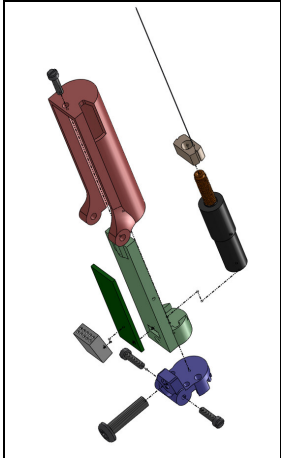


| | |
|---|---------------|
| Single Microdrive Neural Headstage | ND1HS1 |
|---|---------------|

Lightweight Motorized Neural Probe Assembly for Awake Animal Neural Recording

- Single motor microdrive
- 4 microelectrode circuits
- 1 reference circuit
- 1 stimulus circuit
- Independent 3-wire motor control circuits
- Omnetics Nanominiature connector
- 1 gram total microdrive mass



Ordering Information

| Motor Configuration | Part Number |
|-------------------------------|-------------|
| MicroMo 0308A003B+03A 125:1S3 | ND1HS-1 |

Accessories

| Description | Part Number |
|--------------------------|-------------|
| JFet Buffer Assembly | ND1BAJ-1 |
| Tether Cable | ND1TC-1 |
| Shuttle Assembly Fixture | ND1SAF-1 |
| Microelectrode Capillary | ND1MEC-1 |

Absolute Maximum Ratings

| Characteristic | Symbol | Min | Typ | Max | Unit |
|--------------------------------|--------|-----|-------|------|------|
| Microelectrode Circuit Current | I_E | | | 10 | mA |
| Reference Circuit Current | I_R | | | 10 | mA |
| Stimulus Circuit Current | I_S | | 0.020 | 100 | mA |
| Motor Current per Winding | I_W | | 110 | 150 | mA |
| Motor Winding Voltage | V_W | | 3.8 | 5.25 | V |

Specifications

| Characteristic | Symbol | Min | Typ | Max | Unit |
|-------------------------------|-----------------|-----|-------|------|-------------|
| Gearhead Reduction Ratio | GR | | 125:1 | | rotor/shaft |
| Output Shaft Diameter | D _S | | 1.6 | | mm |
| Output Shaft Thread Pitch | TP | | 0.2 | | mm/rev |
| Shuttle Step | L _{SS} | | 0.27 | | μm |
| Shuttle Travel | L _{ST} | | | 4300 | μm |
| Shuttle Speed | V _S | | 1 | 400 | μm/sec |
| Direction Reversal Hysterisis | H _{DR} | | 100 | | μm |
| Microdrive Diameter | D | | 5.0 | | mm |
| Microdrive Length | L | | 20.0 | | mm |
| Microdrive Mass | M | | | 1.0 | gm |
| Electrode Diameter, Tungsten | D _E | | 75 | 100 | μm |

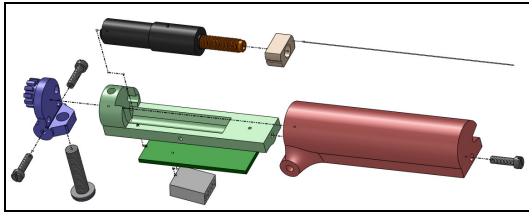


Figure 1 - Headstage Exploded View 1

Key to Exploded Views

| Color | Part |
|-------------|-----------------------|
| red | cover |
| light tan | shuttle |
| gold | lead screw |
| black | motor and gearbox |
| light green | body |
| dark green | printed circuit board |
| light grey | Omnetics connector |
| purple | base |
| black line | electrode |
| dark grey | screws |

