Product Overview
As of March 2011

- *Xenopus* Oocyte Research
- *In vitro* Electrophysiology
- *In vivo* Electrophysiology
New products

Wireless in vivo System
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- All-in-one solution
- 8 channels
- Sampling rate: 20 kHz per channel
- Resolution: 16 bit

New Generation of MEA-Systems:
USB-MEA2100-System

- Flexible contact unit
- 120 recording channels
- Integrated stimulation
- Gain and bandwidth adjustable via software

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- Automated electrophysiology

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- Amplifying, recording, and analyzing
- Amplifying, recording, analyzing, and stimulating

In vivo Electrophysiology
- Recording and analyzing
- Amplifying, recording, and analyzing

Stimulus Generators
- Current and voltage driven stimulation

Software
- Data acquisition and analysis
- Electrical stimulation generation

Microelectrode Arrays
- Contacting

Amplifiers
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- Amplifying
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Accessories
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Xenopus Oocyte Research

- **Automated injection**
  Injection goes automatic: Roboinject

- **Automated electrophysiology**
  Classical usage of compounds: Robooocyte2

- **Automated electrophysiology**
  Non-destructive usage of compounds: HiClamp
Injection goes automatic

Application
Injection of nanoliter volumes of compounds e.g. DNA or mRNA into Xenopus laevis oocytes or other cells of similar size.

Product Features
- Fully automated injection using industry standard 96, 384, as well as custom well plates
- Sequential injection without user intervention
- Injection of up to 4 different samples per well and up to 8 different samples per plate
- Injection freely adjustable from 1 to 100 nl
- Variable injection depth and sample uptake speed
- Automated sample uptake (e.g. RNA or DNA)

Introduction
Until now, injection of nanoliter volumes into cells or embryos has been time-consuming and needed to be performed by highly qualified personnel in order to get reasonable and reproducible results.

Multi Channel Systems is proud to present the Roboinject, the first and only commercially available fully automated robot for compound injection into oocytes, eggs, and embryos using industry standard 96, 384, as well as custom well plates.

The automation of cell injection not only saves time and money, but also greatly enhances reproducibility of injection and survival of cells. It allows your highly qualified personnel to do away with routine work and to concentrate on science.

Technical Data

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<thead>
<tr>
<th></th>
<th>Disposable standard 96, 384, and custom well plates</th>
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<tr>
<td>Usable well plates</td>
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<tr>
<td>Positioning accuracy</td>
<td>20 µm in X, Y and Z dimension</td>
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<tr>
<td>Injection volume</td>
<td>1 - 100 nl</td>
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<tr>
<td>Average time needed for 96 injections</td>
<td>8 min</td>
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<tr>
<td>Movement time from well to well</td>
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</table>
Introduction

Oocytes of the frog *Xenopus laevis* are widely used as an expression system for ion channels and receptors in drug development. They are big, robust cells (about 1–1.2 mm in diameter), can be obtained in large numbers, and are easy to handle. Until now, the low throughput of electrophysiology has prevented its use for secondary functional screening of drug targets.

Multi Channel Systems has developed the Roboocyte2, an all-in-one solution for high throughput secondary screenings. All necessary tasks are accomplished by one single robot. The Roboocyte2 is the only instrument currently available which automates the subsequent two-electrode voltage clamp (TEVC) recording in oocytes, using standard 96-well plates as well as compound application and cell wash.

Application

Screening of ion channels and electrogenic transporters.

Product Features

- Recording of 96 oocytes without supervision
- Automated TEVC recording
- Integrated digital TEVC amplifier
- Voltage-gated, ligand-activated channels, and electrogenic transporters
- Automated compound application
- Automated cell wash

Technical Data

<table>
<thead>
<tr>
<th>Sampling rate</th>
<th>10 kHz, 5 kHz, 2 kHz, 1 kHz, 500 Hz, ..., 1 Hz</th>
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<tbody>
<tr>
<td>Data resolution</td>
<td>16 bits</td>
</tr>
<tr>
<td>Typical rise time</td>
<td>1 ms</td>
</tr>
</tbody>
</table>
Non-destructive usage of compounds

Application
Screening of ion channels and electrogenic transporters.

HiClamp
Automated electrophysiology

Product Features
- Fast drug application
- Minimal compound usage
- Non-destructive usage of compounds
- Works with 200 µl sample volume
- Fully-automated system

Introduction
The HiClamp is built around an entirely new concept: Instead of applying solutions to the oocytes, the HiClamp carries each cell from one compound to the other. Oocytes are transferred automatically one after the other from a 96-well plate into a silver wire basket serving as reference electrode. After automatic impalement of the intracellular glass microelectrodes, the basket is moved together with the oocyte from one compound-containing well to the other. Programmable washing steps effectively prevent cross-contamination between different compounds. The built-in digital amplifier guarantees a stable and accurate voltage-clamp resulting in precise and reproducible current recordings.

Technical Data

<table>
<thead>
<tr>
<th>Sampling rate</th>
<th>10 kHz, 5 kHz, 2 kHz, 1 kHz, 500 Hz, ..., 1 Hz</th>
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<tr>
<td>Data resolution</td>
<td>16 bits</td>
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<tr>
<td>Typical rise time</td>
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</table>
**In vitro Electrophysiology**

- **Recording and analyzing**
  Data acquisition with USB High Speed

- **Amplifying, recording, and analyzing**
  Complete systems with data acquisition card

- **Amplifying, recording, and analyzing**
  Complete systems with USB High Speed

- **Amplifying, recording, and analyzing**
  Integrated system with USB High Speed

- **Amplifying, recording, analyzing, and stimulating**
  Acute hippocampal slice recording system

- **Amplifying, recording, analyzing, and stimulating**
  The new generation of MEA-Systems

**NEW!**
Data acquisition systems with USB High Speed featuring real-time signal detection and feedback

Application
Data acquisition with 64, 128 or 256 channels. Controlling and synchronizing of other devices with TTL pulses. Online and offline analysis via MC_Rack software.

USB-ME-System

Product Features
- Real-time signal detection and feedback
- Portable and flexible
- USB 2.0 High Speed data transfer
- Data acquisition software MC_Rack included

Introduction
The USB-ME-System is a complete plug-and-play data acquisition system based on signal processing technology. Depending on the number of channels, you can connect one, two or four amplifiers at the same time, running different experiments on each of them. Open the data acquisition and analysis software MC_Rack up to four times at once and control your amplifiers independently.

The USB-ME-System has an integrated DSP (Digital Signal Processor) which makes real-time signal detection/feedback possible.

Record in vivo or in vitro - everything is possible from 64 up to 256 channels. Plus you can synchronize more than one USB-ME-System to record from an even higher number of channels.

Technical Data

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
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<tbody>
<tr>
<td>Analog input channels</td>
<td>64, 128 or 256</td>
</tr>
<tr>
<td>Input voltage</td>
<td>± 4 V</td>
</tr>
<tr>
<td>Digital input channels</td>
<td>16</td>
</tr>
<tr>
<td>Digital output channels</td>
<td>16</td>
</tr>
<tr>
<td>Sampling frequency</td>
<td>up to 50 kHz/channel</td>
</tr>
<tr>
<td>Data resolution</td>
<td>16 bit</td>
</tr>
</tbody>
</table>
**Introduction**

The Microelectrode Array (MEA)-System is a compact and innovative tool for *in vitro* experiments. It consists of a data acquisition computer, a MEA amplifier, MEAs, and a temperature controller. You can place cell and tissue preparations from heart, brain, and muscle on the MEA and record the electrophysiological signals with the MEA amplifier. The signals are then analyzed with the included software.

The modular principle offers various possibilities for setup expansions with perfusion and stimulation devices.

The MEA-System is an easy and straightforward solution to apply electrophysiological techniques for drug screening and basic research. Numerous publications in scientific journals prove its versatility and reliability.

