Smart Ephys

multichannel systems
a division of Harvard Bioscience, Inc.

Portable *in vivo* Recording System

- 16 or 32 channel version
- Pre- and filter amplifier included
- USB 2.0 data transfer
- Adapters for commercially available probes
- Real-time signal detection and feedback

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The Portable-ME-System fulfills three functions in one device:

1. **Signal amplification**

- Miniature preamplifiers with 8, 16 and 32 channels available.
- Integrated filter amplifier: includes a common ground and one reference electrode input, which allows the measurement of the voltage difference between the electrodes and one reference electrode - providing a superior common-mode noise rejection.

2. **Data acquisition from 16 or 32 channels**

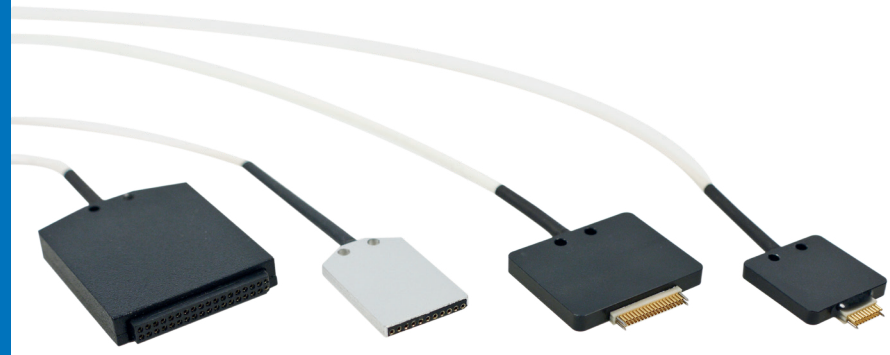
- 16 bit digital input and output.
- Sampling rate of up to 50 kHz per channel.
- Real-time sound output for software selectable channels.
- True USB 2.0 transfer rate.

3. **Online and offline analysis through included software**

- Flexible data stream management.
- Monitor parameters during the running experiment or re-run it any number of times.
- Software updates free of charge.

The Portable-ME-System is a complete plug-and-play data acquisition system based on signal processing technology.

- Includes all components you need to start your experiment immediately.
- Complete all-in-one solution for a variety of *in vivo* and *in vitro* applications.
- Easy installation saves time for your real objectives.
- No restriction to a certain computer. Can be used with any PC or laptop computer.
- Use this configuration in any lab of your choice.
- Any question? Take advantage of our more than 15 years of experience. Our support team will be open for all your queries**.**

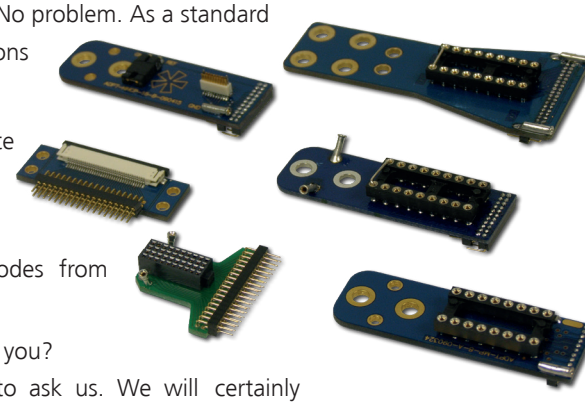


MPA32 MPA8 µPA32 µPA16

You need a specific solution for your setup?

The µPA16 and µPA32 connect directly to probes with Omnetics connectors, such as the probe packages CM or H from NeuroNexus Technologies.

If you want to use other probes: No problem. As a standard we can offer the following solutions for you:



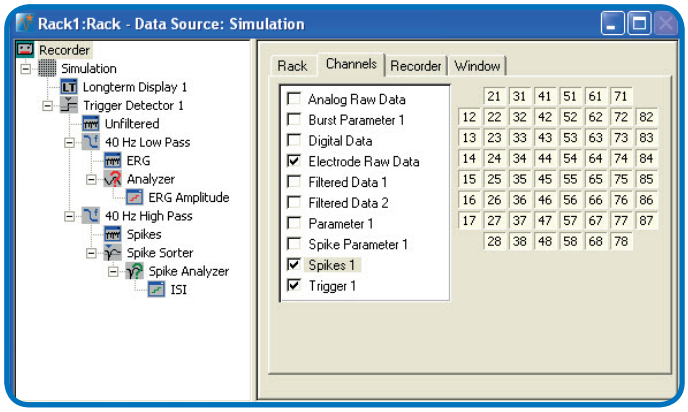
- Adapters for many acute and chronic probes from NeuroNexus Technologies.
- Adapters for Matrix electrodes from FHC Inc.

Do we have the right adapter for you?
If not, please do not hesitate to ask us. We will certainly find a solution that fits to your needs, too.

Flexible and easy to use software

The data acquisition and analysis program MC_Rack is highly adaptable with essentially unlimited possibilities.

