

Wireless-System Manual

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1 Introduction

1.1 About this Manual

This manual comprises all important information about the first installation of the hardware and software, and about the daily work with the instrument. It is assumed that you have already a basic understanding of technical and software terms. No special skills are required to read this manual.

If you are using the device for the first time, please read the **important safety advice** before installing the **hardware** and **software**, where you will find important information about the installation and first steps.

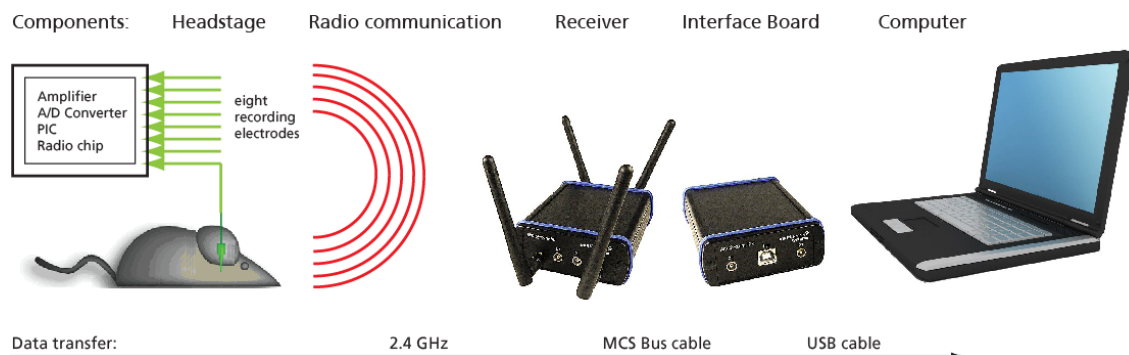
The **printed manual** and **help** are basically the same, so it is up to you which one you will use. The help offers you the advantage of scrolling through the text in a non-linear fashion, picking up all information you need, especially if you use the **Index**, and the **Search** function. If you are going to read larger text passages, however, you may prefer the printed manual.

The device and the software are part of an ongoing developmental process. Please understand that the provided documentation is not always up to date. The latest information can be found in the **help**. Check also the MCS web site (www.multichannelsystems.com) for downloading up-to-date manuals and help files.

1.2 Welcome to the Wireless Recording System

The innovative wireless recording *in vivo* system is the all-in one solution for amplifying, recording, and analyzing *in vivo* data from four, eight, sixteen or thirty-two channels. The bandwidth of the amplifier is 1 Hz to 5 kHz. The sampling rate is software controlled and user defined. With a resolution of 16 bit the accuracy of your data is guaranteed.

The sampling rate is up to 40 kHz when using two electrode channels of the W4-System or four electrode channels of the W8-System and up to 20 kHz when recording on all channels of the W4- or W8-System. For the W16-System the sampling rate is 10 kHz when using all 16 channels or up to 20 kHz when recording on 4 or 8 channels. Respectively, the sampling rate of the W32-System is 5 kHz when using all 32 channels and up to 10 kHz when using 16, 8 or 4 channels only.



The system includes everything you need: Small sized headstage with integrated A/D converter, digitized transmission and a powerful receiver. For controlling the easy to use software package MC_Rack is available. With its excellent signal-to-noise ratio, the **W4-, W8-, W16- or W32-Systems** are the ideal solution for spikes, LFP, EEC, ECG, and ECoG. Additional inputs to the receiver allow the synchronization of the data with external devices.



The headstages of the systems are extremely small and lightweight and allow the recording of neuronal activity in freely moving animals. A/D conversion at up to 20 kHz sampling rate in the headstages decrease the bandwidth for data transmission. Thus, it enables a long transmission range and low power consumption at the same time. This makes flexible long time experiments in large environments possible.

With one system it is possible to use up to four headstages in parallel for measuring several animals one by one. With several complete systems you can record from several animals at the same time. Even so the wireless systems can be adapted to different electrode connectors.

2 Important Information and Instructions

2.1 Important Safety Advice



Warning: Make sure to read the following advice prior to install or to use the device and the software. If you do not fulfill all requirements stated below, this may lead to malfunctions or breakage of connected hardware, or even fatal injuries.



Warning: Obey always the rules of local regulations and laws. Only qualified personnel should be allowed to perform laboratory work. Work according to good laboratory practice to obtain best results and to minimize risks.

The product has been built to the state of the art and in accordance with recognized safety engineering rules. The device may only

- be used for its **intended purpose**;
- be used when in a **perfect condition**.
- Improper use could lead to serious, even fatal injuries to the user or third parties and damage to the device itself or other material damage.



Warning: The device and the software are **not** intended for medical uses and **must not** be used on humans.

Malfunctions which could impair safety should be rectified immediately.

High Voltage

Electrical cords must be properly laid and installed. The length and quality of the cords must be in accordance with local provisions.

Only qualified technicians may work on the electrical system. It is essential that the accident prevention regulations and those of the employers' liability associations are observed.

- Each time before starting up, make sure that the **mains supply** agrees with the specifications of the product.
- Check the **power cord** for damage each time the site is changed. Damaged power cords should be replaced immediately and may never be reused.
- Check the **leads** for damage. Damaged leads should be replaced immediately and may never be reused.
- Do not try to insert anything sharp or metallic into the vents or the case.
- Liquids may cause short circuits or other damage. Keep the device and the power cords always **dry**. Do **not** handle it with wet hands.

Requirements for the installation

Make sure that the device is not exposed to direct sunlight. Do not place anything on top of the device, and do not place it on top of another heat producing device. Never cover the vents, not even partially, so that the air can circulate freely. Otherwise, the device may overheat.

2.2 Guarantee and Liability

The *General conditions of sale and delivery* of Multi Channel Systems MCS GmbH always apply. The operator will receive these no later than on conclusion of the contract.

Multi Channel Systems MCS GmbH makes no guarantee as to the accuracy of any and all tests and data generated by the use of the device or the software. It is up to the user to use good laboratory practice to establish the validity of his findings.

Guarantee and liability claims in the event of injury or material damage are excluded when they are the result of one of the following.

- Improper use of the device.
- Improper installation, commissioning, operation or maintenance of the device.
- Operating the device when the safety and protective devices are defective and/or inoperable.
- Non-observance of the instructions in the manual with regard to transport, storage, installation, commissioning, operation or maintenance of the device.
- Unauthorized structural alterations to the device.
- Unauthorized modifications to the system settings.
- Inadequate monitoring of device components subject to wear.
- Improperly executed and unauthorized repairs.
- Unauthorized opening of the device or its components.
- Catastrophic events due to the effect of foreign bodies or acts of God.

2.3 Operator's Obligations

The operator is obliged to allow only persons to work on the device, who

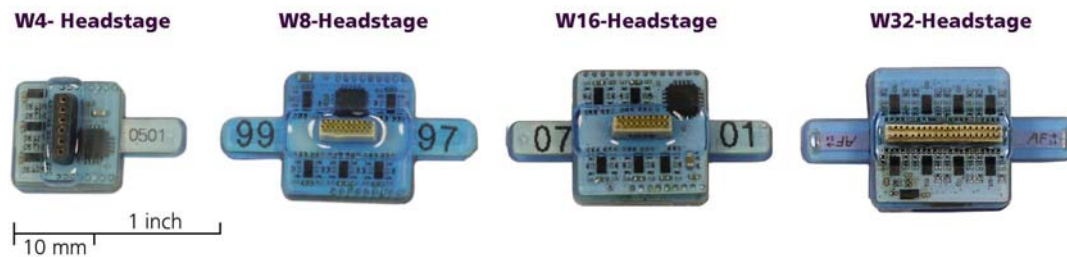
- are familiar with the safety at work and accident prevention regulations and have been instructed how to use the device;
- are professionally qualified or have specialist knowledge and training and have received instruction in the use of the device;
- have read and understood the chapter on safety and the warning instructions in this manual and confirmed this with their signature.

It must be monitored at regular intervals that the operating personnel are working safely.

Personnel still undergoing training may only work on the device under the supervision of an experienced person.

3 Hardware

3.1 Headstage



The headstage is the first of the three elements of the Wireless-System. The headstage is extremely small and lightweight and allows the recording of neuronal activity in freely moving animals. The A/D conversion with a variable sampling rate of 1, 2, 4, 5, 10 and 20 kHz when using all channels and 25, 32 and 40 kHz when using four or less than four channels of the W8-System or one or two channels of the W4-System. For the W16-System the maximal sampling rate is 10 kHz when using all 16 channels or up to 20 kHz when recording on 4 or 8 channels. Respectively, the sampling rate of the W32-System is 5 kHz when using all 32 channels and up to 10 kHz when using 16, 8 or 4 channels only.

Please see the table for the dimensions and weights of the headstages. Thus, the headstage is lightweight and reasonable for the freely moving laboratory animal.

Dimensions / Weight	W in mm	D in mm	H in mm	Weight in g
W4-System	13 (+ antenna)	13	5	1.9 (+ battery)
W8-System	16 (+ antenna)	16	5	2.9 (+ battery)
W16-System	16 (+ antenna)	16	6.5	3.6 (+ battery)
W32-System	16 (+ antenna)	16	7.5	3.7 (+ battery)

The headstage is designed energy efficient. The standard battery (100 mAh) of a headstage permits continuous recording of all channels for more than two hours. Recharging is then realized via USB. When doing experiments with animals insensitive to weight, MCS also offers larger batteries, which provide longer recordings. For the W4-System a smaller 30 mAh battery (1.5 g) is available. Please contact Multi Channel System MCS GmbH for more information on battery options.

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The battery can be fixed on the top side of the headstage or can be stored in a special backpack adapted to the size of the animal.



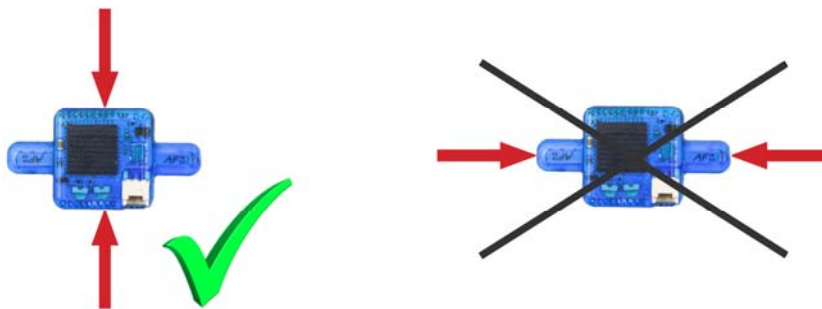
The connector of the headstage is connected to the electrode which is implanted into the brain of the laboratory animal. The external connector of the implanted electrode is fixed, for example with dental cement.

For maximum flexibility, MCS offers headstages with connections to all probes on request.

The headstage records analog signals from the electrodes. The integrated A/D converter converts the analog signals into digital signals, which are sent to the receiver via radio communication in the 2.4 GHz frequency band. Thus, it enables a long transmission range and low power consumption at the same time. This makes flexible long time experiments in large environments possible.

The headstage and the receiver should be placed near to each other in the experimental setup. They may have a distance to each other of about 5 m without data loss.

Handling of the Headstage



Note: Please handle the headstage with great care! Do not touch the antennae, but the body of the headstage!

First Tests of the Headstage with a ME/W-Signal Generator

For initial testing the Wireless-System you do not have to operate with a laboratory animal, but you can use a signal generator.



The **ME/W-System Signal Generator** is a convenient tool for the user. As a variable substitute for laboratory animals you can use the **ME/W-SG** as you would set up a research experiment.

That means you can test your Wireless-System and data acquisition settings without using valuable biological samples. It has the advantage that you do not need an animal, you reduce the number of animal experiments and save laboratory equipment. Please connect the headstage to the signal generator as shown on the picture. Please read the data sheet in the Appendix for operating the ME/W-Signal Generator device.



Charging Set

The charging set for the storage battery works via any USB connector. To recharge the battery, please connect the charging set to an USB port of the computer and plug the battery into the back of the charger.



The red LED on top indicates that the device is on. The yellow LED indicates that the storage battery is being recharged. After approximately one hour the green LED indicates the end of process.

3.2 Receiver



The receiver is the second element of the **Wireless-System**.

The receiver of the Wireless-System receives the digitized signals sent from the headstage in a distance of about 5 m. The device is equipped with four antenna to prevent data loss.

Two Lemo connectors on the front panel, labeled with D0 and D1 are available to feed in TTL signals for synchronization of the Wireless-System with other devices. For example, when passing a light barrier, feeding the animal or other events which manipulate the experiment. The check box "Digital Input Channel" in "Data Source Layout" must be activated when using the external digital data, otherwise it is not possible to display the external data on the MC_Rack screen. Please read chapter "Starting MC_Rack".



The two LEDs on the back of the receiver indicate the status of the system: The green LED indicates that power is on, the system is ready for recording. The blue LED flashes in a slow frequency, when the system is in stand by modus. The blue LED flashes in a fast frequency during data recording.

The receiver and the interface board respectively do not need an own power supply. They are powered by the USB high speed cable connected to the data acquisition computer.

