



SUTTER INSTRUMENT®

2019



CUSTOMER SERVICE

For phone orders, quotation requests, and technical support:

Phone	1.888.883.0128
International Phone	1.415.883.0128
Monday – Friday 8:00am to 5:00pm	

For correspondence by mail:

Sutter Instrument
One Digital Drive
Novato, CA 94949

FAX ORDERS

Fax	1.888.883.0900
International Fax	1.415.883.0572
24 hours a day, every day	

EMAIL

info@sutter.com

WEB SITE

www.sutter.com

PRICES

Prices included herein are for items purchased directly from Sutter Instrument for sales in the USA or Canada. International prices are typically 5% higher and all pricing is subject to change without notice. Products are sold FOB Novato (exclusive of transportation, insurance, and applicable taxes). Please contact Sutter Instrument or your local representative for a price quotation.

SHIPPING

Shipping charges are prepaid and added to the invoice. Unless otherwise specified when placing your order, we will use our best judgement in selecting a reliable and economical shipper of our choice.

RETURNS

Items ordered in error may be returned within 30 days of receipt, and are subject to a 15% restocking fee. You are urged to retain the original shipping containers should there be a need to return the item. Please contact Sutter Instrument for a return authorization number.

QUALITY CONTROL

Sutter Instrument takes great pride in meeting the highest possible standards of quality and reliability. Each instrument undergoes rigorous electronic and mechanical testing protocols during the production process. For our micropipette pullers, every instrument is tested to assure its ability to consistently fabricate micropipettes with ultra-fine tips. A series of pipettes is pulled on each instrument and examined with our scanning electron microscope. No other manufacturer offers this level of quality control.

SERVICE & SUPPORT

We hope that our instruments and products continually meet your needs. However, should a problem arise, please contact our technical support staff to discuss the problem. If the instrument requires factory service, we will furnish shipping instructions. Items under warranty will be repaired free of any costs for parts or service. Both delivery and return shipping costs are the responsibility of the owner.

WARRANTY INFORMATION

Sutter Instrument provides a limited warranty on parts and labor for two years from shipping date on all Sutter made products. To be covered under warranty, the instrument must have been operated in accordance with the instructions outlined in the instruction manual and in a manner that would be expected in the normal use of the product. Items not covered under warranty are: consumables, photo multiplier tubes, galvanometers, Uniblitz® shutters, air tables, and other non-Sutter made products. Non-Sutter made products carry the factory warranty of their original manufacturer. Extended warranties on Sutter made products may be purchased for an additional charge. Please contact Sutter for a quotation. Abuse, misuse, or unauthorized repairs will void any warranty.

PAYMENT METHODS

Payments may be made in U.S. Dollars in one of the following methods: MasterCard, Visa, American Express, bank draft drawn on a U.S. bank, international money order, bank wire transfer, irrevocable letter of credit (a processing fee will apply).

GENERAL INFORMATION

Every effort has been made to ensure that at the time of printing, the information contained herein is accurate. Please phone Sutter or visit our web site for the latest product specifications and pricing.



INDEX

MICROPIPETTE FABRICATION

Introduction	4
PULLERS	
P-2000	6
Laser-Based Micropipette Puller	
P-1000	10
Next Generation Micropipette Puller	
P-97 Flaming/Brown™ Micropipette Puller	14
P-30 Vertical Puller	18
Micropipette Puller Comparison Chart	21
Filaments/Accessories	22
BEVELER	
BV-10 Microelectrode Beveler	24
BOOK	
Advanced Techniques in Micropipette Fabrication	28
GLASS	
Glass Capillary Tubing	30

MICROMANIPULATION con't.

TRANSLATORS, STAGES & MOUNTING SYSTEMS	
MM-33	
Micromanipulator	78
MT-1000/MT-2000/MT-2200	82
Motorized X-Y Translation System	
MT-1078/MT-2078/MT-2278	88
X-Y Translation System	
MPC-78/MP-78	94
Large Moving Platform Stage	
New Features 3DMS	98
3-Dimensional Motorized Stage	
Motorized Stage and Translator Comparison Chart	102
MT-75 Gantry Style Stands	104
MT-70/MT-71 Stands	110
MD SERIES	114
Micromanipulator Platforms	

MICROMANIPULATION

Introduction	36
MANIPULATORS	
New TRIO™ MPC-100 Systems	38
Three-Axis Micromanipulator System	
TRIO™ -245	42
Three-Axis Micromanipulator System	
TRIO™ -235	46
Three-Axis Micromanipulator System	
QUAD®	50
Four-Axis Micromanipulator System	
MPC-200/MPC-385/MPC-325	54
Multi-manipulator System	
Multi-Link™	60
Position Control Software	
MP-285	62
Robotic Micromanipulator	
Micromanipulator Comparison Chart	68
New SOLO	70
Single Axis Manipulator Controller	
MP-85	74
Huxley-Wall Style Micromanipulator	

ELECTROPHYSIOLOGY SYSTEMS

New dPatch®	120
Low-noise ultra-fast digital patch clamp amplifier system	
IPA®/Double IPA®	128
Integrated Patch Amplifiers with Data Acquisition System	
New Features SutterPatch®	134
Data Acquisition, Management and Analysis Software	
Air Tables & Faraday Cages	140
Vibration Isolation Systems	
New Perfusion Systems & Bath Chambers	146
BUNDLED CONFIGURATIONS	152
Manipulators, Stages & Platforms	

MICROSCOPES

Introduction	156
MOM®	158
Movable Objective Microscope®	
SOM®	164
Simple Moving Microscope	



MICROSCOPES con't.

MCS	168
MOM Computer System and Software	
ScanImage	174
Software and FPGA-Based System	
RESSCAN	178
Sutter Resonant Scan Box	
PS-2 / PS-2/LV	182
PMT Power Supplies	
DF-Scope™	186
Multiphoton Imaging Package for Olympus BX51WI Microscope	
New Features BOB™	190
Open-design Upright Microscope	

OPTICAL INSTRUMENTS

Introduction	198
Light Source	200
Comparison Chart	
Filter Wheel Controller	201
Comparison Chart	
LIGHT SOURCES	
Lambda LS	202
Xenon Light Source	
Lambda XL	208
Extended Life Light Source	
Lambda HPX	212
Liquid Cooled LED Light Source	
Lambda HPX-L5	216
High Output LED Light Source	
Lambda TLED/TLED+	220
Transmitted Light Source	
Lambda FLED	224
Fluorescent Light Source	
WAVELENGTH SWITCHERS AND FILTER WHEELS	
Lambda DG-4/DG-5 PLUS	228
High Speed Wavelength Switcher	
Lambda VF-5™/VF-1/VF-10	234
Tunable Filter Changer	
Lambda VF-1 Edge™	240
Tunable Filter Changer	

OPTICAL INSTRUMENTS con't.

Lambda 10-3	244
Optical Filter Changer	
Lambda 10-B	252
Optical Filter Changer	
OPTICAL BEAM COMBINERS	
Lambda OBC	258
Optical Beam Combiner	
Lambda 421	262
Optical Beam Combining System	
SHUTTERING	
Lambda SC	266
SmartShutter® Controller	
SmartShutter®	270
Stepper-motor Driven Shutter	
MICROSCOPE ADAPTERS	
Adapter list	274

MICROINJECTION

Introduction	280
XenoWorks® Micromanipulator	282
XenoWorks® Digital Microinjector	286
Manual Microinjector	290
PRIME TECH	
PMM-4G Piezo Impact Drive	292
HDJ-M3 Hydraulic Microinjector	296
PNJ-T2 Pneumatic Microinjector	298
Applications	300
CUSTOM PRODUCTS	
OEM Products	306

DEALERS

International Dealer Directory	308
--------------------------------	-----

MICROPIPETTE FABRICATION

The P-77 Puller was Sutter Instrument's founding product, and the first electronic pipette puller on the market. After 40 years of continual development, we've become the undisputed leader in micropipette pullers.

Forming glass micropipettes at a nanoscale demands precision and sophisticated controls. From years of continued refinement of the micropipette puller, Sutter pullers represent the state-of-the-art in micropipette fabrication. From the ease

of use of the P-1000 touch screen display, to the P-2000, one of the only pullers available that can fabricate pipettes from pure quartz tubing, Sutter's pullers have become the world standard.

The P-1000 is the latest evolution of the Flaming/Brown™ Style micropipette puller. This puller extends the features of the P-97 by incorporating a color touch screen and integrating new technology that simplifies programming. Unique features such as the safe heat mode, diagnostic testing,



line repeat mode, and jaw temperature sensor assist in creating the ideal pipette morphology. The pre-installed Sutter Pipette Cookbook, glossary and help topics, make it easy to access the extensive library of programs. Both pullers offer: microprocessor controlled programmability, constant current power supply, a self-contained precision air delivery system, and a patented velocity sensing system. These design elements have led to significant improvements in pipette reproducibility when compared to other micropipette pullers.

The current state-of-the-art in micropipette puller technology is the P-2000. It incorporates the mechanical design and programmability of the Flaming/Brown™ pullers, but uses a CO₂ laser as the heat source. With the addition of the laser,

quartz tubing can now be pulled along with other lower melting point glass compositions. Quartz pipettes have helped eliminate some technical barriers in electrophysiological studies and have enhanced microinjection procedures as well as near field scanning microscopy.

The P-30 is Sutter's lowest priced and simplest puller, based upon a National Institutes of Health (NIH) design from the 1950s. As a vertical puller, it is intended for basic micropipette fabrication, sharp electrode, and microinjection work.

The BV-10 micropipette beveler continues to be the state-of-the-art in micropipette beveling technology. For precision beveling of pipette tip diameters from fractions of a micron to tens of microns, it is the system of choice.



P-2000 LASER-BASED MICROPIPETTE PULLER



FEATURES P-2000

- Capable of pulling quartz, borosilicate and aluminosilicate glass
- Fully programmable — including heating filament characteristics
- The laser has no melting point limit as with conventional metal filaments, and therefore, cannot be burned out
- Pulls electrodes with tip diameters that are less than 0.03 μm
- Optimized velocity sensing circuit for maximized sensitivity and reproducibility*
- Operating life of the CO_2 laser is expected to be in excess of ten years with normal use, after which the laser can be refurbished by Sutter Instrument for a fee
- Individual programs can be write-protected in order to secure them from inadvertent changes
- The total time that the heat is on during the pull is displayed for improved program development and troubleshooting
- A date and time stamp is displayed to show when the program was written and/or the last time a program was changed
- The P-2000/F is ideal for applications such as nanospray and NSOM
- Preprogrammed sample programs for intra-cellular and patch pipettes. The P-2000/F is also preprogrammed with an NSOM tip

*Patent No.4,600,424



The P-2000 integrates a CO₂ laser-based heat source with the technology derived from our extensive experience with conventional pullers. This system offers capabilities unmatched by other pullers. A significant advance in the technology of fabrication of micropipettes, optical fiber probes, and nanospray tips, is offered with the P-2000 micropipette puller.

The use of laser heat allows the P-2000 to work with quartz glass (fused silica) as well as conventional glasses. Quartz offers superior material properties for a variety of research applications. Quartz is stronger than other glasses and can facilitate penetration through tough tissues which would normally break conventional pipettes¹. For applications requiring a low noise glass, users will find that quartz is the lowest noise glass available^{2,4}. Quartz contains none of the metals used in conventional glasses³. Optically, quartz is virtually free from fluorescence when illuminated.

A CO₂ laser was selected as the heat source for the P-2000 for several reasons:

- 1) The nominal emission wavelength of the laser approximates the resonant frequency of the SiO₂ lattice in glass. Thus, quartz and other conventional glasses can be melted when the appropriate laser power is supplied.
- 2) Laser heat is clean and leaves no metal residue on the pipette as do conventional heating filaments.
- 3) Laser heat can be turned off instantly, leaving no residual filament heat.
- 4) The user can program the amount and distribution of heat supplied to the glass.
- 5) No filaments to age or burn out.

The P-2000 can store up to 100 separate programs, with each program consisting of up to 8 command lines. Programmable parameters include: laser power level, scan width, trip velocity, delay/laser on time, and hard pull strength.

One important consideration for the use of the P-2000 is the diameter of the glass used. The optical design produces even heating on glass up to 1.2 mm in outside diameter. Larger diameter glass can be used with the P-2000/G (up to 1.5 mm quartz and 1.8 mm conventional glass), but the performance is best with glass that is 1.2 mm diameter or less.

The P-2000/F works well with small diameter glass such as optical fibers, and with small diameter fused silica capillary commonly used for the manufacture of nanospray tips. Smaller diameter glass with an outer diameter in the range of 0.125 mm to 0.6 mm, require special puller bars as well as an optical alignment optimized for the smaller diameter material. These modified components will be installed at the time of purchase.

As with larger diameter glass, a wide range of tip sizes and taper geometries can be produced with this modified P-2000/F and small diameter glass. We have drawn optical fiber tips ranging from less than 10 nm to more than 5 μ m. Please consult our technical staff for further information.

^{1, 2, 3, 4} References listed on page 8



COMMON APPLICATIONS P-2000

P-2000/G

- Patch clamp — single isolated and whole cell
- Intracellular recording
- Microinjection
- Nano probe research
- SECM

P-2000/F

- Nanospray mass spectrometry
- NSOM
- Tapering optical fibers

SPECIFICATIONS P-2000

- **Dimensions** 30 in x 14.25 in x 13.25 in
76 cm x 36 cm x 33.5 cm
- **Weight** 90 lbs
41 kg
- **Electrical** 115/230 Volts
50/60 Hertz power line

■ CLASS I LASER PRODUCT



REFERENCES P-2000

1. Munoz, J.L. and Coles, J. Quartz micropipettes for intracellular voltage microelectrodes and ion selective microelectrodes. *Journal of Neuroscience Methods*: 22:57-64, 1987.

2. Rae, J.L. and Levis, R. A. A method for exceptionally low noise single channel recordings. *European Journal of Physiology - Pflügers Archiv*: 420:618-620, 1992.

3. Zuazaga, C. and Steinacker, A. Patch-clamp recording of ion channels: Interfering effects of patch pipette glass. *News in Physiological Science*: 5:155-59, 1990.

4. Levis, R. A. and Rae, J. L. The use of quartz patch pipettes for low noise single channel recording. *Biophysical Journal*: 65:1666-1677, 1993.

**US PRICES P-2000**

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

■ P-2000/G	Laser-based puller, outfitted for use with glass GREATER than 0.6 mm outer diameter	\$ 18,255
■ P-2000/F	Laser-based puller, outfitted for use with glass LESS than 0.6 mm outer diameter	\$ 19,380

(Pullers include a glass stop, sample box of Q100-70-7.5 glass, mirrored tile and manual)

ACCESSORIES P-2000

■ FPS	Spacer for special procedures	\$ 30
■ GS-I¹	Glass stop (Imperial)	\$ 81
■ GLA¹	Glass loading aid	\$ 160
■ CTS	Ceramic tile for scoring glass	\$ 23
■ PET	Pipette examining tile	\$ 19
■ BX10²	Pipette storage box (holds 10) 4 3/4 in x 3 5/8 in x 3/4 in	\$ 18
■ BX20²	Pipette storage box (holds 20) 7 in x 3 5/8 in x 3/4 in	\$ 18
■ O730350	Mirrored tile	\$ 23
■ PR³	Protective ruler (used with P-2000/F)	\$ 345
■ PBS	Puller bar hard stop	\$ 30

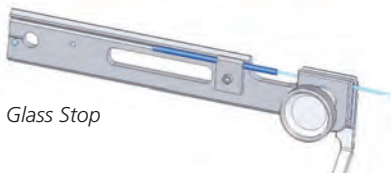
¹ Installs on either puller bar

² Minimum order of any 2 boxes

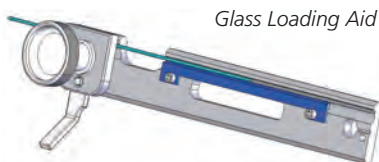
³ Allows user to burn coating off HPLC tubing without damaging tubing. Acts as a guide to allow repeatable location control of burn site.



Protective Ruler



Glass Stop



Glass Loading Aid



P-1000 NEXT GENERATION MICROPIPETTE PULLER



FEATURES P-1000

- Color touch screen display
- Safe heat mode to protect and extend filament life
- Pipette Cookbook program directory
- Pre-heat mode improves stability
- Line repeat mode simplifies multi-line programming
- Help topics and error detection
- Glossary defines micropipette and puller terminology
- Copy & paste function for writing new programs
- Jaw temperature sensor helps define ideal pulling conditions
- Record of last two pull results
- Ramp test more easily accessed and is stored and referenced within each program. Helps to establish program heat settings and protect filament.
- Two symmetrical pipettes with each pull
- Self-contained air supply with filtration system and humidity control chamber
- Memory storage for up to 100 programs
- Two cooling modes: Time and Delay
- Use with single or multi-barrel glass



Developed through years of experience with the Flaming-Brown™ style micropipette pullers, and infused with leading-edge technology, Sutter is proud to offer the P-1000 micropipette puller. The most obvious new feature is the color touch screen display that provides an intuitive and full-featured interface.

The extensive library of programs found in the popular Sutter Pipette Cookbook has been incorporated into the P-1000 puller and is available to the user. You need only specify the glass, filament, and type of pipette you require, and a suitable program is identified and available for installation. This takes the guesswork out of pipette pulling and simplifies programming.

The Pre-heat mode actively heats and controls the jaw temperature and assures that the jaws have reached a specific temperature before the glass is pulled. This can increase the stability of the program from pull to pull. Copy and Paste functions assure that programs can be easily written and the line repeat mode simplifies multi-line programming. A safe heat mode is an additional feature that helps the user avoid using heat settings that might damage or burn out the filament. When the safe heat mode is turned on, the puller will “check” the installed heat and alert the user when a given heat value is too low or too high in relation to the ramp value. User notes can be added to each program for annotating important information.

New features for the P-1000 include: diagnostic testing of all puller components, built-in error detection of air pressure loss or filament burnout, easy access to ramp test, measurement of jaw temperature, and access to previous pull results with the heat-on times for each cycle of the program. Help topics are preloaded to assist with on-site troubleshooting, and the built-in glossary includes text, pictures, and diagrams explaining the terms used in micropipette fabrication. A rotary dial is offered as an alternative to the touch pad for numerical entry.



COMMON APPLICATIONS P-1000

- | | |
|------------------------|-----------------------------|
| ■ Patch pipettes | ■ Zebrafish injection |
| ■ Sharp electrodes | ■ Insect Egg microinjection |
| ■ Pronuclear injection | ■ Aspiration pipettes |

SPECIFICATIONS P-1000

- | | |
|---------------------|--|
| ■ Dimensions | 21 in x 14 in x 12 in
53 cm x 36 cm x 30 cm |
| ■ Weight | 41 lbs
18.59 kg |
| ■ Electrical | 115/230 Volts
50/60 Hertz power line |



US PRICES P-1000

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

- | | | |
|-----------------|--|-----------------|
| ■ P-1000 | Flaming/Brown™ type micropipette puller, glass stop, manual, hard copy of Sutter Pipette Cookbook. Each puller comes with a FB255B filament and a sample box of BF100-50-10, BF150-110-10, and BF150-86-10 glass. Sutter pre-programs the P-1000 with a 2.5 mm x 2.5 mm box filament (FB255B) unless an alternative filament is requested. | \$ 9,379 |
|-----------------|--|-----------------|



ACCESSORIES P-1000

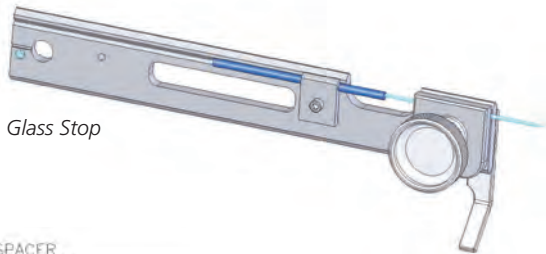
■ FPS	Fire polishing spacer	\$ 30
■ GS-M	Glass stop (Metric)	\$ 81
■ GC-M	Glass clamps with grips (Metric set of 2)	\$ 53
■ CTS	Ceramic tile for scoring glass	\$ 23
■ PET	Pipette examining tile	\$ 19
■ BX10¹	Pipette storage box (holds 10) 4 3/4 in x 3 5/8 in x 3/4 in	\$ 18
■ BX20¹	Pipette storage box (holds 20) 7 in x 3 5/8 in x 3/4 in	\$ 18
■ FILAMENT²	Custom platinum/iridium filament	\$ 66
■ V400103	Replacement Drierite (1 lb)	\$ 25

¹ Minimum order of any 2 boxes

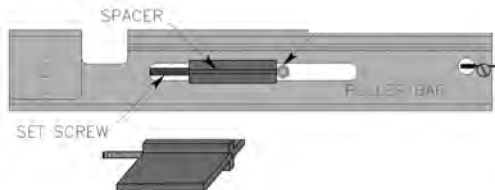
² Standard filaments found on page 23



Pipette storage box



Glass Stop



Fire Polishing Spacer

P-97 FLAMING/BROWN™ MICROPIPETTE PULLER



FEATURES P-97

- Environmental chamber for humidity control
- Programmable air pressure
- Memory storage for up to 100 programs
- Write protection and date stamp for each program
- Two symmetrical pipettes with each pull
- Two cooling modes: time and delay
- Pre-programmed sample programs for intracellular and patch pipettes. Special programming on request
- Ramp test to establish program heat settings when a new filament or glass is introduced
- Vacuum fluorescent display
- Constant current power supply for filament and pull solenoid
- Looping pull cycle for fabrication of patch type micropipettes
- Self-contained air supply with filtration system and humidity control
- Consistent and reliable electrodes with tip diameters less than $0.1\ \mu\text{m}$
- Control over the time and pressure at which the air is delivered
- Optimized velocity sensing circuit for maximized sensitivity and reproducibility
- Quality control, SEM photograph of a tip pulled with each puller; criterion is tip measurement less than $0.1\ \mu\text{m}$ and typically is $\sim 0.06\ \mu\text{m}$



The P-97 Flaming/Brown™ type micropipette puller is ideal for fabricating micropipettes, patch pipettes and microinjection needles. While retaining many of the features of earlier models, the P-97 offers improvements in mechanical, electronic and software design. The result is better control of the pulling process and a higher degree of reproducibility. The P-97 combines a proven mechanical system with a sophisticated, programmable microprocessor controller. This programmable control of the pulling parameters allows the investigator to design application specific pipettes from a wide range of glass compositions and sizes.

A number of other features have been incorporated in the design of the P-97. Most apparent is the environmental chamber which surrounds the heating filament. This environmental chamber is designed to minimize the effect of changing humidity on the reproducibility of pulled pipettes. A 25% increase in power over previous versions allows for the use of larger heating filaments, larger diameter glass and multi-barrel glass. The metal jaws that clamp the heating filament have also been redesigned to minimize heat retention. There are two modes of cooling: time and delay. The delay mode provides extended cooling for large diameter and multi-barrel glass. A spring-loaded clamping mechanism has been added for easier loading of glass. A vacuum fluorescent display has been added that allows easy viewing.

Software improvements on the P-97 include a display of the total heat-on time to assist in program development and troubleshooting. Up to 100 programs can now be written and stored in memory, which makes the P-97 suitable for multiple users. These programs can now be write-protected, adding security to prevent programs from being changed or altered inadvertently. The display shows the last date and time the program was written or edited. In addition, the air pressure is a programmable parameter.

* Patent No. 4,600,424



COMMON APPLICATIONS P-97

- Patch pipettes
- Sharp electrodes
- Pronuclear injection
- Zebrafish injection
- Insect Egg microinjection
- Aspiration pipettes

SPECIFICATIONS P-97

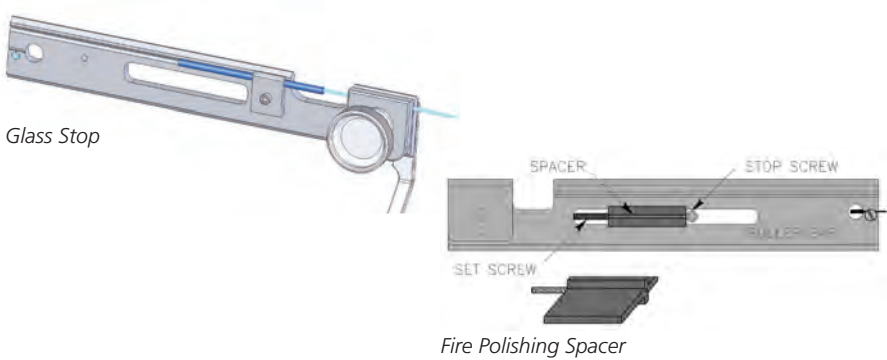
- **Dimensions** 21 in x 16 in x 12 in
53 cm x 40.6 cm x 30 cm
- **Weight** 50 lbs
23 kg
- **Electrical** 115/230 Volts
50/60 Hertz power line



REFERENCES P-97

These references describe the Flaming/Brown™ series of pullers and contain valuable information applicable to the P-97.

1. Brown, K.T. and Flaming, D.G. *Neurosciences Journal*: 2:813-827, 1977.
2. Flaming, D.G. and Brown, K.T., *Journal of Neuroscience Methods*: 6:91-102, 1982.
3. Brown, K.T. and Flaming, D.G., *Advanced Micropipette Techniques for Cell Physiology*. John Wiley and Sons. Great Britain, 1986.





US PRICES P-97

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

- | | | |
|---------------|--|-----------------|
| ■ P-97 | Flaming/Brown™ type micropipette puller, glass stop, manual, hard copy of Sutter Pipette Cookbook. | \$ 8,960 |
|---------------|--|-----------------|

Each puller comes with a FB255B filament and a sample box of BF150-110-10, BF100-50-10, and BF150-86-10 glass. Sutter pre-programs the P-97 with a 2.5 mm box filament unless an alternative filament is requested.

ACCESSORIES P-97

- | | | |
|-------------------------------|---|--------------|
| ■ FPS | Fire polishing spacer | \$ 30 |
| ■ GS-M¹ | Glass stop (Metric) | \$ 81 |
| ■ GS-I¹ | Glass stop (Imperial) | \$ 81 |
| ■ GC-M¹ | Glass clamps with grips (Metric) | \$ 53 |
| ■ GC-I¹ | Glass clamps with grips (Imperial) | \$ 53 |
| ■ CTS | Ceramic tile for scoring glass
(large tips 20 - 200 microns) | \$ 23 |
| ■ PET | Pipette examining tile | \$ 19 |
| ■ BX10² | Pipette storage box (holds 10)
4 3/4 in x 3 5/8 in x 3/4 in | \$ 18 |
| ■ BX20² | Pipette storage box (holds 20)
7 in x 3 5/8 in x 3/4 in | \$ 18 |
| ■ FILAMENT³ | Custom platinum/iridium filament | \$ 66 |
| ■ V400103 | Replacement Drierite (1 lb) | \$ 25 |

¹ Installs on either puller bar. Order Metric for serial numbers that include a "M" and Imperial for all others.

² Minimum order of any 2 boxes

³ Standard filaments found on page 23



Pipette storage box

P-30 VERTICAL MICROPIPETTE PULLER



FEATURES P-30

- Pulls electrodes with tip diameters down to 0.3 μm , consistently and reliably
- A micrometer allows precise reproducibility of trip point settings in producing fine microelectrodes
- Full three digit digital controls for accurate setting of heat and pull values
- Constant current power supplies for filament and pull solenoid
- Enclosed front to reduce variability caused by drafts
- Dual (manually) switched heat settings for patch pulling or two different types of micropipettes
- All working parts are made from corrosion resistant material
- Two heating assemblies available: platinum/iridium (recommended) or Nichrome coil
- Built-in RFI filter and dual voltage/dual frequency operation
- Rubber padded jaws to minimize breakage of capillary tubing
- Designed to take up minimal bench space
- Slope of the front panel aids in preventing glass from entering cabinet/solenoid mechanism



The model P-30 vertical micropipette puller is designed for the fabrication of basic micropipettes and patch-type pipettes. It will pull micropipettes with tip diameters as small as 0.3 μm and moderate taper lengths (6 mm to 10 mm). By using an included patching attachment, the P-30 will pull a patch-type pipette. But, for those needing very short tapers, high cone angles, and advanced reproducibility, one should consider the P-97 or the P-1000 micropipette pullers. Using thin or standard walled capillaries, the P-30 will generate suitable pipettes for microinjection studies. The P-30 is also ideal for student laboratories and other situations which call for an economical, reliable pipette pulling device.

The P-30 is available with either a platinum/iridium or a Nichrome filament. The Nichrome filament is suitable for many applications and is not prone to damage. The platinum filament is more efficient at heating and cooling, and, although it is more prone to damage than the Nichrome filament, the platinum filament is recommended for thick wall and aluminosilicate glass and applications requiring shorter taper lengths.



COMMON APPLICATIONS P-30

- C. elegans
- Xenopus
- Drosophila microinjection

SPECIFICATIONS P-30

- **Dimensions** 18 in x 10 in x 9 in
46 cm x 25 cm x 23 cm
- **Weight** 35 lbs
16 kg
- **Electrical** 115/230 Volts
50/60 Hertz power line



US PRICES P-30

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

- | | | |
|-----------------|---|-----------------|
| ■ P-30/P | Vertical micropipette puller with platinum/iridium filament | \$ 4,160 |
| ■ P-30/N | Vertical micropipette puller with Nichrome filament | \$ 4,160 |

Each puller comes with a sample box of BF100-50-10 glass, and manual. The P-30/P also comes with an additional filament.

ACCESSORIES P-30

- | | | |
|---------------------------------|--|---------------|
| ■ P-30-NFL/M¹ | Nichrome filament block assembly | \$ 237 |
| ■ P-30-PFL/M¹ | Platinum/iridium filament block assembly | \$ 237 |
| ■ PET | Pipette examining tile | \$ 19 |
| ■ BX10² | Pipette storage box (holds 10)
4 3/4 in x 3 5/8 in x 3/4 in | \$ 18 |
| ■ BX20² | Pipette storage box (holds 20)
7 in x 3 5/8 in x 3/4 in | \$ 18 |

¹ Only necessary when changing filament configuration

² Minimum order of any 2 boxes



MICROPIPETTE PULLER COMPARISON CHART



Features	P-1000	P-97	P-2000	P-30
Heat Source				
Platinum Filament with Safe Heat Mode	■			
Platinum Filament		■		
CO ₂ Laser			■	
Platinum or Nichrome Filament				■
Glass Type				
Borosilicate and Aluminosilicate	■	■	■	■
Quartz Glass or Fiber ¹			■	
Max. Glass Size (OD)				
4 mm	■	■		
2 mm				■
1.65 mm Quartz, 1.8mm Borosilicate			■	
Tip Size				
0.06 μ–3 μ	■	■		
0.01 μ–5 μ			■ (Fiber)	
0.03 μ–5 μ			■ (Glass)	
0.30 μ–2 μ				■
Max. Taper Length				
1 cm				■
1.8 cm			■	
2 cm	■	■		
Program Lines				
8		■	■	
1 Stage or 2 Stage with manual adjustment				■
4 plus Line Repeat Mode	■			
Type of Cooling				
Compressed Dry Air with Humidity Control Chamber	■	■		
NA (Laser On/Off)			■	
None				■
Usable Pipettes/Pull	2	2	2	1
Price²	\$9,379	\$8,960	\$18,255 (Glass) \$19,380 (Fiber)	\$4,160

1. Outer diameters < 600 μm require P-2000/F.

2. U.S. prices. International prices vary by country.



FILAMENTS / ACCESSORIES



There is a minimum purchase of 4 filaments.

Appropriate filament selection depends on your research application, but a general guideline for filaments is as follows:

Box Filaments are recommended for small to large diameter borosilicate glass, double barreled, or aluminosilicate glass. Box filaments are particularly suitable for patch pipettes, slice preparations, and for sharp electrodes and microinjection pipettes where gradual parallel walls would aid cell penetration. When using a box filament, the size of the square box should be approximately 1.0 mm to 1.5 mm larger than the outside diameter of the glass that you will be using.

For IVF and ICSI applications, a 2.5 mm x 4.5 mm box filament (FB245B) is recommended. For pronuclear injection work, we recommend a 2.5 mm x 2.5 mm box filament (FB255B). Call for more specific advice or to request a combination of settings, filaments, and glass for your application.

Trough Filaments are excellent general purpose filaments and are recommended for creating longer slice patch pipettes and sharp electrodes. The trough filament is not ideal for making patch pipettes or when using glass over 1.2 mm OD. If very short tapers are required for patch electrodes or for microinjection, a 2.5 mm or 3mm box filament is recommended.

Sutter pre-programs the P-1000 and P-97 with a 2.5 mm x 2.5 mm box filament unless an alternative filament is requested.

For either shape of filament (box or trough), increasing the filament width tends to increase the length of the pipette taper. If there are specific questions as to the filament type needed, please call and our technical support staff will guide you in your choice.

**BOX FILAMENTS**

P-1000, P-97, P-87, P80PC, P80C, PC-84, P-77B



FB215B	2.0 mm square box filament, 1.5 mm wide	\$ 45
FB220B	2.0 mm square box filament, 2.0 mm wide	\$ 45
FB230B	2.0 mm square box filament, 3.0 mm wide	\$ 45
FB255B	2.5 mm square box filament, 2.5 mm wide	\$ 45
FB245B¹	2.5 mm square box filament, 4.5 mm wide	\$ 45
FB315B	3.0 mm square box filament, 1.5 mm wide	\$ 45
FB320B	3.0 mm square box filament, 2.0 mm wide	\$ 45
FB330B	3.0 mm square box filament, 3.0 mm wide	\$ 45

TROUGH FILAMENTS

P-1000, P-97, P-87, P80PC, P80C, PC-84, P-77B



FT315B	1.5 mm wide trough filament	\$ 45
FT320B	2.0 mm wide trough filament	\$ 45
FT330B	3.0 mm wide trough filament	\$ 45
FT345B	4.5 mm wide trough filament	\$ 45

P-30 FILAMENTS

PF30T15	1.5 mm wide trough filament	\$ 45
PF30T20	2.0 mm wide trough filament	\$ 45
PF30T30	3.0 mm wide trough filament	\$ 45
PF30N²	Nichrome filament (3 turns)	\$ 45
PF30N-4²	Nichrome filament (4 turns)	\$ 45

**P-77A LOOP FILAMENTS**

(Serial number 160 and above)



FL315A	3.0 mm loop filament, 1.5 mm wide	\$ 45
FL320A	3.0 mm loop filament, 2.0 mm wide	\$ 45
FL325A	3.0 mm loop filament, 2.5 mm wide	\$ 45

(Serial number below 160)

FL315X	3.0 mm loop filament, 1.5 mm wide	\$ 45
FL320X	3.0 mm loop filament, 2.0 mm wide	\$ 45
FL325X	3.0 mm loop filament, 2.5 mm wide	\$ 45

ACCESSORIES

FILAMENT	Custom platinum/iridium filament	\$ 66
FPS	Fire polishing spacer (P-2000, P-97, P-87)	\$ 30
FS1875	Platinum/iridium sheet, 18 mm x 75 mm x 0.05 mm (40 μ)	\$ 392
CTS	Ceramic tile for scoring glass (large tips 20-200 microns)	\$ 23
BX10	Pipette storage box (holds 10) 4 3/4 in x 3 5/8 in x 3/4 in	\$ 23
BX20	Pipette storage box (holds 20) 7 in x 3 5/8 in x 3/4 in	\$ 23

¹ For P-87, please contact Sutter.

² P-30/N pullers (serial number lower than P-30-680) came with a P30N filament installed. You can now select either the P30N or P30N4 filament. With the P30N4 you can 1) use lower heat settings, 2) pull longer tapers (2-3 cm) and 3) use aluminosilicate glass. If you need to pull very short tapers, the P30N is recommended.



BV-10

MICROELECTRODE BEVELER



(BV-10-D with optional 40X stereo microscope)

FEATURES BV-10

- Vibration-free, magnetically coupled beveling surface
- Abrasive surface optically flat to a half wave (250 nm)
- Finest abrasive surface commercially available
- Synchronous clock motor insures stable rotation rate
- 7 pound steel baseplate adds additional dampening
- Integrated LED lamp
- Robust micromanipulator controls bevel angle and advancement

COMMON APPLICATIONS BV-10

- Deep brain injections
- ES cell and ICSI procedures
- C. elegans injections
- Fish and insect egg injections



Elegant and simple to use, the BV-10 offers precision beveling of micropipette tips between 0.1 μm and 100 μm . The unique abrasive plate drive system is vibration free for greater control of the beveling process. Beveling can be accomplished very rapidly and produces consistent tip diameters using the techniques as described by Brown and Flaming, *Science*, August 1974, Vol. 185.

Intracellular recording electrodes can benefit from beveling because of 1) a reduction in the tip diameter by creation of the sharp point on the electrode and 2) a lowered electrical resistance of the electrode due to the larger cross sectional area of the lumen. This greatly facilitates penetrating and holding very small or difficult cells. Microinjection needles also benefit from beveling by promoting entry into cells with minimal damage while at the same time enhancing the flow of material through the needle.

The basic beveling system consists of a stationary pedestal, optically flat to a half wave (250 nm), surface mounted on a heavy baseplate. This serves as a bearing for an abrasive coated glass grinding plate, which is also flat to half a wave. The flat abrasive plate is coupled to a low vibration, slow-speed motor by means of magnetic fields to provide a wobble-free flat grinding surface. The abrasive plates are fabricated with a proprietary process which insures a consistent abrasive coating.

A 2-axis micromanipulator holds the pipette to be beveled and permits controlled advancement onto the abrasive surface. The bevel angle and speed of advancement are adjustable. An integrated LED lamp with a gooseneck enhances the beveling operation by providing sharp illumination of the abrasive plate and pipette.

The basic system comes with two abrasive plates of your choice, a wick with holder (for wet beveling), pedestal oil, degreasing fluid, and manual.

Two *options* are available for monitoring the beveling process: an 40X stereo microscope, and an electrode impedance meter. Depending on your research application, one or both of these options may be desirable. For all micropipette applications, the swing mounted microscope enhances your control of pipette advancement onto the abrasive plate and allows for viewing of the beveling operation (scope resolution is not sufficient for viewing the actual bevel except in the case of very large tips). For microelectrode applications, the impedance meter is used to monitor the tip resistance during the beveling operation. The meter is an analog design, offering three resistance ranges (0–10 MOhm, 0–100 MOhm, 0–500 MOhm). Measurements are made at 12 Hz to minimize capacitive contributions to the impedance measured and provide a near-true DC resistance value. A rapid roll-off is used to reduce 50/60 Hz interference, allowing operation in a laboratory environment without screening.



SPECIFICATIONS BV-10

■ Bevel Range	0.1 μm through 100 μm finished electrodes depending on abrasive plate used
■ Grinding Surface Variation	Less than 1.0 μm
■ Grinding Speed	60 RPM
■ Bevel Angle Range	5–90 degrees — adjustable
■ Micromanipulator	Course drive: 0.075 in / dial revolution Fine drive: 0.0004 in / dial revolution
■ Dimensions	19 in x 9 in x 8 in 48 cm x 22 cm x 20 cm
■ Weight	Approx. 45 lbs / 20 kg
■ Electrical	100/120 or 200/240 Volts 50/60 Hz power line



OPTIONS

- 40X stereo microscope
- Impedance meter for real-time measurement of tip impedance



(Shown: BVM-CE)

**US PRICES BV-10**

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

■ BV-10-B¹	Micropipette beveler basic system	\$ 3,640
■ BV-10-C	BV-10-B with electrode impedance meter	\$ 4,725
■ BV-10-D	BV-10-B with 40X stereo microscope	\$ 4,725
■ BV-10-E	BV-10-B with impedance meter and 40X stereo microscope	\$ 5,825

¹*Includes micromanipulator, reference wick, reference wick holder, pedestal oil, degreaser, manual, and two abrasive plates of your choice*

ACCESSORIES BV-10

■ BVM-CE	Electrode impedance meter with active and reference lead	\$ 1,675
■ BV-10S	40X stereo microscope	\$ 1,120
■ 104C	Diamond abrasive plate – coarse (5.0 µm to 50 µm tip sizes)	\$ 181
■ 104D	Diamond abrasive plate – fine (2.0 µm to 20 µm tip sizes)	\$ 181
■ 104E	Diamond abrasive plate – very fine (0.7 µm to 2.0 µm tip sizes)	\$ 181
■ 104F	Diamond abrasive plate – extra fine (0.2 µm to 1.0 µm tip sizes)	\$ 181
■ 007	Degreaser (bottle)	\$ 20
■ 008	Beveler pedestal oil	\$ 20

REPLACEMENT PARTS BV-10

■ 101	6-inch reference lead (body to meter)	\$ 20
■ 102	2-inch active lead (platinum to pipette)	\$ 20
■ X050300	Reference wick	\$ 17
■ M100019	Reference wick holder	\$ 40
■ H906100	Drive belt	\$ 30
■ O740130	Reticle grid for BV-10S scope 5mm scale / 100 divisions	\$ 128
■ PEDESTAL	Pedestal plates (top and bottom)	\$ 838

MICROPIPETTE TECHNIQUES

ADVANCED MICROPIPETTE TECHNIQUES FOR CELL PHYSIOLOGY

KENNETH T. BROWN

University of California at
San Francisco

DALE FLAMING

Sutter Instrument Company,
Novato, CA.



Fine glass micropipettes are extensively used in intra- and extracellular physiology as a means of recording electrical activity in cells and as channels for injecting a variety of substances for experimental purposes. In 1973, the authors began a course of systematic studies designed to help them improve the capabilities and efficiency of intracellular research using the micropipette technique. Here, they present for the first time their theory of how micropipette tips are formed, their methods of reducing tip size, and the implications of their work for research on small cells of all kinds, especially cells within the central nervous system. This text not only incorporates this new work, but reviews and analyzes existing publications on micropipette methodology, including patch-clamping, in order to present as complete an account as possible of how micropipettes can be used efficiently and effectively in a wide variety of experimental situations. The information presented here should prove helpful to anyone performing research with micropipettes, from a graduate student conducting a first project to the most experienced investigator.



CONTENTS

Early Methods of Fabricating Micropipettes	Ancillary Techniques for Conducting Intracellular Research
The Flaming/Brown™ Micropipette Puller: Its Background, Design and Underlying Principles	Evaluation of Improved Intracellular Recording Techniques in Vertebrate Photoreceptors
Techniques for Examining and Measuring Micropipette Tips by Scanning Electron Microscopy	Evaluation of Tubing Designs for Intracellular Work
Evaluation of Flaming/Brown Micropipette Puller	The Structure Properties of Glasses for Fabricating Micropipettes
A Theory of Micropipette Tip Formation: Quantitative Prediction and Validation of the Effects of Capillary Wall Thickness Upon Tip Size	Dual-Channel Micropipettes
Effects of a Fused Internal Fiber (Omega Dot) Upon Micropipette Tips	The Burgeoning Field of Patch Clamping
Minimizing Tip Size With Borosilicate Tubing	Extension of the Flaming/Brown Micropipette Puller to Patch Clamping and Conveniently Handling Aluminosilicate Glass
Beveling Micropipette Tips: Techniques and Applications	References
Filling Micropipettes: Techniques and Solutions Advancing Micropipettes Through Tissues and Into Cells	Appendices

US PRICES BOOK

*International prices vary by country. Please contact your local distributor
or Sutter Instrument for a quotation. Prices subject to change without notice.*

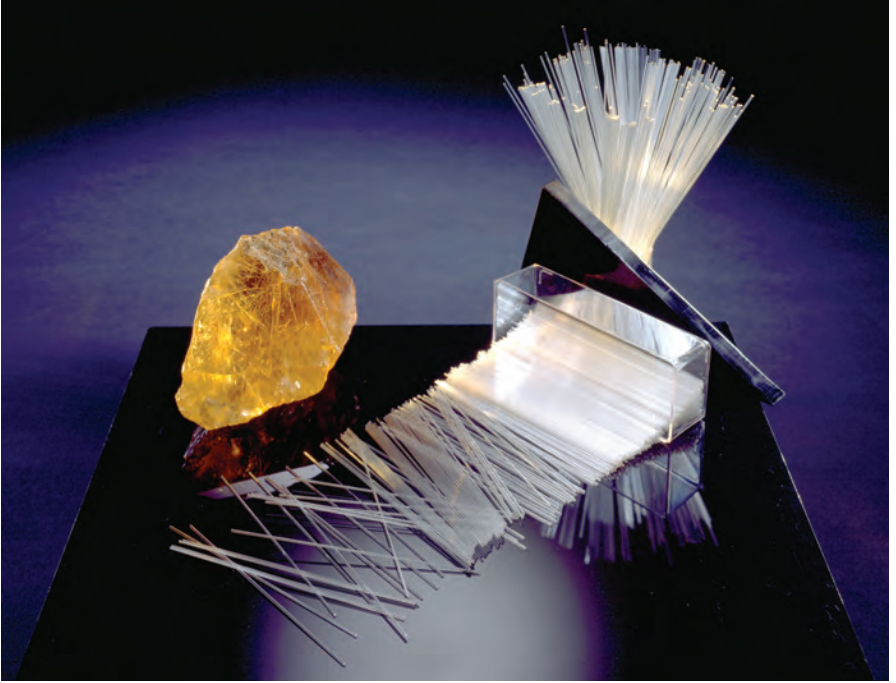
■ BOOK

*Advanced Micropipette Techniques
For Cell Physiology*

\$ 50



GLASS CAPILLARY TUBING



Sutter Instrument, in addition to the finest micropipette pullers available, offers a wide selection of high quality glasses in various sizes and materials. Though there are many types and sizes of glass available, we have carefully selected only those that pass our criteria. Our expertise in micropipette technology assures you of precision and high quality.

We offer capillary tubing in three different compositions: quartz, borosilicate and aluminosilicate. Each composition has its own unique properties and the selection will be determined by your application and your puller's capabilities.

Filamented glass has a small rod of glass annealed to the inner wall and this rod (filament of glass) creates the capillary action required to back-fill the pipette with solution. If the resulting pipette tip is under 1 μl and being used for microinjection or recording, we recommend "filamented-glass." The filament in the glass not only provides capillary action for quick filling of the micropipette, it also helps to reduce the incidence of air bubbles when introducing solution into the pipette. If you have any additional concerns, please contact Sutter for technical support.

FIRE POLISHING

All borosilicate and aluminosilicate capillary glass offered by Sutter Instrument has fire-polished ends. This process eliminates any sharp edges, making it easier to insert into holders, and does not affect the electrical or mechanical properties of the glass.

CUSTOM PIPETTES

Sutter Instrument can make custom pipettes and microtools not commonly available from other pipette manufacturers. For example, we make custom pre-pulled beveled pipettes for microinjection. The custom pipettes are considered non-sterile and are manufactured for research applications and non-human use. Please contact Sutter Instrument for further details.

BOROSILCATE (CORNING 7740)

The most commonly used glass is borosilicate. Sutter Instrument offers only TYPE I-CLASS A borosilicate as described by ASTM Standard 3.1.2¹. This glass softens at 821 degrees Celsius and, as it is pulled, maintains its ratio of inside diameter to outside diameter over the total taper length. Borosilicate softens at a lower temperature than our other glasses and has a wider working range. These unique properties allow for a greater variety of shapes used in microelectrodes, patch pipettes, microinjection needles and, in the case of solid rod, chromosome dissection tools.

ALUMINOSILICATE (SCHOTT 8252)

Aluminosilicate softens at a higher temperature (935 degrees Celsius) than borosilicate and is workable over a much narrower range. It has a tendency to continuously thin out as it is drawn which allows extremely fine tips with very short tapers. For example, we have pulled aluminosilicate tips in the 20 – 30 nanometer range with taper lengths of 5 mm to 6 mm. Its resistivity is several orders of magnitude higher than borosilicate, thus reducing leakage currents when used in ion-selective micropipettes. Aluminosilicate is harder than borosilicate which results in a pipette that is more suitable for penetrating tough tissues.

QUARTZ (HERAEUS HSQ300)

The finest and purest glass available is quartz. It is superior to all other glasses in its mechanical, electrical and optical qualities. It has the lowest dielectric constant, the lowest loss factor and the highest volume resistivity making it ideal for patch clamp recording. Its chemical purity virtually eliminates leakage of ions² and by using quartz in single channel patch clamp recordings the lowest background noise levels have been achieved³. Due to its high melting point, it cannot be pulled on conventional pullers, but can be easily pulled with the Sutter CO₂ laser-based P-2000.

SIZES

Sutter Instrument capillary tubing is available in a broad range of wall thicknesses which allows you to select the size necessary for your application. The ratios of inside diameter to outside diameter typically run between 0.5 mm and 0.75 mm with the lower value being referred to as thick wall tubing and the top of the range as thin wall tubing. All other factors being equal, the thicker wall capillaries produce pipettes with longer tapers and smaller tips which make it more suitable for intracellular microelectrodes. These thicker wall pipettes tend to reduce the noise contributions due to capacitance, which makes them more suitable for patch clamp pipettes. Thinner wall tubing allows for larger pore openings which makes it ideal for microinjection needles and low resistance microelectrodes.

¹ ASTM Designation E438-90 - April 1990.

² Zuzaga C., Steinacker A. Patch-clamp recording of ion channels: Interfering effects of patch pipette glass. *News in Physiological Sciences: International Union of Physiological Sciences and the American Physiological Society*: 5:155-158, August 1990.

³ Rae, James L., Levis Richard A. A Method for exceptionally low noise single channel recordings. *Pflügers Archive; European Journal of Physiology*:420:618-620, Springer-Verlag 1992.



THICK / STANDARD WALLED BOROSILICATE GLASS

WITH FILAMENT

catalog number	outside diameter	inside diameter	overall length	pieces per package	price
BF100-50-7.5	1.00 mm	0.50 mm	7.5 cm	225	\$ 58
BF100-50-10	1.00 mm	0.50 mm	10 cm	225	\$ 54
BF100-50-15	1.00 mm	0.50 mm	15 cm	225	\$ 66
BF100-58-10	1.00 mm	0.58 mm	10 cm	250	\$ 53
BF100-58-15	1.00 mm	0.58 mm	15 cm	250	\$ 63
BF120-60-10	1.20 mm	0.60 mm	10 cm	225	\$ 60
BF120-69-7.5	1.20 mm	0.69 mm	7.5 cm	250	\$ 58
BF120-69-10	1.20 mm	0.69 mm	10 cm	250	\$ 60
BF120-69-15	1.20 mm	0.69 mm	15 cm	250	\$ 64
BF150-75-7.5	1.50 mm	0.75 mm	7.5 cm	225	\$ 64
BF150-75-10	1.50 mm	0.75 mm	10 cm	225	\$ 60
BF150-86-7.5	1.50 mm	0.86 mm	7.5 cm	250	\$ 57
BF150-86-10	1.50 mm	0.86 mm	10 cm	250	\$ 54
BF150-86-15	1.50 mm	0.86 mm	15 cm	250	\$ 99
BF200-100-10	2.00 mm	1.00 mm	10 cm	225	\$ 103
BF200-116-10	2.00 mm	1.16 mm	10 cm	250	\$ 111
BF200-116-15	2.00 mm	1.16 mm	15 cm	250	\$ 112

WITHOUT FILAMENT

catalog number	outside diameter	inside diameter	overall length	pieces per package	price
B100-20-10¹	1.00 mm	0.20 mm	10 cm	225	\$ 125
B100-50-10	1.00 mm	0.50 mm	10 cm	225	\$ 55
B100-50-15	1.00 mm	0.50 mm	15 cm	225	\$ 94
B100-58-10	1.00 mm	0.58 mm	10 cm	250	\$ 55
B100-58-15	1.00 mm	0.58 mm	15 cm	250	\$ 57
B114-53-10NP²	1.14 mm	0.53 mm	10 cm	225	\$ 100
B120-69-8	1.20 mm	0.69 mm	8 cm	250	\$ 51
B120-69-10	1.20 mm	0.69 mm	10 cm	250	\$ 57
B120-69-15	1.20 mm	0.69 mm	15 cm	250	\$ 55
B150-86-7.5	1.50 mm	0.86 mm	7.5 cm	250	\$ 55
B150-86-10	1.50 mm	0.86 mm	10 cm	250	\$ 59
B150-86-15	1.50 mm	0.86 mm	15 cm	250	\$ 91
B200-116-10	2.00 mm	1.16 mm	10 cm	250	\$ 84
B200-116-15	2.00 mm	1.16 mm	15 cm	250	\$ 93

¹ The ends are not fire-polished. Special order minimum of 2.

² Nanoinjection glass. Ends are not firepolished.



HEAVY POLISHED THICK / STANDARD AND THIN WALLED GLASS¹

WITH FILAMENT

catalog number	outside diameter	inside diameter	overall length	pieces per package	price
BF150-86-7.5HP	1.50 mm	0.86 mm	7.5 cm	250	\$ 62
BF150-86-10HP	1.50 mm	0.86 mm	10 cm	250	\$ 62
BF150-110-7.5HP	1.50 mm	1.10 mm	7.5 cm	225	\$ 62
BF150-110-10HP	1.50 mm	1.10 mm	10 cm	225	\$ 62

WITHOUT FILAMENT

catalog number	outside diameter	inside diameter	overall length	pieces per package	price
B100-30-7.5HP	1.00 mm	0.30 mm	7.5 cm	225	\$ 68
B100-50-7.5HP	1.00 mm	0.50 mm	7.5 cm	225	\$ 65
B150-86-7.5HP	1.50 mm	0.86 mm	7.5 cm	250	\$ 62
B150-86-10HP	1.50 mm	0.86 mm	10 cm	250	\$ 64
B150-110-7.5HP	1.50 mm	1.10 mm	7.5 cm	225	\$ 62
B150-110-10HP	1.50 mm	1.10 mm	10 cm	225	\$ 62

¹ Useful for added protection of gaskets and wire in headstages.

