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)

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)

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

Wireless-Systems: Technical specifications

<table>
<thead>
<tr>
<th>Number of Channels</th>
<th>Recording only</th>
<th>Recording + electrical stim.</th>
<th>Recording + optical stim.</th>
</tr>
</thead>
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<tr>
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<td>19.5 x 15.5 x 7.5</td>
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<tr>
<td>16</td>
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<td>19.5 x 15.5 x 7.5</td>
<td>19.5 x 15.5 x 7.5</td>
</tr>
<tr>
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<td>15.5 x 15.5 x 6.5</td>
<td>20.5 x 15.5 x 9.2</td>
<td>20.5 x 15.5 x 9.2</td>
</tr>
</tbody>
</table>

Distributed by:

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Fax: +49-7121-909 25-11
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www.multichannelsystems.com

For complete solutions for electrophysiology visit:
www.smart-ephys.com
**Wireless recording system**

The Wireless-System from Multi Channel Systems is the all-in-one solution for recording, amplifying, 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 video tracking, digital transmission, powerful receiver, interface board, and data acquisition software package. All software required for reliable recording and post-analysis is included (except the channel versions) and is equipped with a graphical and acousto-motorized sensor, which allows synchronization with electrophysiological data. With its excellent signal-to-noise ratio, it is the ideal solution for recording spikes, LFP, EEG, EOGs, and EOGs. Additional inputs to the interface board allow the synchronization of your data with external devices.

**Video-to-data synchronization**

The W2100/Video-System allows wireless in vivo recordings with precise video-to-data synchronization with up to 16 channels. Bidirectional communication between a high quality USB 3.0 camera from ESI and the wireless system allows a precise in vivo-frame synchronous video tracking of electrophysiological data. Both systems can run on the same PC. IR camera options are available on request.

**Electrical and optical stimulation**

MCS uniquely provides headstage for optical and electrical stimulation. For neurostimulation and recordings of information-while-stimulating, the headstage allows you to record and stimulate simultaneously! The headstage for optical stimulation offers an interface to 2 LEDs. In addition to up to 32 recording channels, you can program 2 stimulation patterns for the connected LEDs. Adaptors for optimisation or Thorlabs optical fibres are available through MCS.

The headstage for electrical stimulation have 2 current stimulation channels and up to 32 recording channels. Stimulation can be applied via 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.

**Parallel experiments**

The Wireless-System offers the possibility to record from up to 8 animals simultaneously with one setup (at a reduced sampling rate). Up to 8 mice can be run in parallel in the same room, with a total number of 16 headstages.

**Versatile software: Multi Channel Suite**

The Wireless-System comes with the powerful and easy-to-use software package Multi Channel Suite. In 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 graphical interface, you can create your virtual experiment editing e.g. data sources, filters, spike detection, and recorder battery level and signal quality are indicators 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 data are synchronized and you can easily step through the data from one event to the next.

**Multi Channel Stimulator** for data export for further analysis with third-party programs. Data files are exported into HDF5 (*.h5) (e.g. Matlab, Python), Neurophiler (*.xls), Spindog (*.xls), ASCII file (*.txt) or European Data Format (*.edf or *.mff). Independent of the file format, the import is done quickly and a data compression is included.

**Separate headstage for data acquisition and online analysis.**

Select one of the headstages from the multi-channel recording systems and use it for electrical and/or optical stimulation. The headstage can be used with the included software Multi Channel Experimenter.

**Arrange multiple to any data acquisition.**

Generally, the Wireless-Systems are complete work stations with data acquisition and software from Multi Channel Systems. However, if you have the option to add an analog output of all channels, you can connect your existing data acquisition equipment to the devices in your software.

This gives you the flexibility to integrate the MCS-Wireless-System in your existing setup and use the peripheral equipment you are familiar with – such as recording equipment, video systems, or other online analysis software packages. The Multi Channel Experimenter allows you to manage many different devices with just a few clicks. You can define and run experiments that include data acquisition, stimulation, and behavioral recording.

**Various possibilities for battery placement and electrode connections**

For maximum flexibility, we offer headstages with connections to any type of probes. Just as you choose 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. Either option allows you to record for any duration of time.

**Combining optical and electrical stimulation**

The Wireless-Systems allow you to combine electrical and optical stimulation. The system is designed to support the synchronization of electrical and optical stimulation events. You can define your own stimulation patterns and record the corresponding electrophysiological data.