3.3 USB Interface



The USB interface board is the third element of the **Wireless-System**.

The interface board is connected to the receiver with a MCS Bus cable, which is about 5 m long. Longer cables are delivered on request. The advantage is that the interface board can be placed near to the data acquisition computer in a different room than the experimental laboratory and the test animal will not be disturbed in excess of the experimental setup and the scientist. The connection to the data acquisition computer is realized via USB high speed cable, respectively.

Two additional Lemo connectors are available to feed in TTL signals for synchronization of the Wireless-System with other devices, for example when the test animal is passing a light barrier, when the animal is feeded or other events, which are manipulating the experiment. The check box "Digital Input Channel" in "Data Source Layout" must be activated when using the external digital data, otherwise it is not possible to display the external data on the MC_Rack screen. Please read chapter "Starting MC_Rack".



The two LEDs on the back of the interface board indicate the status of the system: The green LED indicates that power is on. If the green LED flashes, you have to install the newest version of MC_Rack software, which automatically will update your system with the drivers needed. When the hardware is successfully installed, the green LED illuminates stable. The blue LED flashes in slow frequency, when the system is in stand by modus. The blue LED flashes in fast frequency during data recording.

The interface board does not need an own power supply. It is powered via USB high speed cable by the data acquisition computer.

4 Software

4.1 Installing the Software

The data acquisition computer with the **Multi Channel Experimenter** and / or **MC_Rack** program comes preinstalled and preconfigured by MCS for a flawless operation. You should contact your local retailer for assistance if you want to install additional hard- or software, or if you want to replace the computer, as incompatibilities of hardware components or software settings with the data acquisition software may occur.

Caution: You have acquired a high performance data acquisition and analysis computer. Do not modify the system, do not install new hard- or software, or another operating system without asking MCS or your local retailer for advice. Especially do not install virus scanners or firewalls because these programs are known to interfere with the data transfer to the hard disk. MCS cannot guarantee that a modified system is fully operational. Even data loss may occur.

System requirements

Software:

One of the following Microsoft Windows ® operating systems is required: **Windows 10, 8.1 and 7, Vista,** or **XP** (English and German versions supported) with the NT file system. Other language versions may lead to software errors.

Hardware: System of implanted electrodes, headstage, receiver and interface box.

The **Wireless-System**. (Not required for offline analysis or demo mode). If no data acquisition is present, MC_Rack opens in a simulation mode. A computer with low performance may lead to performance limits more often; therefore, MCS recommends an up-to-date computer. Please note that there are sometimes hardware incompatibilities of the **Wireless-System** and computer components; or that an inappropriate computer power supply may lead to artifact signals. Please contact your local retailer for more information on recommended computer hardware.

Important: You need to have installed the latest Wireless-System driver to operate the system, which is automatically installed with MC_Rack. The installation may be invalid if the Wireless-System does not respond. Please contact Multi Channel Systems or your local retailer in this case.

Recommended operating system settings

The following automatic services of the Windows operating system interfere with the data storage on the hard disk and can lead to severe performance limits in the data acquisition software. These routines were designed for use on office computers, but are not very useful for a data acquisition computer.

Turn off **Windows System Restore**.

Turn off automatic **Windows Update**.

Deselect **Windows Indexing Service** for all local disks.

Turn off **Optimize hard disk when idle** (automatic disk fragmentation).

It is also not recommended to run any applications in the background when using the software. Remove all applications from the **Autostart** folder.

Be careful when using a **Virus Scanner**. These programs are known to disturb the software, and even data loss may occur.

When using a **Wireless-System** it is recommended to connect a high performance computer with a separate hard discs for program files and data storage. The provided possibility to make long term experiments with a sample rate of up to 50 kHz needs high memory capacity. Please remove data and defragment the hard disc regularly to ensure optimal performance.



Warning: The operating system settings of the data acquisition computer were preconfigured by MCS and should not be changed by the user. Changing these settings can lead to program instabilities and data loss.

Installing the software

Please check the system requirements before you install the software. MCS cannot guarantee that the software works properly if these requirements are not fulfilled.

Important: Please make sure that you have full control over your computer as an **administrator**. Otherwise, it is possible that the installed software does not work properly.

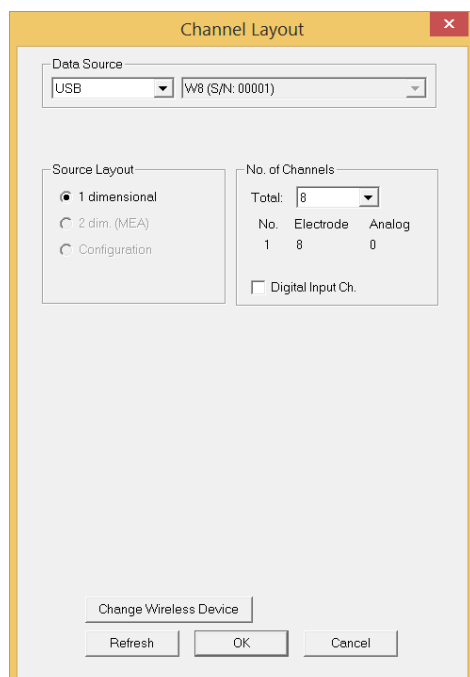
Double-click **Setup.exe** on the installation volume. The installation assistant will show up and guide you through the installation procedure.

Follow the instructions of the installation assistant. The **Wireless-System** driver and the data acquisition software are installed (or updated) automatically.

4.2 Starting MC_Rack

Connect, for example, a **W8-System** via USB high speed cable to the data acquisition computer. Connect the wireless headstage HS8 to a charged battery. Open MC_Rack program.

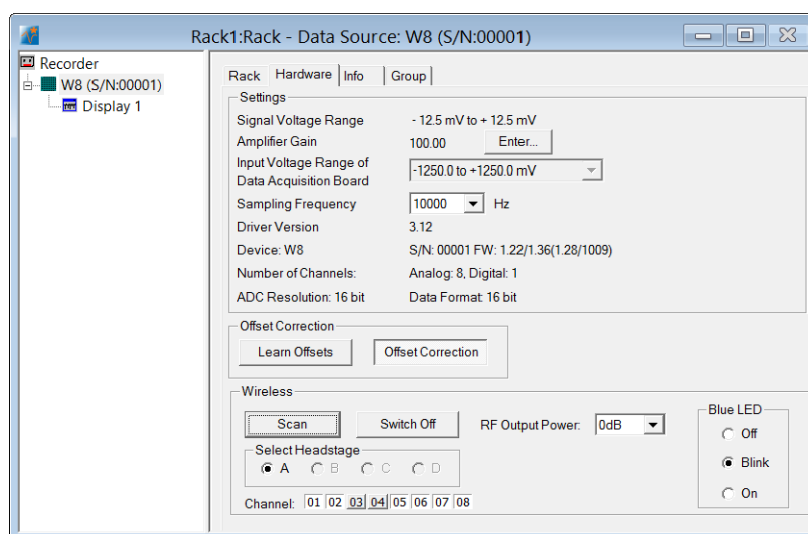
In "Edit" menu choose "Data Source Setup". The following "Channel Layout" dialog appears.



Select USB-MEA in the left drop down menu of "Data Source". The **W8-System** "MCS WPA8 (S/N 0001)" will automatically appear in the right drop down menu. In "Source Layout" the check box "1 dimensional" is predefined and the "Number of Channel" in total is "8".

Enable the check box "Digital Input Channel" if you want to display external TTL signals, feeded into the **W8-System** via Lemo connectors on receiver and interface board. Deselect the check box, if you do not need additional digital channels.

Add the **W8-System** and a display to the virtual rack. Click "Hardware" tab.



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There is an additional window in “Hardware” tab for the W8-System called “Wireless”, and the MC_Rack display shows an additional status line.

For Help, press F1

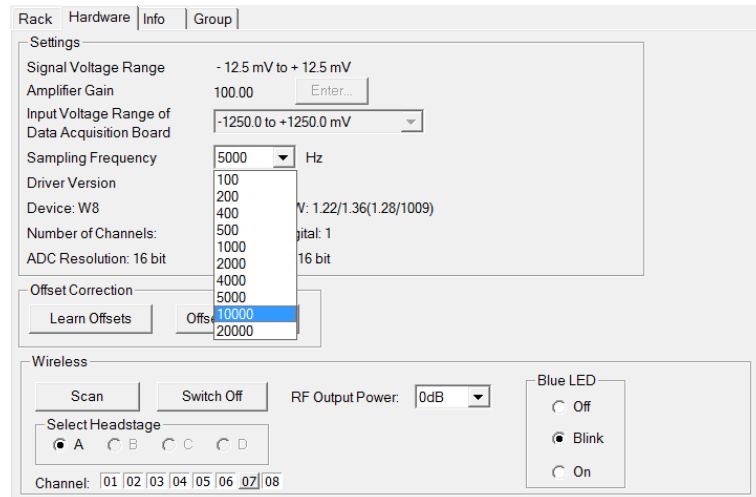
Starting W4 #00001.

W4

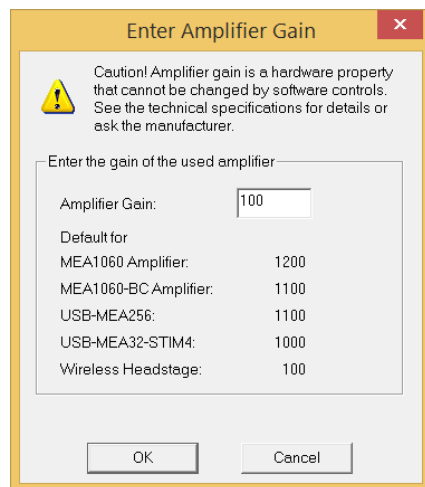
NUM

The “Sampling Frequency” of the system depends on the number of channels which are in use. When recording with all eight available channels the sampling rate is limited to 20 kHz. Recording with one to four channels only is possible with a sampling frequency of up to 40 kHz.

Click the “Sampling Frequency” drop down menu and select the desired sampling rate.

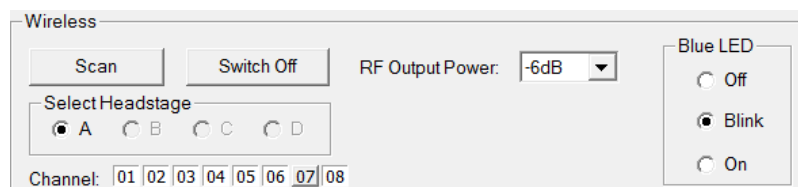


Click “Amplification Gain” button “Enter”.



The “Enter Amplifier Gain” dialog appears. The fixed amplifier gain of 100 for the wireless headstage is displayed in the list. Please type 100 into the window above.

Wireless Window



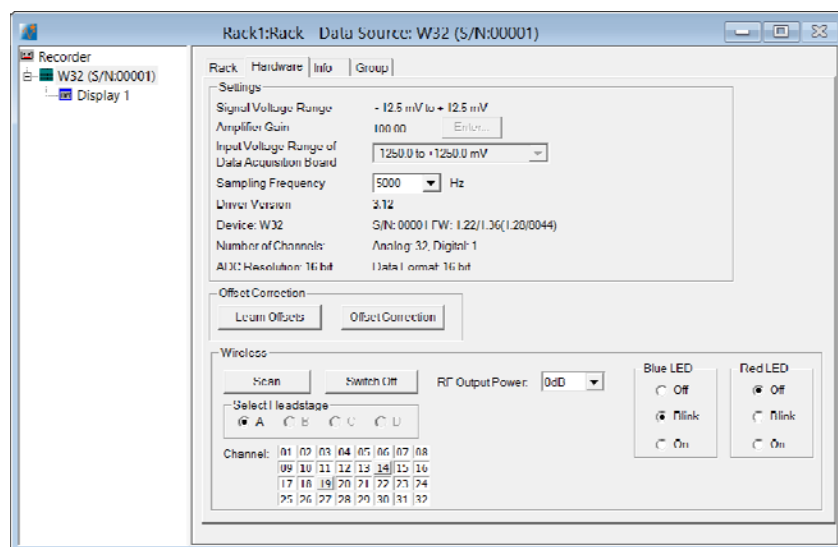
The additional window “Wireless” is for software control of the wireless system. In “Select Headstage” you can select one of the four headstages A, B, C, and D if more than one headstage is connected to the system. After pressing the button “Scan” the receiver scans which headstages are available. Then the user is able to select the desired headstage.

The appropriate channels of the selected headstage are chosen by clicking on the channel number. In the Wireless Window the selected channels appear pressed in as shown on the screenshot, Channel No 05, 06, 07, and 08.

To minimize energy consumption, you can switch off the headstage by clicking the button “Switch Off”. The headstage changes from “Stand By” modus into the “Switch off” modus. From “Switch off” modus it is not possible to switch a headstage back on via software control.

The blue LED mounted on the headstage of the W8-System indicates the recording phases. It can be switched into three modes via radio button. Select “Off” if the laboratory animal is disturbed by the light. Switching off the LED will save a little bit of energy. Select “Blink” and the LED flashes during recording. Select “On” and the LED will be on permanently. This feature can be used, for example for camera tracking.

