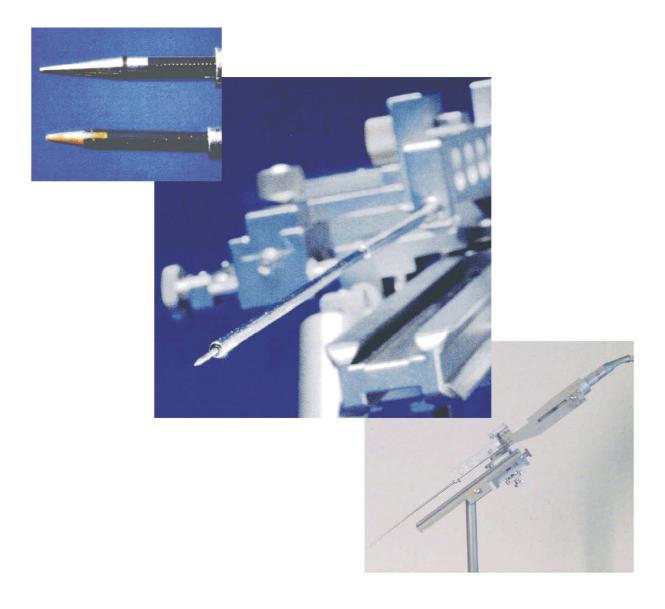


## **Microdrive System**

for

# **32-channel Microelectrode**

**Product Information** 



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#### **PRODUCT DESCRIPTION**

The newly developed 32 channel recording setup consists of a unique 32 channel microelectrode with linear or helical recording site arrangement, a high precision microdrive with integrated 32 channel low-noise preamplifier and a multichannel programmable gain main amplifier with 32 separate signals outputs for spike and field potential signal band.

The 32 channel microelectrode is available with two different recording site configurations. As shown in figure 1. This unique electrode is available with a linear and a helical recording site arrangement with two different intersite spacings. The electrode was designed to realize simultaneous recordings from different cortical layers or deep brain structures.

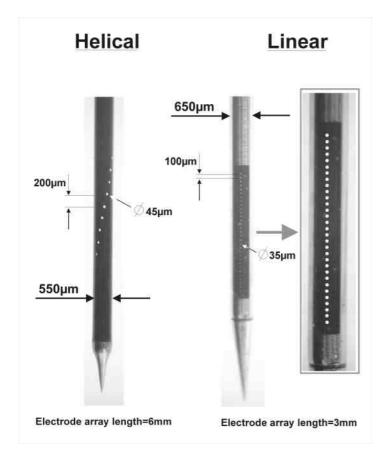


Figure 1: 32 channel microelectrode tip

As shown in this picture the 32 channel microelectrode is available with two different recording site arrangements.

The helical electrode has an outer shaft diameter of app.  $550\mu m$  and an intersite spacing of app.  $200\mu m$ . Each recording site has a diameter of app.  $45\mu m$ .

The linear electrode has an outer shaft diameter of app.  $650\mu m$  and an intersite spacing of app.  $100\mu m$ . Each recording site has a diameter of app.  $35\mu m$ .

This 32 channel electrode is available ready for use with our microelectrode manipulator system type "Eckhorn" or for our standard manual microdrive system. For use with our patented microelectrode manipulator system type "Eckhorn" the electrode is mounted to a special designed electrode carrier unit as shown in figure 2.



Figure 2: 32 channel microelectrode mounted to an electrode carrier unit

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The 32 channel microelectrode is delivered preinstalled in one electrode carrier unit. By using this electrode carrier unit all connections between the 32 electrode contacts and the 32 channel preamplifier input are made automatically while inserting the carrier unit into our microdrive system. No further connections are required. Electrode loading to the drive is done by the user within seconds and recording can start immediately. Figure 3 shows all components of one 32 channel microelectrode prepared to be installed in our electrode carrier unit.

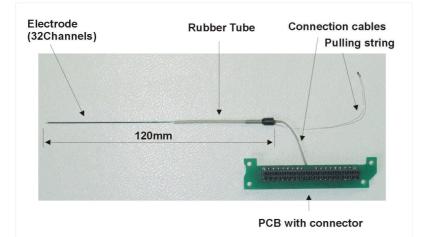


Figure 3: 32 channel electrode with patented rubber tube drive for our microdrive system type "Eckhorn".

One can see that the electrode contacts are connected to a special connector mounted on a printed circuit board. All these components will be integrated in the electrode carrier unit like shown in figure 2.

The microdrive "System Eckhorn" with loaded electrode carrier unit and mounted to the xyzmanipulator is shown in figure 4.

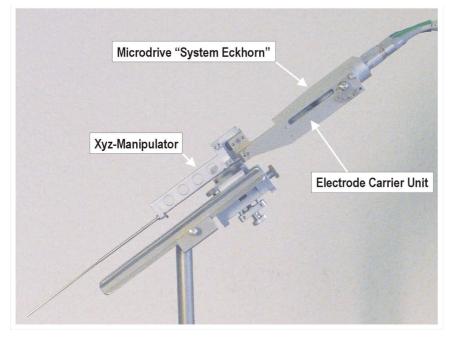


Figure 4: Microdrive "System Eckhorn" with integrated 32 channel preamplifier. The 32 channel microelectrode is loaded to the microdrive. The system is mounted on a xyz-manipulator, ready for recording.

In this case the electrode carrier unit has a long guide tube, adapted for deep brain recordings in human subjects (e.g. Parkinson disease patients) but it is no problem to adapt the recording system to animal recording setups if required.

