



*Shown: TRIO-235 with Sutter IPA® headstage (not included)*

### **TRIO™-235**

3-axis / 0-90 Diagonal Micromanipulator System

Ideal for in-vivo work, the TRIO™-235, replaces the Z-axis and replaces it with an adjustable diagonal axis. This configuration pairs a traditional X and Y-axis with a diagonal axis that can be adjusted in angle with a set screw. The diagonal features 50 mm of travel, with 25 mm of travel in the X and Y-axes. On this model, we have added software to create a synthetic "Z-axis" by combining the Diagonal and X-axes in reverse of how we create a synthetic diagonal axis on our other manipulators. The TRIO-235 features a precision bearing and lead-screw design.

The TRIO-235 controller employs a combination of state-of-the-art software and mechanical design that eliminates the need for the motor to remain powered on during recording, thus eliminating the heating effects of the motors and giving us the electrically quietest manipulators in the industry. This stability ensures that Sutter manipulators will not drift in the middle of experiments.

The compact design of the integrated Rotary Optical Encoder (ROE) controller uses minimal bench space; provides quiet, fan-free operation; and is easy to use. No rack mounted controller is required. Position coordinates, in relative or absolute values, are displayed directly on the ROE. The TRIO manipulators use a logarithmic acceleration algorithm that eliminates the need for speed selection. As the knobs on the ROE are turned faster, acceleration ramps up. This allows for smooth and intuitive motion control of electrode position without the need to stop and change speeds or lift your hand from the knobs. A Y-axis lockout function (accessible by DIP switch) is also available, allowing X/Diagonal-only axial movement during HOME and WORK repositioning.

Five conveniently located buttons control all the functions you will need in normal operation. Press and hold the [WORK] button to quickly store a work position; pressing [WORK] after this will return the manipulator

to the same location. [HOME] sends the manipulator to a second position, often set for a point furthest from the microscope, which is useful for rapid pipette exchange. Pressing [SPEED] allows the selection of one of 4 speed ranges. With practice, there is no need to ever change speeds, however, we have included three low speed ranges for those who work at very high magnification. Holding [SPEED] for three-seconds will lock the knobs out, to prevent accidental movement. Display coordinates can toggle between relative and absolute by pressing the [RELATIVE] button; holding the button down will zero the relative coordinates. Finally, [PULSE] activates a pulse movement mode that produces small, rapid bursts of motion that can be advantageous for cell penetration with sharp electrodes. Hold [PULSE] for three-seconds to set or modify the angle the diagonal axis is positioned at. This allows the controller to calculate the synthetic “Z-Axis”.

Designed with maximum flexibility in mind, a DIP switch on the controller changes the directional movement of the ROE knobs to accommodate the preference of the user. The TRIO-235 comes standard with a universal mounting system suitable for the most popular headstages or pipette holders.

### **FEATURES**

- Three independent axes - 25 mm orthogonal travel in X, Y and Diagonal
- Software-based “Z-axis”
- Sub-micron (less than 100 nm) resolution
- Fast movement with a top speed of 3 mm/sec (while homing)
- Mechanically robust construction for high stability
- Compact, fanless, user-friendly ROE controller preserves bench and rack space
- Carries up to a kilogram
- Push button control of multiple functions - WORK, HOME, SPEED, PULSE and RELATIVE
- Suited for *in vitro* and *in vivo* electrophysiological recording
- Universal mounting system for headstage or pipette holder
- DIP switches on ROE select direction of movement produced by turn of ROE knob
- USB interface for computer control

### **TECHNICAL SPECIFICATIONS**

#### **Travel**

25 mm on X and Y / 50 mm on diagonal

#### **Long Term Stability**

<1 micron in 4 hours

#### **Control Box**

5.5 in x 8 in x 4 in | 14 cm x 20 cm x 10.2 cm

#### **Weight (mechanical)**

2.8 lbs | 1.3 kg

#### **Weight (Controller)**

2.2 lbs | 1.0 kg

#### **Electrical**

115/230 Volts

50/60 Hertz power line

[TRIO-235 CE Certificate](#)