



CMOS-MEA5000-System

Extracellular recordings and stimulation
at the highest resolution

- Active microelectrode arrays for recording and stimulation
- 4225 recording and 1024 stimulation sites
- Outstanding signal quality
- Recordings at sub-cellular level
- Highly customizable controlling software

Highest resolution with active arrays

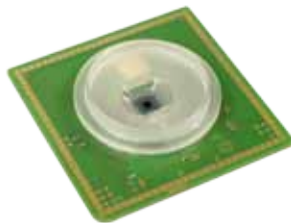
Based on the complementary metal-oxide semiconductor technology, the CMOS-MEA5000-System from Multi Channel Systems opens up new possibilities in electrophysiological research.

With more than 4000 recording sites, each of them sampled at 25 kHz, the chip allows extracellular recordings at a very high spatio-temporal resolution. By including amplification on the chip itself, noise is minimized and a high signal quality is guaranteed.

As stimulation sites are included in the chip and a stimulus generator in the headstage, the system is ideal for closed-loop experiments.

Compact design, powerful components

The CMOS-MEA5000-System consists of three components, which are all designed to be efficient and powerful, while fitting ideally on the lab bench and microscopes.



CMOS-Chip

The chip is based on complementary metal oxide semiconductor (CMOS) technology, facilitating fast, high-resolution imaging of electrical activity.

The chip is equipped with a culture chamber to house your sample, while allowing the use of a microscope.



Headstage

The core of the system is the headstage. It samples the data coming from the chip at 25 kHz per channel (all electrodes simultaneously).

Besides A/D conversion and amplification, the headstage also houses a 3-channel stimulator. You can freely design the stimulation patterns via software and select each of the 1024 stimulation sites.



Interface board

The interface board offers the USB 3.0 interface to transfer the recorded data to a computer. Moreover, it has analog and digital in- and outputs for synchronization with other instruments.



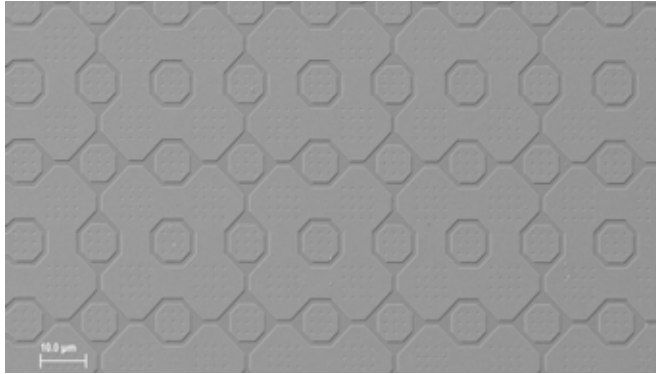
Computer with software

The software CMOS-MEA-Control was programmed specially for the CMOS-MEA5000-System. It facilitates a real-time activity overview on the complete chip with the ability to zoom in and various tools to analyze the data.

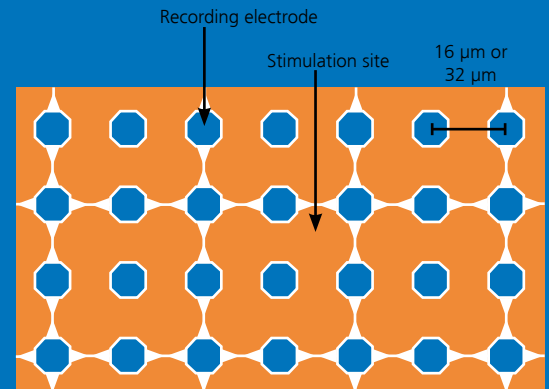
Chip layouts

The CMOS-chip has a 65x65 layout and is available with 16 μm or 32 μm interelectrode distance (center to center). The electrode diameter always is 8 μm . Between the recording electrodes, there is a grid of 32x32 bigger stimulation sites. Summarizing, you can record from 4225 electrodes and stimulate your sample at 1024 sites.

The chip is coated with a planar oxide, similar to glass, enhancing the biocompatibility and biostability.