THIN WALLED BOROSILICATE GLASS

WITH FILAMENT

catalog number	outside diameter	inside diameter	overall length	pieces per package	price
BF100-78-10	1.00 mm	0.78 mm	10 cm	250	\$ 56
BF100-78-15	1.00 mm	0.78 mm	15 cm	250	\$ 65
BF120-94-8	1.20 mm	0.94 mm	8 cm	250	\$ 59
BF120-94-10	1.20 mm	0.94 mm	10 cm	250	\$ 57
BF120-94-15	1.20 mm	0.94 mm	15 cm	250	\$ 68
BF150-110-7.5	1.50 mm	1.10 mm	7.5 cm	225	\$ 53
BF150-110-10	1.50 mm	1.10 mm	10 cm	225	\$ 52
BF150-117-10	1.50 mm	1.17 mm	10 cm	250	\$ 53
BF150-117-15	1.50 mm	1.17 mm	15 cm	100	\$ 52
BF150-120-10	1.50 mm	1.20 mm	10 cm	250	\$ 47
BF165-120-7.5	1.65 mm	1.20 mm	7.5 cm	225	\$ 47
BF165-120-10	1.65 mm	1.20 mm	10 cm	225	\$ 59
BF200-156-10	2.00 mm	1.56 mm	10 cm	250	\$ 65
BF200-156-15	2.00 mm	1.56 mm	15 cm	100	\$ 71

WITHOUT FILAMENT

catalog number	outside diameter	inside diameter	overall length	pieces per package	price
B100-75-10	1.00 mm	0.75 mm	10 cm	225	\$ 55
B100-75-15	1.00 mm	0.75 mm	15 cm	225	\$ 61
B120-90-8	1.20 mm	0.90 mm	8 cm	225	\$ 53
B120-90-10	1.20 mm	0.90 mm	10 cm	225	\$ 53
B120-90-15	1.20 mm	0.90 mm	15 cm	225	\$ 53
B150-110-7.5	1.50 mm	1.10 mm	7.5 cm	225	\$ 53
B150-110-10	1.50 mm	1.10 mm	10 cm	225	\$ 51
B150-117-10	1.50 mm	1.17 mm	10 cm	250	\$ 62
B200-156-10	2.00 mm	1.56 mm	10 cm	250	\$ 56
B200-156-15	2.00 mm	1.56 mm	15 cm	100	\$ 62



MULTI-BARREL BOROSILICATE¹ GLASS

WITH FILAMENT

catalog number	outside diameter	inside diameter	overall length	pieces per package	price
2BF100-50-10	2 barrels	1.00/0.50	10 cm	75	\$ 63
2BF100-75-10	2 barrels	1.00/0.75	10 cm	75	\$ 63
2BF150-86-10	2 barrels	1.50/0.86	10 cm	100	\$ 68
2BF150-86-15	2 barrels	1.50/0.86	15 cm	100	\$ 88
3BF100-50-10	3 barrels	1.00/0.50	10 cm	75	\$ 68
3BF100-75-10	3 barrels	1.00/0.75	10 cm	75	\$ 68
3BF120-69-10	3 barrels	1.20/0.69	10 cm	100	\$ 65
3BF120-69-15	3 barrels	1.20/0.69	15 cm	100	\$ 88

WITHOUT FILAMENT

catalog number	number of barrels	outside/inside diameter	overall length	pieces per package	price
3B100-75-10	3 barrels	1.00/0.75	10 cm	75	\$ 68
4B100-75-10	4 barrels	1.00/0.75	10 cm	75	\$ 71

¹ Multibarrel borosilicate requires a custom filament. Please contact Sutter Instrument for more information when ordering.

QUARTZ GLASS

WITH FILAMENT

catalog number	outside diameter	inside diameter	overall length	pieces per package	price
QF100-50-7.5	1.00 mm	0.50 mm	7.5 cm	100	\$ 133
QF100-50-10	1.00 mm	0.50 mm	10 cm	100	\$ 191
QF100-60-7.5	1.00 mm	0.60 mm	7.5 cm	100	\$ 133
QF100-60-10	1.00 mm	0.60 mm	10 cm	100	\$ 184
QF100-70-7.5	1.00 mm	0.70 mm	7.5 cm	100	\$ 154
QF100-70-10	1.00 mm	0.70 mm	10 cm	100	\$ 184
QF100-70-15	1.00 mm	0.70 mm	15 cm	100	\$ 202
QF120-60-7.5	1.20 mm	0.60 mm	7.5 cm	100	\$ 155
QF120-60-10	1.20 mm	0.60 mm	10 cm	100	\$ 191
QF120-90-10	1.20 mm	0.90 mm	10 cm	100	\$ 137
QF150-75-7.5	1.50 mm	0.75 mm	7.5 cm	100	\$ 137
QF150-75-10	1.50 mm	0.75 mm	10 cm	100	\$ 152

WITHOUT FILAMENT

catalog number	outside diameter	inside diameter	overall length	pieces per package	price
Q100-30-7.5	1.00 mm	0.30 mm	7.5 cm	100	\$ 138
Q100-30-15	1.00 mm	0.30 mm	15 cm	100	\$ 145
Q100-50-7.5	1.00 mm	0.50 mm	7.5 cm	100	\$ 133
Q100-50-10	1.00 mm	0.50 mm	10 cm	100	\$ 178
Q100-70-7.5	1.00 mm	0.70 mm	7.5 cm	100	\$ 124
Q100-70-10	1.00 mm	0.70 mm	10 cm	100	\$ 178
Q114-53-10NP*	1.14 mm	0.53 mm	10 cm	100	\$ 180
Q120-40-7.5	1.20 mm	0.40 mm	7.5 cm	100	\$ 209
Q120-60-7.5	1.20 mm	0.60 mm	7.5 cm	100	\$ 184
Q120-90-7.5	1.20 mm	0.90 mm	7.5 cm	100	\$ 158
Q120-90-10	1.20 mm	0.90 mm	10 cm	100	\$ 209
Q150-50-7.5	1.50 mm	0.50 mm	7.5 cm	100	\$ 191
Q150-75-7.5	1.50 mm	0.75 mm	7.5 cm	100	\$ 133
Q150-75-10	1.50 mm	0.75 mm	10 cm	100	\$ 143
Q150-110-10	1.50 mm	1.10 mm	10 cm	100	\$ 209
Q165-115-10	1.65 mm	1.15 mm	10 cm	100	\$ 184

* The ends are not fire-polished. Nanoinjection glass.



SOLID QUARTZ ROD

catalog number	outside diameter	inside diameter	overall length	pieces per package	price
QR-100-7.5	solid	1.00 mm	7.5 cm	100	\$ 86
QR-100-10	solid	1.00 mm	10 cm	100	\$ 86
QR-100-15	solid	1.00 mm	15 cm	100	\$ 86

QUARTZ THETA GLASS

catalog number	outside diameter	inside diameter	overall length	pieces per package	price
QT120-90-7.5	1.20/0.9 mm	0.15 mm	7.5 cm	50	\$ 91

MULTI-BARREL GLASS

catalog number	number of barrels	outside/inside diameter	overall length	pieces per package	price
7Q033-16-10	7 barrel	1.00/[.33/16 ea]	10 cm	50	\$ 255

ALUMINOSILCATE GLASS

WITH FILAMENT

catalog number	outside diameter	inside diameter	overall length	pieces per package	price
AF100-64-10	1.00 mm	0.64 mm	10 cm	100	\$ 145
AF120-77-10	1.20 mm	0.77 mm	10 cm	100	\$ 145
AF120-87-10	1.20 mm	0.87 mm	10 cm	100	\$ 145
AF150-100-10	1.50 mm	1.00 mm	10 cm	100	\$ 145

WITHOUT FILAMENT

catalog number	outside diameter	inside diameter	overall length	pieces per package	price
A100-64-10	1.00 mm	0.64 mm	10 cm	100	\$ 124
A120-77-10	1.20 mm	0.77 mm	10 cm	100	\$ 124
A120-87-10	1.20 mm	0.87 mm	10 cm	100	\$ 124
A150-100-10	1.50 mm	1.00 mm	10 cm	100	\$ 124

BOROSILICATE THETA GLASS

catalog number	outside diameter	inside diameter	overall length	pieces per package	price
BT-150-10	1.50/1.17 mm	0.165 mm	10 cm	100	\$ 106

SOLID BOROSILICATE ROD

catalog number	outside diameter	inside diameter	overall length	pieces per package	price
BR-100-10	solid	1.00 mm	10 cm	250	\$ 65
BR-100-15	solid	1.00 mm	15 cm	250	\$ 70

MICROMANIPULATION

Micromanipulator design at Sutter began in 1985 with the MP-85, a refined and extended Huxley-style micromanipulator. From that time on, the Company has continued to develop manipulators with stepper-motor drive mechanisms and ergonomic controllers that are adaptable to many different experimental designs and platforms. This design process has yielded multiple motorized manipulators, the industry standard MP-285, the MP-225, the narrow format MP-265, Xenoworks® microinjection manipulators, the four axis QUAD®, and the three-axis TRIO™.

Researchers performing complex experiments are now able to control multiple motorized manipulators with the MPC-200 controller. This controller is capable of operating any two of Sutter's three axis motorized manipulators and can be expanded to run four manipulators off a single ROE-200 input device. This highly flexible solution allows the user to add components to their system as needed.

The newly designed QUAD has a motorized fourth axis in addition to the X, Y, and Z axes, to move the pipette coaxially at the desired angle. This choice is perfect for users that need a true diagonal. The

compact ROE and controller-in-one is easy to use, has built-in robotic capabilities, and a USB port to program more complicated moves.

The TRIO utilizes the lead-screw design of the QUAD in a more traditional three-axis micromanipulator. The TRIO may be configured in either an XYZ configuration (MP-845) or it may be configured with an XY-Diagonal configuration (MP-835). The TRIO controller is uniquely capable of synthesizing a diagonal or Z-axis on the respective manipulators giving both true 4-axis capabilities.

As time has shown, much of what makes a device popular is how easily it can be incorporated into an existing set-up. In the case of micromanipulators, this process has involved designing manipulator platforms that bolt directly to the frames of the most popular microscopes. Alternatively, Sutter also offers rock-steady, freestanding platforms that support its manipulators



by clamping to the table beside the microscope. Our MT-70 stand, originally designed for stable support of the 15-pound Huxley manipulator, and MT-75 gantry-style stand, are perfect freestanding platforms for our manipulators. We have also designed the MD series microscope-specific platforms that bolt directly to the bodies of the most popular Leica, Nikon, Olympus, and Zeiss inverted microscopes. These platforms lend themselves to the low-drift recording configuration required when using Sutter manipulators for positioning patch-electrodes onto attached cells in culture.

The 3DMS, 3-Dimensional motorized stage was designed for experiments that require rapid movement of a chamber or culture dish to multiple locations in a compact space. Two axes provide X-Y translation, and the third axis provides built-in focusing

with sub-micron accuracy. The 3DMS offers robotic programmability of complex motion sequences when used with the MP-285 controller.

A task specific platform for manipulators is the MT-1000 translation system. When coupled with MP-285 or MP-225 manipulators, the system forms a slice-patch workstation. The MT-1000 was born out of a technique now common in slice recording that moves the optical pathway while keeping the slice chamber and recording electrodes fixed. The translation system allows the user to move to multiple locations on the tissue at high resolution without disturbing recording electrodes. The MT-1000 workstation encompasses: an X-Y translator designed to move a microscope smoothly and accurately; two MT-75 gantry-type stands for positioning manipulators on one or both sides of the microscope; and a third gantry stand that becomes the fixed support for the chamber. The MT-2000 uses a motorized X-Y translator. In this design, stepper-motor driven lead screws provide smooth movement of the microscope.

Sutter's large motorized platform stages, the MP-78 and MPC-78, are perfect for multisite experiments where the microscope cannot be translated and a wide field of view is necessary. The MT-78-FS large fixed-stage platform provides the same generous mounting surface for experiments dependent on XY translation.

Rounding out our company's line of manipulators is the MM-33 manual micromanipulator, an economical micromanipulator of sufficient resolution and control for impaling xenopus oocytes and other medium-fine manipulation tasks.



TRIO™ MPC-100 SYSTEMS

THREE-AXIS MICROMANIPULATOR SYSTEM

New



(Shown: TRIO MPC-145-2 with Sutter dPatch® headstage (not included))

FEATURES TRIO™ MPC-100 CONTROLLER

- Controls one or two manipulators
- Sub-micron (less than 100 nm) resolution
- User selectable angle from 0 - 90 degrees via ROE input
- Fast movement with a top speed of 3 mm/sec (while homing)
- Compact, fanless, user-friendly, ROE controller preserves bench and rack space
- Push button control of multiple functions – WORK, HOME, LOCK, PULSE, RELATIVE, SPEED & ANGLE
- DIP switches on ROE select direction of movement produced by turn of ROE knob
- USB interface for computer control

FEATURES TRIO™ MP-845 MECHANICAL

- Now also available in thermally stable stainless steel
- Mechanically robust construction for high stability
- Precision cross-roller bearings
- Three independent axes – 25 mm orthogonal travel in X, Y and Z
- Carries up to a kilogram
- Suited for *in vivo* and *in vitro* electrophysiological recording
- Universal mounting system for headstage or pipette holder



Based on the original TRIO™ manipulator, the latest TRIO MPC-100 system expands TRIOs capabilities, and now supports up to TWO manipulators from a single controller.

The compact design of the integrated Rotary Optical Encoder (ROE) controller requires 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 MPC-100 uses 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 controller. When not moving, the motors are powered down, reducing electrical noise in the system to unmeasurable levels which keeps the motors cool to eliminate thermal drift.

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 4th axis angle between 0 and 90 degrees.

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. A Y-axis lockout function (accessible by DIP switch) is also available, allowing X/Z-only axial movement during HOME and WORK repositioning. The TRIO comes standard with a universal mounting system suitable for the most popular headstages or pipette holders.

The new MP-845 micromanipulator features construction based on the TRIO-245, but with the addition of precision cross-roller bearings for even tighter tolerances, and a 25-pin connector for future compatibility with our other controllers. The MP-845 is a highly stable 3-axis manipulator with 25 mm of travel on each axis. The TRIO MPC-100 controller gives the MP-845 a synthetic 4th axis that can be set in software to any angle between 0 and 90 degrees for diagonal movement. Based on a lead-screw design with a smaller overall size and footprint than most manipulators, the MP-845 is ideal for applications that require 2 pipettes in one setup or for setups where space is limited.

The MP-845 manipulator is now also available in stainless steel! The standard version of the MP-845 has virtually no drift in its motor and bearing assemblies. The last remaining hurdle is that of thermal drift caused by the expansion and contraction of the aluminum body of the manipulator. By utilizing a stainless steel with very low coefficient of expansion, the MP-845S is simply the lowest drift manipulator available on the market. The added mass of the stainless steel body has the additional benefit of dampening out vibration, giving the stainless MP-845S the silkier movement of any manipulator.

Because low expansion stainless steels do have some ferric content, the stainless MP-845S is PVD coated in titanium nitride, giving it its distinctive gold color. This coating will ensure that the stainless trio will resist corrosion caused by exposure to salt solutions in a lab environment.



(TRIO MP-845S)

SPECIFICATIONS TRIO™ MPC-100 SYSTEMS

■ Travel	<i>TRIO MP-845 and TRIO MP-845S:</i> 25 mm on X, Y and Z axes
■ Long Term Stability	<1 micron in 4 hours
■ Control Box Dimensions	<i>TRIO MPC-100:</i> 6.25 in x 8 in x 5.9 in (15.9 cm x 20.3 cm x 10.2 cm)
■ Manipulator Weight	<i>TRIO MP-845 (aluminum):</i> 3.5 lbs (1.6 kg) <i>TRIO MP-845S (stainless steel):</i> 7.7 lbs (3.5 kg) <i>TRIO MPC-100 Controller:</i> 2.3 lbs (1.04 kg)
■ Electrical	115/230 Volts 50/60 Hertz power line



**US PRICES TRIO™ MPC-100 SYSTEMS**

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

ALUMINUM		
■ MPC-145	One MP-845 manipulator mechanical, one TRIO MPC-100 controller, mounting adapter plate, rod holder, hinged headstage mount, 4 inch dovetail extension, manipulator connecting cables, power cord and manual (please specify right or left handed)	\$ 7,950
■ MPC-145-2	TRIO MPC-145 with (2) MP-845 mechanicals (please specify right or left handed)	\$ 13,850
STAINLESS STEEL		
■ MPC-145S	One MP-845S manipulator mechanical in stainless steel, one TRIO MPC-100 controller, mounting adapter plate, rod holder, hinged headstage mount, 4 inch dovetail extension, manipulator connecting cables, power cord and manual (please specify right or left handed)	\$ 10,375
■ MPC-145S-2	TRIO MPC-145 with (2) stainless steel MP-845S mechanicals (please specify right or left handed)	\$ 18,830S
FIXED STAGE PLATFORM		
■ MT-78-FS	Fixed platform stage with imperial/standard holes, chamber insert and gantry supports	\$ 3,900
■ MT-78-FS/M6	Same as above with M6 tapped holes	\$ 3,900
MANIPULATOR COLUMNS		
■ MT-75	Standard gantry stand 8.7 to 13.4in (22.1 to 33.9 cm)	\$ 843
■ MT-75S	Short gantry stand 6.7 to 9.6 in (16.9 to 24.4 cm)	\$ 843
■ MT-75T	Tall gantry stand 10.7 to 15.4 in (27.1 to 39.1 cm)	\$ 960
■ MT-75XT	Extra tall gantry stand 14.7 to 18.5 in (37.4 to 47 cm)	\$ 960

For detailed information on mounting our micromanipulators, refer to the Mounting Systems section or phone for assistance.

ACCESSORIES TRIO™ MPC-100 SYSTEMS

■ 285204	4 inch dovetail extension	\$ 65
■ 285210	Mounting adapter plate	\$ 71
■ 225RBI	Rotating base for TRIO	\$ 485
■ 221165	Z-axis vertical extension	\$ 106
■ BR-AW	Rod holding clamp for XenoWorks injectors (for rod OD 2 to 4 mm)	\$ 101
■ MP-ROD	Rod holder (for rod OD 6.25 mm or larger)	\$ 101
■ MP-RISER-0.5'	1/2 inch riser	\$ 136
■ MP-RISER-1.0'	1 inch riser	\$ 187

¹ Risers can be combined to achieve desired height.

TRIO™-245

THREE-AXIS MICROMANIPULATOR SYSTEM



(TRIO-245 shown with Sutter IPA® headstage (not included))

FEATURES TRIO™-245

- Three independent axes – 25 mm orthogonal travel in X, Y and Z
- Software-based Diagonal axis in any user selectable angle (0 - 90 degrees)
- 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, LOCK, PULSE, RELATIVE, SPEED & ANGLE
- Suited for *in vivo* and *in vitro* 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



The TRIO™-245 from Sutter Instrument is a highly stable 3-axis manipulator with 25 mm of travel on each axis. The TRIO's synthetic 4th axis can be set in software as any angle between 0 and 90 degrees for diagonal movement. Based on a lead-screw design with a smaller overall size and footprint than most manipulators, the TRIO-245 is ideal for setups where space is limited.

The TRIO-245 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 requires 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/Z-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 4th axis angle between 0 and 90 degrees.

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 comes standard with a universal mounting system suitable for the most popular headstages or pipette holders.



SPECIFICATIONS TRIO™-245

■ Travel	25 mm on X, Y and Z axes
■ Long Term Stability	<1 micron in 4 hours
■ Control Box Dimensions	5.5 in x 7.5 in x 4 in (14 cm x 19 cm x 10.2 cm)
■ Weight	3.5 lbs (1.6 kg)
■ Electrical	115/230 Volts 50/60 Hertz power line



**US PRICES TRIO™-245**

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

TRIO™-245**BASIC SYSTEM**

Includes the manipulator, controller, rod holder, 4 inch dovetail extension, mounting adapter plate, Z-axis vertical extension, cables, and power supply

■ TRIO-245-L	3-axis manipulator (X,Y and Z) – left-handed setup	\$ 7,950
■ TRIO-245-R	3-axis manipulator (X,Y and Z) – right-handed setup	\$ 7,950

FIXED STAGE PLATFORM

■ MT-78-FS	Fixed platform stage with imperial/standard holes, chamber insert and gantry supports	\$ 3,900
■ MT-78-FS/M6	Same as above with M6 tapped holes	\$ 3,900

MANIPULATOR COLUMNS

■ MT-75	Standard gantry stand 8.7 to 13.4in (22.1 to 33.9 cm)	\$ 843
■ MT-75S	Short gantry stand 6.7 to 9.6 in (16.9 to 24.4 cm)	\$ 843
■ MT-75T	Tall gantry stand 10.7 to 15.4 in (27.1 to 39.1 cm)	\$ 960
■ MT-75XT	Extra tall gantry stand 14.7 to 18.5 in (37.4 to 47 cm)	\$ 960

For detailed information on mounting our micromanipulators, refer to the Mounting Systems section or phone for assistance.

ACCESSORIES TRIO™-245

■ 285204	4 inch dovetail extension	\$ 65
■ 285210	Mounting adapter plate	\$ 71
■ 225RBI	Rotating base for TRIO	\$ 485
■ 221165	Z-axis vertical extension	\$ 106
■ BR-AW	Rod holding clamp for XenoWorks injectors (for rod OD 2 to 4 mm)	\$ 101
■ MP-ROD	Rod holder (for rod OD 6.25 mm or larger)	\$ 101
■ MP-RISER-0.5[†]	1/2 inch riser	\$ 136
■ MP-RISER-1.0[†]	1 inch riser	\$ 187

[†] Risers can be combined to achieve desired height.

TRIO™-235 THREE-AXIS MICROMANIPULATOR SYSTEM



(TRIO-235 shown with Sutter IPA® headstage (not included))

FEATURES TRIO™-235

- Three independent axes – 25 mm orthogonal travel in X, Y and Z
- Software-based Diagonal axis in any user selectable angle (0 - 90 degrees)
- 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, LOCK, PULSE, RELATIVE, SPEED & ANGLE
- Suited for *in vivo* and *in vitro* 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



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.



SPECIFICATIONS TRIO™-235

■ Travel	25 mm on X and Y / 50 mm on diagonal
■ Long Term Stability	<1 micron in 4 hours
■ Control Box Dimensions	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



**US PRICES TRIO™-235**

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

TRIO™-235**BASIC SYSTEM**

Includes the manipulator, controller, rod holder, 4 inch dovetail extension, mounting adapter plate, Z-axis vertical extension, cables, and power supply

■ **TRIO-235** 3-axis manipulator (X,Y and diagonal) **\$ 6,900**

FIXED STAGE PLATFORM

■ **MT-78-FS** Fixed platform stage with imperial/standard **\$ 3,900**

■ **MT-78-FS/M6** Same as above with M6 tapped holes **\$ 3,900**

MANIPULATOR COLUMNS

■ **MT-75** Standard gantry stand 8.7 to 13.4in (22.1 to 33.9 cm) **\$ 843**

■ **MT-75S** Short gantry stand 6.7 to 9.6 in (16.9 to 24.4 cm) **\$ 843**

■ **MT-75T** Tall gantry stand 10.7 to 15.4 in (27.1 to 39.1 cm) **\$ 960**

■ **MT-75XT** Extra tall gantry stand 14.7 to 18.5 in (37.4 to 47 cm) **\$ 960**

For detailed information on mounting our micromanipulators, refer to the Mounting Systems section or phone for assistance.

ACCESSORIES TRIO™-235

■ **285204** 4 inch dovetail extension **\$ 65**

■ **285210** Mounting adapter plate **\$ 71**

■ **225RBI** Rotating base for TRIO **\$ 485**

■ **221165** Z-axis vertical extension **\$ 106**

■ **BR-AW** Rod holding clamp for XenoWorks injectors **\$ 101**

(for rod OD 2 to 4 mm)

■ **MP-ROD** Rod holder (for rod OD 6.25 mm or larger) **\$ 101**

■ **MP-RISER-0.5'** 1/2 inch riser **\$ 136**

■ **MP-RISER-1.0'** 1 inch riser **\$ 187**

¹ Risers can be combined to achieve desired height.

QUAD®

FOUR-AXIS MICROMANIPULATOR SYSTEM



FEATURES QUAD®

- Four independent axes — 30 mm travel in diagonal for coaxial pipette movement, 25 mm travel in X, Y and Z
- User-friendly, fanless compact controller with ROE preserves bench space
- True diagonal assures coaxial movement
- Suited for *in vivo* electrophysiological recording
- Quiet mode eliminates electrical noise
- Push button control of multiple functions — WORK, HOME, LOCK, PULSE, and RELATIVE
- Robotic Home and Work position moves for easy automated pipette exchange
- Sub-micron 100 nm resolution
- USB interface for computer control



The QUAD® motorized micromanipulator is easy to use and features four independent axes. Each axis has a 25 mm range of motion, a digital display of position and an ROE control. The compact, intuitive controller takes up minimal bench space, is fan free and is easy to use. Three axes provide the X, Y, Z-orthogonal motion typical of most motorized micromanipulators. In the QUAD, Sutter introduces a true fourth axis to move the electrode coaxially at exactly the desired angle of approach. The fourth axis has 30 mm of travel that significantly extends the range of travel for the system.

The QUAD has an intuitive ROE interface. The ROE inputs for each axis allow facile manual control of electrode position. Five conveniently located buttons control all of the basic functions that you will need in normal operation. Press and hold the Work button to quickly store a work position; press Work again and the manipulator will return to the same location. Home sends the manipulator to an initial location that is useful for changing electrodes. When you are ready to begin collecting data, the motor drive, electronics can be suppressed by pressing Lock. Display coordinates can be zeroed at any location by pressing Relative; go back to absolute coordinates by pressing Relative again. Finally, Pulse activates a pulse movement mode that produces small, rapid bursts of motion that can be advantageous for sharp electrode cell penetration.

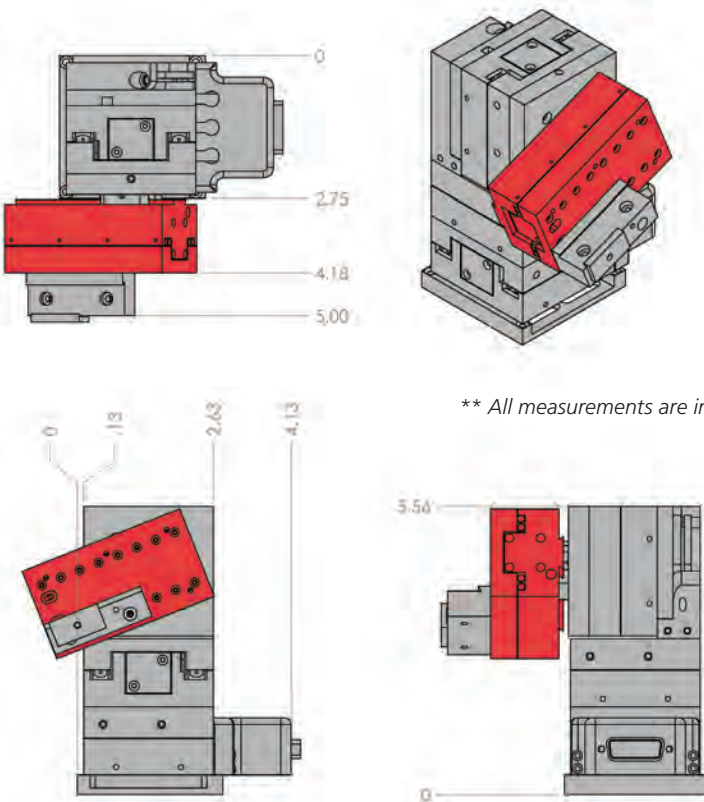


SPECIFICATIONS QUAD®

■ Travel	30 mm on diagonal 4th axis 25 mm on X, Y and Z axes
■ Long Term Stability	<1 micron in 4 hours
■ Control Box Dimensions	5.5 in x 7.5 in x 4 in 14 cm x 19 cm x 10.2 cm
■ Weight	2.2 lbs 1.0 kg
■ Electrical	115/230 Volts 50/60 Hertz power line



MECHANICAL DRAWINGS QUAD®



**** All measurements are in inches**



US PRICES QUAD® SYSTEMS

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

QUAD

BASIC SYSTEM

Includes the manipulator, controller, rod holder, 4 inch dovetail extension, mounting adapter plate, Z-axis vertical extension, cables, and power supply

■ QUAD-L¹	QUAD 4-axis manipulator – left-handed setup	\$ 7,910
■ QUAD-R¹	QUAD 4-axis manipulator – right-handed setup	\$ 7,910

FIXED STAGE PLATFORM

■ MT-78-FS	Fixed platform stage with imperial/standard holes, chamber insert and gantry supports	\$ 3,900
■ MT-78-FS/M6	Same as above with M6 tapped holes	\$ 3,900

MANIPULATOR COLUMNS

■ MT-75	Standard gantry stand 8.7 to 13.4 in (22.1 to 33.9 cm)	\$ 843
■ MT-75S	Short gantry stand 6.7 to 9.6 in (16.9 to 24.4 cm)	\$ 843
■ MT-75T	Tall gantry stand 10.7 to 15.4 in (27.1 to 39.1 cm)	\$ 960
■ MT-75XT	Extra tall gantry stand 14.7 to 18.5 in (37.4 to 47 cm)	\$ 960

For detailed information on mounting our micromanipulators, refer to the Mounting Systems section or phone for assistance.

ACCESSORIES QUAD®

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

■ 285204	4 inch dovetail extension	\$ 65
■ 225RBI	Rotating base for MP-225	\$ 485
■ 221165	Z-axis vertical extension	\$ 106
■ BR-AW	Rod holding clamp for XenoWorks injectors (for rod OD 2 mm to 4 mm)	\$ 101
■ MP-ROD	Rod holder (for rod OD 6.25 mm or larger)	\$ 101
■ MP-RISER-0.5²	1/2 inch riser	\$ 136
■ MP-RISER-1.0²	1 inch riser	\$ 189

¹ Handedness is a convenience. Customer can change orientation as needed.

² Risers can be combined to achieve desired height.

MPC-200/MPC-385/MPC-325 MULTI-MICROMANIPULATOR SYSTEMS



(Shown: MPC-385-2)

FEATURES MPC-200

- Quietest electronics in the industry. Optimized for single channel recording.
- Single controller and ROE will run two stepper motor drive manipulators
- Self-detecting, daisy-chain capability allows control of four manipulators from one ROE-200
- User-friendly interface: single button access to all major functions
- Easily configurable virtual 4th axis set without external computer
- Accelerated Mode for fast, manual manipulator movement
- Easy toggle selection of Mode (speed/resolution, pulsed diagonal, Accelerated Mode)
- Display indicates X, Y, Z coordinates, Mode, active manipulator
- Robotic Home and Work Position moves for easy automated pipette exchange
- Faster robotic moves than previous versions
- Definable 4th axis for coaxial pipette movement, angle selected by DIP switches
- Simple USB interface, open source command set available
- Toggle switch selects which manipulator is connected to input device
- LED and display indicate active manipulator
- Ultra-low drift, ultra-smooth movement



Neurobiological experiments are becoming more complex. Many require multiple manipulators with control units that quickly become space and/or cost prohibitive. The MPC-200 is the solution you have been asking for. A single controller capable of running 2 manipulators! Sutter Instrument has taken the simplicity of the MP-225 controller and expanded it to run two manipulators from a single controller/ROE. The MPC-200 works with our world-renowned mechanicals, the MP-285 (MPC-385), MP-225 (MPC-325) or narrow format MP-265 (MPC-365).

If two manipulators aren't enough, a second controller can be daisy-chained to allow the single ROE-200 to move up to four manipulators. Thus the system can be easily expanded to control highly sophisticated experiments.

The Sutter MPC-200 is electrically quiet. Unique to the MPC-200 is our multi-unit controller which employs linear output circuitry to minimize electrical noise. Sutter adds additional manipulators to the same controller without requiring potentially noisy chopper drives.

In all our manipulators, the 4th axis can be set up and changed without the need to connect an external computer and download and configure software. A separate configuration is allowed for each output on this manipulator controller. If desired, each manipulator can approach the prep at a different angle from the horizontal. The 4th axis can be configured between the X and Z axes or the Y and Z axes (useful when manipulator is rotated 90 degrees relative to the preparation).

Faster automated pipette exchange

The MPC-200 has faster "Home" and "Work Position" moves for quicker pipette exchange. Automation is set up and run via the same interface used in the MP-225 controller; however, the speeds of the automated movement are much faster.

Accelerated manual mode

For users who prefer manual pipette exchange we have added "Accelerated Mode" to the ROE. Using Accelerated Mode, the user can make quick manual moves in and out of a setup. Accelerated Mode amplifies the speed attainable in a manual move by smoothly accelerating to the maximum speed during sustained, fast turns of the ROE. Accelerated movement ends as soon as the user stops turning the knob. This mode can be fully disabled for those who feel the need for direct control of the pipette.

To provide the ultimate in flexibility, the MPC-200 can be purchased separately or as part of a basic system such as the MPC-385, MPC-365 and MPC-325. Additional component pieces can be added at any time, allowing the user to develop a system tailored to his or her particular needs. The controller is self-detecting so there is no need for manual configuration of the components.



SPECIFICATIONS MPC-200

- **Resolution and Full Travel** Minimal microstep size is 62.5 nanometers per microstep.
Display has single micron resolution.
Full travel is 25 mm in each axis.
- **Maximum Speed** MP-225
mechanical 3 mm/sec.
MP-285
mechanical 5 mm/sec.
- **Long Term Stability** <0.5 micron in 20 hours
Drive Mechanism

DIMENSIONS

- **Controller** 15.75 in x 10.75 in x 3.5 in
40 cm x 27.3 cm x 9 cm
- **ROE** 10 in x 6 in x 4 in
25 cm x 15 cm x 23 cm

WEIGHT

- **Controller** 6.5 lbs
3 kg
- **ROE** 3.5 lbs
1.6 kg
- **Electrical** 115/230 Volts
50/60 Hertz power line



**US PRICES MPC-385 SYSTEMS**

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

■ MPC-385	One MP-285 manipulator mechanical, one MPC-200 controller and one ROE-200. Also includes mounting adapter plate, rod holder, hinged headstage mount, 4 inch dovetail extension, manipulator and ROE connecting cables, power cord and manual.*	\$ 9,469
■ MPC-385-2	Same as the MPC-385, but with two MP-285 manipulator mechanicals.*	\$ 15,480
■ MPC-385-3	Same as the MPC-385, but with three MP-285 manipulator mechanicals, and two MPC-200 controllers.*	\$ 23,395
■ MPC-385-4	Same as the MPC-385, but with four MP-285 manipulator mechanicals, and two MPC-200 controllers.*	\$ 28,965

US PRICES MPC-325 SYSTEMS

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

■ MPC-325	One MP-225 manipulator mechanical, one MPC-200 controller and one ROE-200. Also includes mounting adapter plate, rod holder, hinged headstage mount, 4 inch dovetail extension, manipulator and ROE connecting cables, power cord and manual.*	\$ 7,910
■ MPC-325-2	Same as the MPC-325, but with two MP-225 manipulator mechanicals.*	\$ 12,600
■ MPC-325-3	Same as the MPC-325, but with three MP-225 manipulator mechanicals, and two MPC-200 controllers.*	\$ 19,090
■ MPC-325-4	Same as the MPC-325, but with four MP-225 manipulator mechanicals, and two MPC-200 controllers.*	\$ 23,345

* Indicate right- or left-handed set-up when ordering



US PRICES MPC-200 COMPONENTS

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

- | | | |
|----------------------|---|-----------------|
| ■ MPC-200-ROE | Consists of the MPC-200 controller and ROE-200. This "system" is made available at a special price for those who wish to use previously purchased Sutter manipulators with the newer controller system or to use the MPC-200-ROE to control other devices. Includes cable to connect ROE to controller, power cord and manual. | \$ 4,200 |
| ■ MPC-200 | Controller box alone. Purchase this if you intend to daisy-chain two controllers to one ROE-200. In this configuration, up to 4 manipulators can be controlled by a single ROE-200.
NOTE:
This is not a stand-alone device. In order to function, the MPC-200 must be connected to a second MPC-200 with ROE-200 attached or be connected to its own ROE-200. Includes daisy-chain cable, power cord and manual. | \$ 3,120 |
| ■ ROE-200 | This is the ROE alone. Provides user input to one or more MPC-200 controllers. This component is intended for users who have an existing four-manipulator MPC-200 system with a single ROE-200 and wish to split it into two independent two-manipulator systems. Includes cable to connect ROE to controller. | \$ 1,695 |
| ■ MP-285/M | The MP-285 manipulator mechanical alone. This is the mechanical from the MP-285, the manipulator system that made Sutter the world leader in motorized manipulators for electrophysiology. Over 2000 units, many of which have been in use over 5 years, allow us to stand behind the reliability of this design. It is widely known for its smooth movement and low drift. Includes mounting adapter plate, rod holder, 4 inch dovetail extension, hinged headstage mount and cable to connect manipulator to controller.* | \$ 6,130 |
| ■ MP-225/M | The MP-225 manipulator mechanical alone. This is the mechanical unit from the Sutter MP-225. It features modular construction, lower cost, smooth movement and low drift. Includes mounting adapter plate, rod holder, 4 inch dovetail extension, hinged headstage mount and cable to connect manipulator to controller.* | \$ 5,295 |

** Indicate right- or left-handed set-up when ordering*



US PRICES MPC-200 ACCESSORIES

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

■ 285204	4 inch dovetail extension	\$ 65
■ 285210¹	Mounting adapter plate	\$ 71
■ 285RBI	Rotating base for MP-285	\$ 485
■ 225RBI	Rotating base for MP-225	\$ 485
■ 285300	Right angle adapter	\$ 106
■ 285305	Z-axis vertical extension	\$ 106
■ 285310	Z-axis horizontal extension	\$ 106
■ BR-AW	Rod holding clamp for XenoWorks injectors (for rod OD 2 mm to 4 mm)	\$ 101
■ MP-ROD	Rod holder (for rod OD 6.25 mm or larger)	\$ 101
■ 285HEA	Hinged headstage mount	\$ 409
■ M100106	Flat side for controller (each)	\$ 42
■ MP-RISER-0.5²	1/2 inch riser	\$ 136
■ MP-RISER-1.0²	1 inch riser	\$ 187

For detailed information on mounting our micromanipulators, refer to the Mounting Systems section or phone Sutter for assistance.

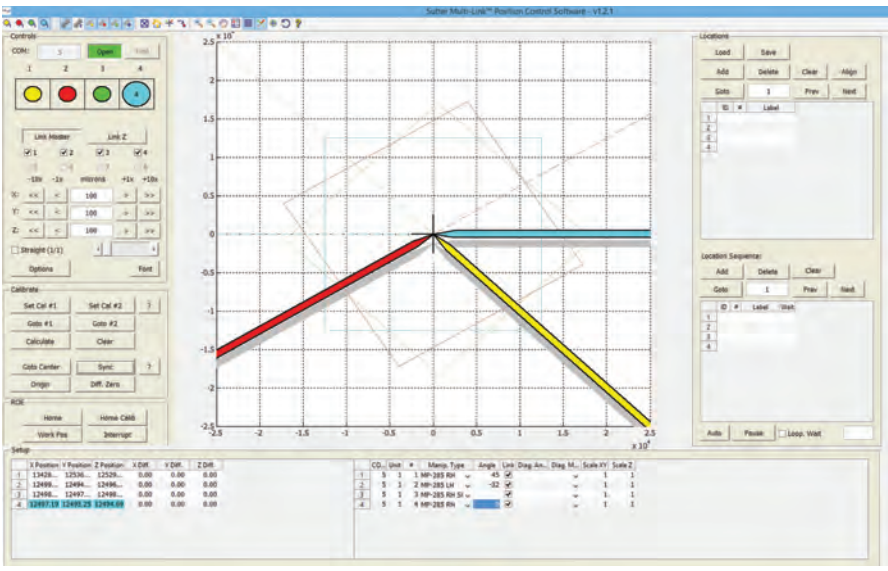
¹ For use with MT and MD series stands and platforms, or any surface with 1 inch centered holes.

² For MP-225 mechanical only. Risers can be combined to achieve desired height.



MULTI-LINK™

POSITION CONTROL SOFTWARE



FEATURES MULTILINK™

- Selectable linking of one, two or more manipulators and translator
- Unlimited memorized positions
- Simultaneous control via ROE and computer GUI
- Positional information mirrored between GUI and ROE
- Pipettes are color coordinated to selected manipulator LED on ROE
- Supports mounting of manipulators at ANY mounting angle in the X-Y plane
- Extended version controls up to 8 manipulators
- Backwards compatible with all existing MPC-200 controllers
- Price: FREE! Available on our Technical Support/Software page at www.sutter.com



The Multi-Link™ Position Control Software is a stand-alone program that interfaces with our MPC-200 manipulator controllers. Multi-Link™ is an intuitive GUI that uses the MPC-200 driver Sutter developed for the NIH freeware μ Manager. It operates any Sutter Instrument device that can be connected to the MPC-200, including: manipulators, motorized microscopes (MOM and SOM), the MT-800 translator (with or without focus drive), and the MPC-78 platform stage (with or without focus drive) and the 3DMS stage.

The most powerful aspect of the Multi-Link software is the ability to link the movement of multiple devices together. The lead pipette can be used to direct the movement of a microscope translator (objective/camera), or the translator can function as the leader and thereby keep the pipettes in the field of view. The leading device can be controlled through the manual input knobs of the ROE-200 or the computer GUI via a mouse or other PC interface.

Multi-Link easily memorizes multiple working locations and can rapidly switch between them. The user simply moves the microscope to a region of interest and clicks to save the location. Turning on "Link" will then coordinate all linked devices (usually manipulators) with moves made by the microscope via a motorized translator. Switching between memorized positions will bring all linked devices to that location. Link, intuitive and easy to use, will allow users to bring all their pipettes to a working location in seconds! The memory positions available in the Multi-Link software allow for most of the same robotic functionality found in our MP-285. Memorized locations can be repeated in looped operation.

While all features found in the ROE-200 have been replicated in Multi-Link, full functionality of the ROE is retained, allowing movement of any connected device by turning the knobs on the ROE or by clicking and dragging the pipettes in software. Moves made in the GUI update the positional information displayed on the ROE, and moves made with the ROE-200 are updated in Multi-Link.

ADDITIONAL FEATURES

Accurately linked moves require "Calibration". A calibration protocol within the software automatically determines the mounting angle of each manipulator in the X-Y plane, so that Linked movement of the pipette will always be accurate. With two simple moves, the software automatically determines the mounting angle of each pipette with respect to the objective/camera.

The ROE-200 always displays the coordinates in an absolute scale, from 0 μm to 25000 μm . Multi-Link displays coordinates in either absolute or relative scale. Press one button to set the relative origin in all three axes and move in a positive or negative direction with respect to the relative origin. Multi-Link can also multiply the coordinates by a user-defined Scaling factor. The Scaling factor allows the user to match the position information displayed in Multi-Link to that of third-party and/or home-made stages, translators, focusing knobs, or other stepper motor devices.

One of the most innovative features of Multi-Link is the GUI representation of all manipulated pipettes. In addition to being a great teaching tool, the GUI allows a user to visualize the relative position of all pipettes in an experiment. Zoom out to see the location of each pipette at each memorized Location, even when these positions are outside the microscope's field of view. Drag the virtual pipettes from one memorized position to another and the manipulators will move the real pipettes in real-time.

All the features of the Multi-Link software, from Link to the virtual pipette GUI, will increase the success rate of your experiments and save time. Another outstanding feature of this software is the price. Sutter is including this software at no charge with all MPC-200 systems. The software is also available as a FREE download for those with existing MPC-200 systems!

MP-285

ROBOTIC MICROMANIPULATOR



(Shown with optional dPatch® headstage)

FEATURES MP-285

- Quietest electronics in the industry. Optimized for single channel recording.
- Highly stable for experiments intolerant of pipette drift
- Sub-micron resolution and integrated coarse positioning
- 1 inch of motorized travel on all three axes
- Virtual 4th axis can be set without need of external computer or software
- Adjustable speed and resolution allows optimization for your experimental setup
- Programmable robotics for complex motion sequences
- Continuous display (in microns) of axes positions
- Switch between continuous or single step movement
- Absolute and relative origins
- Convenient Home function allows pipettes to be quickly repositioned
- Assignable axes permit any orientation of the manipulator
- Easy-to-read vacuum fluorescent display
- Remote computer control via serial interface
- Compact design easily adaptable to your setup
- Universal mounting system for headstage or pipette holder
- Optional mounting adapters (see price list)



One of the first in our line of precision motorized micromanipulators, the MP-285 is affordable yet offers advanced features found in manipulators costing thousands more. Custom engineered stepping motors, precision cross-roller bearing slides and proprietary worm gear capstan drives form the basis of the watch-like mechanical system. The controller provides power to the stage motors with a quiet linear power supply to minimize electrical noise radiation in your setup. Pipette holders and headstages are securely mounted to the MP-285 with one of our several unique and rigid mounting systems.

The MP-285 was designed to meet a wide variety of positioning needs for the scientific community and is suitable for patch clamp experiments, extracellular recording, microinjection, intra-cellular recording and precision robotic positioning applications. An outstanding feature of this system is the unique definable 4th axis for diagonal advancement of the pipette. You select the angle, then activate the 4th axis. As with the other three axes, you may move with adjustable coarse or ultrafine resolution, select the movement speed, and move continuously or in single step increments. To quickly reposition the pipette, simply select the Home function. Axes positions are continuously shown in relative and absolute scales, and are easily readable on the vacuum fluorescent display.

The extremely low backlash of the MP-285 removes traditional drawbacks of "open loop" technology and eliminates drift. This allows submicron resolution down to 0.2 microns in the coarse range and down to 40 nanometers in the fine range. With over 1 inch of motorized travel on all three axes, and a user designated 4th axis, the MP-285 allows tremendous range of motion while maximizing resolution.

In all our manipulators, the 4th axis can be set up and changed without the need to connect an external computer and download and configure software. Unlike other designs, the virtual 4th axis in the MP-285 can comprise any two axes — conventional X-Z to approach along the pipette axis, Y-Z used when the manipulator is rotated 90 degrees, and you can even set up a virtual diagonal in the X-Y plane: useful when the manipulator is set up as a 3DMS (3D movable stage) and one wants to quickly move along the diagonal between two points on a horizontal specimen.

Available with a table-top or rack-mounted controller, our manipulator fits in seamlessly with your other components while the compact design and assignable axes of the MP-285 allow you to easily integrate it into your setup at any orientation. To add to its practicality, the rotary optical encoder (ROE), assures a comfortable experimentation environment, customized to the scientist. Turning one of three 2-inch knobs produces a movement along one axis proportional to the amount and speed of the turn. Buttons allow the activation of "4th axis", change of movement resolution, "Home" return function, and toggle between continuous pulse movements.

For users who require repeatable motion sequences, the MP-285 features easily programmed robotic control from the keypad, or via a remote computer. The system can store up to 500 position instructions, including pauses, and will execute the instruction set once, continuously, or in reverse.

As always, our technical support team is available to address your concerns and answer all questions before, and after your purchase.



SPECIFICATIONS MP-285

■ Travel	1 inch 25 mm on all three axes
■ Resolution	Low: 0.2 $\mu\text{m}/\text{step}$ High: 0.04 $\mu\text{m}/\text{step}$
■ Maximum Speed	2.9 mm/sec
■ Long Term Stability	<10 nm/hour at 24 deg C
■ Drive Mechanism	Precision worm gear capstan drive
■ Serial Interface	RS-232, 9600 baud (1 start bit, 8 data bits, 1 stop bit)
■ Dimensions	<i>Mechanical:</i> 4.5 in x 6 in x 6.25 in 11 cm x 15 cm x 16 cm <i>Controller:</i> 16 in x 10.75 in x 3.75 in 40.6 cm x 27.3 cm x 9.6 cm
■ Weight	<i>Manipulator:</i> 3.85 lbs / 1.7 kg <i>Controller:</i> 10 lb 11 oz / 4.5 kg
■ Electrical	115/230 Volts 50/60 Hertz power line



**US PRICES MP-285**

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

■ MP-285/R	Includes manipulator, rack mount controller unit, rotary optical encoder, cables, rod holder, hinged headstage mount, 4 inch dovetail extension, mounting adapter plate, choice of input device, power cord, and manual	\$ 9,820
■ MP-285/T	Includes manipulator, table top controller unit, rotary optical encoder, cables, rod holder, hinged headstage mount, 4 inch dovetail extension, mounting adapter plate, choice of input device, power cord, and manual	\$ 9,820

When ordering the MP-285, the handedness must be specified. Please list as separate item with no cost.

Select the manipulator handedness

Right-handed setup

Left-handed setup

RIGHT**LEFT**

If you have any questions regarding the part numbering system, please contact Sutter Instrument Company directly.

ACCESSORIES MP-285

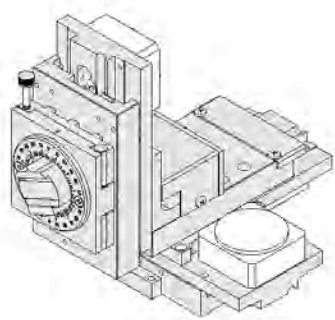
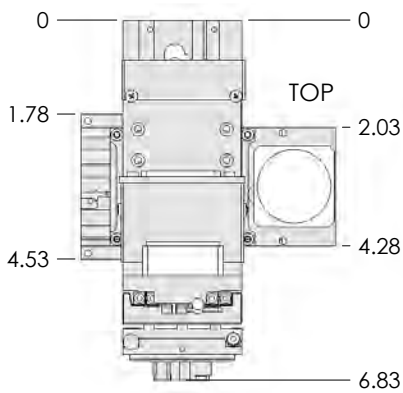
■ 285204	4 inch dovetail extension	\$ 65
■ 285210¹	Mounting adapter plate	\$ 71
■ 285RBI	Rotating base for MP-285	\$ 485
■ 285300	Right angle adapter	\$ 106
■ 285305	Z-axis vertical extension	\$ 106
■ 285310	Z-axis horizontal extension	\$ 106
■ BR-AW	Rod holding clamp for XenoWorks injectors (for rod OD 2 mm to 4 mm)	\$ 101
■ MP-ROD	Rod holder (for rod OD 6.25 mm or larger)	\$ 101
■ 285HEA	Hinged headstage mount	\$ 409
■ M100106	Flat side panel for controller (each)	\$ 42

For detailed information on mounting our micromanipulators, refer to the Mounting Systems section or phone Sutter for assistance.

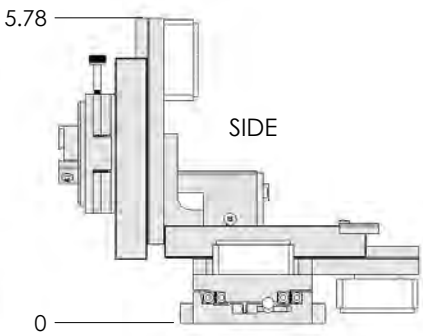
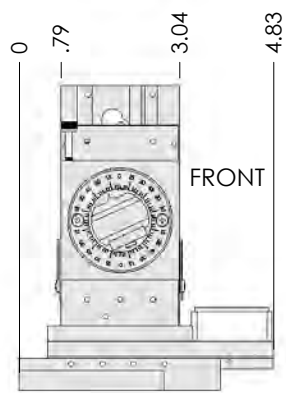
¹ *For use with MT and MD series stands and platforms, or any surface with 1 inch centered holes.*



MECHANICAL DRAWINGS MP-285

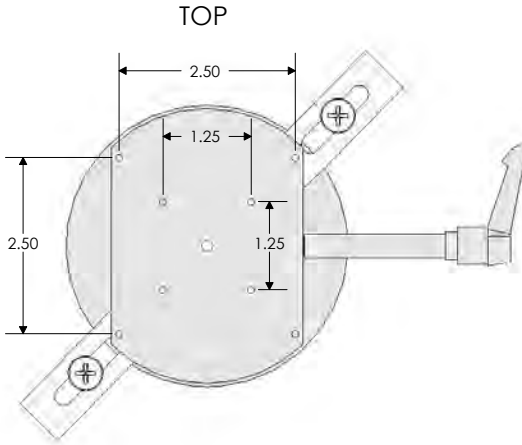


*ALL MEASUREMENTS ARE IN INCHES

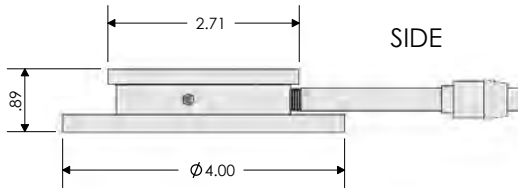




MECHANICAL DRAWINGS OPTIONAL ROTATING BASE (285RBI OR 225RBI)



*ALL MEASUREMENTS ARE IN INCHES





MOTORIZED MICROMANIPULATOR COMPARISON CHART



Features	MPC-385/325	MPC-365	MP-285
Manipulator per Controller	2	2	1
Manipulator per ROE	4	4	1
Memory Moves			
500 and home			■
2 (Home and Work)	■	■	
Travel			
25 mm on all three axes	■		■
25 mm on X and Z axes		■	
12.5 mm on Y axis			
Interface	USB	USB	Serial
Expandable	Yes	Yes	No
Step Size	62.5 nm	62.5 nm	40 nm and 200 nm
Selectable Speeds	6	6	14
Maximum Speed			
5 mm/sec		■	
5 mm/sec (w/MP-285 manipulator)	■		
3 mm/sec			
3 mm/sec (w/MP-225 manipulator)	■		
2.9 mm/sec			
2 mm/sec			
Type of Bearings			
Cross Roller		■	■
Cross Roller (w/MP-285 manipulator)	■		
Ball Bearing			
Ball Bearing (w/MP-225 manipulator)	■		
Price [†]	\$9,469 (MPC-385) \$7,910 (MPC-325)	\$10,250	\$9,820

[†] Price for a single manipulator, controller, and input device. U.S. prices. International prices vary by country.



SOLO SINGLE AXIS MANIPULATOR CONTROLLER

New



(Shown with SOLO-50)

FEATURES SOLO

- Control any single axis from Sutter stepper motor manipulator collection
- User defined Work and Home positions in Absolute mode
- 25 mm or 50 mm length of travel
- Pulse mode
- Absolute and Relative modes
- USB connectivity

APPLICATIONS SOLO

- Can be used with a single axis micromanipulator to design a focus drive for your researcher-made microscope
- Can be used to add a 4th axis to a 3-axis Sutter manipulator
- Ideal for *in vivo* experiments



The SOLO is an extremely easy to operate single axis controller capable of running any single axis from Sutter's line of stepper motor manipulators. The compact design of the SOLO controller requires minimal bench space and provides quiet, fan-free operation.

The SOLO controller features user defined Home and Work positions. Press and hold the Work button to quickly store a work position; press Work again and the manipulator will return to the same location. Home sends the manipulator to an initial location or any user defined position. Position coordinates, in relative or absolute values, are displayed directly on the ROE. A Pulse button activates a discrete 3 micron movement of the axis.

Speed of movement is determined by how fast the ROE knob is turned. We have added three distinct speeds to give the user extreme control over movement. The combination of three speeds and the knob speed control makes the SOLO an ideal, ultra-reliable controller for sub-micron movement.

Single axes are available in lengths of 25 mm or 50 mm. The SOLO is suitable for *in vivo* experiments that require only one motorized axis. Additionally, this single axis controller can be used as a sub-micron focusing system as seen in the Sutter SOM and BOB microscopes. Or add a fourth axis to your existing Sutter manipulator to create a true four-axis motorized *in vivo* and *in vitro* manipulator (such as the QUAD).

USB connectivity and open source commands, along with built-in features such as Work & Home positions, and Pulse mode, make this single axis controller the ideal device for the do-it-yourself scientist.