**Electrical stimulation**

The Electrical system allows you to control the stimulation of the electrodes. You can define the stimulation parameters such as the amplitude, frequency, and duration. The system provides a flexible and user-friendly interface for modifying these parameters in real-time.

**Optical stimulation**

The Optical system allows you to control the light intensity and duration of the stimulation. The system provides a variety of light sources, including infrared and visible light. You can define the specific wavelengths and intensities for each channel.

**Combining optical and electrical stimulation**

The Wireless-Systems allow you to combine electrical and optical stimulation. The system is designed to support the synchronization of electrical and optical stimulation events. You can define your own stimulation patterns and record the corresponding electrophysiological data.

**Electrical stimulus delivery**

The Electrical system allows you to control the stimulation of the electrodes. You can define the stimulation parameters such as the amplitude, frequency, and duration. The system provides a flexible and user-friendly interface for modifying these parameters in real-time.

**Optical stimulus delivery**

The Optical system allows you to control the light intensity and duration of the stimulation. The system provides a variety of light sources, including infrared and visible light. You can define the specific wavelengths and intensities for each channel.

**Combining optical and electrical stimulation**

The Wireless-Systems allow you to combine electrical and optical stimulation. The system is designed to support the synchronization of electrical and optical stimulation events. You can define your own stimulation patterns and record the corresponding electrophysiological data.
Wireless recording system

The Wireless-System from Multi Channel Systems is the all-in-one solution for acquiring, analyzing and organizing in vivo data from 4, 8, 16 or 32 channels. The system allows the recording of up to 8 channels simultaneously, with a maximum of 16 bits, the accuracy of your data is guaranteed. The system includes everything you need:

- Small-sized headstage with integrated A/D converter and LED lights for video tracking, wireless transmission, powerful receiver
- Interface board, and data acquisition software package. All-you-need-for-precise frame-by-frame synchronization between video and electrophysiological data, which allows synchronizing of data with external devices.
- Key advantage: recorded signals into digital data already in large environments.

Parallel experiments

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

Electrical and optical stimulation

The Wireless-System can be used for the recording of electrophysiological data from up to 32 channels. This allows you to record and stimulate simultaneously! 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 electronic connector, or via an external stimulation device connected to the headstage.

Video-to-data synchronisation

The W2100-Video-System in combination with the W2100-System allows wireless in vivo recordings with precise video-to-data synchronisation with up to 8 channels. Bi-directional communication between a high quality USB 3.0 camera from EG and the wireless system allows a precise frame-by-frame synchronisation between video and electrophysiological data. Both systems can run on the same PC. IR camera options are available on request.

Various possibilities for battery placement and electrode connections

For maximum flexibility, we offer headstages with connectors to any type of probes. Just choose the one that you prefer and we will do the adjustment that suits you best. Moreover, depending on your experiment, you can also decide where to position the battery of the headstage. Either fit 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 lightweight. The standard battery of the headstage permits continuous recording of all channels for approx. 2 hours (details on the back of the headstage).

For recording in animals insensitive to weight, we also offer larger batteries, which provide longer recording times. The headstages allow you to record and stimulate simultaneously! The headstages are energy-efficient. The standard battery of the headstage permits continuous recording of all channels for approx. 2 hours (details on the back of the headstage).

For power-saving, the headstage switches to stand-by mode as soon as the data acquisition is stopped. When recording continues, the headstages switch 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 be switched on and off for recording via software. This allows you to adjust energy consumption and sampling rate whenever you like. 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.

Combining 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. You can use the captured videos into the Panlab SMART software and analyze it to extract behavioral events, with the results being saved in one file. 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.

Wireless recording system

The Wireless-System from Multi Channel Systems is the all-in-one solution for acquiring, analyzing and organizing in vivo data from 4, 8, 16 or 32 channels. The system allows the recording of up to 8 channels simultaneously, with a maximum of 16 bits, the accuracy of your data is guaranteed. The system includes everything you need:

- Small-sized headstage with integrated A/D converter and LED lights for video tracking, wireless transmission, powerful receiver
- Interface board, and data acquisition software package. All-you-need-for-precise frame-by-frame synchronization between video and electrophysiological data, which allows synchronizing of data with external devices.
- Key advantage: recorded signals into digital data already in large environments.

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

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The Wireless-System can be used for the recording of electrophysiological data from up to 32 channels. This allows you to record and stimulate simultaneously! 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 electronic connector, or via an external stimulation device connected to the headstage.

