In Vivo Solutions for Extracellular Recording

- Freely moving, head-fixed or anesthetized animals
- Wireless or tethered systems
- Scalable to different experimental dimensions

HB

multichannel systems
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Improve Your LIFE Science — Freely Moving, Head Fixed or Anesthetized

In order to fulfill requirements of ever stricter animal welfare regulations worldwide, your *in vivo* electrophysiology gear needs to come with light weight, powerful, low-irritation and small telemetry solutions, or a flexible tethered solution that disturbs your research suspect as little as possible while providing high data quality and depth to reduce the overall number of trials.

Our flexible, modular and scalable amplifier suite concept will help you optimize your workflows.

The unique telemetry system W2100 allows you to record from up to 8 animals at a time, with headstages featuring 4, 8, 16 and 32 channels each, opening ways for social and behavioral studies. Headstage-integrated optical and electrical stimulation options broaden the range of applications. Driven by an intuitive software a feedback function through a programmable signal processor, as well as additional analog inputs on the IFB-C provide highest flexibility — for all experiments you might envision.

Use the same modular software Multi Channel Suite to also control the tethered setup ME2100, in case you choose to work with head fixed, or anesthetized animal models — and work with best-in-class data depth, signal-to-noise ratios, utmost temporal precision, and resolution. Don’t miss a thing — by being flexible in the experimental approaches you choose.

A Solution for Any Set Up

Wireless Recording System

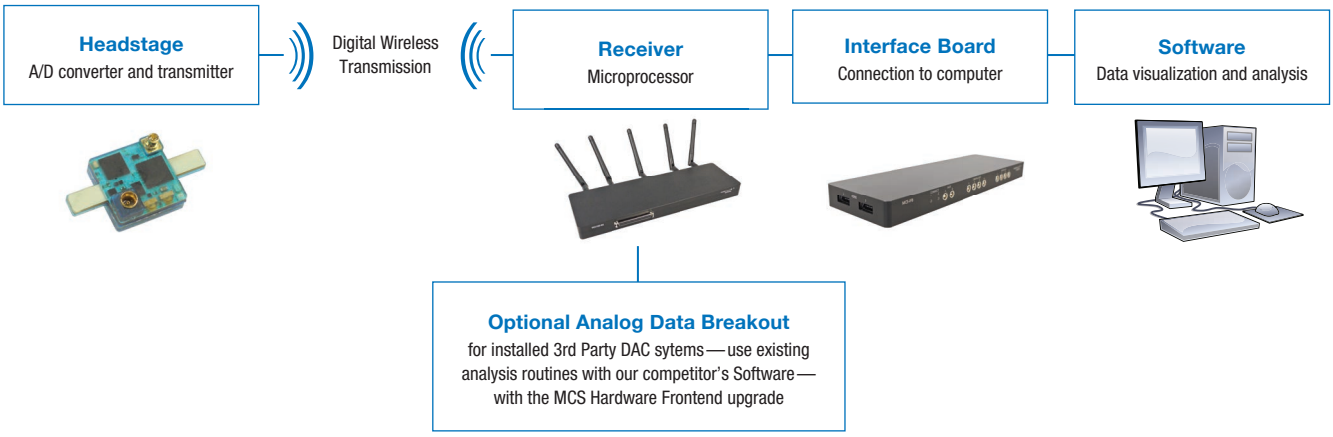
The Wireless-System from Multi Channel Systems is the all-in-one solution for amplifying, recording, and analyzing *in vivo* data sent telemetrically from 4, 8, 16 or 32 channel headstages.

The amplifier bandwidth is 1 Hz to 5 kHz (adjustable to 0.1 Hz or DC by software), sampled at up to 40 kHz per channel simultaneously. With a resolution of 16 bit, the accuracy of your data is guaranteed.