The W32-headstage is equipped with two LEDs, the blue one and an additional red one.



The user has the same options to set the red LED independently from the red one. Both LEDs together improve the camera tracking, because with two LEDs it is possible to track the orientation of the headstage.

Choose a “RF Output Power” value from the drop down menu. The smaller the value, for example –6 dB, the longer the storage battery will support the recording, but the smaller the distance between animal and receiver.

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Strategies for Saving Energy

The standard recording time with a fully charged battery is 120 minutes at 20 kHz and 0 dB output power in a range of up to 5 m between headstage and receiver. Please read chapter "Power Consumption" in the Appendix.

To prolong the recording time until the battery has to be recharged on the one hand you can decrease the sampling frequency, on the other hand you can decrease the RF output power.

For example, when recording with 500 Hz sampling frequency you save 100 mA per hour and the energy of the storage battery lasts for a recording time of eight hours. This may be useful for experiments in epilepsy research.

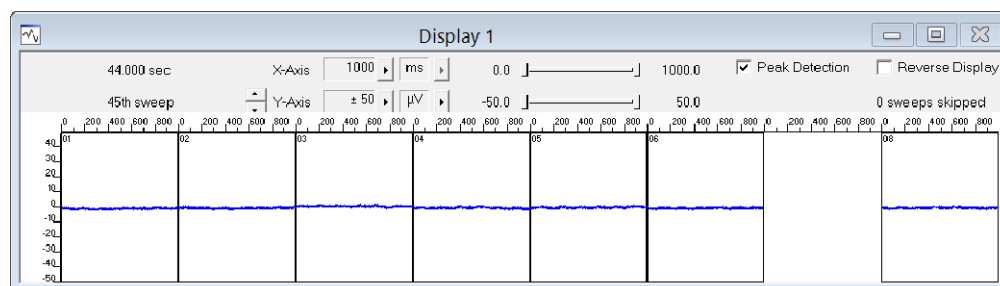
For example, when recording with -18 dB at 20 kHz sampling frequency you save approximately 50 mA per hour, that means the recording time is 30 minutes longer compared to the time when recording with 0 dB. However, the transmission power will decrease respectively.

Starting the W8-System again after switching off via software

To switch the headstage on again after pressing the button "Switch Off", the user has two possibilities: Use the infrared flasher and illuminate the receiver LEDs next to the battery connector. Then press the button "Scan" in "Wireless Window" to reconnect to the headstage.

The second possibility is to unplug the battery from the headstage manually and to reconnect headstage and battery again.

Add a display to your rack.



The number of displayed channels depends on the number of selected channels in "Wireless" of "Hardware" tab.

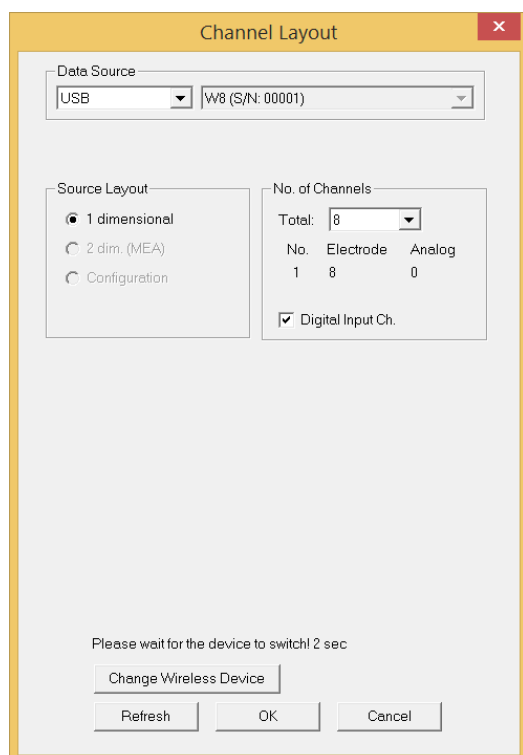
For detailed information about the use of MC_Rack, please read the MC_Rack manual.

Software Settings when using different Types of Headstages with one Wireless-System

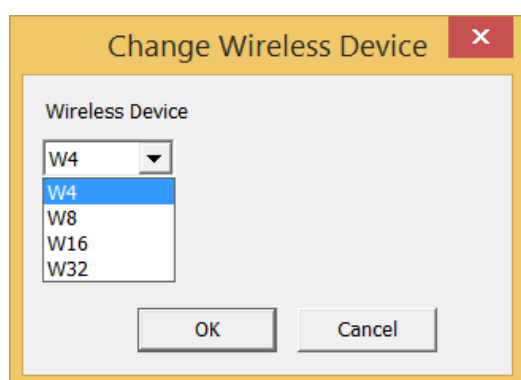
Maybe you will use your wireless system in different experimental setups, that is for example, first with an eight channel headstage and then with a four channel headstage. In this case you have to adapt the wireless system to the variable hardware requirements via MC_Rack software. MC_Rack needs specified driver units for each hardware component, which must be loaded when changing the type of the headstage.

The following example describes how to change a W8-System to a W4-System. The W8-System is already connected to the data acquisition computer and installed.

Open a new empty MC_Rack file and select "Data Source Setup". The system with eight channels will be found and displayed.



Click the button "Change Wireless Device".

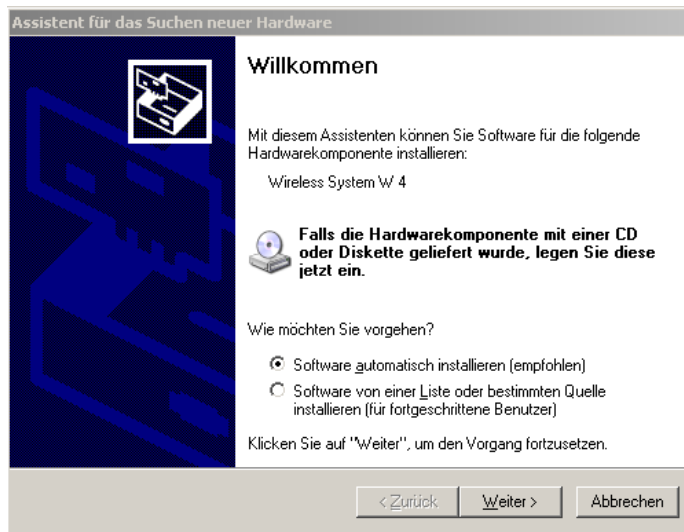


Select the W4-System from the drop down menu "Wireless Device Type" and confirm with "OK". The installation lasts a few seconds.

Please wait until the new driver has been loaded and the headstage is internally switched.

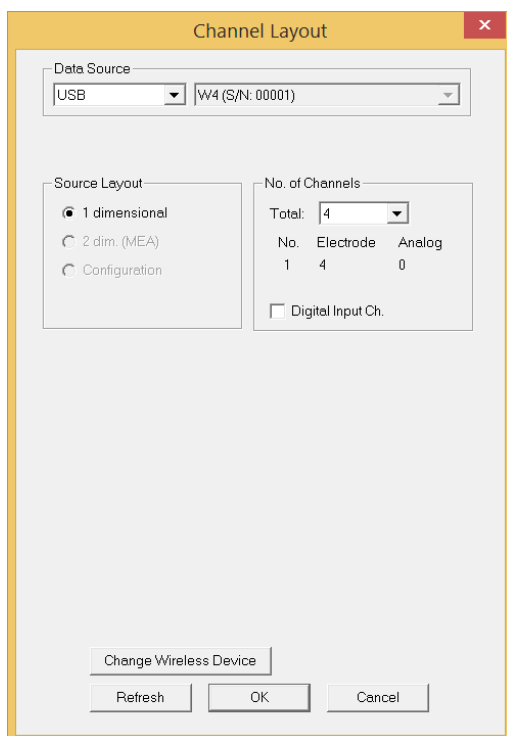
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If you install the W4 headstage for the first time, a hardware installation assistant will appear. Please follow the installation instructions. If the drivers for the W4-System have been installed before, ignore this step and click the "Refresh" button in the "Data Source Setup" dialog.



After the hardware installation process, please click the "Refresh" button in the "Data Source Setup" dialog to update hardware and software.

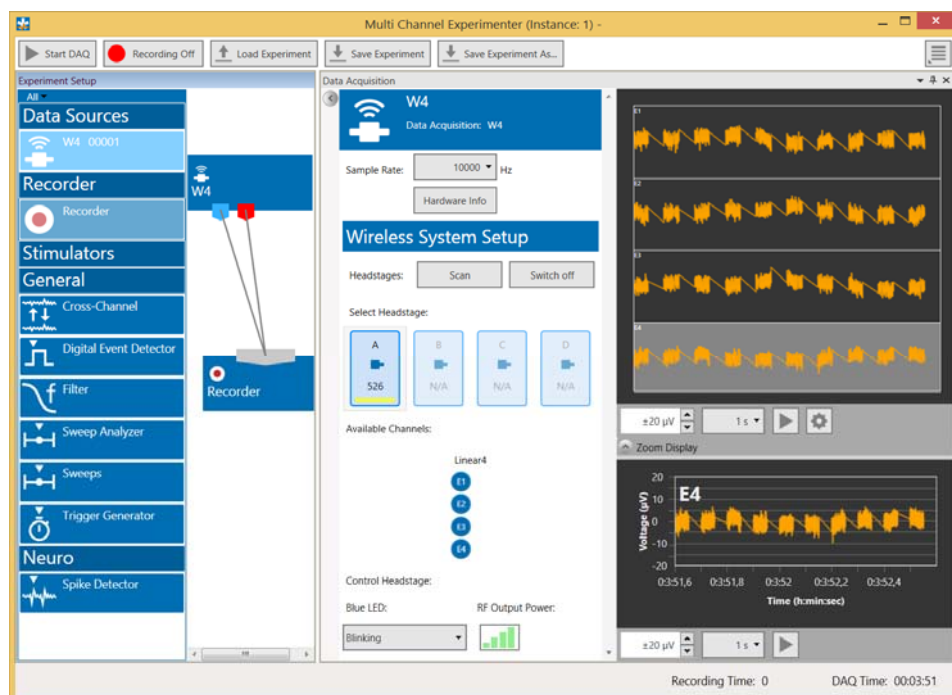
The W4-System will now be available in the "Data Source Setup" dialog. Select the desired headstage device from the drop down menu and start working as described above.



4.3 Multi Channel Experimenter Software Setup

Start the Multi Channel Experimenter software. Please read the Multi Channel Experimenter manual for detailed information of general functions of the program.

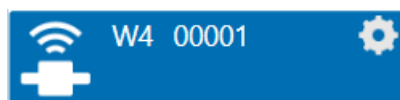
Data Source Wireless Headstage



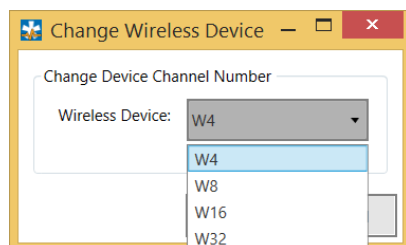
Connect the Wireless-System to the data acquisition computer. The wireless headstage "W4" is integrated as a data source in the main window of the Multi Channel Experimenter. Before using the wireless headstage as a data source, you have to decide which kind of headstage is available.

Important: Choose the headstage type before you start building a rack!

To select the headstage type, please click on the settings button of the wireless headstage icon with the right mouse button.



The "Change Wireless Device" dialog appears.



For selecting the headstage type, please use the drop down menu in "Wireless Device" and confirm the selection with "OK".

Please read chapter "Operating the Multi Channel Experimenter Software" below.

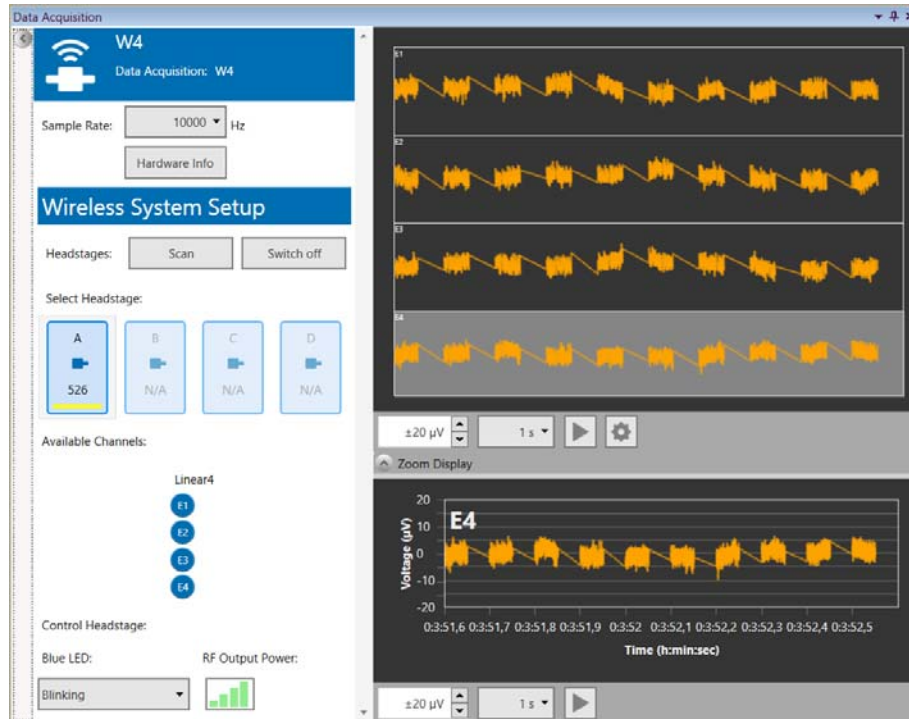
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Move the Wireless Headstage icon via drag and drop to the right part of the main window. Two symbols on the icon appear.



