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SS-8000

MICROELECTRODE POSITIONER



TH[illegible]ORM® MOTOR SYSTEM HELPS CELL PHYSIOLOGISTS OBTA[illegible] PENETRATIONS AND STABLE RECORDINGS

- 25mm of travel for thick slice and in-vivo preparations
- Ultra-high resolution motor of 0.1 nm
- Programmable step-sizes in 0.5µm increments for absolute control of microelectrode position
- Solid-state construction gives the highest position stability and lowest vibration
- High speed and acceleration provides clean tissue and cell penetrations
- Ultra Low Noise (ULN) drive electronics ensure negligible EMI noise in recording measurements
- 2 Year Warranty







Burleigh®

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Burleigh LSS-8000

THE INCHWORM® ADVANTAGE

One of the major goals in any research program is constantly improving productivity. For electrophysiological research, such as intracellular or extracellular recording, increased productivity requires an electrode positioner that results in more clean tissue and cell penetrations while maintaining stable recording conditions. When electrode positioning over many millimeters is needed, the INCHWORM® microdrive system is proven to provide the highest productivity.

INCHWORM® TECHNOLOGY

The INCHWORM® motor has a patented solid-state design that directly creates linear motion by sequential activation of three piezoelectric (PZT) elements. Piezoelectric material is an electrically active ceramic that changes dimension when a voltage is applied. The sequence of operation is shown in *Figure 1*. Each clamp-extend-clamp-unclamp-retract cycle of the INCHWORM® motor produces approximately two micrometers of linear motion. The signal driving the center element is divided into programmable step sizes that can be as small as 0.1 nanometers. Total travel is limited only by the length of the motor shaft. The maximum speed of the INCHWORM® motor is 1.5 millimeters per second and corresponds to a maximum clamp change frequency of approximately 1000 Hz.

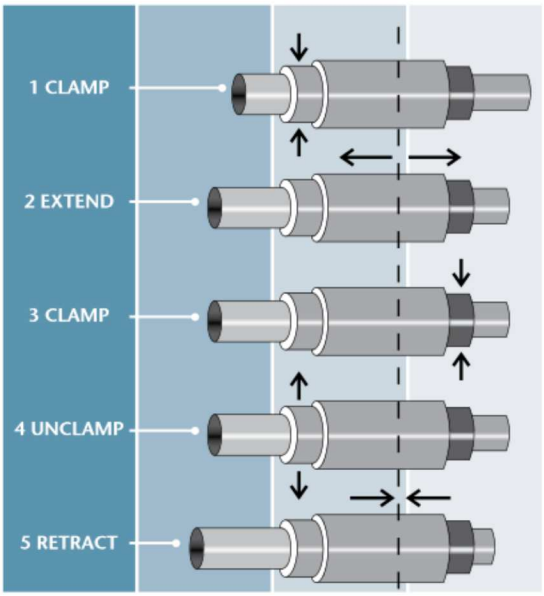


Figure 1. (The INCHWORM® Motor Sequence)

ACCELERATION, VELOCITY & PRECISION

High Acceleration & Velocity - Clean penetrations require a microdrive capable of instant acceleration and velocity as well as rapid decelaration. When penetrating cells, the goal is to avoid membrane dimpling which can result in severe cell damage (*Figure 2*). The INCHWORM® motor's piezoelectric elements respond in microseconds with very high stiffness to achieve inherent high acceleration and velocity. The motor attains its top speed within one clamp change with a velocity range of 0.1mm/seconds to 1.5mm/seconds. When operating in step mode, the step size is programmable and the step speed is adjustable. When the programmed step is achieved, the motion stops instantly without overshoot or creep. In contrast, rotary motor/leadscrew systems suffer from "stick-slip" effects at very slow speeds, which produce unstable motion.

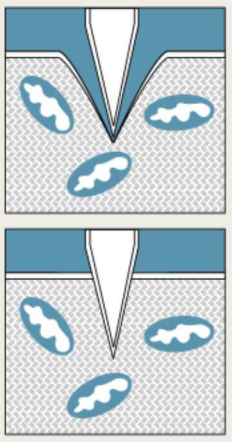


Figure 2.