This newly patented rubber-tube microdrive method for the insertion of probes into neural and muscular tissue was developed by *Thomas RECORDING* in cooperation with Prof. Dr. Reinhard Eckhorn, Dept. of Biophysics, at the Philipps University in Marburg (Germany).

Axial forces for driving the probes into tissue and radial forces against buckling are both provided by a stretched elastic rubber tube, within which the probe is guided outside of the tissue.

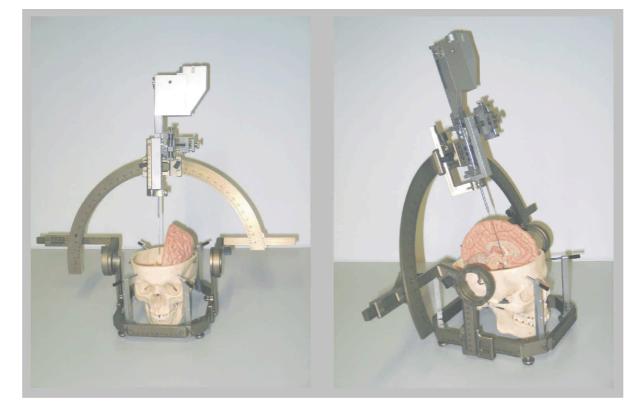
This new rubber tube microdrive system enables smooth and exact movements, can exert high longitudinal forces, can handle a broad range of probes (also manufactured by **Thomas RECORDING**).

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#### Some advantages of our "Eckhorn system" are:

- The specially developed and patented Eckhorn microelectrode drive allows exact jerk- and shock-free positioning of microelectrodes in the brain.
- "Microphonic potentials", usually picked up by high impedance probes during mechanical vibrations (e.g. in step motor driven systems!) are even absent in the rubber tube drive. This enables continuous recordings while the probe scans the tissue at low velocity. This makes it possible to search for the ideal recording position for the microelectrode while the microelectrode is being driven in a forward or backward direction.
- Compared with competitive manipulators which work with cable control, our system has very little hysteresis error caused by electrode movement. Hysteresis error is generally a result of stiction and free motion of the driving mechanism. Our system has a higher degree of positioning accuracy due to its driving mechanism being almost **absolutely free** of stiction and free motion.
- In comparison to piezoelectric microelectrode positioning systems the Eckhorn system does not produce high-voltage noise generated by the former.
- Complete shielding of the Eckhorn manipulator system, from the microelectrode-tip to the low impedance output of the preamplifiers, in order to avoid any hum noise influence on the neural signal.
- Microelectrode exchange is possible within a few seconds by using electrode carrier units.
- Moving velocity of the microelectrode is adjustable, moving direction of the microelectrode is selectable (forward and backward direction)
- Electrode movement is controlled by software
- Axial positioning accuracy of the microelectrode is 1µm



**Figure 5:** Microdrive with 32 channel electrode mounted on a Leksell stereotactic arc for deep brain recordings in human subject. Adaptation to animal setups is no problem. Please feel free to aks for your special setup.

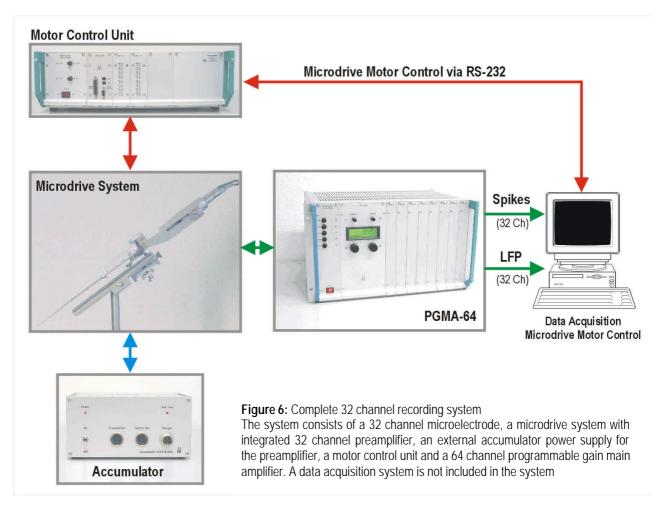
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The 32 channel preamplifier is integrated in the microdrive chassis. As soon as the electrode carrier unit is loaded to the microdrive and the cover of the microdrive chassis is closed, the metal microdrive chassis builds a faraday cage around the high impedance microelectrode and preamplifier input. This avoids hum noise pickup from the lab environment, usually one of the main problems in neurophysiological recordings.

The output of the 32 channel preamplifier is connected to our 64 channel programmable gain main amplifier PGMA-64. This amplifier has 32 channels for spike activity and 32 channels for local field potential filtering and amplification.

In figure 6 one can see a block diagram of a complete 32 channel recording system. This system is delivered completely by Thomas RECORDING. Please pay attention to the fact that a data acquisition system is not included.



The position of the microelectrode loaded to the microdrive system is controlled by a microprocessor motor control unit. This motor control unit is connected to the host personal computer via RS-232 serial interface. Based on the fact that the personal computer is not very busy with the motor control of the microdrive system there is usually enough system performance for operating a data acquisition system on the same PC. The broadband signals picked up by the 32 recording sites of the microelectrode are preamplified by a 32 channel low noise preamplifier that is integrated in the microdrive chassis. The headstage has a recording frequency range of 0.06Hz...15kHz. The preamplified broadband recording signal is connected to a programmable gain main amplifier. This amplifier has 32 channels with for spike recordings (500Hz...15kHz) and 32 channels for field potential filtering and amplification (0.06Hz...150Hz). The gain on each channel is controlled by an user interface at the front panel or via RS-232 interface by software on the personal computer.

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