The color coded symbols are the output ports for the electrode raw data (blue) and the digital raw data (red). Connect the output ports with the input ports of the desired instruments and to the recorder.

Double-click the W4 icon to open the settings dialog as a tabbed page.



The dialog is divided in two major sections: Use the left "Control" section for the "W2100-System" hardware configuration settings. On the right "Data Display" section the available electrode data stream displays are listed: The 4 raw data channels of the W2100-HS4 headstage in overview above and the single view of one channel selected from the raw data channels below.

Control Section

W4
 Data Acquisition: W4

Sample Rate: 10000 Hz
Hardware Info

Wireless System Setup

Headstages: Scan
Switch off

Select Headstage:

A

 526

B

 N/A

C

 N/A

D

 N/A

Available Channels:

Linear4

E1

E2

E3

E4

Control Headstage:

Blue LED:
Blinking

RF Output Power:

Wireless-System Data Acquisition

W4
 Data Acquisition: W4

Sample Rate: 10000 Hz

1000
 2000
 5000
10000
 20000
 25000

Wireless System Setup

Select the "Sampling Rate" in Hz via drop down box. Depending on the number of channels in use it is possible to sample with a rate of up to 25000 Hz.

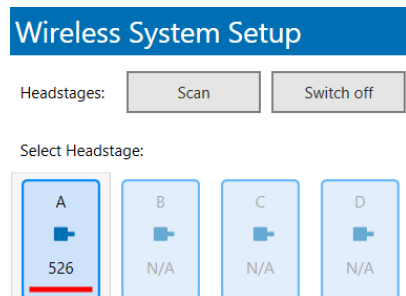
Important: Please keep in mind that the hardware low pass filter on most of our wireless headstages are set to 5 kHz, please refer to the datasheet of the headstage in use. If you sample at a lower frequency than 10 kHz you risk aliasing.

Click the "Hardware Info" button for information about the wireless headstage in use.

Hardware Info

Device Name:	W4
Serial Number:	00001
Headstage Type:	N/A
Voltage Range Electrodes:	-12,5 mV to +12,5 mV
µV/Digit Electrodes:	0,38147
Voltage Range Analog:	-1250,0 - 1250,0 mV
µV/Digit Analog:	38,146973
Firmware Versions:	
PIC	1.22
PIC2	1.36
PIC3	1.28
PIC4	N/A

Close



"Headstages:" Press "Scan" button to find the additional headstages, for example, after changing an experimental configuration or to reselect all channels of the currently used headstage after deselecting some of them. Click "Switch off" to switch a headstage completely off. The bar in the icon indicates this sleep mode in red.

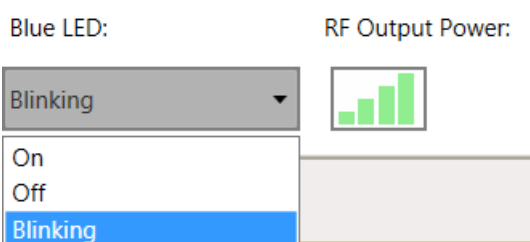
"Select Headstage:" All headstages available in the range of the receiver are displayed. The headstages must be in standby modus that means, all headstages which are not in sleep mode. Read the type of the headstage and the serial number. Click on one of the headstages to select the device. The selected headstage is highlighted in blue and the battery status is displayed. After recording the quality of the headstage to receiver transmission in percent is displayed in red letters. In this mode it is not possible to select more than one headstage. To change your selection, please deactivate the currently used headstage first before selecting another one.

"Available Channels:" Click onto a channel to deselect it, double-click to select it again. Unused channels appear in grey.

Available Channels:



Control Headstage:



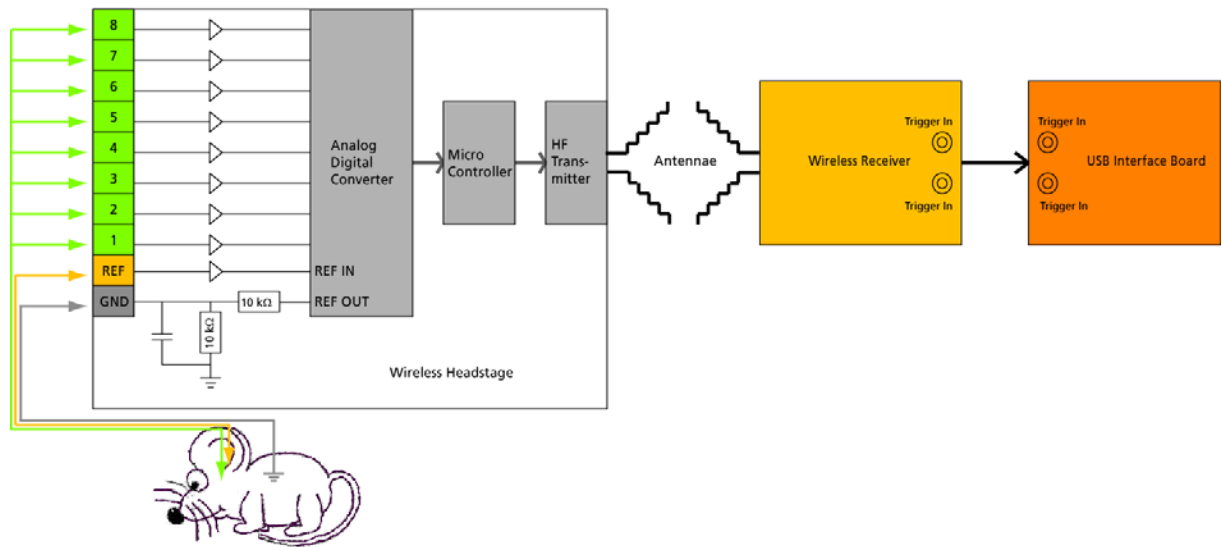
The blue LED is set to permanent mode will be "On" all the time, regardless of the recording status of the headstage. If they are set to blink, they will blink slowly in standby mode and faster while the headstage is acquiring data. An available headstage which is not selected is in standby mode, where it uses about 10 % energy compared to active recording. To shut it down completely, please click the button "Switch off" to turn the headstage off. A headstage which has been switched off is in "Sleep" mode, indicated by the red bar below, will no longer show up in a scan. To reactivate it, you need to shortly disconnect the battery, or use the infrared "IR-Remote Control" flasher.

Decrease the "RF Output Power" value from the histogram by deselecting one or more bars. The smaller the value, for example two bars only, the longer the storage battery will support the recording, but the smaller the distance between animal and receiver.

"Available Channels:" Click onto a channel to deselect it, double-click to select it again. Unused channels appear in grey.

5 Operating a Wireless System

5.1 Experimental Setup



First step to set up an experiment with the wireless system is to implant an electrode into the laboratory animal. The electrode has to be fixed, for example with cement used in dental technic, to guarantee a tight position of the electrode in the desired area of the brain. The electrode connector must be available on the skin surface of the animal. Implant a ground option additionally, if necessary.

Use of the Reference and Ground Electrodes

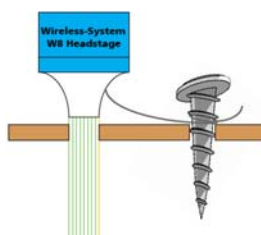
For *in vivo* experiments it is necessary to provide a good option for grounding (GND) and a well placed reference (REF) electrode. Therefore all headstages of the Wireless-System are equipped with electrical isolated pins for a ground and a reference electrode.

Important: For good signal quality you should use dedicated reference and ground electrodes!

The reference electrode is used to measure the relative potential differences in relation to the recording electrodes. It should be out of a similar or the same material as the recording electrodes and it should be of comparable size. The reference is ideally placed near the recording electrodes, but not in active tissue.

The signals from all electrodes are amplified and then each signal from the recording electrodes is compared to the signal from the reference electrode. The difference is measured by the analog to digital converter (ADC) and digitized.

When external interferences, for example heartbeats, muscle potentials, breathing, disturb the measurements, both, the recording and the reference electrodes measure the same disturbance and the noise signal is removed because only the difference between recording and reference electrode is digitized and transmitted (Common Mode Rejection).



To make sure that the animal and the headstage are set to the same electrical potential, a grounding connection is also necessary. A good ground option is usually a large conductor, such as a screw or a silver wire implanted under the skin of the animal.

Experimental Setup

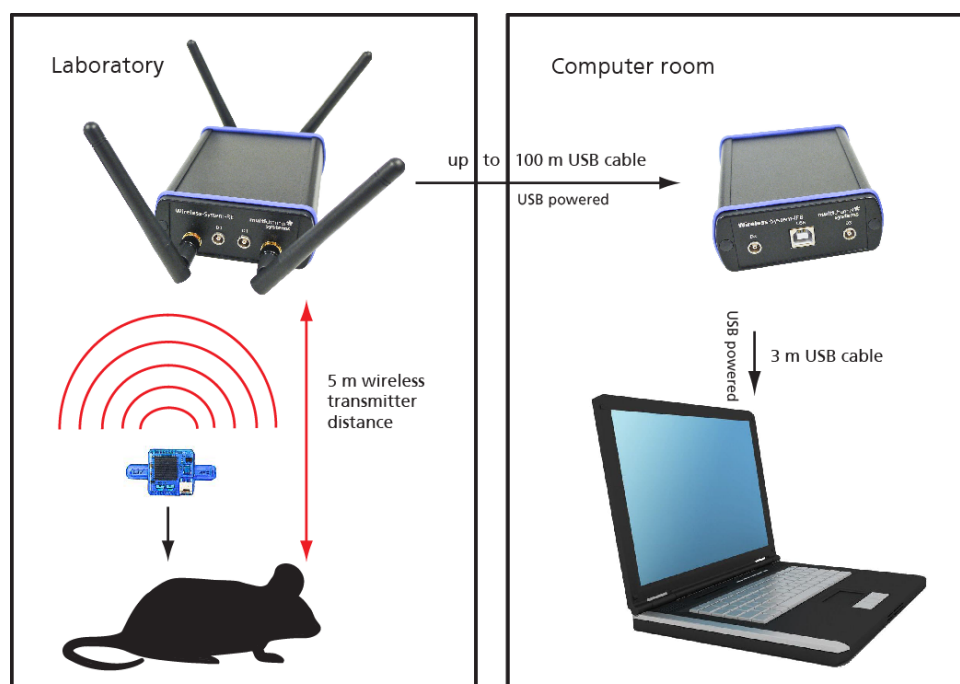
Connect the receiver to the USB interface, and the USB interface to the data acquisition computer. Switch on the computer and start the MC_Rack program.

Make sure that the storage battery of the headstage is charged and plugged in properly. The battery can be fixed on top of the headstage with a magnet or it can be stored in a special backpack on the back of the animal.

Connect the wireless headstage to the electrode connector on the skin surface of the test animal.

Connect the receiver via MCS Bus cable to the interface board and the USB cable to the data acquisition computer. The cable between receiver and interface board is 5 m, longer cables are available on request. The USB cable between USB interface board and computer is 2 m. The receiver and the interface board are powered by the computer.

The Multi Channel Suite software provides tools for data acquisition, analysis and data export. The software MC_Rack is for data acquisition and data analyzing, MC_DataTool for the export of data. Please read the respective manuals for detailed information.



5.2 Operating Modes

Recording Mode

Set up all components of the Wireless-System. Start MC_Rack and add the Wireless-System as data source. Please read chapter "Starting MC_Rack". Define the amplifiers gain of 100 and select the sampling frequency in the "Hardware" tab.

Make sure the storage battery is completely charged. Connect the battery to the white connector on the headstage.

In the "Wireless" window of the MC_Rack "Hardware" tab, press the button "Scan" to find the headstages available. After that the user is able to select the desired headstage (A, B, C, D) when using more than one headstage. All eight recording channels are selected by default. Deselect the channels you do not need.

The Wireless-System is in recording mode now. You can start recording by pressing the "Start" button in MC_Rack. The storage battery allows recording of approximately two hours.

After the experiment stop the recording by pressing the "Stop" button. 

The "Recording Mode" is indicated by a high frequent flashing of the blue LED on the headstage.

Stand By Mode

To save energy the Wireless-System changes from "Recording Mode" into "Stand by Mode" immediately after stopping the recording. The "Stand by Mode" allows starting the recording again at any time. In this mode the storage battery lasts for up to eighty days depending on the recording time before.

