

*made to measure*

# Flexible Extra and Intracellular Recording Systems

Differential Intracellular Recording and up to 16 Additional Extracellular Recording Channels for Field Potentials or Single Units



**TMR-02M**  
Timer  
Module

**DPA-2FS**  
Amplifier/Filter Modules  
for Extracellular Signals

**BF-48DGX**  
Amplifier/Filter Modules  
for Extracellular Signals

**ELC-01MX**  
ELC Amplifier  
Module

**AUDIS-03/8M**  
Audio Monitor  
Module

Ref.: Lapray et al., Nature Neuroscience. 2012. 15(9):1265-1271



Example of Headstage and Breakout Box for 6 extracellular and 1 juxtacellular Channel

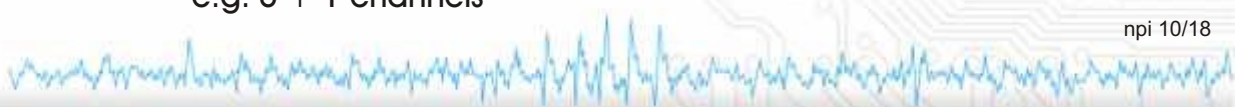
- ⇒ TMR-02M for gating juxtacellular current trains
- ⇒ DPA and BESSEL modules for amplification and filtering of extracellular signals
- ⇒ Extracellular signals can be measured single-ended or differential
- ⇒ ELC-01MX for intracellular recording in bridge mode or juxtacellular recording and stimulation
- ⇒ AUDIS-03/8M for acoustic monitoring of intracellular or extracellular signals
- ⇒ One miniature headstage for recording all signals and for stimulation



Miniature Headstage  
e.g. 6 + 1 channels



Standard Headstage



# Amplifiers for Tetraode Recording

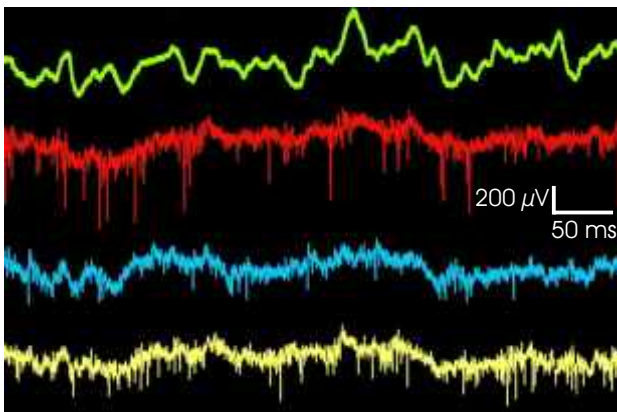
## Sample Configuration



**ISO-STIM 01M**  
Isolated Stimulator  
Module

**DPA**  
 $\mu$ V Amplifier/Filter  
Modules

**EXT-T1M**  
Tetraode  
Module



dentate gyrus of the hippocampus (0.1 - 800 Hz)  
electrode tip diameter: ~15 micrometers

different locations in the dorsal thalamus (0.1 - 6000 Hz)  
electrode tip diameter: 3-6 micrometers

Tetraode recordings (sampling rate: 10 kHz) of rat hippocampus and dorsal thalamus  
(adult rat under light anesthesia)

Data kindly provided by Didier Pinault, Univ. Strasbourg

## Recording with Two Tetraodes



### EXT-T2

- ⇒ One headstage for each tetraode
- ⇒ Lowpass filter: 500, 2k, 7k Hz, set internally by DIL switches
- ⇒ Highpass filter: 0.24, 0.3, 1 Hz, set internally by DIL switches
- ⇒ Gain: x200, x500, x1000, set internally by DIL switches
- ⇒ Headstage with x10 amplification for low-noise operation
- ⇒ Two BNC OUTPUTs for each channel



# Modular Tetrode Recording



- ⇒ Customized configurations
- ⇒ Module for stimulation (up to  $\pm 280$  nA, bipolar) and electrode resistance meter
- ⇒ Current injection frequency and amplitude set by 10-turn potentiometers
- ⇒ Electrode resistance test separately for each tetrode unit (selected by switch)
- ⇒ Low pass filters, high pass filters and gain to be set internally by DIL switches
- ⇒ Can be combined with audio module or high voltage modules for setting lesions