**Product Features**

- Versions for upright and inverted microscopes
- Widest range of MEAs available on the market
- Unlimited and free: flexible data acquisition and analysis software MC_Rack
- Easy adaption to our stimulus generators
- Stimulus artifact suppression
- Expandable to multiple amplifier system

**Technical Data**

<table>
<thead>
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<th>Parameter</th>
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<td>Digital output channels</td>
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<td>Data resolution</td>
<td>14 bit</td>
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<tr>
<td>Broad range of amplifier settings</td>
<td>(bandwidth and gain)</td>
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</table>
Complete systems with USB
High Speed featuring real-time
signal detection and feedback

Application
Non-invasive extracellular multisite recording
with microelectrode arrays from neuronal and
cardiac slice preparations or cultures, including
stem cells and cell lines.
The ideal solution for drug screening and
discovery as well as for safety pharmacology in
the field of cardiac and neuronal research.

Introduction
The USB-MEA-System is similar to the MEA-
System with data acquisition card. The
only difference is that the MEA amplifier is
connected to a USB-ME-System instead of a
data acquisition card. The advantage is that
you can run your experiment on any desktop
PC or notebook. This system also enables you
to make electrical activity audible in real-time.
Furthermore, by moving the analysis from
the PC to the DSP (Digital Signal Processor)
integrated in the USB-ME-System hardware,
real-time signal detection/feedback is possible.
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.
It is also the only system worldwide that enables
you to run four experiments simultaneously,
but completely independently from each other.

USB-MEA-System

Product Features
• Real-time signal detection and feedback
• Versions for upright and inverted microscopes
• Widest range of MEAs available on the market
• Unlimited and free: flexible data acquisition and analysis software
  MC_Rack
• Easy adaption to our stimulus generators.
• Stimulus artifact suppression
• Expandable to multiple amplifier system with independent setups
• Real-time audio channel

Technical Data

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
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<tbody>
<tr>
<td>Analog input channels</td>
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<td>Input voltage</td>
<td>± 4 V</td>
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<td>Digital input channels</td>
<td>16</td>
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<td>Digital output channels</td>
<td>16</td>
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<tr>
<td>Sampling frequency</td>
<td>up to 50 kHz/channel</td>
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<tr>
<td>Data resolution</td>
<td>16 bit</td>
</tr>
<tr>
<td>Broad range of amplifier settings (bandwidth and gain)</td>
<td></td>
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</table>
**Integrated system with USB High Speed**

**Application**
Non-invasive extracellular 256 channel recording with microelectrode arrays from neuronal and cardiac slice preparations or cultures, including stem cells and cell lines.
The ideal solution for drug screening and discovery, as well as for safety pharmacology in the field of cardiac and neuronal research.

**Introduction**
The USB-MEA256-System is a stand-alone data acquisition system based on signal processing technology. All necessary components are combined in one device. You can record from 252+4 channels, i.e. 252 channels from the microelectrode array plus 4 additional channels that can be used for simultaneous patch clamp recordings or any other analog signals such as temperature, pH, etc.
The high number of electrodes has two main benefits. First, you can cover a large area to record from different spots on your preparation. Second, the higher density of electrodes provides a better spatial resolution of the signal propagation. Furthermore, when using our multiwell-MEAs, you can run up to 9 experiments simultaneously on one system. All analog signals are converted to digital data streams through the integrated analog/digital board. The integrated heating system makes this a ready-to-go-setup. If you want, it is easy to adapt our stimulus generators for current and voltage driven stimulation. Each electrode is selectable for stimulation.

**Product Features**
- One version for upright and inverted microscopes
- Multiwell-MEAs available
- Unlimited and free: flexible data acquisition and analysis software MC_Rack
- 256 channels for recording and stimulation
- Easy adaption to our stimulus generators
- Expandable to multiple amplifier system with up to four units (total of 1024 channels)

**Technical Data**

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<tr>
<td>Additional analog channels</td>
<td>4</td>
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<td>Input voltage</td>
<td>± 4 V</td>
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<td>Digital input channels</td>
<td>16</td>
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<tr>
<td>Digital output channels</td>
<td>16</td>
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<td>Sampling frequency</td>
<td>up to 40 kHz/channel</td>
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<tr>
<td>Data resolution</td>
<td>16 bit</td>
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<tr>
<td>Possible bandwidth</td>
<td>1 Hz - 3 kHz</td>
</tr>
<tr>
<td>Gain</td>
<td>1100</td>
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</table>
Acute hippocampal slice recording system

Application
Non-invasive extracellular multisite recording with perforated microelectrode arrays from acute hippocampal slices, including stimulation for standard LTP and LTD experiments.

Introduction
The acute hippocampal slice recording system, USB-MEA32-STIM4-System, is a stand-alone solution for extracellular recording and stimulation using perforated microelectrode arrays (pMEAs). It is designed specifically for experiments with acute hippocampal slices, but can be used for all acute slice preparations. It contains a 32 channel amplifier and data acquisition, as well as a four channel current stimulator. Perfusion heating, and the possibility to apply suction through the pMEAs are also included.

The system is compact and can be used on a standard lab bench. Up to four units can be operated independently from one computer.

The system comes with our standard software package MC_Rack. Optionally, you can use the software package LTP Director and LTP Analyzer, which are specially designed to run standard LTP/LTD experiments. LTP Director includes the control of recording, stimulation, and electrode selection as well as an integrated documentation of the experiment.

USB-MEA32-STIM4-System

Product Features
- Stand-alone solution
- Unlimited and free: flexible data acquisition and analysis software MC_Rack
- Optional software package for LTP and LTD experiments
- Expandable to multiple system with 4 independent setups
- MEA layouts optimized for brain slice recordings with 32 recording and 12 stimulation electrodes
- Compatible constant vacuum pump with pressure control available

Technical Data

<table>
<thead>
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<th>Feature</th>
<th>Specification</th>
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<tbody>
<tr>
<td>Recording channels</td>
<td>32</td>
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<tr>
<td>Input voltage</td>
<td>± 4 V</td>
</tr>
<tr>
<td>Sampling frequency</td>
<td>up to 50 kHz/channel</td>
</tr>
<tr>
<td>Data resolution</td>
<td>16 bit</td>
</tr>
<tr>
<td>Possible bandwidth</td>
<td>0.5 Hz - 3 kHz</td>
</tr>
<tr>
<td>Gain</td>
<td>1000</td>
</tr>
<tr>
<td>Stimulation channels</td>
<td>4</td>
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<tr>
<td>Output current</td>
<td>± 256 µA</td>
</tr>
<tr>
<td>Time resolution of stimulation</td>
<td>20 µs</td>
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</table>
Application
Non-invasive extracellular multisite recording with microelectrode arrays from neuronal and cardiac slice preparations or cultures, including stem cells and cell lines. The ideal solution for drug screening and discovery as well as for safety pharmacology in the field of cardiac and neuronal research.

Introduction
Extending the Multi Channel Systems MEA-product family, the MEA2100-System follows the tradition of high-quality, low-noise amplifiers. It is the complete setup for extracellular recordings from microelectrode arrays (MEAs). It includes everything you need for your experiment: data acquisition computer with software, interface board, MEA-headstage with integrated stimulation, MEAs, as well as temperature control and perfusion canulla. Due to its small-sized design you can position the MEA-headstage on any inverted or upright microscope. It is connected via only one MCS High Speed cable to the interface board, which offers various digital and analog in-/outputs for synchronization with other instruments.

Technical Data

<table>
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<td><strong>Amplifier</strong></td>
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<td>Data resolution</td>
<td>16 bit</td>
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<td>Number of recording channels</td>
<td>120</td>
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<tr>
<td><strong>Stimulus Generator</strong></td>
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<td>Number of stimulation signals</td>
<td>3</td>
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<tr>
<td>Current mode</td>
<td>± 1 mA</td>
</tr>
<tr>
<td>Voltage mode</td>
<td>±10 V</td>
</tr>
<tr>
<td><strong>Data converter and USB interface</strong></td>
<td></td>
</tr>
<tr>
<td>Sampling rate per channel</td>
<td>up to 50 kHz</td>
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</tbody>
</table>

Flexibility
The main advantage of the MEA2100-System is its flexibility. Multi Channel Systems offers various contact units for the MEA-headstage. You can decide whether to work with one 60-electrode MEA, one 120-electrode MEA, or even two 60-electrode MEAs (other variants under development). The contact unit of the MEA-headstage can be exchanged later on according to your experimental needs. The rest of the setup is not affected, so the exchange of the contact unit is uncomplicated, quick, and cost-effective.

