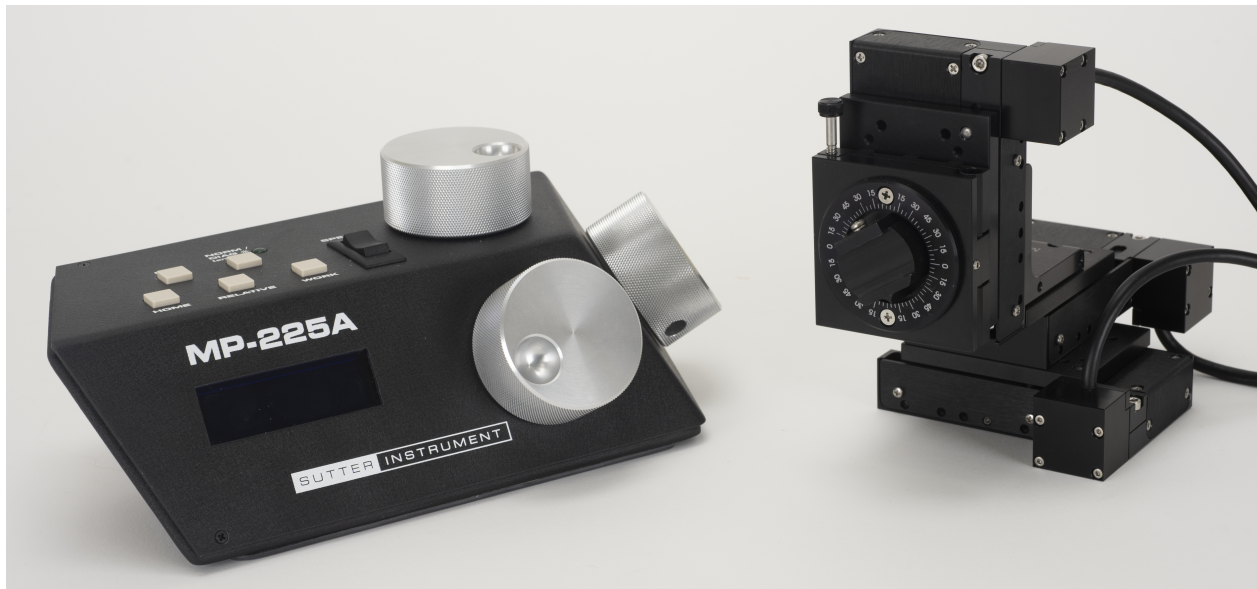


MP-225A

MOTORIZED MICROMANIPULATOR
SYSTEM

OPERATION MANUAL

REV. 2.04 (20211111)



SUTTER INSTRUMENT

ONE DIGITAL DRIVE
NOVATO, CA 94949

VOICE: 415-883-0128 WEB: WWW.SUTTER.COM
FAX: 415-883-0572 EMAIL: INFO@SUTTER.COM



Copyright © 2021 Sutter Instrument Company. All Rights Reserved



CE EU Declaration of Conformity

Application of Council Directives:
2014/30/EU (EMC), 2014/35/EU (LVD), and 2015/863/EU (RoHS 3)

Manufacturer's Name: Sutter Instrument Company

Manufacturer's Address: One Digital Drive
Novato, CA. 94949 USA
Tel: +1 415 883 0128

Equipment Tested: MP-225A Micromanipulator System

Model(s): MP225A/E (controller and ROE (Rotary Optical Encoder)) and
MP225/M (micromanipulator electromechanical)

Conforms to Standards: EMC Emissions: EN 61326-1:2013, including:
EN 55011: 2009 Class B;
EN 61000-3-2:2015, & EN 61000-3-3:2014
EMC Immunity: EN 61000-4-2:2009, EN 61000-4-3:2011,
EN 61000-4-4:2012, EN 61000-4-5:2014,
EN 61000-4-6:2014, EN 61000-4-8:2010, &
EN 61000-4-11:2004
LVD (Safety): EN 61010-1:2010

Tested/Verified (as a QUAD system on which the MP-225A is based) and part on MPC-200 Series systems) by: ITC Engineering Services, Inc.
9959 Calaveras Road, PO Box 543
Sunol, CA 94586-0543 USA
Tel. +1 925 862 2944 Fax: +1 925 862 9013
Email: itcemc@itcemc.com Web: www.itcemc.com
Sutter Instrument

Test Report(s): SI_EMC_QUAD_20160713 (QUAD)
20120511-01A-R1_MC CE RptA R4, SI_EMC_MPC-200_20160713 (MPC-200);
20200520_REACH and RoHS Compliance Statement

Sutter Instrument Company hereby declares that the equipment specified above was tested and conforms to the EU Directives and Standards listed above, and further certifies conformation to the requirements of the European Union's Restriction on Hazardous Substances in Electronic Equipment Directive 2015/863 (2011/65/EU Annex II) for RoHS 3.

Project Engineer:


Mark Flaming
President

SUTTER INSTRUMENT®

One Digital Drive, Novato, CA 94949 USA Phone: +1 415 883 0128 Fax: +1 415 883 0572
Email: info@sutter.com Web: <http://www.sutter.com>

DISCLAIMER

The **MP-225A** system consists of one electromechanical micromanipulator device (MP-225/M) and one ROE (Rotary Optical Encoder) with integrated controller (MP-225A¹). The purpose of the system is for the manipulation at the micro level of micropipettes and probes used in conjunction with a microscope. No other use is recommended.

This instrument is designed for use in a laboratory environment. It is not intended, nor should it be used in human experimentation or applied to humans in any way. This is not a medical device.






Unless otherwise indicated in this manual or by Sutter Instrument Technical Support for reconfiguration, do not open or attempt to repair the instrument.

Do not allow an unauthorized and/or untrained operative to use this device.


Any misuse will be the sole responsibility of the user/owner and Sutter Instrument Company assumes no implied or inferred liability for direct or consequential damages from this instrument if it is operated or used in any way other than for which it is designed.

SAFETY WARNINGS AND PRECAUTIONS

Electrical

- Operate the MP-225A system ROE/controller using 110 – 240 VAC., 50-60 Hz line voltage. This instrument is designed for use in a laboratory environment that has low electrical noise and mechanical vibration. Surge suppression is always recommended.
-  NOTE: There are no user-replaceable fuses in the MP-225A system.
-   The MP-225A system's power supply consists of an external AC to DC switching power adapter. If the external power adapter is damaged due to a mains over or under voltage, it must be replaced.
-   **GROUNDING/EARTHING:** Proper grounding protects the ROE/controller electronics, reduces/eliminates electromagnetic interference, and improves the safety of the system operator. The ROE/controller provides a socket (labeled GROUND) that accepts a banana plug attached to a suitably gauged insulated wire, the other end of which (alligator clip) connects to a solid, proper ground.

Avoiding Electrical Shock and Fire-related Injury

- Always use the grounded power cord provided to connect the system's power adapter to a grounded/earthed mains outlet (3-prong). This is required to protect you from injury if an electrical hazard occurs.
- Do not disassemble the system. Refer servicing to qualified personnel.
-  To prevent fire or shock hazard do not expose the unit to rain or moisture.

