

**PCS-6400CL - January 22, 2019**

Item # PCS-6400CL was discontinued on January 22, 2019. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

**MOTORIZED PATCH-CLAMP MICROMANIPULATORS**

- ▶ Motorized Micromanipulator Assemblies for Precision Control
- ▶ Ideal for Gibraltar™ Microscope Platforms
- ▶ Position Pipette or Electrode Along Three Different Axes



Application Idea

PCS-6300CR



PCS-500-SSH  
Steep/Shallow  
Headstage Adapter

PCS-6400TR and PCS-6400TL Micromanipulators  
Mounted on Our Gibraltar GHB-BX Platform

[Hide Overview](#)

**OVERVIEW**

**Features**

- Motorized Micromanipulators with Stepper Motor and Piezoelectric Translation
- Minimal Drift During Experiments: <1 µm/hr
- Traditional and Cultured Configurations Available
- Translation Along Three Axes
  - 25 mm Coarse Travel (Stepper Motor)
  - 150 or 300 µm Fine Travel (Piezoelectric)
- Repeatably Set Approach Angle Using Adjustable Stop Rings
- Headstage and Pipette Adapters Sold Separately
- Includes Axis Control Unit, Joystick and Computer Controller, and 60 V Power Supply

Common Specifications			
Control Type	Fine (Piezo)		Coarse (Motorized)
Travel	150 µm	300 µm	25 mm
Resolution	<60 nm	<120 nm	1.6 µm (Min)
Speed	Directly Proportional to Rate of Knob Turns		Continuously Variable from 0.5 µm/s to 2 mm/s
Memory Speed	3.5 mm/s		
Drift	<1 µm/hr		
Computer Interface	USB		
Manipulator Dimensions (LxWxH)	7.0" x 8.5" x 7.5" (178 mm x 216 mm x 190.5 mm)		

**For questions and ordering details please contact Tech Support.**

Thorlabs' Motorized Micromanipulators offer excellent control of pipette manipulation for electrophysiology and life sciences research. These micromanipulators use a combination of stepper motors and piezoelectric (PZT) control of translation stages to provide smooth and precise movement of the pipette head. When combined with our Gibraltar Platforms, these micromanipulators achieve unparalleled stability and control.

We offer our motorized micromanipulators in either a traditional configuration or a cultured configuration (see images below). The cultured configuration provides control over the 3 cardinal directions (X, Y, and Z), which is ideal for patching cells. Translation along the X- and Y-axes positions the pipette over the cell of interest and then the Z translation brings the pipette down to patch clamp a cell. For applications such as brain slice work, we offer the traditional configuration. In these applications, control over the Y, Z, and approach axis is preferred. Two adjustable stop rings enable the user to set an approach angle and rotational orientation for fast alignment during pipette swapping (see the *Micromanipulator* tab for more information).

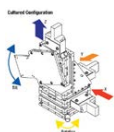
The micromanipulator can move along three different axes. Coarse translation is controlled using a stepper motor that produces a displacement up to 25 mm at a 1.6  $\mu\text{m}$  minimum step size. These electrically quiet motors utilize specially shielded cables, an internal ground skeleton, and a grounding pin to eliminate noise and interference. Fine control on the micromanipulators is achieved with piezoelectric flexure mounts that provide a displacement of either 150  $\mu\text{m}$  or 300  $\mu\text{m}$  along each axis.

These motorized micromanipulators can use either a joystick or computer interface to control the stepper motor translation. Additionally, the user is able to store up to two independent positions in memory. Pushing a button on either control system (joystick or computer) recalls the stored position, allowing the user to quickly and easily move between two predetermined positions on the micromanipulator.

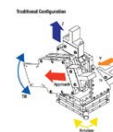
Adapters for positioning a headstage or pipette at steep or shallow approach angles can be purchased separately below. These adapters allow for more experimental flexibility and minimize mechanical clashing with microscopy objectives or other experimental apparatus. A close-approach headstage and pipette adapter is also available that allows pipettes and headstages to be positioned closer to a sample without interference from the micromanipulator.