Positioning Precision - An optical encoder directly measures the INCHWORM® shaft position for maximum precision. The encoder counts and subdivides fringes produced by a Moire interferometer using a proprietary Burleigh design. Absolute position measurement of the shaft complements the outstanding resolution, stability, and acceleration of the INCHWORM® motor to provide full closed loop position control.

The absolute position of the INCHWORM® shaft is displayed on the front panel of the controller with 20nm increments. The INCHWORM® resolution of < 0.1 nm easily produces 20nm position steps with very smooth motion and without overshoot.

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STABILITY

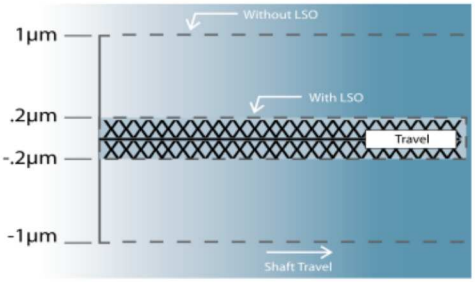
Once an electrode is moved to the desired position, stable and drift free recording conditions may be required for several hours. The solid-state ceramic and metal construction of the INCHWORM® motor provides very high stiffness and does not exhibit any drift typically associated with hydraulic systems. Thermal stability is further enhanced by zero heat dissipation of the INCHWORM® motor when holding position.

The closed loop encoder feedback ensures submicrometer stability of the electrode tip. INCHWORM systems simply hold cells longer!

MINIMUM TIP VIBRATION

The Model IW-811-L INCHWORM® motor used in the LSS-8000 system incorporates the lateral stability option (LSO) on the output shaft to minimize lateral motion. This unique vibration damping system (*Figure 3: INCHWORM® Motor Lateral Shaft Motion*) limits lateral wander of spindle tip to approximately 0.2 µm to preserve integrity.

Figure 3.



ULTRA LOW NOISE MOTOR CONTROLLER

The LSS-8000 system uses a Model 8200 motor controller with drive signals that have less than 5 mv RMS noise and an optimized grounding/shielding design to minimize any possible EMI interference in electrical recordings.