The W2100 comes as a complete working package: Small and light AD-converting headstage amplifiers with onboard LEDs for video tracking, a powerfull data receiver, the MCS Interfaceboard (multiboot option), and a software package for experimental handling and data analysis. All wireless headstages (except the 4-channel versions) are equipped with a triaxial gyroscope and accelerometer sensor, which allows synchronization with electrophysiological data. For parallel experiments, you can record from up to 4 headstages with one receiver.

You can use headstages with optical and electrical stimulation. The biggest advantage of those headstages is that you do not have to give up valuable recording information when stimulating; the headstages can record and stimulate in parallel.

With its excellent signal-to-noise ratio, it is the ideal solution for recording spikes, LFP, EEG, EMG, and ECoG. Additional inputs to the interface board allow the synchronization of your data with external devices.



Video-to-Ephys-Data-Synchronization

The W2100-Video-System allows wireless *in vivo* recordings with precise video-to-data synchronization with up to 50 frames/s.

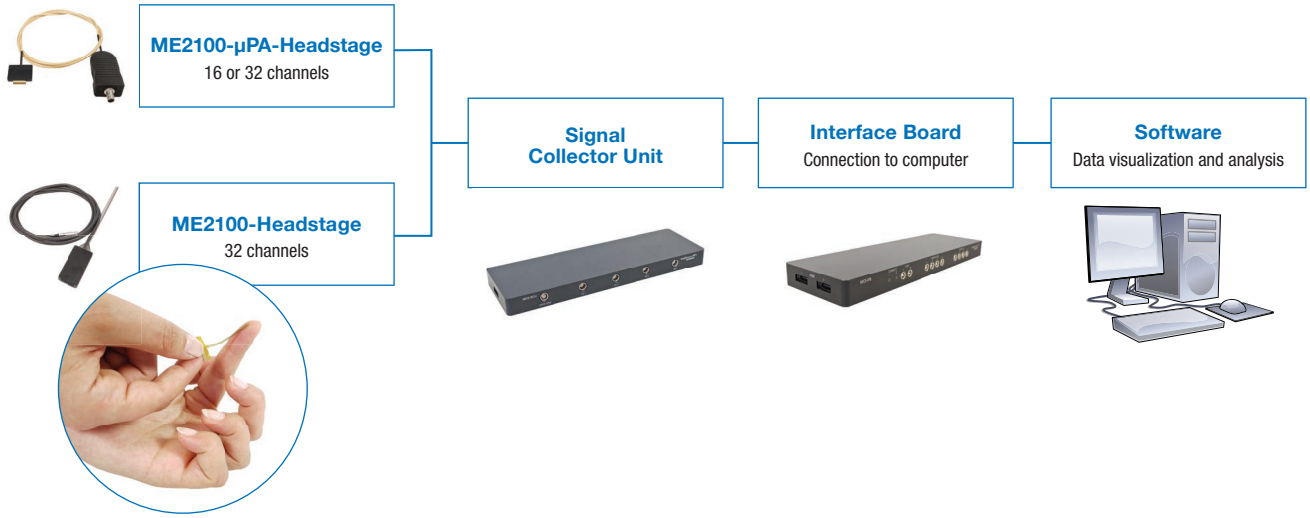
Bidirectional communication between a high quality USB 3.0 camera from IDS and the wireless system allows a precise frame-by-frame synchronization between video and electrophysiological data. Both systems can run on the same PC. IR camera options are available on request.