The flexibility of the MEA-2100-System is also shown in the possibility to connect two MEA-headstages to the interface board. This way, you can record from up to 240 channels. By e.g. using two headstages with two 60-electrode MEAs each, you have a four-fold system and increased throughput. The headstages are controlled completely independently by opening the data acquisition software MC_Rack multiple times.
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 interface board of the MEA2100-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 interface board (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 integrated stimulus generator generates the stimulus pulse (4).

Product Features
• Integrated stimulation
• Gain and bandwidth adjustable via software
• Variable contact unit
• Expandable to multiple amplifier system
• Unlimited and free: flexible data acquisition and analysis software MC_Rack
**In vivo Electrophysiology**

- **Recording and analyzing**
  Data acquisition systems with USB 2.0 High Speed

- **Amplifying, recording, and analyzing**
  Wireless *in vivo* System

- **Amplifying, recording, and analyzing**
  Complete systems with USB 2.0 High Speed

- **Amplifying, recording, and analyzing**
  Integrated systems with USB 2.0 High Speed
Data acquisition systems with USB High Speed featuring real-time signal detection and feedback

Product Features
- Real-time signal detection and feedback
- Portable and flexible
- USB 2.0 High Speed data transfer
- Data acquisition software MC_Rack included

Technical Data
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<tbody>
<tr>
<td>Analog input channels</td>
<td>64, 128 or 256</td>
</tr>
<tr>
<td>Input voltage</td>
<td>± 4 V</td>
</tr>
<tr>
<td>Digital input channels</td>
<td>16</td>
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<tr>
<td>Digital output channels</td>
<td>16</td>
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<tr>
<td>Sampling frequency</td>
<td>up to 50 kHz/channel</td>
</tr>
<tr>
<td>Data resolution</td>
<td>16 bit</td>
</tr>
</tbody>
</table>

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

Depending on the number of channels, you can connect one, two or four amplifiers at the same time running different experiments on each of them. Open the data acquisition and analysis software MC_Rack up to four times at once and control your amplifiers independently.

The USB-ME-System has an integrated DSP (Digital Signal Processor) which makes real-time signal detection/feedback possible.

Record in vivo or in vitro - everything is possible from 64 up to 256 channels. Plus you can synchronize more than one USB-ME-System to record from an even higher number of channels.

Application
Recording of neuronal activity in freely moving animals.
**Introduction**

The brand new wireless *in vivo* system is the all-in-one solution for amplifying, recording, and analyzing *in vivo* data from 8 channels. With a resolution of 16 bit and a 20 kHz sampling rate per channel, the accuracy of your data is guaranteed.

The system includes everything you need: Small-sized headstage with integrated A/D converter, digitized transmission, powerful receiver, as well as the well-known and widely-used software package MC_Rack.

With its excellent signal-to-noise ratio, it is the ideal solution for spikes, LFP, EEC, ECG, and ECoG.

Additional inputs to the receiver allow the synchronization of the data with external devices.

**Product Features**

- 8 channels
- 16 bit resolution
- 20 kHz sampling rate per channel
- Lightweight headstage
- Wide effective range (5m)
Amplifying, recording, and analyzing

**W8-System**

**Energy-efficiency and flexibility**

All devices of the W8-System are designed to be energy-efficient. They are all powered via USB, there is no need for extra power supply. The battery of the headstage permits continuous recording of about 2 hours. Recharging is then realized via USB, too.

For power-saving, you can switch the headstage to stand-by mode or switch it off completely via the software MC_Rack. When switching on, you can either press a button on the headstage or use an infrared flashlight in order to not disturb the animal.

For maximum flexibility, we offer headstages with connections to all probes. Just let us know which probe you want to use and we will provide the corresponding connector. Moreover, depending on your experiment, you can also decide where to position the battery of the headstage. Either fix it on the headstage itself or use a special backpack. Independent of your decision, be sure that the battery is small and lightweight in order to not influence your experiment.

**Recording in freely moving animals**

Innovative wireless recording systems with extremely small and lightweight headstages allow the recording of neuronal activity in freely moving animals. A/D conversion at up to 20 kHz sampling rate in the headstage dramatically decreases the amount of transmitted data and enables a long transmission range and low power consumption at the same time. This makes flexible long time experiments in large environments possible.

**Technical Data**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
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</thead>
<tbody>
<tr>
<td>Recording channels</td>
<td>8</td>
</tr>
<tr>
<td>Dimension of headstage</td>
<td>15 x 15 x 5 mm (+ battery)</td>
</tr>
<tr>
<td>Weight of headstage</td>
<td>5 g (+ battery)</td>
</tr>
<tr>
<td>Battery life</td>
<td>approx. 2 hours (recording) approx. 80 days (stand-by)</td>
</tr>
<tr>
<td>Sampling frequency</td>
<td>20 kHz/channel</td>
</tr>
<tr>
<td>Data resolution</td>
<td>16 bit</td>
</tr>
<tr>
<td>Max. distance between headstage and receiver</td>
<td>5 m</td>
</tr>
<tr>
<td>Control interface</td>
<td>USB 2.0</td>
</tr>
</tbody>
</table>
**In vivo Electrophysiology**

**Integrated systems with USB High Speed**

**Application**
Non-invasive extracellular multisite recording with microelectrode arrays *in vivo*.
Bring your knowledge from *in vitro* experiments on a new level and find answers to effects in the living organism.

**USB-ME-FAI-System**

**Introduction**
For a multitude of applications we offer a small and compact solution. The USB-ME-FAI-System is a complete plug-and-play data acquisition system based on signal processing technology. It includes all components you need to start your experiment immediately, so you can acquire data from either 16 or 32 channels. The system includes headstages with eight or 32 channels and a compatible filter amplifier. A standard USB-cable establishes the connection to your PC or notebook.

The systems are portable and can travel with you. MC_Rack data acquisition software is included and is very flexible for many types of experiments. This is a complete all-in-one solution for a variety of *in vivo* and some *in vitro* applications. The size, cost, and ease of use make it an ideal system for many different applications.

**Product Features**
- All-in-one solution
- Portable and flexible
- Real-time signal detection and feedback
- Lightweight miniature preamplifiers
- Adapters to almost all available acute and chronic probes

**Technical Data**

<table>
<thead>
<tr>
<th><strong>Headstage</strong></th>
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<tr>
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<td>8 or 32</td>
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<tr>
<td>Input voltage</td>
<td>± 500 mV (supply voltage of 5 V)</td>
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<tr>
<td>Bandwidth</td>
<td>DC to 50 kHz</td>
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<tr>
<td>Gain</td>
<td>10</td>
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<table>
<thead>
<tr>
<th><strong>Filter amplifier</strong></th>
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<td>Input voltage</td>
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<td>Digital input channels</td>
<td>16</td>
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<tr>
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<tr>
<td>Sampling frequency</td>
<td>up to 50 kHz/channel</td>
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<tr>
<td>Data resolution</td>
<td>16 bit</td>
</tr>
<tr>
<td>Bandwidth</td>
<td>1 Hz - 5 kHz</td>
</tr>
<tr>
<td>Gain</td>
<td>100</td>
</tr>
</tbody>
</table>
Complete systems with USB High Speed

Introduction
The USB-ME-PGA/FAI-Systems are complete system solutions for in vivo recordings with microelectrode arrays. These include lightweight miniature headstage amplifiers, filter amplifiers with or without programmable gain, and a USB data acquisition box to record from 64 up to 256 channels in real-time. Just connect your amplifier to a USB-ME-System to run your experiment on any desktop PC or notebook. Listen to audible electrical activity in real-time. By moving the analysis from the PC to the DSP (Digital Signal Processor) integrated in the USB-ME-System hardware, real-time signal detection/feedback is possible.

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. These are the only systems in the world, that enable you to run four completely independent experiments simultaneously.

Application
Non-invasive extracellular multisite recording with microelectrode arrays in vivo.
Bring your knowledge from in vitro experiments on a new level and find answers to effects in the living organism.