### Piezoelectric Control

Piezoelectric control is used to achieve superior positioning compared to hydraulic manipulators, mechanical manipulators, or motorized lead screws. Piezoelectric control provides smooth and predictable movement with no backlash and minimal drift ( $<1 \mu\text{m/hr}$  with temperature control). An axis control unit is included with each piezoelectric micromanipulator (see the *Control Unit* tab). Each axis is controlled by an independent knob on the control unit and provides a displacement of 150  $\mu\text{m}$  or 300  $\mu\text{m}$  (depending on model). Three turns on the control unit corresponds to the full piezo travel range, resulting in a resolution of 0.04% of the total travel.



[Click to Enlarge](#)



[Click to Enlarge](#)

[Hide Micromanipulator](#)

## MICROMANIPULATOR

### Micromanipulator Assembly

Thorlabs' Micromanipulator Assembly is composed of three linear translation stages, two rotary stages with lockable stops, one set of angle brackets, and headstage mounting plate. The cross roller bearings of this assembly form a stiff and precise single-axis bearing system with high load capacity and minimal friction. The PZT actuators yield 60 nm resolution, virtually no heating, zero backlash, and negligible drift ( $<1 \mu\text{m/hr}$ ).

The headstage mounting plate easily accommodates headstages and pipettes. Note that while many headstages may be directly bolted to the headstage mounting plate, other headstages may be mounted to the mounting plate by adding the appropriate mounting holes.

The headstage pivot allows for simple optimization of the pipette angle of approach on either an inverted or upright microscope. Additionally, the PCS-500-SSH Steep/Shallow Headstage Adapter or MIS-PHM Pipette Holder may be used in applications requiring very steep or shallow angles. Due to the symmetric design of our micromanipulator assembly, this system can be easily modified for a left-sided or orthogonal approach axis without needing a special adapter kit.



[Click to Enlarge  
Micromanipulator  
Assembly](#)

### Adjustable Stop Ring



[Click to Enlarge](#)  
Adjustable Stop Ring with Pin and  
Brass Block with Locking Thumbscrew

These micromanipulators include two adjustable stop rings that allow a user to repeatedly and accurately set the approach angle and horizontal rotational orientation (see image to the left). Once an appropriate angle or rotation is established, tighten the thumbscrew on the brass block to lock the mount in position. Loosen the two setscrews on either side of the pin using a 0.05" (1.3 mm) balldriver or hex key. Rotate the ring until the protruding pin is in physical contact with the brass block. To lock the ring, tighten the exposed setscrew, then loosen the thumbscrew to allow the mount to rotate freely.

The adjustable stop rings in combination with the headstage adapter or pipette holder (sold separately below) provide a convenient mechanism for quickly changing pipettes and returning to the last position during an experiment, minimizing position readjustments and increasing efficiency. To do this, the user can

set the adjustable stop ring to remember the approach angle and rotation, move the pipette away from the sample using the slide assembly on the adapters, rotate the stage away to exchange the pipette, and then quickly return to same approach angle and rotation as before.

[Hide Control Unit](#)

## CONTROL UNIT

### Axis Control Unit

The axis control unit allows the user to adjust pipette placement by hand with smooth and repeatable movement through control of the piezo flexure mount. Each of the three stages that comprise our micromanipulator assembly can connect to one of the potentiometer knobs on the axis control unit. For convenience during system configuration, the user may choose any knob to control any particular stage. This allows the user to set the axis control unit in the most intuitive configuration for the system.



Click to Enlarge  
Axis Control  
Unit

Each knob controls a three-turn potentiometer, which regulates voltage to the piezo flexure assembly and thus its position. Three turns correspond to the full travel range of the piezo assembly, yielding a resolution that is 0.04% of the total piezo travel range. For example, a 150  $\mu\text{m}$  piezo travel stage will have a 60 nm resolution provided by the axis control unit. Additionally, the user may set the potentiometer friction to suit experimental needs.



