Miniature Telemetry System

Flexible, modular solution—ideal for stimulating and recording neurological activity in vivo

- Lightweight headstages—reduce stress on animal

- Facilitates multi-axis acceleration parameter integration into behavioral studies

- 4, 8, 16 or 32 recording channels—suitable for a vast array of applications and animal models

- Options for electrical and optical stimulation as well as for frame-consistent video tracking integration available

HB

multichannel **＊**
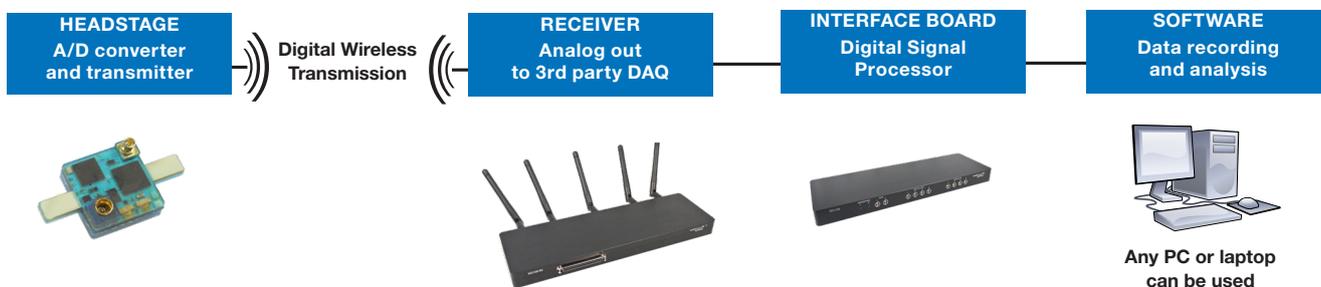**systems**

Count on highly accurate and reliable data

This all-in-one telemetry solution allows amplifying, recording, and analyzing in vivo data from 4, 8, 16 or 32 channels. With amplifier bandwidths of 1 Hz to 5 kHz (adjustable to 0.1 Hz or DC by software), sampling at up to 40 kHz per channel simultaneously, and a 16-bit resolution, you can count on highly accurate and reliable data.

Superior digital data transmission

The Wireless-System converts the recorded signals into digital data already on the headstage. Excellent signal-to-noise ratios and fast sampling rates make the system ideal for recording spikes as well as LFP, EEG, EMG and ECoG signals. In combination with a long transmission range, the digital data transmission permits flexible long-term experiments in large laboratory environments.

Comprehensive System

- Small-sized and lightweight headstage—ideal for small rodents
- Digitized data transmission eliminates noise interference and ensures quality long distance transmission
- Frontend upgrade—offers analog output to interface with existing setups
- Part of the 2100 modular amplifier solution suite
- Powerful data acquisition software included
- Headstages feature triaxial gyroscope and accelerometer sensor, for synchronization of movement data with electrophysiological data
- Options for electrical and optical stimulation and recording—on a single headstage
- Synchronize data with external devices using additional inputs

HEADSTAGE A/D converter and transmitter	Digital Wireless Transmission	RECEIVER Analog out to 3rd party DAQ	INTERFACE BOARD Digital Signal Processor	SOFTWARE Data recording and analysis

Any PC or laptop can be used

Conduct simultaneous experiments

- Save time—record data from up to eight animal experiments simultaneously with one setup
- Scalable—run up to four receivers in the same room, without bandwidth interference
- Flexible—add different types of headstages to meet your varried research needs
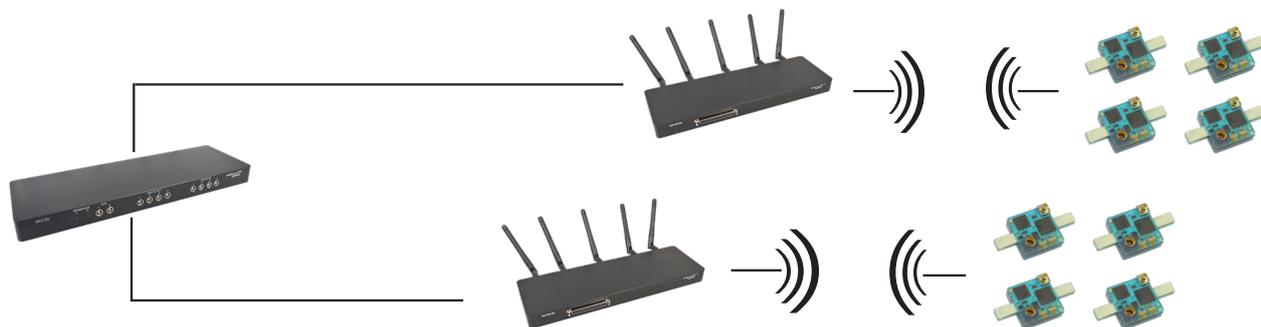
Electrical and optical stimulation