SPECIFICATIONS SOLO

- **Control Box Dimensions** 5.5 in x 5.1 in x 3.2 in
14 cm x 13 cm x 8 cm
- **Weight** *Controller:*
1.2 lbs
0.53 kg
- **Electrical** 115/230 Volts
50/60 Hertz power line



US PRICES SOLO

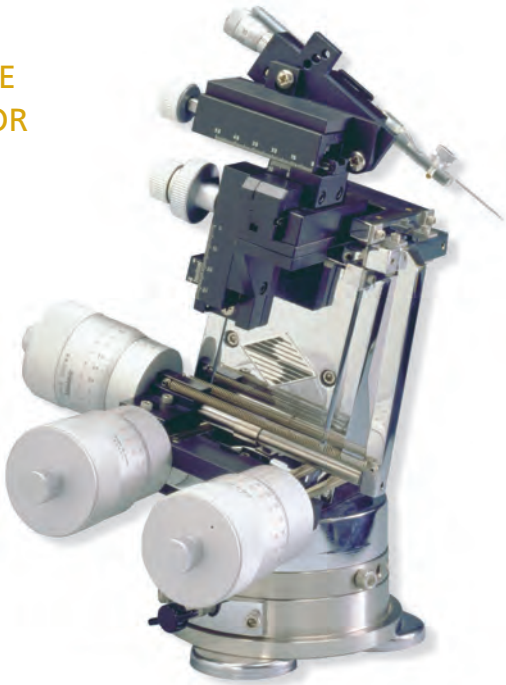
International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

SINGLE AXIS MANIPULATOR CONTROLLER

■ SOLO-25	SOLO controller and single axis with 25 mm travel	\$ 3,165
■ SOLO-50	SOLO controller and single axis with 50 mm travel	\$ 3,420

*Adapters are available to connect your Sutter single axis manipulator to many instruments.
Phone Sutter for details.*

MP-85 HUXLEY-WALL STYLE MICROMANIPULATOR



(Shown with optional spacer, wedge and magnetic feet)

FEATURES MP-85

- Dual springing of the moment arms to insure zero backlash and zero torsion
- The micromanipulator is mounted on a precision rotating base featuring a positive stop and lock
- The coarse movement is an all cross-roller bearing design consisting of coarse X, Y, and Z with an additional fine X motion
- The micromanipulator can be ordered in either a right- or left-handed version

OPTIONS MP-85

- Fifteen degree stackable wedges for tilting the manipulator
- A set of three magnetic feet for increased stability
- One inch thick, chrome plated, solid brass spacer



The classic micromanipulator, developed by Sir Andrew Huxley many years ago, is still considered by many investigators to be the finest manual micromanipulator available. The MP-85 offers the advantage of a very large range of movement with its built-in coarse manipulator and precise submicron movement with the fine controls. Coarse positioning is achieved with a three axis manipulator mounted on top. The ultrafine positioning is accomplished with the large micrometers mounted on the base. These micrometers provide smooth, precise movement through a 10:1 reduction mechanism.

The brass and stainless steel construction of the MP-85 makes for a very heavy and solid micromanipulator with excellent damping properties. This exceptionally stable design is ideal for patch clamp recording, intracellular recording, or any other application that is intolerant of drift.

The MP-85 is chrome-plated and anodized to prevent corrosion. The J.R. Wall designed rotating base is machined from solid, stainless steel with a brass spindle; a thin Teflon washer provides for the bearing surface.

Please contact Sutter Instrument for any additional information on the suitability and use of the MP-85 micromanipulator for your specific application.



SPECIFICATIONS MP-85

■ Coarse X-axis Tilt	0 to 45 degrees in 15 degree increments
■ Coarse Resolution	0.1 mm on all axes
■ Fine X resolution	0.01 mm
■ Ultrafine (Huxley) Resolution	0.2 μ m
■ Huxley Excursion	~2 mm maximum in each axis
■ Dimensions	10 in x 10 in x 12 in 25 cm x 25 cm x 28 cm
■ Weight	<i>Manipulator:</i> 15 lbs 7 kg



US PRICES MP-85

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

MICROMANIPULATOR

■ MP-85/R	Right-handed — Includes manipulator, coarse movement MM-33 micromanipulator, and rotating base	\$ 6,965
■ MP-85/L	Left-handed — Includes manipulator, coarse movement MM-33 micromanipulator, and rotating base	\$ 6,965

ACCESSORIES MP-85

■ Holder/MP85	Headstage adapter	\$ 179
■ RBI	Rotating base for MP-85	\$ 944
■ MAG-85	Magnetic feet (set of 3)	\$ 55
■ 85AX200¹	Headstage adapter for MP-85	\$ 308
■ X850600	15 degree wedges (each)	\$ 105
■ X850700	1 inch increment spacer (No more than three recommended)	\$ 143
■ X700115	MP-85 to MT stand adapter plate	\$ 106

¹ Suitable for Sutter IPA®, dPatch®, Axopatch 200 and Heka EFC-10.

MM-33 MICROMANIPULATOR



(Shown: MM-33 – open profile)

FEATURES MM-33

- Compact design allows use in tight environments
- Rack and pinion drive gives stable movement with minimal backlash
- Cross-loaded roller bearings for smooth, low friction movement
- Vertical axis lock

OPTIONS MM-33

- Rotating base allows horizontal rotation and vertical tilting
- Magnetic feet
- Tilting mount for fine X-axis



Successfully used in conjunction with our other micromanipulators, the MM-33 is available separately for those in need of a small, practical instrument in applications not requiring submicron accuracy.

The MM-33 is the right choice for tight environments which require maximum versatility within a small space. A vertical lock is added to secure the vertical axis in position. The optional rotating base and tiltable X-axis provide even further flexibility.

Stainless steel cross-loaded roller bearings are designed to offer low friction and smooth linear motion with a minimum of side play. The pre-loaded rollers are set at 90 degrees to the hardened steel guides insuring constant contact and accuracy. This precise rack and pinion drive gives stable, drift-free movement with minimal backlash. The controls are placed one above the other which makes for less hand movement and easier positioning. The scales for all axes are calibrated in 0.10 mm increments and the fine micrometer adjustment for the X-axis thrust is calibrated at 0.01 mm with estimates to 5 μ m.

The optional rotating base extends the utility of the MM-33 by providing two additional rotating planes. The rotation in the horizontal plane (approximately 120 degrees) has a positive stop, quick release mechanism for fast insertion and removal of pipettes. The second rotating axis allows the MM-33 to be tilted in a vertical plane from 0 to 70 degrees. The optional tiltable X-axis allows the fine axis to be tilted up to 45 degrees. This option should be ordered at the time of purchase since the modifications require factory installation.



(Shown: MM-33A/L)



INDIVIDUAL EXCURSIONS ARE AS FOLLOWS:

X-axis coarse movement: 37 mm

X-axis fine movement: 10 mm

Y-axis horizontal movement: 20 mm

Z-axis vertical movement: 20 mm



(Shown: MM-33/R)

**US PRICES MM-33**

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

MICROMANIPULATOR

■ MM-33/R	Right-handed micromanipulator with vertical lock (with 1/2 inch rod clamps*)	\$ 1,389
■ MM-33/L	Left-handed micromanipulator with vertical lock (with 1/2 inch rod clamps*)	\$ 1,389
■ MM-33A/R	Right-handed micromanipulator with tilting mount for fine X-axis, vertical lock, rotating base, and two base clamps	\$ 2,170
■ MM-33A/L	Left-handed micromanipulator with tilting mount for fine X-axis, vertical lock, rotating base, and two base clamps	\$ 2,170

**12mm rod clamps available upon request*

ACCESSORIES MM-33

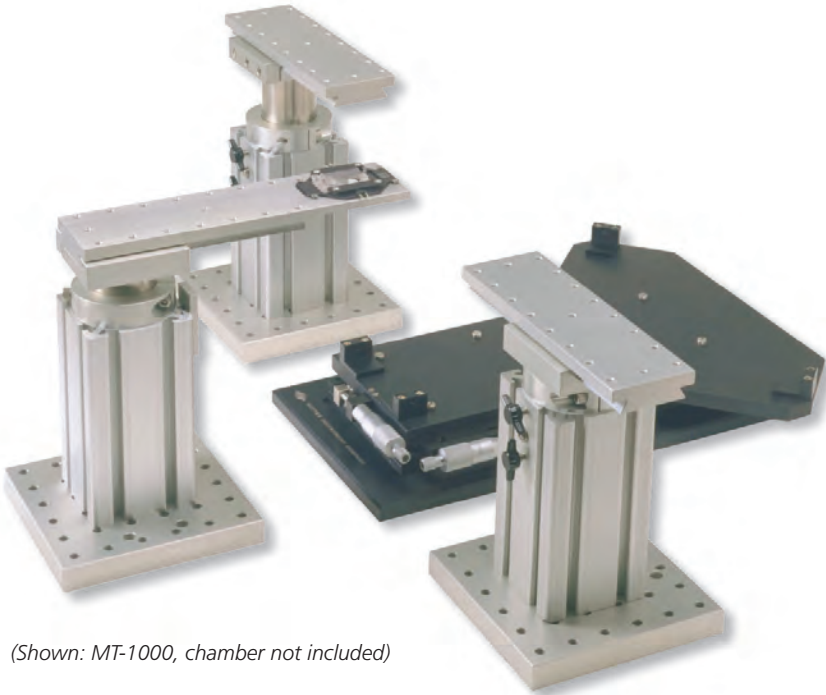
■ MM-33000¹	Right-handed tilting mount for fine X-axis	\$ 196
■ MM-33001¹	Left-handed tilting mount for fine X-axis	\$ 196
■ MM-33002	Rotating base with two base clamps	\$ 667
■ MM-33005¹	Stationary mounting base	\$ 117
■ MM-33006	Rod mounting bracket for use with stands	\$ 341
■ H102905	12 mm rod clamp	\$ 63
■ H102910	1/2 inch rod clamp	\$ 63
■ H102925	Electrode holder	\$ 67
■ MAG-33¹	Magnetic feet for rotating base (set of 3)	\$ 55
■ X850447¹	Vertical lock	\$ 196
■ X330105	Base clamps (2) for clamping rotating base	\$ 50

¹ *Must be ordered with the MM-33 since this option is factory installed only.*



MT-1000 / MT-2000 / MT-2200

MOTORIZED AND MANUAL TRANSLATION SYSTEM FOR FIXED-STAGE MICROSCOPES



(Shown: MT-1000, chamber not included)

FEATURES MT-1000 / MT-2000 / MT-2200

- 22 mm of travel in X & Y
- 40 nm resolution displayed in submicrons (MP-285)
- 62.5 nm resolution displayed in microns (MPC-200)
- Highly stable for experiments intolerant of drift
- Easy to read vacuum fluorescent display
- Adjustable speed and resolution allows optimization for your experimental setup
- Programmable robotics for complex motion sequences (MP-285)
- Continuous display of axes positions
- Convenient Home function allows microscope to be quickly repositioned



The MT-1000 / MT-2000 / MT-2200 systems consist of a microscope translator and three independent stands. Two MT-75 stands used for each manipulator and a similar stand, the MT-150 holds the tissue chamber. The classic design features freestanding columns that provide rock solid mounting for the tissue recording chamber and multiple micromanipulators. Many prefer this methodology as it maximizes working room for adjusting the microscope and changing pipettes. Furthermore, the independent stand design minimizes movement-related cross talk between manipulators.

The MT-1000 uses a manual translator. At the core of the MT-1000 translator systems is the MT-500 X-Y manual translation table. It is designed to allow movement of a microscope's optics with respect to the fixed stage(s). This methodology was developed by electrophysiologists recording from tissue slice preparations. The translator allows visualization and/or imaging of multiple tissue locations while maintaining multiple stable recordings from the preparation. Such a system is also useful for experiments on cells in culture where one wishes to monitor several cells not in the same field of view, e.g., recording from pre and post synaptic neurons in culture and/or imaging one cell while recording from or stimulating another.

The MT-2000 / MT-2200 systems use a motorized translator. At the core of the MT-2000 / MT-2200 system is the MT-800 stepper-motor driven X-Y translation table. The motors can be operated either by the popular MP-285 manipulator controller (MT-2000) or the dual manipulator controller MPC-200 (MT-2200). A two-axis rotary optical encoder (ROE) accepts user input to the motorized translator and can be placed in any convenient location in your setup. Either controller gives the user smooth, high-resolution control of motion. The MP-285 controller offers extensive on-board robotic functionality and a serial computer interface for PC control. The MPC-200 controller offers a USB computer interface for PC control. Systems using the MP-285 controller are called MT-2000 while systems using the MPC-200 controller are designated MT-2200.

Our controller design has allowed Sutter to easily add a focus drive to the MT-2000 / MT-2200. The Sutter focus drive employs a direct-coupled stepper motor for lock-step focus movement and adjustable end of travel sensors to limit the travel of the microscope objective to a safe range for the setup. In the focus drive version, MT-2000/FD and MT-2200/FD, the ROE input device has inputs for X, Y and Z focus.

MT-500 manual translators and MT-800 motorized translators are currently available for the Olympus BX-51WI, Nikon FN1, Zeiss Examiner, Zeiss Axioskop 2 FS and the Leica DM6000FS. Focus drives are available for the Olympus BX51WI. Other microscopes can be supported.



SPECIFICATIONS

MT-1000 / MT-2000 / MT-2200 SYSTEMS

■ Baseplate Dimensions	8 in x 15.25 in x 2.25 in 200 mm x 375 mm x 55 mm
■ Maximum Travel	22 mm
■ Minimal Microstep Size	50 nm (MP-285 controller) 78 nm to 125 nm (MPC-200 controller)
■ Minimal Display Resolution	50 nm (MP-285 controller) 1 micron (MPC-200 controller)
■ Maximum Load	110 lbs 50 kg
■ Weight	35 lbs 16 kg
■ Mechanical Controller	11 lbs 4.5 Kg





US PRICES MT-1000 / MT-2000 / MT-2200

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

COMPLETE SYSTEMS

MT-1000

Includes the MT-500 manual X-Y translator, MT-150 chamber column, two MT-75 micromanipulator columns (without linear slide)

■ MT-1000/Y51¹	MT-1000 for the Olympus BX51WI	\$ 6,575
■ MT-1000/Y53¹	MT-1000 for the Olympus BX53/63	\$ 6,575
■ MT-1000/Y71¹	MT-1000 for the Olympus IX71	\$ 6,575
■ MT-1000/Z25¹	MT-1000 for the Zeiss Axioskop 2 FS	\$ 6,575
■ MT-1000/Z45¹	MT-1000 for the Zeiss Axio Examiner	\$ 6,575
■ MT-1000/N65¹	MT-1000 for the Nikon FN1	\$ 6,575
■ MT-1000/L30¹	MT-1000 for the Leica DMLFS	\$ 6,575
■ MT-1000/L35¹	MT-1000 for the Leica DM6000 FS	\$ 6,575

MT-2200

Includes the MT-800 motorized X-Y translator, MPC-200 controller and ROE, MT-150 chamber column, two MT-75 micromanipulator columns (without linear slide), cables and manual

■ MT-2200/Y51¹	MT-2200 for the Olympus BX51WI	\$ 12,145
■ MT-2200/Y51/FD¹	MT-2200 with focus drive for the Olympus BX51WI	\$ 13,810
■ MT-2200/Y53^{1,2}	MT-2200 for the Olympus BX53/63	\$ 12,145
■ MT-2200/Z25¹	MT-2200 for the Zeiss Axioskop 2 FS	\$ 12,145
■ MT-2200/Z45¹	MT-2200 for the Zeiss Axio Examiner	\$ 12,145
■ MT-2200/N65¹	MT-2200 for the Nikon FN1	\$ 12,145
■ MT-2200/L30¹	MT-2200 for the Leica DMLFS	\$ 12,145
■ MT-2200/L35¹	MT-2200 for the Leica DM 6000 FS	\$ 12,145

MT-2000

Includes the MT-800 motorized X-Y translator, MP-285 controller and ROE, MT-150 chamber column, two MT-75 micromanipulator columns (without linear slide), cables and manual

■ MT-2000/Y51¹	MT-2000 for the Olympus BX51WI	\$ 11,695
■ MT-2000/Y51/FD^{1,2}	MT-2000 with focus drive for the Olympus BX51WI	\$ 13,370
■ MT-2000/Y53¹	MT-2000 for the Olympus BX53/63	\$ 11,695
■ MT-2000/Z25¹	MT-2000 for the Zeiss Axioskop 2 FS	\$ 11,695
■ MT-2000/Z45¹	MT-2000 for the Zeiss Axio Examiner	\$ 11,695
■ MT-2000/N65¹	MT-2000 for the Nikon FN1	\$ 11,695
■ MT-2000/L30¹	MT-2000 for the Leica DMLFS	\$ 11,695
■ MT-2000/L35¹	MT-2000 for the Leica DM 6000 FS	\$ 11,695

¹ Please specify chamber type when ordering.

² Please contact Sutter for availability of focus drive on other microscope makes & models.



US PRICES MT-1000 / MT-2000 / MT-2200

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

COMPONENTS

MANUAL X-Y TRANSLATOR

■ MT-500/Y50	Manual Translator for Olympus BX50WI	\$ 4,350
■ MT-500/Y51	Manual Translator for Olympus BX51WI	\$ 4,350
■ MT-500/Y53	Manual Translator for Olympus BX53/63	\$ 4,350
■ MT-500/Y71	Manual Translator for Olympus IX71	\$ 4,350
■ MT-500/N65	Manual Translator for Nikon FN1	\$ 4,350
■ MT-500/L30	Manual Translator for Leica DMLFS	\$ 4,350
■ MT-500/L35	Manual Translator for Leica DM6000 FS	\$ 4,350
■ MT-500/Z20	Manual Translator for Zeiss Axioskop FS	\$ 4,350
■ MT-500/Z25	Manual Translator for Zeiss Axioskop 2 FS	\$ 4,350
■ MT-500/Z45	Manual Translator for Zeiss Axio Examiner	\$ 4,350

MOTORIZED X-Y TRANSLATOR WITH MPC-200 CONTROLLER AND ROE

■ MT-820/Y51	Translator for Olympus BX51WI	\$ 10,029
■ MT-820/Y51/FD	Translator for BX51WI with focus drive	\$ 11,695
■ MT-820/Y53	Translator for Olympus BXBX53/63	\$ 10,029
■ MT-820/Z25	Translator for Zeiss Axioskop 2 FS	\$ 10,029
■ MT-820/Z45	Translator for Zeiss Axio Examiner	\$ 10,029
■ MT-820/N65	Translator for Nikon FN1	\$ 10,029
■ MT-820/L30	Translator for Leica DMLFS	\$ 10,029
■ MT-820/L35	Translator for Leica DM6000 FS	\$ 10,029

MOTORIZED X-Y TRANSLATOR WITH MP-285 CONTROLLER AND ROE

■ MT-800/Y51	Translator for Olympus BX51WI	\$ 9,475
■ MT-800/Y51/FD	Translator for BX51WI with focus drive	\$ 11,140
■ MT-800/Y53	Translator for Olympus BX53/63	\$ 9,475
■ MT-800/Z25	Translator for Zeiss Axioskop 2 FS	\$ 9,475
■ MT-800/Z45	Translator for Zeiss Axio Examiner	\$ 9,475
■ MT-800/N65	Translator for Nikon FN1	\$ 9,475
■ MT-800/L30	Translator for Leica DMLFS	\$ 9,475
■ MT-800/L35	Translator for Leica DM6000 FS	\$ 9,475



US PRICES MT-1000 / MT-2000 / MT-2200

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

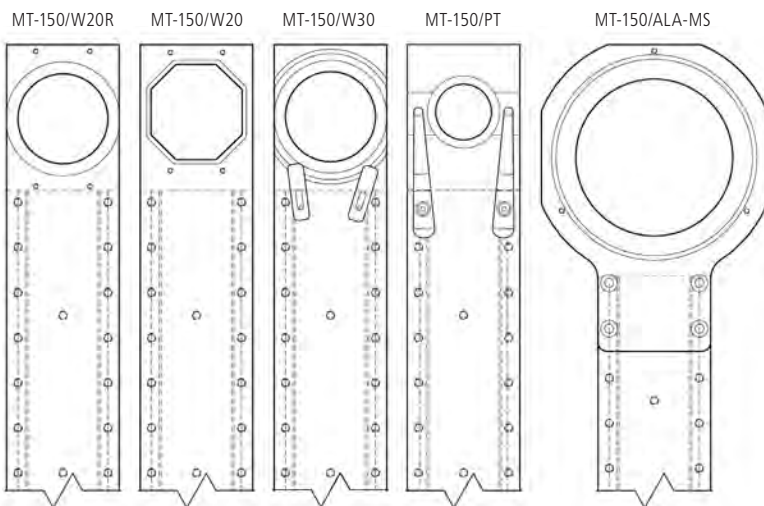
CHAMBER COLUMN

■ MT-150/W20	Chamber column for Warner Series 20 (octagon)	\$ 896
■ MT-150/W20R	Chamber column for Warner Series 20 (round)	\$ 896
■ MT-150/ALA35	Chamber column for ALA 35mm chamber	\$ 896
■ MT-150/ALA-MS	Chamber column for ALA MS	\$ 896
■ MT-150/CUST	Chamber column for non-standard recording chamber	\$ 1,015
■ MT-150/PT	Chamber column for petrie dish or lid	\$ 896
■ MT-150/AUTO	Chamber column for Automate round stage adapter	\$ 896

MANIPULATOR COLUMNS

■ MT-75	Standard gantry stand 8.7 to 13.4 in (22.1 to 33.9 cm)	\$ 843
■ MT-75S¹	Short gantry stand 6.7 to 9.6 in (16.9 to 24.4 cm)	\$ 843
■ MT-75T	Tall gantry stand 10.7 to 15.4 in (27.1 to 39.1 cm)	\$ 960
■ MT-75XT	Extra tall gantry stand 14.7 to 18.5 in (37.4 to 47 cm)	\$ 960
■ MT-75/LS¹	Standard gantry stand with linear slide	\$ 1,442
■ MT-75S/LS¹	Short gantry stand with linear slide	\$ 1,442
■ MT-75T/LS	Tall gantry stand with linear slide	\$ 1,555
■ MT-75XT/LS	Extra tall gantry stand with linear slide	\$ 1,555

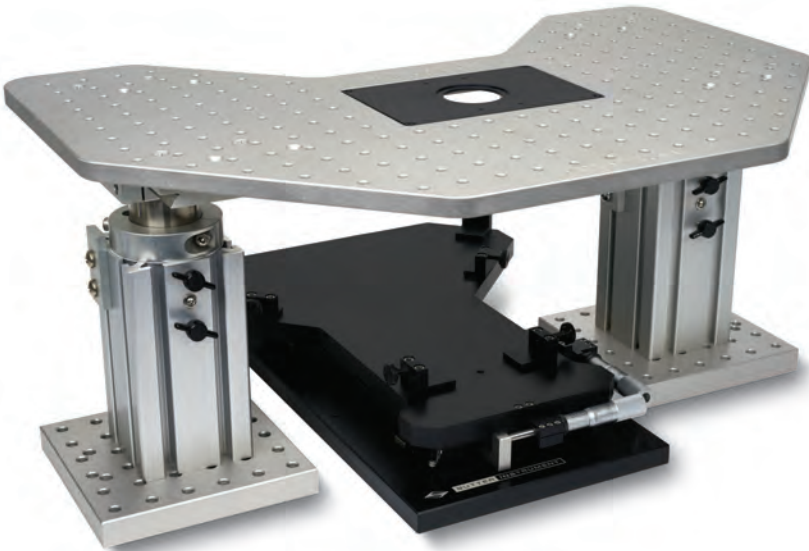
¹ Useful for most upright scopes & Axiovert 25 inverted scope with low stage plate.





MT-1078 / MT-2078 / MT-2278

X-Y TRANSLATION SYSTEM FOR FIXED-STAGE MICROSCOPES



(Shown: MT-1078/Y51)

FEATURES MT-1078 / MT-2078 / MT-2278

- Motorized or manual X-Y translation
- Stable support and solid design
- Open design allows easy access to specimen and microscope
- Highly stable for experiments intolerant of drift
- Accommodates a variety of stage inserts
- Compatible with Nikon, Olympus, Zeiss and Leica upright and inverted microscopes
- Suitable for:
Multi-site electrophysiology where there is a need for a single large stage



The MT-1078 / MT-2078 / MT-2278 systems consist of a X-Y translator and a large fixed stage. The MT-78-FS is designed for users who prefer a large platform stage for their experiments. The stage provides solid, stable support and ample space to attach manipulators and other instruments as needed. The rigid aluminum top plate sits firmly on two MT-75 gantry style stands. These stands provide height adjustment and sturdy attachment to the user's vibration tables.

At the core of the MT-1078 is a manual X-Y translation table, the MT-500. The translator is designed to allow movement of a microscope's optics with respect to the fixed stage. The translator allows visualization and/or imaging of multiple tissue locations while maintaining multiple stable recordings from the preparation.

The MT-2078 / MT-2278 systems use a motorized translator. At the core of the MT-2000/MT-2200 system is the MT-800 stepper-motor driven X-Y translation table. The motors can be operated either by the popular MP-285 manipulator controller (MT-2078) or the dual manipulator controller MPC-200 (MT-2278). A rotary optical encoder (ROE) accepts user input to the motorized translator and can be placed in any convenient location in your setup. Either controller gives the user smooth, high-resolution control of motion. The MP-285 controller offers extensive on-board robotic functionality and a serial computer interface for PC control.

The MPC-200 controller offers a USB computer interface for PC control. Systems using the MP-285 controller are called MT-2078 while systems using the MPC-200-ROE controller are designated MT-2278. In the center of the MT-78-FS top plate is a 4x6 inch milled pocket that will accommodate a variety of aluminum or stainless steel (ferromagnetic) stage inserts, designed to secure various commercial tissue chambers, Petri dishes or slide holders. Custom can also be provided. The ferromagnetic insert allows small magnetic devices such as perfusion lines, ground electrodes and small manipulators to be mounted near the dish.

The MT-500 manual translator and the MT-800 motorized translator are currently available for the Olympus BX-51WI, Nikon FN1, Zeiss Examiner, Zeiss Axioskop 2 FS and the Leica DM6000FS. Focus drives are available for the Olympus BX51WI. Other microscopes can be supported.



SPECIFICATIONS

MT-500 X-Y TRANSLATOR

■ Baseplate Dimensions	8 in x 15.25 in x 2.25 in 200 mm x 375 mm x 55 mm
■ Maximum Travel	1 in 25 mm
■ Resolution	0.0002 in 5 μ m
■ Maximum Load	70 lbs 32 kg
■ Weight	35 lbs 16 kg



*(MT-1078 shown with MPC-385-2.
Headstages and microscope not included)*



US PRICES MT-1078 / MT-2078 / MT-2278

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

COMPLETE SYSTEMS

MT-1078

Includes the MT-500 manual X-Y translator, and MT-78-FS fixed stage platform

■ MT-1078/Y51¹	MT-1078 for the Olympus BX51WI	\$ 7,685
■ MT-1078/Y53¹	MT-1078 for the Olympus BX53/63	\$ 7,685
■ MT-1078/Y71¹	MT-1078 for the Olympus IX71	\$ 7,685
■ MT-1078/Z25¹	MT-1078 for the Zeiss Axioskop 2 FS	\$ 7,685
■ MT-1078/Z45¹	MT-1078 for the Zeiss Axio Examiner	\$ 7,685
■ MT-1078/N65¹	MT-1078 for the Nikon FN1	\$ 7,685
■ MT-1078/L30¹	MT-1078 for the Leica DMLFS	\$ 7,685
■ MT-1078/L35¹	MT-1078 for the Leica DM6000 FS	\$ 7,685

MT-2278

Includes the MT-800 motorized X-Y translator, MPC-200 controller and ROE, MT-78-FS fixed stage platform, cables and manual

■ MT-2278/Y51¹	MT-2278 for the Olympus BX51WI	\$ 13,255
■ MT-2278/Y51/FD¹	MT-2278 with focus drive for the Olympus BX51WI	\$ 14,930
■ MT-2278/Y53¹	MT-2278 for the Olympus BX53/63	\$ 13,255
■ MT-2278/Z25¹	MT-2278 for the Zeiss Axioskop 2 FS	\$ 13,255
■ MT-2278/Z45¹	MT-2278 for the Zeiss Axio Examiner	\$ 13,255
■ MT-2278/N65¹	MT-2278 for the Nikon FN1	\$ 13,255
■ MT-2278/L30¹	MT-2278 for the Leica DMLFS	\$ 13,255
■ MT-2278/L35¹	MT-2278 for the Leica DM6000 FS	\$ 13,255

MT-2078

Includes the MT-800 motorized X-Y translator, MP-285 controller and ROE, MT-78-FS fixed stage platform, cables and manual

■ MT-2078/Y51¹	MT-2078 for the Olympus BX51WI	\$ 12,700
■ MT-2078/Y51/FD¹	MT-2078 with focus drive for the Olympus BX51WI	\$ 14,375
■ MT-2078/Y53¹	MT-2078 for the Olympus BX53/63	\$ 12,700
■ MT-2078/Z25¹	MT-2078 for the Zeiss Axioskop 2 FS	\$ 12,700
■ MT-2078/Z45¹	MT-2078 for the Zeiss Axio Examiner	\$ 12,700
■ MT-2078/N65¹	MT-2078 for the Nikon FN1	\$ 12,700
■ MT-2078/L30¹	MT-2078 for the Leica DMLFS	\$ 12,700
■ MT-2078/L35¹	MT-2078 for the Leica DM6000 FS	\$ 12,700

¹Please specify chamber type and standard or M6 tapped holes when ordering.



ACCESSORIES MT-1078 / MT-2078 / MT-2278

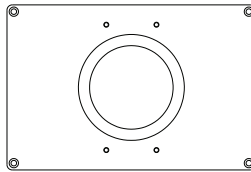
International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

PLATFORM CHAMBER INSERTS

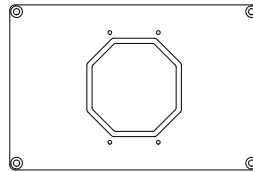
■ X040500¹	Warner Series 20 (round) for PM platform — aluminum	\$ 117
■ X040503¹	Warner Series 20 (round) for PM platform — stainless	\$ 117
■ X040505¹	Warner Series 20 (octagonal) for P & PH — aluminum	\$ 117
■ X040507¹	Warner Series 20 (octagonal) for P & PH — stainless	\$ 117
■ X040510¹	50mm round — aluminum	\$ 117
■ X040512¹	50mm round — stainless steel	\$ 117
■ X040497¹	Blank insert — aluminum	\$ 117
■ X040498¹	Blank insert — stainless steel	\$ 117
■ SI-SLIDE¹	Insert with slide holders	\$ 117
■ SI-PETRI	Insert for petri dish and slides	\$ 329
■ SI-W30¹	Warner Series 30 platform insert — aluminum	\$ 117
■ SI-W30ST¹	Warner Series 30 platform insert — stainless steel	\$ 117
■ SI-ALA-MS¹	ALA MS series insert — aluminum	\$ 117
■ SI-CUSTOM¹	Custom stage insert	\$ 450

¹ No charge when ordered with MPC-78 or MP-78 (metric or standard)

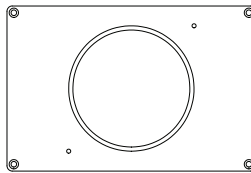
INSERT DRAWINGS



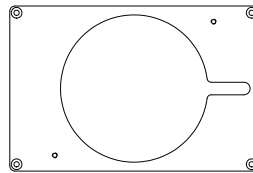
X040500, X040503



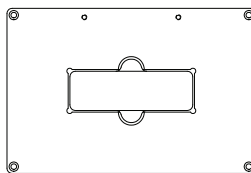
X040505, X040507



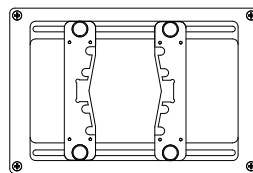
SI-W30, SI-W30-ST



SI-ALA-MS



SI-SLIDE



SI-PETRI



COMPONENTS MT-1078 / MT-2078 / MT-2278

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

INDIVIDUAL COMPONENTS

■ MT-78-FS¹	Fixed platform stage with imperial/standard holes, chamber insert and gantry supports	\$ 3,900
■ MT-78-FS/M6¹	Same as above with M6 tapped holes	\$ 3,900
■ MT-78-CS¹	Platform stage with 12.5 mm manual micrometer movement, chamber insert, and gantry supports	\$ 5,795
■ MT-78-CS/M6¹	Same as above with M6 tapped holes	\$ 5,795

MANUAL X-Y TRANSLATOR

■ MT-500/Y50	Manual Translator for Olympus BX50WI	\$ 4,350
■ MT-500/Y51	Manual Translator for Olympus BX51WI	\$ 4,350
■ MT-500/Y53	Manual Translator for Olympus BX53/63	\$ 4,350
■ MT-500/Y71	Manual Translator for Olympus IX71	\$ 4,350
■ MT-500/N65	Manual Translator for Nikon FN1	\$ 4,350
■ MT-500/L30	Manual Translator for Leica DMLFS	\$ 4,350
■ MT-500/L35	Manual Translator for Leica DM6000 FS	\$ 4,350
■ MT-500/Z20	Manual Translator for Zeiss Axioskop FS	\$ 4,350
■ MT-500/Z25	Manual Translator for Zeiss Axioskop 2 FS	\$ 4,350
■ MT-500/Z45	Manual Translator for Zeiss Axio Examiner	\$ 4,350

MOTORIZED X-Y TRANSLATOR WITH MPC-200 CONTROLLER AND ROE

■ MT-820/Y51	Translator for Olympus BX51WI	\$ 10,029
■ MT-820/Y51/FD	Translator for BX51WI with focus drive	\$ 11,695
■ MT-820/Y53	Translator for Olympus BX53/63	\$ 10,029
■ MT-820/Z25	Translator for Zeiss Axioskop 2 FS	\$ 10,029
■ MT-820/Z45	Translator for Zeiss Axio Examiner	\$ 10,029
■ MT-820/N65	Translator for Nikon FN1	\$ 10,029
■ MT-820/L30	Translator for Leica DMLFS	\$ 10,029
■ MT-820/L35	Translator for Leica DM6000 FS	\$ 10,029

MOTORIZED X-Y TRANSLATOR WITH MP-285 CONTROLLER AND ROE

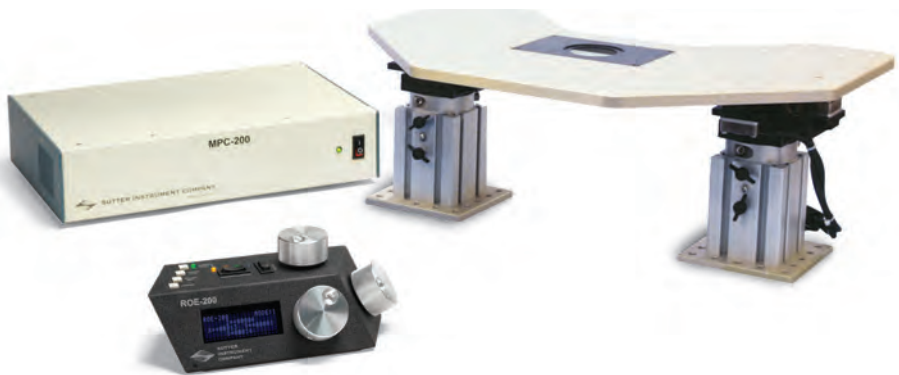
■ MT-800/Y51	Translator for Olympus BX51WI	\$ 9,475
■ MT-800/Y51/FD	Translator for BX51WI with focus drive	\$ 11,140
■ MT-800/Y53	Translator for Olympus BX53/63	\$ 9,475
■ MT-800/Z25	Translator for Zeiss Axioskop 2 FS	\$ 9,475
■ MT-800/Z45	Translator for Zeiss Axio Examiner	\$ 9,475
■ MT-800/N65	Translator for Nikon FN1	\$ 9,475
■ MT-800/L30	Translator for Leica DMLFS	\$ 9,475
■ MT-800/L35	Translator for Leica DM6000 FS	\$ 9,475

¹ Useful for most upright scopes and the Axiovert 25 inverted scope with low stage plate. Please specify chamber type when ordering (Page 86).



MPC-78 / MP-78

LARGE MOVING PLATFORM STAGE



FEATURES MPC-78 / MP-78

- Stable support and solid design
- 25 mm motorized travel in X & Y
- 40 nm or 62.5 nm resolution (depending on controller)
- Convenient Home function allows stage to be quickly repositioned
- Can be operated with MPC-200 or MP-285 controllers
- Easy to read vacuum fluorescent display
- Accommodates a variety of stage inserts
- Compatible with Nikon, Olympus, Zeiss and Leica upright and inverted microscopes
- Suitable for:
 - Multi-site, two-photon, electrophysiology
 - Multi-site, inverted (or other large microscope) electrophysiology



The MPC-78 / MP-78 Large Moving Stage is available for patch slice or in vivo experiments where the microscope body cannot be moved to view different fields of view. This is most common in two-photon experiments where the excitation beam path must enter a fixed microscope. In order to visit wide-spaced fields of view, and potentially position pipettes at wide-spaced locations, the preparation and any associated manipulators must move together on a large stage.

The MPC-78 / MP-78 was introduced at the 2007 Imaging Structure and Function in the Nervous System course at Cold Spring Harbor labs. The stage was very well received. The MPC-78 / MP-78 is also appropriate for use with inverted microscopes or other scopes that are larger and not easily translated.

The MPC-78 version uses our MPC-200 multi-manipulator controller. Connecting the stage to one port leaves the second port open for a Sutter MP-285, MP-265, or MP-225 manipulator. A simple switch on the ROE200 allows you to easily control the stage or manipulator. A second MPC-200 controller can be daisy-chained to allow operation of a more complex system from one ROE200.

The MP-78 version is operated by the MP-285 controller, providing onboard programming capability along with control via a serial interface.

The cast aluminum top plate has an attractive shape with an extensive 1/4-20 threaded hole pattern on 1-inch centers. This hole pattern is appropriate for mounting Sutter MP-285 or MP-225 manipulator mechanicals using the mounting adapter plates that come with these devices. Optional rotating bases (285RBI) are also compatible and add flexibility. Finally, the MP-265/M mechanical can be mounted on its narrow linear slide.

The large-stage platforms provide solid, stable support and ample space to attach manipulators and other instruments as needed. The rigid aluminum top plate sits firmly on two of our well-known MT-75 gantry-style stands. These stands provide height adjustment and sturdy attachment to the user's vibration table. Multiple degrees of freedom accommodate a variety of microscope and instrument arrangements.

In the center of the top plate is a 4 X 6 inch milled pocket that will accommodate a variety of aluminum stage inserts, designed to secure various commercial tissue chambers or slide holders. Custom aluminum inserts can also be provided. An available magnetic stainless steel insert carries commercial chambers or can be provided with a simple large, through hole for mounting a custom chamber. The magnetic insert allows small magnetic devices (perfusion lines, ground electrodes, small manipulators) to be mounted easily near the dish.



SPECIFICATIONS MPC-78 LARGE MOVING STAGE PLATFORM

■ Baseplate Dimensions	8 in x 15.25 in x 2.25 in 200 mm x 375 mm x 55 mm
■ Maximum Travel	1 in 25 mm
■ Resolution	0.625 $\mu\text{m}/\text{step}$ Displayed in microns
■ Maximum Load	110 lbs 50 kg
■ Weight	35 lbs 16 kg
■ Interface	USB



SPECIFICATIONS MP-78 LARGE MOVING STAGE PLATFORM

■ Baseplate Dimensions	8 in x 15.25 in x 2.25 in 200 mm x 375 mm x 55 mm
■ Maximum Travel	1 in 25 mm
■ Resolution	Low: 0.2 $\mu\text{m}/\text{step}$ High: 0.04 $\mu\text{m}/\text{step}$ Displayed in submicrons
■ Maximum Load	110 lbs 50 kg
■ Weight	35 lbs 16 kg
■ Interface	RS-232, 9600 baud



**US PRICES MPC-78 / MP-78**

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

INDIVIDUAL COMPONENTS

■ MPC-78¹	Moving platform stage plate with motorized gantry supports and imperial/standard holes, MP-200 controller (USB interface) and ROE, chamber insert, cables, manual	\$ 13,370
■ MPC-78/M6¹	Same as MPC-78 except M6 tapped holes	\$ 13,370
■ MP-78¹	Moving platform stage plate with motorized gantry supports and imperial/standard holes, MP-285 controller (serial interface) and ROE, chamber insert, cables, manual	\$ 12,145
■ MP-78/M6¹	Same as MP-78 except with M6 tapped holes	\$ 12,145

INDIVIDUAL COMPONENTS

■ MPC-78/Y51/FD²	MPC-78 with focus drive for the Olympus BX51WI	\$ 15,040
■ MP-78/Y51/FD²	MP-78 with focus drive for the Olympus BX51WI	\$ 13,810

ACCESSORIES MPC-78 / MP-78**MP-78 and MPC-78 CHAMBER INSERTS (Diagrams on page 92)**

■ X040500³	Warner Series 20 (round) for PM platform – aluminum	\$ 117
■ X040503³	Warner Series 20 (round) for PM platform – stainless	\$ 117
■ X040505³	Warner Series 20 (octagonal) for P & PH – aluminum	\$ 117
■ X040507³	Warner Series 20 (octagonal) for P & PH – stainless	\$ 117
■ X040510³	50mm round – aluminum	\$ 117
■ X040512³	50mm round – stainless steel	\$ 117
■ X040497³	Blank insert – aluminum	\$ 117
■ X040498³	Blank insert – stainless steel	\$ 117
■ SI-SLIDE³	Insert with slide holders	\$ 117
■ SI-PETRI	Insert for petri dish and slides	\$ 329
■ SI-W30³	Warner Series 30 platform insert – aluminum	\$ 117
■ SI-W30ST³	Warner Series 30 platform insert – stainless steel	\$ 117
■ SI-ALA-MS³	ALA MS series insert – aluminum	\$ 117
■ SI-CUSTOM³	Custom stage insert	\$ 450

¹ Please specify chamber type when ordering.

² Other microscope makes and models may be available. Order with M6 or standard tapped holes.

³ No charge when ordered with MPC-78 or MP-78 (metric or standard)

3DMS

3-DIMENSIONAL MOTORIZED STAGE

New Features



(Shown: 3DMS-200, with 3DMS-W20 stage bracket)

FEATURES 3DMS

- **New:** Variety of stage bracket options provide increased flexibility
- Highly stable for experiments intolerant of pipette drift
- Sub-micron resolution and integrated coarse positioning
- 1 inch of motorized travel on all three axes
- Adjustable speed and resolution allows optimization for your experimental setup
- When used with the MP-285 controller, programmable robotics for complex motion sequences
- Continuous display (in microns) of axes positions
- Switch between continuous or single step movement
- Absolute and relative origins
- Remote computer control
- Compact design easily adaptable to your setup



Many imaging experiments require the ability to move to multiple locations in a chamber or in a tissue culture dish. Large motorized stages accomplish this, but generally make the microscope into a single-use, motorized imaging station. The form factor of motorized stages usually precludes positioning other equipment such as manipulators at the same microscope.

Now, a simple attachment converts a standard Sutter MP-285 manipulator into the 3-Dimensional Motorized Stage. The 3DMS manipulator and stage attachment can be either mounted on an MT-75 gantry stand next to an upright microscope, or on an MD series stand attached to the body of an inverted microscope. The compact size allows manipulators and other equipment to be used simultaneously.

Refocusing is often required at the different X-Y locations when images are automatically acquired. Normally this requires a motorized focus drive to be added to the microscope. Because the 3DMS is a three-axis manipulator, focusing (vertical movement of the stage) is already built in. Surprisingly, this relatively small package still allows for 25 mm of movement in X, Y and Z axes with sub-micron precision.

A variety of stage brackets are available to fit the needs of your experiment. Please consult our technical staff for further information.



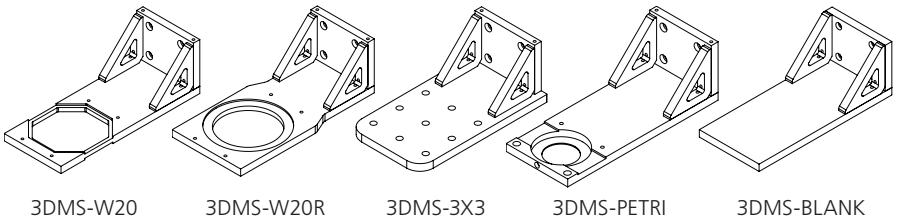


SPECIFICATIONS 3DMS

- **Travel**
 - 1 inch
 - 25 mm on all three axes
- **Resolution (with MP-285 Controller)**
 - Low: 0.2 $\mu\text{m}/\text{step}$
 - High: 0.04 $\mu\text{m}/\text{step}$
- **Maximum Speed**
 - 2.9 mm/sec
- **Long Term Stability**
 - <10 nm/hour at 24 deg C
- **Drive Mechanism**
 - Precision worm gear capstan drive
- **Serial Interface**
 - RS-232, 9600 baud
 - (1 start bit, 8 data bits, 1 stop bit)
- **Dimensions**
 - Mechanical:*
 - 4.5 in x 6 in x 6.25 in
 - 11 cm x 15 cm x 16 cm
 - Controller:*
 - 4 in x 16 in x 12.25 in
 - 10 cm x 40.5 cm x 31 cm
- **Weight**
 - Manipulator:*
 - 3.85 lb
 - 1.7 kg
 - Controller:*
 - 10 lb 11 oz
 - 4.5 kg
- **Electrical**
 - 115/230 Volts
 - 50/60 Hertz power line



MECHANICAL DRAWINGS STAGE BRACKETS



**US PRICES 3DMS SYSTEMS**

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

■ 3DMS-285*	Includes rack mount MP-285 controller, 3-axis motorized stage for microscope, stage bracket, and ROE user interface	\$ 9,365
■ 3DMS-200*	Includes rack mount MPC-200 controller, 3-axis motorized stage for microscope, stage bracket, and ROE user interface	\$ 10,030

** Please specify stage bracket when ordering.*

ACCESSORIES 3DMS**STAGE BRACKETS**

When ordering the 3DMS, the stage bracket must be specified. Please list as a separate item at no cost. Additional stage brackets can be purchased as needed.

■ 3DMS-W20¹	Stage bracket for Warner Series 20 octagonal (P & PH)	\$ 550
■ 3DMS-W20R¹	Stage bracket for Warner Series 20 round (PM)	\$ 550
■ 3DMS-3X3¹	Stage bracket with 3X3 M6 tapped holes	\$ 550
■ 3DMS-PETRI¹	Stage bracket for Petri dish and slides	\$ 550
■ 3DMS-BLANK¹	Stage bracket – blank	\$ 550
■ 3DMS-CUSTOM	Stage bracket – custom design	\$ 950
■ 3DMS/M	3-axis motorized stage mechanical only	\$ 6,685
■ M100106	Flat side panel for controller (each)	\$ 42

¹ No charge when ordering with the 3DMS-200 or 3DMS-285.

MOTORIZED MICROSCOPE STAGE AND TRANSLATOR COMPARISON CHART



	MT-2000 / 2078 MT-2200 / 2278	MP-78 MPC-78	3DMS
<i>DESCRIPTION</i>	Microscope translator and table mounted stands and/or fixed stage for multi-patch	Large moving platform stage	3-dimensional motorized stage
<i>USES</i>	Multi-electrode recording and imaging in slices or other preparations	Simultaneous 2-Photon Imaging and electrophysiology	Multi-site imaging of samples smaller than 25 mm x 25 mm
<i>FEATURES</i>	25 mm X and Y optical train movement via manual or motorized microscope translators. Accomplishes high magnification microscopy/ electrophysiology at multiple sites in a sample. Manipulators and tissue sample can be on separate stands or on a single large fixed stage.	Tissue sample or whole animal and multiple manipulators are supported on a large, moving stage. 25 mm travel in X and Y allow the user to move to multiple sites in brain or other tissue for electrode placement and simultaneous 2-photon imaging. The large moving stage is also useful for inverted microscope or other applications where moving the microscope is not convenient or easily accomplished.	Built-in Z focus drive, compact form factor, compatible with upright or inverted microscopes, 25 mm travel in X, Y, and Z. Adjustable speed and resolution allows optimization for your experimental setup. Absolute and relative origins. Programmable robotics for complex motion sequences when used with MP-285 controller.

Features

Travel

25 mm in X, Y, and Z



22 mm in X and Y



Focus

Built-in



Option for Olympus BX51WI¹



Control

ROE or PC

ROE or PC

ROE

Interface

With MPC-200

USB

USB

USB

With MP-285

Serial

Serial

Serial

Price²

\$11,695 to \$14,930

\$12,145 (MP-78)
\$13,370 (MPC-78)

\$9,365 to \$10,029

¹ Please contact Sutter for availability on other microscope makes and models

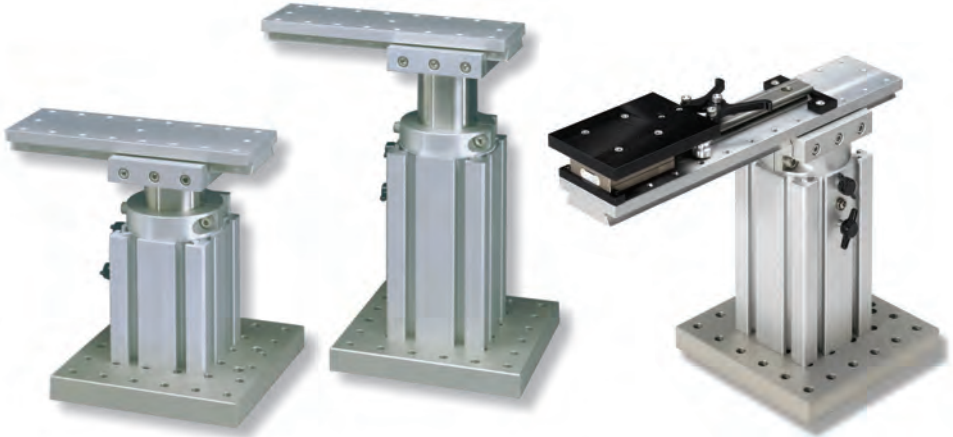
² U.S. prices. International prices are 5% higher





MT-75 SERIES

GANTRY STYLE MICROMANIPULATOR STAND



FEATURES MT-75 SERIES

- Adjustable vertical and horizontal axes
- Up to 360 degrees of rotation
- Suitable for upright and inverted microscopes
- Quick lock mechanism allows for easy positioning
- Solid construction provides stable mounting
- Optional linear slide provides smooth and easy movement for pipette replacement



For ultimate flexibility in positioning micromanipulators or other devices adjacent to your microscope, look to the MT-75 series stands. These unique gantry systems offer adjustable vertical and horizontal axes and up to 360 degrees of rotation. Your manipulator or other device will mount to the 3/4 inch thick aluminum cantilever which is dovetailed for secure positioning. The cantilever assembly is mounted on a heavy 2 inch diameter stainless steel post. The post is supported within the same extruded aluminum tower used in our MT-70 stands. The tower can be center mounted or edge mounted to the baseplate for an additional degree of positioning freedom.

Vertical positioning is achieved with an aluminum collar which securely locks onto the steel post to fix the height of the system. The MT-75 is suitable for use with most inverted microscopes, and can be adjusted from a minimum height of 8.71 inches to a maximum height of 12.25 inches. The MT-75S is suitable for most upright scopes, and can be adjusted from 6.71 inches to 7.25 inches. These systems are very stiff, deflecting approximately 2 μm per 25 mm rise with a 1.5 kg load at the end of the cantilever.

A quick lock mechanism allows easy unlocking and rotation of the post/cantilever assembly up to 320 degrees, then rotation back to the same positive stop position and locking in place (e.g. insertion and removal of microelectrodes from headstages). Remove the positive stop and you have a full 360 degree rotation. A Teflon washer contributes to the smooth rotation of the system.

The solid aluminum baseplate has through-holes on 1 inch (25 mm) centers for mounting onto tables. The cantilever has eighteen 1 inch spaced 10-32 holes along the edges. The MT-75/LS manipulator mount provides additional flexibility of movement. In multiple manipulator setups, rotational movement for pipette replacement is often not possible. Using a long linear rail, the manipulator can be quickly and smoothly moved to a location where there is easy access to the pipette for replacement. After replacement, the manipulator can be slid back into a fixed stop that defines the working position.

The linear slide system can also be added to existing MT-75 stands by ordering the MT-7004 linear slide cantilever alone.



SPECIFICATIONS

MT-75 SERIES

■ Baseplate Dimensions	6 in x 6 in x .75 in 153 mm x 153 mm x 19 mm
■ Cantilever Dimensions	2.5 in x 8 in x .75 in 64 mm x 204 mm x 19 mm
■ Weight	<i>MT-75:</i> 11 lbs 7 oz 5.2 kg <i>MT-75S:</i> 9 lbs 14 oz 4.5 kg <i>MT-75T:</i> 13 lbs 5.9 kg

Illustration is not to scale. See actual product for details.



MT-75 GANTRY STYLE STAND SELECTION GUIDE

For use with an inverted microscope. Independent tower solution when not using our MD manipulator or stage platforms.

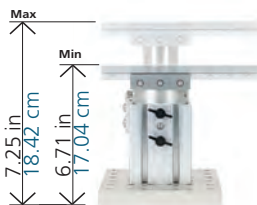
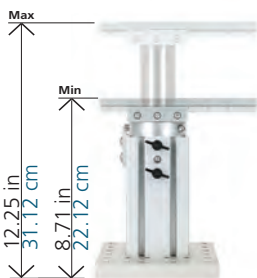
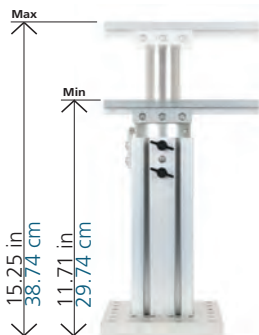
For use with an upright microscope mounted on a translator.

For use with an upright microscope without a translator.

MT-75T

MT-75

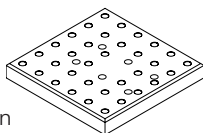
MT-75S



BASEPLATE OPTIONS

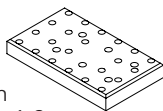
SQUARE

6 in x 6 in x 0.75 in
15.2 cm x 15.2 cm x 1.9 cm



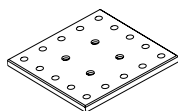
NARROW

3 in x 5 in x 0.75 in
7.6 cm x 12.7 cm x 1.9 cm



THIN

5 in x 5 in x 0.3 in
12.7 cm x 12.7 cm x 0.76 cm



MT-75T MT-75 MT-75S

BASEPLATE	VERTICAL DIMENSIONS					
	Min	Max	Min	Max	Min	Max
SQUARE OR NARROW	11.71 in 29.74 cm	15.25 in 38.74 cm	8.71 in 22.12 cm	12.25 in 31.12 cm	6.71 in 17.04 cm	7.25 in 18.42 cm
THIN	11.26 in 28.60 cm	14.80 in 37.59 cm	8.26 in 20.98 cm	11.80 in 29.97 cm	6.26 in 15.90 cm	6.80 in 17.27 cm

The MT-75 stands come standard with the square baseplate. The narrow or thin baseplate can be substituted at the time of ordering at no additional charge.