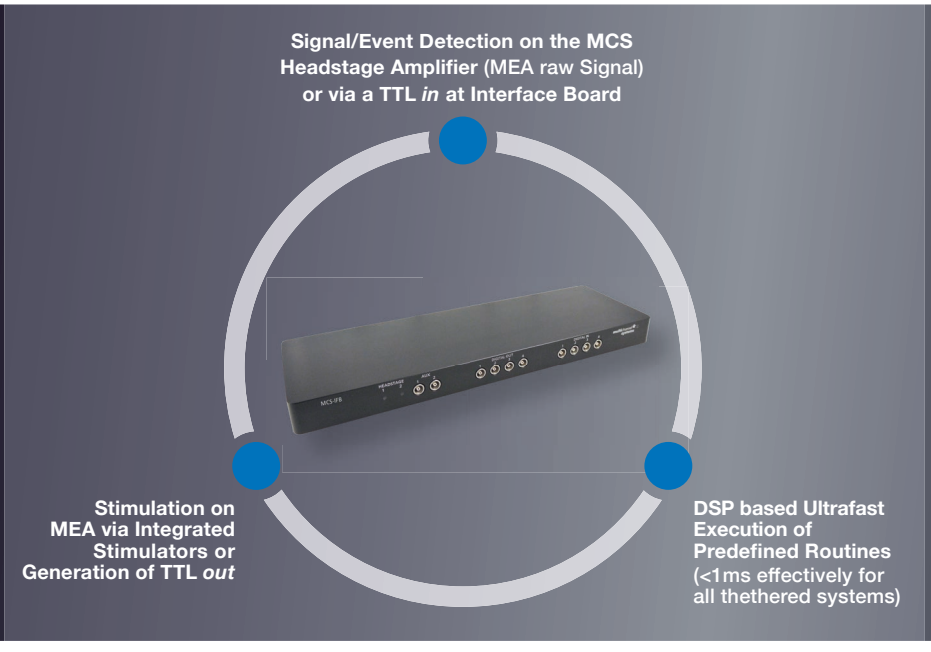
Tethered Recording System: ME2100-System

The ME2100-System is a tethered *in vivo* recording system with 16-256 channels. It is the complete setup for anesthetized/head-fixed animals, including everything you need for your experiment.

The system consists of a signal collector unit for up to four headstages, which also controls up to four optical stimulation units including high power LED (not included). Up to two signal collectors can be connected to one interface board.

The headstage modules of the system have up to 32 recording channels (plus ground and reference inputs). Stimulators, analog preamplifiers and AD converters are all directly on the headstage, which allows low-noise, high quality data acquisition.





