Wireless-Systems

The modular and flexible solution for wireless recording and stimulating in vivo

- 4, 8, 16 or 32 recording channels
- Triaxial gyroscope and accelerometer sensor
- Options for electrical and optical stimulation
- Lightweight headstages
- Integrative video tracking system provided, integrated in GUI
- Combination with Panlab SMART software

www.multichannelsystems.com
The Wireless-System from Multi Channel Systems is the all-in-one solution for amplifying, recording, and analyzing in vivo data from 4, 8, 16 or 32 channels.

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

The systems include everything you need:

- Small-sized headstage with integrated A/D converter and LED lights for video tracking, digitized transmission, powerful receiver, interface board, and data acquisition software package.

All wireless headstages (except the 4-channel versions) are equipped with a triaxial gyroscope and accelerometer sensor, which allows synchronization with electrophysiological data.

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

Additional inputs to the interface board allow the synchronization of your data with external devices.

**Key advantage: Digital data transmission**

The Wireless-System converts the recorded signals into digital data already on the headstage.

This guarantees an excellent signal-to-noise ratio which is independent from the distance between sender and receiver.

In combination with a long transmission range, the digital data transmission permits flexible long-term experiments in large environments.

**Parallel experiments**

The Wireless-System offers the possibility to record from up to eight animals simultaneously with one setup (at a reduced sampling rate). Up to four receivers can be run in parallel in the same room, with a total number of 16 headstages.

**Analog output to any data acquisition**

Generally, the Wireless-Systems are complete work stations with data acquisition and software from Multi Channel Systems.

However, you have the option to add an analog output of all channels.

You can then connect your existing data acquisition and analyze the data in your software.

This gives you the flexibility to integrate the MCS-Wireless-System in your existing set-up and use the peripheral equipment you are familiar with - while adding valuable, undisturbed in vivo data.
**Versatile software: Multi Channel Suite**

The Wireless-System comes with the powerful and easy-to-use software package Multi Channel Suite. It consists of three programs and updates are available for free from the MCS website.

**Multi Channel Experimenter** for data acquisition and online analysis. With an easy-to-use drag’n’drop interface, you simply create your virtual experiment adding e.g. data source, filters, spike detection, and recorder. Battery level and signal quality are indicated here and your data is displayed in real-time.

**Multi Channel Analyzer** for offline analysis. You just import the recorded data and define your in-depth analysis with additional instruments. The Multi Channel Analyzer also supports synchronized video input for behavioral research with freely moving animals. SMART events show up in the analyzed files. Both, the video data and electrophysiological recordings are displayed in parallel and you can easily skip through the data from one event to the next.

**Multi Channel DataManager** for data export for further analysis with third-party programs. Data files are exported into HDF5 (*.h5) (e.g. Matlab, Python), Neuro-Explorer (*.nex), Spike2 (*.smr), ASCII file (*.txt) or European Data Format (*.edf+ or *.emf). Independent of the file format, the export is done quickly and a data compression is included.

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**Electrical and optical stimulation**

MCS uniquely provides headstages for optical and electrical stimulation.

You do not need to give up valuable recording information while stimulat-ing; the headstages allow you to record and stimulate simultaneously!

The headstages for optical stimulation offer an interface to 2 LEDs. So in addition to up to 32 recording channels, you can program 2 stimulation patterns for the connected LEDs. Adapters for optrodes or Thorlabs optical fibers are available through MCS.

The headstages for electrical stimulation have 2 current stimulation channels and up to 32 recording channels. Stimulation can be applied via two dedicated channels of the electrode connector, or via an external stimulation electrode connected to the headstage.

Optical as well as electrical stimulation patterns can be designed freely via the included software Multi Channel Experimenter.

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**Video-to-data synchronization**

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

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

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Combine electrophysiology and behavioral studies with Panlab SMART software

The Multi Channel Experimenter and Video Control software packages allow you to record both physiological data and video in parallel. The video frames are captured synchronously to the data acquisition sampling. You can load the captured video into the Panlab SMART software and analyze it to extract behavioral events, with the results being saved in a file. Finally, the Multi Channel Analyzer allows you analyze not only electrophysiological, but also behavioral data in one software package, by simply loading all data files into the Analyzer software package.