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Various possibilities for battery placement and electrode connections

For maximum flexibility, we offer headstages with connectors to any type of probes. Just choose the one that you prefer and we will do the adjustment that suits you best. Moreover, depending on your experiment, you can also decide where to position the battery of the headstage. Either fit 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 lightweight. The standard battery of the headstage permits continuous recording of all channels for approx. 2 hours (details on the back of the headstage).

For recording in animals insensitive to weight, we also offer larger batteries, which provide longer recording times. The headstages allow you to record and stimulate simultaneously! The headstages are energy-efficient. The standard battery of the headstage permits continuous recording of all channels for approx. 2 hours (details on the back of the headstage).

For power-saving, the headstage switches to stand-by mode as soon as the data acquisition is stopped. When recording continues, the headstages switch 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 be switched on and off for recording via software. This allows you to adjust energy consumption and sampling rate whenever you like.
The Wireless-System from Multi Channel Systems is the all-in-one solution for recording, analyzing, and archiving 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 target tracking, digital transmission, powerful receiver, interface board, and data acquisition software package. All amplifiers can use the same channel numbers. The headstage is 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 spiking, LFP, EEG, EOG, and ECG. Additional inputs to the interface board allow the synchronization of your data with external devices.

Parallel experiments

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

Video-to-data synchronization

The W2100-Video-System in combination with the W2100-System allows wireless in vivo recordings with 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.

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 sources, filters, spike detection, and recorder battery level and signal quality are indicated.

Multi Channel Analyzer: for offline analysis. You just import the recorded data and define your depth in analysis with additional instruments. The Multi Channel Analyzer also supports synchronized video input for behavioral research with freely moving animals. SMART events show up as annotated video frames, the video data and electrophysiology are displayed and you can easily step through the data from one event to the next.

Multi Channel Database: for data export for further analysis with third-party programs. Data files are exported into ASCII (*txt), Excel (*xls), or MATLAB (*mat). Also, data files can be exported into standard file formats (*edf, *emf). The database is structured and can be filtered to allow the data export.

Electrical and optical stimulation

The Wireless-System is uniquely provided with an optical stimulation option. You not only have a powerful solution for recording information while stimulating, the headstage allows you to record and stimulate simultaneously! The headstage for optical stimulation offers an interface to 2 LEDs. In addition to up to 32 recording channels, you can program 2 stimulation patterns for the connected LEDs. Adapters for options or Thorlabs optical fibers are available through MCS.

The headstage for electrical stimulation have 2 current stimulation channels and up to 32 recording channels. Stimulation can be applied on 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 defined freely via the included software Multi Channel Experimenter.

Various possibilities for battery placement and electrode connections

For maximum flexibility, we offer headstages with connectors 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-System 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). Blackening is then reduced via a USB charger.

For recording in animals that have to be weighed, 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 standby 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.

For maximum flexibility, we offer headstages with connectors 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-System 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). Blackening is then reduced via a USB charger.

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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)

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): *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)
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

<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>4</td>
<td>12.5 x 12.5 x 5.5</td>
<td>1.8 g</td>
<td></td>
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<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 g</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 g</td>
<td>15.5 x 15.5 x 9.2</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
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<th>Recording + electrical stim.</th>
<th>Recording + optical stim.</th>
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<tbody>
<tr>
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<td>12.5 x 12.5 x 5.5</td>
<td>1.8</td>
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</tr>
<tr>
<td>8</td>
<td>15.5 x 15.5 x 5.2</td>
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</tr>
<tr>
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<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

<table>
<thead>
<tr>
<th>Battery types and approx. weights</th>
<th>Weight of battery (cable</th>
<th>battery board)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lithium-Polymer, rechargeable</td>
<td>1.5 g</td>
<td>30 mAh</td>
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<tr>
<td>Standard batteries, other capacities available on request</td>
<td>3.7 g</td>
<td>100 mAh (standard)</td>
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<tr>
<td></td>
<td>5.1 g</td>
<td>200 mAh</td>
</tr>
<tr>
<td></td>
<td>8.1 g</td>
<td>300 mAh</td>
</tr>
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</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: ± 12.4 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 channels</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>4</td>
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<tr>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>16</td>
<td>32</td>
</tr>
</tbody>
</table>

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
- triaxial gyroscope, range 1000 °/s

Software:
- Operating system: Windows 10, 8.1 (64 bit) (English and German versions supported)
- Multi Channel Suite: Version 3.15 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