



PatchStar Micromanipulator





Packing list

The Scientifica PatchStar is a piece of scientific equipment and as such requires care when handling. If the outside of the shipping packaging is damaged, notify your shipping department immediately. The shipping department may wish to notify the carrier at this point.

If the shipping carton is not damaged, carefully remove and identify all of the components as listed below.

The PatchStar system includes:

- PatchStar Micromanipulator
- Ultra Low Noise Controller rack
- Axis Control Cube
- Joystick Module (optional)
- Operating Manual
- PatchStar 25 Way to 25 Way Cable
- PatchStar breakout box
- Mains Cable
- Mounting screw Kit
- Configuration software
- RS232 cable

If any of these items are missing, contact, Scientifica Ltd. Please retain the packaging for future storage or transportation of the system.

System Components:

PatchStar Micromanipulator

The Scientifica PatchStar is a highly stable positioning system designed for ultra precise positioning of electrodes. The micromanipulator utilizes high precision stepper motors and anti-backlash lead screws to achieve ultimate control. The stage provides 20mm travel in X Y and Z axis.

Ultra-low noise controller rack

The Ultra-low noise controller rack provides a sophisticated means of driving the Scientifica range of stepper motor actuated products. This can be driven via any of the Scientifica Ltd user interfaces or directly from a pc.

Axis Control Cube (ACCi)

The ACC provides a convenient method of controlling the position of the manipulator.

Optional Joystick Module

The joystick provides an alternative method of positioning the manipulator. Special function buttons provide programmable position setting.



Setting Up

Right Handed or Left handed configuration

The manipulator can be set up for use in either a left handed or right handed configuration. This allows the user to mount the manipulator on either side of the experiment and maintain the operation of the virtual approach axis as well as providing easy access to the manual adjusters. In the left handed set up the dovetail headstage slide projects to the right and the rotary stage and linear stage knobs are conveniently positioned away from the microscope. The right handed set up essentially mirrors the left handed one.



Left Handed configuration

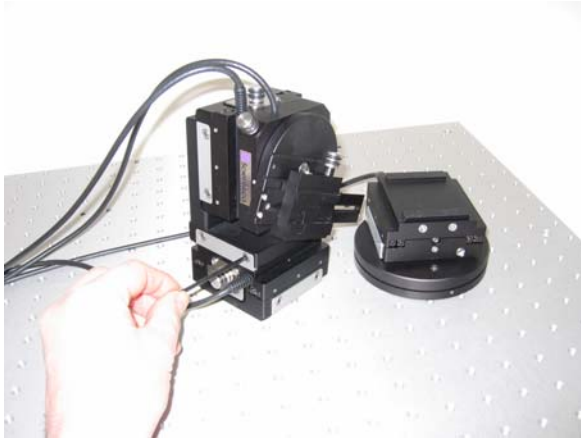


Right Handed configuration

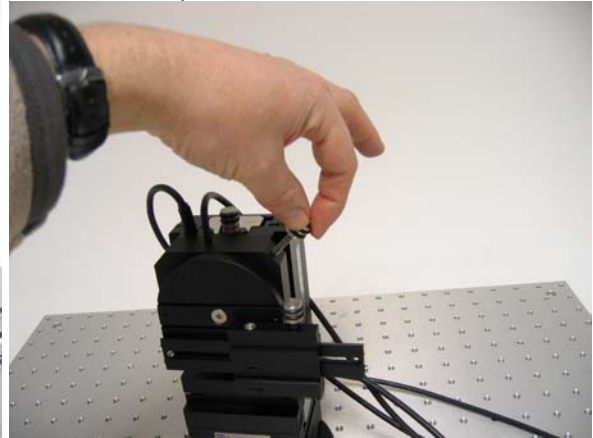
The Patchstar is designed in a modular fashion in order to make the manipulator as flexible as possible. This ensures that changing the configuration from left to right handed is very simple: Firstly loosen the x stage dovetail screws as shown using a 3mm allen key. Then slide the upper part of the manipulator off the Y axis.