Tetrode Headstage

## EXT-T1M

Tetrode  
Amplifier

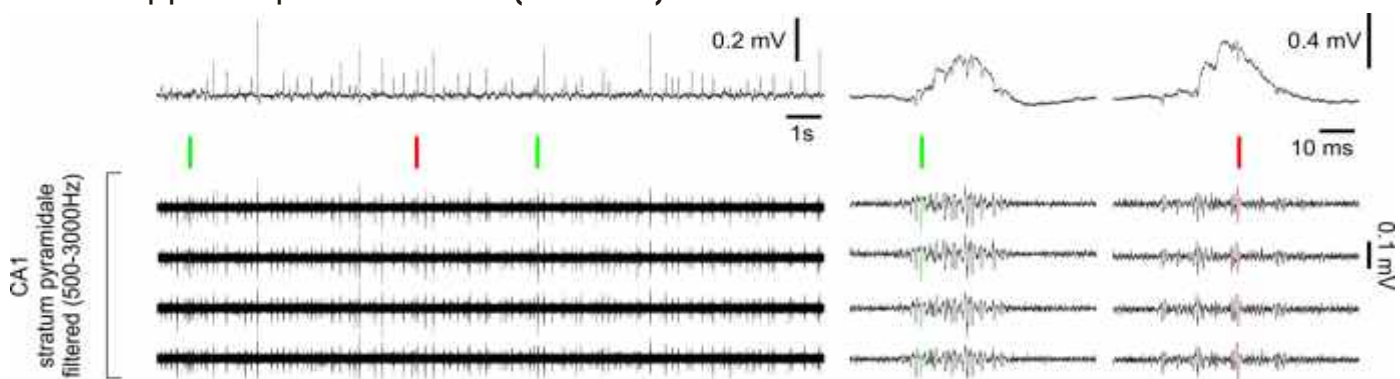
## R/I-T1M

Resistance Test,  
Current Injection



Tetrode recordings *in vitro* from the CA1 region (stratum pyramidale) of a hippocampal mouse slice (raw data)

500 ms



Further analysis (PCA, Klustakwik, (Harris, JNeuroSci 84, 2000)) reveals well separated single-unit signals

Data kindly provided by Susanne Reichinnek, INMED, Marseille

Ref.: Reichinnek, et al., J Neurosci. 2010. 17;30(46):15441-15449



# Amplifier for Multiple Site Recording



## R/I-T1DX - EXT-16DX

### Extracellular Amplifier - Electrode Resistance Meter / Current Injection Unit

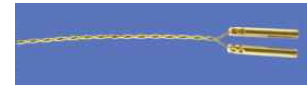
- ⇒ Extracellular recordings with up to 16 channels
- ⇒ Up to 16 gain stages, 16 high pass and 16 low pass filter corner frequencies; set by rotary switch
- ⇒ Customized configuration for each channel (set by factory)
- ⇒ Digital display of selected channel, gain, high pass and low pass filter corner frequency
- ⇒ Remote operation with digital I/O card or manual operation with rotary switches and push buttons
- ⇒ Brightness of displays adjustable
- ⇒ Referenced or single ended recording mode (set by switch)
- ⇒ External npi power supply or rechargeable batteries
- ⇒ Extracellular signals available at BNC connectors or at SCSI/SubD connector for direct linking to data acquisition card
- ⇒ Electrode resistance test separately for each electrode

### Suitable for:

- ⇒ NeuroNexus Electrodes



- ⇒ PlasticsOne Electrodes



- ⇒ Tucker Davis Electrodes



Ref.: Stroh et al., Neuron. 2013. 20;77(6):1136-1150

Justus et al., Nature Neuroscience. 2016. 20(1): 16-19

# Ejector / Extracellular Amplifier



## PEXT-01

### Pneumatic Drug Ejector and Extracellular Amplifier

- ⇒ Pneumatic drug ejection and extracellular recording with the same or different electrodes
- ⇒ INPUT with BNC connectors or small headstage with high impedance
- ⇒ OUTPUT: DC with OFFSET control or AC FILTERED (x10 to x10k); with AUDIO monitor



# Extracellular Recording Systems

For Recording Field Potentials or Single Units



**EXT-02B**

Dual Channel Amplifier with Headstages. Adjustable Gain and Filters, Notch Filter. Additional Input for Stimulator. With External Power Supply. Electrode Resistance Meter and Audio Monitor Optional. For up to 8 Channels



EXT standard headstage



Miniature EXT headstage without housing



Miniature EXT headstage with housing and gold pin for electrode holder

Miniature Headstages for Recording in Freely Moving Animals Available with or without Housing



**EXT-02F/1**

Single Channel Amplifier with Optional Headstage. Adjustable Gain and Filters. Notch Filter optional. Audio Monitor with Threshold for Removing Background Noise



**EXT-02F/2**

Dual Channel Amplifier with Optional Headstage. Adjustable Gain and Filters. Notch Filter optional. Audio Monitor with Threshold for Removing Background Noise



# Modular Extracellular Recording and Signal Processing



## EXT 10-2F

Single Channel Amplifier with Headstage, Gain and Filters



## EXT-10C

Single Channel Amplifier with Headstage, Gain and Capacity Compensation



## DPA-2FX/2FS

Amplifier with High/Low Pass Filters and Gain



## DPA-2FL

Extra Low-Noise Amplifier with High/Low Pass Filters and Gain



## LPBF-01GX

Amplifier with Low Pass BESSEL Filter and Gain



## BF-48DGX

Amplifier with High Low Pass BESSEL Filters and Gain



## DI-01NX

Differentiator Integrator



## WD-01

Window Discriminator

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