Various possibilities for battery placement and electrode connections

For maximum flexibility, we offer headstages with connections to any type of 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 for the cable-connected battery. All devices of the Wireless-Systems are designed to be energy-efficient. The standard battery of the headstage permits continuous recording of all channels for approx. 2 hours (details on back side). Recharging is then realized via a USB charger.

For recording in animals insensitive to weight, we also offer larger batteries, which provide longer recording times. Please contact Multi Channel Systems for more information on battery options.

For power-saving, the headstage switches to stand-by mode as soon as the data acquisition is stopped. When recording continues, the headstage switches on automatically. Another possibility is to turn off the headstage completely via the data acquisition software. For switching on without any interference, just use the included infrared flashlight which does not disturb the animal.

Single channels can always be switched on and off for recording via software. This allows you to adjust energy consumption and sampling rate whenever you like.
Wireless-Systems: Technical specifications

Number of channels  
4, 8, 16 or 32

Dimensions (W x D x H) (Width w/o antennas; height w/o battery)

Weight (Headstage without battery)

<table>
<thead>
<tr>
<th>Number of channels</th>
<th>Recording only</th>
<th>Recording + electrical stim.</th>
<th>Recording + optical stim.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dimension [mm]</td>
<td>Weight [g]</td>
<td>Dimension [mm]</td>
</tr>
<tr>
<td>4</td>
<td>12.5 x 12.5 x 5.5</td>
<td>1.8</td>
<td>---</td>
</tr>
<tr>
<td>8</td>
<td>15.5 x 15.5 x 5.2</td>
<td>2.8 (OM), 3.0 (SR)</td>
<td>15.5 x 15.5 x 7.5</td>
</tr>
<tr>
<td>16</td>
<td>15.5 x 15.5 x 5.2</td>
<td>2.9</td>
<td>15.5 x 15.5 x 7.5</td>
</tr>
<tr>
<td>32</td>
<td>15.5 x 15.5 x 6.5</td>
<td>3.6</td>
<td>15.5 x 15.5 x 9.2</td>
</tr>
</tbody>
</table>

Battery types and approx. weights
(Standard batteries, other capacities available on request)

| Capacity       | Weight of battery (cable | battery board) |
|----------------|--------------------------|
| 30 mAh         | 1.5 g | 1.5 g |
| 100 mAh (standard) | 3.7 g | 3.8 g |
| 200 mAh        | 5.1 g | 6.7 g |
| 300 mAh        | 8.1 g | 8.7 g |

Battery life (until recharge)
e.g. 8 channels at 25 kHz with 100 mAh battery: approx. 2 hours

Resolution
16 bit

Input voltage range
± 12.4 mV

Input noise
< 1.9 µV RMS

Max. sampling rate (kHz per channel)
(in single headstage mode)

<table>
<thead>
<tr>
<th>Sampling rate (kHz/ch)</th>
<th>Number of selected channels</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
</tr>
<tr>
<td>W2100-HS4</td>
<td>40</td>
</tr>
<tr>
<td>W2100-HS4-opto</td>
<td>10</td>
</tr>
<tr>
<td>W2100-HS8*</td>
<td>40</td>
</tr>
<tr>
<td>W2100-H16*</td>
<td>40</td>
</tr>
<tr>
<td>W2100-HS32*</td>
<td>40</td>
</tr>
</tbody>
</table>

*Recording only + optical + electrical stimulation

Bandwidth
1 Hz to 5 kHz (Adjustable to 0.1 Hz or DC by software)

Distance for wireless link
5 m guaranteed (under normal lab conditions)

Control interface
USB 3.0

Sensor (except 4 channel version)
16 bit digital resolution

- triaxial accelerometer, range ± 8 g
- triaxial gyroscope, range 1000 °/s

Software:
Operating system
Windows 10, 8.1 (64 bit) (English and German versions supported)

Multi Channel Suite
Version 2.13.5 and higher