US PRICES MT-75 SERIES

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

MT-75 SERIES

■ MT-75	Standard gantry stand 8.7 to 13.4in (22.1 to 33.9 cm)	\$ 843
■ MT-75S¹	Short gantry stand 6.7 to 9.6 in (16.9 to 24.4 cm)	\$ 843
■ MT-75T	Tall gantry stand 10.7 to 15.4 in (27.1 to 39.1 cm)	\$ 960
■ MT-75XT	Extra tall gantry stand 14.7 to 18.5 in (37.4 to 47 cm)	\$ 960
■ MT-75/LS¹	Standard gantry stand with linear slide	\$ 1,442
■ MT-75S/LS¹	Short gantry stand with linear slide	\$ 1,442
■ MT-75T/LS	Tall gantry stand with linear slide	\$ 1,555
■ MT-75XT/LS	Extra tall gantry stand with linear slide	\$ 1,555

MT-81 MICROINJECTION SERIES

■ MT-81-DOV8²	MT-81 stand with 8 inch dovetail	\$ 626
■ MT-81-DOV12²	MT-81 stand with 12 inch dovetail	\$ 626

¹ Useful for most upright scopes and the Axiovert 25 inverted scope with low stage plate.

² Useful for low profile stereoscopes and microinjection.

ACCESSORIES MT-75 SERIES

■ MT-7004	Linear slide cantilever (no stand)	\$ 778
■ MAG-MT	Magnetic feet (set of 4)	\$ 70
■ X700080³	Thin baseplate – 5 in x 5 in x 0.3 in thick	\$ 121
■ X700095³	Narrow baseplate – 3 in x 5 in x 0.75 in thick	\$ 121
■ X700100³	Square baseplate – 6 in x 6 in x 0.75 in thick	\$ 121
■ X750090³	12 inch dovetail	\$ 384

³ Can be substituted at time of ordering with MT-75 stands at no additional charge.



(Shown: MT-81-DOV8. Suitable for microinjection)



MT-70 / MT-71 STANDS



FEATURES MT-70 / MT-71

- Solid extrusion provides sturdy, stable mounting
- Accommodates a variety of special layouts
- Individual components provide a variety of mounting options
- Suitable for upright and inverted microscopes
- Adjustable height cantilever available



The MT-70 series of stands are sturdy, stable, and extremely versatile for mounting components for a variety of research applications. They were designed for placing our heavy Huxley-style micromanipulators adjacent to any microscope. We found them to be so useful and adaptable that we also use them for mounting other items such as optical components.

The stands are based on a rigid extruded aluminum tower which is available in 3 inch increments up to 12 inches. The tower is mounted on a sturdy 3/4 in thick aluminum baseplate and then fitted with a 5/16 in thick aluminum mounting platform. These systems are configurable as fixed height stands or, in the MT-71 series, have an adjustable height cantilevered side platform for added versatility. The tower can be center or edge mounted to the baseplate for accommodating various spatial layouts. Rows of 1 inch and 25 mm centered clearance holes are provided in the baseplate for attachment to tables. The mounting platforms have tapped 1/4-20 mounting holes on 1 inch centers.

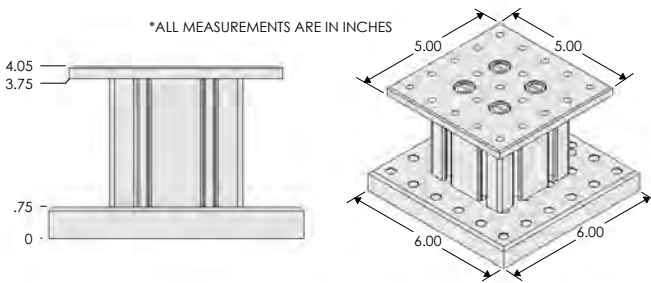
The stands are available in sets, or you can order individual components separately to meet your specific requirements. Custom heights can be made to order for an additional fee. To securely fasten our MP-85 Huxley style manipulator to the mounting plates, please order the manipulator adapter plate at the time of purchase. Larger baseplates or mounting plates are available upon special order.



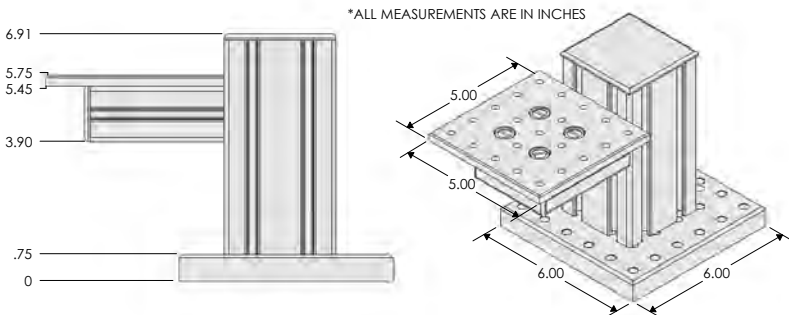
SPECIFICATIONS MT-70 / MT-71

- **Baseplate Dimensions** 6 in x 6 in x .75 in
153 mm x 153 mm x 19 mm
- **Mounting Plate Dimensions** 5 in x 5 in x 5/16 in
128 mm x 128 mm x 8 mm
- **Total Stand Height** depending on configuration
4 1/16 in to 13 1/16 in
104 mm to 333 mm
- **Weight** depending on configuration
3 lbs 11 oz to 8 lbs 5 oz
1.7 kg to 3.8 kg

MECHANICAL DRAWINGS MT-70-3



MECHANICAL DRAWINGS MT-71-6



**US PRICES MT-70 / MT-71 STANDS**

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

MT-70 SERIES

■ MT-70-3	3 inch tower, baseplate, mounting platform and fastening hardware	\$ 315
■ MT-70-6	Same as above with 6 inch tower	\$ 345
■ MT-70-9	Same as above with 9 inch tower	\$ 384
■ MT-70-12	Same as above with 12 inch tower	\$ 412

(Custom tower lengths available: \$20 per inch, \$25 per cut)

MT-71 SERIES

■ MT-71-3	3 inch tower, baseplate, mounting platform and fastening hardware	\$ 379
■ MT-71-6	Same as above with 6 inch tower	\$ 412
■ MT-71-9	Same as above with 9 inch tower	\$ 444
■ MT-71-12	Same as above with 12 inch tower	\$ 480

(Custom tower lengths available: \$20 per inch, \$25 per cut)

ACCESSORIES MT-70 / MT-71 STANDS

■ MT-7001	Cantilever mounting assembly	\$ 166
■ MAG-MT	Magnetic feet (set of 4)	\$ 70
■ X700080	Thin baseplate — 5 in x 5 in x 0.3 in thick	\$ 121
■ X700095	Narrow baseplate — 3 in x 5 in x 0.75 in thick	\$ 121
■ X700100	Square baseplate — 6 in x 6 in x 0.75 in thick	\$ 121
■ X700102	Mounting plate — 5 in x 5 in x 0.3 in thick	\$ 91
■ X700115	MP-85 adapter plate	\$ 106



MD SERIES MICROMANIPULATOR PLATFORMS

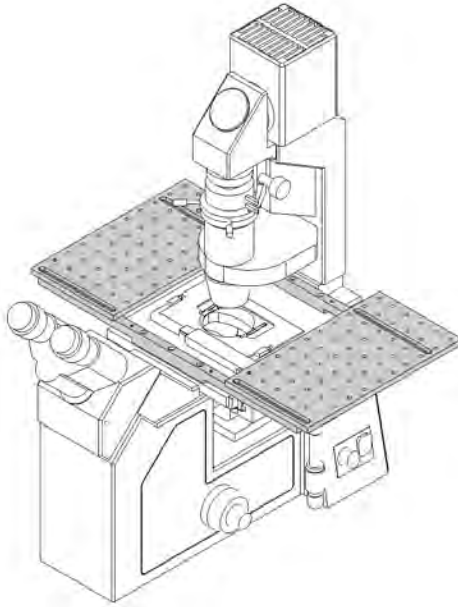


FEATURES MD SERIES

- Creates a stable matrix of 1/4-20 or M6 holes on one or both sides of a mechanical stage
- Open design allows easy access to specimen and microscope
- Mounts directly on microscope, preserving valuable optical bench space
- Independent platform separate from specimen
- Allows for flexible mounting of all Sutter motorized manipulators

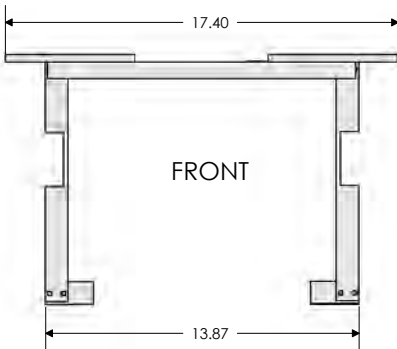


We've designed a series of Microscope Dependent (MD) stands for those who wish to use a Sutter Instrument manipulator in conjunction with an inverted microscope. The typical MD stand is a manipulator platform that bolts directly to the frame of an inverted microscope. Stands are available in either single-sided or double-sided versions for the most common inverted microscopes made by Nikon, Olympus, Leica, and Zeiss. These platforms lend themselves to the absolutely drift-free recording configuration required when using the manipulators to position patch-electrodes to record from attached cells in culture. To mount the MP-285 to an MD stand, you also need either the X285210 mounting adapter plate (for orthogonal mounting), or the 285RBI rotating base that allows for non-orthogonal mounting and rotation of the entire manipulator (note: the X285210 mounting plate is included with each MP-285 and MP-225). New mounting options and adapters for new microscopes are being added frequently. Please see our web site for new additions, current mechanical drawings, and dimensions.

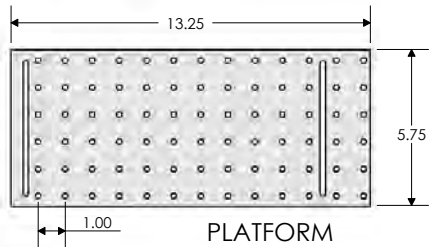
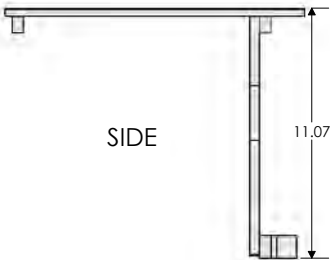
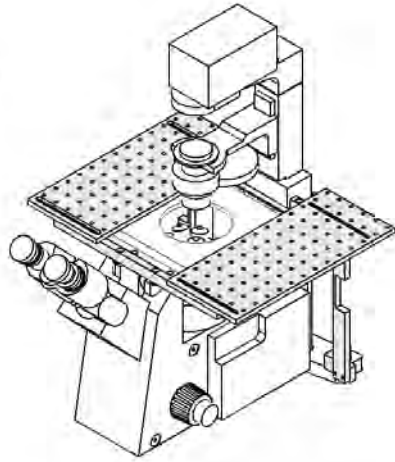




MECHANICAL DRAWINGS MD-SERIES



*ALL MEASUREMENTS ARE IN INCHES



(Dimensions vary by scope)



US PRICES MD-SERIES

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

MD part numbers have top plates with an imperial hole pattern ($\frac{1}{4}$ -20 on 1 inch centers) and our MDM part numbers indicate a metric hole pattern (M6 tapped holes on 25 mm centers). The last digit of the MD and MDM part number identifies a single-sided universal platform (-1), single-sided positional (-1L, -1R), or a double-sided platform (-2). If you do not see a metric top plate for your microscope, please phone Sutter as it may be available.

Olympus

MD-80 SERIES

Olympus IX 50/70

MD-80-1	Single-sided	\$ 510
MD-80-2	Double-sided	\$ 1,020

Olympus IX 51/71/81

MD-81-1	Single-sided	\$ 510
MD-81-2	Double-sided	\$ 1,020

Olympus IX 51/71/81 with zero drift stage

MD-81-1ZDC	Single-sided	\$ 510
MD-81-2ZDC	Double-sided	\$ 1,020

Olympus IX 53/73

MD-73-1	Single-sided	\$ 510
MD-73-2	Double-sided	\$ 1,020

Olympus IX 53/73 (metric tap)

MDM-73-1	Single-sided	\$ 510
MDM-73-2	Double-sided	\$ 1,020

Olympus IX 83

MD-83-1	Single-sided	\$ 510
MD-83-2	Double-sided	\$ 1,020

Olympus IX 83 (metric tap)

MDM-83-1	Single-sided	\$ 510
MDM-83-2	Double-sided	\$ 1,020

Zeiss

MD-90 SERIES

Axiovert 100/135

MD-90-1	Single-sided	\$ 510
MD-90-2	Double-sided	\$ 1,020

Axiovert 200 / Axio Observer

MD-91-1	Single-sided	\$ 510
MD-91-2	Double-sided	\$ 1,020

Axiovert 200 / Axio Observer (metric tap)

MDM-91-1	Single-sided	\$ 510
MDM-91-2	Double-sided	\$ 1,020

Axiovert 25

MD-92-1	Single-sided	\$ 510
MD-92-2	Double-sided	\$ 1,020



US PRICES MD-SERIES

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

Nikon

Nikon Diaphot 200/300 and Nikon TE 200/300

MD-50-1	Single-sided	\$ 510
MD-50-2	Double-sided	\$ 1,020

Nikon TMD

MD-51-1	Single-sided	\$ 510
MD-51-2	Double-sided	\$ 1,020

Nikon TE-2000

MD-52-1	Single-sided	\$ 510
MD-52-2	Double-sided	\$ 1,020
MD-52-1/UP	Single-sided for scopes with Stage Up Kit	\$ 510
MD-52-2/UP	Double-sided for scopes with Stage Up Kit	\$ 1,020

Nikon TE-2000 (metric tap)

MDM-52-1	Single-sided	\$ 510
MDM-52-2	Double-sided	\$ 1,020
MDM-52-1/UP	Single-sided for scopes with Stage Up Kit	\$ 510
MDM-52-2/UP	Double-sided for scopes with Stage Up Kit	\$ 1,020

Nikon Ti

MD-54-1/L	Single-sided left	\$ 510
MD-54-1/R	Single-sided right	\$ 510
MD-54-2	Double-sided	\$ 1,020
MD-54-1/M	Single-sided for scopes with motorized stage	\$ 510
MD-54-2/M	Double-sided for scopes with motorized stage	\$ 1,020
MD-54-1/UP	Single-sided for scopes with Stage Up	\$ 510
MD-54-2/UP	Double-sided for scopes with Stage Up	\$ 1,020
MD-54-1/MUP	Single-sided for scopes with Stage Up — motorized	\$ 510
MD-54-2/MUP	Double-sided for scopes with Stage Up — motorized	\$ 1,020

Nikon Ti (metric tap)

MDM-54-1/L	Single-sided left	\$ 510
MDM-54-1/R	Single-sided right	\$ 510
MDM-54-2	Double-sided	\$ 1,020
MDM-54-1/M	Single-sided for scopes with motorized stage	\$ 510
MDM-54-2/M	Double-sided for scopes with motorized stage	\$ 1,020
MDM-54-1/UP	Single-sided for scopes with Stage Up	\$ 510
MDM-54-2/UP	Double-sided for scopes with Stage Up	\$ 1,020
MDM-54-1/MUP	Single-sided for scopes with Stage Up — motorized	\$ 510
MDM-54-2/MUP	Double-sided for scopes with Stage Up — motorized	\$ 1,020

Nikon Ti2

MD-55-1/L	Single-sided left	\$ 510
MD-55-1/R	Single-sided right	\$ 510
MD-55-2	Double-sided	\$ 1,020

Nikon Ti2 (metric tap)

MDM-55-1/L	Single-sided left	\$ 510
MDM-55-1/R	Single-sided right	\$ 510
MDM-55-2	Double-sided	\$ 1,020
MD-SPACER-15	15mm spacer for Nikon Ti2 with motorized stage (set of 4)	\$ 61



US PRICES MD-SERIES

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

Leica

Leica DMIRB

MD-60-1/L

MD-60-1/R

Leica DMIRB

MD-60-2

Leica DMIL

MD-61-1

MD-61-2

Leica DMI 4000/5000/6000

MD-62-1/L

MD-62-1/R

MD-62-2

Leica DMI 8

MD-63-1/L

MD-63-1/R

MD-63-2

MD-63-1L/M

MD-63-1R/M

MD-63-2/M

Leica DMI 8 (metric tap)

MDM-63-1L

MDM-63-1R

MDM-63-2

MDM-63-1L/M

MDM-63-1R/M

MDM-63-2/M

MD-60 SERIES

Single-sided left

Single-sided right

Double-sided

Single-sided

Double-sided

Single-sided left

Single-sided right

Double-sided

Single-sided left

Single-sided right

Double-sided

Single-sided left for scopes with motorized stage

Single-sided right for scopes with motorized stage

Double-sided for scopes with motorized stage

Single-sided left

Single-sided right

Double-sided

Single-sided left for scopes with motorized stage

Single-sided right for scopes with motorized stage

Double-sided for scopes with motorized stage

\$ 510

\$ 510

\$ 1,020

\$ 510

\$ 1,020

\$ 510

\$ 510

\$ 1,020

\$ 510

\$ 510

\$ 1,020

\$ 510

\$ 510

\$ 1,020

\$ 510

\$ 510

\$ 1,020

\$ 510

\$ 510

\$ 1,020

dPatch®**LOW-NOISE ULTRA-FAST DIGITAL
PATCH CLAMP AMPLIFIER SYSTEM****New***(Shown: DPATCH-2)***FEATURES dPatch®**

- Fully integrated single- or dual-headstage patch clamp amplifier and data acquisition system ensures quick and easy setup
- Ultra-high bandwidth enables characterization of the fastest signals
- Optimized for low-noise single-channel as well as whole-cell patch clamp recordings in cell-free patches, tissue slices, adherent or dissociated cells
- Full computer control provides automated compensation of electrode and whole-cell capacitance
- Comprehensive digital compensation circuitry provides the utmost precision and signal fidelity
- Voltage and true current clamp capability for complete characterization of cells' electrical activity
- Line frequency reduction in SutterPatch® software
- Three headstage feedback ranges for single-channel and whole-cell patch clamp recordings
- Bundled SutterPatch® software provides a contemporary user interface, versatile data management, intuitive navigation and streamlined data analysis

COMMON APPLICATIONS dPatch®

- Single-channel recordings
- Auditory research and other rapidly changing signals
- Tissue slice recordings
- Cultured cell experiments
- Cell line studies from adherent or dispersed cells
- Optogenetics



Sutter Instrument is proud to introduce the latest cutting-edge tool for electrophysiology research, the dPatch® Digital Patch Clamp Amplifier. Using high-speed digital processing, matched with high-resolution data converters and paired with SutterPatch® software's intuitive user interface, this low-noise, high-bandwidth precision instrument provides capabilities previously unattainable to electrophysiologists.

Available in either a single- or dual-headstage configuration, the dPatch amplifier's architecture makes swapping headstages, or adding a second one to a single-headstage version, a plug-and-play operation. The two headstages are independently configurable for either voltage clamp or true high-speed current clamp. Data is streamed from each headstage in parallel and fully synchronized.

5 MHz SAMPLING RATE, UP TO 22-bit RESOLUTION

One unique feature with dPatch is the headstage-based data sampling system. The signal from each headstage is continually digitized at 5 MHz. Output filtering has thirteen settings between 100 Hz and 1 MHz. A resolution of 18 bits is achieved at 1 MHz. For lower filter settings, automatic downsampling increases resolution while optimizing data rates. At a bandwidth setting of 1 kHz the dPatch system provides a signal resolution of better than 22 bits.

OPTIMAL NOISE PERFORMANCE IN BOTH THE CAPACITIVE AND RESISTIVE FEEDBACK RANGES

When other products remove thermal energy from the headstage circuitry, it in turn heats up the headstage housing. That leads to thermal drift of the pipette and other, cumbersome side effects. One of the development goals of the dPatch headstage was achieving a comparable noise performance at room temperature, without the need for a cooled headstage. In the two resistive feedback modes, the dPatch amplifier is even quieter than any of the competitor systems.

BUILT-IN DATA ACQUISITION SYSTEM MEANS NO THIRD-PARTY HARDWARE

Using a multiplexer-free design, the dPatch provides 8 fully differential analog input channels, 4 analog output channels, and 16 digital outputs (TTL). All I/O channels are sampled continuously (200 kHz for analog inputs, 250 kHz for analog and digital outputs) and available through the user interface.

SUTTERPATCH® SOFTWARE

The dPatch amplifier, in combination with SutterPatch software, has been engineered to automatically capture and store all amplifier settings, stimulus information and external experiment parameters, and associate them in time with the raw data traces. This includes all amplifier and acquisition settings, as well as timing and progress of the experiment. Fully integrated computer control of the amplifier stages means that the acquisition software is aware of the internal state of the amplifier and digitizer at all times and can track any changes that may occur. This is independent of whether a change is triggered automatically or initiated by the user.

TRACKING OF OTHER EXTERNAL DATA

In addition to status changes in connected hardware that are automatically tracked, the researcher can manually trigger tags to document events like stimulus application using instruments not connected to the amplifier.

Information about environmental parameters and a more detailed specification of sample properties can be recorded and stored with the raw data. A total of over 600 metadata attributes are supported. Examples include: animal species, genotype,



date/time when a cell sample was prepared, recording solutions, pipette resistance, hardware properties, and detailed information about stimuli applied.

DATA VISUALIZATION AND ANALYSIS

SutterPatch® software has been designed to simplify the navigation and analysis of complex datasets. The scope window supports multiple view modes in both two-dimensional and an innovative three-dimensional display. The 3D view is particularly useful during assay development. Built on top of the latest version of the proven Igor Pro platform, SutterPatch combines native Igor Pro functionality with a wealth of features that are tailored to electrophysiology applications. Both the newcomer and the experienced user of patch clamp programs will quickly feel comfortable using SutterPatch software.

Application modules provide focused functionality for particular applications.

Currently Available

- Event Detection Module: A deconvolution algorithm that excels at detecting miniature synaptic events even on a noisy background
- Action Potential Analysis Module: Phase plane plot, timing and waveform statistics
- Camera Module: An easy way to document the identity and condition of the recorded cell

A LABORATORY WORKHORSE

While the dPatch® System is ready for cutting-edge research, its feature set makes it immediately valuable in any lab setting.

- Three headstage feedback ranges for optimal whole-cell and single-channel recording
- Automated or manual compensation of electrode and whole-cell capacitance
- Series resistance compensation
- Simple cabling, quick and easy set-up
- High dynamic range of digitizer means no need for variable gain stages
- High speed of digitizer means no concern about sample rate



The dPatch® Integrated Digital Patch Clamp Amplifier is a computer-controlled single- or dual-headstage system optimized for both single-channel and whole-cell recording applications.



Back panel of dPatch

Amplifier

- Hardware architecture enables all data conversion to be performed near the preparation, well away from known noise sources, such as power supplies and high-speed digital circuitry
- Voltage clamp and true current clamp modes with smart switching between modes to avoid current artifacts
- Three choices of headstage feedback elements to optimize both single-channel and whole-cell recording

Feedback Element	Range	Analog Bandwidth	Noise 10 kHz BW	Pipette Capacitance Compensation Range	Series Resistance Range	Cell Capacitance Range
Capacitive	± 20 nA	>500 kHz	<0.22 pA _{RMS}	10 pF	N/A *	N/A *
500 M Ω	± 20 nA	>250 kHz	<0.75 pA _{RMS}	10 pF	100 M Ω	100 pF
50 M Ω	± 200 nA	>250 kHz	<2.4 pA _{RMS}	10 pF	10 M Ω	1000 pF

* Capacitive feedback range is optimized for single-channel voltage clamp recordings. Whole-cell compensation and current clamp mode are disabled with this range.

- Automatic compensation routines for pipette compensation, whole-cell compensation, and series resistance compensation
- Novel 2D matrix and triple-slider controls for manual compensation adjustment
- Series resistance prediction and correction independently programmable
- 8-pole Bessel filter 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50, 100, 250, 500, 1000 kHz
- Signal processing of filter output to increase resolution and reduce data file size
- Resolution over 22 bits at 1 kHz filter setting
- High dynamic range of analog to digital converters eliminates need for variable output gain stages
- Holding potential ± 1000 mV
- Current clamp bridge compensation and pipette capacitance compensation

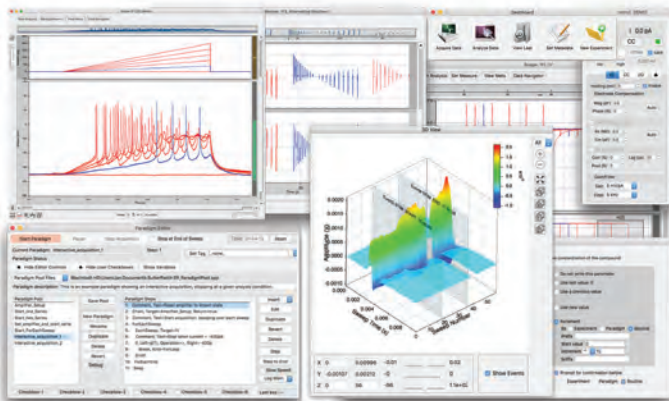


Data Acquisition

- Embedded data acquisition system eliminates the need for an external data acquisition board
 - 5 MHz sampling rate per headstage, up to 22-bit resolution
 - 8 Auxiliary analog inputs, 16-bit fully differential, ± 10 V input, each continuously sampled at 200 kHz
 - 4 Analog outputs, 16-Bits, ± 10 V output each continuously updated at 250 kHz
 - 16 Digital outputs (TTL) each running at 250 kHz
 - Independent Trigger IN / Trigger OUT for synchronization of external instrumentation
- Single high-speed 3.0 USB connection controls both data acquisition and amplifier settings
- Complex command waveforms
- Data acquisition can be initiated by an onboard microsecond clock or external (TTL) trigger

SutterPatch® Software

- Built on the foundation of Igor Pro (WaveMetrics, Inc.)
- Paradigms and Routines provide complete experimental control
- Waveform Editor for easy creation of even the most complex stimulus patterns or user-defined templates
- Associated metadata stores all relevant information regarding your experiment
- Comprehensive data analysis routines and publication quality graphics
- Rapid-response online line-frequency reduction
- Runs on Windows 7 or later (64-bit), or Mac OS X 10.11 (El Capitan) or newer versions



Screen shot of SutterPatch software



SPECIFICATIONS dPatch®

■ Dimensions

dPatch®:

19 in x 11 in x 3.5 in
48.2 cm x 28 cm x 9 cm

dPatch® Preamplifier:

7.6 in x 3.5 in x 1.2 in
19.5 cm x 9 cm x 3 cm

dPatch® Headstage:

3.9 in x 1.4 in x 0.75 in
10 cm x 3.5 cm x 1.9 cm

■ Weight

dPatch®:

15 lbs
6.8 kg

■ Electrical

110/240 Volts
50/60 Hertz power line



SYSTEM REQUIREMENTS

■ Operating System

Windows 7 or later: 64-bit versions
Mac OS X 10.11 (El Capitan) or newer

■ Computer Hardware

Minimum Configuration

Central Processing Unit (CPU): Dual-core i5
Random Access Memory (RAM): 6 GB
Solid-state Drive (SSD), 500 GB or greater
Display Resolution: 1024 x 768 (XGA)
1 available USB 3.0 Super Speed port

Recommended Configuration

To utilize the full speed potential of the dPatch System, you should use the most powerful computer system you can afford.



US PRICES dPatch®

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

■ DPATCH	Includes: dPatch® System with headstage and preamplifier, EH-P170 pipette holder, model cell; SutterPatch® software suite with Igor Pro 8 license, rack mounting hardware.	\$ 23,900
■ DPATCH-2	Includes: dPatch System with two headstages and preamplifiers, two EH-P170 pipette holders, two model cells; SutterPatch software suite with Igor Pro 8 license, rack mounting hardware.	\$ 28,900

ACCESSORIES dPatch®

■ DPATCH-HS	Headstage & preamplifier for dPatch Amplifier System	\$ 6,500
■ DPATCH-PCH	dPatch expansion panel	\$ 895

While polycarbonate is a proven material for patch pipette holders, it undergoes significant thermal expansion. Uneven warming may lead to motion of the pipette tip and is often incorrectly perceived as drift in the micromanipulator. Quartz has a significantly lower thermal expansion coefficient and virtually eliminates thermal drift. Note: Quartz is fragile and may crack or shatter on impact. Treat your quartz electrode holder with the same care you would with any optical component.

■ EH-P170	Polycarbonate holder 1.0 mm to 1.7 mm O.D.	\$ 169
■ EH-Q170	Quartz holder 1.0 mm to 1.7 mm O.D.	\$ 495
■ RACK-PK	Rack mounting hardware	\$ 17
■ GP-17	Ground point	\$ 250



The Ground Point GP-17 provides reliable, low resistance connections for a star ground configuration, the proven method to avoid ground loops in any electrophysiology setup. Accepts 9 banana plugs + 8 bare wires up to 10 gauge or banana plugs. The baseplate mounts directly on imperial or metric air table tops with the included ¼-20 and M6 screws. Made of solid, machined brass with plated banana/clamp connectors.





IPA® and DOUBLE IPA® INTEGRATED PATCH AMPLIFIERS WITH DATA ACQUISITION SYSTEM



FEATURES IPA® / DOUBLE IPA®

- Combination of any two IPA or Double IPA devices enables up to four headstage channels for as many as 16 signals
- Fully integrated patch clamp amplifier and data acquisition system ensures quick and easy setup
- Optimized for whole-cell patch clamp recordings in tissue slices, adherent or dissociated cells
- Full computer control provides automated compensation of electrode and whole-cell capacitance
- Voltage and current clamp capability for complete characterization of cells' electrical activity
- Bundled SutterPatch® software excels in comprehensive data management, intuitive navigation and streamlined data analysis
- Line frequency reduction in SutterPatch

COMMON APPLICATIONS IPA® / DOUBLE IPA®

- Tissue slice recordings
- Cultured-cell experiments
- Cell line studies from adherent or dispersed cells
- *In vivo* patch clamp
- Network studies
- Optogenetics



The IPA® family of Integrated Patch Amplifiers enables efficient, low-noise whole-cell recordings. The IPA systems, available in either a single headstage (IPA) or dual headstage (DOUBLE IPA), combine state-of-the-art amplifier technology with fully integrated D/A and A/D conversion and a high-speed USB interface. Acquisition, data management, and streamlined analysis are performed using the bundled SutterPatch® Data Acquisition and Analysis Software, built on the foundation of Igor Pro (WaveMetrics, Inc.).

EXTERNAL INPUTS & OUTPUTS

External signals, such as environmental parameters or stimulus information, can be recorded using 4 auxiliary analog input channels. The IPA systems also support the control of peripheral hardware, such as wavelength or solution switchers, with 2 analog and 8 digital (TTL) output channels. Alternatively to the standard breakout cable, the available Patch Panel provides a tidy way of connecting auxiliary signals on the front of your rack.

SUTTERPATCH SOFTWARE

The IPA system, in combination with SutterPatch software, has been engineered to automatically capture and store all amplifier settings, stimulus information and external experiment parameters and associate them in time with the raw data traces. This includes all amplifier and acquisition settings, as well as timing and progress of the experiment. Fully integrated computer control of the amplifier stages means that the acquisition software is aware of the internal state of the amplifier and digitizer at all times and can track any changes that may occur. This is independent of whether a change is triggered automatically or initiated by the user.

TRACKING OF OTHER EXTERNAL DATA

In addition to status changes in connected hardware that are automatically tracked, the experimenter can manually trigger tags to document events like stimulus application in instruments not connected to the IPA system.

Information about environmental parameters and a more detailed specification of sample properties can be recorded and stored with the raw data. A total of over 600 metadata attributes are supported. Examples include: animal species, strain, genotype, date/time when a cell sample was prepared, recording solutions, pipette resistance, hardware properties, and detailed information about stimuli applied.

DATA VISUALIZATION AND ANALYSIS

SutterPatch software has been designed to simplify the navigation and analysis of complex datasets. The scope window supports multiple view modes in both two-dimensional and an innovative three-dimensional display. The 3D view is particularly useful during assay development. Built on top of the latest version of the proven Igor Pro platform, the SutterPatch program combines native Igor Pro functionality with a wealth of features that are tailored to electrophysiology applications. Both the newcomer and the experienced user of patch clamp programs will feel comfortable using SutterPatch software.



Application modules provide focused functionality for particular applications.

- **Event Detection Module:** A deconvolution algorithm that excels at detecting miniature synaptic events even on a noisy background.
- **Action Potential Analysis Module:** Phase plane plot, timing and waveform statistics.
- **Camera Module:** An easy way to document the identity and condition of the recorded cell.

The IPA® and Double IPA® Integrated Patch Clamp Amplifiers are computer-controlled single- or dual-headstage amplifiers optimized for whole-cell recording applications.

Amplifier

- Voltage clamp and true current clamp modes with smart switching between modes to avoid current artifacts
- Open-Circuit (RMS) noise of 1.4 pA in a 0.1–10 kHz bandwidth
- 500 M Ω headstage feedback resistor provides a maximal range of ± 20 nA
- Fast pipette capacitance compensation and whole-cell compensation
 - Pipette capacitance compensation up to 25 pF
 - Whole-cell compensation: C_m from 1–100 pF; R_s from 1–100 M Ω
- Onboard automatic compensation routines
- Series resistance prediction and correction (0–100 M Ω)
- Four-pole Bessel low-pass filter (cutoff = 0.5–20 kHz)
- Output gain: 0.5–25 mV/pA (voltage clamp); 10–500 mV/mV (current clamp)
- Holding potential ± 1000 mV
- Current clamp bridge compensation and capacitance neutralization
- Slow holding potential tracking can compensate for drift during current clamp recordings

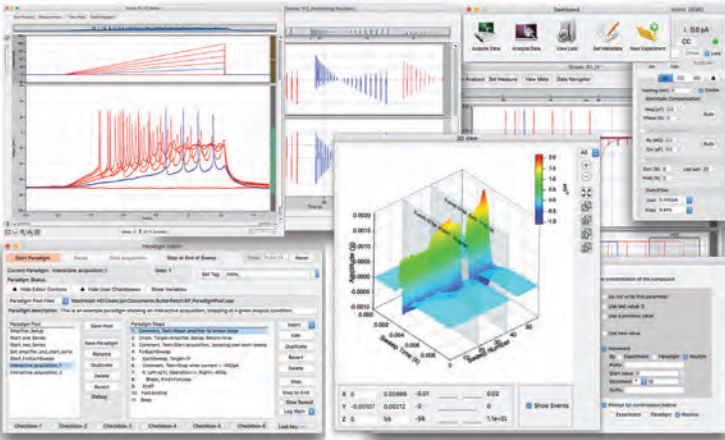
Data Acquisition

- Embedded data acquisition system eliminates the need for an external data acquisition board and facilitates setup
- Single high-speed USB connection controls both data acquisition and amplifier settings
- Up to 6 or 8 input channels (1–50 kHz sampling rate per channel)
- Up to 400 kHz aggregate sampling rate (1–10 kHz sampling rate per channel)
- Multi-amplifier mode: A combination of any two IPA or Double IPA Amplifiers can be connected, providing up to 16 input channels
- Complex command waveforms
- Auxiliary input / output for control of other instrumentation
 - 4 analog input channels (± 10 V)
 - 2 analog output channels (± 10 V)
 - 8 digital output channels (TTL)
- Data acquisition can be initiated by an onboard microsecond clock or external (TTL) trigger



SutterPatch® Software

- Built on the foundation of Igor Pro (WaveMetrics, Inc.)
- Paradigms and Routines provide complete experimental control
- Waveform Editor for easy creation of even the most complex stimulus patterns or user-defined templates
- Associated metadata stores all relevant information regarding your experiment
- Comprehensive data analysis routines and publication quality graphics
- Rapid-response online line-frequency reduction
- Runs on Windows 7 or later (64-bit), or Mac OS X 10.11 (El Capitan)



Screen shot of SutterPatch software

Optional IPA Patch Panel

The IPA and Double IPA Amplifiers come standard with an “octopus” breakout cable for auxiliary inputs and outputs, and digital outputs. The optional IPA Patch Panel, machined from ½ inch thick billet aluminum stock like the IPA faceplate, brings the auxiliary I/O connections to the front of the rack in a tidy 2U rack mount panel with BNC connectors.

The IPA Patch Panel includes a 2.5 ft (76 cm) connector cable and replaces the standard cable that ships with the IPA system.



IPA-PCH Patch Panel for tidy, convenient connection of peripherals at the front of the rack



SPECIFICATIONS IPA® / DOUBLE IPA®

■ Dimensions

IPA®: 18.8 in x 11.8 in x 1.8 in / 48 cm x 30 cm x 4.5 cm

DOUBLE IPA®: 18.8 in x 11.8 in x 3.5 in / 48 cm x 30 cm x 9 cm

PATCH PANEL: 18.8 in x 2 in x 3.5 in / 48 cm x 5 cm x 9 cm

■ Weight

IPA®: 9 lbs / 4 kg

DOUBLE IPA®: 8.1 lbs / 3.7 kg

PATCH PANEL: 3.5 lbs / 1.6 kg

■ Electrical

110/240 Volts / 50/60 Hertz power line



SYSTEM REQUIREMENTS

■ Operating System

Windows 7 or later: 64-bit versions
Mac OS X 10.11 (El Capitan) or newer

■ Computer Hardware

Minimum Configuration

Central Processing Unit (CPU): Dual-core i5

Random Access Memory (RAM): 3 GB

Hard Disk Free Space: 500 GB

Display Resolution: 1024 x 768 (XGA)

1 available USB 3.0 Super Speed port

Recommended Configuration

Central Processing Unit (CPU): Dual-core i5

Random Access Memory (RAM): 8 GB

Solid-state drive (SSD), 500 GB or greater

Display Resolution: 1024 x 768 (XGA)



US PRICES IPA® / DOUBLE IPA®

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

■ IPA	Includes: IPA® system with headstage, EH-P170 pipette holder, model cell, "octopus" break-out cable, rack mounting hardware, and SutterPatch® software suite with Igor Pro 8 license.	\$ 13,900
■ IPA-2	Includes: DOUBLE IPA® system with two headstages, two EH-P170 pipette holders, model cell, "octopus" break-out cable, rack mounting hardware, and SutterPatch software suite with Igor Pro 8 license.	\$ 17,900

ACCESSORIES IPA® / DOUBLE IPA®

PATCH PANEL

■ IPA-PCH	Patch panel with 8 digital out / 4 aux. in / 2 aux. out BNC connectors, 19" x 2U rack format, D-Sub connecting cable, rack mounting hardware	\$ 595
------------------	--	---------------

PIPETTE HOLDERS

While polycarbonate is a proven material for patch pipette holders, it undergoes significant thermal expansion. Uneven warming may lead to motion of the pipette tip and is often incorrectly perceived as drift in the micromanipulator. Quartz has a significantly lower thermal expansion coefficient and virtually eliminates thermal drift. Note: Quartz is fragile and may crack or shatter on impact. Treat your quartz electrode holder with the same care you would with any optical component.

■ EH-P170	Polycarbonate holder 1.0 mm to 1.7 mm O.D.	\$ 169
■ EH-Q170	Quartz holder 1.0 mm to 1.7 mm O.D.	\$ 495

ACCESSORIES

■ RACK-PK	Rack mounting hardware	\$ 17
■ GP-17	Ground point	\$ 250

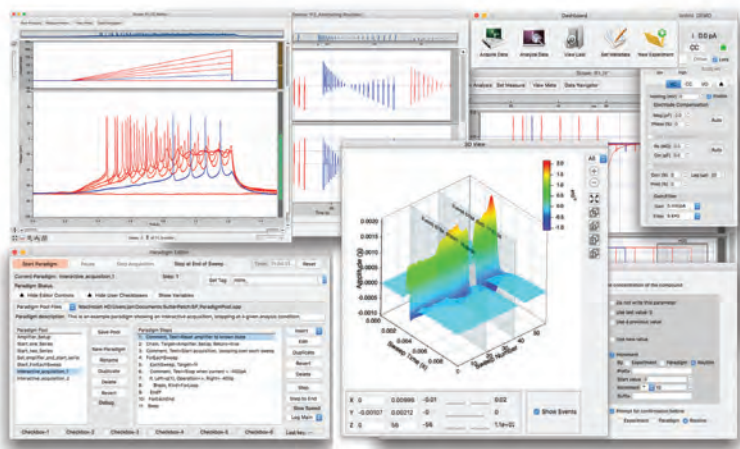


The Ground Point GP-17 provides reliable, low resistance connections for a star ground configuration, the proven method to avoid ground loops in any electrophysiology setup. Accepts 9 banana plugs + 8 bare wires up to 10 gauge or banana plugs. The baseplate mounts directly on imperial or metric air table tops with the included 1/4-20 and M6 screws. Made of solid, machined brass with plated banana/clamp connectors.



SUTTERPATCH® DATA ACQUISITION, MANAGEMENT AND ANALYSIS SOFTWARE

New Features



Screen shot of
SutterPatch software

FEATURES SUTTERPATCH®

- **New:** Support for all Sutter Instrument amplifier systems, including the new dPatch® Digital Patch Clamp Recording System
- Scope Window provides intuitive, efficient navigation through your data
- Routines control data acquisition with or without application of command waveforms
- Line frequency reduction
- Paradigms enable process automation and eliminate operator bias
- The Data Navigator displays the entire experiment in a tree structure
- Real-time and off-line analysis, including mini / synaptic event detection and action potential characterization



SutterPatch® software is a full-featured electrophysiology data acquisition, management and analysis application for Windows or Mac OS computers. SutterPatch comes bundled with all Sutter Instrument Patch Clamp Amplifier Systems. The software controls data acquisition, provides real-time measurements to aid decision making during the experiment, keeps track of all amplifier parameters, records the experimental progress and stores a set of up to 600 metadata parameters. Built within the latest version of Igor Pro by WaveMetrics, Inc., SutterPatch provides immediate access to Igor's powerful scientific and engineering analysis tools.

Version 2 of SutterPatch software adds support for the new dPatch® Digital Patch Amplifier System as well as a multitude of new features and user interface improvements that also apply to the IPA Family of Amplifier Systems. The Membrane Test and Free Run have been upgraded. New triple slider and 2D-matrix controls facilitate compensation adjustments in the Amplifier Control Panel.

Particular emphasis was put into intuitive navigation through large data sets. Controls that are familiar from electrophysiology software or applications in other fields, as well as entirely new approaches make finding a particular section of an experiment very easy.

The structured architecture of the data files was designed to retain the context of every sample within an experiment. With little effort at the beginning of an experiment, a plethora of metadata parameters are recorded – automatically where possible, configured by the user where desired. Each parameter can be reviewed before a Paradigm or Routine is executed.

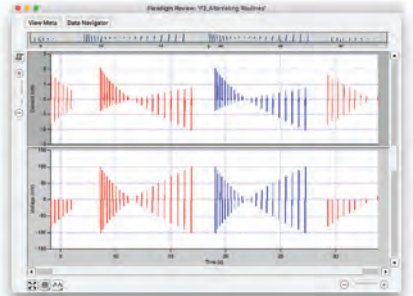
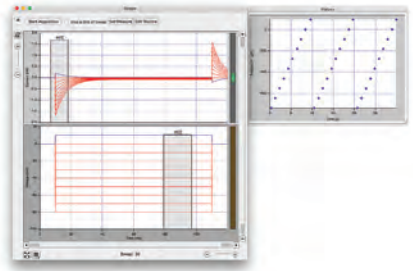
SutterPatch software comes with a collection of sample Paradigms and Routines that facilitate the configuring of commonly executed experimental scenarios.

SutterPatch provides real-time analysis capability that creates graphs like I-V curves or a time course plot while the experiment is in progress. Up to 8 analysis graphs can be shown, each derived from 16 possible measurements from the input signals. Analyses include mean, slope, rise time, frequency of threshold crossing, etc. This facilitates making decisions about the further course of an experiment.

In addition to real-time analysis, SutterPatch supports further processing after the experiment for the most sophisticated analysis procedures and adds application-specific capabilities on top of the expansive analysis feature set that is native to Igor Pro. Equations and Variables facilitate the use of more complex algorithms in both Routines and Paradigms.

FEATURE HIGHLIGHTS

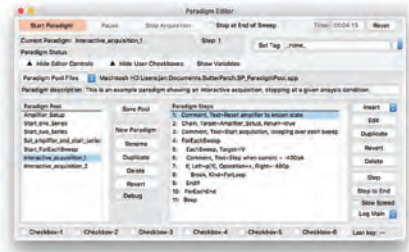
- Scope Window provides intuitive, efficient navigation through your data
 - Zoom control buttons and sliders
 - Drag along axis to zoom in
 - Mouse wheel zoom
 - Marquee zoom
 - Scroll bars
 - Continuous and snapshot autoscale
 - Sweep, time course and concatenated display
 - Novel 3D display
 - Unique Overview Navigator for panoramic examination of and convenient movement within a data section
 - Paradigm Review window gives quick access to individual Routine Data
- Membrane Test keeps track of cell health and other quality control parameters
 - Waveform types include double pulses, sine and triangle trains and instantaneous RMS noise measurement.
 - Simultaneous display of up to two amplifier or auxiliary input signals and a command waveform.
 - Test pulse parameters fully configurable
 - Pulse averaging
 - Audio monitor
- Routines control data acquisition with or without application of command waveforms
 - Sample Routine Pool with pre-configured Paradigms for many common applications
 - Hard-wired signals from Sutter Instrument hardware and auxiliary input signals are recorded
 - The command signal as applied to the cell is monitored and recorded
 - Analog and digital output signals control periphery and third-party information
 - Up to 50 Segments per Sweep for utmost flexibility in shaping the most complex command waveforms
 - Preconfigured Segment shapes, such as Sine, Square and Chirp, for easy waveform design
 - Waveform Template enables "playback" of a recorded signal to a cell or applying a mathematical expression as a waveform
 - Measurements provide the basis for real-time analysis and enable decision making in the course of the experiment





■ Paradigms enable process automation and eliminate operator bias

- Sample Paradigm Pool with pre-configured Paradigms for many common applications
- Configure the amplifier to reproducible standard settings
- Acquisition of Routine sequences enables pre-planned experimentation and minimizes operator bias.
- Flow control for interactive or automated decision-making during the experiment
- Chaining Paradigms provides added flexibility
- Automatic creation of Layouts for standardized documentation

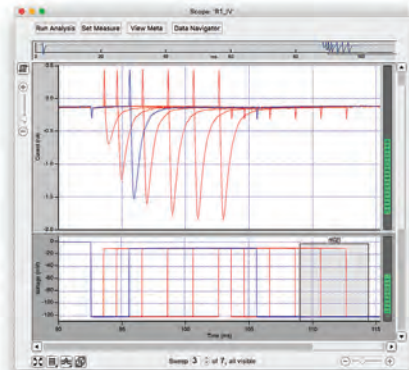


■ The Solution Editor lets you keep track of solutions and compounds and supports direct control of a solution switcher.

- Initial conditions and all solution changes are automatically written to the MetaData.
- Analog or digital outputs control all common solution switchers.

■ The Data Navigator displays the entire experiment in a tree structure

- Preview of the first acquired signal
- Quick access to Paradigm Review, Reanalysis Scope, Metadata and Routine information



■ Real-time and off-line analysis

- Measurements configured as part of Routines create real-time graphs
- Virtual signals provide the user with information derived from physical input signals, mathematical equations, signal modification, or any combination thereof. High- and low-pass filters, lock-in amplifier capability and subtraction of a reference sweep are new in version 2.
- Paradigms can access measurements for further real-time analysis
- Equations and variables provide utmost flexibility
- Event detection using a high-performance, deconvolution-based algorithm
- Easily exports data to Microsoft Excel and other spreadsheet programs for compatibility with existing analysis procedures
- A wealth of native Igor Pro analysis features

■ Support for IPA multi-amplifier mode

- A combination of any two IPA® or Double IPA® Amplifiers can be connected.
- Up to 16 input channels are supported



SYSTEM REQUIREMENTS SUTTERPATCH®

■ Operating System

Windows 7 or later: 64-bit versions
Mac OS X 10.11 (El Capitan) or newer

■ Hardware

For IPA Family Systems:

Minimum Configuration

Central Processing Unit (CPU): Dual-core
Random Access Memory (RAM): 3 GB
Hard Disk Free Space: 500 GB
Display Resolution: 1024 x 768 (XGA)
1 available USB 2.0 High Speed port

Recommended Configuration

Central Processing Unit (CPU): Dual-core i5
Random Access Memory (RAM): 8 GB
Solid-state drive (SSD), 500 GB or greater
Display Resolution: 1920 x 1080 (Full HD)

For dPatch® Systems:

Minimum Configuration

Central Processing Unit (CPU): Dual-core i5
Random Access Memory (RAM): 6 GB
SSD, 500 GB or greater
Display Resolution: 1024 x 768 (XGA)
1 available USB 3.0 Super Speed port

Recommended Configuration

To utilize the full speed potential of the dPatch System, you should use the most powerful computer system you can afford.



US PRICES SUTTERPATCH®

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

■ **SUTTERPATCH** Data Acquisition Management
System and Analysis Software

**Included with
all Sutter Amplifier
Systems**



AIR TABLES & FARADAY CAGES

VIBRATION ISOLATION SYSTEMS



FEATURES AIR TABLES & FARADAY CAGES

- Provides a stable, level basis for your experimental setup
- Active air suspension maintains leveling
- Vertical and horizontal vibration isolation
- Available with metric or imperial tapped hole pattern
- Optional Faraday cage for low-noise electrophysiology applications
- Optional casters facilitate relocation and cleanup after a spill
- Optional accessories to meet your individual needs



Physiological experiments, such as electrophysiological recordings and imaging experiments, are susceptible to environmental factors that introduce noise to the signals. Predominant noise sources are mechanical vibrations and, in the case of electrophysiology, electromagnetic interference (EMI). The cleanest way of dealing with noise of any modality is to avoid it at the source rather than attempting to remove it from a noisy signal after the fact. This strategy avoids the risk of introducing filter artifacts or other unwanted effects. Air tables and Faraday cages are proven ways to eliminate noise caused by vibration and electromagnetic fields, respectively. Sutter Instrument now offers a series of vibration isolation tables from TMC with feature sets tailored for scientists who perform electrophysiological recordings, including patch clamp, microinjections, or imaging experiments that require the utmost stability.

Each air table comes with a state-of-the-art stainless steel, magnetic breadboard tabletop in either metric (M6 tapped holes on 25 mm centers) or imperial (¼-20 tapped holes on 1" centers) versions. Custom configurations and additional options are available on request. Please contact Sutter to discuss your specific requirements.

Electrophysiology and Microinjection Workstations

Patch clamp and other electrophysiological techniques share the same requirements for vibration isolation with most microinjection techniques. The AT-3036 Air Table will meet the needs of most electrophysiology and microinjection applications, providing excellent vibration isolation across the entire relevant spectrum. A perimeter enclosure prevents one from accidentally pushing the tabletop and carries a practical sliding shelf just above the work surface for easy access to control devices. Optional padded armrests conveniently attach to the front guardrail and provide support for the researcher who prefers using the eyepieces of the microscope over camera-and-monitor operation. If more space is required, e.g., if voluminous imaging equipment needs to be installed for combined patch clamp and imaging experiments, the AT-3648 Air Table offers additional room for these complex applications.

Options and Accessories

A set of retractable casters helps move the table during relocation, or facilitates clean-up in the event of a spill. For most electrophysiology applications, the Faraday cage with wire mesh roll-up door is strongly recommended. An optional overhead u-shaped rear shelf is available for the cage to accommodate the components of a gravity perfusion set-up or to provide storage for items that need to be easily accessible during the experiment.

Optical Tables

Imaging experiments, such as two-photon microscopy using Sutter's MOM® Moveable Objective Microscope®, typically require larger vibration isolation tables, but rarely need electromagnetic shielding. Three configurations of optical tables are available for these types of experiments: the models AT-48, AT-58 and AT-510. Each version is available as a stand-alone table or with casters.

Applications

- Electrophysiology
- Cellular and subcellular microinjection
- Photomicroscopy
- Videomicroscopy



SPECIFICATIONS AIR TABLES

All Air Tables come with a state-of-the-art stainless, magnetic breadboard tabletop in either metric (M6 tapped holes on 25-mm centers) or imperial (¼-20 on 1-in centers) versions. Custom sizes, configurations, or additional options are available upon request. Please contact Sutter for details.

AIR SUPPLY

Source	Compressor (Sutter AT-COMP-xxx or equivalent), house air or air cylinder
Pressure	>30 psi to max. 80 psi, depending on payload
Quality	Dry, oil-free (in-line filter comes installed)
Fittings	1/4 inch press-lock (quick-fit), or threading for 1/8 or 1/4 in NPT fittings (adapters included)

PATCH CLAMP / ELECTROPHYSIOLOGY AND MICROINJECTION AIR TABLES

Model	AT-3036	AT-3648
■ Dimensions¹	36 in x 30 in x 28.5 in 91 cm x 76 cm x 72 cm	48 in x 36 in x 28.5 in 122 cm x 91 cm x 72 cm
■ Load Capacity²	500 lbs / 227 kg	700 lbs / 318 kg
■ Table Top Thickness	2 in / 5 cm	2 in / 5 cm
■ Table Construction	Honeycomb core with magnetic, stainless steel top layer	
■ Table Hole Pattern³	M6 on 25-mm centers or ¼-20 on 1-in centers	
■ Faraday Height	40 in / 102 cm	40 in / 102 cm
■ Faraday Cage Cable Pass-through	Three circular openings with diameters of 2 in / 5 cm	
■ Sliding Shelf Width	8 in / 20 cm	8 in / 20 cm

IMAGING / OPTICAL AIR TABLES

Model	AT-48	AT-58	AT-510
■ Dimen.¹	96 in x 48 in x 36 in 244 cm x 122 cm x 91 cm	96 in x 59 in x 36 in 244 cm x 150 cm x 91 cm	120 in x 59 in x 36 in 305 cm x 150 cm x 91 cm
■ Load Capacity²	1500 lbs / 680 kg	1800 lbs / 590 kg	1200 lbs / 544 kg
■ Table Top Thickness	8 in / 20 cm	8 in / 20 cm	8 in / 20 cm
■ Table Const.	Plated steel honeycomb core		
■ Table Hole Pattern³	M6 on 25-mm centers or ¼-20 on 1-in centers		

¹Width x depth x height. Height to top of table surface.

²A high center of gravity may reduce the load capacity.

³Smooth top layer available on request.