Electromagnetic Interference

To comply with FDA and CE/EU electromagnetic immunity and interference standards; and to reduce the electromagnetic coupling between this and other equipment in your lab always use the type and length of interconnect cables provided for interconnecting the electro-mechanical devices and ROE/controller (refer to Technical Specifications for more details).

¹ The MP-225A ROE/controller replaces the discontinued "MP-225" controller and ROE.

Operational

Failure to comply with any of the following precautions may damage this device.

- This instrument is designed for operation in a laboratory environment (Pollution Degree I) that is free from mechanical vibrations, electrical noise, and transients.
- **⚠ DO NOT CONNECT OR DISCONNECT THE CABLES BETWEEN THE CONTROLLER AND THE MECHANICAL UNITS WHILE POWER IS ON.**
Please allow at least 20 seconds after turning the unit off before disconnecting the mechanical units. Failure to do so may result in damage to the electronics.
- Operate this instrument only according to the instructions included in this manual.
- Do not operate if there is any obvious damage to any part of the instrument.
- **⚠ Do not operate this instrument near flammable materials.** The use of any hazardous materials with this instrument is not recommended and, if undertaken, is done so at the users' own risk.
- **⚠ Do not operate if there is any obvious damage to any part of the instrument.** Do not attempt to operate the instrument with the electromechanical manipulator shipping tape in place or severe motor damage may result. When transporting the mechanical manipulator, be sure to reinstall the shipping tape (using masking tape or equivalent only) to the original locations. Failure to do this may result in damage to the motors.
- **⚠ Never touch any part of the micromanipulator electromechanical device while it is in operation and moving.** Doing so can result in physical injury (e.g., fingers can be caught and pinched between the moving parts of the micromanipulator).
- **⚠ If the MP-225A system is used in a microinjection environment, please observe the following.** As with most micromanipulation devices, sharp micropipettes can fly out of their holder unexpectedly. Always take precautions to prevent this from happening. Never loosen the micropipette holder chuck when the tubing is pressurized, and never point micropipette holders at yourself or others. Always wear safety glasses when using sharp glass micropipettes with pressure tubing.
- **⚠ Take care to ensure no cables pass close to the electromechanical micromanipulator within the spherical movement limits of all its axes combined.**

Other

- Retain the original packaging for future transport of the instrument.
- Sutter Instrument reserves the right to change specifications without prior notice.
- Use of this instrument is for research purposes only.

Handling Micropipettes

⚠ Failure to comply with any of the following precautions may result in injury to the users of this device as well as those working in the general area near the device.

- The micropipettes used with this instrument are very sharp and relatively fragile. Avoid contact with micropipette tips to prevent accidentally impaling oneself.
- Always dispose of micropipettes by placing them into a well-marked, spill-proof "sharps" container.

TABLE OF CONTENTS

DISCLAIMER.....	iii
SAFETY WARNINGS AND PRECAUTIONS.....	iii
Electrical	iii
Avoiding Electrical Shock and Fire-related Injury.....	iii
Electromagnetic Interference	iii
Operational	iv
Other.....	iv
Handling Micropipettes.....	iv
1. INSTRODCTION	1
1.1 Structure of the MP-225A Documentation Package	1
1.2 Components of the MP-225 System.....	1
1.3 Technical Support.....	2
2. INSTALLATION	3
2.1 Unpacking and Mountings Instructions	3
2.1.1 Mounting the MP-225 Series to the Stand or Platform.....	3
2.2 Headstage Mounting	6
2.3 Other Accessories.....	7
2.4 Electrical Connections and Initial Power Up	8
2.5 ROE/Controller Rear Panel Controls and Configuration.....	9
2.5.1 Power Switch	9
2.5.2 Configuration Switches	9
2.5.2.1 Switches 1, 2, 3, and 4	9
2.5.2.2 Switch 5: Y-Axis Lockout during HOME and WORK moves.....	10
2.5.2.3 Switch 6: Calibration Homing on Power On.....	10
3. OPERATING INSTRUCTIONS.....	11
3.1 Front Panel Controls and Quick Start Operation.....	11
3.2 Detailed Display Instructions	12
3.2.1 Initial Startup	12
3.3 Operation of MP-255A Integrated ROE/Controller.....	12
3.3.1 Maximum Positive Position Value	12
3.3.2 Speed Control (SPEED)	13
3.3.3 Setting the Angle of the Pipette/Headstage Holder	13
3.3.4 Using SET-NORMAL/DIAG to Create the Virtual D Axis	13
3.3.5 Moving to the Home Position	14
3.3.6 Moving to the Work Position	14
3.3.7 Setting Position for HOME or WORK.....	15
3.3.8 Setting Absolute/Relative Coordinates Mode.....	15
3.3.9 Display Coordinates (Absolute/Relative) Modes Indications.....	15
3.3.10 Movement Knobs Disabling and Lock Mode ([SPEED]/LOCK)	16
3.3.11 Pausing Home Movements (HOME (while moving to Home))	16
3.3.12 Pausing Work Movements (WORK (while moving to Work))	16
APPENDIX A. LIMITED WARRANTY	17

APPENDIX B. ACCESSORIES 19

APPENDIX C. TECHNICAL SPECIFICATIONS 21

APPENDIX D. QUICK REFERENCE 23

 D.1. Manual Operation..... 23

 D.2. Configuration..... 24

 Rear-Panel DIP Switches..... 24

TABLE OF FIGURES

Figure 1-1. MP-225A Components.	2
Figure 2-1. Side view of MP-225 showing mounting adapter plate and lock screws.	4
Figure 2-2. Mounting the MP-225 on the Adapter Plate.	5
Figure 2-3. MP-225A accessories.	6
Figure 2-4. Setting the angle of the headstage/rotary dovetail.....	7
Figure 2-5. Rear of MP-225A ROE/Controller cabinet.....	8
Figure 2-6. Configuration switches on the of MP-225A ROE/Controller units (switch positions shown are factory defaults).	9
Figure 3-1. MP-225A controls.	11
Figure 3-2. LCD Display showing startup screen.	12
Figure 3-3. Startup screen.....	12
Figure 3-4. Factory default startup (Home) position with calibration enabled.....	12
Figure 3-5. Maximum positive values.....	13
Figure 3-5. Entering angle prompt.....	13
Figure 3-8. Moving to Home position (screen is blue moving).	14
Figure 3-9. Factory default Home position.....	14
Figure 3-10. Example Home position defined and saved.	14
Figure 3-11. Example Work position.....	14
Figure 3-12. Relative mode.....	15
Figure 3-13. Relative mode.....	15
Figure 3-14. Absolute mode.....	15

TABLE OF TABLES

Table 2-1. Configuration Switches 1 – 4: Configuration the direction of each axis.	9
Table 2-2. Configuration Switch 5: Configuring Y-Movement Lock Out.....	10
Table 2-3. Configuration Switch 6: Configuring Sensor Test.....	10
Table 3-1. Maximum positive position value of each axis	12
Table 3-2. Screen colors and modes.....	16
Table C-1. MP-225A Controller cables and receptacles/connectors.....	22
Table D-1. MP-225A configuration switches (rear).....	24

1. INTRODUCTION

1.1 Structure of the MP-225A Documentation Package

The MP-225A is a 3-axis motorized micromanipulator system comprised of the MP-225A integrated ROE/controller, a power adapter, and one MP-225 stepper-motor-based eletromechanical micromanipulator. This manual consists of tree parts: Chapter 1, Introduction, which provides an overview and general description of the MP-225 system; Chapter 2, Installation, which describes how to install, set up, and configure all components of the system; and Chapter 3, Operations, which describes tow to operate the MP-225A integrated REO/controller.