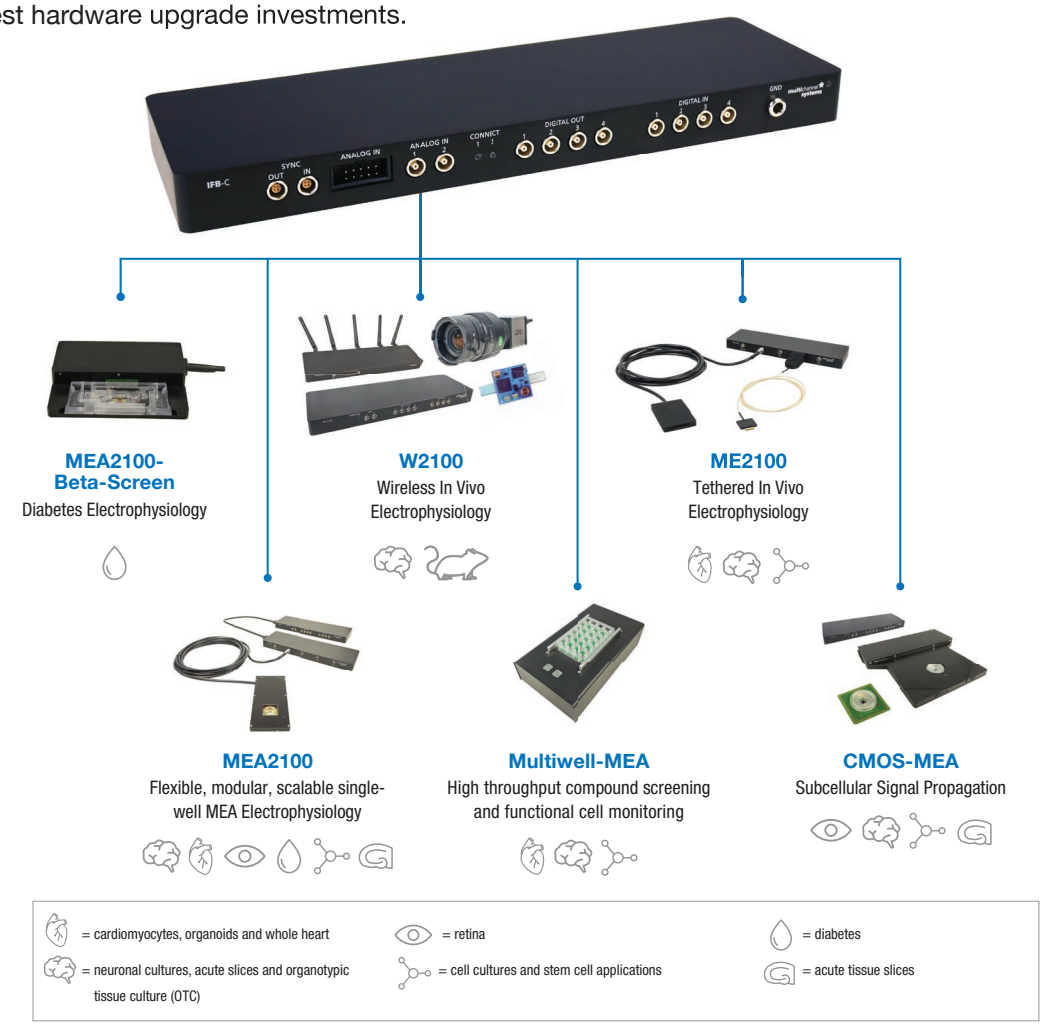
Real-Time Signal Detection and Feedback

The real-time signal detection/feedback is an advantageous feature if you need fast and predictable reactions related to recorded analog signals with minimum time delay. Moving the feedback feature to the onboard DSP shortcuts the detour through a PC (otherwise up to 100ms, depending on OS and performance), and allows feedback stimulation with a delay <1ms.

Interface Board Multiboot

The Multiboot Interface Board facilitates operation of all MCS *in vitro* and in vivo headstages within the entire 2100 amplifier solution suite. This suite includes: MEA2100-HS, Multiwell- MEA-HS, CMOS-MEA-HS, MEA2100-Beta-Screen-HS, W2100-HS and ME2100-HS. The modular 2100 amplifier solution suite design makes it easy to modify your lab equipment generally with modest hardware upgrade investments.

It comes with a freely programmable digital signal processor, which can be used ffor closed-loop stimulation and features various analog and digital in- and outputs for integration of auxiliary data and timestamps for synchronization with other devices.



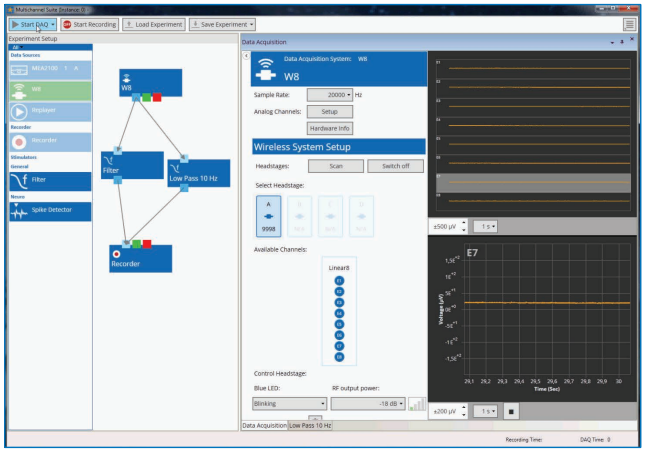
Flexible Microelectrode Arrays

The Natural and Medical Sciences Institute (NMI) in Reutlingen, Germany (www.nmi.de) is a research institute that produces high quality MEAs on a variety of different substrates, with flexible electrode geometries and configurations for many diverse applications. The NMI and Multi Channel Systems have collaborated on many projects and over many years. Together, we have developed flexible microelectrode arrays. The electrodes of FlexMEAs are imbedded in a thin and very flexible polyimide foil. This flexibility allows the attachment of the MEAs tightly to the surface of brain or heart preparations.