The "Stand By Mode" is indicated by a very weak and slow flashing of the blue LED on the headstage.

Switched Off Mode

To save more energy than in "Stand by Mode" you can switch the headstage off.

In the "Wireless" window of the MC_Rack "Hardware" tab, please press the button "Switch Off" to switch off the selected headstage.

In this mode the battery lasts for up to 130 days depending on the recording time before.



Important: Please pay attention to the orientation of the flasher as the infrared beam has to meet the receiver LEDs on the headstage directly!

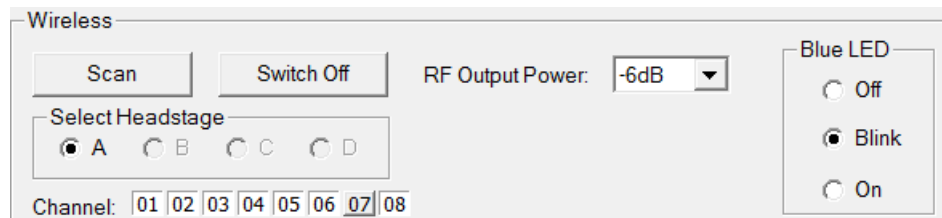
Switching the headstage on from this mode is not possible via software control. To do so the user has two possibilities: Use the infrared flasher and illuminate the receiver LEDs next to the connector for the battery. The flasher and the headstage should have a distance of about 5 to 10 cm. The second possibility is to unplug the battery from the headstage manually and to reconnect headstage and battery again.

Then press the button "Scan" in "Wireless Window" to reconnect to the headstage.

Operating up to four Headstages rotatory with one Wireless-System

It is possible to operate up to four different headstages connected to one Wireless-System in a rotatory system. The headstages are discriminated via frequency band for the radio communication. Each headstage is labeled with a letter (A, B, C, D). Please see the bill of delivery for the assignment of the headstage and the frequency band. (When using one single headstage only, the headstage is automatically A without a label.)

After pressing the button "Scan" the receiver scans which headstages are available. Then the user is able to select the desired headstage.



After recording from the first headstage, you can choose the second headstage in the "Wireless" window, the third and the fourth.

Operating up to four Wireless-Systems in parallel with one Computer

It is also possible to operate up to four different complete Wireless-Systems with one data acquisition computer. This way, you can experiment with up to four laboratory animals contemporaneous. The headstages are discriminated via frequency band for the radio communication again. Headstages and related receivers are labeled for differentiation.

Set up the Wireless-Systems and connect them to the data acquisition computer. Start as many instances of MC_Rack software as you need. In "Data Source Setup" assign the Wireless-Systems via serial number to the instances of MC_Rack.



6 Troubleshooting

6.1 Troubleshooting

Most problems occur seldom and only under specific circumstances. In most cases, it is only a minor problem that can be easily avoided or solved.

If the problem persists, please contact your local retailer. The highly qualified staff will be glad to help you. Please inform your local retailer as well, if other problems that are not mentioned in this documentation occur, even if you have solved the problem on your own. This helps other users, and it helps MCS to optimize the instrument and the documentation.

Please pay attention to the safety and service information of chapter "Important Safety Advice". Multi Channel Systems has put all effort into making the product fully stable and reliable, but like all high-performance products, it has to be handled with care.

6.2 Error Messages

The headstage sends signals to the receiver in 2.4 GHz frequency band. That is why devices, working in the same frequency band may disturb the data communication between headstage and receiver. Please do not use, for example, a mobile phone equipped with blue tooth or a WLAN connection or a microwave in the vicinity of headstage and receiver otherwise it may cause troubles in data transfer.

Important: For compatibility reasons it is not recommended to use an USB hub to connect the Wireless-System to your computer.

7 Appendix

7.1 Technical Support

Please read the "**Troubleshooting**" part of the manual or help first. Most problems are caused by minor handling errors. Contact your local retailer immediately if the cause of the trouble remains unclear. Please understand that information on your hardware and software configuration is necessary to analyze and finally solve the problem you encounter.

If you have any question or if any problem occurs that is not mentioned in this documentation, please contact your local retailer. The highly qualified staff will be glad to help you.

Please keep information on the following at hand

- Description of the error (the error message text or any other useful information) and of the context in which the error occurred. The more information on the actual situation you can provide, the easier it is to track the problem.
- The serial number of the device. You will find it on the bottom side of the main unit, and when adding the device to the virtual rack of MC_Rack program.
- The software of MC_Rack version you are currently using. On the "Help" menu, click "About MC_Rack". The displayed dialog box shows the version number. In Multi Channel Experimenter software, please click the "About" option in the "Settings" button.
- The hardware version of the **Wireless-System** you are currently using is displayed in the "Hardware" tab of the starting dialog in MC_Rack.
- The operating system and service pack number on the connected computer.
- The hardware configuration (microprocessor, frequency, main memory, hard disk) of the connected computer. This information is especially important if you have modified the computer or installed new hard- or software recently.

Storage Batteries



■ Batteries and accumulators do not belong in normal household waste and, thus, must always be disposed of within the framework of existing legislation.

Longterm Storage of the Lithium Polymer Batteries

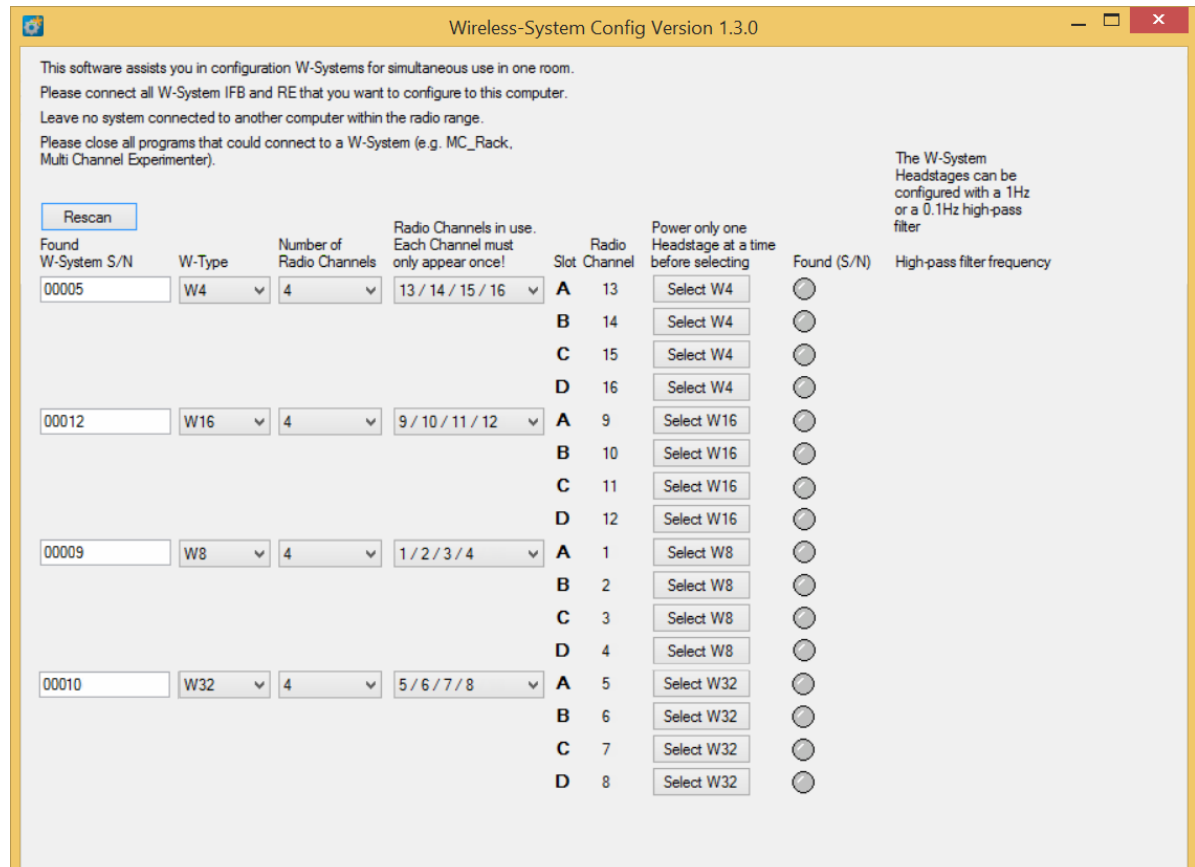
Important: Ideally store the batteries 70% charged in a low humidity environment at 5 to 7 °C, for example in the fridge, but not in the freezer. Please check the charging state quarterly to prevent totally self-discharge, which can destroy the storage batteries.

7.2 Wireless-System Configuration

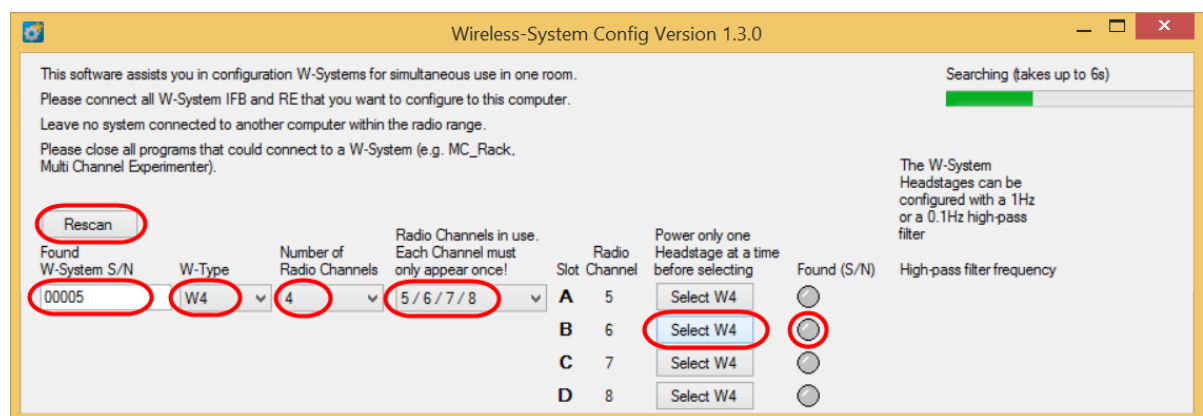
The software tool "Wireless-System Configuration" helps to configure new wireless headstages to a present setup and to arrange the assignments of headstages of several systems for simultaneous use. Additional it is possible to change the high pass settings of the respective Wireless-System.

Important: Please always run the Wireless-System Config tool before you start working with a new headstage!

Main Window



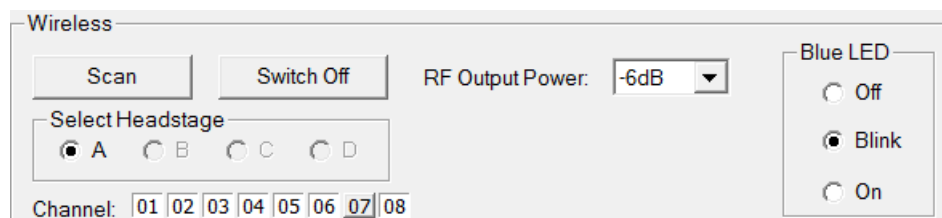
The screenshot above shows the main window, when the maximal number of four Wireless-Systems are connected to one data acquisition computer. To each system you can connect up to four headstages.



In the header of the main window you are informed about aims and purposes of the software tool.




At first the software detects all Wireless-Systems which are connected to one data acquisition computer. In "Found W-System SN" the systems are defined by the serial number. You can find the serial number on the bottom of the receiver and interface board. It is possible to connect, for example, one W4- and one W8-System. Please set the number of channels of your system from the "W-Type" drop down menu. Define the "Number of Radio Channels" from the drop down menu. Each connected system needs to be assigned to "Radio Channels in Use" and "Each Channel must only appear once".

The letters A, B, C, D denote the connected headstages of the respective system. These letters are the same as they are used in the MC_Rack hardware dialog.