US PRICES AIR TABLES

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

STANDARD AIR TABLES

AT-3036

30 in x 36 in x 2 in thick (75 cm x 90 cm x 5 cm thick) table top, perimeter enclosure, and sliding side shelf

- **AT-3036-ST** 30 in x 36 in Air Table, 1/4-20 threaded top
- **AT-3036-M6** 30 in x 36 in Air Table, M6 tapped hole top
- **AT-3036-ST-F** 30 in x 36 in Air Table, 1/4-20 threaded top, and Faraday cage with roll-up door
- **AT-3036-M6-F** 30 in x 36 in Air Table, M6 tapped hole top, and Faraday cage with roll-up door

**Phone
Sutter
for
pricing**

AT-3648

Includes 36 in x 48 in x 2 in thick (90 cm x 120 cm x 5 cm thick) table top, perimeter enclosure, and sliding side shelf

- **AT-3648-ST** 36 in x 48 in Air Table, 1/4-20 threaded top
- **AT-3648-M6** 36 in x 48 in Air Table, M6 tapped hole top
- **AT-3648-ST-F** 36 in x 48 in Air Table, 1/4-20 threaded top, and Faraday cage with roll-up door
- **AT-3648-M6-F** 36 in x 48 in Air Table, M6 tapped hole top, and Faraday cage with roll-up door

**Phone
Sutter
for
pricing**





US PRICES AIR TABLES

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

OPTICAL AIR TABLES

AT-48

Includes 4 ft x 8 ft x 8 in thick (122 cm x 244 cm x 20 cm thick) table top and legs

- **AT-48-ST** 4 ft x 8 ft Air table, 1/4-20 threaded top
- **AT-48-M6** 4 ft x 8 ft Air table, M6 tapped hole top
- **AT-48-ST-C** 4 ft x 8 ft Air table, 1/4-20 threaded top, and casters
- **AT-48-M6-C** 4 ft x 8 ft Air table, M6 tapped hole top, and casters

**Phone
Sutter
for
pricing**

AT-58

Includes 5 ft x 8 ft x 8 in thick (152 cm x 244 cm x 20 cm thick) table top and legs

- **AT-58-ST** 5 ft x 8 ft Air table, 1/4-20 threaded top
- **AT-58-M6** 5 ft x 8 ft Air table, M6 tapped hole top
- **AT-58-ST-C** 5 ft x 8 ft Air table, 1/4-20 threaded top, and casters
- **AT-58-M6-C** 5 ft x 8 ft Air table, M6 tapped hole top, and casters

**Phone
Sutter
for
pricing**

AT-510

Includes 5 ft x 10 ft x 8 in thick (152 cm x 305 cm x 20 cm thick) table top and legs

- **AT-510-ST** 5 ft x 10 ft Air table, 1/4-20 threaded top
- **AT-510-M6** 5 ft x 10 ft Air table, M6 tapped hole top
- **AT-510-ST-C** 5 ft x 10 ft Air table, 1/4-20 threaded top, and casters
- **AT-510-M6-C** 5 ft x 10 ft Air table, M6 tapped hole top, and casters

**Phone
Sutter
for
pricing**





US PRICES ACCESSORIES

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

FOR ALL AIR TABLES

■ AT-ARM	Padded arm rests (set of 2)	Phone Sutter for pricing \$ 250
■ AT-CASTER	Casters for non-optical air tables (set of 4)	
■ AT-COMP-110	Air compressor – 110 V, 60 Hz	
■ AT-COMP-220	Air compressor – 220 V, 50 Hz	
■ GP-17¹	Ground point	

FOR AT-3036 30 IN X 36 IN AIR TABLE

■ AT-30-OSF	U-shaped shelf (for Faraday cage)
■ AT-30-FC²	Faraday cage

FOR AT-3648 36 IN X 48 IN AIR TABLE

■ AT-36-OSF	U-shaped shelf (for Faraday cage)	Phone Sutter for pricing
■ AT-36-FC²	Faraday cage	

FARADAY CAGES – BENCH TOP

Stand-alone cage with stainless steel base plate. Breadboards with threaded or tapped holes sold separately. Cages with cut-out bedplates available upon request. Phone Sutter for detail.

■ AT-3036-FCB	Faraday cage, 30 in x 36 in solid stainless steel	Phone Sutter for pricing
■ AT-3048-FCB	Faraday cage, 30 in x 48 in solid stainless steel	
■ AT-3648-FCB	Faraday cage, 36 in x 48 in solid stainless steel	
■ AT-MOUNT-ST	Mounting kit for stand-alone cage – imperial	
■ AT-MOUNT-M6	Mounting kit for stand-alone cage – metric	



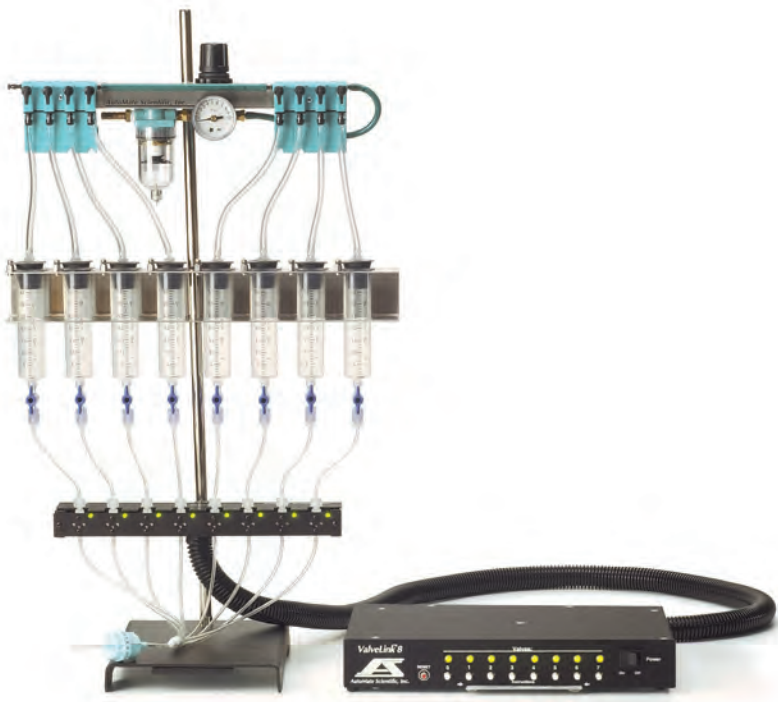
¹The Ground Point GP-17 provides reliable, low resistance connections for a star ground configuration, the proven method to avoid ground loops in any electrophysiology setup. Accepts 9 banana plugs + 8 bare wires up to 10 gauge or banana plugs. The baseplate directly on imperial or metric air table tops with the included 1/4-20 and M6 screws. Made of solid, machined brass with plated banana/clamp connectors.

² Must use with perimeter enclosure (included in metric or imperial AT-3036 or AT-3648). Phone Sutter for information on options or configurations.



PERFUSION SYSTEMS AND BATH CHAMBERS

New



(Shown: AM-PS8-PR Perfusion System)

FEATURES PERFUSION SYSTEMS

- Reliable solution exchange for tissue oxygenation or pharmacology experiments
- 1, 4 or 8 fluid reservoirs
- Available for room temperature operation, inline-heated, or with both inline and bath chamber heating
- ValveLink8.2® and ThermoClamp Controllers compatible with SutterPatch® Software
- High reliability through low-maintenance pinch valves
- Electrically quiet circuitry for valve switching and temperature control



An electrophysiology setup is not complete without a perfusion system. Depending on your application, the objective could be as simple as keeping the preparation alive by supplying oxygenated saline, or as complex as applying a wide range of concentrations of an ion channel modulator, complete with positive and negative controls to obtain a high-quality concentration-response curve. In addition, experiments with mammalian cells or tissues frequently require elevated temperature.

Sutter Instrument now offers the popular perfusion systems and bath chambers made by AutoMate Scientific. Our standard product portfolio consists of perfusion systems with one, four or eight reservoirs, with the option of room temperature operation, inline heating, or a heated bath chamber in addition to inline heating. The standard bath chambers are compatible with either the Sutter platform stages, or with the MT-150 chamber column. Solution switching can be controlled by SutterPatch® software for complete integration into your data acquisition and analysis workflow. Manual operation, as well as control through other patch clamp software, or through digital (TTL) or analog signals from other sources is also possible.

The AutoMate Scientific ValveLink8.2® Controller avoids vibrations produced by switching solutions by hand. Low-noise circuitry and low-maintenance pinch valves switch in 20 ms and contribute to problem-free operation. Liquids never touch the valves. All AutoMate Scientific valves include an individual indicator LED. The aluminum enclosure keeps the valves dry from spills and provides Luer lock ports for syringe reservoirs.

All perfusion systems include syringe reservoirs (140 mL for the one-channel systems, 60 mL each for the four- and eight-channel systems), 2-way stopcocks, a ringstand with reservoir mounts, tubing, Luer connectors and a manifold where applicable.

In addition to the standard perfusion systems which cover the most frequently required configurations, a high degree of customization is possible. Please contact Sutter Instrument for a configuration that meets your particular requirements.

SPECIFICATIONS PERFUSION SYSTEMS

■ ValveLink8.2®



- Low noise & low voltage valve control
Designed for electrophysiology.
- ValveGuard™ technology detects bad valves
- Run experiments automatically – even unattended
- Manual push buttons
- Red/green LED indicators
- 1.5 A, 12 VAC supply included (specify 110 V or 220 V)
- Dimensions: 9.28" x 1.6" x 5.13"
- Weight: 3 lbs. (1.4 kg.)
- Eight TTL inputs directly activate 8 valves or control 16 valves with only four digital outputs
- Analog input selects 8 valves
- Analog out "event marker" to record all valve activity
- Push buttons, TTL, analog and USB inputs ALL work simultaneously
- Capable of switching valves in 1 millisecond
- Capable of powering 12 W (1 A) valves and 24 W (2 A) total



ValveLink® Controller

■ Pinch valves for reduced maintenance

- Easiest valves to clean and switch tubing
- Liquids never touch the valves
- 20 ms switching
- 1/32" i.d. silicone tube passes through, and is pinched closed by solenoid activation
- Individual indicator LEDs
- Aluminum enclosure keeps the valves dry from spills and offers luer lock ports for syringe reservoirs

■ ThermoClamp-1® or ThermoClamp-2®



- Advanced auto-tuning temperature lock
- Includes power supply, bath and safety sensors
- Ambient to 50°C
- Large LED 0.1°C temperature display
- Analog temperature output (100 mV/°C)
- Dimensions: 11.5" x 2" x 7"
- Weight: 4 lbs. (1.8 kg.)
- ThermoClamp-2 contains two separate ThermoClamp-1 units



SPECIFICATIONS PERFUSION SYSTEMS

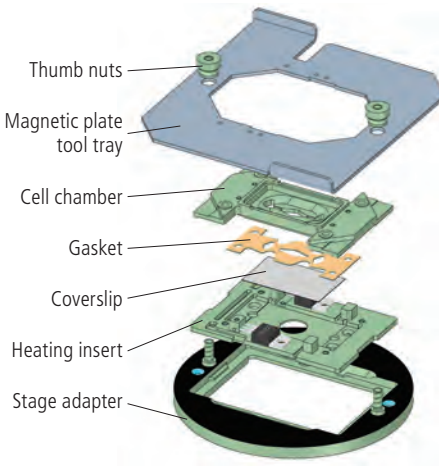
■ **Inline heater**

(Heated Perfusion Pencil®)

- Combination inline heater plus multi-channel focal drug delivery
- Luer lock tube connections
- Steady 37°C at 5 mL/min flow rates through both the bath line and tip
- Designed for physiology research – No metal anywhere in the flow path
- Low noise for electrophysiology
- Internal and external grounding plus electrical isolation between liquids and heating elements

■ **Heated QuickStage™ Bath Chamber**

- Integrated spill channel
- Magnetic stainless steel tool platform holds your tubes and electrodes for the next experiment
- Release two thumb nuts to change coverslips and clean the entire stack
- Four heated and three unheated chambers available
- Adapters for 35 mm Petri dishes from Nunc, WillCo, Falcon, In Vitro, Corning, Mattek
- Standard 24 mm x 40 mm #1 thickness coverslip



QuickStage™ Recording Chamber – Assembly View



StageHands™ Magnetic Tool Holders

Perfusion Systems and Chamber trademarks belong to AutoMate Scientific.



US PRICES PERFUSION SYSTEMS

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

PERFUSION SYSTEMS

Standard configurations come with a chamber insert for either the Sutter Instrument MT/MP-78 and -88 stages, or the MT-150/AUTO gantry stand. Other inserts are available on request.

Single-reservoir Perfusion Systems

140 mL reservoir on a ringstand, 2-way Luer stopcock, Tygon tubing with Luer-lock fittings, horizontal perfusion chamber

■ AM-PS1	Single-reservoir Perfusion System, gravity feed, unheated	\$ 521
■ AM-PS1-INL	Single-reservoir Perfusion System, gravity feed, inline-heated	\$ 2,151
■ AM-PS1-FULL	Single-reservoir Perfusion System, gravity feed, inline-heated, heated bath chamber	\$ 3,646

Four-channel Perfusion Systems

ValveLink8.2® 4-ch. Pinch Valve Perfusion System, mounting, cables, ringstand set, 4-into-1 manifold, flow controller, 4 x 60 ml syringes, stopcocks, pinch fittings, 2-way Luer stopcocks, Tygon tubing with Luer-lock fittings, horizontal perfusion chamber, grounding kit

■ AM-PS4	4-channel Perfusion System, gravity feed, unheated	\$ 2,434
■ AM-PS4-PR	4-channel Perfusion System, pressurized, Perfusion Pencil with 250 µL removable tip	\$ 3,079
■ AM-PS4-INL	4-channel Perfusion System, pressurized, inline -heated Perfusion Pencil with 250 µL removable tip	\$ 4,749
■ AM-PS4-FULL	4-channel Perfusion System, pressurized, inline-heated Perfusion Pencil with 250 µL removable tip, heated bath chamber	\$ 6,244

Eight-channel Perfusion Systems

ValveLink8.2® 8-ch. Pinch Valve Perfusion System, mounting, cables, ringstand set, 8-into-1 manifold, flow controller, 8 x 60 ml syringes, stopcocks, pinch fittings, 2-way Luer stopcocks, Tygon tubing with Luer-lock fittings, horizontal perfusion chamber, grounding kit.

■ AM-PS8	8-channel Perfusion System, gravity feed, unheated	\$ 3,189
■ AM-PS8-PR	8-channel Perfusion System, pressurized, Perfusion Pencil with 250 µL removable tip	\$ 3,934
■ AM-PS8-INL	8-channel Perfusion System, pressurized, inline-heated Perfusion Pencil with 250 µL removable tip	\$ 5,604
■ AM-PS8-FULL	8-channel Perfusion System, pressurized, inline-heated Perfusion Pencil with 250 µL removable tip, heated bath chamber	\$ 7,099



US PRICES ACCESSORIES

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

ACCESSORIES

■ AM-01-17	ValveLink rack mounting brackets (to std. 19" rack) with 6-32 x 1/8" screws	\$ 20
■ AM-01-17b	Rack mounting brackets – ThermoClamp-1 and old ValveLink8	\$ 35
■ AM-01-47	Rack mounting brackets – ThermoClamp-2 to standard 19" rack	\$ 65
■ AM-01-19	BNC-ValveLink8.2® cable – 4 BNC plugs to DB-9	\$ 70
■ AM-01-20	Full BNC-ValveLink8.2 cable – 8 BNC plugs to DB-9	\$ 125
■ AM-04-100	100 µm Removable Tip for Perfusion Pencil®	\$ 35
■ AM-04-250	250 µm Removable Tip for Perfusion Pencil®	\$ 35
■ AM-04-360	360 µm Removable Tip for Perfusion Pencil®	\$ 35
■ AM-220	220 V Power and CE upgrade	\$ 85
■ AM-SH-1	StageHands Magnetic tool holder	\$ 399

COMPONENTS

ValveLink®

■ AM-17-PP-24	ValveLink8.2® 4-ch. Pinch Valve Perfusion System, ValveLink8.2® controller = 4+4 solutions (expandable), 4 Pinch Valves, mounting, cables, ringstand set, 4-into-1 manifold, 1/16" tubing, flow controller, 4 x 60 ml syringes, stopcocks, pinch fittings	\$ 1,962
■ AM-17-PP-54	ValveLink8.2® 8-ch. Pinch Valve Perfusion System, ValveLink8.2® controller = 8 solutions, 8 Pinch Valves, mounting, cables, ringstand set, 8-into-1 manifold with flow control, 1/16" tubing, 8 x 60 ml syringes, stopcocks, pinch fittings	\$ 2,662

QuickStage

■ AM-QSH-LS-TT-ZK	QuickStage heated large slice chamber (upright), ToolTray	\$ 2,087
■ AM-QSU-H-TT-ZK	QuickStage unheated horizontal perfusion chamber, ToolTray	\$ 417

Thermoclamp® Inline Solution Heater

■ AM-03-11-LL	ThermoClamp®-1 – 1-Channel Controller, 1-channel heated Perfusion Pencil® with bath sensor	\$ 1,630
■ AM-03-14-250	ThermoClamp®-1 – 4-Channel Controller, 4-channel heated Perfusion Pencil® with 250 µm tip & bath sensor	\$ 1,920
■ AM-03-18-250	ThermoClamp®-1 – 8-Channel Controller, 8-channel heated Perfusion Pencil® with 250 µm tip & bath sensor	\$ 1,920



ELECTROPHYSIOLOGY SYSTEMS

BUNDLED CONFIGURATIONS



(Shown: 1078-385-N65. Headstages and microscope not included)

FEATURES BUNDLED SYSTEMS

- Discounted pricing offers savings and value
- Classic electrophysiology designs available through a single system configuration
- Each bundled system comes with 2 manipulators
- Easy toggle selection of active component
- Single ROE input device controls manipulators and motorized components providing ease of operation
- All features of manipulators, stages and translators are retained
- Systems with platforms include rotating bases for mounting manipulators
- Simple USB interface



MANIPULATOR / STAGE / PLATFORM BUNDLED SYSTEMS

Over the last 20 years, electrophysiology rigs have developed spontaneously around several platforms. In all, the central concept is that manipulators and the sample are fixed in one frame and the microscope is fixed in a second frame. These two separate frames of reference are then moved with respect to each other in order to locate cells. Sutter Instrument is now offering several systems or "Big Kits" that include dual manipulators and either manipulator stands and scope translator or large moving stage and dual manipulators systems as one big kit. By specifying and offering the Big Kit systems, Sutter is able to extend significant price savings over the same components purchased separately.

Sutter San Francisco... the classic moving scope design with manual translator and three columns and two manipulators. Developed by labs at UCSF and later used throughout the Bay Area, the U.S., and the world. The time-honored method allows for easy hand access to controls on the scope and manipulators for pipette exchange and other adjustments.

Sutter Alcatraz... another classic design. Relies on a manual scope translator, but uses a single large fixed plate stage rather than separate stands for manipulators. Many electrophysiologists want the ability to add additional manipulators or other devices to a single large platform.

Both the San Francisco and the Alcatraz are available with a motorized (rather than manual) translator.

Sutter Long Island... intended specifically for multi-pipette electrophysiology on two-photon microscopes. Designed in conjunction with Northwestern University and first used for the CSHL Imaging course. The large moving stage can easily hold an *in vivo* or slice preparation and two or more manipulators. The scope is allowed to be fixed to the table top which is required for scopes attached to two-photon sources. This same design is also good for systems where the scope has become too large to move easily, like spinning disc confocals and large camera systems. The stage and manipulator systems have been used on many two-photon and other scopes including those from Intelligent Imaging Innovations, Zeiss, Olympus and Leica. This configuration is also used by researchers in custom built two-photon microscopes.

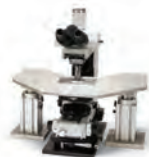
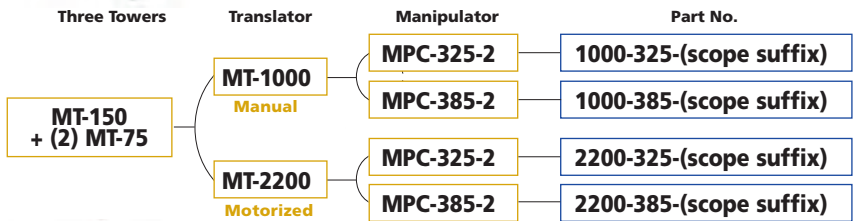
Software compatibility: Motorized translation and motorized stage systems are compatible with a wide range of commercial and freeware imaging software platforms including Intelligent Imaging Innovations' Slidebook, ScanImage, MicroManager and Sutter's MCS MOM® computer system. Please contact Sutter for a current listing of software suites that are compatible with our products.



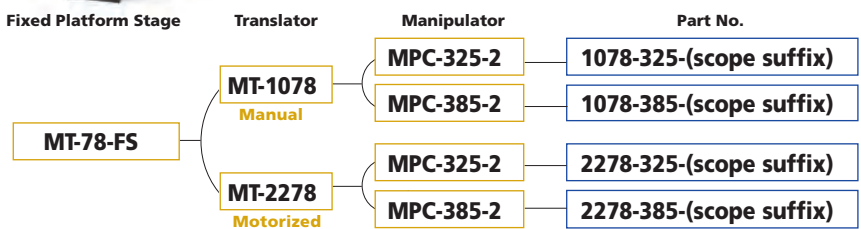
CHOOSING THE RIGHT BUNDLED SYSTEM



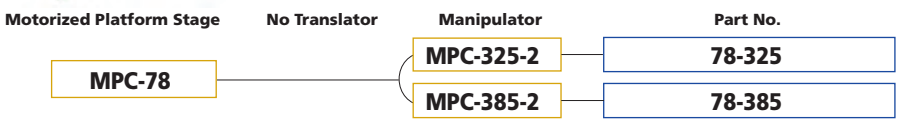
SAN FRANCISCO¹



ALCATRAZ¹



LONG ISLAND²



¹ Supported microscopes. Others may be available. Please call Sutter for details.

- | | | | |
|--------|---------------------------------------|-----|-------------------------|
| Z25 | Zeiss Axioskop 2 FS | L30 | Leica DM LFS |
| Z45 | Zeiss Axio Examiner | L35 | Leica DM6000 FS, DM6 FS |
| Y51 | Olympus BX51WI | N65 | Nikon FN1 |
| Y51-FD | Olympus BX51WI (includes focus drive) | | |
| Y53 | Olympus BX53/63 | | |

² The Long Island has no translator and is appropriate when the microscope must be stationary.



US PRICES BUNDLED SYSTEMS

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

MICROSCOPE MODELS - Use this scope suffix when ordering

Z25	Zeiss Axioskop 2 FS	L30	Leica DM LFS
Z45	Zeiss Axio Examiner	L35	Leica DM6000 FS, DM6 FS
Y51	Olympus BX51WI	N65	Nikon FN1
Y51-FD	Olympus BX51WI (includes focus drive) – add \$1,600 to price		
Y53	Olympus BX53/63		

SAN FRANCISCO

MT-1000 with manual X-Y translator, micromanipulators

■ 1000-325-(scope suffix)	With two MP-225 manipulators	\$ 18,625
■ 1000-385-(scope suffix)	With two MP-285 manipulators	\$ 21,400

MT-2200 with motorized X-Y translator, micromanipulators

■ 2200-325-(scope suffix)	With two MP-225 manipulators	\$ 24,030
■ 2200-385-(scope suffix)	With two MP-285 manipulators	\$ 24,685

ALCATRAZ

MT-1078 with manual X-Y translator, micromanipulators

■ 1078-325-(scope suffix)¹	With two MP-225 manipulators	\$ 20,650
■ 1078-385-(scope suffix)¹	With two MP-285 manipulators	\$ 23,420

MT-2278 with motorized X-Y translator, micromanipulators

■ 2278-325-(scope suffix)¹	With two MP-225 manipulators	\$ 26,055
■ 2278-385-(scope suffix)¹	With two MP-285 manipulators	\$ 28,825

LONG ISLAND

MT-78 with motorized platform stage, and micromanipulators

■ 78-325¹	With two MP-225 manipulators	\$ 27,210
■ 78-385¹	With two MP-285 manipulators	\$ 28,825

¹ Specify stage insert type when ordering.

MICROSCOPES

When the Movable Objective Microscope® (MOM®) was being developed at Max Planck Institute, Winfried Denk turned to Sutter for its experience in precision machining and 3D stepper-motor control to prototype the first two-photon moving objective microscope. The Sutter MOM rapidly grew to be the standard for two-photon in vivo microscopy. The open frame structure of this scope gives it unsurpassed flexibility, allowing for a range of configurations.

Building on the successful design of the MOM, Sutter has recently introduced the SOM®, simple moving microscope. In the SOM, Sutter followed the lead of customers who requested a low-cost,

robotic microscope with the versatility of the MOM. The SOM was designed with electrophysiology in mind and is an appropriate platform for in vivo or brain slice preparations with little or no modification. The SOM uses the popular MP-285 as its mechanical base, and Sutter has designed a variety of adapters for video cameras, objective flippers, and illumination sources.

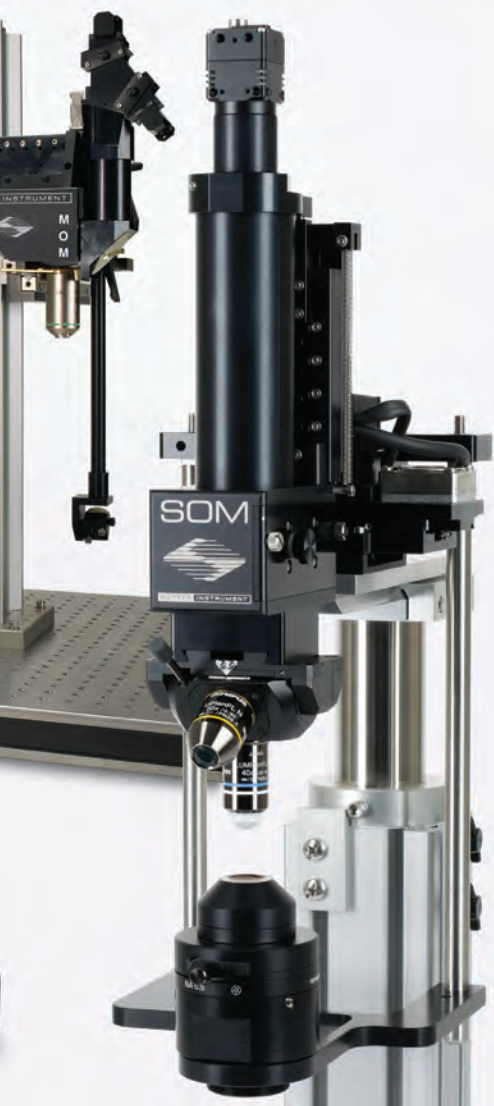


The DF-Scope™ is another customer-inspired microscope design. Rather than a complete microscope, this package adds multiphoton imaging capability to the ubiquitous Olympus BX51WI upright microscope. Many laboratories already have BX51WI microscopes for use in electrophysiology and epifluorescent imaging experiments. The DF-Scope

package provides the necessary optics and electronics for the BX51WI to be used for multiphoton imaging (with the addition of a Ti:Sapphire laser and scanning software). The design incorporates subassemblies from the MOM including resonant and galvo scan boxes and controllers, detector paths, PMTs, PMT power supplies, scan lens, and tube lens.

Our latest offering, the BOB open-design upright microscope, incorporates the Olympus vertical illuminator and objectives. By simplifying the microscope to its bare essentials, we've created a much more flexible and open system that can be used for a variety of applications.

Rounding out Sutter's microscope line is a growing list of stand-alone accessories for two-photon and other microscopes. Components available as standalone include MCS, the MScan software suite with PC workstation and data acquisition cards, RESSCANNER, an ultra-quiet resonant scan box and controller that is available as a MOM upgrade or a generic version that can be used in home built scopes, PS-2 and PS-2/LV, two different dual power supplies for PMTs, and a small selection of Hamamatsu PMTs.



MOM® MOVABLE OBJECTIVE MICROSCOPE®



(Shown with optional trinocular head and CCD camera. Objective not included)

FEATURES MOM®

- Objective moves 22 mm in X, Y and Z
- Objective rotates about optical axis for imaging of non-horizontal surfaces and volumes
- Customizable open platform design
- Cambridge Technology XY scanners
- Two or four channel detector system with Hamamatsu PMTs and preamplifiers
- Sutter PS-2 / PS-2 LV dual channel PMT power supply
- National Instrument / Measurement Computing based data acquisition systems

COMMON APPLICATIONS MOM®

- *In vivo* two-photon imaging
- Electrophysiological recording and imaging (culture, large *in vivo* preparations, etc.)
- Immunology
- Embryology
- Non-horizontal surface microscope
- Simultaneous retinal stimulation and two photon microscope*
- Whole animal imaging

** Eyecup scope-optical recordings of light stimulus-evoked fluorescence signals in the retina" Euler et al, Pflugers Arch, 2008*



The Movable Objective Microscope® (MOM®) is a two-photon microscope capable of imaging deep within living specimens when combined with a Ti:Sapphire Laser. The MOM design is unique in providing 3-dimensional objective movement and rotation allowing the specimen to remain stationary. Many highly regarded imaging laboratories around the world use the Sutter MOM and we constantly work with our customers to adapt the design for their changing needs.

MOM Opto-mechanical Design

The MOM consists of two independent microscopes. The wide-field half of the microscope consists of an Olympus vertical illuminator, Sutter Xenon arc lamp and camera mount to provide standard epifluorescence. The two-photon side of the microscope provides the optical pathway for guiding the excitation laser light from the table up into the scanning galvanometric mirrors and then expanding the beam through the scan lens and directing into the back of the objective. Following two-photon excitation, the emitted photons are directed by a dichroic mirror immediately above the objective into the detection pathway. The main body of the microscope moves backwards on a rail system allowing easy access to the specimen prior to imaging.

The objective translates in X, Y and Z as well as rotates around the X axis. Two moving mirrors allow the microscope to maintain efficient delivery of the excitation light to the back aperture of the objective regardless of movement or orientation. The X, Y and Z movements used are the same as that in our MP-285 micromanipulator so you know the movements are smooth, fine in scale, drift-free and highly reproducible. These movements permit Z-stacks and mosaic images of large regions of tissue to be recorded without the need for a moving stage.

The horizontal light path allows for rotation of the objective away from the standard vertical position. As a result of this rotation, the MOM can easily be converted from an upright to an inverted microscope and the objective positioned from 0 to 180 degrees. This positional freedom permits the imaging of non-horizontal surfaces and volumes.

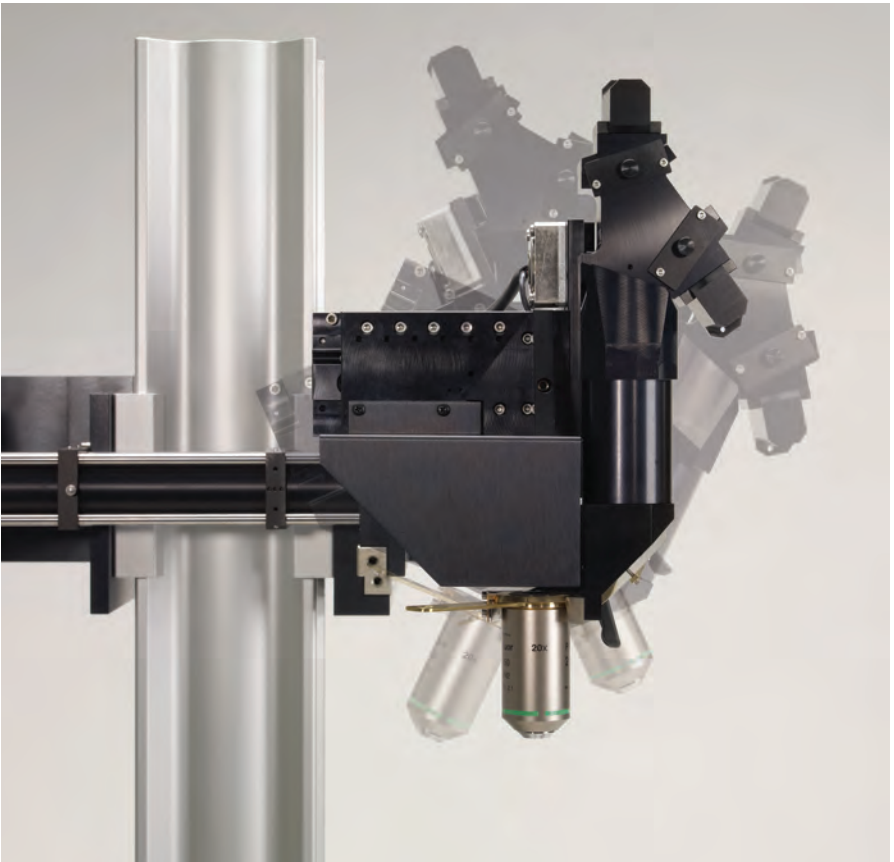
MOM Scanning Systems

During the last 10 years, scanning technology has changed dramatically: objectives changed requiring larger beam sizes and scanner technology advanced providing dependable resonant scanners. Unlike other two photon microscope designs, the MOM has lived through and adapted to changes in scanning technology. Throughout this development, Sutter has maintained two principles. First, existing scopes can be upgraded to new technology as it becomes available. Many original scopes with 3 mm galvo scanners have been upgraded to either 6 mm galvo scanners or resonant/galvo scanners. Second, Sutter continues to supply the original designs if they are needed for current research. We can provide a 3 mm or 6 mm conventional scanning MOM or a resonant/galvo scanning MOM all at competitive prices.



Imaging Software

Starting in 2011, Sutter began offering the MOM® Computer System and Software (MCS). Before this software package was developed, most users relied on ScanImage or MPScope to generate scanned images. Customers valued the fact that the MOM would operate with open source freewares, however, there seemed to also be a market for a commercial package. Sutter MScan offered a number of functions that were not available in the existing freeware packages including photostimulation and the ability to combine imaging with electrophysiological recording and photostimulation. As resonant scanning became popular, and none of the freewares supported resonant scanning on the MOM, Sutter and MScan took the initiative. The latest version, MScan 2.0, coupled with a faster data acquisition system, allowed the MOM to generate fast, resonant images. To this day, the Sutter MOM with MScan 2.0 remains the one platform available that can switch back and forth between conventional and resonant scanning.



The MOM is both an inverted and upright microscope with 0° to 180° rotation



The MOM® has always been compatible with ScanImage freeware, the two-photon imaging software developed by Karel Svoboda and collaborators. One of the reasons the MOM platform exists in its present form is the strong support from the ScanImage community. In 2014, Vidrio became the principle vehicle for support and new development of ScanImage. Sutter is happy to make Vidrio ScanImage Premium available to customers who wish premium support and the latest features. ScanImage freeware is also still available as SI5. Sutter provides packages that include the necessary data acquisition hardware to couple the MOM and other scanning microscopes to ScanImage Premium or SI5.

*2-channel**4-channel**Short path (2-channel)**Wide path*

The MOM is available with four different detector path designs. The original 2 channel pentagon, which can become a four channel detector path. The Short path and the Wide path are two designs that increase the chances of capturing ballistic photons by getting the first collection lens either closer to the back aperture of the objective (Short path) or by using a larger aperture collection lens and dichroic (Wide path)

Sutter MOM packages include all of the equipment (less the Ti:Sapphire laser and objective) needed for a complete imaging system.

- Cambridge Technology XY galvanometric and resonant scanners. (conventional with 3 mm or 6 mm mirrors or resonant with 5 mm mirrors).
- Hamamatsu photomultiplier tubes (PMTs): R6357 multialkali or H10770PA-40 (GaAsP) products. (Sutter is an authorized reseller for Hamamatsu).
- Power supplies for PMTs:
Either a Sutter PS-2 (dual channel high-voltage power supply for R6357 PMTs) or Sutter PS-2LV (dual channel low-voltage power supply for H10770PA-40 (GaAsP) PMTs) can be ordered.
- Hamamatsu, Sigmam or FEMTO pre-amplifiers, selection varies with software and type of scan.
- Data acquisition: National Instruments and Measurement Computing systems.
- Conoptics Pockels Cells for laser intensity control.



SPECIFICATIONS MOM® AND CONTROLLER

■ Travel	22 mm on all three axes
■ Resolution	MP-285 controller Low: 0.2 $\mu\text{m}/\text{step}$ High: 0.04 $\mu\text{m}/\text{step}$ MPC-200 controller 0.0625 $\mu\text{m}/\text{step}$
■ Maximum Speed	MP-285 controller 2.9 mm/sec MPC-200 controller 5.0 mm/sec
■ Long Term Stability	1-2 $\mu\text{m}/\text{hour}$
■ Drive Mechanism	Precision worm gear capstan drive
■ Communication	MP-285: RS-232 Serial MPC-200: USB
■ Electrical	115/230 Volts 50/60 Hertz power line

LAMBDA LS 300W XENON ARC LAMP

■ Lamp Life	1,000 hours (500 hour warranty) Longer life depends on application
■ Electrical	115/230 Volts 50/60 Hertz power line

PS-2/PS-2LV PMT POWER SUPPLY

■ Electrical	115/230 Volts 50/60 Hertz power line
---------------------	---

MDR-3 / MDR-6 / MDR-R SCAN DRIVE CONTROLLER

■ Electrical	115/230 Volts 50/60 Hertz power line
---------------------	---





US PRICES MOM®

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

BASIC SYSTEM FOR 2-PHOTON MICROSCOPY

Includes Movable Objective Microscope®, 2-channel detector with multialkali PMTs, preamps and PS-2 power supply, XY scanners with drive electronics, wide field fluorescence unit including vertical illuminator, Lambda LS 300 Watt Xenon Arc lamp, LLG and light guide adapter, C-mount for wide field camera, data acquisition system.

■ MOM-3MM¹	MOM System with 3 mm XY scanners	\$ 115,380
■ MOM-6MM¹	MOM System with 6 mm XY scanners	\$ 118,475
■ MOM-RES-MCS¹	MOM System with Resonant scanners and MScan 2.0 software	\$ 139,075
■ MOM-RES-SIP¹	MOM System with Resonant scanners and ScanImage Premium	\$ 149,380

ACCESSORIES MOM®

■ MOM-SETUPKIT-M	Basic table optics for laser routing	\$ 2,340
■ MOM-ALIGNTOOL²	MOM alignment tool	\$ 1,590

¹ Final pricing depends on detector path selected and does not include several devices necessary for a complete 2-photon microscope (i.e. Ti:Sapphire laser, objective, camera, trinocular head, table mount optics). Please phone Sutter for details.

² Useful tool for aligning the laser in MOM scopes, especially those with resonant scanners.

SOM® SIMPLE MOVING MICROSCOPE



(Shown with optional camera.
Objectives not included)

FEATURES SOM®

- Simple moving microscope based on an MP-285 / MPC-385 motorized micromanipulator
- Free Multi-Link™ software coordinates movement with micropipette positioning of MPC-200
- X, Y and Z axes of manipulator used to position the microscope over the sample and focus. No need for large translators or moving stages.
- Transmitted IR and EPI fluorescent imaging modes
- Optimized to allow *in vivo* and *in vitro* experimentation on one setup
- Flexible excitation port easily allows addition of secondary sources for photostimulation
- Standard configuration accepts RMS thread objectives. Contact Sutter for additional options.
- MPC-200 controller with USB interface and open source commands



The Son of MOM® (SOM®) is a small, simple microscope designed to allow a single experimental setup to be used for both *in vivo* and *in vitro* experimentation. As in our two-photon Movable Objective Microscope® (MOM®), positioning over the sample and focusing is accomplished robotically. This removes the need for the large translators and stages that normally limit the available space beneath the objective for *in vivo* experimentation. For example, the SOM will allow whole-cell patch recordings from neurons *in vivo* on one day followed by multi-cell recordings in slices on the next.

The SOM opens up experimental possibilities that otherwise might be limited by the ever growing space constraints in modern laboratories. The SOM is designed to take full advantage of our free Multi-Link™ software program for micromanipulator positioning.

For instance, during whole-cell patch recording in slices it is commonly necessary to search over a large area of tissue to find neurons appropriate to your experiment. With the SOM, you simply translate over your sample to search for your target. The software programs will then retrieve your recording and stimulation pipettes so that you can begin recording immediately. Moreover, if you then find you need to stimulate a region outside of the current objective's field of view, the programs will allow you to lock the position of your recording pipette and reposition the objective and stimulating pipette(s) to their required positions.

An optional Oblique Coherent Contrast (OCC) condenser that is illuminated with an LED is also available. The condenser translates with the microscope in the X & Y axes, which allows for consistent illumination during re-positioning of the SOM over the sample.

How it Works:

The SOM is designed to take advantage of the high-quality images that can be obtained with a simple IR LED-based transmitted light source combined with an IR capable CCD camera. This combination is sufficient for the majority of *in vitro* electrophysiology needs. The SOM is also designed with a two-position filter cube to allow for identification of fluorescently-tagged cells for recording or for photostimulation. If you populate both of the filter cube positions, one of the filter sets will need to pass IR to allow for transmitted light imaging. As many filter combinations will pass IR, transmitted light imaging can generally be done in either of the two filter positions

The fluorescence excitation port of the microscope has C-mount threading as well as mounting holes for standard cage components. This allows for customization by the user to various experimental needs. For instance, multiple light sources can be coupled to the excitation port with small cage assemblies.



COMMON APPLICATIONS SOM®

- *In vivo* and *in vitro* electrophysiology
- Wide field imaging (fluorescent dyes, genetic fluorescent proteins, intrinsic fluorescent signals)
- Surface inspection
- Imaging on many sample types including: tissue slices, *Drosophila*, zebra fish, mice, and much larger animal models

SPECIFICATIONS SOM®

- **Travel** 25 mm on all three axes
- **Resolution** MP-285 controller
Low: 0.2 $\mu\text{m}/\text{step}$
High: 0.04 $\mu\text{m}/\text{step}$
MPC-200 controller
0.0625 $\mu\text{m}/\text{step}$
- **Maximum Speed** MP-285 controller
2.9 mm/sec
MPC-200 controller
5.0 mm/sec
- **Drive Mechanism** Precision worm gear capstan drive
- **Communication** MP-285: RS-232 Serial
MPC-200: USB
- **Electrical** 115/230 Volts
50/60 Hertz power line



(Shown: SOM-T-QUAD with additional QUAD®)

**US PRICES SOM®**

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

BASIC SYSTEM		
■ SOM-T	SOM Microscope system with MPC-200 controller and ROE, mounted on tall (MT-75T) tower.	\$ 15,920
■ SOM-XT	SOM Microscope system with MPC-200 controller and ROE, mounted on extra tall (MT-75XT) tower.	\$ 15,920

BUNDLED SYSTEMS

Includes a SOM, TLED+ white LED light source with 50/50 beam splitter, one micromanipulator, a gantry stand, and P-1000 Micropipette puller.

■ SOM-T-QUAD	SOM-T with QUAD® 4-axis manipulator	\$ 36,355
■ SOM-T-285	SOM-T with MP-285 mechanical manipulator	\$ 33,185
■ SOM-T-225	SOM-T with MP-225 mechanical manipulator	\$ 32,390
■ SOM-XT-QUAD	SOM-XT with QUAD 4-axis manipulator	\$ 36,355
■ SOM-XT-285	SOM-XT with MP-285 mechanical manipulator	\$ 33,185
■ SOM-XT-225	SOM-XT with MP-225 mechanical manipulator	\$ 32,390

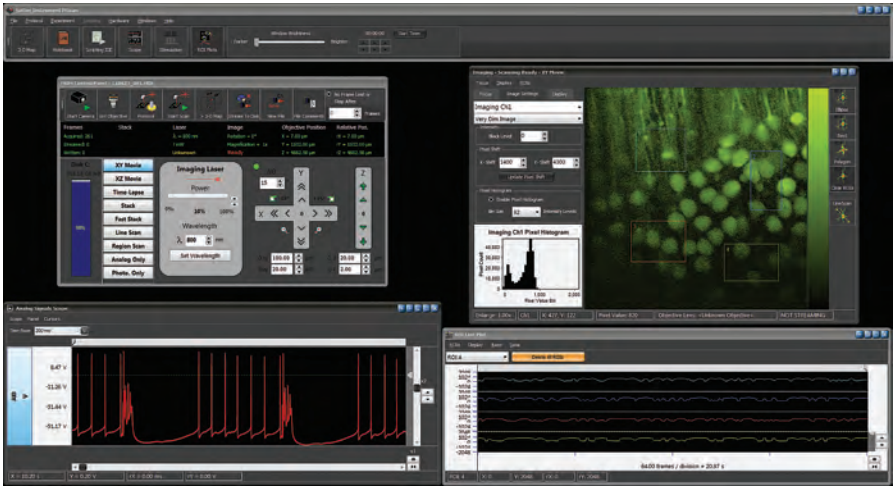
ACCESSORIES SOM®

■ SOM-COND	SOM OCC condensor with TLED	\$ 4,515
OBJECTIVES		
■ OBJ-522	4X - UPLFLN4X;U PLAN FLUORITE 4X OBJECTIVE;NA 0.13, WD 17MM	\$ 436
■ OBJ-524	10X - UPLFLN10X2;U PLAN FLUORITE 10X OBJECTIVE;NA 0.3, WD 10MM	\$ 799
■ OBJ-587	40X - LUMPLFLN40X/W;U M PLAN FLN 40X/W NA0.8 WD3.3MM,IR,ECO	\$ 2,556
■ OBJ-592	60X - LUMPLFLN60X/W; U M PLAN FLN 60X/W NA1.0 WD2.0MM,IR,ECO	\$ 3,007
■ OBJ-672	60X - LUMFLN60X/W;LUMFLN 60X/W NA1.1WD1.5MM 25 ANGLE,IR.CC,ECO	\$ 9,267



MCS

MOM COMPUTER SYSTEM AND MSCAN 2.0 SOFTWARE



FEATURES MCS

The MCS is especially designed for:

- Large-scale, high-resolution, deep-tissue mapping
- Multispectral, high-speed, functional optical imaging
- Resonant scanning capable with imaging rates to 30 frames per second
- Photostimulation while imaging through the same optical pathway ("photostimaging")
- Two-photon microscopy and concurrent electrophysiology with computer-controlled placement of electrodes by Sutter micro-manipulators

COMMON APPLICATIONS MCS

- Two-photon imaging
- Deep tissue imaging
- Neurophysiology
- Immunology
- Embryology



The MOM® Computer System (MCS) includes the software package MScan 2.0. This program has been designed to seamlessly control two-photon imaging, photostimulation and electrophysiology. While designed exclusively for use with the MOM®, it is also compatible with other two-photon platforms. The MCS is designed to take on complex experiments in deep-tissue intravital imaging. Its intuitive user interface, is easy to use. The MCS and MOM together form a formidable tool to understand the most complex issues in neuroscience, immunology or oncology. Importantly, you will find in MCS the same standard of technical excellence that is the hallmark of all Sutter Instrument products.

The MScan 2.0 software has been developed to simplify the many tasks inherent in a complicated imaging experiment. MScan 2.0 is extensively multithreaded to take advantage of multicore processors. This ensures reliability and user interface responsiveness. Furthermore, MScan is multiuser based to facilitate sharing of a MOM microscope with MCS among experimenters. Experimenters can then send their data to other workstations for analysis. The MCS analysis program MView is available for free download on the Sutter Instrument website.

MCS includes a Windows 7 workstation, National Instruments data acquisition boards, a USB 2.0 camera and a USB controlled MPC-200. The National Instruments boards included are a PCI-6110 board for imaging, a PCIe-6353 board for control of imaging and photostimulation laser power and a PCIe-6321 board for electrophysiology. The package is a turnkey system as all data acquisition boards and software come installed within the workstation.

An important feature provided in MScan 2.0 is the ability to do bidirectional frame scanning with sub-pixel line offset adjustment. Conventional two-photon frame scanning has involved unidirectional scanning. In these scenarios, data is only recorded when sweeping in one direction across the sample. To increase the rate of data acquisition, it is then necessary to steer the laser beam back to the origin of the scan as quickly as possible to begin the subsequent line. As galvanometric scanners are most taxed and most likely to be damaged during these high-frequency movements, bidirectional scanning both increases the speed at which frames can be recorded and decreases the likelihood of damage to expensive galvanometers.



■ IMAGING FEATURES

4 imaging channels with independent gains and user-adjustable pixel duration

Bidirectional line scan with sub-pixel line offset adjustment

User or TTL triggered

■ IMAGING MODES

1. XY movie

Real-time continuous zoom and rotation, 1° increment

2. XZ movie

Requires z-piezo nanopositioner

3. Timelapse

4. Stack

Synchronized z focus and power modulation (linear or exponential)
On-line averaging

5. Fast stack

Fast XYZT time series when used with z- piezo nanopositioners
Synchronized z focus and power modulation (linear or exponential)

6. Line scan

User-drawn trajectory with arbitrary orientation and position

7. Region scan

User-designated collections of points, lines, rectangles, ellipses or polygons
Unlimited number of regions

8. Photostimulation scan

User-designated collections of points, lines, rectangles, ellipses or polygons

For each region, users can set:

- Dwell time per pixel
- Laser intensity
- Duty cycle to output trains of light in the region

■ CONTROL OF IMAGING POWER

Dedicated fast analog output (sub-microsecond response time) to control laser intensity via Pockels cell allowing beam blanking on scan turnabout.

■ PHOTOSTIMULATION

Dedicated fast analog output (sub-microsecond response time) to control laser intensity via:
- Pockels cell

■ POWER MEASUREMENT

Interfaces with an optical laser power meter for accurate, real-time measurement of laser power to the preparation

■ FOCUS CONTROL

Full XYZ control of objective placement with Sutter Instrument MPC-200

■ PHOTOSTIMAGING

Photostimaging is photostimulation during imaging. Photostimaging can be enabled during an XY movie, line scan or region scan.

Photostimaging requires a photostimulation laser (i.e., an ultrafast laser coupled to a Pockels cell or an analog-controlled blue-green diode laser) sharing the imaging pathway with the imaging laser via a dichroic mirror.



■ 3-D MAP WINDOW

Stores multispectral frames or stacks in a 25 nm x 25 nm x 25 mm 3-D world in objective coordinates

■ FUNCTIONAL IMAGING

Real-time display of averaged intensities of regions of interest (ROIs) in scrolling plot

- ROIs can be rectangles, ellipses or polygons
- Unlimited number of regions
- Automatic selection of the same region in other channels (useful for FRET)

■ ANALOG INPUTS

8 analog channels, up to 250 kHz continuous acquisition rate

■ SOFTWARE STIMULATOR

Ideal to interface electrical or optogenetic stimulators

- 2 analog out channels
- 8 digital out lines

■ TARGETED PATCH-CLAMPING

Support for one Sutter Instrument micromanipulator

Control of two more micromanipulators with additional MPC-200 controller

■ CELLULAR AMPLIFIER CONTROL

Automatic real-time scaling of inputs via telegraph gain

Supports Axon Instruments AxoClamp 900A, Axopatch 200B and Multiclamp 700B

■ INTEGRATED DEVELOPMENT ENVIRONMENT

Rich object model to control hardware, fully compatible with ActiveX Automation

■ MCS DATA FILES

Designed with GLP (Good Laboratory Practice) compliant header, visible from Windows shell

Contain imaging data, analog data and snapshots from CCD focusing camera

Standard tags and custom tags, queryable from other programs via ActiveX Automation interface

■ DATA FILE MANAGEMENT

Semi-automatic backup of data files at the end of a session at up to two different locations (i.e., thumb drive, network disk...)

■ BLOGGABLE LAB NOTEBOOK

Automatic log of events accessible via the built-in web browser.



SPECIFICATIONS

MCS MOM® COMPUTER SYSTEM

■ **Dimensions** *CPU:*
20.5 in x 8.25 in x 20 in
52 cm x 21 cm x 51 cm
Monitor:
26 in x 10 in x 19 in
67 cm x 24 cm x 48 cm

■ **Weight** *CPU:*
31 lbs
14 kg
Monitor:
15 lbs
7 kg

■ **Electrical** 115/230 Volts
50/60 Hertz power line





US PRICES MCS SYSTEM

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

- | | | |
|------------------------------|---|------------------|
| ■ MOM-MCS¹ | System includes preinstalled MScan 2.0 software, Windows 7 workstation, data acquisition boards, USB 2.0 camera | \$ 19,045 |
|------------------------------|---|------------------|

¹Must be used with MOM® systems equipped with MOM-DAQ, MPC-200 and ROE-200

US PRICES MCS COMPONENTS

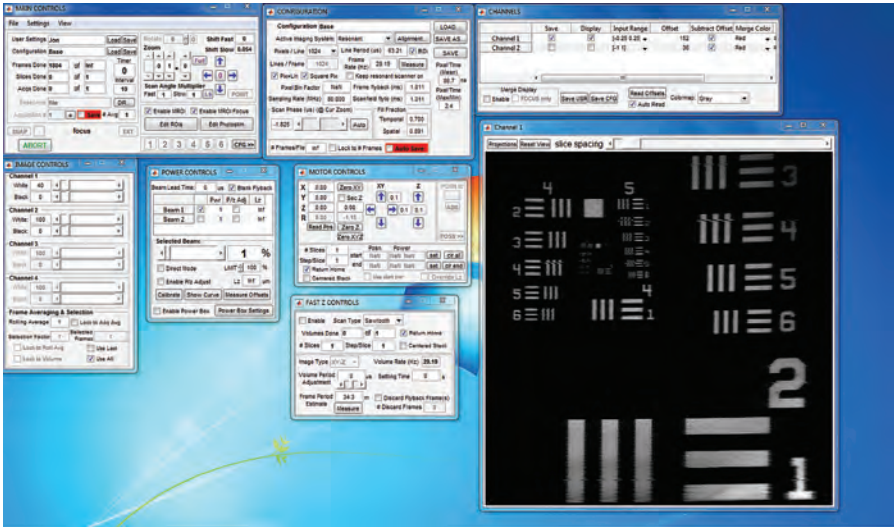
International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

- | | | |
|----------------------|--|-----------------|
| ■ MOM-DAQ | MOM® data acquisition system (includes NI 6110E) | \$ 5,645 |
| ■ MPC-200-ROE | Includes MPC-200 controller and ROE-200 | \$ 3,900 |

NOTE: The MOM-MCS communicates with the MPC-200 controller via the USB port for control of X, Y and Z movement. It is not compatible with the MP-285 controller. Please contact Sutter for more information.

SCANIMAGE

SOFTWARE AND FPGA-BASED ACQUISITION SYSTEM



FEATURES SCANIMAGE

- Supports linear galvanometer and resonant scanning hardware
- Provides support for resonant, galvanometer, galvanometer triple scanner combination
- Precise experimental synchronization between imaging, physiology and behavior with user defined triggers and internal clock signals
- Full support for simultaneous imaging and photostimulation applications requiring parallel scanner paths
- Multi-region of interest mode provides targeted sequential imaging and photostimulation
- Multiple arbitrary line scanning
- Continuous volume imaging with fast piezo support (PI, nPoint)
- Step and settle volume imaging with piezos or Optotune
- FPGA based continuous, gap-free data acquisition for real-time image processing and future closed loop data processing
- MatLab interface offers user scripting and custom analysis capabilities with a full hardware control API exposed for automating experiments
- Integration with WaveSurfer enables synchronized electrode recording and general data recording



ScanImage is imaging software for scanning microscopes developed by Karel Svoboda and coworkers (Pologruto et al, 2003) and judiciously maintained by members of the Svoboda lab, first at Cold Spring Harbor Lab and then at Janelia Farms, HHMI. It is hard to over estimate the influence of this software in the field of two-photon scanning microscopy.