USB-ME-PGA/FAI-System

Product Features
- Lightweight miniature preamplifiers
- Filter amplifiers with customizable bandwidth
- Advanced filter amplifiers with programmable gain
- Adapters to most available acute and chronic probes
- Expandable to multiple amplifier systems

Technical Data

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrode channels</td>
<td>64, 128 or 256</td>
</tr>
<tr>
<td>Input voltage</td>
<td>± 4 V</td>
</tr>
<tr>
<td>Digital input channels</td>
<td>16</td>
</tr>
<tr>
<td>Digital output channels</td>
<td>16</td>
</tr>
<tr>
<td>Sampling frequency</td>
<td>up to 50 kHz/channel</td>
</tr>
<tr>
<td>Data resolution</td>
<td>16 bit</td>
</tr>
</tbody>
</table>
• **Current and voltage driven stimulation**

Stimulus generators with integrated isolation units
Stimulus generators with integrated isolation units

Application

Neuronal networks:
- Long-term, feedback, and white noise stimulation.
- Biological signals as stimulation patterns.

Brain slices:
- Flexible LTP induction patterns.
- Studies of synaptic plasticity.

Skeletal muscle:
- Evoke isometric and isotonic contractions.

Cardiac cells and tissues:
- Pace cardiac cell cultures, slices, purkinje fibers, or papillary muscle.

Stem cells:
- Mimic cardiac or neuronal environment.

STG4000-Series

Introduction

The 4000 series stimulus generators operate in voltage or current mode. The respective mode is software selected. 2, 4 or 8 completely independent stimulus outputs are available. Every single output is optically isolated and has the ability to provide any arbitrary analog waveform as a stimulation signal. Every STG comes with MC_Stimulus II software. Furthermore, for every single stimulus output, there is one TTL in- and output, so you can synchronize your data acquisition or trigger other devices. You can dynamically change the output signal and downstream pulses during stimulation.

The standard multi file mode allows you to switch between different stimulus patterns on the same electrode. You can have as many files as your specific STG has output channels. The extended multi file mode for the STGs with 4 and 8 output channels allows even more: up to 256 stimulation patterns can be assigned to one or more outputs of the stimulus generator.

Product Features

- Current and voltage driven stimulation
- Completely software driven
- Integrated isolation units for each channel
- Each channel optically isolated
- Each channel has one TTL in- and output
- Arbitrary analog waveforms
- Each channel - all features - full flexibility

Technical Data

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog output channels</td>
<td>2, 4 or 8</td>
</tr>
<tr>
<td>Voltage output</td>
<td>-8 V to +8 V @ ± 20 mA</td>
</tr>
<tr>
<td>Voltage output resolution</td>
<td>1 mV</td>
</tr>
<tr>
<td>Voltage output slope</td>
<td>&gt; 4 V/µs</td>
</tr>
<tr>
<td>Current output</td>
<td>-160 μA to +160 μA @ 120 V</td>
</tr>
<tr>
<td></td>
<td>-1.6 mA to +1.6 mA @ 120 V</td>
</tr>
<tr>
<td></td>
<td>-16 mA to +16 mA @ 120 V</td>
</tr>
<tr>
<td>Resolution</td>
<td>14 bit</td>
</tr>
<tr>
<td>Time resolution</td>
<td>20 µs</td>
</tr>
</tbody>
</table>
Software

• **Data acquisition and analysis**
  Flexible and powerful: MC_Rack

• **Data acquisition and analysis**
  Semi-automated QT-prolongation studies: QT-Lite

• **Data acquisition and analysis**
  Excitation patterns and conduction velocity studies: Cardio2D

• **Data acquisition, analysis, and stimulation**
  Long-term potentiation and long-term depression studies: LTP-Director

• **Electrical stimulus generation**
  Current or voltage driven stimulation: MC_Stimulus II and STG Lite
MC_Rack

Product Features

- Recording, graphing, and online or offline analysis in real-time
- Free software updates from our website
- Free support via email or phone
- Free tutorials with application examples
- Free demo data and sample racks
- Free add-on program for exporting data: MC_DataTool

Technical Data

<table>
<thead>
<tr>
<th>Operating system</th>
<th>Microsoft Windows® 7, Vista or XP with NTFS; English and German versions supported</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data export</td>
<td>Axon Binary File (<em>.abf), ASCII file (</em>.txt), and binary file (*.raw) format</td>
</tr>
<tr>
<td>Data file format compatible with</td>
<td>NeuroExplorer, Spike2, Offline Sorter, Signal Data Explorer, sigTool, FIND, Chronux, MEA Tools</td>
</tr>
</tbody>
</table>
Software

Semi-automated QT-prolongation studies

Application
QT-Lite is a complete software solution for reliable acquisition and analysis of electrophysiological data from multi-well microelectrode arrays. Test drugs on cardiomyocytes - be they primary cells, derived from stem cells, or iPS cells - for their potential to block sodium, calcium, and potassium channels.

Introduction
QT-Lite is an easy to use data acquisition and analysis program customized for drug testing on cultured cardiomyocytes. Cells cultured on multi-well microelectrode arrays allow increasing the throughput of the assay. The QT-Lite software will measure the QT interval and sodium peak, as well as analyze for proarrhythmic events. The software will calculate dose response curves and even generate a complete report sheet to assist the safety pharmacologist in cardiac risk estimation of novel drug candidates. The assay is based on primary cardiomyocytes or stem cell derived cardiomyocytes. QT-Lite runs on all kinds of Multi Channel Systems MEA-Systems.

Product Features
- Measure cardiac field potential duration
- Detect proarrhythmic events
- Increase throughput by multi-well microelectrode arrays
- Standardized experiments
- Simplified analysis through automated dose response curve generation
- Automated report sheet generation

Technical Data

<table>
<thead>
<tr>
<th>Operating system</th>
<th>Microsoft Windows® 7, Vista or XP with NTFS; English and German versions supported</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data acquisition and online monitoring</td>
<td>QT-Lite</td>
</tr>
<tr>
<td>Data analysis, display, report sheet generation</td>
<td>QT-Analyzer</td>
</tr>
</tbody>
</table>
Excitation patterns and conduction velocity studies

Cardio2D

Product Features
- Map cardiac field potential propagation
- Create local activation time plots
- Measure conduction velocity
- Create false color plots
- Display cardiac waves as a movie

Application
Cardio2D is used to acquire and analyze cardiac data from cardiac cells and tissue via microelectrode arrays. The software focuses on spatiotemporal properties such as local activation time patterns and conduction velocity as well as the visualization of this data.

Introduction
Cardio2D has a data acquisition and an analysis module. It is used to analyze cardiac cell and tissue cultures for signal propagation properties. This includes conduction velocity, local activation time maps, and signal propagation movies. The software can be used to map activation patterns on the surface of a heart, in a cardiac slice or in cardiac cell cultures.
Cardio2D allows monitoring for re-entry cycles – an important indicator in the generation of atrial fibrillation. It can also be used to evaluate the integration of stem cell derived cardiomyocytes into cardiac tissue in vitro and in vivo.

Technical Data

<table>
<thead>
<tr>
<th>Operating system</th>
<th>Microsoft Windows® 7, Vista or XP with NTFS; English and German versions supported</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data acquisition, online monitoring, and movie generation</td>
<td>Cardio2D</td>
</tr>
<tr>
<td>Data analysis, display, and movie generation</td>
<td>Cardio2D+</td>
</tr>
</tbody>
</table>
Software

Long-term potentiation and depression studies

Application
LTP-Director is a specialized software solution to run standardized LTP (long-term potentiation) experiments in hippocampal slices. It features complete control of recording and stimulation, as well as automated perfusion, online data analysis, and documentation of the experiments.

Introduction
The LTP-Director/LTP-Analyzer software package is designed to run and analyze standardized LTP and LTD experiments in hippocampal slices. You can control the recording, stimulation, and perfusion equipment from within one software. It is possible to set up the complete experiment in advance and then run it automatically. All relevant experimental parameters are documented and saved together with the acquired data in one file.

