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))
  - 4 channels: 12.5 x 12.5 x 5.5
  - 8 channels: 15.5 x 15.5 x 7.5
  - 16 channels: 15.5 x 15.5 x 7.5
  - 32 channels: 15.5 x 15.5 x 9.2
- Weight (Headstage without battery)
  - 4 channels: 1.8 g
  - 8 channels: 2.8 (OM), 3.0 (SR) g
  - 16 channels: 2.9 g
  - 32 channels: 3.6 g

Battery
- Lithium-Polymer, rechargeable
- Battery types and approx. weights
  - 30 mAh: 1.5 g (cable | battery board)
  - 100 mAh (standard): 3.7 g (cable | battery board)
  - 200 mAh: 5.1 g (cable | battery board)
  - 300 mAh: 8.1 g (cable | battery board)
- 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 ± 1000 °/s
  - Triaxial accelerometer: range ± 8 g
- Software:
  - Operating system: Windows 10, 8.1 (64-bit; English and German versions supported)
  - Multi Channel Suite: Version 2.13.5 and higher

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www.multichannelsystems.com

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

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
For offline analysis. You just import the recorded data – it’s valuable, undisturbed recording set-up and use the peripheral equipment of the MCS-Wireless-System in your existing work stations with data acquisition software. The Wireless-System allows you to add an option to record data from up to eight animals simultaneously with one setup (at a reduced sampling rate). Up to four receivers can be run in parallel. The Wireless-System offers the possibility to record from up to 32 channels.

### Electrical and optical stimulation

The Wireless-System is the all-in-one solution for recording, analyzing and visualizing 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,
- Digital transmission, powerful receiver, amplifying, recording, and analyzing signals from any type of probes.
- Interface board, and data acquisition software package. All necessary protocols for recording and analyzing electrophysiological and behavioral signals are included.

The state-of-the-art recording software package Multi Channel Suite is easy-to-use and allows you to define your virtual experiment and your data display by drag’n’drop. You can adjust the 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 analyze not only electrophysiological, but also behavioral data from one event to the next.

### 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 and store all data for offline analysis.
- **Multi Channel Analyzer** for offline analysis. You import the recorded data and define your virtual experiments with additional instructions. The Multi Channel Analyzer also supports synchronized video input for behavioral research with freely moving animals. The headstage sends visual or acoustic cues to the animal which it can easily track through the data from one event to the next.

### Video-to-data synchronization

The Wireless-System in combination with the Wireless-System allows wireless in vivo recordings with precise video-to-data synchronization with up to 50 frames/s. The synchronization with up to 50 frames/s is independent of the file format. The export is done quickly and a data compression is included.

### Electrical and optical stimulation

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 PainLab SMART software and analyze it to extract behavioral events, with the results being saved in a file. Finally the Multi Channel Analyzer analyzes the raw data to extract synaptic events, using the results of the Multi Channel Experimenter.

### Video-to-data synchronization

The wireless headstages are equipped with a triaxial gyroscope and LED lights for video tracking. Independent of the file format, the export is done quickly and a data compression is included. In combination with a long transmission range, the digital data transmission guarantees an excellent signal-tonoise ratio which is independent of the distance between sender and receiver. This permits flexible long-term experiments in vivo.

### Electrical and optical stimulation

The headstage for electrical stimulation has 2 current stimulation channels and 4 sensory 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.

### Electrical and optical stimulation

In combination with a long transmission range, the digital data transmission guarantees an excellent signal-to-noise ratio which is independent of the distance between sender and receiver. This permits flexible long-term experiments in vivo.

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**Wireless recording system**

The Wireless-System from Multi Channel Systems is the all-in-one solution for high-quality recording, amplifying, and analyzing electrophysiological signals. The system includes everything you need to set up a complete wireless recording setup:

- Interface board
- Data acquisition software package
- Digitizer
- Amplifiers
- LED lights
- Video tracking devices
- Various power options

The Wireless-System allows for offline analysis. You can import the recorded data and adjust the setup in the included software Multi Channel Experimenter.

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**Parallel experiments**

The wireless system offers the possibility to record from up to eight animals simultaneously with one or two independent channels. The wireless system comes with a total number of 16 headstages, which are included in the package.