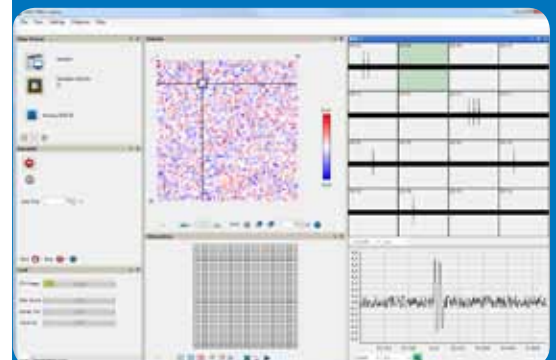
Electron micrograph of the CMOS-chip surface (NMI Reutlingen, Germany)



Versatile and high performance control software

The CMOS-MEA5000-System is controlled and its data recorded by the software package CMOS-MEA-Control. The software gives an online, real-time activity overview on the complete chip. You can then define regions of interest and zoom into the areas, where you see most activity. You can also switch off areas to decrease file size.

The software also controls the integrated stimulator. You can freely define 3 independent stimulus patterns, using and adjusting the drag'n'drop modules.



Advantages of the CMOS-MEA5000-System

Highest resolution of chip

First, the 16 μm interelectrode distance chip offers the world-wide highest resolution. Second, with the high number of electrodes, you can record from a large surface (1 mm^2 @ 16 μm distance, 4 mm^2 @ 32 μm distance). Thereby, you can see the signals from every single cell and even the signal propagation along an axon, while still getting an overview on your complete sample, e.g. a cell culture and see how the cells interact.

Highest data quality

Your data is sampled at 25 kHz per channel. Thus, no signal is lost - even axonal spikes are displayed and recorded thoroughly. Together with the A/D conversion at 14 bit, the system ensures accurate and precise data.

Integrated stimulation

The integrated stimulator facilitates arbitrary stimulation shapes on selected areas of the 1024 stimulation sites. One big advantage is that you can record instantly after stimulation. Even on the electrode right next to the stimulation site, recording is possible <1ms after the stimulation pulse.

Ease-of-use

The CMOS-MEA5000-System is very easy to use. The headstage can be positioned on a microscope. After opening the lid, you just place the chip in the headstage. When the lid is closed, the contact pins are pressed on the pads on the chip and signals are transmitted. There is no need for many cables, the interface board and headstage only need one eSATA cable. Connection to the computer is done via USB 3.0, so again no complication here.

Technologically advanced interface board

The interface board offers various inputs and outputs for synchronization with other instruments. Apart from digital and analog in- and outputs, it also includes a digital signal processor, which is freely programmable for real-time feedback and closed-loop experiments.

CMOS-MEA5000-System: Technical specifications

General characteristics

Dimensions (W x D x H)	Headstage: 256 mm x 230 mm x 25 mm Interface board: 250 mm x 83 mm x 25 mm
Weight	Headstage: 1.4 kg Interface board: 0.3 kg

Amplifier

Data resolution	14 bit
Number of recording channels	4225
Bandwidth	0.1 Hz - 10 kHz

Stimulus generator

Number of stimulation patterns	3 independent patterns
Signal shapes	Freely programmable (monophasic, biphasic, bursts, sinusoidal) or Ground
Stimulation sites	1024
Output voltage	2 V amplitude

Data converter and USB interface

Control interface	USB 3.0
Sampling rate per channel	up to 25 kHz on all channels simultaneously

Heating element and temperature sensor

Heating element impedance	20 Ω
Temperature sensor type	PT 100 with 4 wire connection

Software

Operating system	Microsoft Windows® 8.1 (64 bit) English and German versions supported
CMOS-MEA-Control software	Version 1.4.0 and higher
Data export	HDF5 and C# DLL

Check out our website on MEA-technology:
www.multielectrodes.com



Developed in cooperation with Prof. Roland Thewes, TU Berlin, and Dr. Günther Zeck, Natural and Medical Sciences Institute (NMI), Reutlingen, Germany

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