Click to Enlarge  
Joystick

### Joystick and Computer Controller

Control of the stepper motors is accomplished through the use of either the included joystick or through a computer GUI interface. Computer control features a virtual joystick and gives 3-D position readouts. The joystick offers analog control allowing the motorized assembly speed to be controlled continuously between 0.5 nm/s to 2 mm/s (for computer control, this sensitivity can be directly set in the GUI) and offers a minimum step size of 1.6  $\mu\text{m}$ . Both joystick and computer control allow the user to store up to two independent positions in memory and give simple push button recall to said positions. This allows the user to quickly and reliably switch between two preset positions.

### Power Supply

Our micromanipulator power supply provides a regulated, low noise, 60 V output for the axis control unit. Two voltage outputs enable the power supply to regulate two axis control units. This allows the user to run two micromanipulation assemblies from the same power source, saving both money and space. This power supply accepts an input power range of 100 - 240 V at 50 - 60 Hz.



Click to Enlarge  
60 V Power  
Supply

[Hide Right-Handed, Traditional Micromanipulator](#)

### Right-Handed, Traditional Micromanipulator

Item #	Coarse Travel <sup>a</sup>	Fine Travel <sup>b</sup>			Description
	All Axes	Y Axis	Z Axis	Approach Axis	
PCS-6200TR	25 mm	150 $\mu\text{m}$	150 $\mu\text{m}$	150 $\mu\text{m}$	150 $\mu\text{m}$ PZT Travel in All Axes
PCS-6300TR	25 mm	150 $\mu\text{m}$	150 $\mu\text{m}$	300 $\mu\text{m}$	Recommended for working in slices where longer PZT travel on the approach axis is required.
PCS-6400TR	25 mm	300 $\mu\text{m}$	300 $\mu\text{m}$	300 $\mu\text{m}$	Recommended for working in thick slices where maximum flexibility is needed.

 Motorized Control Using Stepper Motor

 Piezoelectric Control Using Axis Control Unit

Part Number	Description	Price	Availability
PCS-6200TR	Motorized, Traditional Micromanipulator Assembly, RH, 150 $\mu\text{m}$ XZ, and Approach Travel	\$9,544.30	Lead Time
PCS-6300TR	Motorized, Traditional Micromanipulator Assembly, RH, 150 $\mu\text{m}$ XZ, 300 $\mu\text{m}$ Approach Travel	\$9,944.30	Lead Time
PCS-6400TR	Motorized, Traditional Micromanipulator Assembly, RH, 300 $\mu\text{m}$ XZ, and Approach Travel	\$10,444.30	Lead Time

[Hide Left-Handed, Traditional Micromanipulator](#)

### Left-Handed, Traditional Micromanipulator

Item #	Coarse Travel <sup>a</sup>	Fine Travel <sup>b</sup>			Description
	All Axes	Y Axis	Z Axis	Approach Axis	
PCS-6200TL	25 mm	150 µm	150 µm	150 µm	150 µm PZT Travel in All Axes
PCS-6300TL	25 mm	150 µm	150 µm	300 µm	Recommended for working in slices where longer PZT travel on the approach axis is required.
PCS-6400TL	25 mm	300 µm	300 µm	300 µm	Recommended for working in thick slices where maximum flexibility is needed.

 Motorized Control Using Stepper Motor

 Piezoelectric Control Using Axis Control Unit

Part Number	Description	Price	Availability
PCS-6200TL	Motorized, Traditional Micromanipulator Assembly, LH, 150 µm XZ, and Approach Travel	\$9,544.30	Lead Time
PCS-6300TL	Motorized, Traditional Micromanipulator Assembly, LH, 150 µm XZ, 300 µm Approach Travel	\$9,944.30	Lead Time
PCS-6400TL	Motorized, Traditional Micromanipulator Assembly, LH, 300 µm XZ, and Approach Travel	\$10,444.30	Lead Time

[Hide Right-Handed, Cultured Micromanipulator](#)

### Right-Handed, Cultured Micromanipulator

Item #	Coarse Travel <sup>a</sup>	Fine Travel <sup>b</sup>			Description
	All Axes	X Axis	Y Axis	Z Axis	
PCS-6200CR	25 mm	150 µm	150 µm	150 µm	150 µm PZT Travel in All Axes
PCS-6300CR	25 mm	150 µm	150 µm	300 µm	Longer Fine Z-Axis Travel
PCS-6400CR	25 mm	300 µm	300 µm	300 µm	Highest PZT Range for Maximum Flexibility