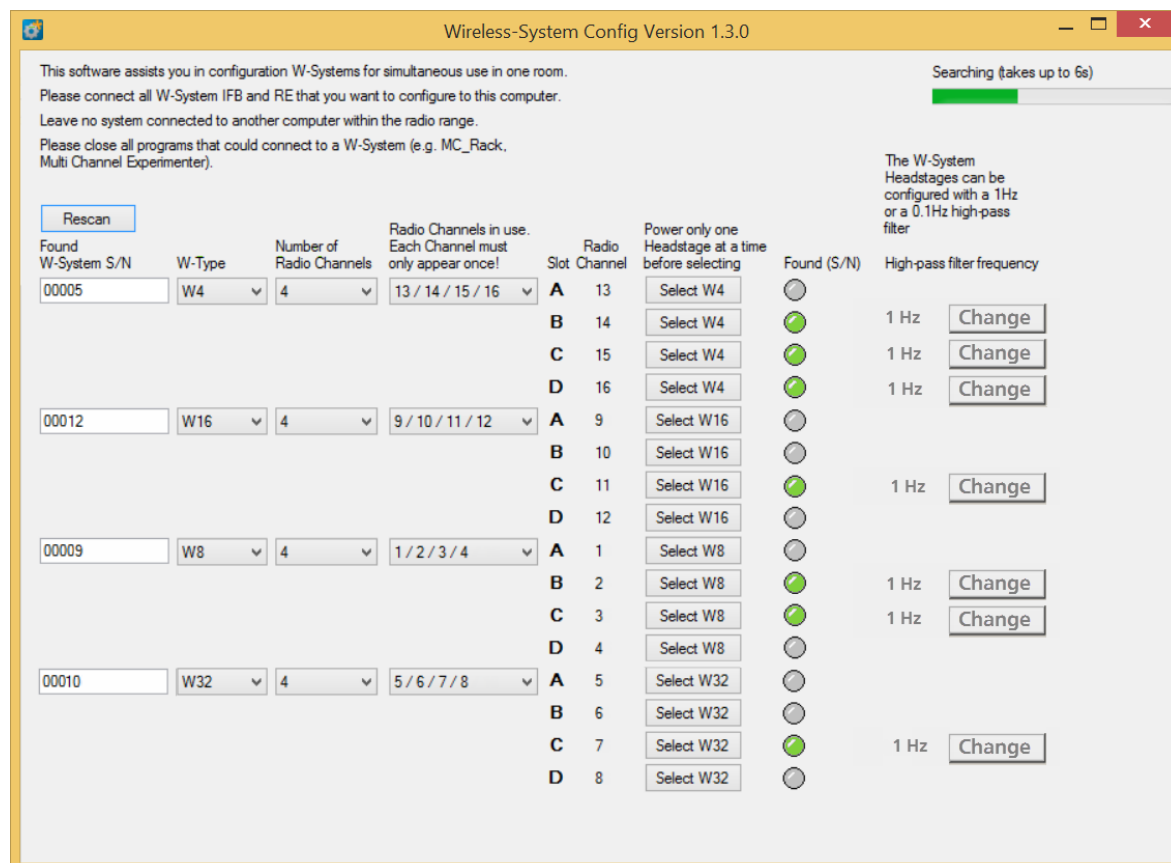
The Wireless-System Config tool is able to assign one headstage after the other to the respective Wireless-System.

Please connect the desired headstage to the battery and press the desired button A, B, C, or D

 to assign the headstage to A, B, C or D. Press "Rescan"  and the headstage will be found which is indicated by the green color in the "Found" button .

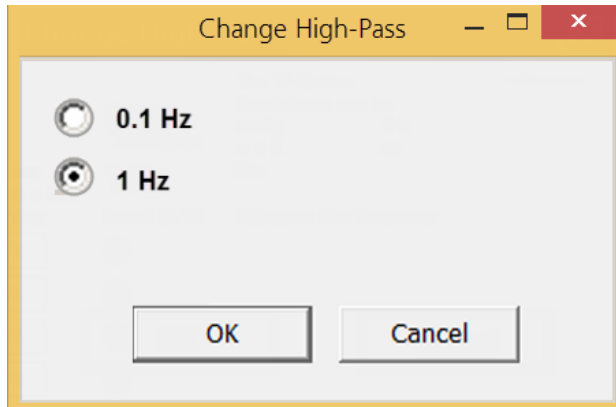
To change your selection, please choose a new assignment and press "Rescan" again. The information whether the headstage is A or C for example, will be stored on the headstage and can be changed at any time. The last assignment will be permanently stored on the headstage.

Power the next headstage of that system and assign it to another letter or to another system with a different "Frequency ID" by pressing "Rescan".



In the screenshot above, different headstages are assigned to one of the four Wireless-Systems connected to the data acquisition computer, defined by the "Frequency" and the labels "A", "B", "C" and "D".

To change the high pass filter, press the button "Change". The "Change High-Pass" dialog will open. Click the radio button of the desired frequency 0.1 Hz or 1 Hz.



To Do Checklist before start working with a Wireless-System in a new configuration:

Start the Wireless-System Config program. The main window opens.

When connecting more than one Wireless-System to the data acquisition computer the main window appears twice or more. You just have to take care to choose different frequency ID's (1 - 4) when using more than one Wireless-System in one room.

Your Wireless-System(s) is / are now detected by the Wireless-System Config tool. The serial number of your system(s) is / are displayed in "Found Wireless-System S/N".

If needed, please set the W-Type from the drop down menu.

Now connect the first headstage to a battery. The headstage switches on, that means the blue light flickers.

Important: Connect only one headstage at a time to the battery!

Press, for example "Select W4", to define the headstage as "A", "B", "C"; or "D".

The established connection is indicated by the green color of the "Found" button.

Disconnect the first headstage, which is assigned now. Connect the next headstage and assign it either to the same Wireless-System with the same frequency ID, but to another option A, B, C or D. Or you connect the headstage to another Wireless-Systems and perform the same procedure as described above.

Connect all headstages together for a final check of the system(s).

7.3 Technical Specifications

The **Wireless-System** is a 4-, 8-, 16- or 32-channel wireless *in vivo* system with headstage, receiver and interface board. Analog signals are converted in digital data streams in real-time.



Warning: The devices may only be used together with Wireless-Systems from Multi Channel Systems MCS GmbH, and only for the specified purpose. Damage of the devices and even fatal injuries can result from improper use. Do not open the receiver or the interface box and do not change hardware configuration as it could lead to improper behavior of the system.

General characteristics

Operating temperature	10 °C to 50 °C
Storage temperature	0 °C to 50 °C
Relative humidity	10 % to 85 %, non-condensing

Headstage

Dimensions (W x D x H)	4 channels: 13 mm (+ antennae) x 13 mm x 5 mm (+ battery) 8 channels: 16 mm (+ antennae) x 16 mm x 5 mm (+ battery) 16 channels: 16 mm (+ antennae) x 16 mm x 6.5 mm (+ battery) 32 channels: 16 mm (+ antennae) x 16 mm x 7.5 mm (+ battery)
Weight	4 channels: approximately 1.9 g (+ battery) 8 channels: approximately 2.9 g (+ battery) 16 channels: approximately 3.6 g (+ battery) 32 channels: approximately 3.7 g (+ battery)
Number of analog recording channels	4, 8, 16 or 32

Amplifier integrated in the headstage

Bandwidth	1 Hz to 5 kHz (0.1 Hz on request)
Gain	101
Resolution	16 bit
Input voltage range	+ / - 12.4 mV

Sampling rate

Sampling rate (kHz/ch)		Number of selected channels				
		2	4	8	16	32
Type of head-stage	W4-HS	40	20	-	-	-
	W8-HS	40	40	20	-	-
	W16-HS	20	20	20	10	-
	W32-HS	10	10	10	10	5

Distance for wireless link	5 m guaranteed under normal conditions
----------------------------	--

Storage battery

Storage battery	Lithium polymer, rechargeable
Storage battery life until recharge (100 mAh)	4 channels: 3.5 hours (recording @ 20 kHz) 8 channels: 2 hours (recording @ 20 kHz) 16 channels: 2 hours (recording @ 10 kHz) 32 channels: 1.3 hours (recording @ 5 kHz) for all channels: 80 days (in stand-by mode)
Dimensions (W x D x H) of battery	17 mm x 11 mm x 3 mm (30 mAh battery) 26 mm x 19.5 mm x 2.3 mm (100 mAh battery) 26 mm x 20 mm x 4.5 mm (200 mAh battery) 27.5 mm x 19.5 mm x 5 mm (300 mAh battery)
Weight of battery	Approx. 1.2 g (30 mAh battery) Approx. 3.5 g (100 mAh battery) Approx. 4.6 g (200 mAh battery) Approx. 6.8 g (300 mAh battery)

Recharging Device

Dimensions (W x D x H)	55 mm x 20 mm x 10 mm
Period of charging	1 hour
Power	USB powered

Receiver

Dimensions (W x D x H)	126 mm x 84 mm x 35 mm w/o antenna
Dimension of antenna	110 mm x 10 mm (length x diameter)
Frequency band	2.4 GHz
Impedance of antennae	50 Ohm

Interface Board

Dimensions (W x D x H)	115 mm x 84 mm x 35 mm
Control interface	USB 2.0 High Speed

Software

Operating system	Microsoft Windows ® 10, 8.1, 7, XP or Vista with NTFS, English and German version supported
Data acquisition software	
Multi Channel Experimenter	Version 2.2.0 and higher
Multi Channel Analyzer	Version 2.2.0 and higher
MC_Rack program	Version 4.1.0 and higher
Data export software	
Multi Channel DataManager	Version 1.5.1 and higher
MC_DataTool program	Version 2.6.2 and higher Axon binary file (*.abf), ASCII file (*.txt), binary file (*.raw)

7.4 Power Consumption

To determine the battery life-time divide the capacity of the battery in use by the current drawn by the headstage. Please see the following table for the power consumption.

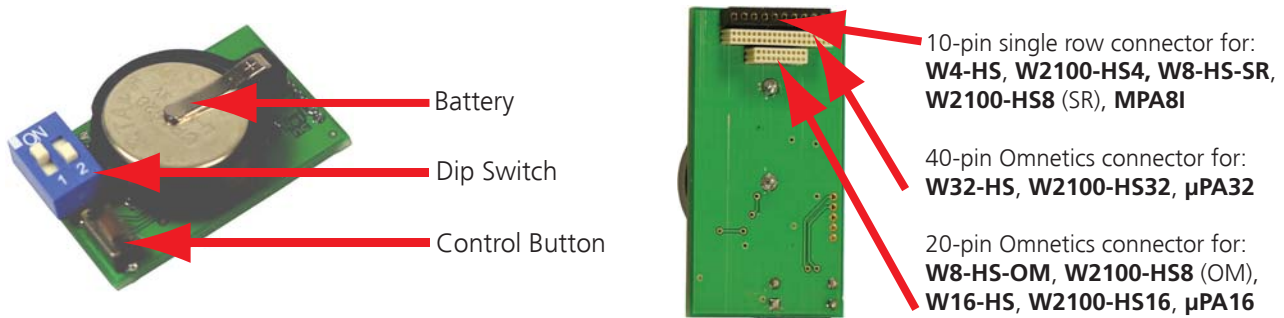
Example: Using a 100 mAh battery with a W4-System, sampling at 0.5 kHz with all four channels, you have a battery life of approximately $100 \text{ mAh} / 13.8 \text{ mA} = 7 \text{ h and } 15 \text{ min.}$

7.5 ME/W-Signal Generator

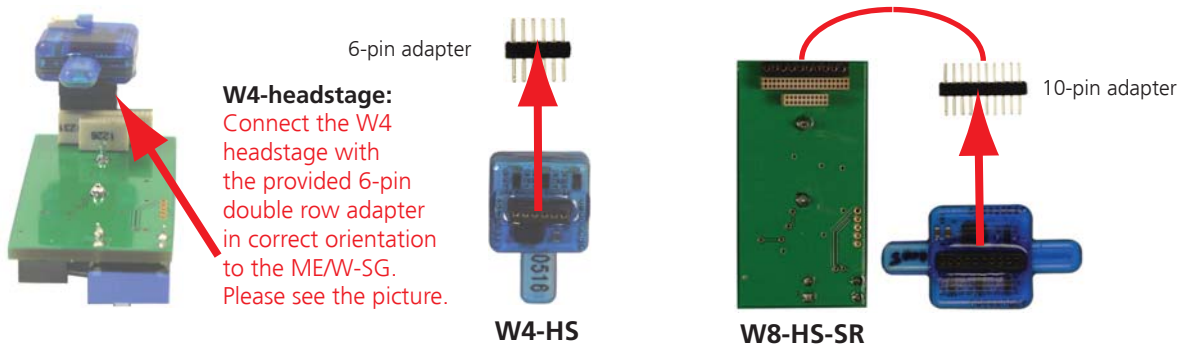
ME/W-SG

Signal Generator for the ME-Systems and the Wireless-Systems

The ME/W-Signal Generator is a very convenient tool for users of the basic and advanced Wireless-Systems and for users of ME-Systems. Use the ME/W-SG instead of setting up a complete experiment for training, controlling, and troubleshooting purposes.



Basic Wireless-System



W4-HS: Connect the W4-headstage with the provided 6-pin adapter in correct orientation to the **single row** connector of the ME/W-SG. Please see the pictures above.

W8-HS-SR with single row connector: Connect the W8-HS-SR headstage with the provided 10-pin adapter to the **single row** connector of the ME/W-SG. The orientation of the W8-headstage with single row connector does not matter.

W8-HS-OM and **W16-HS:** Connect the W8-HS-OM with Omnetics connector and the W16-headstage according to the guide posts to the **20-pin Omnetics** connector as shown on the photos below.