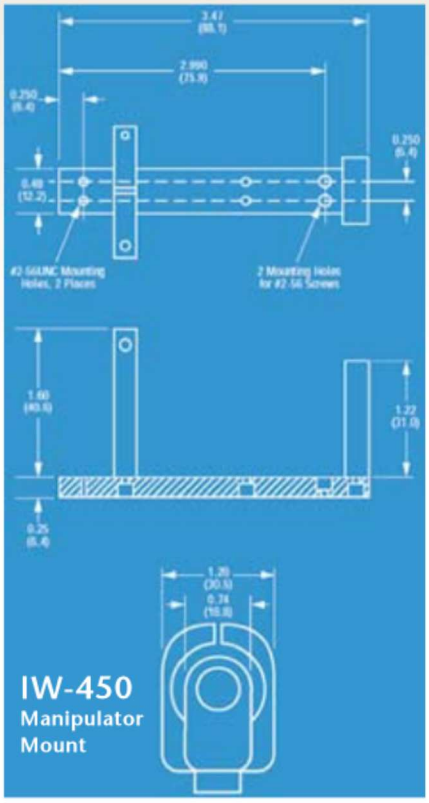
8200 Controller

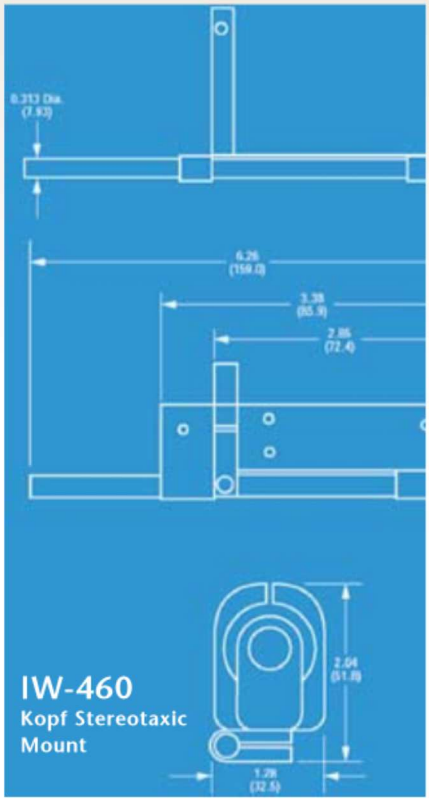
The Model 8005 handset controls the direction, speed, starts and stops of the motor. Run/jog or step mode can be selected and are easily programmed on the front panel of the 8200.

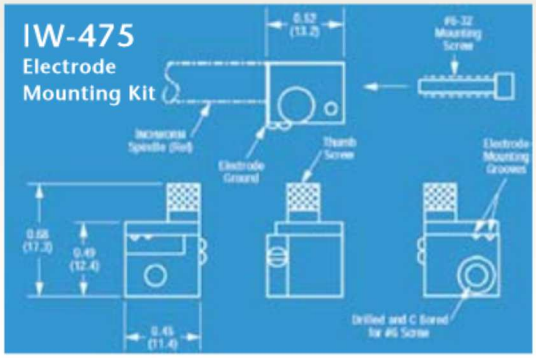


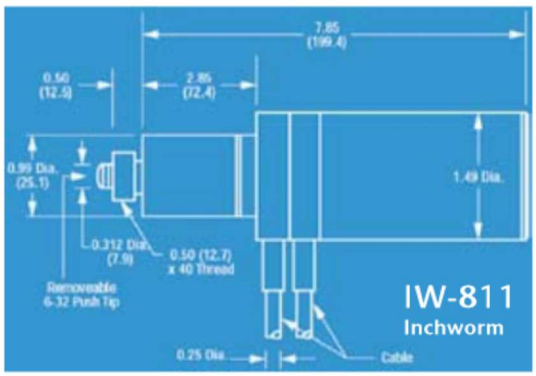
Handset

OUTLINE DIMENSIONS









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SPECIFICATIONS

LSS-8000 INCHWORM® SYSTEM INCLUDES:

PART	DETAILS
#1. Model IW-811-L, INCHWORM® MOTOR	25 mm travel, 20nm encoder & lateral stability option, 2 meter interconnect cables
#2. Model 8200 controller	Single-axis, closed loop, with RS-232 interface
#3. Model 8005 handset	With cable

IW-811 INCHWORM® MOTOR

PARAMETER	DETAILS
Maximum range of motion	25 mm
Motor resolution	< 0.1 nm
Encoder resolution	20nm
Encoder accuracy	± 1.5 µm (optional)
Nominal speed	0.1 nm/sec to 1.5 mm/sec
Maximum axial load	1.0 kg
Maximum lateral load	0.1 kg
Lateral motion	± 1 µm (± 0.2µm with lateral stability option)
Operating temperature	0 to 50° C

WARRANTY

2 years

OTHER OPTIONS & ACCESSORIES

OPTIONS

- 50 mm travel (LSS-8100)
- Longer interconnect cables
- GPIB computer interface
- Up to three axes of independent motor control in each 8200 chassis
- Model 8003 joystick with cable

ACCESSORIES

Mounting:

- **IW-450** Micromanipulator Mount (does not include micromanipulator)
- **IW-460** Kopf Stereotaxic Mount
- **IW-475** Electrode Mounting Kit

Rack Mount Kit:

- Controller Rack Mount Kit

Extension Cables (must be orde sets, one for INCHWORM® motor & one fo er

- **8011-1** 3 meter motor cable
- **8011-2** 7.5 meter motor cable
- **8011-3** 15 meter motor cable
- **8007-1** 3 meter encoder motor cable
- **8007-2** 7.5 meter encoder motor cable
- **8007-2** 15 meter encoder motor cable

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