FlexMEAs are available with 24, 36 or 72 electrodes of gold or titanium nitride (TiN) on polyimide foil and are the perfect solution for recordings from several species in acute experiments. Contact us for custom designs and contacting.

Powerful Software Package for Online and Offline Analyses

Multi Channel Suite is a complete software solution for reliable acquisition and analysis of electrophysiological data. It is included with all *in vivo*-systems from Multi Channel Systems.

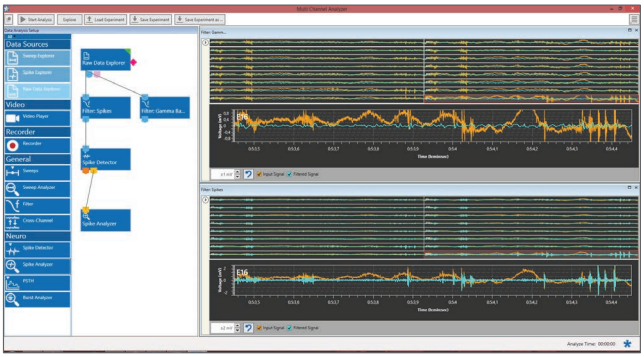


Consisting of three tools, it features:

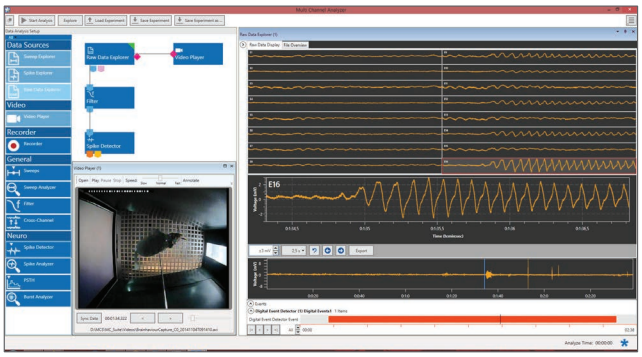
- **Multi Channel Experimenter**: Online real-time recording, graphing, and analysis of extracellular activity of excitable cells for *in vivo* and *in vitro* applications.
- **Multi Channel Analyzer**: Offline analysis of the recorded data.
- **Multi Channel DataManager**: Data export for analysis in Matlab, Neuroexplorer, Spike2, Python, Plexon Offline Sorter or EDF format.
- **Multi Channel VideoControl**: Tool to utilize synchronized video recording with the Wireless System.

Flexible and Easy-to-Use

With daily lab work in mind, the program is set up like an instrument rack on a workbench, allowing you to combine virtual instruments (e.g. recorder, filter, event detector, spike detector, stimulus generator or signal-triggered TTL pulse) in any way you want. The experimental set-up is very flexible and intuitive. All you have to do is choose the instruments by drag'n'drop and connect them, the way you want. Changes to the set-up are always possible.



Data is easily exported into HDF5 format, to process data further in Python or Matlab routines, if intended. Or you can analyze the recorded data in the Multi Channel Analyzer. This tool also offers the import of video data, which can be connected to the recorded data by time stamps.