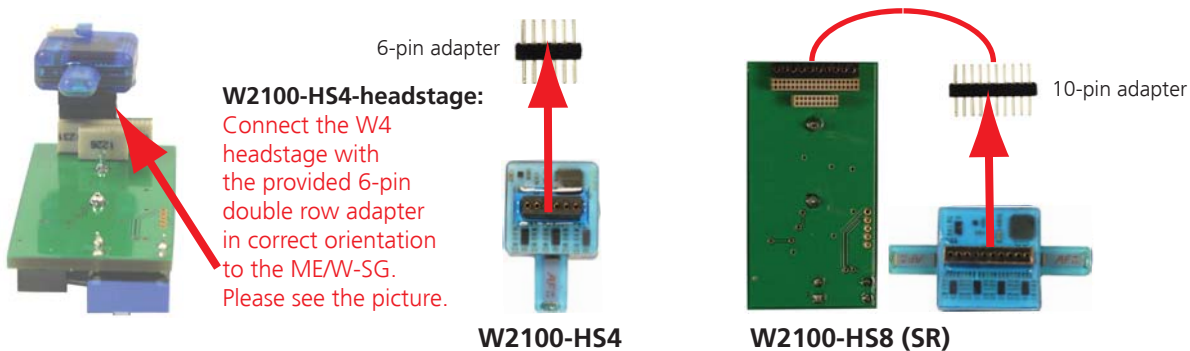
W32-HS: Connect the W32-headstage to the **40-pin Omnetics** connector. The orientation of the W32-HS does not matter.



ME/W-SG

Signal Generator for the ME-Systems and the Wireless-Systems

Advanced W2100-System



W2100-HS4: Connect the W2100-HS4-headstage with the provided 6-pin adapter in correct orientation to the **single row** connector of the ME/W-SG. Please see the pictures above.

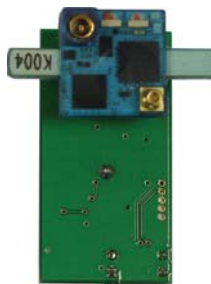
W2100-HS8 (SR) with single row connector: Connect the W2100-HS8 (SR)-headstage with the provided 10-pin adapter to the **single row** connector of the ME/W-SG. The orientation of the W2100-HS8 (SR) with single row connector does not matter.

W2100-HS8 (OM) and **W2100-HS16:** Connect the W2100-HS8 (OM) with Omnetics connector and the W2100-HS16-headstage according to the guide posts to the **20-pin Omnetics** connector as shown on the photos below.

W2100-HS32: Connect the W2100-HS32-headstage to the **40-pin Omnetics** connector. The orientation of the W2100-HS32-headstage does not matter.



W2100-HS8 (OM)



W2100-HS16



W2100-HS32

ME/W-SG

Signal Generator for the ME-Systems and the Wireless-Systems

ME-System

Micro Preamplifier System

μPA16: Connect the μPA16 of the ME-System to the **20-pin Omnetics** connector. Please orientate the μPA16 according to the guide posts.

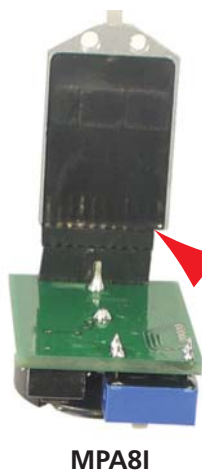
μPA32: Connect the μPA32 of the ME-System to the **40-pin Omnetics** connector. The orientation of the μPA32 of the ME-System does not matter.



μPA32 connected to the ME/W-SG.
The orientation of the μPA32 of the ME-System does not matter.

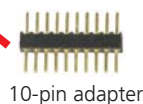
ME-System

Miniature Preamplifier System



MPA8I: Please insert the MPA8I headstage together with the adapter in correct orientation into the 10-pin **single row** connector as shown on the photo beside.

The MPA8I headstage is equipped with an 11-pin connector, that is why one of the pins is not connected. The bottom of the MPA8I headstage (black side) must show to the bottom of the signal generator. The free pin of the 11-pin connector must be on the right side.



MPA8I headstage connected to the ME/W-SG

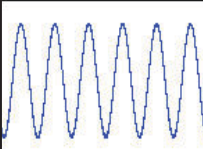
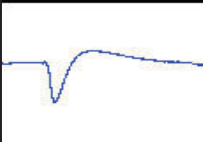
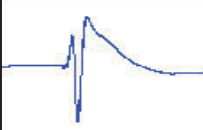
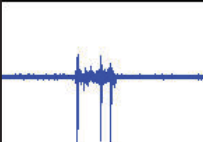
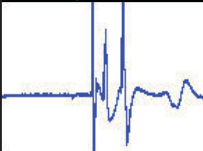

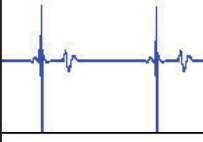
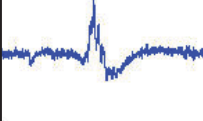
Please connect the MPA8I headstage with the provided 10-pin double row adapter in correct orientation to the ME/W-SG.

MPA32I: Please note that the MPA32I cannot be connected to the ME/W-SG.

ME/W-SG

Signal Generator for the ME-Systems and the Wireless-Systems

Switch ME/W-SG on: Press the control button. Switch off: Press control button longer than two seconds.

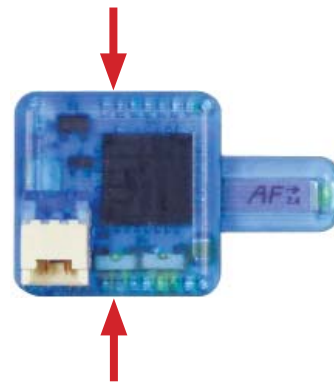
Switch 1	Switch 2	press Button slowly n times	Signal Source	Signal Type
OFF	OFF	1 (The ME/W-SG is ON)	Artificial Sine Wave (1.75 mV) 0.005 Hz Note: sine waves < 1 Hz might not be visible because of the hardware filter bandwidth.	
		2	Sine Wave 0.01 Hz	
		3	Sine Wave 0.03 Hz	
		4	Sine Wave 1.25 Hz	
		5	Sine Wave 12.5 Hz	
ON	OFF	1 (The ME/W-SG is ON)	Hippocampal Slice EPSP	
		2	Hippocampal Slice Population Spike	
		3	Hippocampal Neurons Spikes	
OFF	ON	1 (The ME/W-SG is ON)	Heart ECG Atrium	
		2	Heart ECG Ventricle	
		3	Cardiomyocytes Ventricle FP	
ON	ON	1 (The ME/W-SG is ON)	Retina ERG with Spike	

7.6 Pin Layout

Pin Layout of the Wireless-System Headstages

W4-HS Headstage

4-Channel Wireless Headstage for Use with the Wireless-System



W4-HS top side:
Connector for the battery

Applications

The W4 headstage is the ideal solution for spikes, LFP, EEG, ECG, EMG, and ECoG. Additional inputs to the interface board allow the synchronization of the data with external devices.

Important: Please handle the headstage with great care!
Do not touch the antenna, but the body of the headstage.

Technical Specifications

Advantages

- Small-sized headstage with integrated A/D converter.
- The Wireless-System converts the recorded signals into digital data already on the headstage.
- The signal-to-noise ratio is excellent and most important, independent from the distance between sender and receiver.
- The signal amplitude is independent of the distance, too, and the data arrives safely and completely at the receiver for further analysis.

Number of recording channels
Weight (without battery)
Dimensions (W x D x H)
Distance for wireless link

4
+/- 2.2 g
13 x 13 x 5 mm
5 m and more under normal conditions

Amplifier

Gain
Bandwidth
Input impedance
Resolution
Input voltage range
Input noise

101
1 Hz to 5 kHz (0.1 Hz on request)
1 GΩ || 10 pF
16 bit
+/- 12.4 mV
< 1.9 μV_{RMS}

Sampling rate

4 channels simultaneously
2 channels simultaneously

20 kHz
40 kHz

Software

Operating system
Data acquisition and analysis software

Windows ® 10, 8.1, 7 (64 bit)
Multi Channel Suite
Version 1.5.1 and higher
MC_Rack Version 4.6.2 and higher

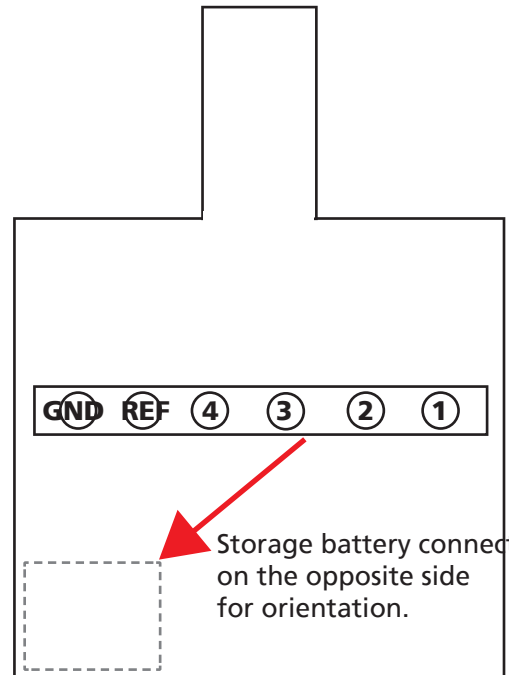
W4-HS Headstage

Layout



W4 Headstage with Single Row Connector

Diagram of the bottom side with pin layout. Please orientate the headstage as shown in the diagram.



Pin Layout of the single row precession socket (1.27 mm, round pins)

Channel 1
Channel 2
Channel 3
Channel 4
REF (Reference)
GND (Ground)

Wireless-B-100mAh

Standard battery for the W4-HS. Please connect the battery via cable to the headstage. The recording time with a 100 mAh battery at maximal sampling rate on all four channels is 3.2 hours.



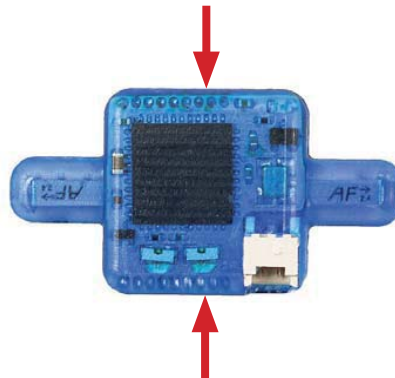
W4-HS bottom side:
Connector for the electrode probe or for the ME/W-Signal generator.

Connector for W4 Headstage with single row precession socket (1.27 mm, round pin).

The connector mates with a standard single row 1.27 mm pin connector such as: preci-dip 850-10-006-10-001101

W8-HS Headstage

8-Channel Wireless Headstage for Use with the Wireless-System



W8-HS top side:
Connector for the battery

Applications

The W8 headstage is the ideal solution for spikes, LFP, EEG, ECG, EMG, and ECoG. Additional inputs to the interface board allow the synchronization of the data with external devices.

Important: Please handle the headstage with great care!
Do not touch the antennae, but the body of the headstage.

Advantages

- Small-sized headstage with integrated A/D converter.
- The Wireless-System converts the recorded signals into digital data already on the headstage.
- The signal-to-noise ratio is excellent and most important, independent from the distance between sender and receiver.
- The signal amplitude is independent of the distance, too, and the data arrives safely and completely at the receiver for further analysis.

Technical Specifications

Number of recording channels	8
Weight (without battery)	+/- 2.9 g
Dimensions (W x D x H)	16 x 16 x 5 mm
Distance for wireless link	5 m and more under normal conditions
Amplifier	
Gain	101
Bandwidth	1 Hz to 5 kHz (0.1 Hz on request)
Input impedance	1 GΩ 10 pF
Resolution	16 bit
Input voltage range	+/- 12.4 mV
Input noise	< 1.9 μV _{RMS}
Sampling rate	
8 channels simultaneously	20 kHz
4 channels simultaneously	40 kHz
2 channels simultaneously	40 kHz
Software	
Operating system	Windows® 10, 8.1, 7 (64 bit)
Data acquisition and analysis software	Multi Channel Suite Version 1.5.1 and higher MC_Rack Version 4.6.2 and higher

W8-HS Headstage

Layout for the W8-HS Headstage with Single Row Connector

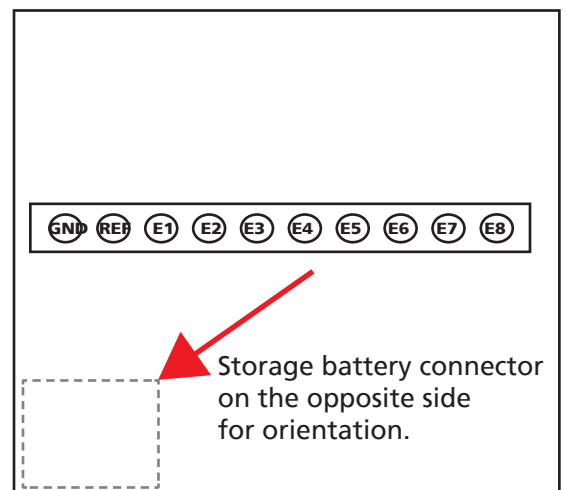


Wireless-B-100mAh

Standard battery for the W8-HS. Please connect the battery via cable to the headstage. The recording time with a 100 mAh battery at maximal sampling rate on all eight channels is 2 hours.