ScanImage was designed to be a freely available open source program and its early maintenance was "easily" supported. However, as ScanImage became increasingly popular and as new versions were required to cover changes in operating systems and hardware drivers, it soon became obvious that a high level of maintenance could not be sustained based on the "freeware model". Ultimately, ScanImage support and development has become a commercial enterprise and Vidrio is the new face of ScanImage.

Two-photon microscope development at Sutter Instrument has been closely tied to ScanImage software for years. In addition to the MOM® *in vivo* two-photon scope, Sutter has many products that are used by two-photon microscopists using ScanImage including our stepper motor drive XYZ controllers, galvo and resonant scanner systems, PMTs and PMT power supplies. We are grateful to have had a mutual, continuing connection to ScanImage and the ScanImage community for over ten years.

Sutter provides hardware that operates seamlessly with all versions of ScanImage. Products can be purchased ala carte or as a bundled system with ScanImage Premium or SI 5.

For technical information about ScanImage Premium and SI 5, we direct you to the Vidrio and ScanImage web sites.

VIDRIO - <http://scanimage.vidriotechnologies.com/pages/view page.action?pagelid=36141>

ScanImage - <https://openwiki.janelia.org/wiki/display/ephus/ScanImage>



COMMON APPLICATIONS SCANIMAGE

- Two-photon imaging
- Deep tissue imaging
- Complex neurophysiology experimentation control

**US PRICES SCANIMAGE**

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

**SCANIMAGE
PREMIUM****BUNDLED SYSTEMS¹**

Includes SIP-SOFT, RESSCAN-MOM or RESSCAN-GEN, preconfigured NI-FLEX RIO data acquisition system, and two FEMTO DHPCA-100 fast preamps with power supplies.

■ RES-MOM-SIP	Resonant Scanner for Sutter MOM® w/ ScanImage Premium software	\$ 50,565
■ RES-GEN-SIP	Resonant Scanner for 60 mm cage based microscope w/ ScanImage Premium software	\$ 50,565

SI 5**BUNDLED SYSTEMS¹**

Includes RESSCAN-MOM or RESSCAN-GEN, preconfigured NI-FLEX RIO data acquisition system, and two FEMTO DHPCA-100 fast preamps with power supplies.

■ RES-MOM-SI5	Resonant Scanner for Sutter MOM w/ SI 5	\$ 39,425
■ RES-GEN-SI5	Resonant Scanner for 60 mm cage based microscope w/ SI 5	\$ 39,425

COMPONENTS

■ RESSCAN-MOM	Resonant Scanner for Sutter MOM — Stand Alone	\$ 13,895
■ RESSCAN-GEN	Resonant Scanner for 60 mm cage based microscope — Stand Alone	\$ 13,895
■ SIP-SOFT	ScanImage Premium software	\$ 11,140
■ DAQ-FPGA	Basic National Instruments Flex-RIO Data Acquisition system compatible with SI 5 freeware and ScanImage Premium software	\$ 16,535
■ CO-0040335	FEMTO DHPCA-100 preamplifier	\$ 4,790
■ CO-0040337	FEMTO power supply	\$ 319

¹ Please note, ScanImage Premium Bundles are not turnkey packages. You will need to supply an appropriate computer with MATLAB® software installed. MATLAB® is a product of MathWorks.



RESCAN SUTTER RESONANT SCAN BOX



(Shown: RESSCAN-MOM)

FEATURES RESCAN

- | | |
|---|---|
| <ul style="list-style-type: none"> ■ Can easily be added to existing MOM® systems ■ Can be used as a component for customers building their own scope ■ Compatible with MScan, as well as many freeware and commercial software packages | <ul style="list-style-type: none"> ■ Full frame scanning at up to 30 frames per second ■ Whisper quiet resonant scanners ■ Flexible hardware works with a variety of systems ■ Turnkey or bundled options available |
|---|---|



The Sutter Resonant Scan box (RESSCAN) is a general purpose resonant scan box using the industry standard Cambridge Technologies CRS 8 kHz resonant scanner for fast X scanning and a second Cambridge galvo scanner (6215 5 mm) for Y axis scanning. The scan box is whisper quiet and the package allows full frame scanning at up to 30 frames per second (actual values are software dependent). Unlike other resonant systems designed to be used with proprietary hardware and/or software, the Sutter resonant scan box and its connections to the outside world are intentionally generic.

Two versions of the scan box are currently available:

- RESSCAN-MOM — a version that fits in the standard scanner location in the MOM and can be purchased either with a new MOM® or used to field convert an existing MOM.
- RESSCAN-GEN — a generic version compatible with 60 mm cage systems. This version of the resonant scan box was designed for the Janelia Farms MIMMs scope, but will work with any scope with a scan pathway designed around a 60 mm optical cage.

The resonant scan box controller (MDR-R) connects to and drives the resonant scan box and provides the exact inputs and outputs supplied by Cambridge Technologies scanner controller cards (SYNC and ZOOM for the CRS scanner and Position for the slow Y scanner). This is helpful for those who have existing software that runs with other scopes using Cambridge Resonant scanners.

The Sutter resonant scanner system can be purchased in several configurations. Those who wish a ready-to-use, turnkey Resonant scanner system, complete with software, should purchase either RES-MOM-MCS or RES-GEN-MCS. If you wish to use your RESSCAN with ScanImage Premium, you should purchase either RES-MOM-SIP or RES-GEN-SIP.

Alternatively, you may wish to take advantage of the standard connections on the controller to use the Sutter scanner system with existing freeware (Helioscan, MP Scope, or SI 5), third party commercial software (3I Slidebook) or software of your own design. Sutter carries stand alone NI FLEX RIO data acquisition packages to use with SI 5.



SPECIFICATIONS RESSCAN

■ Dimensions

Resonant Scan Box:

5 in x 4 in x 2 in

13 cm x 10 cm x 5 cm

Controller:

16 in x 11 in x 3.5 in

41 cm x 28 cm x 9 cm

■ Weight

Resonant Scan Box:

2.0 lbs

1 kg

Controller:

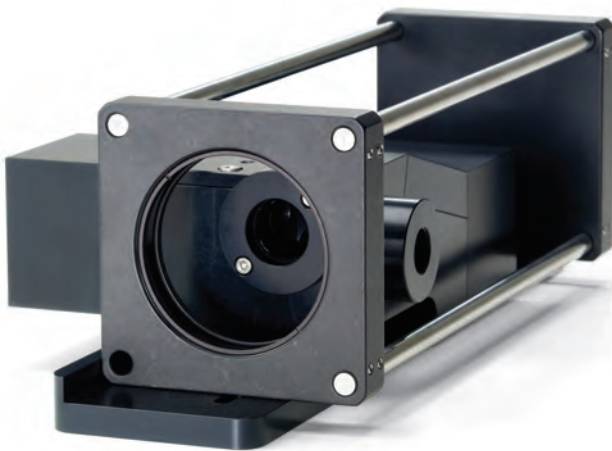
6.5 lbs

3 kg

■ Electrical

115/230 Volts

50/60 Hertz power line



(Shown: Generic resonant scanner)



US PRICES RESSCAN

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

RESSCAN

BASIC SYSTEM

Resonant Scan Box for Sutter MOM® or Researcher-built Microscope

Includes: Cambridge CRS 8 kHz Resonant Scanner and 6215 5 mm Galvo Scanner in Sutter-designed, quiet, sealed enclosure; MDR-R controller for both scanners with power supply, SYNC output and ZOOM and Y position inputs; power cord and cables to connect to Resonant Scan Box, and mounting adapter for Sutter MOM or standard 60 mm cage (drawings available).

■ RESSCAN-MOM	Resonant Scanner for Sutter MOM — Stand Alone	\$ 13,895
■ RESSCAN-GEN	Resonant Scanner for 60 mm cage based microscope — Stand Alone	\$ 13,895

MCS & MScan 2.0

BUNDLED VERSION

In addition to the stand alone versions, the bundles include Windows 7 workstation with pre-installed MScan 2.0 software, all necessary data acquisition boards, USB 2.0 camera, MPC-200-ROE three axis controller for moving stepper drive XYZ of MOM or researcher-built microscope and two fast preamps.

■ RES-MOM-MCS	Resonant Scanner for Sutter MOM — Bundle Version	\$ 42,395
■ RES-GEN-MCS	Resonant Scanner for 60 mm cage based microscope — Bundle Version	\$ 42,395

SCANIMAGE PREMIUM

BUNDLED VERSION¹

In addition to the stand alone resonant scan box (RESSCAN-MOM or RESSCAN-GEN) ScanImage bundles also include ScanImage Premium software, preconfigured NI-FLEX RIO data acquisition system, and two FEMTO DHPCA-100 fast preamps.

■ RES-MOM-SIP	Resonant Scanner for Sutter MOM — ScanImage Premium Bundle version	\$ 50,565
■ RES-GEN-SIP	Resonant Scanner for 60 mm cage-based microscope — ScanImage Premium Bundle version	\$ 50,565

¹ Please note, ScanImage Premium Bundles are not turnkey packages. You will need to supply an appropriate computer with MATLAB® software installed. MATLAB® is a product of MathWorks.



PS-2 / PS-2/LV

PMT POWER SUPPLIES



FEATURES PS-2 / PS-2/LV

- Dual power supplies, discrete gain, on/off controls and high voltage displays for each PMT connected
- Rear panel has +/-12 VDC (two outlets) and +/-5 VDC (two outlets).
- Mating connectors supplied for high and low voltage outputs
- Low noise linear power for all low voltages and for driving high voltage supplies

The PS-2 and PS-2/LV are Sutter PMT power supplies sold with the Sutter MOM®. They are also available to those who need dual power supplies for either their own scanning microscope or other projects that need PMT power supplies. The PS-2 is a dual high voltage supply specifically designed to be used with the Hamamatsu R6357 multi alkali PMT but applicable to other similar PMTs. The PS-2/LV was originally designed to be used with the Hamamatsu H10770PA-40 PMT Module, but is applicable to many other similar PMT modules that have the high voltage supply built into the device and only require a low voltage supply and a control voltage to set gain.

The PS-2 and PS-2/LV have additional outputs for running preamplifiers and other associated circuitry. Both are dual supplies with discrete on/off switches, gain controls and voltage displays for the two PMTs attached. These two models are manually controlled, which is convenient for those designing their own scopes; there is no need to worry about PC control of various parameters. Just plug in the PMT and power up! To keep generated noise at a minimum, linear power supplies are used to generate all low voltages and to power the high voltage supplies.

APPLICABLE PMTs

PS-2

Hamamatsu R6357, R3896, R3811

PS-2/LV

Hamamatsu H10770PA-40, H10770PB-40, H10770PA-50 as well as gated modules like H11706-40 and H11526-110

Please call Sutter for applicability of the PS-2 and PS-2/LV to other PMTs and PMT modules.

HAMAMATSU PMTs

Sutter Instrument is an authorized reseller for Hamamatsu. We have been using Hamamatsu PMTs and PMT modules in the Sutter MOM scope since 2006 and also offer various Hamamatsu PMTs for sale as individual components.

We keep a small inventory of PMTs and PMT modules, provide PMT testing, cabling and mounting solutions and we also provide several Sutter designed PMT power supplies. Please contact Sutter for a list and pricing of the Hamamatsu PMTs that we carry, or to find out if we can help you design a PMT into a custom instrument.



SPECIFICATIONS PS-2 / PS-2/LV

- **Front panel Controls/Indicators**
 - Main power switch for entire unit
 - Discrete controls/indicator for each On/Off Switch
 - 10 turn potentiometer to set high voltage/gain
 - LED display showing high voltage 0 V to 1250 V
- **Voltage and Current of rear panel outputs**
 - PS-2 PMT High Voltage output:
0 VDC to -1250 VDC,
current 0.6 mA
 - PS-2 / LV PMT Module output:
constant +15 VDC as well as
control Vref supplied by module
 - Preamp / Auxiliary power outputs:
+/-12 VDC, 200 mA per side
+/-5 VDC, 200 mA per side
- **Dimensions**
 - 16 in x 11 in x 3.5 in
 - 4 cm x 28 cm x 9 cm
- **Weight**
 - 6.5 lbs
 - 3 kg
- **Electrical**
 - 115/230 Volts
 - 50/60 Hertz power line





US PRICES PS-2 / PS-2/LV

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

■ PS-2	Includes PMT power supply, power cord and mating connectors for all outputs (Suitable for RG357 or like PMTs).	\$ 3,565
■ PS-2/LV	Includes PMT power supply, power cord and mating connectors for all outputs (Suitable for H10770 or like PMTs with built-in high voltage power supply).	\$ 3,565

DF-SCOPE™ MULTIPHOTON IMAGING PACKAGE FOR OLYMPUS BX51WI MICROSCOPES



(Olympus parts not included)

FEATURES DF-SCOPE™

- Converts a standard Olympus BX51WI into a two-photon microscope while retaining standard microscope functions (transmitted light and epifluorescent imaging).
- Includes detector(s) and “whisper-quiet” resonant scan box developed for the MOM® 2-Photon microscope.
- Upper and lower photodetectors for increased collection efficiency.
- Fully compatible with the Sutter MPC-78 Large Moving Stage Platform and motorized focus drive.
- Designed to be controlled with the Sutter MCS (MOM Computer System) Imaging Software including resonant scanning with MScan 2.0.
- Also fully compatible with most multiphoton freeware such as ScanImage 5.0, Helioscan, and MPScope.
- Breadboard format in scan pathway allows easy addition of photostimulation light sources to the main scanned laser path.



The DF-Scope™ is a customer-inspired, multiphoton, imaging package for the ubiquitous BX51WI upright microscope. Many laboratories already have BX51WI microscopes for use in electrophysiology and epifluorescent imaging experiments. The DF-Scope package provides the necessary optics and electronics for the BX51WI to be used for multiphoton imaging (with the addition of a Ti:Sapphire laser). The design incorporates subassemblies from our MOM® (Movable Objective Microscope®) system including resonant and galvo scan boxes and controllers, detector paths, PMTs, PMT power supplies, scan lenses and tube lenses.

A hallmark of multiphoton imaging is that all of the light emitted by the sample is known to be from the focal volume as a result of the nonlinear excitation of the fluorophore. High sensitivity photomultiplier tubes (PMTs) are used to collect as many of these photons as is possible in order to reconstruct the scanned image. The DF-Scope design allows for two detector paths to gather more emitted light, one above the sample and one below. If using a thin sample, like a brain slice, we recommend the lower (sub-stage) detectors to increase signal detection. Additional signal will be available at the trans detector path. This substage detector assembly is designed to work with a variety of Olympus condensers.

NOTE: The DF-Scope design requires an Olympus BX51WI and the following Olympus parts: WI-ARMAD, 5-UR710LP and U-M619.



COMMON APPLICATIONS DF-SCOPE™

- Deep tissue imaging
- Slice imaging and SFCC recording
- Retinal ex-plant imaging
- Imaging on many sample types including: tissue slices, Drosophila, zebra fish, mice, etc.

SPECIFICATIONS DF-SCOPE™

- **Front panel Controls/Indicators**
 - Main power switch for entire unit
 - Discrete controls / indicator for each
 - On / Off Switch
 - 10 turn potentiometer to set high voltage/gain
 - LED display
- **Voltage and Current of rear panel outputs**
 - PS-2 PMT High Voltage output: 0 VDC to -1250 VDC, current 0.6 mA
 - PS-2 / LV PMT Module output: constant +15 VDC as well as control Vref supplied by module
 - Preamp/Auxiliary power outputs: +/-12 VDC, 200 mA per side
 - +/-5 VDC, 200 mA per side
- **Dimensions**
 - 16 in x 11 in x 3.5 in
 - 41 cm x 28 cm x 9 cm
- **Weight**
 - 6.5 lbs
 - 3 kg
- **Electrical**
 - 115/230 Volts
 - 50/60 Hertz power line





US PRICES DF-SCOPE™

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

DF-Scope™

Multiphoton Imaging package for Olympus BX51WI Microscope

Includes Sutter-designed custom scanner mount with scan lens, tube lens and two position mirror mount to choose between two photon and widefield operation, XY scanners with drive electronics, special Olympus-made, wide-field fluorescence unit that incorporates two-photon detector pathway, two channel detector with PMTs, preamps and PS-2 power supply and data acquisition system.

■ DF-3MM	DF-Scope package with 3 mm scanners	\$ 90,020
■ DF-6MM	DF-Scope package with 6 mm scanners	\$ 93,285
■ DF-RES	DF-Scope package with Resonant scanners, MCS Computer System and MScan 2.0 software	\$ 114,940

ACCESSORIES DF-SCOPE™

■ MOM-DETECT-S1-M	MOM® short path #1 detector	\$ 12,580
■ DF-LOWER	DF-Scope lower detector mounting	\$ 7,210
■ PS-2	PMT power supply and mating connectors for all outputs (suitable for RG357 or like PMT's)	\$ 3,565
■ PS-2/LV	Includes PMT power supply, power cord and mating connectors for all outputs (Suitable for H10770 or like PMTs with built-in high voltage power supply).	\$ 3,565
■ CO-0040368	PMT amplifier C7319	\$ 712
■ LB-SC	Lambda SC control unit, serial, USB cable, power cord and manual	\$ 850
■ IQ25-SA	25mm SmartShutter® with stand alone housing	\$ 1,225
■ MOM-SETUPKIT-M	Basic table optics for laser routing	\$ 2,340
■ MOM-BEAMSPLITTER	MOM Beam Splitter	\$ 2,550
■ MPC-78/Y51/FD¹	MPC-78 with focus drive for the Olympus BX51WI	\$ 15,040
■ MP-78/Y51/FD¹	MP-78 with focus drive for the Olympus BX51WI	\$ 13,810

¹ When ordering please specify 1/4-20 or M6 tapped holes, and chamber insert (see page 91).

BOB™ OPEN-DESIGN UPRIGHT MICROSCOPE

New Features



FEATURES BOB™

- **New:** Optional motorized or fixed XY stage, or motorized translator.
- Open-design microscope with motorized focus.
- Quickly configurable based on experimental needs.
- Optimized to allow *in vivo* and *in vitro* experimentation on one setup.
- Designed for use with Olympus objective lenses.
- Free Multi-Link™ software coordinates movement with micropipette positioning of MPC-200.
- Oblique Coherent Contrast (OCC) or Differential Interference Contrast (DIC)
- Epi-fluorescent illumination



The Sutter BOB™ – designed to eliminate the conventional microscope frame – is a simple, open-design upright microscope platform ideal for slice electrophysiology, wide field functional imaging, two photon retinal imaging, photostimulation and new techniques just being developed! A microscope, in its simplest form, is an objective and a tube lens. Other components of most modern microscopes are designed to serve specific functions: different types of experiments, methods of illumination and means of signal detection.

Replacing the microscope frame with an optical rail builds in the ability to adjust the overall height of the microscope, unheard of in conventional microscope designs. Work on slices in January, do *in vivo* experiments in March. The BOB microscope is a compact, single assembly that mounts to the “blue rail” with one massive, stable connection. Focusing is motorized and incorporated between the focus arm and the optical rail.

Fluorescence epi-illumination is built into the basic BOB via an Olympus vertical illuminator. LED transmitted light illumination uses the Olympus Oblique Coherent Contrast (OCC) condenser. Sutter’s TLED and TLED controller form the trans-illumination light source. The TLED controller is capable of being triggered with a digital signal eliminating the need for shutters and adding the ability to photostimulate from the trans location. In experiments where transmitted light is not desired, the LED, condenser focus mechanism and OCC condenser are easily removed as a single assembly. Additionally, the transmitted light path is shorter than in other frames, allowing the microscope body to sit significantly lower than a conventional microscope. When the microscope is shorter, there is more stability and increased ergonomics for ease of use.

The Sutter BOB, when configured with an optional motorized XY stage or translator with MPC-200 controller, takes full advantage of our free Multi-Link™ software program for micromanipulator positioning. During whole-cell patch recording in slices, it is common to search a large area of the slice to find appropriate neurons. If the BOB is configured with Multi-Link, after you find your target, Multi-Link will then retrieve your recording and stimulation pipettes to the same field of view so that you can begin recording immediately. If later you need to stimulate a region outside the current field of view, Multi-Link can release the recording pipette and allow you to reposition the objective and stimulating pipette(s) to the new stimulation region.

Applications

- *In vivo* and *In vitro*
- Whole-cell imaging
- Intracellular imaging
- Material science



SPECIFICATIONS BOB™

■ Dimensions

9.1 in x 10.8 in x 20.4 in
23.1 cm x 27.5 cm x 51.9 cm

■ Weight

BOB:
23.9 lbs
10.8 kg
BOB-TL:
29.3 lbs
13.3 kg

■ Electrical

115/230 Volts
50/60 Hertz power line



**CONFIGURE YOUR BOB™ MICROSCOPE****STEP 1:** Use this chart to determine the BOB system suited to your requirements**BOB SYSTEMS WITH FLUORESCENCE**

FEATURES	Trinocular head or camera mount	Transmitted light	Add a second wavelength to transmitted light
BOB-FL	Camera	No	No
BOB-FLTL	Camera	Yes	No
BOB-FLTL2	Camera	Yes	Yes
BOB-FLTR	Trinocular Head	No	No
BOB-FLTRTL	Trinocular Head	Yes	No
BOB-FLTRTL2	Trinocular Head	Yes	Yes

BOB SYSTEMS WITHOUT FLUORESCENCE

BOB	Camera	No	No
BOB-TL	Camera	Yes	No
BOB-TL2	Camera	Yes	Yes
BOB-TR	Trinocular Head	No	No
BOB-TRTL	Trinocular Head	Yes	No
BOB-TRTL2	Trinocular Head	Yes	Yes

US PRICES BOB™

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

BOB systems *with* fluorescence

■ BOB-FL	BOB microscope with epi-illuminator	\$ 17,900
■ BOB-FLTRTL	BOB with epi-illuminator, trinocular head, transmitted light	\$ 29,200
■ BOB-FLTRL2	BOB with epi-illuminator, trinocular head, dual transmitted light	\$ 30,600
■ BOB-FLTR	BOB with epi-illuminator, trinocular head	\$ 24,700
■ BOB-FLTL	BOB with epi-illuminator, transmitted light	\$ 22,400
■ BOB-FLTL2	BOB with epi-illuminator, dual transmitted light	\$ 23,800

BOB systems *without* fluorescence

■ BOB	BOB microscope	\$ 12,900
■ BOB-TRTL	BOB with trinocular head, transmitted light	\$ 24,200
■ BOB-TRTL2	BOB with trinocular head, dual transmitted light	\$ 25,600
■ BOB-TR	BOB with trinocular head	\$ 19,700
■ BOB-TL	BOB with transmitted light	\$ 17,400
■ BOB-TL2	BOB with dual transmitted light	\$ 18,800



CONFIGURE YOUR BOB™ MICROSCOPE

STEP 2: Choose your objective(s)

The BOB uses a standard Olympus turret. You can select from this list, use your own objectives, or choose from one below. Objectives in GREEN are recommended for electrophysiology.

■ OBJ-522¹	4X – UPLFLN4X;U PLAN FLUORITE 4X OBJECTIVE; NA 0.13, WD 17MM	\$ 436
■ OBJ-342	5X – LMPLFLN5X;LWD M PLAN FL 5X OBJECTIVE; NA 0.13, WD 22.5MM	\$ 946
■ OBJ-343	10X – LMPLFLN10X;LWD M PLAN FL 10X OBJECTIVE; NA 0.25, WD 21MM	\$ 1,272
■ OBJ-524¹	10X – UPLFLN10X2;U PLAN FLUORITE 10X OBJECTIVE; 11:21 AM	\$ 779
■ OBJ-824	10X – UPLSAPO10X2;UPLANS S-APO 10X OBJECTIVE; NA 0.4,WD 3.1MM	\$ 2,255
■ OBJ-525	20X – UPLFLN 20X;U PLAN FLUORITE 20X OBJECTIVE; NA 0.5, WD 2.1MM	\$ 925
■ OBJ-585	20X – UMPLFLN20XW; LWD PLAN FLOUR 20X WTR DIPPING OBJ, NA 0.5, WD 3.5MM, IR	\$ 1,657
■ OBJ-766	20X – UAPON20XW340; UAPON 20X WATER 340NM OBJ, NA0.7, WD 0.35MM	\$ 4,222
■ OBJ-825	20X – UPLSAPO 20X;UPLAN S-APO 20X OBJECTIVE; NA 0.3, WD 10MM	\$ 2,435
■ OBJ-527	40X – UPLFLN 40X;U PLAN FLUORITE 40X OBJECTIVE; NA 0.75, WD 0.51MM	\$ 1,012
■ OBJ-587¹	40X – LUMPLFLN40X/W;U M PLAN FLN 40X/W NA0.8 WD3.3MM,IR,ECO	\$ 2,556
■ OBJ-769	40X – UAPON40XW340; UAPON 40X WATER OBJ; NA1.15, WD 0.25MM, W/CC, BFP1	\$ 4,222
■ OBJ-350	50X – LMPLFLN50X;LWD M PLAN FL50X OBJECTIVE; NA 0.5, WD 10.6MM	\$ 2,706
■ OBJ-592¹	60X – LUMPLFLN60X/W; U M PLAN FLN 60X/W NA1.0 WD2.0MM,IR,ECO	\$ 3,007
■ OBJ-672¹	60X – LUMFLN60X/W;LUMFLN60X/W NA1.1WD1.5MM 25 ANGLE,IR.CC,ECO	\$ 9,267
■ OBJ-832	60X – UPLSAPO60XO;U PLAN S-APO 60X OIL OBJ; NA 1.35,WD 0.15MM, BFP1	\$ 5,089
■ OBJ-893	60X – UPLSAPO60XW;U PLAN S-APO 60X W OBJ; NA 1.2,WD 0.28MM, W/CC0.13-0.21	\$ 9,505

¹ These objectives are recommended for electrophysiology.

**CONFIGURE YOUR BOB™ MICROSCOPE****STEP 3:** For models with **TL** in the part number: Choose a condensor.

■ OCC	Oblique contrast condensor	\$ 3,465
■ DIC-40X[†]	Differential interference contrast condenser for BOB with 40X objective	\$ 5,960
■ DIC-60X[†]	Differential interference contrast condenser for BOB with 60X objective	\$ 6,460

[†] For DIC models, select the one that matches the highest power of your selected objectives.

CONFIGURE YOUR BOB™ MICROSCOPE**STEP 4:** For models with **TR** in the part number: Choose a filter cube(s) and a light source.**FILTER CUBES**

■ CUBE-GFP	Filter Cube – GFP	\$ 1,220
■ CUBE-CY3	Filter Cube – CY3	\$ 1,220
■ CUBE-YFP	Filter Cube – YFP	\$ 1,220
■ CUBE-DAPI	Filter Cube – DAPI	\$ 1,220
■ CUBE-A635	Filter Cube – ALEXA 635	\$ 1,220

LIGHT SOURCES

Not necessary if you already have a light source with a liquid light guide.

■ HPX-L5	Lambda HPX-L5 High powered LED light source	\$ 5,650
■ LS-OF30	Lambda LS with 300 Watt ozone free lamp	\$ 5,550
■ Lambda 421	Lambda 421 Optical Beam Combiner (Select 4 wavelengths)	\$ 9,715
■ Lambda OBC	Lambda OBC Optical Beam Combiner (Please contact Sutter to discuss your configuration)	Contact Sutter
■ FLED-BOB	Lambda HPX-L5 High powered LED light source	\$ 2,860
■ FLED-DC-BOB	Lambda HPX-L5 High powered LED light source	\$ 5,825

LIGHT SOURCE ADAPTER

■ LG-BOB	Liquid light guide adapter for light source	\$ 580
-----------------	---	---------------



CONFIGURE YOUR BOB™ MICROSCOPE

STEP 5: Select a stage and translator as needed.

MOTORIZED LARGE PLATFORM STAGE

If you are planning on using our free Multi-Link Software, you will need to purchase a stage with the MPC-200 controller.

■ MPC-88¹	Moving platform stage plate with motorized gantry supports, MPC-200 controller and ROE, cables and manual	\$ 13,615
■ MPC-88-M6¹	Same as MPC-88 except with M6 tapped holes	\$ 13,615
■ MPB-88¹	Moving platform stage plate with motorized gantry supports, BOB controller, cables	\$ 11,025
■ MPB-88-M6¹	Same as MP-88 except with M6 tapped holes	\$ 11,025
■ MP-88¹	Moving platform stage plate with motorized gantry supports, MP-285 controller and ROE, cables and manual	\$ 12,415
■ MP-88/M6¹	Same as MP-88 except with M6 tapped holes	\$ 12,415

¹ Please specify chamber type when ordering.

MOTORIZED TRANSLATOR AND STANDS

Includes a motorized X-Y translator, a controller, two micromanipulator stands, MT-150 chamber stand, and cables. If you are planning on using our free Multi-Link Software, you will need to purchase a stand and translator with the MPC-200 controller.

■ MT-2000/BOB	Motorized translator with MP-285 controller, ROE, and stands	\$ 11,580
■ MT-2200/BOB	Motorized translator with MPC-200 controller, ROE, and stands	\$ 12,025
■ MT-2800/BOB	Motorized translator with BOB controller, ROE, and stands	\$ 10,580

MOTORIZED TRANSLATOR AND FIXED PLATFORM STAGE

Includes a motorized X-Y translator, controller, cables, and fixed platform stage. If you are planning on using our free Multi-Link Software, you will need to purchase a stage and translator with the MPC-200 controller.

■ MT-2088/BOB	Motorized translator with MP-285 controller, ROE, and fixed platform stage	\$ 12,700
■ MT-2288/BOB	Motorized translator with MPC-200 controller, ROE, and fixed platform stage	\$ 13,255
■ MT-2888/BOB	Motorized translator with BOB controller, ROE, and fixed platform stage	\$ 11,700



CONFIGURE YOUR BOB™ MICROSCOPE

STEP 5 continued: Select a stage and translator as needed.**MOTORIZED TRANSLATOR ONLY (no stand or platform)**

Includes a motorized X-Y translator, controller, and cables. If you are planning on using our free Multi-Link Software, you will need to purchase a translator with the MPC-200 controller.

■ MT-800/BOB	Motorized translator with MP-285 controller, and ROE	\$ 9,380
■ MT-820/BOB	Motorized translator with MPC-200 controller, and ROE	\$ 9,930
■ MT-880/BOB	Motorized translator with BOB controller, and ROE	\$ 8,380

CONFIGURE YOUR BOB MICROSCOPE

STEP 6: Select a camera as needed.**CAMERA**

■ CAM-EL	ELECTRO, Cooled 1.4MP CCD Camera	\$ 4,950
■ CAM-PR	PRIME 25B, Back illuminated CMOS Camera	\$ 24,950
■ CAM-BIS	PRIME BSI, High-res scientific CMOS Camera	\$ 18,450

ACCESSORIES BOB™

MP-88 / MPC-88 CHAMBER INSERTS

■ X040500[†]	Warner Series 20 (round) — aluminum	\$ 117
■ X040503[†]	Warner Series 20 (round) — stainless steel	\$ 117
■ X040505[†]	Warner Series 20 (octagonal) — aluminum	\$ 117
■ X040507[†]	Warner Series 20 (octagonal) — stainless steel	\$ 117
■ X040510[†]	50 mm round — aluminum	\$ 117
■ X040512[†]	50 mm round — stainless steel	\$ 117
■ X040497[†]	Blank insert — aluminum	\$ 117
■ X040498[†]	Blank insert — stainless Steel	\$ 117
■ SI-SLIDE[†]	Insert with slide holder	\$ 117
■ SI-PETRI	For petri dish and slides	\$ 329
■ SI-W30[†]	Warner Series 30 platform — aluminum	\$ 117
■ SI-W30ST[†]	Warner Series 30 platform — stainless steel	\$ 117
■ SI-ALA-MS[†]	ALA MS series insert — aluminum	\$ 117
■ SI-CUSTOM	Custom stage insert	\$ 361

[†] No charge when ordered with MP-88 or MPC-88.

OPTICAL INSTRUMENTS

Precise mechanical movement and well engineered electronics have always been hallmarks of Sutter Instrument products. Over twenty years ago, our entrance into the optical products market capitalized on these attributes when we set out to produce a reliable, fast, electronically quiet, computer controlled filter wheel. The result was the Lambda 10, which met all of our original performance goals, and proved itself as a very rugged and reliable instrument.

The success of the Lambda 10 led to the development of a new generation of wavelength switching products, and one of the widest ranges of accessories in the industry. Our current design, the Lambda 10-3 controller, allows for the use of three filter wheels without the expense of additional controllers. The Lambda 10-B has also been added as a lower cost alternative for those who do not require all the features of the Lambda 10-3. Both of these controllers can be coupled to our

original filter wheel, as well as our latest line of wheels which have been designed for 25 mm as well as larger diameter filters.

Taking advantage of the latest in thin-film filter technology, Sutter has incorporated tunable filters into a single and 5-position filter changer, the Lambda VF-1™ and Lambda VF-5™, providing access to any center bandpass from 338 nm to 900 nm in nanometer increments.

When the Lambda 10 was first introduced, most imaging systems could not keep up with its 55 msec switching time. As technology has advanced in the field



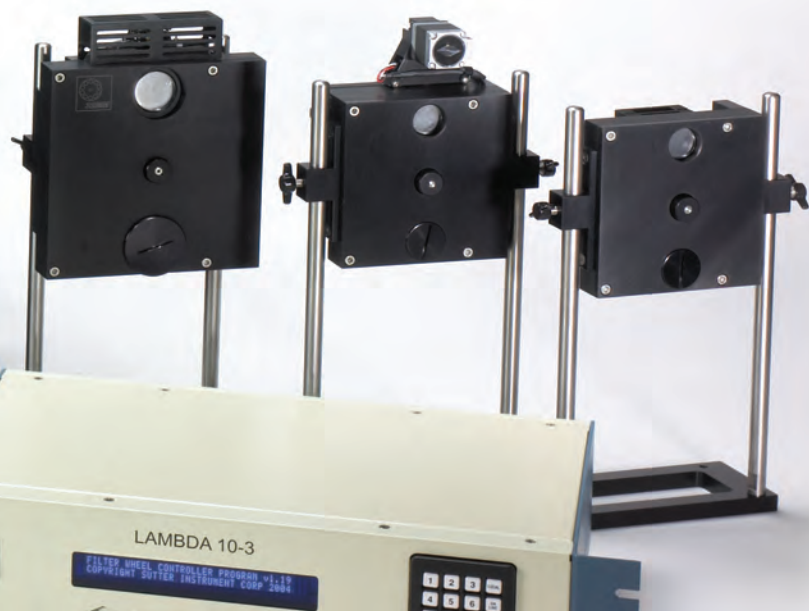
of imaging, demand has increased for faster wavelength switching speed. Sutter Instrument has responded with the Lambda DG-4 PLUS, an integrated illumination system capable of switching wavelengths in less than 0.5 msec.

As demands for high throughput and lower exposure times have increased, the need for a stand-alone high power light source was met with the Lambda LS. This integrated 175 (or 300) Watt xenon arc lamp, cold mirror, and power supply system is available in an efficient single cabinet design.

Sutter Instrument developed and designed the *SmartShutter*® to address the need for a robust and reliable shutter to serve as a component in our imaging line or as a stand-alone solution for optical applications. The *SmartShutter* offers the most sophisticated shutter control available. Microprocessor control of the

stepper-motor allows the user to optimize movement for speed or smoothness, produce a variable aperture, and achieve open/close times of 8 msec from trigger. The *SmartShutter* is compatible with the Lambda 10-3, Lambda 10-B/IQ, and Lambda SC controllers.

Customization of our optical product line for unique applications has become a specialty for Sutter Instrument. New technology has been incorporated in various custom and OEM filterwheels. For example, for systems using a large number of filter wheels, Sutter Instrument developed an RS-485 serial bus to allow up to 16 controllers to share a single serial port on a host computer. Sutter Instrument has also developed sensor and motor technology for a system of filter wheels running at liquid helium temperatures for use with astronomical telescopes. Please contact us directly for more information about custom filter changing devices.





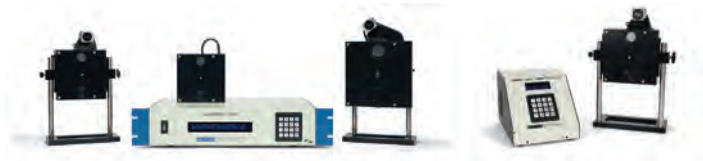
LIGHT SOURCE COMPARISON CHART

This chart of light source options and capabilities will assist you in selecting the product best suited to your application. Sutter product managers are happy to discuss your particular technical requirements in order to ensure you receive the best light source for your research needs. Please contact Sutter for further assistance.

	Light Source	Fluorescent Microscopy	Calcium Imaging	FURA	Optogenetics	Transmitted Light	PHASE	DIC	Hyper Spectral Imaging	Ultra High Speed Wavelength Selection	High Speed Wavelength Selection	Wavelength Selection
Lambda DG-4 Plus	Xenon	■	■	■	■					■	■	■
Lambda LS	Xenon	■	■	■	■						■	■
Lambda XL	Xenon LEP	■	■	■	■						■	■
Lambda HPX	LED	■			■							
Lambda HPX-L5	LED	■			■							
Lambda TLED/TLED+	white LED				■	■	■	■				
Lambda FLED	LED	■	■		■							
Lambda FLED-DC	LED	■	■	■	■					■	■	■
Filter Wheel	N/A	■	■	■	■						■	■
Lambda 421	LED	■	■	■	■					■	■	■
Lambda OBC	LED	■	■	■	■					■	■	■
Lambda VF-5	varies	■	■	■	■				■			■



FILTER WHEEL CONTROLLER COMPARISON CHART



Features	Lambda 10-3	Lambda 10-B
Maximum # of Wheels	3	1
Maximum # of Shutters	3 ¹	2 ¹
Shutter Type		
SmartShutter®	■	■
Uniblitz®	■	■
Filter Diameter (mm)		
12/25/32/50 ²	■	■
Minimum Switching Time ³ (ms)		
40 ms — 25 mm wheel	■	■
50 ms — 32 mm wheel	■	■
31 ms — 4-position 25 mm	■	■
Power Supply	Chopper	Chopper
Computer Interface		
Serial	■	■
Parallel	■	
USB	■	■
TTL In/Out	Yes	Yes
Price ⁴	\$6,810	\$5,835

1. The Lambda 10-3 can be used to drive up to 3 filter wheels and 2 shutters, or 3 shutters and 2 filter wheels. The Lambda 10-B, two shutters or one wheel and one shutter.
2. The controller automatically detects the installed hardware.
3. Minimum switching time between adjacent filters depends on the filter load. The given values are for a load of 2 filters.
4. For one controller with one non-shuttered standard 10-position 25 mm filter wheel. U.S. prices. International prices vary by country.



LAMBDA LS

STAND-ALONE XENON ARC LAMP AND POWER SUPPLY



*(Shown with optional light
guide and lens tube)*

FEATURES LAMBDA LS

- Xenon lamps provide light levels which exceed those of standard microscope fluorescence lamps
- Equipped with a cold mirror to eliminate IR heating of downstream optical components
- Compact stand-alone lamp housing power supply enclosure
- Pre-aligned bulb eliminates common focusing problems
- Integrated hour meter for convenient monitoring of lamp life
- Modular construction allows use of optional liquid light guide for flexible direction of light output
- Easily accommodates Sutter Instrument filter wheels or *SmartShutter®* within the body of the lamp.
- Can be coupled via a liquid light guide to many standard microscopes (Nikon, Zeiss, Leica and Olympus). Microscope coupling requires special adapters (not included). Please see the Microscope Adapter section in this catalog.



The Lambda LS is a stand-alone lighting system consisting of a xenon arc lamp, lamp housing, cold mirror and power supply in a single enclosure. The Lambda LS is designed to be used with a liquid light guide which transmits remarkably flat, intense, illumination to the optical train of the user's microscope or other instrumentation. The lamp's cabinet accommodates a standard Sutter Instrument filter wheel that slides easily in and out of a slot in the light path. If desired, a second filterwheel can be mounted on the outside of the cabinet. When used with appropriate adapters, the light guide output is compatible with most common microscope systems. Unlike the arc lamps used with most fluorescence microscopes, the xenon bulb is pre-aligned using a parabolic mirror and does not require alignment, focusing or collimation. In the standard configuration, the Lambda LS bulb is capable of producing light output from 330 nm to a cutoff of 650 nm determined by the cold mirror. An optional enhanced UV bulb produces output much lower into the UV (cut off near 200 nm). As with any UV generating light source, the optional bulb generates significant quantities of ozone and must be used in an adequately ventilated environment.

The Lambda LS utilizes a compact design, which places power supply, lamp house, arc lamp and cold mirror in a single enclosure. This system eliminates a common failure associated with standard arc lamp designs: when using a remote power supply aging may lead to a decreased ability to light the lamp due to loss of the insulating characteristics of the lengthy high-tension line. As with all our equipment, the power supply has been designed to minimize electrical noise that can be picked up by physiological recording equipment.

The liquid light guide can be coupled to the illumination port of most microscopes using an adapter which can be purchased separately. Please refer to the "Microscope Adapters" section for further information. Extended output ranges are possible with various cold mirror and light guide combinations. Phone Sutter to discuss your specific application requirements.



COMMON APPLICATIONS LAMBDA LS

- Fluorescent microscopy
- Calcium imaging
- FURA
- Optogenetics
- High speed wavelength selection

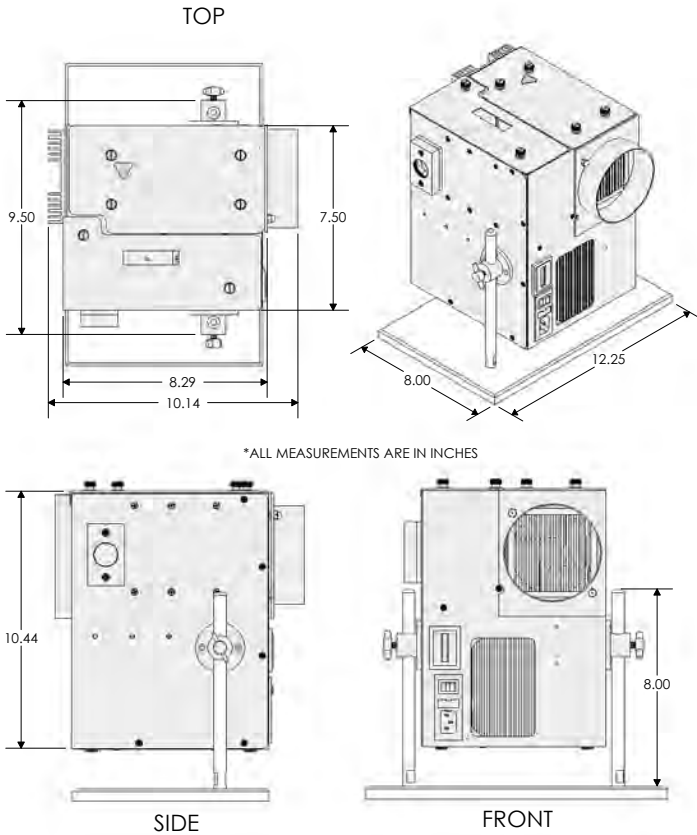
SPECIFICATIONS LAMBDA LS

- **Output Range** 330 nm to 650 nm — Ozone free
200 nm to 650 nm — Full spectrum (Note: full spectrum produces ozone)
- **Lamp Type** 175 or 300 Watt Xenon
(pre-aligned to produce collimated output)
- **Radiant Output** 2.5 Watts (175 W lamp)
4.5 Watts (300 W lamp)
(broadband, full beam)
- **Lamp Life** 1000 hours (Bulb carries a prorated warranty for 500 hours.
Longer life depends on application.
Expected life is 1000 hours)
- **Power Consumption** 175 Watts or 300 Watts
- **Dimensions** 10.5 in x 9.5 in x 10 in
26.7 cm x 24.1 cm x 25.4 cm
- **Weight** 10.5 lbs
4.8 kg
- **Electrical** 120/240 Volts
50/60 Hertz power line





MECHANICAL DRAWINGS LAMBDA LS



*(There is additional depth when
second filterwheel is attached)*



US PRICES LAMBDA LS

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

LAMBDA LS

Includes a xenon lamp, cold mirror, power supply and lamp housing, support base with mounting rods, drop-in filter holder and manual.

BASIC SYSTEM

■ LB-LS/OF30	Lambda LS with 300 Watt ozone free lamp	\$ 5,550
■ LB-LS/FS30*	Lambda LS with 300 Watt full spectrum lamp	\$ 5,550
■ LB-LS/OF17	Lambda LS with 175 Watt ozone free lamp	\$ 5,300
■ LB-LS/FS17*	Lambda LS with 175 Watt full spectrum lamp	\$ 5,300
■ LB-LS/OF30R¹	Lambda LS with 300 Watt ozone free lamp and cold mirror that reflects to 780 nm	\$ 5,600
■ LB-LS/OF30IR²	Lambda LS with 300 Watt ozone free lamp and cold mirror that reflects to 1100 nm	\$ 5,600
■ LB-LS/FS30UV^{3*}	Lambda LS with 300 Watt full spectrum lamp and cold mirror that reflects to 275 nm	\$ 5,600

**Note: Full spectrum bulbs produce ozone. Please be certain that you have ventilation. Contact Sutter for details.*

¹ Order with LLG/380

² Order with LLG/2000 or LLG/380

³ Order with LLG/250

FILTER WHEELS & SHUTTER

■ LB10-NW1Q/LS	10 position 25 mm filter wheel with SmartShutter®	\$ 3,940
■ LB10-NW**	10 position 25 mm filter wheel (can be mounted inside Lambda LS or outside if used as a second wheel)	\$ 3,110
■ IQ-25/LS	25 mm SmartShutter for mounting in Lambda LS	\$ 1,775

*** Will need to purchase additional controller if using as a second wheel.*



US PRICES LAMBDA LS

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

ACCESSORIES

■ LLG	Liquid light guide and coupling adapter (2 meters, 3 mm dia.), C-mount, lens and lens tube	\$ 1,485
■ LLG/380¹	Liquid light guide and coupling adapter (2 meters, 3 mm dia.), C-mount, lens and lens tube	\$ 1,485
■ LLG/2000²	Liquid light guide and coupling adapter (2 meters, 3 mm dia.), C-mount, lens and lens tube	\$ 1,485
■ LLG/250³	Liquid light guide (2 meters, 3 mm dia.), C-mount, lens and lens tube	\$ 1,485
■ LLGPLUS⁴	Liquid light guide (2 meters, 3 mm dia.), Heatsink, C-mount, lens and lens tube	\$ 1,695
■ LLGPLUS/380⁴	Liquid light guide (2 meters, 3 mm dia.), Heatsink, C-mount, lens and lens tube	\$ 1,695
■ LLGPLUS/2000⁴	Liquid light guide (2 meters, 3 mm dia.), Heatsink, C-mount, lens and lens tube	\$ 1,695
■ DROP-IN	Drop-in filter holder (25 mm)	\$ 82
■ O777655⁵	Replacement 3 mm light guide (300 series)	\$ 650
■ O777651⁶	Replacement 3 mm light guide (380 series)	\$ 650

Mounting adapters for Nikon, Zeiss, Leica and Olympus microscopes are available. Please see the Microscope Adapter list at the end of this section.

¹ Supports transmission into near IR.

² Supports transmission into near IR. No output below 420 nm

³ Supports transmission into near UV.

⁴ Extends the lifetime of the LLG when the Lambda LS is used without a SmartShutter®.

⁵ Maximum UV transmission.

⁶ Allows light input into near IR

BULBS

■ O661176	Ozone free 175 Watt xenon bulb (attenuated output below 340 nm)	\$ 710
■ O661175*	Full spectrum 175 Watt xenon bulb	\$ 710
■ O661301	Ozone free 300 Watt xenon bulb (attenuated output below 340 nm)	\$ 710
■ O661300*	Full spectrum 300 Watt xenon bulb	\$ 710
■ O661115	Housing and heat sink for bulb (bulb will be installed when ordering at same time as housing)	\$ 305

* Full spectrum bulbs produce ozone. Please be certain that you have ventilation. Contact Sutter for details.



LAMBDA XL

EXTENDED LIFE LIGHT SOURCE



FEATURES LAMBDA XL

- | | |
|---|--|
| <ul style="list-style-type: none"> ■ 10,000 hour expected lifetime* ■ No high-voltage pulse ■ Very stable output | <ul style="list-style-type: none"> ■ Built-in driver for filterwheel and SmartShutter® ■ Compact stand-alone design ■ USB interface <p style="text-align: right;"><i>*Bulb carries a prorated 2-year warranty</i></p> |
|---|--|

COMMON APPLICATIONS LAMBDA XL

- | | |
|---|---|
| <ul style="list-style-type: none"> ■ Fluorescent microscopy ■ Calcium imaging ■ FURA | <ul style="list-style-type: none"> ■ Optogenetics ■ High speed wavelength selection |
|---|---|



The Lambda XL is a broad spectrum, highly stable light source (1% peak-to-peak fluctuations). The connection to the microscope is made through a liquid light guide, which assures output uniformity in the field of view. Two light guide options are available, one optimized for the near UV-visible and the other for the visible-near IR regions.

The output at the end of the light guide is similar to that of our popular 300Watt Lambda LS xenon arc light source. The lamp module is expected to last in excess of 10,000 hours and expected to maintain at least 50% of the original intensity.

The compact, stand-alone cabinet design contains the bulb, lamp housing, power supply and optics in a single enclosure. The new design also includes a filter wheel and *SmartShutter*® driver, making it a versatile choice for fluorescence imaging applications. The Sutter filter wheel with *SmartShutter* or the stand-alone *SmartShutter* can be accommodated within the body of the Lambda XL. Filters with an absorbing layer are likely to be damaged by the extraordinary power of the Lambda XL and are not recommended for use with this product.

The light intensity can be adjusted to different levels of attenuation. When the optional filter wheel is used, each filter position can be associated with its own programmable attenuation level, selected every time the filter is called.*

Mounting adapters for Nikon, Olympus, Zeiss and Leica microscopes are available.

**Patent pending*



SPECIFICATIONS LAMBDA XL

- **Output Range** 330nm to 700nm
- **Lamp Expected Life** 10,000 hours
- **Dimensions** 9.4in x 7.6in x 12.6in
23.9cm x 19.3cm x 32cm
- **Electrical** 120/240 Volts
50/60 Hertz power line





US PRICES LAMBDA XL

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

BASIC SYSTEM

■ LB-XL	Includes the Lambda XL light source, power cord, and manual	\$ 6,505
----------------	---	-----------------

ACCESSORIES

■ LLG/XL	Liquid light guide and heat sink (2 meters, 3mm diameter)	\$ 1,645
■ LLG/5XL¹	Liquid light guide and heat sink (2 meters, 5mm diameter)	\$ 1,645
■ LLG/XL380²	Liquid light guide and heat sink (2 meters, 3mm diameter)	\$ 1,645
■ LLG/5XL380²	Liquid light guide and heat sink (2 meters, 5mm diameter)	\$ 1,645
■ IQ25-XL	25mm <i>SmartShutter</i> ® with housing to fit Lambda XL	\$ 1,495
■ LB10-NWIQ/XL	10 position 25mm filter wheel with <i>SmartShutter</i> for mounting in Lambda XL	\$ 3,825
■ LB10-WHS4IQ/XL	4 position 25mm filter wheel with <i>SmartShutter</i> for mounting in Lambda XL	\$ 3,825
■ O800115³	Replacement lamp	\$ 1,645

Mounting adapters for Nikon, Zeiss, Leica and Olympus microscopes are available. Please see the Microscope Adapter list at the end of this section.

¹ *This lightguide offers a larger field of view but less intensity per unit area.*

² *Allows higher output into the near IR.*

³ *Requires installation and realignment at Sutter. Labor included in price of lamp.*



LAMBDA HPX

LIQUID COOLED LED LIGHT SOURCE



FEATURES LAMBDA HPX

- | | |
|---|--|
| ■ Pre-filled liquid cooling | ■ TTL and Analog controls |
| ■ Dimming via PWM or current control | ■ Integral Shuttering |
| ■ Lifetime >50,000 hours | ■ White light and UV combination available |
| ■ Front mounted connectors for ease of access | |

COMMON APPLICATIONS LAMBDA HPX

- | | |
|--------------------------|----------------|
| ■ Fluorescent microscopy | ■ Optogenetics |
|--------------------------|----------------|



The Lambda HPX represents the latest generation of liquid-cooled high-output LED light sources. Designed around a single 90 W 4.25 mm LED die, the Lambda HPX provides light output comparable to a 200 W xenon arc lamp. A quiet, vibration-free liquid cooling head (pre-filled at the factory) allows us to maintain the low junction temperatures required to reach the manufacturer's projected bulb life of 60,000 hours. The HPX is expected to retain 95% of its original output at 5000 hours, and 80% after 10,000 hours. The lightweight precision-machined LED head is designed to mount directly on the epi port of a microscope using an included microscope adapter (specify at time of order). This affords the maximum amount of light coupled directly to the scope, without the losses associated with a liquid light guide.

Because LEDs exhibit color shift with current change, the Lambda HPX was designed to dim the LED using either PWM or current control. PWM will be preferable for most applications, and allows the LED to run cooler. PWM switching is at 28 kHz, high enough for use with most high speed cameras. For those with applications intolerant of pulsed output, dimming via current control is also available. PWM and current information are conveniently displayed on the front panel display, and are manually selectable via control knobs. Integral shuttering time is 10 microseconds to turn on and off.

PWM can also be controlled externally via analog input. TTL input and output allows for triggering from either software or directly from another device such as a camera or digital IO board. The LED cable and cooling lines are easily removable from the chassis with no-drip quick connectors. This allows for easy set up and routing of cables through your setup. Active temperature monitoring insures that the LED life will be maximized.

Light output is in the visible spectrum from 430 nm to 700 nm. A cool white LED is available. Special order units are available with 630 nm, 530 nm, 460 nm, 405 nm, 385 nm, and 365 nm wavelength specific LEDs. The Lambda HPX can also be combined with our FLED to create a two-channel system with any combination of wavelengths.



SPECIFICATIONS LAMBDA HPX

■ Output Range	White light (430 nm to 700 nm)
■ Shuttering	Turn on time: 10 μ s Turn off time: 10 μ s
■ LED Life	>50,000 hours
■ Noise/Short Term Stability	0.02%
■ PWM Frequency	28 kHz
■ Input/Output	TTL & Analog
■ Standard White LEDs	Cool White
■ Optional LEDs	630 nm, 530 nm, 460 nm, and 405 nm
■ Dimming	PWM or Current Control
■ Dimensions	<i>Control Box:</i> 12.25 in x 9 in x 5.25 in 311 mm x 229 mm x 133 mm <i>Head (attaches to scope):</i> 2.5 in x 3 in x 5 in 64 mm x 76 mm x 127 mm <i>Length of cabling between Head and Control Box:</i> 4 ft 1.2 m
■ Weight	12.5 lbs 5.7 kg
■ Electrical	120/240 Volts 50/60 Hertz power line 150 Watts max.



