



## Extracellular Recording with Microelectrode Arrays from 256 channels

- 256 channels for recording and stimulation
- All-in-one-solution
- Integrated data acquisition
- USB 2.0 data transfer
- Integrated heating system



The USB-MEA256-System fulfills four functions in one device:

- Signal amplification.
- Converting analog into digital signals.
- Recording and stimulation on all channels.
- Online and offline analysis through included software.

## All-in-one system for 256 channels

The USB-MEA256-System is a stand-alone plug-and-play data acquisition system based on signal processing technology.

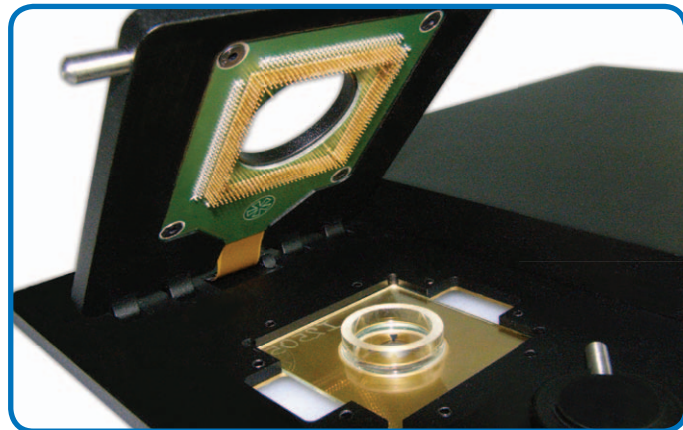
All necessary components combined in one device:

- Integrated amplifier for 252+4 channels: 252 channels from the microelectrode array plus 4 additional channels for e.g. simultaneous patch clamp recordings or any other analog signals such as temperature, pH, etc.
- Integrated Analog/ Digital board for converting analog signals to digital data streams.
- Integrated heating system.
- Easy adaption to our stimulus generators for current and voltage driven stimulation. Each electrode is selectable for stimulation.

## Optimized for your experimental needs

The compact USB-MEA256 housing is suitable for almost every kind of upright or inverted microscope.

When the housing is closed, the contact pins in the lid are pressed onto the microelectrode array's (MEA) contact pads. No cable connections between MEA and amplifier are necessary, which greatly reduces the noise level. The complete system can be used in a dry incubator. We provide culture chamber solutions for the MEA to keep your preparation sterile under stable environmental conditions.



## Perfect integration into your setup

On the rear panel of the USB-MEA256-System you have additional connectors:

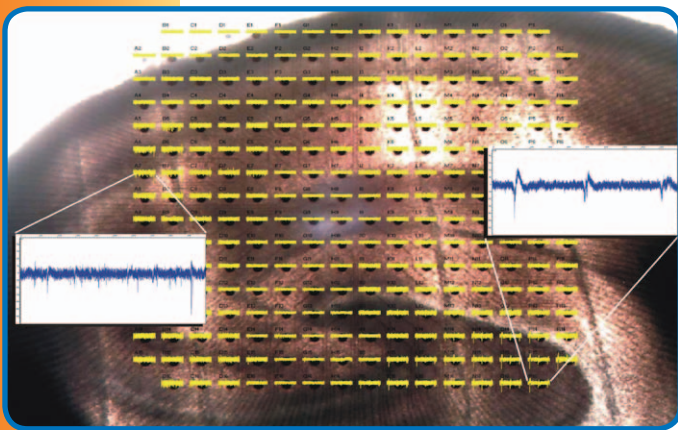
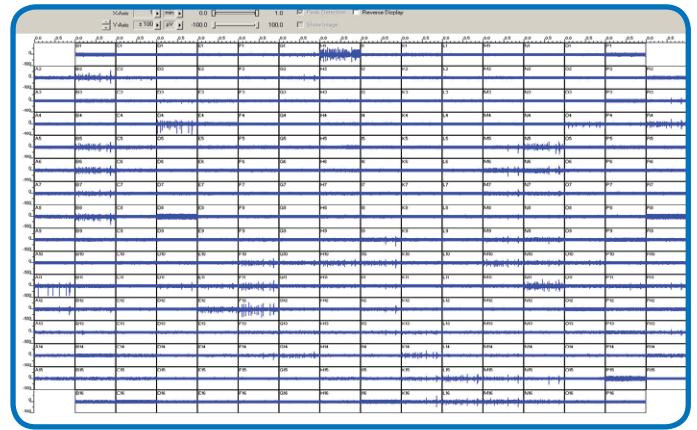
- Digital IN/ OUT: Control and synchronize other devices with TTL pulses, like imaging system, stimulus generator, patch clamp system, etc.
- D0 Out and D0 In: Independent access from the Digital IN/OUT connector with a Lemo connector. Generate and accept TTL pulses.
- AUDIO: Make electrical activity audible in real- time.
- Analog Input A1 to A4: Additional analog inputs for additional signals from external devices.
- USB: Transfer the amplified and digitized data from all channels to any connected computer or laptop via High Speed USB 2.0.
- Ground: Additional ground, if necessary.