W8 Headstage with Single Row Connector

Diagram of the bottom side with pin layout. Please orientate the headstage as shown in the diagram.



W8-HS bottom side:
Connector for the
electrode probe or
for the ME/W-Signal
generator.

Connector for W8 Headstage with single row precession socket (1.27 mm, round pin).

The connector mates with a standard
single row 1.27 mm pin connector such as:
preci-dip 850-10-006-10-001101

Pin Layout of the single row precession socket
(1.27 mm, round pins)

GND	Ground
REF	Reference
E1	Channel 1
E2	Channel 2
E3	Channel 3
E4	Channel 4
E5	Channel 5
E6	Channel 6
E7	Channel 7
E8	Channel 8

W8-HS Headstage

Layout for the W8-HS Headstage with Omnetics Connector

Connector for W8 Headstage with Omnetics Connector.

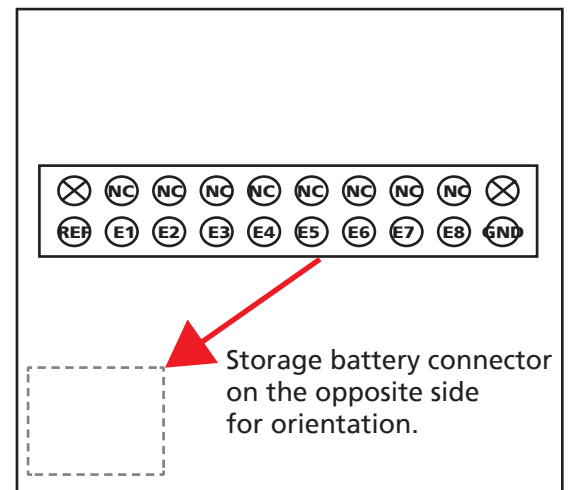
The Omnetics connector mates with standard pin connector such as:
Through-Hole:
A79038-001 (NPD-18-DD-GS)
Horizontal Surface Mount:
A79040-001 (NPD-18-AA-GS)
Vertical Surface Mount:
A79042-001 (NPD-18-VV-GS)
Cable (18.0" 34 AWG lead-wire):
A79044-001 (NPD-18-WD-18.0-C-GS)

W8-HS bottom side:
Connector for the
electrode probe or
for the ME/W-Signal
generator.



W8 Headstage with Omnetics Connector

Diagram of the bottom side with pin layout. Please orientate the headstage as shown in the diagram.



Wireless-B-100mAh

Standard battery for the W8-HS. Please connect the battery via cable to the headstage. The recording time with a 100 mAh battery at maximal sampling rate on all eight channels is 2 hours.



Pin Layout of the single row precession socket (1.27 mm, round pins)

	Guide post	REF	Reference
NC	not connected	E1	Channel 1
NC	not connected	E2	Channel 2
NC	not connected	E3	Channel 3
NC	not connected	E4	Channel 4
NC	not connected	E5	Channel 5
NC	not connected	E6	Channel 6
NC	not connected	E7	Channel 7
NC	not connected	E8	Channel 8
	Guide post	GND	Ground

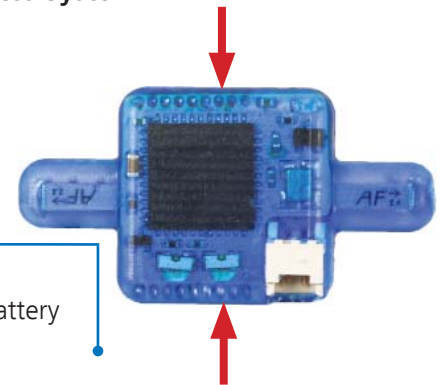
W16-HS Headstage

16-Channel Wireless Headstage for Use with the Wireless-System

Applications

The W16 headstage is the ideal solution for spikes, LFP, EEG, ECG, EMG, and ECoG. Additional inputs to the interface board allow the synchronization of the data with external devices.

W16-HS top side:
Connector for the battery



Important: Please handle the headstage with great care!
Do not touch the antennae, but the body of the headstage.

Technical Specifications

Number of recording channels	16
Weight (without battery)	+/- 3.6 g
Dimensions (W x D x H)	16 x 16 x 6.5 mm
Distance for wireless link	5 m and more under normal conditions
Amplifier	
Gain	101
Bandwidth	1 Hz to 5 kHz (0.1 Hz on request)
Input impedance	1 GΩ 10 pF
Resolution	16 bit
Input voltage range	+/- 12.4 mV
Input noise	< 1.9 μV _{RMS}
Sampling rate	
16 channels simultaneously	10 kHz
8 channels simultaneously	20 kHz
4 channels simultaneously	20 kHz
2 channels simultaneously	20 kHz

Software

Operating system	Windows ® 10, 8.1, 7 (64 bit)
Data acquisition and analysis software	Multi Channel Suite Version 1.5.1 and higher MC_Rack Version 4.6.2 and higher

Advantages

- Small-sized headstage with integrated A/D converter.
- The Wireless-System converts the recorded signals into digital data already on the headstage.
- The signal-to-noise ratio is excellent and most important, independent from the distance between sender and receiver.
- The signal amplitude is independent of the distance, too, and the data arrives safely and completely at the receiver for further analysis.

W16-HS Headstage

Layout



Wireless-B-100mAh

Standard battery for the W16-HS. Please connect the battery via cable to the headstage. The recording time with a 100 mAh battery at maximal sampling rate on all sixteen channels is 1.7 hours.



W16-HS bottom side:

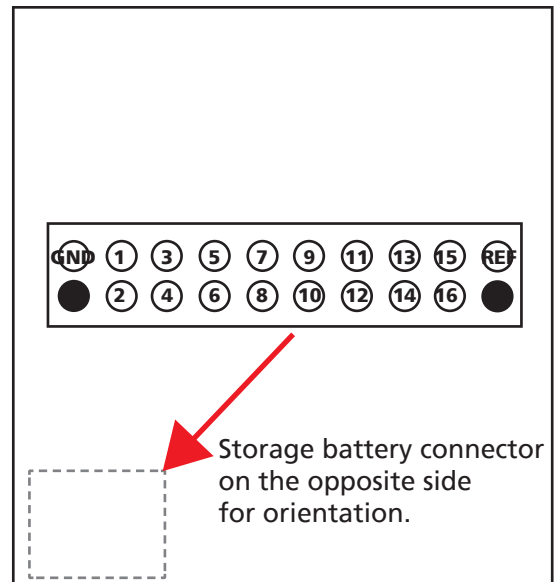
Connector for the electrode probe or for the ME/W-Signal generator.

Connector for W16 Headstage with Omnetics Connector

The Omnetics connector A79039-001 (NSD-18-DD-GS) mates with standard pin connector such as:
Through-Hole:
A79038-001 (NPD-18-DD-GS)
Horizontal Surface Mount:
A79040-001 (NPD-18-AA-GS)
Vertical Surface Mount:
A79042-001 (NPD-18-VV-GS)
Cable (18.0" 34 AWG lead-wire):
A79044-001 (NPD-18-WD-18.0-C-GS)

W16 Headstage with Omnetics Connector

Diagram of the bottom side with pin layout. Please orientate the headstage as shown in the diagram.



Pin Layout of the Omnetics Connector
A79039-001 (NSD-18-DD-GS)

GND (Ground)	Guide Post
Channel 1	Channel 2
Channel 3	Channel 4
Channel 5	Channel 6
Channel 7	Channel 8
Channel 9	Channel 10
Channel 11	Channel 12
Channel 13	Channel 14
Channel 15	Channel 16
REF (Reference)	Guide Post

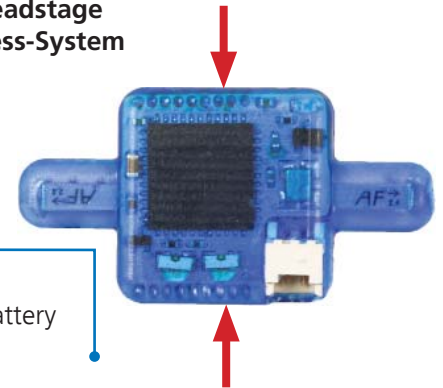
W32-HS Headstage

32-Channel Wireless Headstage for Use with the Wireless-System

Applications

The W32 headstage is the ideal solution for spikes, LFP, EEG, ECG, EMG, and ECoG. Additional inputs to the interface board allow the synchronization of the data with external devices.

W32-HS top side:
Connector for the battery



Important: Please handle the headstage with great care!
Do not touch the antennae, but the body of the headstage.

Technical Specifications

Number of recording channels	32
Weight (without battery)	+/- 3.7 g
Dimensions (W x D x H)	16 x 16 x 7.5 mm
Distance for wireless link	5 m and more under normal conditions
Amplifier	
Gain	101
Bandwidth	1 Hz to 5 kHz (0.1 Hz on request)
Input impedance	1 GΩ 10 pF
Resolution	16 bit
Input voltage range	+/- 12.4 mV
Input noise	< 1.9 μV _{RMS}
Sampling rate	
32 channels simultaneously	5 kHz
16 channels simultaneously	10 kHz
8 channels simultaneously	10 kHz
4 channels simultaneously	10 kHz
2 channels simultaneously	10 kHz
Software	
Operating system	Windows ® 10, 8.1, 7 (64 bit)
Data acquisition and analysis software	Multi Channel Suite Version 1.5.1 and higher MC_Rack Version 4.6.2 and higher

Advantages

- Small-sized headstage with integrated A/D converter.
- The Wireless-System converts the recorded signals into digital data already on the headstage.
- The signal-to-noise ratio is excellent and most important, independent from the distance between sender and receiver.
- The signal amplitude is independent of the distance, too, and the data arrives safely and completely at the receiver for further analysis.

W32-HS Headstage

Layout

Wireless-B-100mAh

Standard battery for the W32-HS. Please connect the battery via cable to the headstage. The recording time with a 100 mAh battery at maximal sampling rate on all thirty-two channels is 1.3 hours.

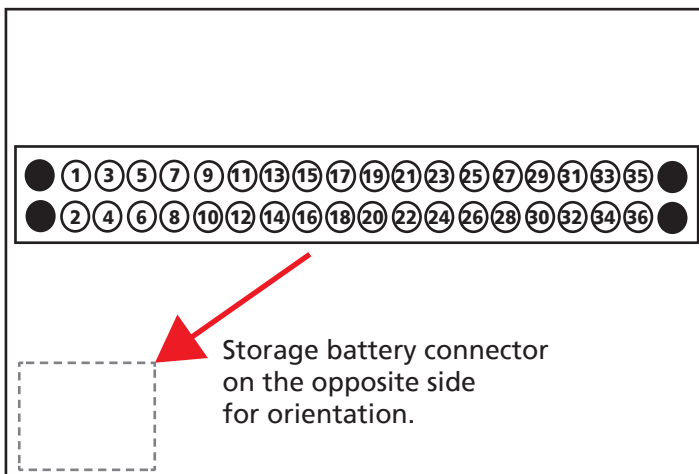


W32-HS bottom side:

Connector for the electrode probe or for the ME/W-Signal generator.

W16 Headstage with Omnetics Connector

Diagram of the bottom side with pin layout. Please orientate the headstage as shown in the diagram.



Connector for W32 Headstage with Omnetics Connector

A79023-001 (NSD-36-DD-GS female, 4 guide posts mates with standard pin connector such as:
Straight Thru-Hole:
A79022-001
Horizontal Surface Mount:
A79024-001
Vertical Surface Mount:
A79026-001
Cable (18.0" 34 AWG lead-wire):
A79028-001

Pin Layout of the Omnetics Connector

Pin 1	GND (Ground)	Pin 13	Channel 11	Pin 25	Channel 23
Pin 2	REF (Reference)	Pin 14	Channel 12	Pin 26	Channel 24
Pin 3	Channel 1	Pin 15	Channel 13	Pin 27	Channel 25
Pin 4	Channel 2	Pin 16	Channel 14	Pin 28	Channel 26
Pin 5	Channel 3	Pin 17	Channel 15	Pin 29	Channel 27
Pin 6	Channel 4	Pin 18	Channel 16	Pin 30	Channel 28
Pin 7	Channel 5	Pin 19	Channel 17	Pin 31	Channel 29
Pin 8	Channel 6	Pin 20	Channel 18	Pin 32	Channel 30
Pin 9	Channel 7	Pin 21	Channel 19	Pin 33	Channel 31
Pin 10	Channel 8	Pin 22	Channel 20	Pin 34	Channel 32
Pin 11	Channel 9	Pin 23	Channel 21	Pin 35	GND (Ground)
Pin 12	Channel 10	Pin 24	Channel 22	Pin 36	GND (Ground)

7.7 Contact Information

Local retailer

Please see the list of official MCS distributors on the MCS web site.

User forum

The Multi Channel Systems User Forum provides the opportunity for you to exchange your experience or thoughts with other users worldwide.

Mailing list

If you have subscribed to the Mailing List, you will be automatically informed about new software releases, upcoming events, and other news on the product line. You can subscribe to the list on the MCS web site.

www.multichannelsystems.com

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