Now remove the Z stage and bracket from the x axis stage. Turn the x axis stage through 180° so that the manual adjustment knob and cable are positioned on the right side of the assembly and re-tighten the dovetail screws.



Now slide the X / Z assembly back onto the Y axis. The vertical rotation stage locking knob can be located into the left hand side position.



Finally, the head stage slide can be set to project on the left side of the manipulator. This is achieved by loosening the two button headed screws using a 2mm allen key and sliding the dovetail to the required position.





Mounting the PatchStar

The PatchStar is designed to mount to either a metric or inch spaced location using M6 or 1/4"-20 socket head cap screws. The rotation base is used to secure the manipulator to the users table or platform. To do this; first remove the manipulator assembly from the rotary base by loosening the two dovetail locking screws using a 3mm allen key and sliding the assembly off the base.



Ensure that the 2 set screws that fix the rotary stop ring are loose thus enabling the upper plate to rotate 360°. There are 4 mounting holes in the lower plate of the base that are accessed by rotating the upper plate relative to the lower plate. Insert two M6 or 1/4"-20 socket head cap screws in two of the holes. Now position the rotation plate in the desired location and tighten the two screws.



Next, rotate the upper plate to reveal the other two mounting holes and insert and tighten two more screws.

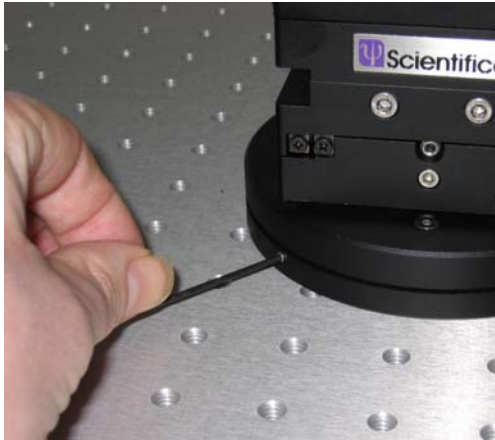
Slide the manipulator assembly back onto the rotation base and tighten the 2 dovetail locking screws.



Setting the rotation stages

Each PatchStar manipulator includes two rotation stages which have user settable stops. The rotary base has two magnetic stops which allow the user to rotate the manipulator away from the experiment and then return to the original position without having to undo any locking mechanism or use any tools. The vertical rotary stage uses mechanical stops and a locking screw to allow the user to rotate vertically. In addition, the vertical rotary stage incorporates a sensor that measured the angle that the front plate is set to. The manipulator controller automatically reads this angle and uses it to drive the manipulator in the virtual fourth axis.

To set the stops for the rotary base; first ensure that the 2 set screws that fix the rotary stop ring are loose thus enabling the manipulator to rotate 360° relative to the base plate.



Rotate the manipulator until one of the magnetic stops engages with its mating part. Rotate the manipulator (with the stop engaged) to the required orientation. Now tighten the 2 set screws using a 1.5mm allen key to secure the rotary stop ring. Ensure that the manipulator can be rotated in the direction and return as required.



To set the stops for the vertical rotation stage; first ensure that the 2 set screws that fix the rotary stop ring are loose and that the thumb screw lock is loose thus enabling the front plate to rotate 360°.



Rotate the front plate 1 full rotation (this has the effect of pushing the stop around with it). Once past one full revolution, continue rotating until the desired angle is reached. Now tighten at least one of the set screws to fix the rotational stop.

Attaching the headstage

The dovetail slide assembly is mounted to the front of the vertical rotation plate. This can be mounted using any pair of the mounting holes on the vertical rotation plate to suit the application. The sliding carriage is locked in the required position on the dovetail slide using the thumb screw. The sliding carriage is designed to accommodate a range of dovetail based headstages including the Axon. The dovetail headstages are secured by tightening the dovetail clamp using a 3mm allen key. In addition there are two M3 mounting holes on the underside of the sliding carriage that can be used to attach a sub-mounting plate to attach a wider range of headstages.