Optical as well as electrical stimulation patterns can be designed freely via the included Multi Channel Experimenter software. The headstages offer an additional output to connect either LEDs (optical stimulation) or wires (electrical stimulation). Chose from a variety of LED colors to suit your application needs.

Video-to-data synchronization

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

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

## Versatile software: Multi Channel Suite

The telemetric system comes with the powerful and easy-to-use Multi Channel Suite software, which consists of three programs. Regular updates including new functionalities are complimentary.
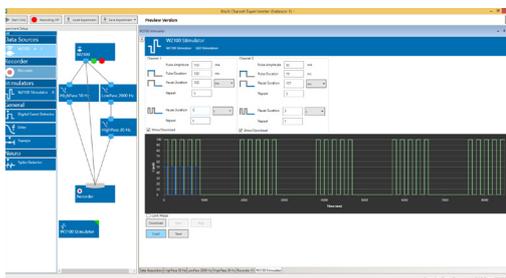
Multi Channel Experimenter streamlines data acquisition and online analysis (data displayed in real—time). An intuitive drag'n'drop interface enables powerful waterfall visualisation, making it easy to create your virtual experiment.
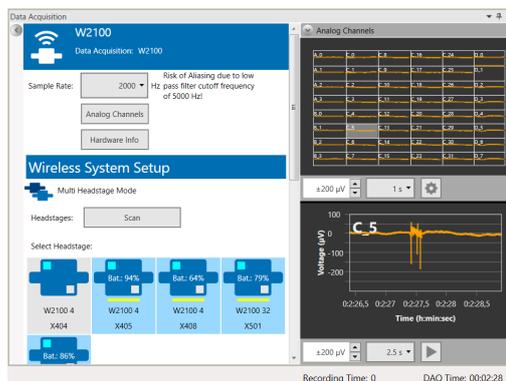
Multi Channel Analyzer simplifies offline analysis. Just import the recorded data and run your in-depth analysis. The Multi Channel Analyzer also supports synchronized video input for behavioral research with freely moving animals. Both the video data and electrophysiological recordings are automatically synchronized allowing you to easily move through data from one event to the next.
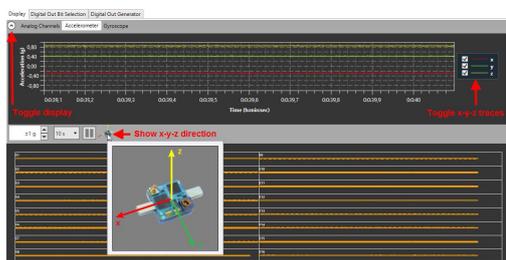
Multi Channel DataManager allows data export for further analysis with third-party programs. Data files are exported with a single click into HDF5 (*.h5) (e.g. Matlab, Python), NeuroExplorer (*.nex), Spike2 (*.smr), ASCII file (*.txt) or European Data Format (*.edf+ or *.emf).

Combine electrophysiology and behavioral studies with Panlab SMART software

The Multi Channel Experimenter and Video Control software packages allow you to record both physiological data and video in parallel. The video is captured in-frame to the data acquisition sampling. Just load the captured video into the Panlab SMART software and correlate behavioral events with electrophysiological data.
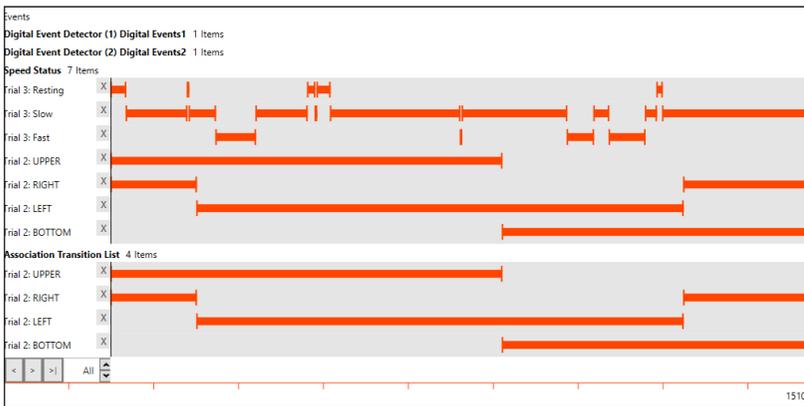

## Battery options and connectors

Headstages with single row and Omnetics connectors provide maximum flexibility. Custom adapters are also available.