Multiple parameters, for example EPSP slopes and population spike amplitudes, can be analyzed in parallel, online or offline. Results can be normalized to control conditions directly within the software and exported to a database as ASCII data. The softwares’ main advantages are user friendliness and reproducibility of experimental conditions. The LTP-Director/LTP-Analyzer software package is compatible with all MEA-Systems with blanking circuit and the USB-MEA32-STIM4-System.

Product Features
- User friendly
- Standardized experiments
- Control stimulation
- Control drug delivery and perfusion
- Automated report sheet generation

Technical Data

<table>
<thead>
<tr>
<th>Operating system</th>
<th>Microsoft Windows ® 7, Vista or XP with NTFS; English and German versions supported</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data acquisition, stimulation, and online monitoring</td>
<td>LTP-Director</td>
</tr>
<tr>
<td>Data analysis, display, report sheet generation</td>
<td>LTP-Analyzer</td>
</tr>
</tbody>
</table>
Current or voltage driven stimulation

MC_Stimulus is the software solution that is used to control our STG series stimulus generators. You can choose between current or voltage driven stimulation. Freely design waveforms, be it pulses, ramps or sine waves, import (ASCII), and download complex stimulus pulses to the STG.

Product Features

- Extremely flexible
- Stimulation patterns of unlimited complexity on each output channel
- Import and edit files generated by external programs (e.g. biological signals)

Technical Data

<table>
<thead>
<tr>
<th>Operating system</th>
<th>Microsoft Windows® 7, Vista or XP with NTFS; English and German versions supported</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data import</td>
<td>ASCII file format</td>
</tr>
</tbody>
</table>

Introduction

MC_Stimulus is a flexible software solution to control the STG series stimulus generators. One can program current and voltage pulses and download the stimulation patterns into the stimulus generator. Pulse patterns can be as simple as rectangular pulses or as complex as biological signal shapes or even white noise.

For simple protocols the separate STG-Lite-software provides a simple adjustment of the frequency and the amplitude of stimulus signals by virtual knobs. MC_Stimulus allows free signal programming and ASCII import.

Application

MC_Stimulus is the software solution that is used to control our STG series stimulus generators. You can choose between current or voltage driven stimulation. Freely design waveforms, be it pulses, ramps or sine waves, import (ASCII), and download complex stimulus pulses to the STG.
Microelectrode Arrays

- **Contacting**
  Where they come from: Material and production

- **Contacting**
  Available for a variety of applications: MEA-Layouts

- **Contacting**
  Suits your needs: MEA-Types
Where they come from

Application
Extracellular recording in vitro from almost all excitable or electrogenic cells and tissues. Examples are central or peripheral neurons, cardiomyocytes, whole-heart preparations, retina, or stem cells.

Material and production

Product Features
- Available with opaque (titanium) and transparent (ITO) tracks and contact pads
- Long life, can be reused many times
- Electrode layouts for all applications
- Electrodes with very low impedance
- Substrate-integrated reference electrode for almost all MEAs
- Electrodes as small as 10 µm in diameter

Technical Data

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>49 x 49 mm (49 x 25 mm for 32 electrodes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of electrodes</td>
<td>32, 60, 120 or 256</td>
</tr>
<tr>
<td>Interelectrode distances (µm)</td>
<td>30, 60, 100, 200, 300, 500, 700</td>
</tr>
<tr>
<td>Electrode diameters (µm)</td>
<td>10, 30, 100</td>
</tr>
<tr>
<td>Track options</td>
<td>Ti, ITO, Au</td>
</tr>
<tr>
<td>Electrode grids</td>
<td>8x8, 6x10, 12x12, 16x16, 2x(5x6), hexagonal, 6x(3x3), 9x(6x5), special layouts</td>
</tr>
</tbody>
</table>

Introduction
The Natural and Medical Sciences Institute (NMI) in Reutlingen, Germany (www.nmi.de) is a research institute which produces high-quality MEAs using utmost biocompatible materials. The NMI and Multi Channel Systems have collaborated on multiple projects and over many years. Quality controls and production processes have been improved over the last years so that MEAs are always of excellent and consistent quality. The electrodes are coated with titanium nitride (TiN), a very stable material, which guarantees that the MEAs can be reused many times. The majority of the MEAs have glass carriers, which facilitate the examination of the sample under any upright or inverted microscope. Tracks and contact pads are available in opaque and transparent versions and most MEAs have internal reference electrodes.
Microelectrode Arrays

Available for a variety of applications

Introduction
The broad range of applications is reflected by the variety of MEAs with different geometries that have been developed to cover as many applications as possible.

Standard 8x8 layout
The configuration of 8 by 8 electrodes is the most versatile configuration. Applications range from neuronal networks to brain slices and from stem cell derived cardiomyocytes to cardiac tissue preparations. The spacing of the electrodes available are 100 and 200 µm. This represents a square shaped recording area of 700 µm and 1.4 mm respectively. The electrodes are available with diameters of 10 µm and 30 µm. The advantage of 30 µm diameter electrodes is their low impedance and low noise level. 10 µm electrodes enable recording from single neurons or single cardiomyocytes.

Many MEAs feature internal reference electrodes. Due to the integrated reference the culture can be kept sterile during recording to enable repeated recordings of long-term cultures. Stimulation of each electrode is also possible.

6x10 layout
The 6 by 10 layout features an interelectrode distance of 500 µm. This creates a recording field of 4.5 mm by 2.5 mm. With these dimensions larger tissue samples can be recorded on one array. Each of the electrodes can be used for stimulation as well. All MEAs with the 6x10 layout also feature internal reference electrodes. The electrode material is TiN. The micro-column structure of each electrode minimizes impedance and allows low-noise recordings. The extremely durable material allows as much as 50 re-use cycles with acute experiments.
Hexagonal layout
- 60 electrodes
- Available with equal or varying electrode diameter and distance
- Layout perfect for retina recordings

High Dense layout
- 60 electrodes in two recording areas
- Interelectrode spacing of only 30 µm, electrode diameter of only 10 µm
- High resolution recording of individual neurons in neuronal networks

MEA-Layouts

Special layouts
- Wide range of special electrode layouts developed together with customers
- Specially shaped stimulation electrodes or layout with four quadrants of high density recording areas

Multi-well layouts
- 60 electrodes divided into 6 wells
- 256 electrodes divided into 9 wells
- Increases throughput
- Ideal for toxicology, neurobiology, stem cell research, and safety pharmacology
Application
Several MEA geometries and materials are provided for a wide variety of applications. Almost all excitable or electrogenic cells and tissues can be used for extracellular recording in vitro, for example, central or peripheral neurons, cardiomyocytes, whole-heart preparations or retina.

Perforated MEAs
Perforated MEAs (pMEAs) are manufactured on a thin polyimide foil, which is fixed on a glass carrier for physical stability. Surrounding the electrode field, there is a circular area where the foil is perforated (see image, dark spots).

pMEAs were designed to enable perfusion of the tissue on the array from the bottom. When recording from an acute slice preparation with MEA electrodes, signals are detected from cells at the bottom of the slice. These cells are probably less healthy than the ones on the top, because they get less oxygen and nutrients from the perfusion solution. Perfusion from the bottom solves this problem and enables better signals and improved long-term survival of your acute slices. In addition, slices can be held in stable contact with the MEA surface by applying a negative pressure with the constant vacuum pump available from MCS. If you wish to work with pMEAs, all you need to do is to equip your MEA-System with a perfusion ground plate (PGP) and start recording.

