

The IZ2M/IZ2MH Stimulator

System 3

Overview. The IZ2M/IZ2MH stimulator converts user-defined digital waveforms to analog current and provides high precision electrical stimulus control as part of a computer-controlled neural stimulator system. It outputs constant-current stimulation across multichannel electrodes and provides feedback of actual voltages delivered to the electrode. The device is battery operated and includes mains power connection, with full medical-grade isolation, for in-device battery charging.

The stimulator is available with 64, or 32 channels and in two versions: the IZ2M for standard, micro stimulation and the IZ2MH for high current, macro stimulation. The IZ2MH delivers a maximum of 3 mAmps (300 μ Amps for IZ2M) of current per electrode up to 12 V on up to ten electrodes simultaneously. Electrical isolation and additional safety features ensure safe operation at all times.

Stimulation: The stimulator can deliver arbitrary waveforms at up to 50 kHz sampling rate. Each channel uses PCM D/As to ensure sample delays of only 4 samples and square edges on pulse stimulation waveforms. Stimulation control waveforms for each electrode channel are first defined on the RZ base station and digitally transmitted to the stimulator. Special circuitry on the stimulator converts voltage waveforms from the D/A converters to constant current waveforms. A combination of circuit control, ground control, and resistors applied by channel ensure high fidelity stimulus delivery even when using electrodes with very high impedance at DC that would normally produce large quiescent DC voltages.



Safety: The IZ2M/IZ2MH's robust safety profile includes both software and hardware components. Control software ensures that the device always boots in safe-mode, meaning all channels power up by default with their relays open. The relays are kept open until the device finishes booting, passes all internal safety checks, and is armed by the user. This ensures absolutely zero current can flow until proper software control is established. During operation, control software ensures that no more than 10 of the channels can be enabled for stimulation at the same time and that maximum output current is not exceeded.

At the hardware level, the IZ2M/IZ2MH features an air flow system to regulate temperature and a power supply monitoring system. These systems are controlled on an independent compliance board that will not allow stimulation currents to flow unless all safety checks are met. An ARM/STOP button allows for manual safety override.

The IZ2M/IZ2MH's power supply has been validated to ensure 4,000 volts of isolation between the input and output, 1,500 volts of isolation between the input and ground, and 500 volts of isolation between the output and ground. Safety approvals for the power supply include the following: UL60601-1, EN60601-1, CSA C22.2 No. 601.1 CE Mark LVD.

The IZ2M Stimulator

IZ2M Stimulator Part Numbers:

IZ2M-64, 64 Channel Micro Stimulator

IZ2MH-64, 64 Channel Macro Stimulator (high current)

IZ2M-32, 32 Channel Micro Stimulator

IZ2MH-32, 32 Channel Macro Stimulator (high current)

Software Control: Operation of the stimulator system is controlled via low level software that runs on the connected RZ base station. The user can access this control via user-friendly software, such as OpenEx, or custom software developed using OpenDeveloper.

Monitoring the Stimulation. Eight PCM A/D converters on the stimulator monitor the actual output voltage for a chosen bank of channels and send that information back to the RZ for user monitoring.

The Stimulator System: A typical system consists of IZ2M/IZ2MH stimulator, an RZ processor equipped with a specialized DSP [RZ-DSP-I] and additional fiber optic connector on the back panel, and a PC for the user interface.

Technical Specifications for the IZ2M/IZ2MH Stimulator

The IZ2M/IZ2MH is rack mountable in a standard 19" (482.6 mm) rack and is 2 U tall.

Stimulus Output Channels:	32 or 64
Sampling Rate:	Up to 48.828125 kHz
Stimulus Output Voltage:	+/- 12 V
Stimulus Output Current:	IZ2M: +/- 300 μ A up to 40 kOhm IZ2MH: +/- 3 mA up to 4 kOhm load
DC Offset Current:	< 100 nA on active channels and < 3 nA on open channels
Battery:	240 Wh 20 hours to fully charge, 16-18 hours to charge to 95% capacity 7.5 hours between charges