 Motorized Control Using Stepper Motor

 Piezoelectric Control Using Axis Control Unit

Part Number	Description	Price	Availability
PCS-6200CR	Motorized, Cultured Micromanipulator Assembly, RH, 150 µm X, Y, and Z	\$9,544.30	Today
PCS-6300CR	Motorized, Cultured Micromanipulator Assembly, RH, 150 µm X and Y, 300 µm in Z	\$9,944.30	Lead Time
PCS-6400CR	Motorized, Cultured Micromanipulator Assembly, RH, 300 µm X, Y, and Z	\$10,444.30	Lead Time

[Hide Left-Handed, Cultured Micromanipulator](#)

### Left-Handed, Cultured Micromanipulator

Item #	Coarse Travel <sup>a</sup>	Fine Travel <sup>b</sup>			Description
	All Axes	X Axis	Y Axis	Z Axis	
PCS-6200CL	25 mm	150 µm	150 µm	150 µm	150 µm PZT Travel in All Axes
PCS-6300CL	25 mm	150 µm	150 µm	300 µm	Longer Fine Z-Axis Travel
PCS-6400CL	25 mm	300 µm	300 µm	300 µm	Highest PZT Range for Maximum Flexibility

 Motorized Control Using Stepper Motor

 Piezoelectric Control Using Axis Control Unit

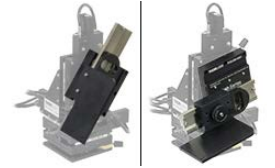
Part Number	Description	Price	Availability
PCS-6200CL	Motorized, Cultured Micromanipulator Assembly, LH, 150 µm X, Y, and Z	\$9,544.30	Lead Time

PCS-6300CL	Motorized, Cultured Micromanipulator Assembly, LH, 150 µm X and Y, 300 µm in Z	\$9,944.30	Lead Time
PCS-6400CL	Motorized, Cultured Micromanipulator Assembly, LH, 300 µm X, Y, and Z	\$10,444.30	Lead Time

[Hide Micromanipulator Headstage Adapter and Pipette Holder Mounts](#)

## Micromanipulator Headstage Adapter and Pipette Holder Mounts

- ▶ Mount Headstages or Pipettes onto Manual or Motorized Micromanipulator Assemblies
- ▶ Three Options Available:
  - ▶ PCS-500-SSH: Two Dovetails with a Mounting Platform for Large Axon or HEKA Headstages
  - ▶ PCS-AXN-ADP: Single-Dovetail, Close-Approach Adapter for Smaller Headstages
  - ▶ MIS-PHM: Two Dovetails with Pipette Mount that Provides 360° Rotational Positioning
- ▶ Smooth Motion Allows Orientation of Headstage or Pipette at Very Steep (>45°) or Very Shallow (<25°) Angles
- ▶ Multiple Mounting Position Options Provide Extra Clearance Near Objectives



Click to Enlarge  
The PCS-500-SSH can be mounted for steep (left) or shallow (right) approach angles.

These adapters for the micromanipulator assemblies provide a flexible platform for mounting a headstage or pipette; see the table below for details. Each adapter allows the mounted headstage or pipette to be positioned at steep or shallow approach angles. Steep approach angles are often desired in electrophysiology experiments in order to minimize the length of the electrode in solution, ensuring that electrical noise is kept to a minimum. In contrast, slice electrophysiology experiments often use electrodes positioned nearly parallel (15° to 25° angle) to the experimental surface to allow the pipette tip to be moved in a straight line over the sample chamber. Shallow approach angles also enable users to stack multiple pipettes or headstages in close proximity. In both these cases, extra clearance for steep or shallow approach angles is needed to prevent interference with the microscope or other experimental apparatus.