MEA with 256 electrodes
With the introduction of the USB-MEA256-System, MCS also introduced MEAs with 256 electrodes. There are three advantages with the increased number of electrodes:

• Higher spatial resolution
• Larger recording area
• Higher throughput

By reducing the electrode spacing it is possible to map a distinct area with a higher spatial resolution. In a 16 by 16 electrode array grid electrode spacing of 60, 100, and 200 μm are available. For the 60 μm spacing the electrode diameter is 10 μm. For 100 μm and 200 μm spacing 30 μm diameter electrodes are used. All 256MEA layouts have four internal reference electrodes.
**ThinMEAs**
- Recording area is as thin as a coverslip glass (180 µm)
- Facilitates use of low working distance objectives with high magnification
- UV transmission possible
- Transparent tracks, perfect vision

**EcoFlexMEAs**
- Made of flexible polyimide foil (50 µm thick)
- Available with 24 and 36 electrodes
- Low cost-option for routine *in vivo/*ex vivo experiments and specific *in vitro* applications
- Gold electrodes
- Can easily be connected to MCS headstages

**MEA-Types**

**EcoMEAs**
- Low cost option for routine experiments
- Gold electrodes (very robust, many re-use cycles)
- 100 µm diameter electrodes, 700 µm spacing
- Either float glass carrier or printed circuit board

**Flexible MEAs**
- Made of flexible polyimide foil (12 µm thick)
- Available with 36 and 72 electrodes
- For *in vivo/*ex vivo experiments and specific *in vitro* applications
- Titanium nitride electrodes
- Can easily be connected to MCS headstages
Amplifiers

- **Preamplifying**
  Lightweight and small-sized headstages

- **Filter amplifying *in vitro***
  MEA amplifiers for upright and inverted microscopes

- **Filter amplifying *in vivo***
  Fixed or programmable gain
Lightweight and small-sized headstages

Application
Non-invasive extracellular multisite recording with microelectrode arrays in vivo.
Bring your knowledge from in vitro experiments on a new level and find answers to effects in the living organism.

Miniature Preamplifiers

Product Features
- 2, 8, 16, and 32 channel versions
- Small-sized and lightweight
- Wide range of adapters available

Technical Data

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>MPA2I: 12 x 31 x 3 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MPA8I: 17 x 25 x 1.8 mm</td>
</tr>
<tr>
<td></td>
<td>MPA16I: 16 x 11 x 3 mm</td>
</tr>
<tr>
<td></td>
<td>MPA32I: 27 x 36 x 5 mm</td>
</tr>
<tr>
<td>Weight without cable and plug</td>
<td>MPA2I: 1.3 g</td>
</tr>
<tr>
<td></td>
<td>MPA8I: 1.3 g</td>
</tr>
<tr>
<td></td>
<td>MPA16I: 1.4 g</td>
</tr>
<tr>
<td></td>
<td>MPA32I: 7 g</td>
</tr>
<tr>
<td>Cable length</td>
<td>1.5 m</td>
</tr>
<tr>
<td>Max. tensile strength of cable</td>
<td>2 kg</td>
</tr>
<tr>
<td>Gain</td>
<td>10 (other gain on request)</td>
</tr>
</tbody>
</table>

Introduction
Multi Channel Systems offers miniature preamplifiers (MPA) with 2, 8, 16, and 32 channels, which provide tenfold amplification.
Just connect it to any standard microelectrode array, such as a NeuroNexus probe for acute and chronic implantations, and start your in vivo experiment.
Adapters to connect the MPA to all standard electrodes are offered by MCS. You can also connect the MPA to a MCS’s flexible microelectrode array and record your data.
For data acquisition, you can connect the MPA either to the integrated USB-ME16/32-FAI-System or to any filter amplifier, followed by a data acquisition system.
All miniature preamplifiers have additional common ground and reference electrode inputs. The metal cases provide electrical shielding. Stable long-term recordings are ensured by the high input impedance.
Amplifiers

For upright and inverted microscopes

Application
Non-invasive extracellular multisite recording with microelectrode arrays in vitro from neuronal and cardiac slice preparations or cultures, including stem cells and cell lines. These are the ideal solution for drug screening and discovery as well as for safety pharmacology in the field of cardiac and neuronal research.

Introduction
MEA amplifiers are the core element of any MEA-System, but can also be integrated easily in other set-ups. Raw data from up to 60 electrodes of a microelectrode array (MEA) are amplified by a 60 channel filter amplifier that is built very small and compact using SMD (Surface Mounted Devices) technology. The MEA is placed directly into the small-sized MEA amplifier. When the amplifier is closed, the contact pins in the lid of the amplifier are pressed onto the MEA contact pads. The close location of the amplifier to the MEA sensor gives a high signal-to-noise ratio.
MEA amplifiers can easily be connected to any data acquisition, temperature controller, stimulus generator or constant vacuum pump system.

Product Features
- Versions for inverted and upright microscopes
- Available with blanking circuit for stimulus artifact suppression
- Integrated heating element and sensor
- Available with different gain and bandwidth configurations
- Excellent signal-to-noise ratio

Technical Data

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible bandwidth</td>
<td>1 Hz - 10 kHz</td>
</tr>
<tr>
<td>Possible gain</td>
<td>500 - 5000</td>
</tr>
<tr>
<td>Number of input channels</td>
<td>60</td>
</tr>
<tr>
<td>Number of output channels</td>
<td>60</td>
</tr>
</tbody>
</table>
Fixed or programmable gain

Application
Non-invasive extracellular multisite recording with microelectrode arrays in vivo from 8 to 64 channels.
Bring your knowledge from in vitro experiments on a new level and find answers to effects in the living organism.

Filter Amplifiers and Programmable Gain Amplifiers

Product Features
- Suitable for a variety of applications
- Choose between fixed or programmable gain
- Configurations (bandwidth and gain) according to your needs

Technical Data

<table>
<thead>
<tr>
<th>Filter amplifier (fixed gain): FA</th>
<th>Possible gain</th>
<th>10 - 1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible bandwidth</td>
<td>0.1 Hz - 10 kHz</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Programmable gain amplifier: PGA</th>
<th>Possible gain</th>
<th>10 - 5000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandwidth</td>
<td>1 - 5000 Hz or 1 - 300 Hz &amp; 300 - 5000 Hz</td>
<td></td>
</tr>
</tbody>
</table>
Accessories

• **Heating**
  Temperature controllers

• **Checking**
  Impedance testing for in vivo probes

• **Checking**
  Impedance testing for microelectrode arrays

• **Pumping**
  Constant vacuum pump

• **Pumping**
  Accessories for fluidic devices
Temperature controllers

Application
Temperature controller for biological samples:

*In vitro*: Control the temperature of the built-in heating element in the MEA amplifier as well as the temperature of the flowing perfusion solution in the heatable perfusion cannula. Heat up slices or cell cultures on MEAs using the MCS warming plate.

*In vivo*: Keep anesthetized animals under stable temperature conditions using the MCS warming plate.

TC01 and TC02

Product Features
- General purpose temperature controller
- One or two output channels
- PI-based technology
- High accuracy (± 0.1 °C)
- Temperature tracking

Introduction
The general purpose temperature controller (TC) is available with one or two output channels.

The built-in Pt100 sensor guarantees a stable and precise temperature control over a wide temperature range. You can adjust the temperature accurately from ambient temperature up to 105 °C using either the buttons on the device itself or the included TCX_Control software. This software also tracks the temperature and saves the data, so you can review it anytime.

MCS temperature controllers are highly accurate (± 0.01 °C) because of their proportional-integrator based technology. Apart from the accuracy, the PI controller also guarantees that the setpoint temperature is reached quickly.

Technical Data

<table>
<thead>
<tr>
<th>Sensor type</th>
<th>Pt100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring method</td>
<td>Four wire measuring bridge</td>
</tr>
<tr>
<td>Measuring temperature range</td>
<td>0 °C - 105 °C</td>
</tr>
<tr>
<td>Control range</td>
<td>Ambient temperature (min. 5 °C) - 105 °C</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.01 °C</td>
</tr>
</tbody>
</table>
Accessories

Impedance testing for *in vivo* probes

**Application**

64-channel impedance testing device to test for electrode site impedances to identify faulty sites and for conditioning of electrode sites for effective stimulation.

**Introduction**

Microelectrode arrays for neuronal recording require testing of electrode site impedances to identify faulty sites, and conditioning of sites for effective microstimulation. Manual methods are labor intensive. The nanoZ was specifically designed for testing multichannel electrodes, and has several electroplating modes for automated impedance matching, site activation, and site rejuvenation. It uses very low test currents for *in vitro* or *in vivo* testing, and can accurately measure the impedances of a 64-channel electrode in just 15 seconds.

We designed the nanoZ to be flexible yet easy to use. The nanoZ requires no additional hardware other than a PC with a spare USB port. Simply plug the nanoZ into the computer, install the intuitive, easy-to-use software suite, and you are ready to go.