**US PRICES LAMBDA HPX**

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

LAMBDA HPX

Includes the Lambda HPX LED light source, microscope adapter, and cables.

■ HPX-Y¹	Lambda HPX LED light source for Olympus	\$ 6,645
■ HPX-N¹	Lambda HPX LED light source for Nikon	\$ 6,645
■ HPX-Z¹	Lambda HPX LED light source for Zeiss	\$ 6,645
■ HPX-L¹	Lambda HPX LED light source for Leica	\$ 6,645

AVAILABLE WAVELENGTHS

■ WC-HPX	LED, Cool White
■ 460-HPX	LED, 460 nm
■ 530-HPX	LED, 530 nm
■ 630-HPX	LED, 630 nm

LAMBDA HPXUV

Includes the Lambda HPXUV Ultraviolet LED light source, microscope adapter, and cables.

■ HPXUV-Y¹	Lambda HPX UV LED light source for Olympus	\$ 6,855
■ HPXUV-N¹	Lambda HPX UV LED light source for Nikon	\$ 6,855
■ HPXUV-Z¹	Lambda HPX UV LED light source for Zeiss	\$ 6,855
■ HPXUV-L¹	Lambda HPX UV LED light source for Leica	\$ 6,855
■ HPXUV-C¹	Lambda HPX UV LED light source with C-mount	\$ 6,855

AVAILABLE WAVELENGTHS

■ 365-HPX	UV LED, 365 nm
■ 385-HPX	UV LED, 385 nm
■ 405-HPX	UV LED, 405 nm

LAMBDA HPX-DC*

Includes the Lambda HPX LED light source with cool white LED, Lambda FLED with Ultraviolet LED, and cables.

■ HPX-DC-Y	Lambda HPX and FLED for Olympus	\$ 9,645
■ HPX-DC-N	Lambda HPX and FLED for Nikon	\$ 9,645
■ HPX-DC-Z	Lambda HPX and FLED for Zeiss	\$ 9,645
■ HPX-DC-L	Lambda HPX and FLED for Leica	\$ 9,645

** Suitable for additional DAPI channel.*

ACCESSORIES LAMBDA HPX

■ TRIGGER²	USB trigger box	\$ 525
------------------------------	-----------------	---------------

¹ Select one wavelength when ordering.

² Compatible with Micro-Manager software



LAMBDA HPX-L5

HIGH-OUTPUT LED LIGHT SOURCE



FEATURES LAMBDA HPX-L5

- Vibration-free coupling via liquid light guide
- Dimming via PWM or current control
- Lifetime >50,000 hours
- Front mounted connectors for ease of access
- TTL and Analog controls
- Integral Shuttering
- White light and UV combination available

COMMON APPLICATIONS LAMBDA HPX-L5

- Fluorescent microscopy
- Optogenetics



The Lambda HPX-L5 was created as a liquid light guide coupled version of the HPX, our newest high power LED light source. The liquid light guide allows for LED cooling via an internal heatsink with a whisper fan. This requires less maintenance than the liquid-cooled direct mount version. Designed around a single 90 W 3 mm LED die, the Lambda HPX-L5 provides light output comparable to a 150 W Xenon arc lamp when using the same light guide. The Lambda HPX-L5 is optimized for coupling to an optional 5 mm liquid light guide, and off-the-shelf microscope adapter. The HPX-L5 is expected to retain 95% of its original output at 5,000 hours, and 80% after 10,000 hours.

Because LEDs exhibit color shift with current change, the Lambda HPX was designed to dim the LED using either PWM or current control. PWM will be preferable for most applications, and allows the LED to run cooler. PWM switching is at 28 kHz, high enough for use with most high speed cameras. For those with applications intolerant of any pulsed output, dimming via current control is also available. PWM and Current information are conveniently displayed on the front panel display, and are manually selectable via control knobs. Integral shuttering time is 10 microseconds to turn on and off. TTL input and output allows for triggering from either software or directly from another device such as a camera or digital IO board. PWM can also be controlled externally via analog input. Active temperature monitoring insures that the LED life will be maximized.

Light output is in the visible spectrum from 430 nm to 700 nm. Special order units are available with 630 nm, 530 nm, 460 nm, and 405 nm wavelength specific LEDs. The Lambda HPX-L5 can also be combined with our FLED to create a two-channel system with any combination of wavelengths.



SPECIFICATIONS LAMBDA HPX-L5

■ Output Range	White light (430 nm to 700 nm)
■ Shuttering	Turn on time: 10 μ s Turn off time: 10 μ s
■ LED Life	> 50,000 hours
■ Noise/Short Term Stability	0.02%
■ PWM Frequency	28 kHz
■ Input/Output	TTL & Analog
■ Standard White LEDs	Cool White
■ Optional LEDs	405 nm, 460 nm, 530 nm, and 630 nm
■ Dimming	PWM or Current Control
■ Dimensions	<i>Control Box:</i> 12.25 in x 9 in D 5.25 in 311 mm x 229 mm x 133 mm <i>Head (attaches to scope):</i> 2.5 in x 3 in x 5 in 64 mm x 76 mm x 127 mm <i>Length of cabling between Head and Control Box:</i> 4 ft 1.2 m
■ Weight	8.8 lbs 4 kg
■ Electrical	120/240 Volts 50/60 Hertz power line 150 Watts max.



**US PRICES LAMBDA HPX-L5**

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

LAMBDA HPX-L5

Includes the Lambda HPX-L5 LED light source, liquid light guide, and cables (select one wavelength when ordering).

■ HPX-L5¹	Lambda HPX-L5 LED light source	\$ 5,650
AVAILABLE WAVELENGTHS		
■ WC-HPX-L5	LED, Cool White	
■ 460-HPX-L5	LED, 460 nm	
■ 530-HPX-L5	LED, 530 nm	
■ 630-HPX-L5	LED, 630 nm	

LAMBDA HPX-L5UV

Includes the Lambda HPX-L5UV LED light source, and cables. liquid light guide, and cables.

■ HPX-L5UV¹	Lambda HPX-L5UV LED light source	\$ 6,380
AVAILABLE WAVELENGTHS		
■ 405-HPX-L5	LED, 405 nm	

LAMBDA HPX-L5DC* Includes the Lambda HPX-L5 LED light source with cool white LED, Lambda FLED with UV LED, and cables.

■ HPX-L5DC-Y¹	Lambda HPX and FLED for Olympus	\$ 8,655
■ HPX-L5DC-N¹	Lambda HPX and FLED for Nikon	\$ 8,655
■ HPX-L5DC-Z¹	Lambda HPX and FLED for Zeiss	\$ 8,655
■ HPX-L5DC-L¹	Lambda HPX and FLED for Leica	\$ 8,655

** Suitable for additional DAPI channel.*

ACCESSORIES LAMBDA HPX-L5

■ 0777648	Liquid light guide (2 meters, 5 mm diameter)	\$ 650
■ TRIGGER²	USB trigger box	\$ 525

¹ You will need a mounting adapter for your microscope

² Compatible with Micro-Manager software

Mounting adapters for Nikon, Zeis, Leica and Olympus microscopes are available. Please see the Microscope Adapter list at the end of this section.



LAMBDA TLED / TLED+ LED TRANSMITTED LIGHT SOURCE



FEATURES LAMBDA TLED / TLED+

- >50,000 hour lifetime
- <25 μ secs On-Off time
- TTL control (with polarity switch)
- Very stable output
- Compact stand-alone design
- Easy installation

COMMON APPLICATIONS LAMBDA TLED / TLED+

- Transmitted light
- Phase Contrast
- Differential Interface Contrast (DIC)



The Lambda TLED and TLED+ are stand-alone LED light sources that can be used with the transmitted light path of a microscope or in other applications with similar requirements.

This basic system consists of an LED mounted on a special black-anodized aluminum heat sink and a controller. The Lambda TLED and TLED+ controllers are powered by a rugged modular universal power supply. The controllers provide intensity control and on-off control via a toggle switch or TTL logic. The on-off time is $<25 \mu\text{secs}$ when using TTL control. In addition to digital input control, the Lambda TLED+ has analog input to modulate the LED intensity. The Lambda TLED and TLED+ are expected to have stable output that will last in excess of 50,000 hours.

The Lambda TLED and TLED+ can be ordered with a high-output white light LED, making it a suitable light source for contrast methods, including Phase, and Differential Interference Contrast (DIC).

Each Lambda TLED/TLED+ system includes an optical mounting adapter for the microscope and detailed installation instructions. Mounting adapters are designed to fit most models of Nikon, Olympus, Zeiss and Leica microscopes. Custom adapters for the Lambda TLED/TLED+ are available at an additional cost.

The TLED-RL is a ring light illuminator for stereo microscopes with lenses up to 65 mm in outside diameter. The ring light is composed of a circular assembly of many white light LEDs that provides even and direct illumination of the sample.



SPECIFICATIONS LAMBDA TLED / TLED+

- **Output Range** White light (400 nm to 700 nm)
- **LED Life** >50,000 hours
- **Noise/Short Term Stability** 0.01%
- **Control Box Dimensions**

TLED	3 in x 3.5 in x 4.1 in
	7.6 cm x 8.9 cm x 10.2 cm
TLED+	4 in x 3.25 in x 4.1 in
	10.2 cm x 8.3 cm x 10.2 cm
- **Weight** 2.2 lbs
1 kg
- **Electrical** 120/240 Volts
50/60 Hertz power line
75 Watts max



ACCESSORIES LAMBDA TLED / TLED+

- **TRIGGER¹** USB trigger box **\$ 525**

¹ Compatible with Micro-Manager software

**US PRICES LAMBDA TLED / TLED+**

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

TLED

Includes Lambda TLED light source, TLED controller, white light LED, and power supply.

■ TLED-N	Lambda TLED for Nikon	\$ 2,035
■ TLED-N40	Lambda TLED for Nikon E400/E600	\$ 2,035
■ TLED-N50	Lambda TLED for Nikon AZ100	\$ 2,035
■ TLED-N65	Lambda TLED for Nikon FN1	\$ 2,035
■ TLED-Y	Lambda TLED for Olympus	\$ 2,035
■ TLED-Z	Lambda TLED for Zeiss	\$ 2,035
■ TLED-L	Lambda TLED for Leica	\$ 2,035
■ TLED-C	Lambda TLED with C-mount	\$ 2,035

TLED+

Includes Lambda TLED+ light source, TLED+ controller, white light LED, and power supply.

■ TLEDPLUS-N	Lambda TLED+ for Nikon	\$ 2,355
■ TLEDPLUS-N25¹	Lambda TLED+ for Nikon TE200/300, Diaphot 200/300	\$ 2,355
■ TLEDPLUS-Y	Lambda TLED+ for Olympus	\$ 2,355
■ TLEDPLUS-Z	Lambda TLED+ for Zeiss	\$ 2,355
■ TLEDPLUS-L	Lambda TLED+ for Leica	\$ 2,355
■ TLEDPLUS-C	Lambda TLED+ with C-mount	\$ 2,355

TLED-RGB

Includes Lambda TLED-RGB light source, TLED controller and power supply.

■ TLED-RGB-N	Lambda TLED-RGB for Nikon	\$ 2,250
■ TLED-RGB-Y	Lambda TLED-RGB for Olympus	\$ 2,250

TLED-RL

Includes Lambda TLED-RL light source, TLED controller and ring light.

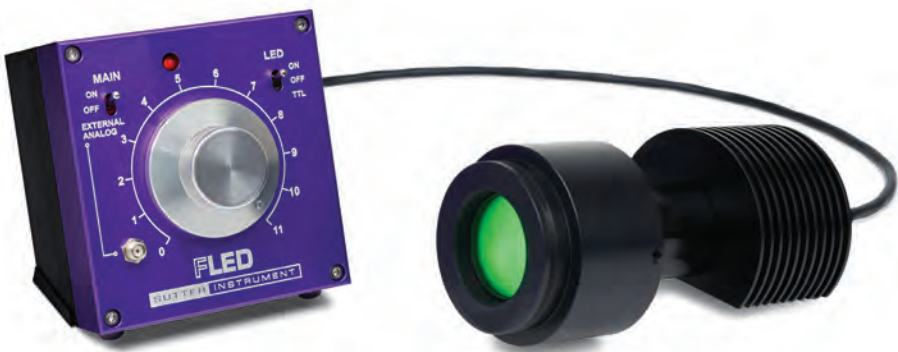
■ TLED-RL	Lambda TLED-RL reflected light illuminator	\$ 1,615
------------------	--	-----------------

** Custom mounting adapters are available for all models at an additional cost. Contact Sutter for details.*

¹ Replaces the epi-illuminator.



LAMBDA FLED FLUORESCENT LIGHT SOURCE



FEATURES LAMBDA FLED

- | | |
|--------------------------------------|------------------------------|
| ■ >50,000 hour lifetime | ■ Very stable output |
| ■ <25 µsecs On-Off time | ■ Compact stand-alone design |
| ■ TTL control (with polarity switch) | ■ Easy installation |

COMMON APPLICATIONS LAMBDA FLED

- | | |
|--------------------------|---|
| ■ Fluorescent microscopy | ■ Ultra high speed wavelength selection (FLED-DC) |
|--------------------------|---|

The Lambda FLED was designed as a high-power LED driver for fluorescence microscopy. Based on our proven TLED+ design, the FLED has been optimized for single-channel, high-current LEDs used as excitation light sources.

The basic system consists of an LED mounted on a special black-anodized aluminum heat sink and a controller. The controller is CNC machined from solid aluminum billet, and powered by a rugged modular universal power supply. The FLED provides intensity control and on-off control via a toggle switch or TTL logic. The on-off time is less than 25 μ secs when using TTL control. In addition to digital input control, the Lambda FLED has an analog input to modulate the LED intensity. The Lambda FLED is expected to have stable output that will last more than 50,000 hours.

The Lambda FLED can be ordered with several different wavelength-specific LEDs that range from 365 nm to 940 nm. Please call us if you require a wavelength is not listed.

Our dual channel Lambda FLED option combines two high power LEDs into a single light path. The FLED-DC allows the use of two channels for fluorescence imaging. Both channels are driven by individual FLED controllers and can be triggered, also individually, by a TTL signal. For greater than two LEDs in a setup, please see our Lambda 421 or Lambda OBC.

Product	Wavelength options (nm)*	External Control
FLED	340, 365, 385, 410, 440, 460, 480, 506, 530, 561, 590, 630, 660, 740, 850, 940	Digital (BNC) / Analog (SMA)

* other wavelengths available upon request

Each Lambda FLED system includes an optical mounting adapter for the excitation port of the microscope and detailed installation instructions. Mounting adapters are designed to fit most models of Nikon, Olympus, Zeiss and Leica microscopes. Custom adapters are available at an additional cost.



SPECIFICATIONS LAMBDA FLED

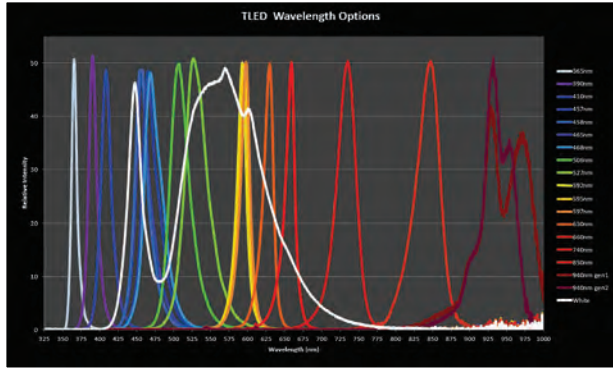
- **Output Range** White light (400 nm to 700 nm)
- **LED Life** >50,000 hours
- **Noise/Short Term Stability** 0.01%
- **Control Box Dimensions** FLED 4 in x 3.25 in x 4.1 in
10.2 cm x 8.3 cm x 10.2 cm
- **Weight** 2.2 lbs
1 kg
- **Electrical** 120/240 Volts
50/60 Hertz power line
75 Watts max



ACCESSORIES LAMBDA FLED

- **TRIGGER¹** USB trigger box **\$ 525**

¹ Compatible with Micro-Manager software



**US PRICES LAMBDA FLED**

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

LAMBDA FLED**Single Channel LED Light Source**

Includes Lambda FLED light source, FLED controller and power supply. Please select one wavelength when ordering.

■ FLED-N	Lambda FLED for Nikon	\$ 2,860
■ FLED-N25¹	Lambda FLED for Nikon TE200/E300, Diaphot 200/300	\$ 2,860
■ FLED-N50	Lambda FLED for Nikon AZ100	\$ 2,860
■ FLED-Y	Lambda FLED for Olympus	\$ 2,860
■ FLED-Z	Lambda FLED for Zeiss	\$ 2,860
■ FLED-L	Lambda FLED for Leica	\$ 2,860
■ FLED-C²	Lambda FLED with C-mount	\$ 2,860

AVAILABLE WAVELENGTHS* (in nm)

340, 365, 385, 410, 440, 460, 480, 506,
530, 561, 590, 630, 660, 740, 850, 940

LAMBDA FLED-DC**Dual Channel LED Light Source**

Includes Lambda FLED light source, 2 FLED controllers, and power supplies. Please select two wavelengths of your choice.

■ FLED-DC-N	Dual Channel Lambda FLED and 2 controllers for Nikon	\$ 5,825
■ FLED-DC-Y	Dual Channel Lambda FLED and 2 controllers for Olympus	\$ 5,825
■ FLED-DC-Z	Dual Channel Lambda FLED and 2 controllers for Zeiss	\$ 5,825
■ FLED-DC-L	Dual Channel Lambda FLED and 2 controllers for Leica	\$ 5,825
■ FLED-DC-C	Dual Channel Lambda FLED and 2 controllers with C-mount	\$ 5,825

AVAILABLE WAVELENGTH COMBINATIONS* (in nm)

340, 365, 385, 410, 440, 460, 480, 506,
530, 561, 590, 630 660, 740, 850, 940, White

** Other wavelengths and wavelength combinations may be available.
Custom mounting adapters available on all models at an additional cost. Contact Sutter for further details.*

¹ Replaces the epi-illuminator.

² Suitable for SOM microscope.



LAMBDA DG-4 / DG-5 PLUS

HIGH SPEED WAVELENGTH SWITCHER



FEATURES

LAMBDA DG-4 / DG-5 PLUS

- USB support
- Built-in *SmartShutter*® control
- Expanded menu options and enhanced triggering
- Complete system for wavelength switching
- Integral shuttering
- Integral neutral density filtering
- Two outputs for monitoring filter position
- Turbo blanking
- Strobe-pulsed ring buffer control
- Direct computer control via parallel, serial or USB interface
- Switches in 0.5 msec



The Lambda DG-4/DG-5 PLUS is a complete illumination system offering speed and versatility for experiments requiring rapid wavelength switching. New digital servo technology allows faster filter switching and 30% greater light output than the first generation DG-4/DG-5. The instrument retains all the advantages of interference filter based systems, yet eliminates the temporal constraints imposed by traditional filter changing devices like filter wheels. Switching between any two wavelengths is achieved in 0.5 msec, allowing the user to perform real-time video imaging. The high switching speed of the Lambda DG-4/DG-5 PLUS facilitates the ability to follow fast changes in ion concentrations in dual wavelength ratio imaging applications and to monitor other concomitant changes in the studied system at additional wavelengths.

Narrow bandpass systems, such as single cavity interference filters, grating monochromators, and A.O. modulators, pass unwanted harmonics of the desired wavelength. Also, with variable wavelength devices, it is not always possible to obtain sufficient blocking of out-of-band wavelengths. Modern interference filters, as used in the Lambda DG-4/DG-5 PLUS, do not pass harmonics and have integral blocking characteristics 1000 times better than typical monochromator systems. For the same full width at half maximum (FWHM), interference filters have a narrower spectral bandpass than monochromators due to the absence of the slit function.

The dual galvanometer design of the Lambda DG-4/DG-5 PLUS allows tuning of the relative intensities at each wavelength. This adjustment is difficult to obtain in variable wavelength devices with a single optical path. Unlike monochromators and other wavelength selective systems, the Lambda DG-4/DG-5 PLUS can be used as a source of white light when required.

How it works:

This unique optical design of the Lambda DG-4/DG-5 PLUS is based on dual scanning galvanometers utilizing interference filters for wavelength selection. The light from the xenon arc lamp is focused on the first galvanometer mirror which directs it via a parabolic mirror, through one of the interference filter channels. Following the filter, a second parabolic and a second galvanometer mirror collect and redirect the light into the light guide. A cold mirror in the beginning of the light path eliminates the IR radiation, reducing significantly the amount of heat absorbed by the optics and the sample. Cold mirrors modified to pass near-IR to 780 to 880 nm are also available.

A built-in shutter function allows reduction of light intensity by five to six orders of magnitude. For applications requiring mechanical shuttering, like time lapse experiments or very sensitive samples, an optional *SmartShutter*® can be installed in the device to assure that the light is completely blocked. A newly integrated *SmartShutter* controller eliminates the need to purchase a separate control device.

The standard system, the Lambda DG-4 PLUS, holds up to four 25 mm interference filters. The Lambda DG-5 PLUS, a five filter version, accommodates three 18 mm and two 25 mm filters. While the switching time between any two wavelengths is done in less than 0.5 msec, the dwell time at any wavelength is arbitrarily set by the user.

The liquid light guide can be coupled to the illumination port of most microscopes using an adapter which can be purchased separately. Please refer to the "Microscope Adapters" section for further information. Extended output ranges are possible with various cold mirror and light guide combinations. Phone Sutter to discuss your specific application requirements.



COMMON APPLICATIONS LAMBDA DG-4 / DG-5 PLUS

- Fluorescent microscopy
- Optogenetics
- Calcium imaging
- Ultra high speed wavelength selection
- FURA

SPECIFICATIONS LAMBDA DG-4 / DG-5 PLUS

- **Lamp Type** 300 Watt ozone free or full spectrum xenon arc bulb (pre-aligned to produce collimated output)
- **Output Range** 330 nm to 650 nm – Ozone free
200 nm to 650 nm – Full spectrum
(Note: full spectrum produces ozone)
- **Lamp Life** 1000 hours (Bulb carries a prorated warranty for 500 hours. Longer life depends on application. Expected life is 1000 hours)
- **Power Consumption** 350 Watts
- **Filter Diameter** DG-4 PLUS: Four, 25 mm (1 in)
DG-5 PLUS: Two, 25 mm (1 in) and Three 18mm
- **Dimensions** 10 in x 10 in x 19 in
25 cm x 25 cm x 48 cm
- **Light Guide** 2 meters long
3 mm diameter
- **Weight** 45 lbs
20 kg
- **Electrical** 115/230 Volts
50/60 Hertz power line





FEATURES

LAMBDA DG-4 / DG-5 PLUS

■ COMPLETE SYSTEM FOR WAVELENGTH SWITCHING

The Lambda DG-4 / DG-5 PLUS is a complete integrated 175 (or 300) Watt light source and wavelength switching excitation system.

Four or five interference filters can be easily installed in the DG-4 PLUS or DG-5 PLUS, respectively. An additional standard neutral density filter can be inserted in the common path of the light.

The light guide output from the Lambda DG-4 / DG-5 PLUS provides uniform spatial illumination, as well as vibration isolation from your microscope.

A cold mirror assembly eliminates IR radiation, extending the lifetime of the optics and the light guide, and preventing the exposure of the sample to IR when white light is necessary.

■ INTEGRAL SHUTTERING

The Lambda DG-4 / DG-5 PLUS provides a high speed shutter function with open/close times of 500 μ s. The shutter function reduces light intensity by 5 to 6 orders of magnitude.

If complete light shuttering is required, a mechanical shutter (i.e. *SmartShutter*®) can be incorporated into the Lambda DG-4 / DG-5 PLUS.

■ INTEGRAL NEUTRAL DENSITY FILTERING

Neutral density filtering is achieved by offsetting the output galvanometer such that the light is not centered on the liquid light guide. Up to 15 logical filters can be defined with this method. Due to the scrambling effect of the light guide, the output has excellent uniformity.

Direct insertion of neutral density optical filters is also possible in the filter holders at any of the four optical channels. A final neutral density optical filter can be placed in the exiting light path which will reduce the light output from all optical channels.

■ TWO OUTPUTS FOR MONITORING FILTER POSITION

A 4 bit TTL signal transmits the current optical channel (filter) position.

A digital-to-analog converter (DAC) output produces a voltage showing which filter is in use.

■ TURBO BLANKING

The turbo blanking feature is designed for situations when the switching is done between non-adjacent filter positions. When the instrument is in this mode, the input and output galvanometer mirrors move out of sync, thus preventing the sample from being exposed to light of unwanted wavelength during switching and shuttering.



METHODS OF CONTROL LAMBDA DG-4 / DG-5 PLUS

■ DIRECT COMPUTER CONTROL VIA USB, PARALLEL OR SERIAL INTERFACE

When operated in these modes, the Lambda DG-4 / DG-5 PLUS control commands are a subset of our Lambda 10-2 controller and will operate with software written for the Lambda 10-2.

If you plan to control the device with other interfaces, please contact Sutter for specific issues.

■ STROBE-PULSED RING BUFFER CONTROL

A sequence of up to 32 filter values can be loaded into a ring buffer via keypad or computer. The system will switch to the next filter in the buffer on a TTL level (trigger) strobe pulse. After executing the last filter change in the string, the system resets to the first filter and continues.



(View of back panel)

APPLICATIONS

- Fluorescence microscopy
- Ratio imaging
- Fura 2
- Optogenetics
- Mosaic® / PAGFP
- Mosaic Channel Rhodopsin



US PRICES LAMBDA DG-4 / DG-5 PLUS

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

DG-4 / DG-5 PLUS BASIC SYSTEM WITH IMPROVED GALVOS

Includes main unit with 300 W pre-aligned xenon arc bulb, 4 slide-in filter holders (25 mm), 1 neutral density filter holder (25 mm), power cord, serial and parallel cables, liquid light guide, spanner wrench, and manual. (DG-5 PLUS includes an additional 18 mm filter holder and flat wrench. Three positions are 18 mm, and two are 25 mm in diameter).

■ DG-4PLUS/OF30	DG-4 PLUS with 300 Watt ozone-free bulb	\$ 22,840
■ DG-4PLUS/FS30*	DG-4 PLUS with 300 Watt full spectrum bulb	\$ 22,840
■ DG-5PLUS/OF30	DG-5 PLUS with 300 Watt ozone-free bulb	\$ 22,840
■ DG-5PLUS/FS30*	DG-5 PLUS with 300 Watt full spectrum bulb	\$ 22,840

SPECIALTY DG-4

■ DG-4/T¹	DG-4 PLUS with tungsten bulb	\$ 24,735
-----------------------------	------------------------------	------------------

¹ Power supply is supplied by the customer.

*Note: Full spectrum bulbs produce ozone. Please be certain that you have ventilation. Contact Sutter for details.

ACCESSORIES LAMBDA DG-4 / DG-5 PLUS

■ O661176¹	Ozone free 175 Watt xenon bulb (useful wavelength range 330 nm – 700 nm)	\$ 710
■ O661301	Ozone free 300 Watt xenon bulb (useful wavelength range 330 nm – 700 nm)	\$ 710
■ O661175¹	Full spectrum 175 Watt xenon bulb (useful wavelength range 300 nm – 700 nm)	\$ 710
■ O661300	Full spectrum 300 Watt xenon bulb (useful wavelength range 300nm – 700 nm)	\$ 710
■ O661115	Housing and heat sinks for bulb (bulb will be installed when ordered at the same time as housing)	\$ 305
■ IQ25-DG	25 mm SmartShutter® to fit Lambda DG-4 / DG-5 (requires controller)	\$ 1,645
■ DG-IF	Interference filter holder (25 mm)	\$ 102
■ DG-IF/18	Interference filter holder (18 mm)	\$ 102
■ DG-ND	Neutral density filter holder	\$ 102
■ X100160	Retaining ring (25 mm)	\$ 19
■ X100150	Filter spacer (25 mm)	\$ 19
■ X100120	Interference filter cup (25 mm)	\$ 26
■ X664162	Neutral density filter cup (25 mm)	\$ 38
■ X100158	Retaining ring (18 mm)	\$ 22
■ X100148	Filter spacer (18 mm)	\$ 22
■ X100118	Interference filter cup (18 mm)	\$ 53
■ CMAC	Serial cable for Mac	\$ 107
■ X664176	18 mm brass spanner key	\$ 60
■ X100560	25 mm spanner wrench	\$ 107

¹ 175 W bulbs are for the earlier model DG-4/DG-5.

Mounting adapters for Nikon, Zeiss, Olympus and Leica microscopes are available. Please see the Microscope Adapter list at the end of this section.



LAMBDA VF-5™ / VF-1™ / VF-10

TUNABLE FILTER CHANGERS



(Shown: Lambda VF-5)

FEATURES LAMBDA VF-5 / VF-1 / VF-10

- | | |
|--|--|
| <ul style="list-style-type: none"> ■ Supported by the Lambda 10-3 (with special programming) ■ Patented white light output capability ■ Wavelength range as wide as 338 nm to 900 nm ■ Access any center-wavelength in nanometer increments ■ Images pass through filters making it suitable for both excitation and emission | <ul style="list-style-type: none"> ■ Easily switch between fluorephore combinations ■ Optional liquid light guide offers absolute vibration isolation ■ All the advantages of thin-film technology – high transmission, steep spectral edges, high out-of-band blocking ■ Polarization independence (s and p nearly identical) |
|--|--|



Sutter Instrument has developed several filter changers specially designed for wavelength selection over a wide spectral range to any given nanometer value. The Lambda VF-5™, Lambda VF-10, and Lambda VF-1™, employ the innovative VersaChrome® and VersaChrome Edge™ thin-film filter technology from Semrock® to provide outstanding bandpass characteristics such as high transmission (close to 100%), steep edges and out-of-band blocking. Since these filters pass an image, they are equally suitable for emission and excitation paths.

How It Works

A specific wavelength within the wide spectral range of each filter is obtained by adjusting the angle of incidence from 0 to 60 degrees. This tuning causes little or no change in spectral performance of the filter regardless of the state of polarization of the light passing through the filter. The current VersaChrome series has 7 filters covering 338 nm to 900 nm. By simply selecting the desired center-wavelength on the controller, users can select any combination of filters for the Lambda VF-5 (which holds up to 5 filters), any single filter in the series for the Lambda VF-1 or any one of 10 filters in the VF-10 that uses smaller filters suitable for laser applications.

The controller for these new tunable filter changers is a special version of our Lambda 10-B. Users can select the desired center wavelength in 1nm increments from the keypad, or via the serial or USB ports. This allows control of the Lambda VF instruments with minimal changes to existing software supporting the popular Lambda 10-B controller. A sequence of wavelengths can be stored in the controller and the TTL input can then be used to trigger selection of the wavelengths in the sequence step-to-step. The firmware includes filter-specific data for each of the VersaChrome filters in the series.

The Lambda VF-5

Along with the ability to select any wavelength in the range covered by any combination of 5 VersaChrome filters, the Lambda VF-5 has a patented white-light output mode that allows the user to access the full spectral output of the excitation light source when it is required. White-light output is achieved by capturing the rejected light from the VersaChrome filter at a 45 degree angle and then combining the two beams on the output side of the VF-5. If this configuration is desired, it requires an additional custom light guide and SmartShutter® system.

When using the Lambda VF-5 for emission applications, we suggest installation of the 5 filters with the longer center-wavelengths covering from 430 nm to 800 nm. For excitation applications, we suggest installing the 5 filters with the shortest wavelengths covering 338 nm to 620 nm. For special applications, any combination of 5 filters could be installed in the Lambda VF-5. The compact Lambda VF-1 accepts any single filter in the series. The single VersaChrome filter installed in the Lambda VF-1 can be changed as needed.



The Lambda VF-1

The Lambda VF-1™ accepts any single filter in the series, which can be exchanged with other filters as needed. This model offers faster switching times as well as a more compact and affordable system. When used with the Lambda VF-1, the controller is able to also control a separate filter wheel or *SmartShutter*®.

The Lambda VF-10

The Lambda VF-10 was originally purpose-built for use with white light supercontinuum lasers. The special size Versachrome filters are 8 mm x 16 mm; therefore they are ideally sized for use with a laser beam. The VF-10 also includes an uncoated glass substrate, identical to the Versachrome filters, which is mounted to an additional stepper motor near the output port of the instrument. This uncoated “filter” changes angle simultaneously with the Versachrome filter and compensates for the laser beam displacement that takes place natively when the filter changes angle for wavelength selection.

APPLICATIONS

- Hyperspectral imaging
- Fluorescence imaging
- Ratiometric imaging

* Patent # 8,733,978, B2

VersaChrome® and VersaChrome Edge® are registered trademarks of Semrock®, an IDEX company



COMMON APPLICATIONS LAMBDA VF-5 / VF-1 / VF-10

- Fluorescent microscopy
- Calcium imaging
- FURA
- Optogenetics
- Hyperspectral imaging wavelength selection

SPECIFICATIONS LAMBDA VF-5 / VF-1 / VF-10

- **Lambda VF-1™**
2.8 in x 2.8 in x 4.4 in
7 cm x 7 cm x 11 cm
3.3 lbs
1.5 kg
- **Lambda VF-5™**
9.4 in x 6 in x 5 in
23.8 cm x 15.2 cm x 12.7 cm
11.7 lbs
5.3 kg
- **Lambda VF-10**
7.2 in x 5 in x 4 in
18.3 cm x 12.7 cm x 10.2 cm
7.3 lbs
3.3 kg
- **Controller**
8.2 in x 5.9 in x 5.1 in
14.9 cm x 20.8 cm x 13 cm
2.6 lbs
1.1 kg
- **Electrical**
120/240 Volts
50/60 Hertz power line
75 Watts max



(Shown: Lambda VF-1)



US PRICES LAMBDA VF-5 / VF-1 / VF-10

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

BASIC SYSTEM

■ VF-1¹	Includes the Lambda VF-1™, a single VersaChrome® filter, Lambda 10-B control unit, serial and USB cables, power cable and manual	\$ 5,100
■ VF-5¹	Includes the Lambda VF-5™, five VersaChrome® filters, Lambda 10-B control unit, serial and USB cables, power cable and manual	\$ 14,465
■ VF-10¹	Lambda VF-10, eight special VersaChrome® filters, Lambda 10-3 control unit, beam shift compensator, serial and USB cables, power cable and manual	\$ 16,740

VERSACHROME® FILTERS² – ORIGINAL SERIES

■ CO-0573380	Tunable filter, 380–338 nm with 16 nm bandwidth	\$ 1,275
■ CO-0573440	Tunable filter, 440–388 nm with 16 nm bandwidth	\$ 1,275
■ CO-0573490	Tunable filter, 490–429 nm with 15 nm bandwidth	\$ 1,275
■ CO-0573550	Tunable filter, 550–487 nm with 15 nm bandwidth	\$ 1,275
■ CO-0573620	Tunable filter, 620–547 nm with 14 nm bandwidth	\$ 1,275
■ CO-0573700	Tunable filter, 700–615 nm with 13 nm bandwidth	\$ 1,275
■ CO-0573800	Tunable filter, 800–699 nm with 12 nm bandwidth	\$ 1,275

VERSACHROME® FILTERS² – EXTENDED OVERLAP SERIES

■ CO-0573400	Tunable filter, 402–357 nm with 16 nm bandwidth	\$ 1,275
■ CO-0573449	Tunable filter, 451–398 nm with 15 nm bandwidth	\$ 1,275
■ CO-0573501	Tunable filter, 503–446 nm with 15 nm bandwidth	\$ 1,275
■ CO-0573561	Tunable filter, 564–498 nm with 14 nm bandwidth	\$ 1,275
■ CO-0573628	Tunable filter, 632–557 nm with 14 nm bandwidth	\$ 1,275
■ CO-0573784	Tunable filter, 708–623 nm with 13 nm bandwidth	\$ 1,275
■ CO-0573790	Tunable filter, 794–696 nm with 12 nm bandwidth	\$ 1,275
■ CO-0573900	Tunable filter, 900–787 nm with 11 nm bandwidth	\$ 1,275

¹ Please select filter(s) when ordering.

² The ranges described above are the designed performance values for the VersaChrome coatings. The Semrock® catalog tuning ranges will be narrower due to different criteria.

VersaChrome® is a registered trademark of Semrock®



US PRICES LAMBDA VF-5 / VF-1 / VF-10

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

VERSACHROME® FILTERS - 8 X 16mm

■ CO-0574400	Tunable filter, 402–357 nm with 16 nm bandwidth	\$ 1,275
■ CO-0574449	Tunable filter, 451–398 nm with 15 nm bandwidth	\$ 1,275
■ CO-0574501	Tunable filter, 503–446 nm with 15 nm bandwidth	\$ 1,275
■ CO-0574561	Tunable filter, 564–498 nm with 14 nm bandwidth	\$ 1,275
■ CO-0574628	Tunable filter, 632–557 nm with 14 nm bandwidth	\$ 1,275
■ CO-0574704	Tunable filter, 703–627 nm with 13 nm bandwidth	\$ 1,275
■ CO-0574790	Tunable filter, 794–696 nm with 12 nm bandwidth	\$ 1,275
■ CO-0574900	Tunable filter, 900–787 nm with 11 nm bandwidth	\$ 1,275

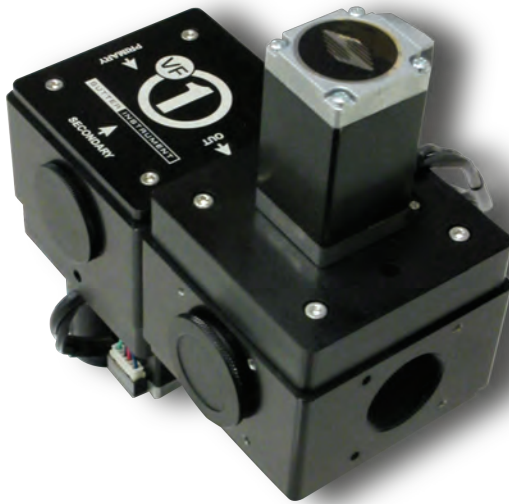
ACCESSORIES

■ O629950	Male-to-male C-mount adapter for mounting SmartShutter® to Lambda VF-5 / VF-1	\$ 70
■ VF5-WL	Lambda VF-5™ white light kit	\$ 1,905
■ VF5-EMMSN-ADP	Emission adapter	\$ 4,220



LAMBDA VF-1 Edge™

TUNABLE FILTER CHANGERS



FEATURES LAMBDA VF-1 EDGE™

- Separate tunable high-pass and low-pass filters let user define the bandpass in nanometer steps
- User selectable band-width and center wavelength
- Blocking filter ensures best blocking outside bandpass
- Based on Semrock® VersaChrome® Edge technology

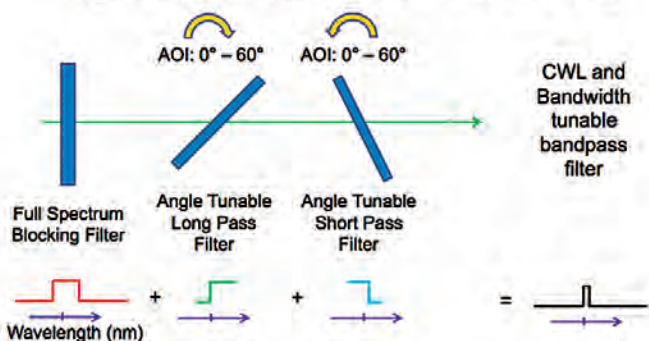
To take advantage of the new VersaChrome® Edge filters, Sutter has introduced the Lambda VF-1 Edge system that allows user selection of both the long and short end of the bandpass in nanometer steps. This new device incorporates two of our VF-1™ filter tilting modules and a Sutter Lambda 10-B controller to give direct control over the bandpass via the unit's keypad or through external control from a computer or other device. Individual VF-1 modules can also be used with the VersaChrome Edge filters to provide tunable high-pass or short pass filtering.

The filter sets available for the VF-1 Edge cover the wavelengths from <400 nm to more than 1100 nm. Within this range you can select the half-power point for the high-pass and low-pass filters to any value in steps of 1 nm. If the low pass wavelength is set higher than the high pass wavelength the transmission will be blocked, acting as a shutter. In the case of this filter set there are more than 5,000 combinations of filter settings available.

VersaChrome® Edge Tunable Filters

- **Create any single-band filter**

- Any Center Wavelength (CWL: 425 to 1050 nm)
- Any Full Width Half Maximum (FWHM: 1 nm to 12% of CWL)



Creating Your Own Bandpass Filter, Craig Hodgson, Ph.D. and Cicely Rathmell, M.Sc., <http://www.semrock.com/Data/Sites/1/semrockpdfs/smk-versachrome-wp.pdf>



COMMON APPLICATIONS LAMBDA VF-1 EDGE™

- Fluorescent microscopy
- Calcium imaging
- FURA
- Optogenetics
- Hyperspectral imaging wavelength selection

SPECIFICATIONS LAMBDA VF-1 EDGE™

- **Lambda VF-1™ Edge**
Dimensions:
5.6 in x 2.8 in x 4.4 in
14 cm x 7 cm x 11 cm
Weight:
6.6 lbs
3 kg
- **Controller**
Dimensions:
8.2 in x 5.9 in x 5.1 in
14.9 cm x 20.8 cm x 13 cm
Weight:
2.6 lbs
1.1 kg
- **Electrical**
120/240 Volts
50/60 Hertz power line
75 Watts max





US PRICES LAMBDA VF-1 EDGE™

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

BASIC SYSTEM

■ VF-1 EDGE¹	Includes the Lambda VF-1 Edge™, longpass and shortpass VersaChrome Edge® filter, Lambda 10-B control unit, serial and USB cables, power cable and manual	\$ 9,865
--------------------------------	--	-----------------

VERSACHROME® EDGE FILTERS¹

■ CO-0575448-L	Edge Tunable longpass filter, 453–394 nm	\$ 1,275
■ CO-0575448-S	Edge Tunable shortpass filter, 453–397 nm	\$ 1,275
■ CO-0575501-L	Edge Tunable longpass filter, 508–441 nm	\$ 1,275
■ CO-0575501-S	Edge Tunable shortpass filter, 507–445 nm	\$ 1,275
■ CO-0575561-L	Edge Tunable longpass filter, 568–449 nm	\$ 1,275
■ CO-0575561-S	Edge Tunable shortpass filter, 568–448 nm	\$ 1,275
■ CO-0575628-L	Edge Tunable longpass filter, 636–552 nm	\$ 1,275
■ CO-0575628-S	Edge Tunable shortpass filter, 635–557 nm	\$ 1,275
■ CO-0575704-L	Edge Tunable longpass filter, 713–619 nm	\$ 1,275
■ CO-0575704-S	Edge Tunable shortpass filter, 712–623 nm	\$ 1,275
■ CO-0575790-L	Edge Tunable longpass filter, 799–692 nm	\$ 1,275
■ CO-0575790-S	Edge Tunable shortpass filter, 800–699 nm	\$ 1,275
■ CO-0575887-L	Edge Tunable longpass filter, 898–778 nm	\$ 1,275
■ CO-0575887-S	Edge Tunable shortpass filter, 898–784 nm	\$ 1,275
■ CO-0575995-L	Edge Tunable longpass filter, 1007–872 nm	\$ 1,275
■ CO-0575995-S	Edge Tunable shortpass filter, 1007–881 nm	\$ 1,275
■ CO-05751116-L	Edge Tunable longpass filter, 1130–979 nm	\$ 1,275
■ CO-05751116-S	Edge Tunable shortpass filter, 1129–988 nm	\$ 1,275

¹ Please select 2 – one for Longpass (low cut) and the other for Shortpass (high cut) filtering.



LAMBDA 10-3

OPTICAL FILTER CHANGER



FEATURES LAMBDA 10-3

- As fast as 40 msec between adjacent filters (10 position wheel)
- As fast as 30 msec between adjacent filters (4 position wheel)
- As fast as 28 msec with a fully loaded wheel using STR filter from Semrock
- Can control three wheels and two shutters, or two wheels and three shutters
- Can accommodate *SmartShutter*® and Uniblitz® shutter
- 7 speed settings to optimize movement
- Command set compatible with Lambda 10-2
- Automatically detects installed hardware
- Serial, parallel and USB interfaces
- Can control a variety of 25 mm, 32 mm and 50 mm wheels
- Chopper drives
- Universal power supply

COMMON APPLICATIONS LAMBDA 10-3

- Fluorescent microscopy
- Calcium imaging
- FURA
- Optogenetics
- High speed wavelength selection



The Lambda 10-3 is the latest generation of Sutter's high performance filter wheel changers. The controller now offers faster switching times, synchronous independent control of 3 filter wheels and 2 shutters (or 2 filter wheels and 3 shutters), and expanded communication interface options. Recent advances in motor technology allow the Lambda 10-3 to achieve switching times of 40 msec between adjacent filters. In addition, the controller commands can now be accessed via USB, serial, parallel, and keypad interfaces.

The Lambda 10-3 controls a variety of standard Sutter filter wheels including the popular 10 position 25 mm wheel, a lighter 4 position 25 mm wheel, a 10 position 32 mm wheel, 5 position 50 mm wheel, and a compact belt-drive 4 position wheel. The embedded controllers automatically detect the equipment installed and the source of the external commands, so there are no jumper wires or switches to set. There are seven speed settings available to optimize the rate of movement in accordance with the load of the wheel. The Lambda 10-3 can operate up to 40 msec switching time with the traditional 25 mm filter wheel as well as our newer, high-speed 32 mm version. The 4 position wheel (LB10-NWHS4) provides additional speed and can achieve switching times of less than 33 msec. Nearly all of our filter wheels employ a direct drive system. This design eliminates problems with belt slippage and backlash, assuring that our wheels are exceptionally robust.

Each wheel will accommodate filters from 1 mm to 9 mm in thickness, allowing multiple filters to be used in each position. For instance, this allows users to insert a neutral density filter along with an interference filter in a single position. We have designed the body of the filter wheel with a trap to eliminate light scatter. For added stability, non-emission filter wheels come with a sturdy support stand and 12 inch rods. In addition to filter wheels, the Lambda 10-3 controller supports our patented stepper-motor controlled *SmartShutter*® as well as the Uniblitz® shutter. Either shutter can be mounted directly onto the wheel, providing a compact wheel/shutter package for systems with mounting constraints.

Both shuttered and non-shuttered filter wheels can be installed directly on the microscope in a number of locations: excitation, emission, Infinity path, and the trinocular head. Up to two excitation and/or neutral density filter wheels can be used with the Lambda LS xenon light source and liquid light guide, in vibration sensitive systems. The *SmartShutter* can be mounted independently from the wheel in any location in the light path (including the Lambda LS and Lambda DG-4/DG-5), and driven in a stand-alone configuration by the Lambda 10-3 controller. The microscope specific adapters necessary for any configuration of wheels and shutter are listed in the Microscope Adapters section of the catalog.



The Lambda 10-3 commands are a superset of the Lambda 10-2, thus integrating all previously available features into the new design. Additional commands are incorporated to access the third wheel as well as the special *SmartShutter*® features. These configurations can be programmed through the keypad making it easy to use the previous shutter commands to access the *SmartShutter* specific functions such as the neutral density or the 'soft' shutter mode.

Filter selection can be made directly from the keypad or from a computer via the serial, parallel, or USB port. The controller determines the shortest route to the selected filter and an acceleration/deceleration algorithm minimizes vibrations during the movement of the wheel. Internal sensors ensure correct filter positioning and current filter position is displayed on the front panel. The serial port accepts RS-232 level signals through a DB-9 connector. USB input is made through a standard connector and can be directly connected to a PC USB port.

The universal power supply will automatically switch to accommodate the line voltage – no user adjustment is required. An optional liquid light guide is available for applications requiring absolute vibration isolation, and/or spatial illumination uniformity.

GETTING FASTER FILTER SWITCHING TIMES WITH MANY FILTERS INSTALLED

The Sutter filter wheel systems have always been optimized for fast switching of a lightly loaded wheel. When many thick filters are installed, the added mass requires an increase in the time required to switch from one filter to another. Switching times improve significantly with filters made on a thin substrate that do not require a thick layer of additional glass to obtain the desired blocking. Semrock® has the required coating technology to offer filters with substrates down to 2 mm in thickness.

We have now taken the additional step of designing a special threaded ring that Semrock can install in place of their typical plain filter cells. Filters mounted in these rings can be threaded directly into the body of our filter wheels when our standard filter cups have been removed. Semrock filters actually weigh less than the filter cup and retaining ring normally used to mount filters in the Sutter wheels. Thus, if you remove our filter cups and mount the new threaded filters directly in the wheel, even a fully loaded wheel will be able to run at speeds that previously could only be used with just 2 filters installed.

The STR Semrock filters are available in both 25 mm and 32 mm versions and should be purchased directly from Semrock. If you are installing these filters in a Sutter wheel that has filter cups, you will need to remove the cup from the position you intend to use to mount the threaded filter. Contact Sutter for details. When installing the new threaded filters, you will want to use the new wrench designed for this purpose.

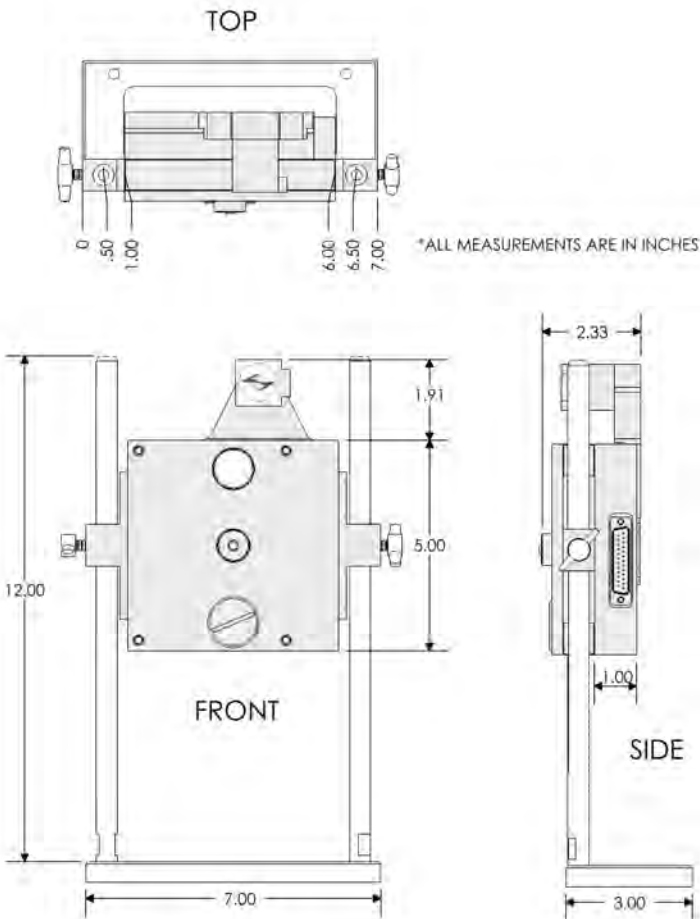


SPECIFICATIONS LAMBDA 10-3

- **Control Box Dimensions** 15.75 in x 11 in x 4 in
40 cm x 28 cm x 10.2 cm
- **Weight** 20 lbs
11 kg
- **Electrical** 120/240 Volts
50/60 Hertz power line
75 Watts max



MECHANICAL DRAWINGS LAMBDA 10-NW1Q



(Shown with optional Smart Shutter®)



US PRICES LAMBDA 10-3

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

CONTROLLER

■ LB10-3	Includes one Lambda 10-3 controller unit, serial, parallel and USB cables, power cable and manual	\$ 2,700
-----------------	---	-----------------

WHEELS

■ LB10-NW	25 mm Filter Wheels — 10-position	
	10-position 25 mm filter wheel without shutter	\$ 4,110
■ LB10-NWIQ	10-position 25 mm filter wheel with <i>SmartShutter</i> ®	\$ 4,940
■ LB10-NWS	10-position 25 mm filter wheel with Uniblitz® shutter	\$ 4,750
■ LB10-NWE	10-position 25 mm filter wheel set up for emission	\$ 3,815

25 mm Filter Wheels — 4-position

■ LB10-WHS4	4-position 25 mm filter wheel without shutter	\$ 4,160
■ LB10-WHS4IQ	4-position 25 mm filter wheel with <i>SmartShutter</i>	\$ 4,950
■ LB10-WHS4E	4-position 25 mm filter wheel set up for emission	\$ 4,160

Thin Filter Wheels — 10-position

■ LB10-TW¹	10-position 25 mm thin wheel without shutter	\$ 4,110
■ LB10-TWIQ¹	10-position 25 mm thin wheel with <i>SmartShutter</i>	\$ 4,940
■ LB10-TWE¹	10-position 25 mm thin wheel set up for emission	\$ 3,815
■ LB10-TW32¹	10-position 32 mm thin wheel without shutter	\$ 4,375

25 mm Dual Filter Wheels

■ LB10-WD	Back to back mounting of two 25 mm filter wheels without shutter. No drop-in filter holders	\$ 6,190
■ LB10-WDIQ	Back to back mounting of two 25 mm filter wheels with <i>SmartShutter</i> and one slide-in filter holder	\$ 7,135
■ LB10-WDS	Back to back mounting of two 25 mm filter wheels with one Uniblitz shutter and one slide-in filter holder	\$ 7,030

32 mm Filter Wheels — 10-position

■ LB10-W32	10-position 32 mm filter wheel without shutter	\$ 3,780
■ LB10-W32IQ	10-position 32 mm filter wheel with <i>SmartShutter</i>	\$ 5,070
■ LB10-W32S	10-position 32 mm filter wheel with Uniblitz shutter	\$ 4,690
■ LB10-TW32¹	10-position 32 mm thin wheel without shutter	\$ 3,380
■ LB10-W32-Y73²	32 mm emission wheel for Olympus IX73/83	\$ 4,560

50 mm Filter Wheel — 5-position

■ LB10-W50	5-position 50 mm filter wheel without shutter	\$ 4,110
-------------------	---	-----------------

Specialty Wheels

■ LB10-W12	10-position 12.5 mm filter wheel without shutter	\$ 3,900
■ LB4-W	Belt drive 4-position 25 mm filter wheel without shutter	\$ 3,560
■ LB10-NWE-N29B	10-position 25 mm emission for bottom port of Nikon Ti	\$ 4,410
■ LB10-NWE-Z40	10-position 25 mm emission for Zeiss Axio Observer	\$ 3,815
■ LB5-W32-N31	5-position 32 mm wheel for infinity path of Nikon Ti2	\$ 3,560

¹ Must be used with Semrock® filters that have Sutter threaded ring.