### Steep/Shallow Headstage Adapter

The PCS-500-SSH Steep/Shallow Angle Headstage Adapter features a flexible mounting platform for Axon CV-5, Axon CV-203B, and HEKA EPC-9 headstages. The adapter consists of the headstage adapter plate, the slide assembly with a dovetail on the back, a clamping plate, and a mounting plate (shown in the image to the right). Using the adapter, users can quickly exchange pipettes during an experiment.



Click to Enlarge  
PCS-500-SSH Headstage Adapter Components

The mounting plate provides two possible dovetail grooves for securing the slide. For shallow approach angles, the slide is placed within the lower dovetail bracket, while for steep approach angles, the slide is placed in the upper dovetail bracket (see the image above to the right). Mounting in this manner provides maximum clearance above the micromanipulator when it is rotated for a steep angle approach.

To install the adapter, attach the mounting plate to the micromanipulator using the included 4-40 screws (3/32" hex). Secure the slide assembly in one of the dovetail grooves by installing the clamping plate with the included 2-56 cap screws and 5/64" (2 mm) hex key. The user can loosen the clamping plate and position the entire slide assembly; this determines the stop locations that correspond to the fully extended and fully retracted positions of the pipette. At least 1" of the slide assembly should be held by the clamping plate to ensure stability of the mount. To adjust the slide position, turn the locking handle to loosen, then move the slide to the desired location, and retighten the locking handle.

### Close Approach Headstage Adapter

The PCS-AXN-ADP Headstage Adapter is a compact solution for the close approach mounting of a smaller headstage or pipette mount (sold separately). This compact solution provides more clearance room for other equipment.

It is attached to the micromanipulator using the headstage adapter plate included with the micromanipulator and the included 2-56 cap screws and 5/64" (2 mm) hex key. When mounted to this adapter, the PCS-AXN-ADP will be offset from the micromanipulator body, allowing it to be used in closer proximity to the experiment while reducing mechanical clashing. Please see the manual for detailed mounting instructions.

A single dovetail groove is provided to hold a headstage or pipette mount. The groove is the same width as the other headstage adapters, making it compatible with the headstage adapter plate included with the PCS-500-SSH and the pipette mount included with the MIS-PHM.

### Pipette Holder Mount

The MIS-PHM Pipette Holder Mount can hold pipettes up to Ø4 mm and position them at steep or shallow approach angles. It uses the same mounting plate and dovetail clamping mechanism as the PCS-500-SSH Headstage Adapter, which allows for positioning of the slide position and two mounting locations. The pipette clamp can freely rotate 360°, allowing for coarse control of the pipette rotation angle. Fine control of the approach angle is accomplished using the micromanipulator itself.

For users who have an older pipette holder, please contact Tech Support for information on replacement options.



Click for Details  
The PCS-AXN-ADP  
Close-Approach  
Adapter Secured to a  
Micromanipulator



Click to Enlarge  
MIS-PHM Pipette  
Holder Mount Secured  
to Micromanipulator

Compatibility

Item #	Headstage	Pipette Mount <sup>a</sup>	Approach Angles <sup>b</sup>	Mounting
PCS-500-SSH	Axon CV-203B Axon CV-5 HEKA EPC-9	Yes (Not Included)	Smooth Motion for Steep (>45°) or Shallow (<25°)	Mounts Directly to Micromanipulator
PCS-AXN-ADP	Axon CV-203B Axon CV-7B	Yes (Not Included)		Close Approach, Requires Headstage Adapter Plate (Included with Micromanipulators)
MIS-PHM		Yes (Included)		Mounts Directly to Micromanipulator

<sup>a</sup>A pipette mount is included with the MIS-PHM. It is compatible, but not included, with the PCS-AXN-ADP and PCS-500-SSH.

<sup>b</sup>Steep and shallow approach angles can be achieved using the PCS-500-SSH and MIS-PHM by using the top or bottom dovetail on the back plate.

Part Number	Description	Price	Availability
PCS-500-SSH	Steep/Shallow Headstage Adapter	\$780.30	Today
PCS-AXN-ADP	Close Approach Headstage Adapter	\$208.08	Today
MIS-PHM	Pipette Holder Mount	\$802.74	Today