Multiple batteries in different sizes are included to suit your varied experimental conditions. Connect to the headstage either directly (via the battery board, or with a flexible cable allowing positioning of the battery in a backpack to relieve strain on the animal's head). The energy-efficient battery design allows weight-endurance optimization in your experimental design.

The external battery concept lets you easily charge back-ups—even while an experiment is being performed, enabling continuous recording. Further maximize battery efficiency using automatic stand-by and infrared remote control features.
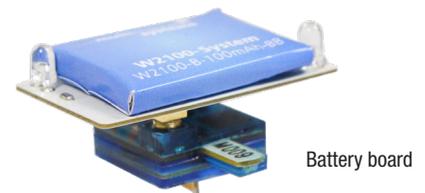
Battery board

Cable connection
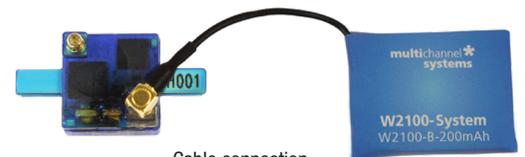
MEA2100   **Multiwell-MEA**   **CMOS-MEA**

Interface board

The Multiboot Interface Board facilitates operation of all MCS in vitro and in vivo headstages within the entire 2100 amplifier solution suite. This suite includes: MEA2100-HS, Multiwell-MEA-HS, CMOS-MEA-HS, MEA2100-Beta-Screen-HS, W2100-HS and ME2100-HS. This modular amplifier-family concept allows flexible experimental design and -adaptations with minor hardware upgrade investments.

MEA2100-Beta-Screen   **W2100**   **ME2100**

Telemetry-Systems: Technical specifications

Number of channels   4, 8, 16 or 32

	Recording only	Recording + electrical stim.	Recording + optical stim.
Number of channels	**Dimension [mm]	Weight [g]**	**Dimension [mm]	Weight [g]**	**Dimension [mm]	Weight [g]**
4	12.5 x 12.5 x 5.5	2.1	---	12.5 x 12.5 x 5.5	2.1
8	15.5 x 15.5 x 5.2	2.8 (OM), 3.0 (SR)	15.5 x 15.5 x 7.5	3.8	15.5 x 15.5 x 7.5	3.8 (OM), 4.1 (SR)
16	15.5 x 15.5 x 5.2	2.9	15.5 x 15.5 x 7.5	3.8	15.5 x 15.5 x 7.5	3.8
32	15.5 x 15.5 x 6.5	3.6	15.5 x 15.5 x 9.2	4.5	15.5 x 15.5 x 9.2	4.8

Dimensions (W x D x H) (Width w/o antennas; height w/o battery)   Weight (Headstage without battery)

Battery (Lithium-Polymer, rechargeable)

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

Capacity	Weight of battery (cable | battery board)
30 mAh	1.7 g	1.6 g
100 mAh (standard)	3.8 g	4.2 g
200 mAh	5.6 g	6.7 g
300 mAh	8.5 g	9.4 g

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

A/DC Resolution   16 bit

Input voltage range   ± 12.4 mV

Input noise   < 1.9 μV_{RMS}

Max. sampling rate
(kHz per channel)

(in single headstage mode)

Sampling rate (kHz/ch)		Number of selected channels				
		2	**4**	**8**	**16**	**32**
Type of headstage	**W2100-HS4**	40	25	-	-	-
	W2100-HS4-opto	10	10	-	-	-
	W2100-HS8*	40	40	25	-	-
	W2100-H16*	40	40	25	25	-
	W2100-HS32*	40	40	25	25	20

*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)

Inertial Measurement Unit   triaxial accelerometer, range ± 8 g @ 16 bit digital resolution

(except 4 channel version)   triaxial gyroscope, range 1000 °/s @ 16 bit digital resolution

Software:

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

Multi Channel Suite   Version 2.13.5 and higher

multichannel ✳
systems

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