Connecting the cables

Caution:

Never plug or unplug either end of the stage cable or joystick module to a rack controller with the power switched on.

Connect the manipulator RJ45 connectors to the PatchStar breakout box aligning the colour of the connector boots with the reference dots on the breakout box. Connect the 25 way parallel cable to the other side of the breakout box and connect the remaining end to the 1U rack.



Connect the ACC (Axis Control Cube) or joystick module to the 1U rack.

Connect the power cord to the rack and mains power outlet.

Turn the instrument on using the power switch located on the front panel, the Scientifica logo should now be illuminated.

The manipulator can now be driven by rotating the wheels on the ACC or deflecting the joystick. To drive at a fast speed switch the upper toggle switch on the ACC or if using a joystick; deflect the joystick whilst depressing the “Turbo” button on the top of the joystick.

Should your instrument fail this initial check, please contact Scientifica Ltd for further instructions.



Driving the Manipulator

The Manipulator can be controlled by 3 methods; most commonly by using the ACC (Axis Control Cube), a Joystick or by computer control.

ACC Control

A manipulator axis is moved by rotating a wheel on the ACC; the blue wheel moves the left and right axis (X), green moves front and back (Y) and red the vertical axis (Z). The manipulators can be driven in two speed ranges fast for course positioning or slow speed for fine control. The speed range is selected using the toggle switch on the top of the ACC.



Virtual approach axis

The PatchStar has the ability to be driven in a virtual 4th “approach” axis as opposed to 3 orthogonal axes. This is used to approach the sample on the axis of the pipette. There is a rotary sensor embedded in the vertical rotary stage. When the rotation plate is moved, the angle of the plate is measured. When the approach axis is activated the X wheel will now drive the Z and X axis stages proportionally so that they precisely follow the angle of the front rotation plate. The approach axis is activated using the toggle switch on the top left corner of the ACC. I turns compound approach on and O turns it off.

Step

Momentarily pressing the Step button causes the manipulator to advance by the amount set in the “Set Step Size After Home In” setting within the LinLab software. If Approach is set to (I) the step will be made in the compound axis, otherwise the step will be in Z only. This value can be set from $\pm 1\mu\text{m}$ to 10mm in $1\mu\text{m}$ steps.

**M+**

Momentarily depressing the M+ button will store the current position of the manipulator as a memory position. Moving the manipulator and pressing M+ again will store another position etc. Up to 25 memory positions can be stored.

MR

Momentarily depressing the MR button will recall the first memory position. If more than one position is stored, repeated button presses allow you to cycle through all of the memory positions.

Clearing Memory Positions

In order to clear stored memory positions, simultaneously depress the M+ and the MR.

Home In

Home In can work in two different modes. As standard the system is shipped in Mode1. If you wish to change to Mode 2; move to the desired Home In position and hold down the Home In button for 3 seconds. To switch back to Mode 1; simultaneously hold down the Home In and Home Out buttons for 3 seconds.

Mode 1 (Standard Mode)

Home In becomes active only after the manipulator has been Homed Out. From the Home Out position, pressing the Home In button will cause the manipulator to return its original position prior to Home Out, minus any safety offset that has been set in the Set Home In Offset setting within the LinLab software.

Mode 2

This allows the user to set a specific position as the Home In point. Move the manipulator to the desired Home In position, and then depress the Home In button and hold down for 3 seconds. This stores the current position as the Home In point. No home in offsets will be applied using this mode.