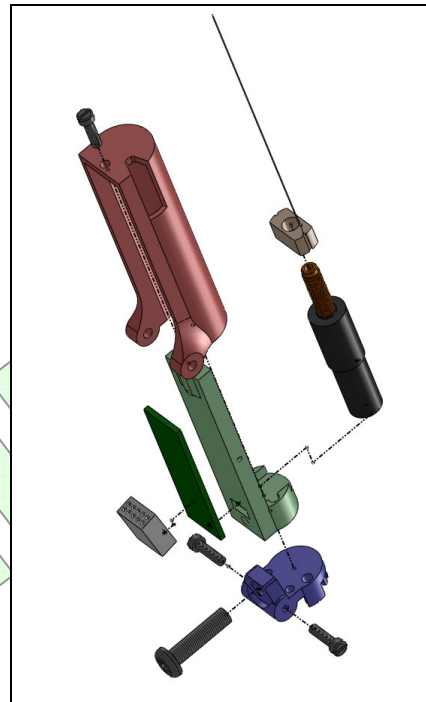


Figure 2 - Headstage Exploded View 2

Description

The ND1HS headstage incorporates a miniature motor and gear head mounted within a cylindrical body made of sturdy, lightweight, and chemically resistant anodized aluminum (See Fig. 1). The gear head reduces 125 motor rotations to one output shaft rotation. The output shaft is a threaded rod, turning in a screw thread within a sliding shuttle. The shuttle can carry from one to four tungsten electrodes. The rotational movement of the threaded rod transforms to linear movement of the shuttle at 0.2 mm per shaft revolution. The minimal motor step is 60 degrees, corresponding to 0.27 μm of longitudinal movement of the electrode(s).

To achieve reproducible electrode placement, always move them in one direction. For example, if the main direction is forward, then to move electrodes back, first retract them farther than the desired position by at least the amplitude of the hysteresis ($H_{\text{DR}} = 100 \mu\text{m}$) and then move them forward to the desired position.

Electrodes are glued to the shuttle with epoxy. Electrical connection between electrodes and contact pads on the head stage is made using thin copper wire (40 AWG). It is recommended to embed the electrode wire connection and part of the wire close to the shuttle in epoxy.

During implantation the cup and body are fixed to the skull of the animal with dental cement. The cup and tube prevent contact by the motor and other electronics with dental cement and live tissue. To remove the headstage from the animal, gently pull the tube from the cup and remove it. The cup remains on the animal until euthanasia. Remove the dental cement from the cup by dissolving it in solvent.

The circuits for motor control, microelectrode signals, the neural reference signal, stimulus signal, and ground reference are accessed through the printed circuit board solder pads. A dual row 10-pin fine pitch connector provides an attachment point for an external tether cable.

The printed circuit board connects only to the 3 motor control leads on the headstage. Any remaining pads are connected to the multi-pin Omnetics connector. The function of these user accessible pads is defined by the electronics of the attached tether, not by the headstage itself.