1.2 Components of the MP-225 System

Carefully remove all items from the box. In addition to his manual, the following should be included:

- A. MP-225A Integrated ROE/controller
- B. MP-225 eletromechanical micromanipulator
- C. MP-225 cable adapter (converts the three short modulator cables permanently attached to the mechanical to a 25-pin connector).
- D. 25-pin DSUB cable (connects the ROE/controller to the micromanipulator via the cable adapter)
- E. Power adapter
- F. AC mains cable appropriates for your location
- G. Ground/Earth cable



Figure 1-1. MP-225A Components.

1.3 Technical Support

Unlimited technical support is provided by Sutter Instrument Company at no charge to our customers. Our technical support staff is available between the hours of 8:00 AM and 5:00 PM (Pacific Time) at (415) 883-0128. You may also E-mail your queries to info@sutter.com.

2. INSTALLATION

2.1 Unpacking and Mountings Instructions

When installing the MP-225 system for the first time, it is recommended that the components of the system be installed in the following order: MP-225 electromechanicals micromanipulator first followed by the MP-225A integrated ROE/Controller.

IMPORTANT

Once the MP-225 system has been unpacked, remove two shipping screws from each axis of the micromanipulator. These screws must be removed before operating the MP-225 system or damage may occur. If you need to transport the MP-225 series in the future, reinstall the shipping screws or apply 2 to 3-inch pieces of masking taped to side of each axis. Once the shipping screws have been removed, handle the MP-225 with care. The mechanism can be damaged if any of the axes are inadvertently moved by hand or if the manipulator is dropped or put down forcefully.

The following sections describe how to mount the MP-225 manipulator to an stand using the mounting adapter plate, how to adjust the pipette angle and how to mount different headstages.

2.1.1 Mounting the MP-225 Series to the Stand or Platform

The MP-225 attaches to the mounting adapter plate using four M3.5x6 hex head locking screws.

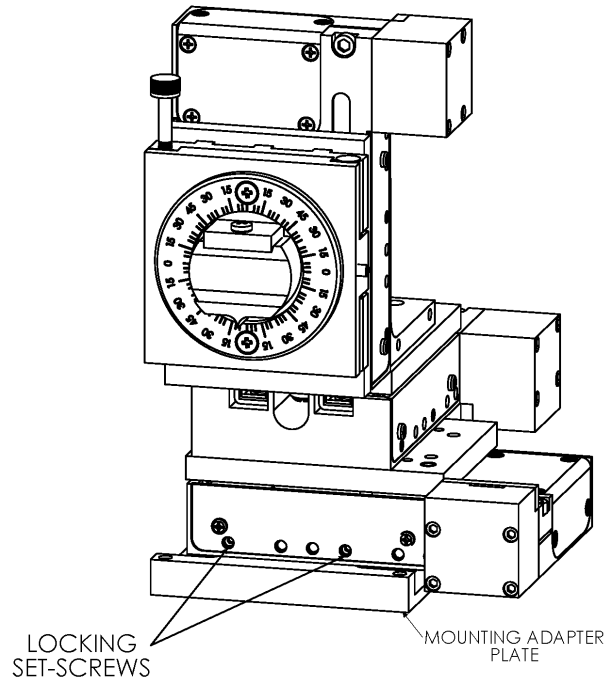


Figure 2-1. Side view of MP-225 showing mounting adapter plate and lock screws.

The MP-225 is shipped with the mounting adapter plate in place. It is attached using four tapered pegs, along with four locking screws.

To remove it, first loosen the four hex crews that secure the manipulator to the pegs on the adapter plate. The rear pair of locking screws is in a similar location in the back of the manipulator. Once the locking screws are sufficiently loosened, lift the MP-225 upwards off the adapter plate,

Before reattaching the MP-225 to the adapter plate, you need to decide where to position the manipulator and adapter plate on your stand/platform. The stand can be any flat surface carrying $\frac{1}{4}$ -20, 10-32, or M6 holes on one-inch or 25mm centers (such as a Sutter Instrument MT-series stand or MD series platform).

Examine the space on the platform onto which installation is to take place. Move the entire unit (including the adapter plate) around on the platform until the desired position is determined. Once you have determined the correct location, lift the manipulator off the adapter plate and connect the adapter plate to the stand/stage in that location. A small bag containing the necessary hardware to attach the MP-225 to the stand is included.

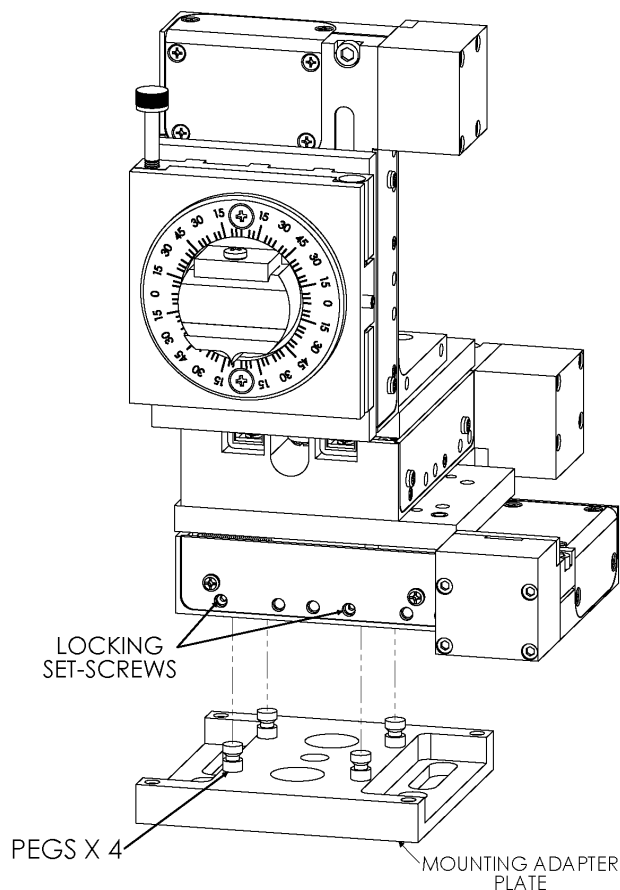


Figure 2-2. Mounting the MP-225 on the Adapter Plate.

Once the plate is mounted, align the pegs on top of the plate with the holes in the manipulator, push the X-axis firmly on the plate, and retighten the locking hex set screws.

Finally, attach the DB-25 cable to the cable adapter and the adapter to the three cables on of MP-225 micromanipulator. You may want to be sure that the cables are positioned on a way that the adapter box and DB-25 cable are not pulling on the manipulator. Sometimes it is appropriate to give the adapter box “support” such that the three cables running to the micromanipulator have some slack or “service loops” so none of the cables are puling on the manipulator.

2.2 Headstage Mounting

Sutter IPA or dPatch headstages, Axon 203B or CV-7 headstages, and the Heka EPC-10 headstage all have an integral dovetail that fits directly into the rotary dovetail clamp on the MP-225. The dovetail clamp on the MP-225 also supports older Axon and Heka headstages when using the 4" dovetail extension.