## Monitor activity on all 256 channels

Our data recording and analysis software MC\_Rack offers many options to display data from all channels simultaneously. You can zoom in on any electrode by a single mouseclick.

- High resolution zoomable displays for all electrodes.
- Continuous Long Term Display to show up to one hour of data in one window.
- Spikes are displayed as overlay or rasterplot.
- Display raw data and various analyzed parameters simultaneously.



## Enjoy the advantages of 256 channels

Multi Channel Systems offers four MEA-Layouts for the USB-MEA256-System. You can choose between electrode spacings of 60µm, 100µm, and 200µm, all having a 16x16 electrode grid. Moreover, you can select a 9-well MEA for high-throughput experiments.

The USB-MEA256-System provides benefits like:

- Solution of trade-off between high resolution and size of the recording area (often present in traditional 60 electrode MEAs).
- High number of possible stimulation sites for electrical stimulation.
- Suitable for cells and tissue of cardiac or neuronal origin, as well as for stem cells and organotypic cultures.

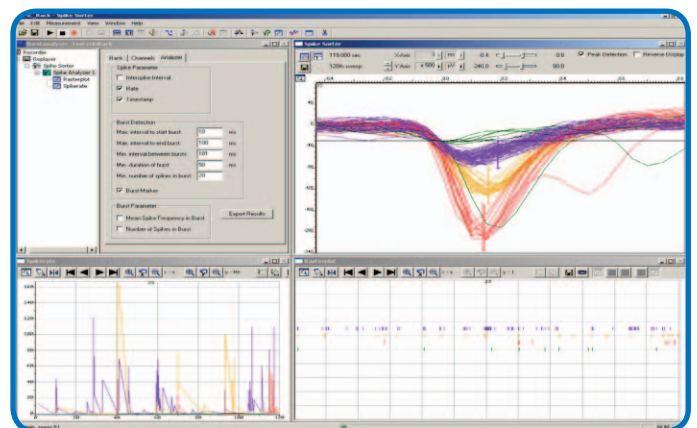
## Online and offline analysis with one powerful software

The software MC\_Rack offers the possibility to detect spikes and field potentials online, and to analyze various features like:

- Spike detection, ISI, spike rate, rasterplots, etc.
- Spike burst detection and analysis, burst rate, percentage of spikes in burst, inter burst interval, etc.
- Analysis of evoked field potentials, amplitudes, slopes, t [min], t [max], etc.

Online processing options allow the separation of slow and fast signal components and the reduction of overall noise.