---

**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 updates and is available for free from the MCS website.

- **Multichannel Experimenter** for data acquisition and online analysis. With an easy-to-use graphical user interface, you can easily save and load your experiment data.
- **Multichannel Analyzer** for offline analysis. You can load the recorded data from the Virtual Data File (VDF) and define your analysis parameters.
- **Multi Channel Experimenter** for data export and further analysis. With its intuitive interface, you can easily manage your data and save it in an easy-to-use format.

**Video-to-data synchronization**

The Neuro2100 Video-System in combination with the Wireless-System allows wireless recording with precise frame-to-frame synchronization. Both systems can run on the same computer, and they can be used for synchronized recording and online analysis. With an easy-to-use interface, you can easily manage your data and save it in an easy-to-use format.

**Video software: Multi Channel Suite**

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- **Multi Channel Experimenter** for data export and further analysis. With its intuitive interface, you can easily manage your data and save it in an easy-to-use format.

**Combinable systems and devices**

- **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 load the captured videos into the Panlab SMART software and analyze its content simultaneously with the data acquisition data.

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

For maximum flexibility, we offer headstages with connectors to any type of probe. 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. Each unit in the headstage itself or via a special backpack for the cable-connected battery. All devices of the Wireless-Systems are designed to be extremely lightweight and simple to use.

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, we recommend to use an on/off switch for the animal's comfort. 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 extremely lightweight and simple to use.

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**Interface board 3.0 multichannel**

The MCS-IFB 3.0 multichannel is a new generation of interface board, which enables you to operate a wide range of devices in vivo or in vitro. It is available through MCS and allows you to control and synchronize your experiments with third-party equipment.

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**Battery options**

Available for all devices of the Wireless-Systems are different battery options.

- **MCS-IFB 3.0 multichannel**
- **MCS-IFB 3.0 single channel**
- **MCS-IFB 3.0 headstage**

---

**Software packages**

- **Multi Channel Experimenter**
- **Multi Channel Analyzer**
- **Multi Channel Experimenter for data acquisition and online analysis.**
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**Additional information**

- **MCS-IFB 3.0 multichannel**
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The Wireless-System from Multi Channel Systems is the all-in-one solution for recording, online analysis, and anamalysing 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 components include everything you need: Small-sized headstage with integrated A/D converter and LED lights for visual tracking, digital transmission, powerful receiver, interface board, and data acquisition software package. All you need to connect the recorded data to any data source, filters, spike detection, and recorder. Battery level and signal quality are visible on your computer.

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 mice can be ran in parallel in the same room, with a total number of 16 headstages.

Flexible and easy-to-use software

Generally, the Wireless-Systems are complete workstations with data acquisition and software from Multi Channel Systems. However, you have the option to add an analog output of all channels. You can connect your existing data acquisition and analyse the data 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 - solely adding wireless, undisturbed in vivo data.

Remote control for any data recording

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

Easy mounting of any data recording

External infrared flashlight which does not disturb the animal. Another possibility is to turn off the headstage completely via the interface board and recharging is then realized via a USB charger.

Video-to-data synchroniziation

The W2100 Video-System allows wireless in vivo recordings with precise video-to-data synchronisation with up to 32 channels.

If electrical and neuronal 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.

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 visible on your computer.

Multi Channel Analyzer: for offline analysis. You import the recorded data and define your data set 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 file. Both, the video data and electrical recordings are displayed and you can easily step through the data from one event to the next.

Multi Channel Experimenter: for data export for further analysis with third-party programs. Data files are exported into HDF5 (*.h5) (e.g. Matlab, Python), Neuroexplorer (new), Spike2 (old), AIDA file (*.ada) or European Data Format (*.edf or *.enf). 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.

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<table>
<thead>
<tr>
<th>Number of Channels</th>
<th>Recording only</th>
<th>Recording + electrical stim.</th>
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</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>12.5 x 12.5 x 5.5</td>
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</tr>
<tr>
<td>8</td>
<td>15.5 x 15.5 x 5.2</td>
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**Weight (Headstage without battery)**

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**Battery**: Lithium-Polymer, rechargeable

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<tr>
<td>30 mAh</td>
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**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 — requires additional 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

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**Distributed by:**

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

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- Triaxial gyroscope and accelerometer sensor
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- Lightweight headstages
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- Input voltage range: ± 12.4 mV
- Input noise: < 1.9 µV RMS
- Max. sampling rate per channel: 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)
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- Sensor (except 4 channel version): triaxial accelerometer, range ± 8 g
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