outputs. Furthermore, analog waveform generation is not readily available without adding expensive output boards and the required programming is non-standard. Besides, it is very inconvenient to make connections from the back of a PC using parallel ribbon cables. On the other hand, a dedicated single board computer controller, as used in the DS8000, allows very complicated waveforms to be easily generated with very accurate and precise timing. Yes, WPI's Digital Stimulator offers all of these solutions plus Good Laboratory Practices (GLP) compliance for research traceability.

DS8000 — *there is no competition!*

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