Rod-mounted headstages and micro tools are accommodated by the use of a rod clamp that fits into the dovetail (not shown). The following mounting accessories are included with the manipulator and are shipped in several plastic bags.

- A. Rod holder
- B. Dovetail extension (4 inches (10.16 cm))
- C. Ground Cable
- D. Hardware for mountain plate
- E. Hex wrenches

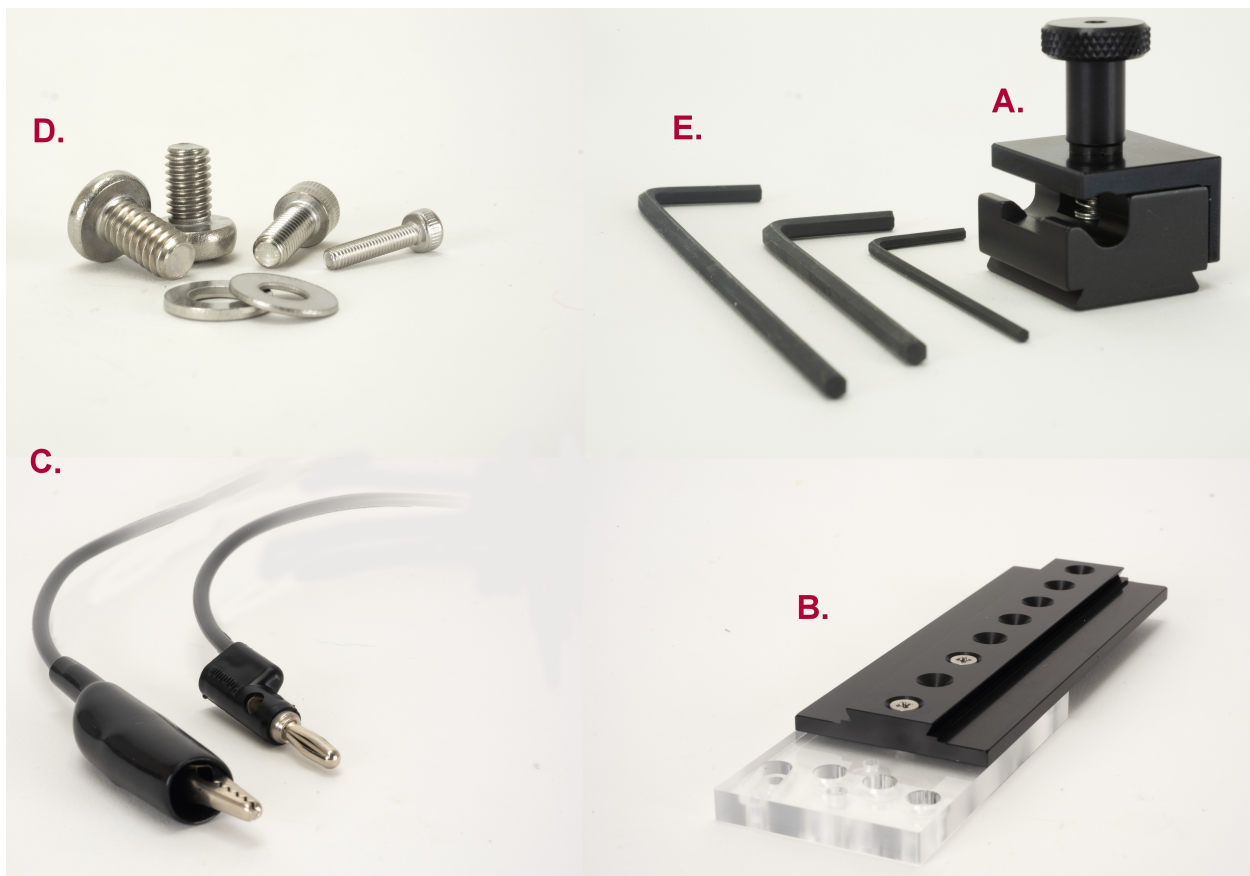


Figure 2-3. MP-225A accessories.

The angle of the headstage/rotary dovetail is adjusted by loosening the hex set screw located on the side of the swing-out gate. You can set a particular angle using the knife-edge on the dovetail and the scale on the faceplate. Tighten the screw securely to fix the angle,

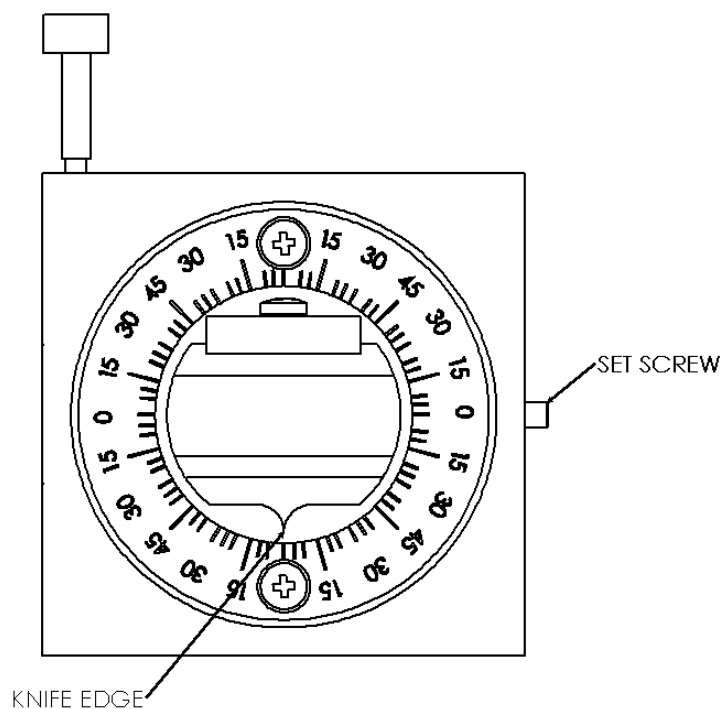


Figure 2-4. Setting the angle of the headstage/rotary dovetail.

To change pipettes, loosen the thumbscrew. The swing-out gate will open allowing the headstage and holder to rotate almost 90 degrees. Make sure to swing gate tightly closed and tighten the thumbscrew securely while holding the gate closed. The thumbscrew is designed to pull the gate closed with tightening. Thumb and finger tightening is sufficient,

The height of the swing-out gate on front of the Z-axis is adjustable. To change the position, open the gate and loosen the 4 Philips-head screws that mount the swing gate. As shipped from the factory, the gate is positioned to allow shipping screw holes. You may find it beneficial to move the gate up before you start using your MP-225.

2.3 Other Accessories

One or more accessories may have been ordered and received for mounting the MP-225 and/or modifying the headstage mount to the manipulator (i.e., rotating base, microscope stage mount, gantry, dovetail extension, etc.). Setup of these accessories is normally covered in the documentation accompanying the accessory,

2.4 Electrical Connections and Initial Power Up

Initially, you may want to simply connect the MP-225 manipulator and the integrated controller together and try some gross movements in order to get a feel for the controls and how to make simple movements. It is perfectly acceptable to set the manipulator in the middle of a bench top, make all electrical connections and then observe each unit's movement by eye, but see the following caution.