- Savitzky-Golay High and Low pass filter
- Butterworth average filter
- Selectable reference electrode

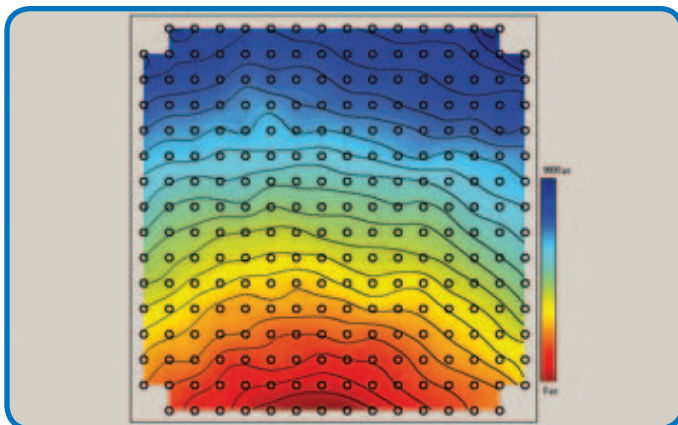
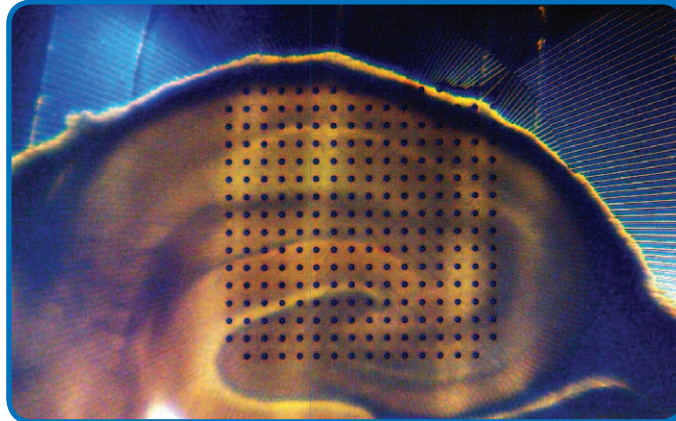




## Neuronal cells and tissues

Activity from cells, organotypic cultures or acute tissue slices can be recorded with a high spatial resolution.

It is possible to analyze neuronal networks in cell culture or tissue preparations with a novel combination of a large recording area and electrode density. Co-cultivation of several tissue areas becomes feasible, as well as large acute preparations which contain long range projections in one slice. The large number of electrodes also allows a much more precise and flexible control of electrical stimulation and monitoring of the evoked signals.



## Discover arrhythmia - space and resolution in one assay

In atrial fibrillation research you can discover electrically remodelled cells and map for reentry simultaneously.

QT-prolongation & drug induced ventricular tachycardia are important parameters in cardiac safety pharmacology. The USB-MEA256-System allows mapping of transmural QT dispersion in slices and monitoring of midmyocardial cell field potential within one experiment.

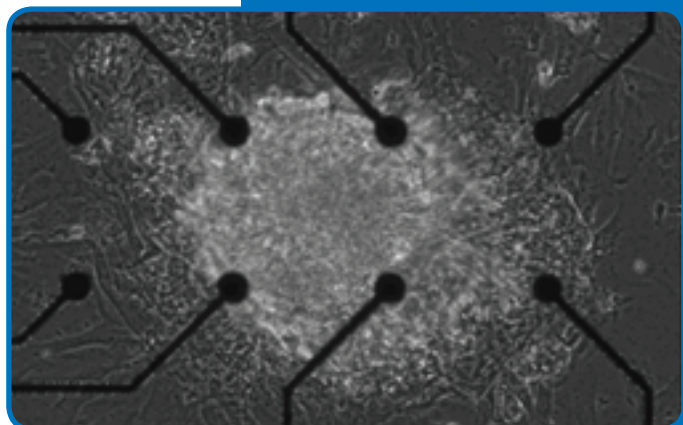
You can map slices, cells, and tissue samples with high resolution. Moreover, you can calculate conduction velocity, access local activation times, draw isochronous lines, and detect reentry.