For routine lab work, the program is set up like an instrument rack on a workbench:



- Combine virtual instruments (e.g. oscilloscope, filter, spike sorter, and many more).
- Virtual instrument rack: Use task-oriented template racks or design your own.
- Select any permutation of data streams for displaying, analyzing, exporting, etc.
- Extract parameters like spike rates in online or offline analysis.
- Apply several virtual filters with different cutoff frequencies e.g. to separate spike activity from local field potentials.

Real-time signal detection and feedback

The real-time signal detection/feedback is an advantageous feature if you need fast and predictable reactions related to recorded analog signals without time delay.

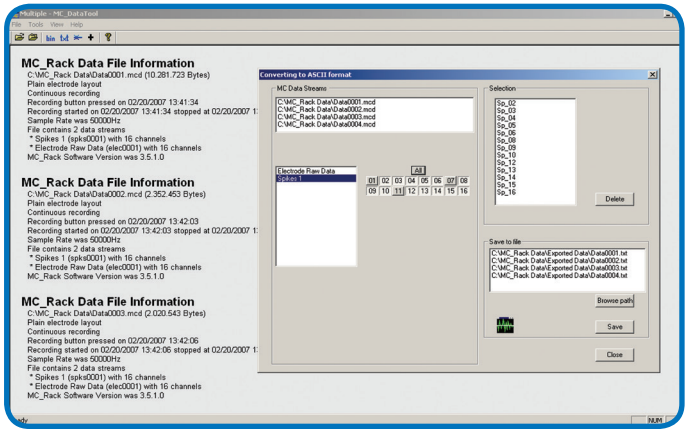
Before, the signal had to be analyzed by the computer, which led to an unpredictable time delay of the stimulus of at least 100 ms. By moving the analysis from the PC to the DSP (Digital Signal Processor) integrated in the Portable-ME-System, the detour is obsolete and the time delay is now far below 1 ms. All you need to do is to define the condition for the feedback and download it to the portable-ME-System (1). During recording (2), the DSP filters the data and detects spikes (3), checking whether your condition is fulfilled. When a designated event is detected, the connected stimulus generator generates the stimulus pulse (4).

MC_Rack export features

You can easily export graphics as bitmap or ASCII directly from the software to your presentation or spreadsheet. Or just pick your favourite offline analysis tool. The data file format is compatible with various programs, like NeuroExplorer and Spike 2.

MC_Rack also supports Neuroshare- a universal file format for data recorded with electrophysiological methods as used e.g. by FIND (a novel tool for spike data analysis - http://find.bccn.uni-freiburg.de).

As an additional tool you can use the powerful data file handling of MC_DataTool: export raw data or spike cutouts from selected channels of interest as Axon Binary File (*.abf), ASCII file (*txt), or as binary file (*.raw).



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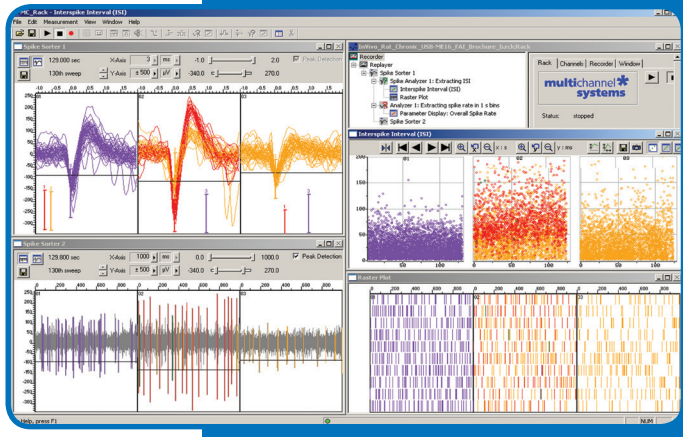
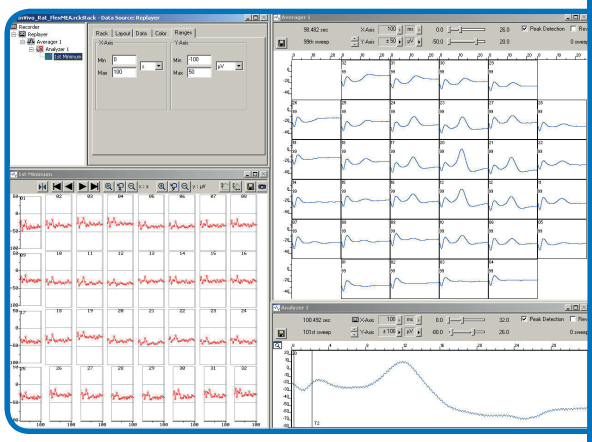
Acute and chronic *in vivo* recordings

The Portable-ME-Systems are compatible with all kinds of *in vivo* electrode arrays on the market. Spike activity from acute or chronically implanted electrodes can be recorded with high resolution. It is possible to monitor any channel as an audio output in real-time, which helps positioning the electrode in the brain. All relevant parameters can be monitored online on all channels. The screenshot on the right shows data from an electrode array chronically implanted in a rat brain. Spikes are sorted online, overall spike rate and unit-specific ISI are monitored simultaneously.