CAUTION: Unless the MP-225 micromanipulator electromechanical baseplate is firmly bolted down to a breadboard or solidly to a firm surface, the manipulators is likely to tip over when fully extending all three axes, especially if it is loaded with a headstage that extends beyond the manipulators current center of gravity,

Upon deciding to directly install the MP-225 manipulator in your rig, it is useful to follow the initial setup procedure to learn how to move the unit and to understand how to configure the integrated ROE/controller.

1. With the power switch on the back of the ROE in the OFF (0) position, connect the power adapter's 24VDC cable to the POWER receptacle.

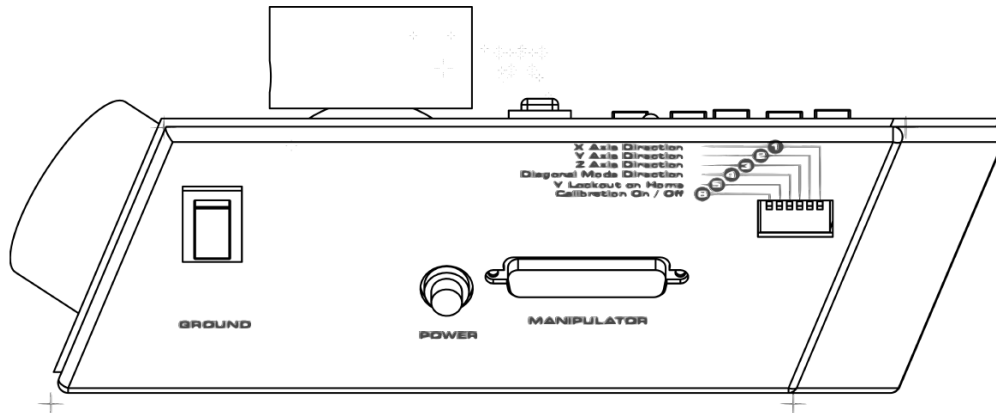


Figure 2-5. Rear of MP-225A ROE/Controller cabinet.

2. With the power OFF (rear panel switch in the "0" positioned), connect a well-grounded/earthed wire to the GROUND banana plug receptacle.
3. With the power OFF, connect the male end of the DB-25 cable to the MANIPULATOR connector on the ROE, the other end is connected to the DB-25 pin cable adapter box.
4. The three RJ-45 connectors on the adapter box, in turn, are connected the three flat cables on the micromanipulator mechanical, one ore axis.
5. Verify that the six switches on the rear of the ROE are set as desired (see Section 2.5.2 below),
6. Power up the system by moving the power switch on the rear of the REO to the "1" position.

*** ⚠ CAUTION: NEVER CONNECT OR DISCONNECT TO THE ROE/CONTROLLER FROM THE ELECTROMECHANICLE MANIPULATOR WHILE THE POWER IS ON!**

2.5 ROE/Controller Rear Panel Controls and Configuration

2.5.1 Power Switch

The power switch for the MP-225 manipulator is located on the rear of the ROE/controller. At power up, the microprocessor in the ROE/controller scans the attached equipment and switches and configures that system accordingly.

CAUTION: *When changing the configuration switched describes in the following paragraphs, make sure that controller's power switched is turned off.*

2.5.2 Configuration Switches

A set of 6 DIP switches on the back of integrated ROE/controller configure various functions of the MP-225.

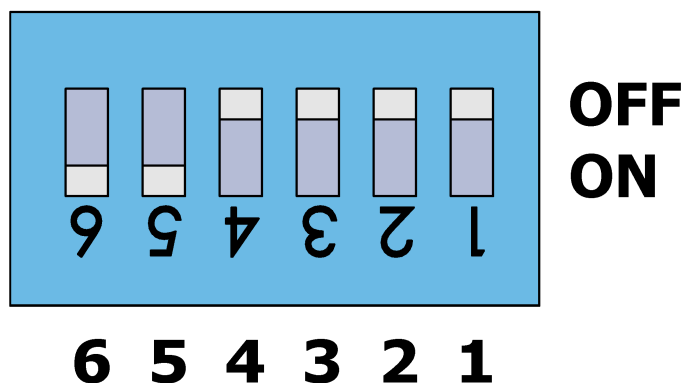


Figure 2-6. Configuration switches on the of MP-225A ROE/Controller units (switch positions shown are factory defaults).

2.5.2.1 Switches 1, 2, 3, and 4

These switches set the directionality for each of four axes.

Table 2-1. Configuration Switches 1 – 4: Configuration the direction of each axis.

Switch #	Definition	State	Setting	Position
1	X-Axis Knob Rotation for Forward (+) Movement	Clockwise*	OFF*	DOWN*
		Counterclockwise	ON	UP
2	Y-Axis Knob Rotation for Forward (+) Movement	Clockwise*	OFF*	DOWN*
		Counterclockwise	ON	UP
3	Z-Axis Knob Rotation for Forward (+) Movement (Normal Mode)	Clockwise*	OFF*	DOWN*
		Counterclockwise	ON	UP
4	Z-Axis Knob Rotation for Forward (+) Movement (Diagonal Mode)	Clockwise*	OFF*	DOWN*
		Counterclockwise	ON	UP

* Factory default (recommended normal operation settings)

2.5.2.2 Switch 5: Y-Axis Lockout during HOME and WORK moves

Table 2-2. Configuration Switch 5: Configuring Y-Movement Lock Out.

Switch #	Definition	State	Setting	Position
5	Y-Axis lock out during HOME and WORK moves	Disabled: Not locked (Y moves along with X & Z during HOME and WORKD moves)*	ON*	UP*
		Enabled: Locked (Y does not move along the X & Z during HOME and WORK move)	OFF	DOWN

* Factory default (recommended normal operation settings)

2.5.2.3 Switch 6: Calibration Homing on Power On

Table 2-3. Configuration Switch 6: Configuring Sensor Test.

Switch #	Definition	State	Setting	Position
6	Calibration Homing on Power On	Enabled: Automatically calibrates to 1000μm on all axes at power on. Power-off position is forgotten*	ON*	UP*
		Disabled: Automatic calibration does not occur at power on. Power-off position is retained in memory until next power on.	OFF	DOWN

* Factory default (recommended normal operation settings)

