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>Weight (Headstage)</th>
<th>Weight (Headstage w/ battery)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>1.8 g</td>
<td>1.9 g</td>
</tr>
<tr>
<td>8</td>
<td>2.8 g (OM), 3.0 g (SR)</td>
<td>3.8 g (OM), 4.1 g (SR)</td>
</tr>
<tr>
<td>16</td>
<td>2.9 g</td>
<td>3.8 g</td>
</tr>
<tr>
<td>32</td>
<td>3.6 g</td>
<td>4.5 g</td>
</tr>
</tbody>
</table>

Battery:

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

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):

<table>
<thead>
<tr>
<th>Type of input</th>
<th>Sampling rate (kHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recording only</td>
<td>5000</td>
</tr>
<tr>
<td>Recording + electrical</td>
<td>3000</td>
</tr>
<tr>
<td>Recording + optical</td>
<td>2000</td>
</tr>
</tbody>
</table>

Bandwidth:

- 1 Hz to 5 kHz (Adjustable to 0.1 Hz or DC by software)
- 5 kHz guaranteed (under normal lab conditions)

Control interface: USB 3.0

Sensor (except 4 channel version):

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

Software:

- Operating system: Windows 10, 8.1 (16-bit English and German versions supported)
- Multi Channel Suite: Version 2.7.3 and higher

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
- Excellent signal-to-noise ratio and parallel recordings possible
- Option to access analog data
- Integrative video tracking system provided, integrated in GUI
- Combination with Panlab SMART software
The Wireless-System from Multi Channel Systems is the all-in-one solution for amplifying, recording, and analyzing in vivo data from 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 signal checking, digital transmission, powerful receiver, interface board, and data acquisition software package. All you need is to plug in the channel versions) are equipped with a disposible 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 ECG. Additional inputs to the interface board allow the synchronization of your data with external devices.

The Wireless-System from Multi Channel Systems is an all-in-one solution for amplifying, recording, and analyzing in vivo data from 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.

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

The Wireless-System from Multi Channel Systems is the all-in-one solution for amplifying, recording, and analyzing in vivo data for 8, 16 or 32 channels. The amplifier bandwidth is 1 Hz to 5 kHz (adjustable to 0.1 Hz or 0.01 Hz 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 easy tracking, signals from all channels, powerful receiver, interface board, and data acquisition software package. All you have to do is install the drivers (including the embedded operating system) and then connect the headstages to the computer. This allows online data analysis and results being saved in a file. Finally, the Multi Channel Analyzer allows you to export data for further analysis with third-party software.

Parallel experiments

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

Electrical and optical stimulation

The Wireless-System comes with the powerful and easy-to-use software package Multi Channel Suite. It consists of three programs and the Multi Channel Analyzer allows you to program 2 stimulation channels. Additional inputs to the interface board allow the synchronization of your data with external devices.

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 32 channels. A bidirectional communication between a high quality USB 3.0 camera with 16 channel video input and the wireless system allows a precise frame-to-frame synchronization of video and electrophysiological data. Both systems can run on the same PC. IR camera options are available on request.

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 user interface, you simply create your virtual experiment adding e.g. data sources, filters, spike detection, and recorder battery level and signal quality are indicated 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 information. 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 data are displayed and you can quickly step through the data from one event to the next.

Multi Channel Data Explorer: for data export for further analysis with third-party programs. Data files are exported into HDF5 (*.h5), 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.

Combine electrophysiology and behavioral studies with Panlab SMART software

The Multi Channel Experimenter and Video Control software package allows you to record both physiological data and video in parallel. The video frames are captured synchronously to the data acquisition sampling rate. You can use the captured videos 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 to export 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 connectors to any type of probe. Just confuse 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-System are designed to be rechargeable. 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 large batteries, which provides 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 shut off the headstage completely via the data acquisition software. For switching on without any interference, just use the internal infrared flashlights which do not disturb the animal.

Single channels can be switched on and off for recording via software. This allows you to adjust energy consumption and sampling rate wherever you like.
Wireless recording system
The Wireless-System from Multi Channel Systems is the all-in-one solution for long-term in vivo experiments. The system allows for recording from up to 16 channels (except the 4-channel versions) are included in the standard package. The Wireless-System permits flexible long-term experiments in the same room, with a total number of 16 headstages. In combination with a long transmission range, the digital data transmission guarantees an excellent signal-to-noise ratio which is independent on the headstage.

Video-to-data synchronization
The Video-to-data synchronization in combination with the W2100-System allows wireless in vivo recordings with precise video-to-data synchronization with up to 50 frames/s. Electrical and optical stimulation
The Wireless-System is uniquely provides headstages for optical and electrical stimulation. For neurometabolic readouts of functional information while stimulating, the headstages allow you to record and stimulate simultaneously. The headstages for optical stimulation offer an interface to two LEDs. In addition to up to 16 recording channels, you can program 2 stimulation patterns for the connected LEDs. Adapters for TTL or TriState optical fibers are available through MCS.

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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>Battery</th>
<th>Battery types and approx. weights (Standard batteries, other capacities available on request)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lithium-Polymer, rechargeable</td>
<td>100 mAh (standard)</td>
</tr>
<tr>
<td></td>
<td>3 g</td>
</tr>
</tbody>
</table>

Battery life (until recharge): e.g. 8 channels at 25 kHz with 100 mAh battery: approx. 2 hours
Resolution: 16 bit
Input voltage range: ± 12.5 mV (OM), ± 12.4 mV (SR)
Input noise: < 1.9 µV RMS
Max. sampling rate (kHz per channel): 25 kHz

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): triaxial accelerometer, range ± 8 g

Softwares:
Operating system: Windows 10, 8.1 (16 bit English and German versions supported)
Multi Channel Suite: Version 2.7.3 and higher

For complete solutions for electrophysiology visit: www.smart-ephys.com

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- 4, 8, 16 or 32 recording channels
- Triaxial gyroscope and accelerometer sensor
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- Lithium-Polymer, rechargeable

Battery types and approx. weights:

- Standard batteries, other capacities available on request

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):

- 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):

- Triaxial gyroscope, range ± 8 g
- Triaxial accelerometer, range ± 9 g

Software:

- Operating system: Windows 10, 8.1 (64-bit), English and German versions supported
- Multi Channel Suite: Version 2.7.3 and higher

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