Adapters for NeuroNexus probes, MEAs, and connectors from Millmax and Omnetics are available. Channel mapping for different adaptors is handled transparently by the software.

**Product Features**

- Rapid and precise impedance testing
- Automated electroplating modes
- 64 channels for microelectrode arrays

**Technical Data**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of channels</td>
<td>64</td>
</tr>
<tr>
<td>Z measurement range</td>
<td>1 kΩ to 10 MΩ</td>
</tr>
<tr>
<td>Z accuracy &amp; precision</td>
<td>1 kΩ display resolution</td>
</tr>
<tr>
<td></td>
<td>5 kΩ to 15 MΩ ± 1 %</td>
</tr>
<tr>
<td></td>
<td>(at test frequencies &lt; 2 kHz)</td>
</tr>
<tr>
<td></td>
<td>channels matched to within 1 %</td>
</tr>
<tr>
<td>Constant current electroplating</td>
<td>± 12 μA range, ± 5 V compliance</td>
</tr>
</tbody>
</table>
Impedance testing for MEAs

**Application**
Impedance testing device for MEAs with 60 or 120 electrodes to test for electrode site impedances to identify faulty sites.

**MEA-IT**

**Product Features**
- Quick and easy identification of electrode impedances
- User-friendly, intuitive software
- Monitor quality of MEAs over time
- Export data to any database

**Technical Data**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of channels</td>
<td>120</td>
</tr>
<tr>
<td>Measurement range</td>
<td>5 kΩ ... 2 MΩ</td>
</tr>
<tr>
<td>Test signal</td>
<td>100 mV; 1 kHz Sinus</td>
</tr>
<tr>
<td>Accuracy</td>
<td>5%</td>
</tr>
<tr>
<td>Power supply</td>
<td>USB powered</td>
</tr>
</tbody>
</table>

**Introduction**
Do you need to know the impedance of your MEA electrodes? Do you want to identify faulty sides? Or would you like to monitor the impedance of your electrodes over time? Not a problem - with the MEA-IT, the impedance testing device from Multi Channel Systems. The MEA-IT is the reliable, easy-to-use solution to test the quality of your microelectrode array. All you need to do is to connect the device via the included USB cable to any PC or laptop, insert the MEA, open the software, and start the measurement. Within less than a minute, you know the impedance of every single electrode.

The complete measurement process is controlled via the included software. On the virtual MEA-layout, you can see the impedance of each electrode. Colors indicate the condition of the electrode and facilitate a quick overview. You can save the data after each measurement and export the history of one MEA. This way you can monitor the development of each electrode’s impedance over the entire life span of the array.
Introduction
The constant vacuum pump (CVP) with pressure control is a vacuum pump with a precision pressure sensor and a waste bottle.

The differential sensor measures the pressure in the compartment attached to the waste bottle and compares it to the ambient pressure. The suction pump is then regulated to maintain the selected negative pressure in this compartment. It is now possible to precisely control the suction and to keep the negative pressure stable.

The constant vacuum pump is the perfect addition to your MEA-System if you want to work with perforated microelectrode arrays.

You can establish and most importantly control the suction so you get better electrode-to-tissue contact without the need of a weight and your slice is kept in place. Moreover, your experiments are more repeatable since you can reproduce the exact same suction again and again.

Product Features
- Simple integration to any setup
- Ideal for use with perforated MEAs
- User-friendly handling
- Precise control of suction

Technical Data

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature</td>
<td>10 °C - 40 °C</td>
</tr>
<tr>
<td>Maximum pressure</td>
<td>-200 mbar below atmospheric pressure</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.1 mbar</td>
</tr>
<tr>
<td>Sensor accuracy</td>
<td>± 2.5 %</td>
</tr>
<tr>
<td>Capacity of pp-bottle</td>
<td>5 l</td>
</tr>
</tbody>
</table>

Application
Any experiment where negative pressure is needed.
Especially suitable for use with perforated microelectrode arrays.
Accessories for fluidic devices

**Application**

Any experiment where liquids are an issue.

**Introduction**

Many electrophysiological experiments require the use of liquids. In order to offer you an entirely complete setup, we collaborate with many manufacturers to provide you with any liquid handling devices you might need. Moreover, we have perfusion equipment as well as pumps in our own product portfolio, too. All you need to do is to let us know what you need and we will get it for you. Peristaltic pumps, valves, tubes, and perfusion tool holders are just some examples for our product range in fluidic.

The advantage for you is that you can get everything you need for your setup from one single source. We at Multi Channel Systems with our research experience and knowledge of the market, know what products you might need and what details to pay attention to, and most importantly, we know where to purchase those products or how to manufacture the best product ourselves.

Complete systems for electrophysiology from Multi Channel Systems live up to their promise: They truly include everything you might need!
Manipulators and Microscope Mounting Systems from Scientifica Ltd.

• **Moving in sub-microns**
  Ultra stable, super smooth micromanipulator: PatchStar

• **Moving in sub-microns**
  Versatile, reliable and ultra-stable stereotaxic manipulator: *in vivo* manipulator

• **Moving in sub-microns**
  Compact micromanipulator offering new rig configuration opportunities: MicroStar

• **Imaging systems**
  Outstanding optics and complete control: SliceScope

• **Stability and precision**
  Mounting systems for manipulators and microscopes
Ultra stable, super smooth micromanipulator

Application
Patch clamping, sharp electrode recording, microinjection, stretch testing, and other procedures requiring delicate and long-term positioning.

PatchStar

Introduction
The PatchStar motorised micromanipulator was developed in collaboration with electrophysiology researchers to create a stable, versatile, low-noise yet affordable micromanipulator.

The high quality materials and assembly along with the super smooth motion and long-term stability have proven that the PatchStar offers the best choice for even the most demanding applications.

The PatchStar offers 3 axes of motorised motion, X, Y, and Z, as well as a virtual approach axis. This micromanipulator can be easily mounted next to both upright and inverted microscopes and suits many experimental types.

Ultra low noise means that small signals can be detected, stability allows work with small cells and long experiments to be performed. The super smooth motion allows for probe positioning onto delicate cells and the fast pipette exchange system saves you time.

Product Features
• Ultra stable - less than 1 micron drift in 2 hours allows long-term experiments
• Low noise electronics - suitable for single channel recordings
• Super smooth motion - 20 nm resolution and quality engineering means you can reliably position your electrode or probe on the cell of choice
• Easy pipette exchange - increased productivity and reproducible positioning
• Choice of controls - control cube, joystick, PatchPad or software controlled

Technical Data

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of axis</td>
<td>3</td>
</tr>
<tr>
<td>Resolution</td>
<td>20 nm</td>
</tr>
<tr>
<td>Drift</td>
<td>less than 1 micron in 2 hours</td>
</tr>
<tr>
<td>Control unit</td>
<td>19” rack (mountable), USB connection</td>
</tr>
<tr>
<td>Software</td>
<td>LinLab for setup, PC control, and custom settings</td>
</tr>
</tbody>
</table>
Manipulators and Microscope Mounting Systems from Scientifica Ltd.

**Versatile, reliable and ultra-stable stereotaxic manipulator**

**Application**

*In vivo* recordings and studies from thick slice preparations.

**Introduction**

The IVM is a motorised manipulator ideally suited to high stability, low-noise *in vivo* recordings. Featuring the long travel required for these studies and intelligent programmable functions, the IVM is ideal for *in vivo* electrophysiology. Its modular design and full range of accessories ensures versatile mounting options and that a variety of headstages and probes can be fitted. The IVM is available with either one or three axis of smooth motorised movement, controlled via the intuitive hardware or Windows® based LinLab software.

High quality materials and precision assembly, along with the super smooth motion and long term stability, means that the IVM offers the best choice for the most demanding *in vivo* applications.