3. OPERATING INSTRUCTIONS

3.1 Front Panel Controls and Quick Start Operation

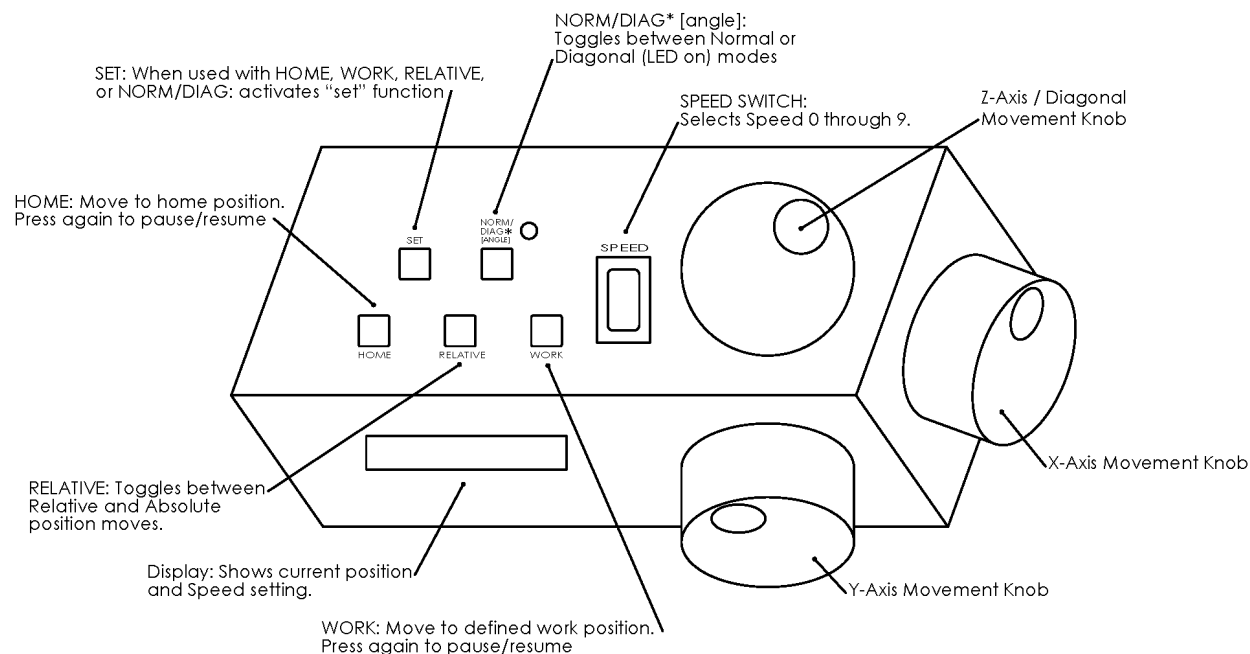


Figure 3-1. MP-225A controls.

Screen-color mode indications:

Green = Used during startup and when Display shows Absolute position

Blue = Display shows Relative position

Setting a new Home location: Move to the desired location, press and hold down SET then press and release HOME. One beep indicates home position is now set to the current positioned.

Setting a new Work location: Move to the desired location, press and hold down SET then press and release WORK. One beep indicates home position is now set to the current position,

Setting a new Relative Origin: Move to the desired location, press and hold down SET and then press and release RELATIVE. One beep indicates the current position is the new relative origins, You will now be in the Relative display mode at RELATIVE 0,0,0 and the display will turn from green to blue. You can toggle back and forth using the RELATIVE button.

Setting a new angle for Diagonal Movements: Press and hold down SET and press and release NORM/DIAG *(angle). The display will say “Select the angle in use (0-90)” and show the currently saved angle (30 degrees initially). You will have 10 seconds to select a new angle by rotating the Z axis knob. The screen will be green during this procedure.

3.2 Detailed Display Instructions

3.2.1 Initial Startup



Figure 3-2. LCD Display showing startup screen.

When starting the MP-225A system for the first time or if the HOME position has not yet been defined (saved), the values of all four axes will be 1,000 micrometers (microns).

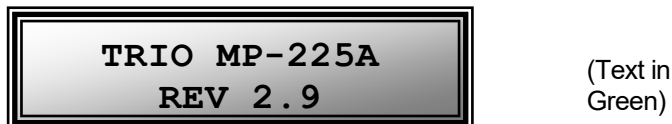


Figure 3-3. Startup screen

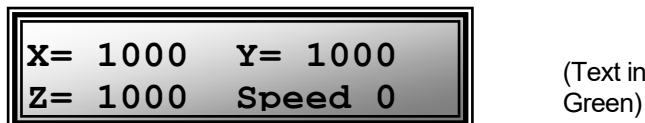


Figure 3-4. Factory default startup (Home) position with calibration enabled.

Normal screen color: Green. Move in progress (HOME, WORK, etc.), screen goes Blue, then back to green when done.

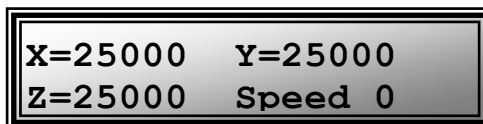
3.3 Operation of MP-255A Integrated ROE/Controller

3.3.1 Maximum Positive Position Value

Move the dial of an axis clockwise until position value stops incrementing. The following table lists the maximum position value (in microns) for each axis.

Table 3-1. Maximum positive position value of each axis

Axis	Maximum Position Value (in microns)
X	25,000
Y	25,000
Z	25,000



(Text in Green)

Figure 3-5. Maximum positive values

3.3.2 Speed Control (SPEED)

The speed at which the ROE axis knobs move the eletromechanical can be adjusted with the SPEED toggle. Each press of the button up or down increases or decrease how far each knob moves each axis. The rate cycles through ten speeds: 0 fastest through 9 slowest.

3.3.3 Setting the Angle of the Pipette/Headstage Holder

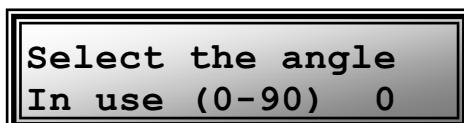
The MP-225 consists of three physical axes: X, Y, and Z. The integrated MP-225 ROE/controller uses the X and Z axes and the angle of the holder to create a virtual D axis. Use angles between 10° and 90° for best results.

To change the angle of the holder, loosen the hex set screw located on the side of the swing-out gate. You can set/read a particular angle using the knife-edge on the dovetail and the scale of the faceplate. Tighten the screw securely to fix the rotary dovetail.

If you are not satisfied with the accuracy of the knife-edge, you can measure the angle of the holder using the kevel on your smart phone.

3.3.4 Using SET-NORMAL/DIAG to Create the Virtual D Axis

To set the angle for the internal firmware, press and hold SET and then press NORMAL/DIAG *. On releasing both buttons, the display shows the following prompt in green:



(Text in Green)

Figure 3-6. Entering angle prompt.

Zero (0°) is set with the diagonal being paralleled to the table and 90° is set with the diagonal being perpendicular to the table.

The screen will indicate the following: “Select the angled to use (0-90)” and give the current angle (30 degrees is t factory default).

You will have 0 seconds t set a new value. Rotate the Z knob on the ROE to set the value of the angle. Once this value is dialed in, do not touch the ROE knob for 8-10 sec. The virtual D angle will now be set.

3.3.5 Moving to the Home Position

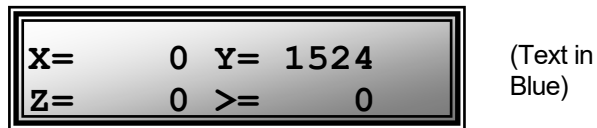


Figure 3-7. Moving to Home position (screen is blue moving).

If the Home position has not yet been defined and saved, the home position values for all axes will default to 1,000 microns, as shown in the following figure.

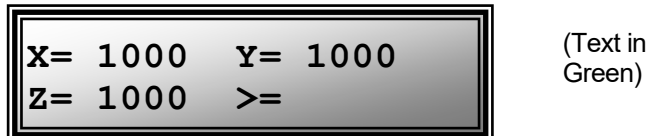


Figure 3-8. Factory default Home position.

If the Home position has been previously defined (saved), pressing HOME will make a move to the defined home position (see example in the following figure).