Surface mapping

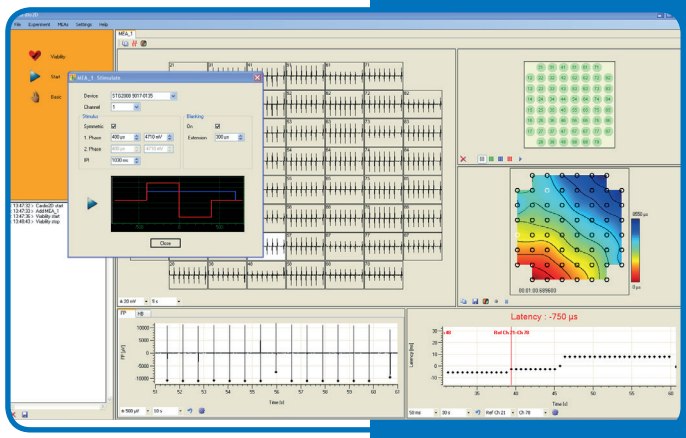
Flexible microelectrode arrays based on polyimide foil can be used to record from a large area at the surface of brain or heart *in vivo* or *ex vivo*. The flexibility of the array allows an optimal electrode-to-tissue contact on uneven surfaces. The image on the left shows signals recorded from a rat barrel cortex with a 32-channel FlexMEA. Signals are averaged and high pass filtered and the minimum of the first signal component is monitored online.

Cardio 2D

Cardio2D is a software package to record cardiac data and analyze for spatial properties of cardiac signal propagation.

With the Portable-ME-System it is possible to perform epicardial mapping recordings or map signal propagation in cardiac slices.

Cardio2D obtains false color coded maps with isochronous lines for local activation times. Conduction velocity is calculated automatically.



Technical specifications

Headstage Preamplifiers

Headstage	MPA8I	MPA32I	µPA16	µPA32
Dimensions (W x D x H)	17 x 25 x 2 mm	27 x 36 x 5 mm	21 x 17 x 2.5 mm	24 x 25 x 3 mm
Weight (w/o cable and plug)	1.3 g	7.0 g	1.5 g	2.0 g
Max. tensile strength of cable	20 N	20 N	20 N	20 N
Input connector type	Single-row precision sockets; 50 mil (1.27 mm) grid pattern for 0.35-0.45 mm round pin	Dual-row precision sockets; 50 mil (1.27 mm) grid pattern for 0.35-0.45 mm round pins	18-pin dual-row Omnetics A79039-001 (NSD-18-DD-GG with 2 guide posts, female)	36-pin dual-row Omnetics A79023-001 (NSD-36-DD-GS with 4 guide posts, female)
Number of input channels	8	32	16	32
Input voltage	± 500 mV (with respect to a supply voltage of 5 V)		± 250 mV (with respect to a supply voltage of 2.5 V)	
Input impedance	1 TΩ (@1 kHz)		1 GΩ (@1 kHz)	
Input capacitance	10 pF		13 pF	
Input noise	< 1.5 μV_{RMS} (1 Hz to 5 kHz, inputs short-circuited)		< 1.2 μV_{RMS} (0.1 Hz to 10 Hz, inputs shortened)	
Noise density	e_n = 15 nV/ √ Hz @ 1 kHz		e_n = 10 nV / √ Hz @ 1 kHz	
Bandwidth	DC to 50 kHz		DC to 50 kHz	
Gain	10		10	

Filter amplifier:

Number of input channels	16 or 32
Input voltage	AC coupled
Input impedance	300 Ω
Input noise	< 1 μV_{RMS} (full bandwidth, inputs short-circuited)
Noise density @ 1 kHz	e_n = 9 nV/√ Hz @ 1 kHz
Bandwidth	1-5000 Hz *
Filter slope	80 db/decade
Gain	100 *

* Other gain and filter settings available on request

Data acquisition:

Sampling frequency	Up to 50 kHz/ channel
Data resolution	16 bit
Crosstalk (channel to channel)	Typically 0.01 %, max. 0.1 %
Number of analog input channels	16 or 32
Number of digital input channels	16 TTL (CMOS 3.3V TTL Level)
Number of digital output channels	16 TTL (CMOS 3.3V TTL Level)

Interface and connectors:

Analog inputs (16 channel version)	2 x 15-pin D-SUB for MPA8I
	1 x 26-pin HD D-SUB for µPA16
Analog inputs (32 channel version)	2 x 26-pin HD D-SUB for µPA16
	1 x 44-pin HD D-SUB for µPA32
16bit digital input and output	68 Pin SCSI-type
Data transfer	USB 2.0 High Speed (true USB 2.0 transfer rate)

MC_Rack program:

Operating system	XP, Vista, 7 or 8 (English and German versions supported)
Data export	Axon Binary File (*.abf), ASCII file (*.txt), binary file (*.raw) format; .NET DLL for use with your own software available

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Distributed by:

SE Smart Ephys | multichannel systems a division of Harvard Bioscience, Inc.

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