**Product Features**

- Ultra stable - less than 1 micron drift in 2 hours allows long term experiments
- Low noise electronics - suitable for single channel recordings
- Super smooth motion - 20 nm resolution and quality engineering means you can reliably position your electrode or probe on the cell of choice
- Long travel - 75 mm of travel for thick slice and *in vivo* preparations

**Technical Data**

<table>
<thead>
<tr>
<th>Number of axis</th>
<th>Available with 1 or 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution</td>
<td>20 nm</td>
</tr>
<tr>
<td>Travel</td>
<td>70 mm in all axis</td>
</tr>
<tr>
<td>Drift</td>
<td>less than 1 micron in 2 hours</td>
</tr>
<tr>
<td>Control unit</td>
<td>19” rack mountable, USB connection</td>
</tr>
<tr>
<td>Software</td>
<td>LinLab for setup, PC control, and custom settings</td>
</tr>
</tbody>
</table>
Compact micromanipulator offering new rig configuration opportunities

Application
Ideal for neuroscientists studying synaptic connectivity and networks, but also for a wider range of applications where space around tissue samples is at a premium.

MicroStar

Product Features
- Impressive travel - 20 mm in X & Z axis, and 14 mm in the Y axis
- Compact Design - allows arrangement of more electrodes around a sample
- Ultra stable - less than 1 micron drift in 2 hours allows long term experiments
- Modular design - easily configured between left and right-handed operation

Technical Data

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of axis</td>
<td>4 (3 orthogonal, 1 virtual approach)</td>
</tr>
<tr>
<td>Resolution</td>
<td>20 nm</td>
</tr>
<tr>
<td>Travel</td>
<td>20 mm (X and Z) and 14 mm (Y)</td>
</tr>
<tr>
<td>Drift</td>
<td>less than 1 micron in 2 hours</td>
</tr>
<tr>
<td>Control unit</td>
<td>19” rack mountable, USB connection</td>
</tr>
<tr>
<td>Software</td>
<td>LinLab for setup, PC control, and custom settings</td>
</tr>
<tr>
<td>Max. travel</td>
<td>50 mm in X and Y axes</td>
</tr>
<tr>
<td>Resolution (electronic)</td>
<td>20 nm</td>
</tr>
</tbody>
</table>
Manipulators and Microscope Mounting Systems from Scientifica Ltd.

Outstanding optics and complete control

Application
Patch clamping, sharp electrode recording, micro-injection, stretch testing, and other procedures requiring delicate control and outstanding image clarity.

Introduction
The SliceScope defines a new benchmark in imaging and electrophysiology research. Developed in collaboration with world leading researchers, the SliceScope provides an ultra stable, compact platform with outstanding optics. The SliceScope’s smart design is ready to accept a wide range of accessories and light sources to best suit your application.

Based around the industry standard Olympus BX51/61-WI optics, the SliceScope has been designed to offer outstanding imaging clarity and complete control.

Inspired design together with high quality components guarantee super smooth motion, long-term stability and intuitive control. For your demanding applications, the SliceScope offers the most cost effective choice for both now and in the future.

Every SliceScope comes with the unique “follow” software function. This allows the micromanipulators to move at the same time as the scope stage or platform so that the pipettes are always in the field of view.

Product Features
- Motorised focus - gives remote fingertip focus control
- Motorised condenser - for optimal Koehler illumination
- Narrow, ultra stable profile - extra room for equipment around your experiment
- Low noise electronics - suitable for demanding single channel recordings
- In vivo & in vitro - can be configured and converted between the two

Technical Data

<table>
<thead>
<tr>
<th>Dimensions (L x W x H)</th>
<th>402 x 126 x 369 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective</td>
<td>Motorized</td>
</tr>
<tr>
<td>Condenser focus</td>
<td>Motorized</td>
</tr>
<tr>
<td>Control</td>
<td>Control cube or LinLab control software</td>
</tr>
</tbody>
</table>
Mounting solutions for manipulators and microscopes

Application
Patch clamping, sharp electrode recording and other procedures requiring delicate and long-term positioning.

SlicePlatforms, Moveable Top Plates and Microscope Stages

Product Features
- Compatible with major microscopes from Olympus, Zeiss, Nikon, and Leica
- Slice platforms have height adjustable legs to compliment any microscope or setup
- Maximum stability for manipulators and sample
- Slice platforms, microscope platforms, and manipulators offer combinations for all applications

Technical Data

<table>
<thead>
<tr>
<th>Slice platforms (for upright microscopes)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>adjustable from 238 mm to 298 mm</td>
</tr>
<tr>
<td>Dimensions of top plate</td>
<td>600 mm (width) by 390 mm (depth)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Motorised Moveable Top Plates (for upright microscopes)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>Adjustable from 191 mm to 237 mm</td>
</tr>
<tr>
<td>Max. travel</td>
<td>25.4 mm in X and Y axes</td>
</tr>
<tr>
<td>Dimensions of top plate</td>
<td>600 mm (width) by 390 mm (depth)</td>
</tr>
<tr>
<td>Resolution (electronic)</td>
<td>&lt; 1 micron</td>
</tr>
</tbody>
</table>

| Universal Motorized Stage                             |               |
| Max. travel                                           | 50 mm in X and Y axes                               |
| Resolution (electronic)                               | 20 nm                                                  |

Introduction
Crucial to consider for every experimental setup is a stable mounting system. This range of slice platforms, top plates and microscope stages has been developed for researchers undertaking electrophysiology and related techniques who would like to move outside the field of view of the objective. Various configurations can achieve this in different ways, either by translating the entire microscope between fixed apparatus, or, where laser inputs or other limitations prevent this, by translating the sample and manipulators as one around a fixed microscope.

The height-adjustable SlicePlatforms are usually applied in combination with a manual or motorised translation stage, allowing the microscope objective to be positioned over the complete preparation. As an alternative to this approach, moveable top plates enable micromanipulators, the sample and any other equipment to be translated in the X and Y axis as one, while keeping the microscope position fixed.
Electrophysiological Laboratory Equipment

- Investigating and isolating
  Everything you need in your lab
Everything you need in your lab

**Application**
Fundamental accessories for your setup in any electrophysiological experiment.

**Laboratory Tables and Faraday Cages**

**Introduction**
When doing electrophysiological experiments, a crucial factor is the surroundings. The stability of the table, electric fields in the proximity of the sample, and the possibilities to fasten other instruments and accessories are fundamental.

We at Multi Channel Systems have more than 15 years of experience in the field of electrophysiology. We know your needs, what details and product features to consider, and most importantly, we have the knowledge of and contacts to equipment suppliers.

We offer you the complete laboratory equipment, starting with vibration-free tables, Faraday cages, and any other accessories for the setup.

You will receive your complete system in one shipment, from one supplier. You do not have to worry about obtaining quotations and invoices, or arranging the various shipping dates. This way everything arrives together. We take care of everything and you receive the entire setup from one source.

**Product Features**
- Well-known manufacturers
- High quality products
- Convincing combination of compatible products
- Complete setup from one source

Service only available in MCS sales area. Please contact your local distributor for details in your country.
About Us

- **Company profile**
  Who we are
Who we are

Multi Channel Systems MCS GmbH was founded in 1996 and is based in the Science and Technology Park in Reutlingen in Southwest Germany. MCS operates globally from this location.

The main focus of our company is the development of precise scientific measuring instrumentation in the field of electrophysiology for research groups at universities and for the pharmaceutical industry. Our modular product principle approach allows us to adjust our products to your specific experimental needs. MCS products are flexible and are designed to fit into tight laboratory spaces. Our main goal is to develop products that are focused on our customer’s specific needs and applications. Our team includes basic science researchers so we know what it is like to work in a lab environment.

Our constant dialog with scientists helps us to be at the cutting edge of technology. We are also involved in several national and international research projects that are pushing the limits of technology for science.

With many years of experience, a global distribution network, and over 500 satisfied customers worldwide MCS is the global market leader in the field of non-clinical microelectrode array electrophysiology.

Multi Channel Systems

Our goal is to provide you with products of the highest quality and performance and give you the best customer service. Since all departments are located in one building, our communication and interaction between different teams is smooth and efficient. Our manufacturing department gives feedback to the R&D team, logistics works closely with manufacturing, the support department collaborates with software and manufacturing, and so on. Our customers’ needs and issues can be considered by all departments both before and after the purchase. Therefore, we guarantee that you will receive the best product and the best support possible.

Owner Management
Karl-Heinz Boven and Andreas Möller

Technical departments
R&D Software Production Technical support Biological application