Home Out

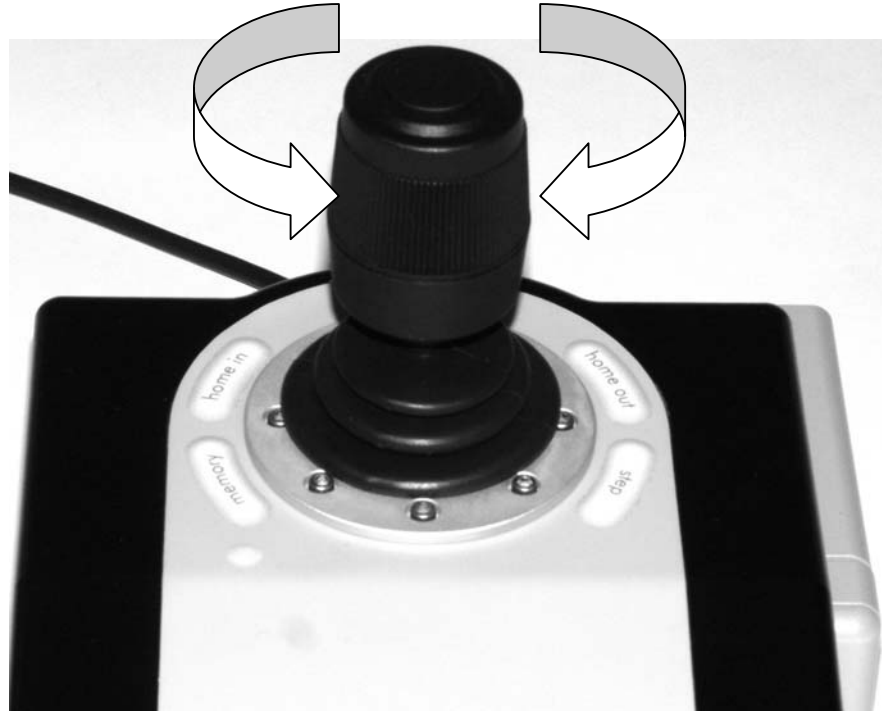
Press and hold down this button for approx. 3 seconds to store the current manipulator position as the home out location. This will be permanently stored until an alternative Home Out position is stored. Momentary pressing of this button will cause the manipulator to drive out to the stored Home Out position.

Joystick Control

If using a joystick to control the manipulators, deflect the joystick in the direction of travel required. The joysticks used are proportional, so the speed varies with the amount of deflection applied. Left and right motion is achieved by deflecting the joystick to the left or right, back and forth, by deflecting the joystick backwards or forwards and vertical motion is achieved by rotating the knurled top of the joystick. If you wish to move at high speed; press the Turbo button on top of the joystick whilst deflecting the joystick. As soon as the button is released; the motion will revert to fine control.



Memory and Step



The **MEMORY** key stores the current position of the stage. Pressing the **STEP** key changes the position of the stage to the stored memory points in a cyclic fashion. Therefore, if three different memory points were stored: A, B, and C using the **MEMORY** key, pressing **STEP** would drive the stage to position A, the next press of the step key would drive the stage to B, the next to C, and then the next would go back to A etc.

Troubleshooting Manipulator Instability

The following is a list of the most common issues liable to cause positional instability:

1. Pipette glass – is it the right size for the pipette holder?
2. Pipette holder – have any of the rings been changed recently? Do the rings fit snugly with the pipette glass?
3. Is the cooling headstage switched off (you should allow half an hour after switching off before re-testing stability)
4. Ensure that any wires are not straining the manipulator? Sometimes a wire can become snagged which puts a tension onto the manipulator or



headstage and causes movement. There should be a soft loop on any wires from the manipulator, ideally anchored to a point close to the manipulator mount ie: the post from a post and platform.

5. Are the rotation locks tightened when in place – they should be lightly tightened. It is not necessary to do them up with a lot of force – this could be counter productive.
6. Rotary base – when locked in place the rotary base magnetic lock should feel firm, Any movement or slop in this could cause undesired movement.
7. Air conditioning – Is there an air conditioning vent close to the set up? The motion of air and frequent changes in temperature can cause thermal issues.
8. Have there been any other changes to the rig recently?

General Specifications

Number of axis	3 with virtual 4 th axis
Travel	20 mm
Step size	<50nm
Speed	(minimum) 4µm per second (maximum) 4 mm per second
Mechanical Resolution	<1µm
Load Capacity	>0.2Kg
Temperature range	Operation 15 to +40°C Storage 0 to +60°C