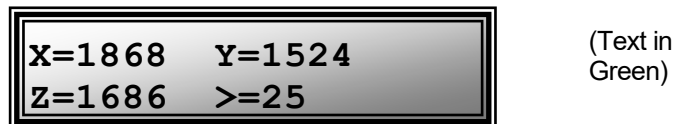


Figure 3-9. Example Home position defined and saved.

To move to the home position, press HOME. If the current position before pressing HOME is greater than the home position, the movement will be as follows:

NOTE: Movement to the Home position works only if X coordinates of the HOME position are less than the WORK position. HOME and WORK positions cannot be the same.

Movement begins by retracting the X and Z axis together (at the angle currently set) away from the sample. Movement then continues along the X axis toward the home position. The final movement is along the Y-axis towards the operator and away from the microscope.

NOTE: Step 3 occurs only if “Y-Lockout” is disabled. Otherwise, no movement along the Y-axis occurs.

3.3.6 Moving to the Work Position



Figure 3-10. Example Work position

To move to the Work position, press the WORK button. If the current position before pressing WORK is less than the Work position, the movement will be as follows:

1. Movement travels along the Y-axis away from the operator and towards the microscope.

- Movement is then made along the X axis toward the sample. Travel then continues along the diagonal until reaching its end-of-travel point.

NOTE: Step 1 occurs only if “Y-Lockout” is disabled. Otherwise, movement begins with Step 2.

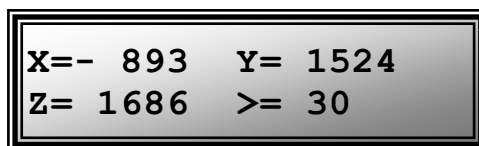
3.3.7 Setting Position for HOME or WORK

To set position, press and hold down SET and the then press and release HOME or WORK button. Beep will sound.

3.3.8 Setting Absolute/Relative Coordinates Mode

The RELATIVE button toggles between Relative and Absolute coordinate systems. The default coordinate system on power up is Absolute, with the coordinates on the screen shown in green. To switch to relative coordinates, press the RELATIVE button once. To reset the current position to all zeroes, depress the RELATIVE for 3 seconds or until a beep is heard, and then release the button. This resets the current position to all zeroes.

Press RELATIVE once (briefly for < 2 sec.)

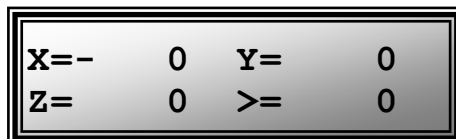


X=- 893 Y= 1524
Z= 1686 >= 30

(Text in Blue)

Figure 3-11. Relative mode

Depress RELATIVE for 3 sec. or until beep sounds.

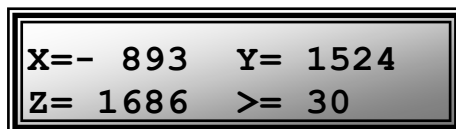


X=- 0 Y= 0
Z= 0 >= 0

(Text in Blue)

Figure 3-12. Relative mode

Pressing RELATIVE briefly while in Relative mode, returns displayed coordinates back to Absolute mode.



X=- 893 Y= 1524
Z= 1686 >= 30

(Text in Green)

Figure 3-13. Absolute mode

3.3.9 Display Coordinates (Absolute/Relative) Modes Indications

The MP-225 system has two modes of operation: Absolute coordinate and Relative coordinates. The display turns color for each specific mode, as shown in the following table.

Table 3-2. Screen colors and modes

Screen Color	Mode	Example
Green	Absolute Coordinates	<pre>X= 1868 Y= 1524 Z= 1686 SPEED 0</pre>
Blue	Relative Coordinates	<pre>X=- 0 Y= 0 Z= 0 SPEED 0</pre>

3.3.10 Movement Knobs Disabling and Lock Mode ([SPEED]/LOCK)

Axis-movement knobs are disabled during movements to Home, Work.

3.3.11 Pausing Home Movements (HOME (while moving to Home))

After Move to Home has been initiated, and while the move is in progress, pressing HOME a second time pauses the manipulator. Pressing HOME again resumes movement.

3.3.12 Pausing Work Movements (WORK (while moving to Work))

After Move to Work has been initiated, and while the move is in progress, pressing WORK a second time pauses the manipulator. Pressing WORK again resumes movement.

APPENDIX A. LIMITED WARRANTY

- Sutter Instrument Company, a division of Sutter Instrument Corporation, limits the warranty on this instrument to repair and replacement of defective components for two years from date of shipment, provided the instrument has been operated in accordance with the instructions outlined in this manual.
- Abuse, misuse, or unauthorized repairs will void this warranty.
- Warranty work will be performed only at the factory.
- The cost of shipment both ways is paid for by Sutter Instrument during the first three months this warranty is in effect, after which the cost is the responsibility of the customer.
- The limited warranty is as stated above and no implied or inferred liability for direct or consequential damages is intended.
- Consumables, PMTs, galvanometers, and Uniblitz^{®1} shutters are exempt from this warranty.
- An extended warranty for up to three additional years can be purchased at the time of ordering, or until the original warranty expires. For pricing and other information, please contact Sutter Instrument.

¹ Uniblitz[®] is a registered trademark of Vincent Associates.

(This page intentionally left blank.)

APPENDIX B. ACCESSORIES

The following accessories are available for the MP-225A.

285204	4-inch dovetail extension
285210¹	Mounting adapter plate
225RBI	Rotating base for MP-225
X285300	Right angle adapter
X285305	Z-axis vertical extension
X285310	Z-axis horizontal extension
BR-AW	Rod-holding clamp for XenoWorks ^{®2} injectors
MP-ROD	Rod holder
285HEA	Hinged headstage mount
M100106	Flat side panel for controller

¹ For use with MT- or MD-series stands/platforms, or any surface with 1-inch centered holes.

² XenoWorks[®] is a registered trademark of Sutter Instrument Company.

(This page intentionally blank.)

APPENDIX C. TECHNICAL SPECIFICATIONS



Travel:	25 mm (1 in) on all three axes
Resolution:	less than 100nm
Maximum Speed:	3.0mm/sec (0.11 in/sec)
Long Term Stability:	1-2 μm/hour maximum
Drive Mechanism:	Integral miniature stepper motor anti-backlash gear head
Dimensions: (H x W x D):	
MP-225/M Manipulator:	5.5 x 4 x 6 in (15 x 10 x 15.5 cm)
MP-225A/E ROE/Controller:	4 x 10 x 5.5 in (10.16 x 25.4 x 13.97 cm)
Weight:	
MP-225/M Manipulator:	2.95 lbs. (1.3 kg)
MP-225A/E ROE/Controller:	3.1 lbs. (1.4 kg.)
Electrical:	
Power Adapter:	Meanwell GS60A24-P1J
Input (mains)	100 - 240 VAC, 50/60 Hz, 1.4A
Output (to controller)	24V DC, 2.5A, 60W Max. (see following table for cable specs)
System Power consumption	60-Watts maximum
Mains fuses	None replaceable (power protection built into the Power Adapter)
Cables	(Refer to the following tables for a description of all possible cables.)

Table C-1. MP-225A Controller cables and receptacles/connectors.