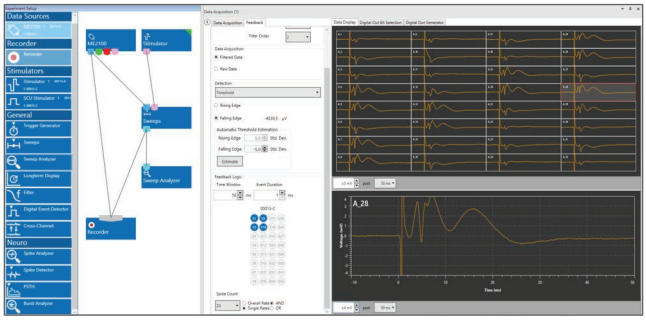


The Multi Channel Suite is an easy-to-use, flexible, yet powerful tool for online and offline data analysis. If your analysis demand is beyond on the shelve software, reach out to MCS support for direct hardware access options, and control your MCS hardware directly with your own code.

Application Examples

Acute and Chronic Recordings with Closed Loop Stimulation

Tethered and wireless recording systems from Multi Channel Systems are compatible with all kinds of *in vivo* electrode arrays on the market. Activity from acute or chronically implanted electrodes can be recorded with 24 bit A/D resolution at up to 50kHz. All relevant parameters can be monitored online on all channels. As a unique feature, the integrated stimulators of the ME2100 and W2100 headstages and the signal processor integrated in the IFB allow closed loop stimulation experiments with very low latencies between a detected event and the resulting stimulation. The screenshot shows data from an ME2100 system set up for closed loop stimulation.



Recording from Freely Moving Animals in Combination with Stimulation and Video Tracking

With the W2100 system, recordings from freely moving animals ranging from mouse to non-human primates are possible. The headstage type and batteries can be adjusted to the animal size. If needed, the electrophysiological recordings can be synchronized frame-by-frame to a constant video stream with the optional W2100-Video-System extension. In addition to recording, there are headstage types available capable of providing optical or electrical stimulation. The fully software-controlled stimulators are integrated in the respective headstage. They can be connected to a selection of stimulation electrodes or LEDs, respectively. The image shows a mouse implanted with an Optrode for optical stimulation, connected to a W2100-HS4-opto headstage with four recording channels.

Integrate study techniques and tools to unlock new opportunities in your research

Our solutions are used in combination with many other technologies for a variety of research applications (e.g. respiratory, behavior, metabolism) in both small and large animal models. The benefits of holistic research include:

- Greater chance of study approval and funding
- Decrease in the number of animals used
- Ability to identify physiological changes from multiple organ systems
- Translational impact

Implantable Telemetry

- Fully implantable continuous, stress-free collection of physiologic data (e.g. EEG, EMG, temperature) from conscious, freely moving laboratory animals of multiple sizes in chronic or acute studies.

Hardwired Acquisition

- Minimally invasive continuous measurement of up to 12 channels of EEG, EMG, EOG, etc. in acute studies of small animals. Compact, Functional, and Flexible Systems
- Complete plug and play data acquisition system with light-weight and functional components
- Modular systems, can be easily upgraded and combined with other instrumentation
- Adapters for all standard microelectrode arrays such as NeuroNexus probes
- Plug-and-play systems

Perfect for a Wide Variety of Applications

- Wireless and tethered systems available
- Real-time signal detection and feedback
- Simultaneous spike and local field potential recording
- Software adjustable filters, build in stimulation, closed loop stimulation
- Multi-unit and single-unit recording from awake behaving animals
- Supports multitrode analysis for improved spike sorting

Powerful Software for Data Acquisition and Analysis

- Flexible data stream management saving disk space
- Data file format compatible with many analysis tools such as Matlab, NeuroExplorer, Spike2, Python, Plexon Offline Sorter or EDF format
- Numerous online analyses from simple data streaming and storage to online spike sorting and spike burst analysis
- Online digital filtering and event detector based on threshold or on waveform
- Multiple ways to display signals for the best presentation of data
- User-friendly graphical interface, free and unlimited software updates

High-Quality Product from the Market Leader

- Developed, produced, and tested in-house in Germany
- Over 20 years of experience in the electrophysiology market
- World-wide distribution network
- Fast, friendly, and qualified support

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