Additional Views

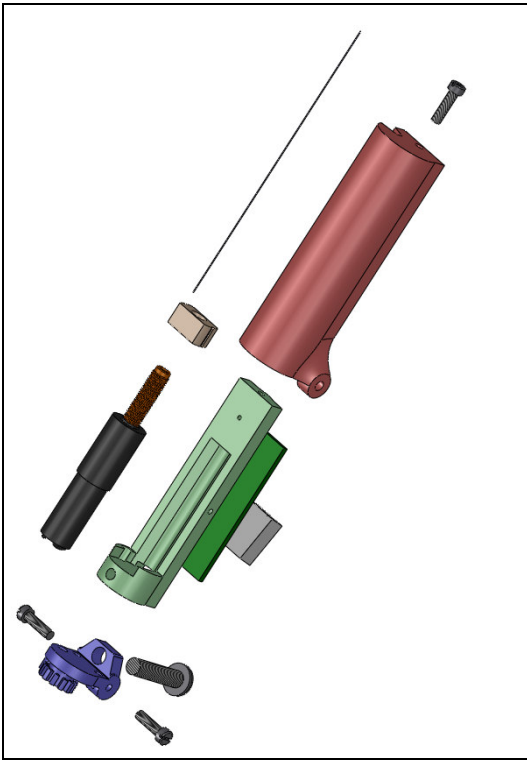


Figure 3 - Headstage Exploded View 3

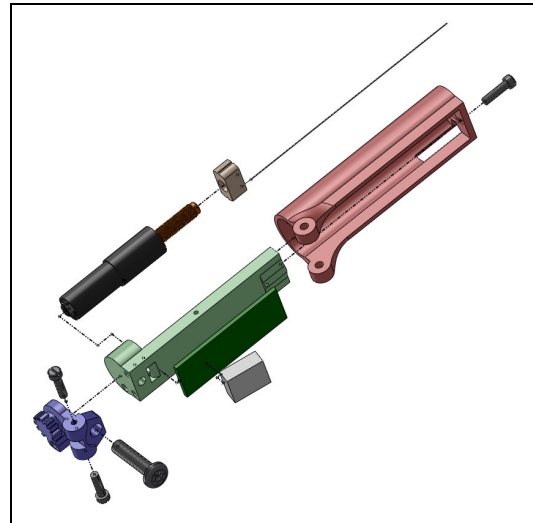


Figure 4 - Headstage Exploded View 4

Kit Assembly Information

| Tool | Supplier |
|-------------------------------------|------------------------------|
| tap 000-120, taper chamfer, 2 flute | J.I. Morris |
| tap 0-80 | J.I. Morris or McMaster-Carr |
| filled epoxy, 1C-LV, # 6430A35 | McMaster-Carr |
| rubber coating, Plasti Dip | Home Depot |

I/O Information

ND1HS-NPD-10 (Omnetics Nanominiature Male) 10-Pin Interface Connector

| Pin # | Signal | Pad | Input/Output | Pin # | Signal | Pad | Input/Output |
|-------|--------|-----|--------------|-------|------------|-----|--------------|
| 1 | Probe1 | E1 | Output | 2 | Reference1 | R | Output |
| 3 | Probe2 | E2 | Output | 4 | MotA | A | Input |
| 5 | Ground | G | ----- | 6 | MotB | B | Input |
| 7 | Probe3 | E3 | Output | 8 | MotC | C | Input |
| 9 | Probe4 | E4 | Output | 10 | Stimulus1 | S | Input |

Electrode Pad Information

Fig. 6 shows the top layer of the headstage flex printed circuit boards. The exploded views in this document show the B29 PCB and the corresponding 10-pin connector. All electrode, reference and stimulus connections are accessible on this layer. In the **I/O Information** table above, the **Pad** column refers to the pad labels shown in this figure. The pads for the 10-pin interface connector are not labeled in this figure. For B29, there are 4 pads for electrode circuits ('E1' to 'E4'), one pad for the reference circuit ('R'), one pad for the stimulus circuit ('S') and one pad for the ground circuit ('G'). The other PCB options have only a subset of these pads. The C02 and C04 options have extra pads on the same circuits, in case repeated connections to electrodes damages one set of pads.

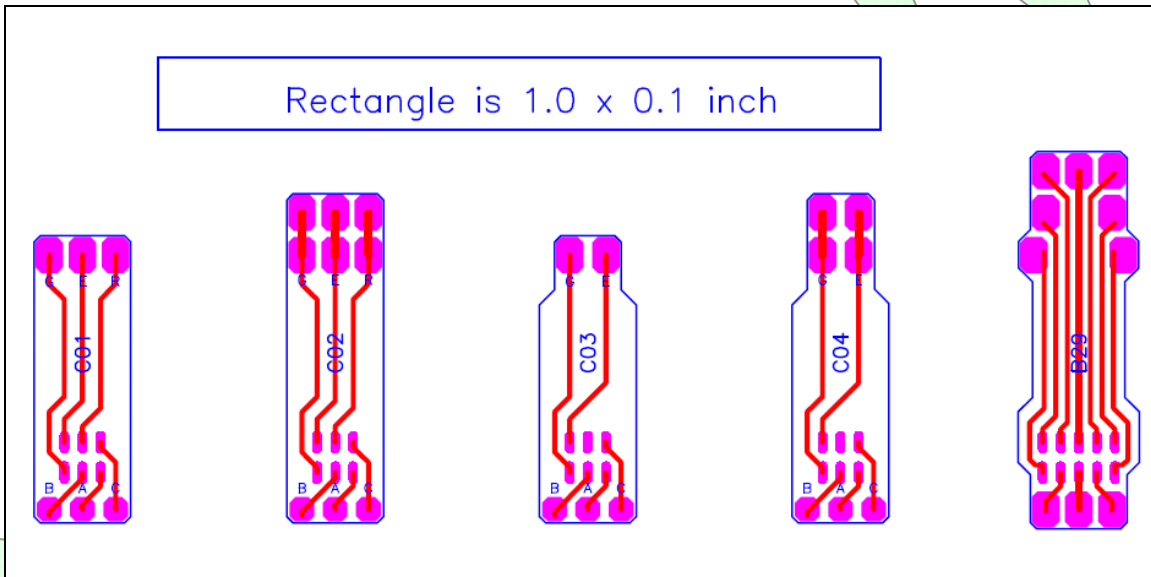


Figure 6 - Headstage PCB Options (Top Surface)