The Cardio2D software complements the system and offers various features for USB-MEA256 data acquisition and analysis.

## Cardiogenic & neurogenic differentiation of stem cells

Differentiation of stem cells or induced pluripotent cells (iPS) into electrogenic cells usually requires a manual selection step. Cells are identified by beating or neural/cardiac markers and manually transferred on MEA recording chambers. With the 256MEA, we multiplied the area covered with electrodes without reducing the resolution. This allows differentiation directly on the 256MEA.

Long-term experiments with continuous mapping allow deeper insight in the electrophysiological integration of co-cultures. The strong advantage of the 256MEA is the option of a close-up view of the interface of the different cell types and large scale mapping. These recordings can be done over clinically relevant time frames of weeks to months.



The **USB-MEA256-System** is a 256 channel amplifier with integrated Analog / Digital board converting analog signals to digital data streams in real-time.

It is intended to directly contact to a 256MEA (Microelectrode Array).

#### **Amplifier:**

Number of electrode channels	252
Input voltage range	+/- 3.7 mV
Data resolution	16 Bit
Bandwidth	1 Hz – 5 kHz
Gain of analog signal source	1100
Cross talk (channel to channel)	typical 0.01 %, max. 0.1 %

#### **Additional analog inputs:**

Number of additional inputs	4
Input voltage range	+/- 4.096 V
Bandwidth	DC to 15 kHz
Input impedance	1 M $\Omega$    1 nF
DC offset	max. +/- 2 mV

#### **Digital inputs & outputs:**

Number of digital input channels	16
Digital input signal levels	CMOS (3.3 V input)
Digital input impedance	100 k $\Omega$
Number of digital output channels	16
Digital output signal levels	CMOS (3.3 V output)

#### **Data converter and USB interface:**

Sampling frequency	Up to 40 kHz/ channel
Maximal data rate	20.5 MB/s
Data resolution	16 Bit
USB Version	USB 2.0 High Speed

#### **Heating element and temperature sensor:**

Heating element impedance	20 $\Omega$
Temperature sensor type	PT 100 with 4 wire connection

#### **Rear Panel interface and connectors:**

16 bit digital in / out	68-Pin MCS standard connectors, MCS High Grade cable
4 additional analog inputs	Lemo connector (EPL.00.250 NTN)
Digital out (D0 OUT)	Lemo connector (EPL.00.250 NTN)
Digital in (D0 IN)	Lemo connector (EPL.00.250 NTN)
Audio output	Stereo jack 3.5 mm
USB	USB 2.0 High Speed cable (type A – mini-B)
Power supply	Barrel connector 0.7 x 2.35 mm
Ground	Common jack 4 mm, banana plug

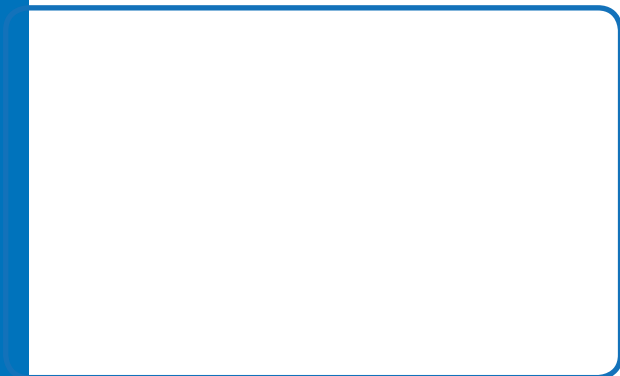
#### **Power supply unit (MPU 30):**

Input voltage	100 - 240 VAC @ 47 - 63 Hz
Output voltage	12 V DC @ max. 2.5 A
Max. power	30 W

#### **Software:**

Operating system	Windows XP, Vista or 7 with NTFS English and German versions supported
MC_Rack program	Version 3.7.0 and higher
MC_DataTool program	Version 2.4.5 and higher
Data export	ASCII (*.txt), binary file (*.raw) format

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