Controller Rear Panel Port Connector/Receptacle	Cable Connector Types	Connects to ...	Cable Type	Cable Max. Length
Power Adapter 3-pin male connector	← 3-pin power standard (female) 3-pin male → (Geographical region dependent)	Mains power source.	10A, 250V, with safety ground plug	3 meters (approx. 10 feet)
DRIVE MODULE (25-Pin DSUB female receptacle)	← DB-25 male DB-25 female → (straight-through)	MP-225/M adapter (25-Pin DSUB male connector) (MP-225/M Adapter has three RJ45 connectors for three cables that connect to the MP-225/M electromechanical)	Minimum of 26 awg stranded wire with 500 Volt (see note)	3 meters (approx. 10 feet)
Power Adapter	← (fixed) ID 2.1 x OD 5.5 mm Barrel Plug (male) →	ROE/Controller Cabinet: POWER receptacle (center pin positive)	UL1185 18AWG	1.8 meters (approx. 6 feet)
ROE/Controller Cabinet: GROUND (1-pin Banana-style female receptacle)	← Banana male Alligator clip → (hooded)	Ground/earth source (user determined)		

NOTE: A ferrite at the controller end is strongly recommended (Fair-Rite part number 0443164-251). Fair-Rite Products Corp., P.O. Box J, One Commercial Row, Wallkill, NY, 12589, USA

APPENDIX D. QUICK REFERENCE

D.1. Manual Operation



- A. **NORM / DIAG (angle):** Normal or Diagonal (LED on) mode. In diagonal Mode, Z-axis knob moves Z & X axes simultaneously along the diagonal set by the angle, while X & Y knobs move their axes independently.
- B. **Set:** Used together with **HOME**, **WORK**, **RELATIVE**, or **NORM/DIAGONAL** to set Home, Work position, Relative origin 0,0,0 to the current position or to enter angle-set mode.
- C. **HOME:** Move to a defined home position. Press again to pause/resume.
- D. **RELATIVE:** Toggles between Relative and Absolute position moves.
- E. **WORK:** Move to a defined work position. Press again to pause/resume.
- F. **SPEED:** Selects speed 0 through 9.
- G. **Display:** Shows current position and Speed setting. Also angle setting prompt when in Angle Set mode.
- H. **Z-Axis Movement Knob**
- I. **X-Axis Movement Knob**
- J. **Y-Axis Movement Knob**

Setting Home, Work, or Relative Mode Origin Position: To set position, hold down SET and then HOME, WORK, or RELATIVE button, then release.

Screen-color mode indications: Green = Absolute position and other prompts; Blue = Relative position;

Setting Home to the current position: Press and hold down SET then HOME, and release both keys. Two beeps indicate home position is now set to the current position.

Setting Work to the current position: Press and hold down SET then WORK, and release both keys. One beep indicates Work position is now set to the current position.

Setting the Origin for relative movement to the current position: Press and hold down SET then RELATIVE, and release both keys. One beep indicates the current position is now set as the origin (X=0, Y=0, & Z=0) for relative moves. Relative movement mode is active until RELATIVE is pressed again. HOME and WORK in either NORM or DIAG modes will now work in relative mode.

Axis Movement Order: HOME: X & Z first, Y last. WORK: Y first, X & Z last.

X & Z movement precedence and simultaneity is determined by angle setting: At 45°, movement is simultaneous; at <45°, Z has precedence; at >45°, X has precedence.

Angle Entry: Press and hold down SET then press NORM/DIAG * [angle]. On release of both buttons, the enter angle prompt will display for 10 seconds. Use the Z knob to select angle between 0 and 90.

D.2. Configuration

Rear-Panel DIP Switches

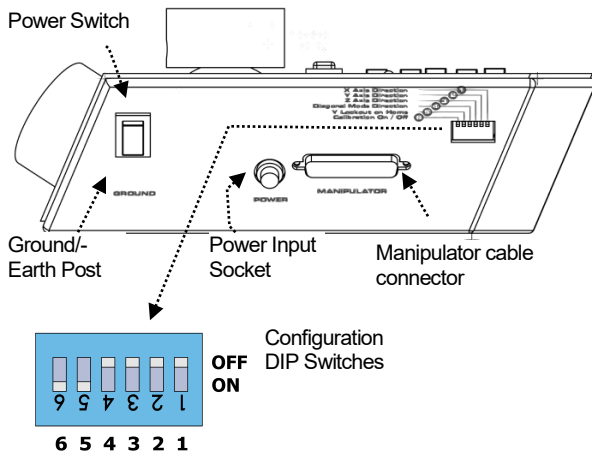


Table D-1. MP-225A configuration switches (rear).

Switch #	Definition	State	Setting	Position (rear view)
1	X-Axis Knob Rotation for Forward (+) Movement	Counter	ON	UP
		Clockwise*	OFF*	DOWN*
2	Y-Axis Knob Rotation for Forward (+) Movement	Counter	ON	UP
		Clockwise*	OFF*	DOWN*
3	Z-Axis Knob Rotation for Forward (+) Movement (Normal Mode)	Counter	ON	UP
		Clockwise*	OFF*	DOWN*
4	Z-Axis Knob Rotation for Forward (+) Movement (Diagonal Mode)	Counter	ON	UP
		Clockwise*	OFF*	DOWN*
5	Y Axis Lock Out for Homing	Disabled*	ON*	UP*
		Enabled	OFF	DOWN
6	Calibration Homing on Power On **	Enabled *	ON*	UP*
		Disabled	OFF	DOWN

NOTES:

INDEX

C	
Components of the MP-225 System	1
configuration	24
controller	
cable specs	22
D	
dimensions.....	21
disclaimer	iii
E	
electrical	
specifications	21
electromagnetic interference	iii
F	
fuses, mains	21
fuses, replacement	
mains.....	iii
G	
glassware	
precautions.....	iv
H	
HOME button (while moving to Home).....	16
I	
input	
voltage	21
M	
mains	
fuses	iii, 21
voltage	21
manual operation	23
N	
notes	
user.....	26
O	
Operations	
control operations	
movement knobs disabling	16
moving to the Home Position.....	14
moving to the Work Position.....	14
pausing Home movements	16
pausing Work movements	16
setting Absolute/Relative coordinates mode	15
Setting Position for HOME or WORK	15
Setting the Angle of the Pipette/Headstage Holder	13
Speed Control (SPEED).....	13
Using SET-NORMAL/DIAG to Create the Virtual D Axis	13
display	12
initial startup	12
Display Coordinates (Absolute/Relative) Modes Indications.....	15
Maximum Positive Position Value.....	12
Operation of MP-255A Integrated ROE/Controller	12
R	
resolution.....	21
S	
safety warnings	
mains fuse.....	iii
safety warnings & precautions	
operational	iv
SAFETY WARNINGS & PRECAUTIONS	iii
electrical	iii
specifications	
dimensions.....	21
drive mechanism.....	21
electrical.....	21
long term stability	21
maximum speed.....	21
resolution.....	21
travel.....	21
weight	21
Structure of the MP-225 Documentation Package	1
T	
technical specifications.....	21
electrical	
cables	21
mains fuses	21
power adapter	21
input (mains)	21
output (to controller)	21
system power consumption	21
technical support	2
travel	21

<i>U</i>		mains	21
unpacking and mounting.....	3	<i>W</i>	
<i>V</i>		warranty	17
voltage		weight	21
input	21	WORK button (while moving to Work).....	16

NOTES