² Includes emisison adapter



US PRICES LAMBDA 10-3

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

SMARTSHUTTER®

■ IQ12-SA	12.5 mm <i>SmartShutter</i> with stand-alone housing	\$ 1,165
■ IQ12-AN	12.5 mm hard anodized <i>SmartShutter</i>	\$ 1,260
■ IQ25-SA¹	25 mm <i>SmartShutter</i> with stand-alone housing	\$ 1,225
■ IQ25-W²	25 mm <i>SmartShutter</i> with housing to fit filter wheel	\$ 1,225
■ IQ25-WU	25 mm <i>SmartShutter</i> to retrofit non-shuttered filter wheel	\$ 1,275
■ IQ25-LS	25 mm <i>SmartShutter</i> with housing to fit Lambda LS	\$ 1,775
■ IQ25-DG	25 mm <i>SmartShutter</i> to fit in Lambda DG-4/DG-5	\$ 1,645
■ IQ35-W	35 mm <i>SmartShutter</i> with housing to fit filter wheel	\$ 1,725
■ IQ35-SA	35 mm <i>SmartShutter</i> with stand-alone housing	\$ 1,725

Mounting adapters for Nikon, Zeiss, Leica and Olympus microscopes are available. Please see the Microscope Adapters section of the catalog or contact Sutter Instrument for pricing and further information.

¹ Where vignetting may be an issue, we recommend the 35mm shutter.

² For upgrading a 25 mm filter wheel with existing Uniblitz® shutter to *SmartShutter*.



US PRICES LAMBDA 10-3

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

CABLES AND ACCESSORIES

■ CIQ-2	One 25-pin connector to two 9-pin connectors (Allows connection of one stand-alone <i>SmartShutter</i> ® to controller)	\$ 107
■ SLIDE-IN ¹	Slide-in filter holder for 25 mm wheel	\$ 82
■ DROP-IN ²	Drop-in filter holder for 25 mm wheel	\$ 82
■ DROP-IN/32	Drop-in filter holder for LB10-W32IQ	\$ 82
■ X100120	25 mm filter cup	\$ 26
■ X100145 ³	25 mm angled filter spacer	\$ 26
■ X100150	25 mm spacer	\$ 19
■ X100160	25 mm retaining ring	\$ 19
■ X100122	32 mm filter cup	\$ 26
■ X100152	32 mm spacer	\$ 20
■ X100162	32 mm retaining ring	\$ 20
■ X100124	50 mm filter cup	\$ 26
■ X100126	50 mm short filter cup	\$ 22
■ X100154	50 mm spacer	\$ 22
■ X100164	50 mm retaining ring	\$ 22
■ LLG	Liquid light guide (2 meters, 3 mm diameter) C-mount, lens, and lens tube	\$ 1,485
■ SHUTTER	25 mm replacement shutter for Uniblitz® shutter (not an upgrade)	\$ 600
■ W620005	9-pin male/female serial cable	\$ 35
■ W620007	15-pin shielded cable for standard filter wheel	\$ 35
■ W620009	25-pin cable for wheels with <i>SmartShutter</i>	\$ 35
■ W621520	USB cable	\$ 35
■ X100111	35 mm replacement Uniblitz shutter (not an upgrade)	\$ 960
■ X100208	8 inch guide rod for stand (each)	\$ 55
■ X100210	12 inch guide rod for stand (each)	\$ 60
■ X100212	22 inch guide rod for stand (each)	\$ 70
■ X100560	25 mm spanner wrench	\$ 107
■ X100555	25 mm thin wheel spanner wrench	\$ 40
■ X100565	32 mm spanner wrench	\$ 40
■ X100558	32 mm thin wheel spanner wrench	\$ 40
■ X100567	50 mm spanner wrench	\$ 40

¹ Slide-in filter holders are for wheels **with** a shutter.

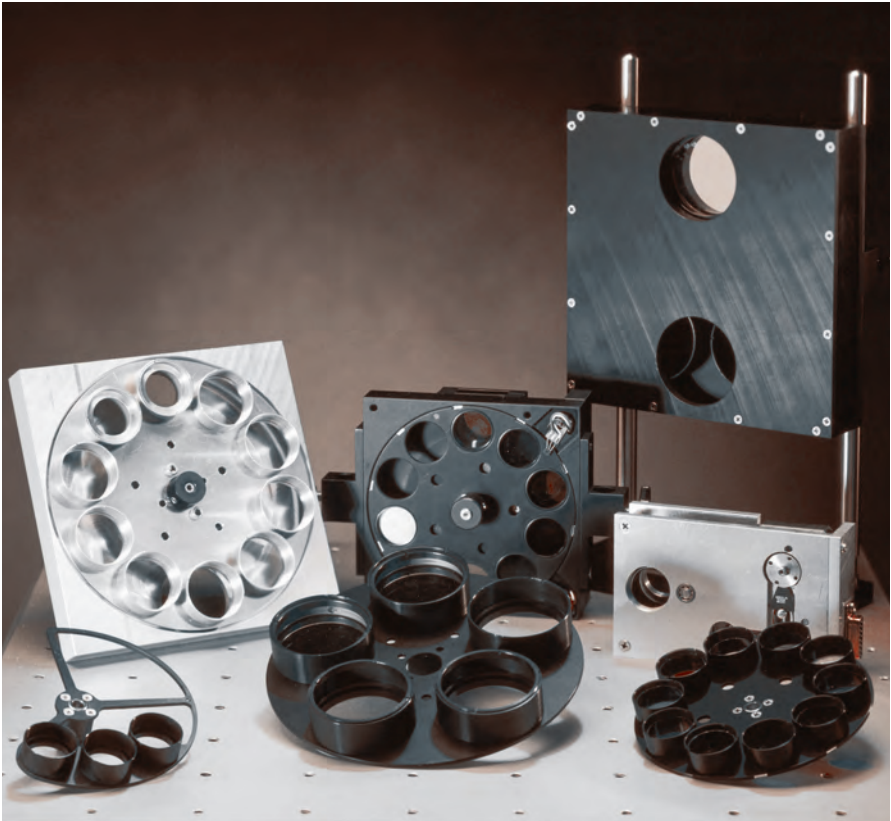
² Drop-in filter holders are for wheels **without** a shutter.

³ Two spacers are required for each filter position.



OEM WHEELS AVAILABLE

For OEM applications, the Lambda 10-3 can readily be modified to meet your specific requirements. By utilizing the 10-3 controller to drive customized wheels, we can provide an economical solution to your OEM design specification. To date we have made custom 2-, 3-, 4-, 5-, 10- and 12-position wheels and have designed for 50 mm, 32 mm and 25 mm filters. Our technical staff will be happy to discuss with you special application requirements.





LAMBDA 10-B

OPTICAL FILTER CHANGER



(Shown with LB10-NW/Q)

FEATURES LAMBDA 10-B

- As fast as 40 msec between adjacent filters (10-position wheel)
- As fast as 30 msec between adjacent filters (4-position wheel)
- As fast as 28 msec with a fully loaded wheel using STR filter from Semrock®
- Serial and USB interfaces
- Can control a variety of 25 mm, 32 mm, and 50 mm wheels
- Controls one wheel and one optional shutter, or two *SmartShutter*®
- Can accommodate *SmartShutter* and Uniblitz® shutter
- Chopper drives
- Universal power supply

COMMON APPLICATIONS LAMBDA 10-B

- Fluorescent microscopy
- Calcium imaging
- FURA
- Optogenetics
- High speed wavelength selection



The Lambda 10-B is a high performance, microprocessor-controlled filter wheel for imaging applications requiring a single filter wheel. The latest release in Sutter's optical filter changer product line, the Lambda 10-B, uses recent advances in motor technology to achieve switching times of 40 msec between adjacent filters. When used with the high-speed 4-position wheels, the Lambda 10-B achieves switching times of less than 31 msec. It features both USB and serial port interfaces as well as keypad control. The Lambda 10-B is capable of controlling both the *SmartShutter*® as well as the Uniblitz® shutter. The Lambda 10-B is a low-cost alternative and ideal for imaging applications requiring a single filter wheel.

The Lambda 10-B can operate with switching times as brief as 40 msec with our standard 25 mm filter wheel as well as our 32 mm wheel. The user can select from seven speeds, allowing the speed to be adjusted in accordance with the load of the wheel. Except for the 4-position compact wheel, our filter wheels employ a direct drive system: a feature that prevents belt slippage or backlash. An optional shutter installation is also available.

Filter selection can be made directly from the keypad or from a computer via the serial or USB port. The Lambda 10-B controller determines the shortest route to the selected filter and an acceleration/deceleration algorithm minimizes vibrations during the movement of the wheel. The current filter position is displayed on the front panel. Internal sensors monitor the position of the filter wheel to insure that the correct filter is in place. The drive uses switching mode current regulation, which is more economical than the linear supply of the Lambda 10-2. Although this is not a problem with most imaging applications, the Lambda 10-2 may be more appropriate for systems where electrophysiology is performed.

Both serial and USB input ports are provided to allow complete and easy control from a remote computer. The serial port accepts RS232 level signals through a DB-9 connector. USB input is made through a standard connector and can be directly connected to a USB port. The Lambda 10-B's USB port interface supports multiple USB devices simultaneously, allowing a user to run in tandem as many units as USB ports. The universal power supply will automatically switch to accommodate local line voltage.

OPTIONS:

The basic system for the Lambda 10-B includes our popular 10-position 25 mm filter wheel. A significant advantage of the Lambda 10-B controller is that it can accommodate a variety of Sutter filter wheels to suit your particular requirements. The controller will automatically detect and determine the model of wheel installed and adjust for the number of positions and filter size.

Our 32 mm wheel was designed to remedy the problem of vignetting that may occur with a 25 mm filter format in certain microscope systems, and can achieve the same 40 msec switching times as our 25 mm wheel.



For applications requiring a larger aperture opening, there is a 5-position 50 mm filter wheel. If additional speed is required, we offer a high-speed, 4-position 25 mm wheel which is capable of achieving 31 msec switching times between adjacent filters. An optional liquid light guide is available for applications requiring absolute vibration isolation, and/or spatial uniformity independent of wavelength. The Lambda 10-B is also capable of controlling either the *SmartShutter*® or the Uniblitz shutter.

GETTING FASTER FILTER SWITCHING TIMES WITH MANY FILTERS INSTALLED

The Sutter filter wheel systems have always been optimized for fast switching of a lightly loaded wheel. When many thick filters are installed, the added mass requires an increase in the time required to switch from one filter to another. Switching times improve significantly with filters made on a thin substrate that do not require a thick layer of additional glass to obtain the desired blocking. Semrock® has the required coating technology to offer filters with substrates down to 2 mm in thickness.

We have now taken the additional step of designing a special threaded ring that Semrock can install in place of their typical plain filter cells. Filters mounted in these rings can be threaded directly into the body of our filter wheels when our standard filter cups have been removed. Semrock filters actually weigh less than the filter cup and retaining ring normally used to mount filters in the Sutter wheels. Thus, if you remove our filter cups and mount the new threaded filters directly in the wheel, even a fully loaded wheel will be able to run at speeds that previously could only be used with just 2 filters installed.

The STR Semrock filters are available in both 25 mm and 32 mm versions and should be purchased directly from Semrock. If you are installing these filters in a Sutter wheel that has filter cups, you will need to remove the cup from the position you intend to use to mount the threaded filter. Contact Sutter for details. When installing the new threaded filters, you will want to use the new wrench designed for this purpose.

SPECIFICATIONS LAMBDA 10-B

■ Control Box Dimensions	6 in x 8.25 in x 5.25 in 15.2 cm x 21 cm x 13.3 cm
■ Weight	2.6 lbs 1.1 kg
■ Electrical	120/240 Volts 50/60 Hertz power line 75 Watts max





US PRICES LAMBDA 10-B

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

CONTROLLER

- | | | |
|--------------------------------|--|-----------------|
| ■ LB10-B/IQ¹ | Lambda 10-B control unit, serial and USB cables, power cord and manual | \$ 1,725 |
|--------------------------------|--|-----------------|

WHEELS

- | | | |
|--|--|-----------------|
| 25 mm Filter Wheels — 10-position | | |
| ■ LB10-NW | 10-position 25 mm filter wheel without shutter | \$ 4,110 |
| ■ LB10-NWIQ | 10-position 25 mm filter wheel with <i>SmartShutter</i> [®] | \$ 4,940 |
| ■ LB10-NWS | 10-position 25 mm filter wheel with Uniblitz [®] shutter | \$ 4,750 |
| ■ LB10-NWE | 10-position 25 mm filter wheel set up for emission | \$ 3,815 |

- | | | |
|---|--|-----------------|
| 25 mm Filter Wheels — 4-position | | |
| ■ LB10-WHS4 | 4-position 25 mm filter wheel without shutter | \$ 4,160 |
| ■ LB10-WHS4IQ | 4-position 25 mm filter wheel with <i>SmartShutter</i> | \$ 4,950 |
| ■ LB10-WHS4E | 4-position 25 mm filter wheel set up for emission | \$ 4,160 |

- | | | |
|---|---|-----------------|
| Thin Filter Wheels — 10-position | | |
| ■ LB10-TW² | 10-position 25 mm thin wheel without shutter | \$ 4,110 |
| ■ LB10-TWIQ² | 10-position 25 mm thin wheel with <i>SmartShutter</i> | \$ 4,940 |
| ■ LB10-TWE² | 10-position 25 mm thin wheel set up for emission | \$ 3,815 |
| ■ LB10-TW32² | 10-position 32 mm thin wheel without shutter | \$ 4,375 |

- | | | |
|--|---|-----------------|
| 32 mm Filter Wheels — 10-position | | |
| ■ LB10-W32 | 10-position 32 mm filter wheel without shutter | \$ 3,780 |
| ■ LB10-W32IQ | 10-position 32 mm filter wheel with <i>SmartShutter</i> | \$ 5,070 |
| ■ LB10-W32S | 10-position 32 mm filter wheel with Uniblitz shutter | \$ 4,690 |
| ■ LB10-TW32² | 10-position 32 mm thin wheel without shutter | \$ 3,380 |
| ■ LB10-W32-Y73³ | 32 mm emission wheel for Olympus IX73/83 | \$ 4,560 |

- | | | |
|--|---|-----------------|
| 50 mm Filter Wheel — 5-position | | |
| ■ LB10-W50 | 5-position 50 mm filter wheel without shutter | \$ 4,110 |

- | | | |
|-------------------------|--|-----------------|
| Specialty Wheels | | |
| ■ LB10-W12 | 10-position 12.5 mm filter wheel without shutter | \$ 3,900 |
| ■ LB4-W | Belt drive 4-position 25 mm filter wheel without shutter | \$ 3,560 |
| ■ LB10-NWE-N29B | 10-pos. 25 mm emission for bottom port of Nikon Ti | \$ 4,410 |
| ■ LB10-NWE-Z40 | 10-position 25 mm emission for Zeiss Axio Observer | \$ 3,815 |
| ■ LB5-W32-N31 | 15-pos. 32 mm wheel for infinity path of Nikon Ti2 | \$ 3,560 |

¹ CIQ-2 cable provided when ordered with stand-alone shutter.

² Must be used with Semrock[®] filters that have Sutter threaded ring.

³ Includes emission adapter.



US PRICES LAMBDA 10-B

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

SMARTSHUTTER®

■ IQ12-SA	12.5 mm <i>SmartShutter</i> ® with stand-alone housing	\$ 1,165
■ IQ12-AN	12.5 mm hard anodized <i>SmartShutter</i>	\$ 1,260
■ IQ25-SA¹	25 mm <i>SmartShutter</i> with stand-alone housing	\$ 1,225
■ IQ25-W²	25 mm <i>SmartShutter</i> with housing to fit filter wheel	\$ 1,225
■ IQ25-WU	25 mm <i>SmartShutter</i> to retrofit non-shuttered filter wheel	\$ 1,275
■ IQ25-LS	25 mm <i>SmartShutter</i> with housing to fit Lambda LS	\$ 1,775
■ IQ25-DG	25 mm <i>SmartShutter</i> to fit in Lambda DG-4/DG-5	\$ 1,645
■ IQ35-W	35 mm <i>SmartShutter</i> with housing to fit filter wheel	\$ 1,725
■ IQ35-SA	35 mm <i>SmartShutter</i> with stand-alone housing	\$ 1,725
■ IQ50-SA	50 mm <i>SmartShutter</i> with stand-alone housing	\$ 1,725

ACCESSORIES

■ CIQ-2	One 25 pin connector to two 9 pin connectors (Connects up to 2 stand-alone shutters to LB10-B/IQ controller)	\$ 107
■ FSWITCH	Foot switch with BNC connector – Changes state of shutter with foot press as long as foot press is maintained	\$ 107
■ FSTOGGLE	Foot switch with BNC connector – Alternates open/close with each foot press	\$ 107
■ W620005	9-pin male/female serial cable	\$ 35
■ W620007	15-pin shielded cable for standard filter wheel	\$ 35
■ W621512	25-pin cable for wheels with <i>SmartShutter</i>	\$ 35
■ W621520	USB cable	\$ 35
■ SLIDE-IN³	Slide-in filter holder for 25 mm wheel	\$ 82
■ DROP-IN⁴	Drop-in filter holder for 25 mm wheel	\$ 82
■ DROP-IN/32	32 mm drop-in filter holder for LB10-W32IQ	\$ 82
■ X100120	25 mm filter cup	\$ 26
■ X100145⁵	25 mm angled filter spacer	\$ 26
■ X100150	25 mm spacer	\$ 19
■ X100160	25 mm retaining ring	\$ 19
■ X100122	32 mm filter cup	\$ 26
■ X100152	32 mm spacer	\$ 20
■ X100162	32 mm retaining ring	\$ 20
■ X100124	50 mm filter cup	\$ 26
■ X100126	50 mm short filter cup	\$ 22
■ X100154	50 mm spacer	\$ 22
■ X100164	50 mm retaining ring	\$ 22

¹ Where vignetting may be an issue, we recommend the 35 mm shutter.

² For upgrading a 25 mm filter wheel with existing Uniblitz® shutter to *SmartShutter*.

³ Slide-in filter holders are for wheels **with** a shutter.

⁴ Drop-in filter holders are for wheels **without** a shutter.

⁵ Two spacers are required for each filter position.



US PRICES LAMBDA 10-B

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

ACCESSORIES – continued

■ LLG	Liquid light guide (2 meters, 3 mm diameter), C-mount, lens, and lens tube	\$ 1,485
■ SHUTTER	25 mm replacement shutter for Uniblitz® shutter (not an upgrade)	\$ 600
■ X100111	35 mm replacement Uniblitz shutter (not an upgrade)	\$ 960
■ X100208	8 inch guide rod for stand (each)	\$ 55
■ X100210	12 inch guide rod for stand (each)	\$ 60
■ X100212	22 inch guide rod for stand (each)	\$ 70
■ X100560	25 mm spanner wrench	\$ 107
■ X100555	25 mm thin wheel spanner wrench	\$ 40
■ X100565	32 mm spanner wrench	\$ 40
■ X100558	32 mm thin wheel spanner wrench	\$ 40
■ X100567	50 mm spanner wrench	\$ 40

SHUTTER MOUNTING POST

Stainless steel 1/2 in diameter. One end is 1/4-20 (M6) tapped hole. Other end is #8-32 (M4) removable threaded stud. Can be used with 25 mm *SmartShutter*, or 35 mm when used with the PMA-IQ35.

■ O620120	1 in / 25 mm long post	\$ 20
■ O620122	1.5 in / 38 mm long post	\$ 20
■ O620123	2 in / 50 mm long post	\$ 20
■ PMA-IQ35	35 mm post mount adapter	\$ 107

POST HOLDER

■ O620125	Holder and spring loaded thumbscrew for mounting post	\$ 20
------------------	---	--------------

POST BASE PLATE

■ O620140	2 in x 3 in x 3/8 in base plate. Suitable for Imperial or Metric tables, posts, and post holders	\$ 20
------------------	--	--------------

POST COLLAR

■ O620150	Slip-on collar, 1 in OD x 0.5 in ID	\$ 20
------------------	-------------------------------------	--------------

Mounting adapters for Nikon, Zeiss, Leica and Olympus microscopes are available. Please call Sutter Instrument for pricing and further information. Also, please see the Microscope Adapters section of this catalog.



LAMBDA OBC

OPTICAL BEAM COMBINER



FEATURES LAMBDA OBC

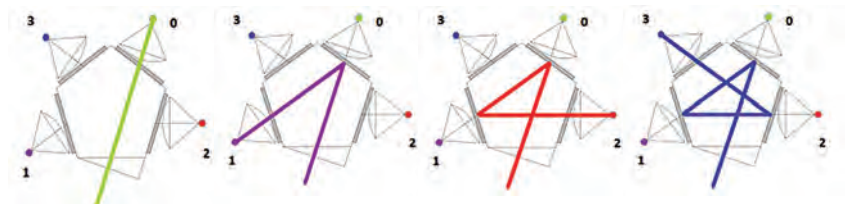
- | | |
|---|---|
| <ul style="list-style-type: none"> ■ Up to 4 channel ultra high speed LED light source (<25 μsec) ■ LLG or direct mount connection options for all common microscopes ■ Capable of combining any combination of LEDs or any liquid light guide delivered light sources | <ul style="list-style-type: none"> ■ Easy to reconfigure ■ LEDs driven by our proven FLED controllers |
|---|---|

COMMON APPLICATIONS LAMBDA OBC

- | | |
|---|---|
| <ul style="list-style-type: none"> ■ Fluorescent microscopy ■ Calcium imaging ■ FURA | <ul style="list-style-type: none"> ■ Optogenetics ■ High speed wavelength selection |
|---|---|



The Lambda OBC (optical beam combiner) is a new, patented, concept for combining separate light sources with different spectra into a single common output beam. Each separate light source is collimated before entering the optical path through a bandpass filter. The filters for each light source also function as mirrors that reflect the collimated beams from the previous light sources. In the diagram below the optical paths are outlined for each position including the reflections that occur:



Optical path for each light source position from 0 through 3. The position number of the light sources are labeled based on the number of total reflections.

Traditionally, combining more than two light sources required the use of a dichroic ladder. Dichroic mirrors, which switch from transmission to reflection at one point in the spectrum, allow the combining of separate light sources, provided that those sources do not have overlapping wavelengths. The downside of this approach is that light sources cannot be easily changed.

Dichroic ladders also demand careful attention to the order in which the light sources are introduced into the optical path to avoid having the light blocked by the next dichroic in line. Typically, additional bandpass filters must be added in front of each light source before the dichroic, to select the desired range of wavelengths for each source. Each filter and dichroic used in the ladder decreases the total light output of the system.

FEATURES

- Capable of combining any light source

- Any suitable filter can be placed in any of 4 positions without concern for the order

- Directly mount to the microscope epi-illuminator

- Wavelength selection and beam reflection using Semrock®-STR Filters

The Pentagon shape of the Lambda OBC was designed to keep the size of the beam combiner small and the optical path short and efficient. Thin-film bandpass filters, such as Semrock's STR, reflect greater than 90% of out-of-band light. If the band pass of each light source does not overlap, it is possible to use the filters for both attenuation and reflection of the light from the other sources. By arranging the filters and sources into a pentagon, we could combine four light sources in a compact design with lower losses than previously achievable. As an added benefit, the last position in the optical train does not require any filter, since no other input reflects from that position. This input can be used with any sort of light source if you are aware of the possible losses if there are filters in use that overlap this light source. The fifth side of the pentagon becomes the output for the combined sources. The filters are easily exchangeable and are installed on small sliders inside the core of the pentagon. Filters and associated light sources can be arranged in any order around the pentagon.



Notes:

- The light from position #0 goes directly to the device output without being reflected. This position might be preferred for the source with the greatest desired output.
- The filter for the fourth light source is not used as a reflective surface and could be omitted if a broad-band source were desired.
- In configurations with fewer than 4 light sources, sources should be filled from lowest to highest number of reflections to ensure the greatest light output.
- The optical path for each input is tilted by 18 degrees relative to the filter for that port. This will cause a small shift in the band pass toward shorter wavelengths. While it would be ideal to have a coating optimized for this application, we have found that stock -STR filters can be used if you correct for the shift in the band pass when selecting the filters. This lends itself to combining narrow-band sources such as LEDs and lasers with a broad-band sources such as an arc lamps or white light LEDs. In the case of LEDs, wavelengths can be shuttered at the speed of the individual source. Sutter Instrument HPX and FLED products can switch in 10-25 microseconds respectively.

The Lambda OBC is designed for ultimate flexibility and expandability. Should your illumination needs change over time, a simple configuration change and possibly additional filters can produce an entirely different output.

SPECIFICATIONS OBC

■ Output Range	(330 nm to 960 nm) Depending the LED's selected for use
■ Shuttering	Turn ON/OFF time: <25 μ s
■ Noise/Short Term Stability	0.01 %
■ LED Life	>50,000 hours
■ Dimensions	<i>Control Box – FLED:</i> 4 in x 3.25 in x 4.1 in 10.2 cm x 8.3 cm x 10.2 cm <i>Lambda OBC – with 4 LEDs:</i> 9.65 in x 9.25 in x 3 in 24.5 cm x 23.5 cm x 7.5 cm
■ Weight	<i>Control Box – FLED:</i> 2.2 lbs 1 kg <i>Lambda OBC – with 4 LEDs:</i> 4.7 lbs 2.13 kg
■ Electrical	120/240 Volts 50/60 Hertz power line



US PRICES LAMBDA OBC

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

OPTICAL BEAM COMBINER

Includes Lambda OBC optical beam combining pentagon that accommodates up to 4 LED modules (purchased separately).

■ LB-OBC-N	Lambda Optical Beam Combiner for Nikon	\$ 3,500
■ LB-OBC-Y	Lambda Optical Beam Combiner for Olympus	\$ 3,500
■ LB-OBC-Z	Lambda Optical Beam Combiner for Zeiss	\$ 3,500
■ LB-OBC-L	Lambda Optical Beam Combiner for Leica	\$ 3,500
■ LB-OBC-LLG	Lambda Optical Beam Combiner with 3 mm series 380 liquid light guide	\$ 5,150

CONTROLLER FOR LED MODULES

One Lambda FLED controller is needed for each LED ordered (part numbers OBC-XXX). Up to 4 controllers can be used with the Optical Beam Combiner.

■ FLED-E	Lambda FLED Controller (one needed for each LED module ordered (part numbers OBC-XXX).	\$ 1,110
-----------------	---	-----------------

LED MODULES FOR LAMBDA OBC

The LED modules consist of the LED and the appropriate Semrock®-STR excitation filter for the output of the LED. Four LED modules can be installed in the Optical Beam Combiner at one time, however, the purchase of additional LED modules adds versatility to the system as you can reconfigure the Lambda OBC by substituting wavelengths as needed for your application.

■ OBC-340	LED, 340 nm for Optical Beam Combiner	\$ 1,495
■ OBC-365	LED, 365 nm for Optical Beam Combiner	\$ 1,495
■ OBC-385	LED, 385 nm for Optical Beam Combiner	\$ 1,495
■ OBC-410	LED, 410 nm for Optical Beam Combiner	\$ 1,495
■ OBC-440	LED, 440 nm for Optical Beam Combiner	\$ 1,495
■ OBC-460	LED, 460 nm for Optical Beam Combiner	\$ 1,495
■ OBC-480	LED, 480 nm for Optical Beam Combiner	\$ 1,495
■ OBC-506	LED, 506 nm for Optical Beam Combiner	\$ 1,495
■ OBC-530	LED, 530 nm for Optical Beam Combiner	\$ 1,495
■ OBC-561	LED, 561 nm for Optical Beam Combiner	\$ 1,495
■ OBC-590	LED, 590 nm for Optical Beam Combiner	\$ 1,495
■ OBC-630	LED, 630 nm for Optical Beam Combiner	\$ 1,495
■ OBC-660	LED, 660 nm for Optical Beam Combiner	\$ 1,495
■ OBC-740	LED, 740 nm for Optical Beam Combiner	\$ 1,495
■ OBC-850	LED, 850 nm for Optical Beam Combiner	\$ 1,495
■ OBC-940	LED, 940 nm for Optical Beam Combiner	\$ 1,495
■ OBC-W5	LED, White Light for Optical Beam Combiner	\$ 1,495



LAMBDA 421

OPTICAL BEAM COMBINING SYSTEM



FEATURES LAMBDA 421

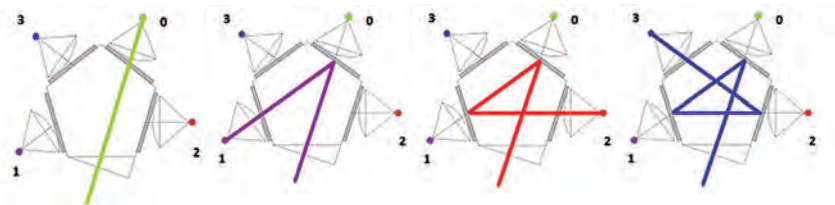
- 4 channel ultra high speed LED light source (<25 μ sec)
- Liquid light guide connection to all common microscopes
- Capable of combining any combination of LEDs or any liquid light guide delivered light sources
- Easy to reconfigure
- Supported in nearly all 3rd party software suites (DG commands)
- Advanced control methods (USB, TTL, Ring Buffer)

COMMON APPLICATIONS LAMBDA 421

- Fluorescent microscopy
- Calcium imaging
- FURA
- Optogenetics
- High speed wavelength selection



The Lambda 421 beam combiner is a new, patented, concept for combining separate light sources with different spectra into a single common output beam. Each separate light source is collimated before entering the optical path through a bandpass filter. The filters for each light source also function as mirrors that reflect the collimated beams from the previous light sources. In the diagram below the optical paths are outlined for each position including the reflections that occur:



Optical path for each light source position from 0 through 3. The position number of the light sources are labeled based on the number of total reflections.

Traditionally, combining more than two light sources required the use of a dichroic ladder. Dichroic mirrors, which switch from transmission to reflection at one point in the spectrum, allow the combining of separate light sources, provided that those sources do not have overlapping wavelengths. The downside of this approach is that light sources cannot be easily changed.

Dichroic ladders also demand careful attention to the order in which the light sources are introduced into the optical path to avoid having the light blocked by the next dichroic in line. Typically, additional bandpass filters must be added in front of each light source before the dichroic, to select the desired range of wavelengths for each source. Each filter and dichroic used in the ladder decreases the total light output of the system.

The Lambda 421 was designed to keep the size of the beam combiner small and the optical path short and efficient. Thin-film bandpass filters, such as Semrock's STR, reflect greater than 90% of out-of-band light. If the band pass of each light source does not overlap, it is possible to use the filters for both attenuation and reflection of the light from the other sources. By arranging the filters and sources into a pentagon, we were able to combine four light sources in a compact design with lower losses than previously achievable. As an added benefit, the last position in the optical train does not require any filter, since no other input reflects from that position. This input can be used with any sort of light source as long as you are aware of the possible losses if there are filters in use that overlap this light source. The fifth side of the pentagon becomes the output for the combined sources. The filters are easily exchangeable and are installed on small sliders inside the core of the pentagon. Filters and associated light sources can be arranged in any order around the pentagon.



SPECIFICATIONS LAMBDA 421

- **Output Range** (330 nm to 960 nm) Depending the LED's selected for use
- **Shuttering** Turn ON/OFF time: <25 μ s
- **Noise/Short Term Stability** 0.01 %
- **LED Life** >50,000 hours
- **Control Box Dimensions** 15.75 in x 11 in x 7.5 in
40 cm x 27.9 cm x 19.05 cm
- **Weight** 17.8 lbs
8.07 kg
- **Electrical** 120/240 Volts
50/60 Hertz power line



US PRICES LAMBDA 421

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

LAMBDA 421 OPTICAL BEAM COMBINER AND CONTROLLER

Includes Lambda 421 with liquid light guide, cables, and power cord. The instrument accepts up to 4 LED modules (listed below) and can easily be reconfigured. The LED modules consist of the LED and the appropriate Semrock®-STR excitation filter for the output of the LED.

■ **LB-421-DG** Lambda 421 Optical Beam Combiner and controller **\$ 9,715**

LED MODULES FOR LAMBDA 421

■ OBC-340	LED, 340 nm for Optical Beam Combiner	\$ 1,495
■ OBC-365	LED, 365 nm for Optical Beam Combiner	\$ 1,495
■ OBC-385	LED, 385 nm for Optical Beam Combiner	\$ 1,495
■ OBC-410	LED, 410 nm for Optical Beam Combiner	\$ 1,495
■ OBC-440	LED, 440 nm for Optical Beam Combiner	\$ 1,495
■ OBC-460	LED, 460 nm for Optical Beam Combiner	\$ 1,495
■ OBC-480	LED, 480 nm for Optical Beam Combiner	\$ 1,495
■ OBC-506	LED, 506 nm for Optical Beam Combiner	\$ 1,495
■ OBC-530	LED, 530 nm for Optical Beam Combiner	\$ 1,495
■ OBC-561	LED, 561 nm for Optical Beam Combiner	\$ 1,495
■ OBC-590	LED, 590 nm for Optical Beam Combiner	\$ 1,495
■ OBC-630	LED, 630 nm for Optical Beam Combiner	\$ 1,495
■ OBC-660	LED, 660 nm for Optical Beam Combiner	\$ 1,495
■ OBC-740	LED, 740 nm for Optical Beam Combiner	\$ 1,495
■ OBC-850	LED, 850 nm for Optical Beam Combiner	\$ 1,495
■ OBC-940	LED, 940 nm for Optical Beam Combiner	\$ 1,495
■ OBC-W5	LED, White Light for Optical Beam Combiner	\$ 1,495

Mounting adapters for Nikon, Zeiss, Leica and Olympus microscopes are available. Please call Sutter Instrument for pricing and further information. Also, please see the Microscope Adapters section of this catalog.



LAMBDA SC

SMARTSHUTTER® CONTROLLER



(Shown with IQ35-SA and stand)

FEATURES SMARTSHUTTER

- | | |
|--|---|
| <ul style="list-style-type: none"> ■ Robust design ■ Life tested to 100 million cycles ■ Modular repairable design ■ Opening time 8 msec from trigger (for 25 mm and 35 mm versions) | <ul style="list-style-type: none"> ■ Continuous operation frequencies as high as 40 Hz ■ Stand-alone or use with Sutter filter wheel ■ Mountable in Lambda LS and Lambda DG-4 / DG-5 |
|--|---|

FEATURES LAMBDA SC

- | | |
|--|--|
| <ul style="list-style-type: none"> ■ Microprocessor based controller ■ Serial, USB and TTL interfaces ■ User can produce a variable aperture by selecting the degree of shutter opening ■ "Soft" action mode provides minimum vibration ■ TTL activation of the shutter can be set to high, low, or Toggle on rising/falling edge | <ul style="list-style-type: none"> ■ Programmable delay and exposure intervals of up to 5 hours with millisecond resolution ■ Commands can run continuously or loop a specified number of times ■ Programmable delayed sync out ■ Universal power supply |
|--|--|



The Lambda SC is a full-featured micro-processor controlled shutter driver for the *SmartShutter*®. It supports the same shutter command set used for our other Lambda controllers and offers enhanced performance through additional modes of operation. The additional operating modes allow programmable control over the exposure time, the delay between exposures, the number of exposures, the mode of triggering and the mode of shutter operation. The Lambda SC utility program allows computer control and configuration of multiple SC controllers through serial or USB ports.

In the Lambda 10 family of filter wheel controllers, shutter timing is controlled directly by the time of occurrence of commands or TTL input. In most cases, the system software used with these controllers has provisions for controlling the timing of the shutter. The Lambda SC shutter controller may be used in applications that would benefit from enhanced control options built into the controller. A convenient toggle switch on the front panel has three positions: OPEN (shutter will open regardless of other inputs), CLOSED (shutter will close regardless of other inputs) and AUTO. In the AUTO position, the controller can be operated remotely from a computer through the USB port, or opened and closed using a logic level input.

In the free running mode, the shutter will open and close repeatedly. The time between closing and reopening can either be directly timed, or set as an interval for the entire cycle. Delay and exposure intervals can be set by the user for up to 5 hours with millisecond resolution. This mode can be set to continuously run or loop for a specific number of cycles. The mode is initiated from power up, or a trigger pulse, and can be interrupted by using a stop command.

Because the *SmartShutter* incorporates a microprocessor controlled motor/wiper design, the trajectory of each move can be controlled and the motion of the blade optimized for speed or for smoothness. When speed is the most important condition, the user can select the fast mode. If the modest amount of vibration in the fast mode is objectionable and speed is not important, the "soft" mode can be selected, moving the blade slower through the overall travel.

The neutral density mode results in a partial opening of the *SmartShutter*. Any one of the 144 steps from a fully closed to fully open can be selected. Using this variable aperture opening along with a liquid light guide acts to spatially homogenize the light to produce a uniform spatial illumination that's independent of the geometry of the input illumination.

The *SmartShutter* can be coupled to the illumination ports of most microscopes using an adapter which can be purchased separately. Please refer to the "Microscope Adapters" section for further information. An optical black coating option for the shutter blade is available to eliminate reflection. Please phone Sutter for details.



SPECIFICATIONS LAMBDA SC

■ Dimensions	8.5 in x 5.25 in x 2 in 21.6 cm x 13.5 cm x 5 cm
■ Weight	1.7 lbs 0.77 kg
■ Electrical	120/240 Volts 50/60 Hertz power line 75 Watts max



US PRICES LAMBDA SC

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

CONTROLLER

■ LB-SC	Includes one Lambda SC control unit, serial and USB cable, power cord and manual	\$ 850
----------------	--	---------------

SMARTSHUTTER

■ IQ12-SA	12.5 mm <i>SmartShutter</i> ® with stand-alone housing	\$ 1,165
■ IQ12-AN	12.5 mm hard anodized <i>SmartShutter</i>	\$ 1,260
■ IQ25-SA¹	25 mm <i>SmartShutter</i> with stand-alone housing	\$ 1,225
■ IQ25-LS	25 mm <i>SmartShutter</i> with housing to fit Lambda LS	\$ 1,775
■ IQ25-DG	25 mm <i>SmartShutter</i> to fit in Lambda DG-4 / DG-5	\$ 1,645
■ IQ35-W	35 mm <i>SmartShutter</i> with housing to fit filter wheel	\$ 1,725
■ IQ35-SA	35 mm <i>SmartShutter</i> with stand-alone housing	\$ 1,725
■ IQ50-SA	50 mm <i>SmartShutter</i> with stand-alone housing	\$ 1,725

¹ Where vignetting may be an issue, we recommend the 35mm shutter.



US PRICES LAMBDA SC

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

CABLES AND ACCESSORIES

■ W621520	USB cable	\$ 35
■ W620005	9-pin male/female <i>SmartShutter</i> ® (no wheel)	\$ 35
■ FSWITCH	Foot switch with BNC connector – Changes state of shutter with foot press as long as foot press is maintained	\$ 107
■ FSTOGGLE	Foot switch with BNC connector – Alternates open/close with each foot press	\$ 107

SHUTTER MOUNT POSTS

Stainless steel 1/2 in diameter. One end is 1/4-20 (M6) tapped hole. Other end is #8-32 (M4) removable threaded stud. Can be used with 25 mm *SmartShutter*, or 35 mm when used with the PMA-IQ35.

■ O620120	1 in / 25 mm long post	\$ 20
■ O620122	1.5 in / 38 mm long post	\$ 20
■ O620123	2 in / 50 mm long post	\$ 20
■ O620124	3 in / 76 mm long post	\$ 20
■ O620117	4 in / 100 mm long post	\$ 20
■ O620119	8 in / 203 mm long post	\$ 20
■ PMA-IQ35	35 mm post mount adapter	\$ 107

POST HOLDER

■ O620125	1 in / 25 mm holder & spring loaded thumbscrew for post	\$ 20
■ O620130	2 in / 50 mm holder & spring loaded thumbscrew for post	\$ 20
■ O620134	4 in / 100 mm holder & spring loaded thumbscrew for post	\$ 20
■ O620136	6 in / 152 mm holder & spring loaded thumbscrew for post	\$ 20

POST BASE PLATE

Suitable for Imperial or Metric tables, posts, and post holders.

■ O620143	1 in x 2.3 in x 3/8 in base plate.	\$ 20
■ O620140	2 in x 3 in x 3/8 in base plate.	\$ 20

POST COLLAR

■ O620150	Slip-on collar, 1 in OD x 0.5 in ID	\$ 20
------------------	-------------------------------------	--------------

Mounting adapters for Nikon, Zeiss, Leica and Olympus microscopes are available. Please call Sutter Instrument for pricing and further information. Also, please see the Microscope Adapters section of this catalog.



SMARTSHUTTER®

STEPPER-MOTOR DRIVEN SHUTTER



(Shown with LB10-B/I/Q controller)

FEATURES SMARTSHUTTER®

- Robust design
- Life tested to 100 million cycles
- Modular repairable design
- Opening time 8 msec from trigger (for 25 mm and 35 mm versions)
- Continuous operation frequencies as high as 40 Hz
- Stand-alone or use with Sutter filter wheel
- Mountable in Lambda LS, Lambda DG-4 / DG-5, and Lambda XL
- Microprocessor based controller
- "Soft" action mode provides minimum vibration
- Selection partial opening function for neutral density
- Serial, USB and TTL interfaces
- Manual input via keypad (on LB10-B/I/Q)
- Universal power supply
- Patent No. 7,253,575





The *SmartShutter*® is designed to complement our growing line of optical products and sets a new standard for shutter performance and reliability. In the traditional shutter design there are two or more “leaves” that rub against each other. Given time, the blades will wear down, bind, and the shutter will fail to open. The *SmartShutter* is designed with only one moving part, which virtually eliminates the effects of wear and markedly improves performance. In the traditional shutter design there is an additional issue of the leaves binding in extreme temperature conditions. To solve this problem our shutter blade has the ability to perform well under very high temperature conditions and extending the life of the shutter.

The *SmartShutter* incorporates a new high-performance motor drive and precision stepper-motor to provide added control and durability. Traditional shutters use a solenoid actuator requiring a high initial opening voltage for rapid opening of the shutter. This can overheat or burn out the coil of the shutter if the shutter is opened too frequently. With our microprocessor controlled motor/wiper design, we can control the trajectory of each move and optimize the motion of the blade for speed or for smoothness. The *SmartShutter*, in either the 25 mm or 35 mm version, operates with open/close times of 8 msec from the command (3 msec from the start of motion). Since our robust design does not rely on over-driving the windings, we can achieve continuous operation at certain frequencies up to 40 Hz for the 25 mm version, and 20 Hz for the 35 mm model. While the 25 mm *SmartShutter* can run at frequencies up to 40 Hz, some repetition rates may excite undesirable resonances that interfere with proper operation. A small adjustment in frequency will normally correct this.

Because the shutter blade is stopped by the action of the motor rather than mechanical stops, *SmartShutter* units tested for over 100 million cycles show no sign of failure. The standard *SmartShutter* blade is made of untreated aluminum. Non-reflective coatings are available upon request and are not recommended for use with arc lamps.

The microprocessor-based controller provides exceptional versatility and is adaptable to various modes of operation and function. The *SmartShutter* can be programmed for a variety of movement profiles or to produce a variable aperture by determining the degree of shutter opening. When used in our Lambda LS xenon light source and coupled with a liquid light guide, the shutter acts as a programmable neutral density filter. In addition, while the impulse of our shutter is minimal, a “soft” action mode can be selected to decrease vibration.

The LB10-B/IQ controller for the *SmartShutter* is capable of driving up to two shutters. To support this function a TTL input is supplied for remote triggering of the shutter, as well as a TTL output to support remote triggering of external devices such as a camera. The controller can also be operated locally (manually) from the controller keypad or remotely from a computer through either the USB or serial port.

A dedicated single shutter controller, the Lambda SC is also available and provides a USB port, serial, TTL in and TTL sync out. The Lambda SC allows programmable control over the exposure time, and the delay between trigger and shutter opening.

Originally designed to be integrated into our 25 mm and 32 mm filter wheels, housings are also available for stand-alone units and for use in our Lambda LS, Lambda XL, and Lambda DG-4/DG-5 optical products. The standard *SmartShutter* blade is made of untreated aluminum. Non-reflective coatings are available upon request and are not recommended for use with arc lamps. The modularity of the *SmartShutter* assures that repairs, should they be necessary, are simple and economical.



US PRICES SMARTSHUTTER®

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

CONTROLLER

■ LB10-B/IQ	Lambda 10-B control unit, serial and USB cables, power cord and manual	\$ 1,725
■ LB-SC	Includes one Lambda SC control unit, serial and USB cable, power cord and manual	\$ 850

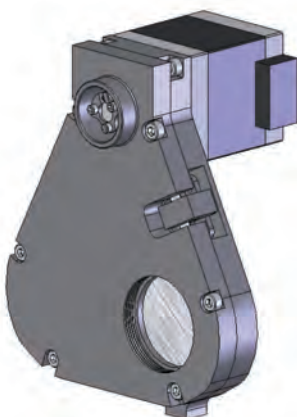
SMARTSHUTTER

■ IQ12-SA	12.5 mm <i>SmartShutter</i> ® with stand-alone housing	\$ 1,165
■ IQ12-AN	12.5 mm hard anodized <i>SmartShutter</i>	\$ 1,260
■ IQ25-SA¹	25 mm <i>SmartShutter</i> with stand-alone housing	\$ 1,225
■ IQ25-W²	25 mm <i>SmartShutter</i> with housing to fit filter wheel	\$ 1,225
■ IQ25-WU	25 mm <i>SmartShutter</i> to retrofit non-shuttered filter wheel	\$ 1,275
■ IQ25-LS	25 mm <i>SmartShutter</i> with housing to fit Lambda LS	\$ 1,775
■ IQ25-DG	25 mm <i>SmartShutter</i> to fit in Lambda DG-4 / DG-5	\$ 1,645
■ IQ35-W	35 mm <i>SmartShutter</i> with housing to fit filter wheel	\$ 1,725
■ IQ35-SA	35 mm <i>SmartShutter</i> with stand-alone housing	\$ 1,725
■ IQ50-SA³	50 mm <i>SmartShutter</i> with stand-alone housing	\$ 1,725

¹ Where vignetting may be an issue, we recommend the 35 mm shutter.

² For upgrading a 25 mm filter wheel with existing Uniblitz® shutter to *SmartShutter*.

³ Compatible with Lambda SC controller.



(Shown: IQ25-SA.
Visit our website for images of other
shutters.)



US PRICES SMARTSHUTTER®

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

CABLES AND ACCESSORIES

■ CIQ-2	One 25-pin connector to two 9-pin connectors (Connects up to 2 stand-alone shutters to LB10-B/IQ controller)	\$ 107
■ W621520	USB cable	\$ 35
■ W620005	9-pin male/female <i>SmartShutter</i> ® (no wheel)	\$ 35
■ FSWITCH	Foot switch with BNC connector – Changes state of shutter with foot press as long as foot press is maintained	\$ 107
■ FSTOGGLE	Foot switch with BNC connector – Alternates open/close with each foot press	\$ 107

SHUTTER MOUNT POSTS

Stainless steel 1/2 in diameter. One end is 1/4-20 (M6) tapped hole. Other end is #8-32 (M4) removable threaded stud. Can be used with 25 mm *SmartShutter*, or 35 mm when used with the PMA-IQ35.

■ O620120	1 in / 25 mm long post	\$ 20
■ O620122	1.5 in / 38 mm long post	\$ 20
■ O620123	2 in / 50 mm long post	\$ 20
■ O620124	3 in / 76 mm long post	\$ 20
■ O620117	4 in / 100 mm long post	\$ 20
■ O620119	8 in / 203 mm long post	\$ 20
■ PMA-IQ35	35 mm post mount adapter	\$ 107

POST HOLDER

■ O620125	1 in / 25 mm holder & spring loaded thumbscrew for post	\$ 20
■ O620130	2 in / 50 mm holder & spring loaded thumbscrew for post	\$ 20
■ O620134	4 in / 100 mm holder & spring loaded thumbscrew for post	\$ 20
■ O620136	6 in / 152 mm holder & spring loaded thumbscrew for post	\$ 20

POST BASE PLATE

Suitable for Imperial or Metric tables, posts, and post holders.

■ O620143	1 in x 2.3 in x 3/8 in base plate.	\$ 20
■ O620140	2 in x 3 in x 3/8 in base plate.	\$ 20

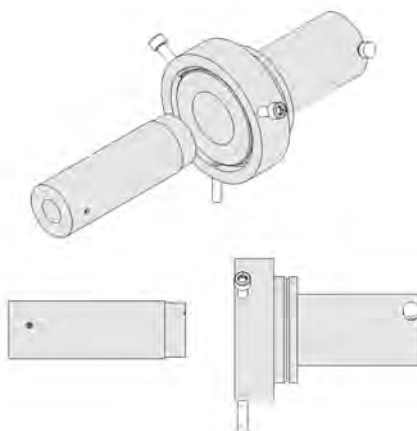
POST COLLAR

■ O620150	Slip-on collar, 1 in OD x 0.5 in ID	\$ 20
------------------	-------------------------------------	--------------

Mounting adapters for Nikon, Zeiss, Leica and Olympus microscopes are available. Please call Sutter Instrument for pricing and further information. Also, please see the Microscope Adapters section of this catalog.



MICROSCOPE ADAPTERS



ORDERING INFORMATION

It is advisable to contact Sutter Instrument to discuss your adapter needs prior to purchasing. All prices are U.S. prices. Pricing in other countries may vary.

LAMBDA FILTERWHEELS

Excitation adapters (suffix EC) include all components necessary for mounting our filter wheels between the microscope lamp housing and excitation port. Please select adapters with a prefix of 10 for wheels with a 25 mm aperture, and a prefix of 32 for wheels with a 32 mm aperture.

LAMBDA DG-4 / DG-5 PLUS

The Lambda DG-4 / DG-5 PLUS will only require a light guide adapter (prefix LG).

LAMBDA LS and LAMBDA HPX-L5

It is recommended that these instruments be used with the optional Liquid Light Guide and a light guide adapter (prefix LG).

LARGE FORMAT LIGHT GUIDE ADAPTERS

The large format light guide adapter (suffix LF) is necessary when a demagnification lens is present in the emission path to eliminate vignetting in the camera. This adapter is also recommended for those customers wishing to eliminate vignetting in the eyepiece.

LAMBDA VF-5™, VF-1™, VF-10, and VF-1™ Edge

Please phone Sutter to discuss your microscope and/or mounting requirements.



SMARTSHUTTER®

The SmartShutter® can be mounted on the microscope excitation and transmitted light ports using our standard adapters. For easy reference:

IQ25 Excitation – use adapters that begin with 10

IQ35 Excitation – use adapters that begin with 32

IQ25 & IQ35 Transmitted light – use adapters ending with TL

MICROSCOPE ADAPTERS

OLYMPUS

IX-70 / IX-50 (Y70) *Please contact Sutter to discuss your needs.*

BX-50 / BX-60 (Y50)

10-Y50-EC	EXCITATION	\$ 415
32-Y50-EC	EXCITATION – 32 mm	\$ 415
10-Y50-EM	EMISSION	\$ 580
LG-Y50	LIGHT GUIDE	\$ 580
LG-Y50-LF	LIGHT GUIDE – Large Format	\$ 1,050
25-Y50-TL	TRANSMITTED – 25 mm	\$ 415
35-Y50-TL	TRANSMITTED – 35 mm	\$ 415

BX-51 / BX-61 (Y51)

10-Y51-EC	EXCITATION	\$ 415
32-Y51-EC	EXCITATION – 32 mm	\$ 415
10-Y51-EM	EMISSION	\$ 580
LG-Y51	LIGHT GUIDE	\$ 580
LG-Y51-LF	LIGHT GUIDE – Large Format	\$ 1,050
25-Y51-TL	TRANSMITTED – 25 mm	\$ 415
35-Y51-TL	TRANSMITTED – 35 mm	\$ 415

BX-53 / BX-63 (Y53)

10-Y53-EC	EXCITATION	\$ 415
32-Y53-EC	EXCITATION – 32 mm	\$ 415
10-Y53-EM	EMISSION	\$ 580
10-Y53-IEM	EMISSION – Infinity	\$ 636
LG-Y53	LIGHT GUIDE	\$ 580
LG-Y53-LF	LIGHT GUIDE – Large Format	\$ 1,050
25-Y53-TL	TRANSMITTED – 25 mm	\$ 415
35-Y53-TL	TRANSMITTED – 35 mm	\$ 415

IX-51 / IX71 / IX-81 (Y71)

10-Y71-EC	EXCITATION	\$ 415
32-Y71-EC	EXCITATION – 32 mm	\$ 415
10-Y71-EM	EMISSION	\$ 580
10-Y71-SU	STAGE UP (IX71 only)	\$ 2,120
LG-Y71¹	LIGHT GUIDE	\$ 580
LG-Y71-LF	LIGHT GUIDE – Large Format	\$ 1,050
25-Y71-TL	TRANSMITTED – 25 mm	\$ 415
35-Y71-TL	TRANSMITTED – 35 mm	\$ 415

IX-73 / IX-83 (Y73)

10-Y73-EC	EXCITATION	\$ 415
32-Y73-EC	EXCITATION – 32 mm	\$ 415
10-Y73-EM	EMISSION	\$ 580
LG-Y73¹	LIGHT GUIDE	\$ 1,050
LG-Y73-LF	LIGHT GUIDE – Large Format	\$ 1,050
25-Y73-TL	TRANSMITTED – 25 mm	\$ 415
35-Y73-TL	TRANSMITTED – 35 mm	\$ 415
Y73-UP²	UP/DOWN SCOPE ADAPTER	\$ 1,510

¹ Replaces the epi-illuminator

² Contact Sutter for details



MICROSCOPE ADAPTERS

OLYMPUS

(CONTINUED)

OPTICAL DECKS

OD-Y73-7	OPTICAL DECK – NARROW	\$ 530
OD-Y73-15	OPTICAL DECK – WIDE	\$ 687
OD-Y73-R	RIGHT SIDE EXTENSION – 5"X9"	\$ 318
OD-Y73-L	LEFT SIDE EXTENSION – 5"X5"	\$ 212

NIKON

TMD (N10)
TS100 (N15)
DIAPHOT 200/300 (N20)
OPTIPHOT (N30)

Please contact Sutter to discuss your needs.

TE200/300 (N25)

10-N25-EC	EXCITATION	\$ 350
32-N25-EC	EXCITATION – 32 mm	\$ 350
10-N25-EM	EMISSION (needs 1x relay lens)	\$ 415
35-N25-TL*	TRANSMITTED – 35 mm	\$ 350
10-N25-QB	BOTTOM (QUANTUM)	\$ 415
LG-N25¹	LIGHT GUIDE	\$ 815

TE2000 (N27)

10-N27-EC	EXCITATION	\$ 350
32-N27-EC	EXCITATION – 32 mm	\$ 350
10-N27-EM	EMISSION	\$ 415
35-N27-TL	TRANSMITTED – 35 mm	\$ 350
LG-N27¹	LIGHT GUIDE	\$ 815
LG-N27-LF	LIGHT GUIDE – Large Format	\$ 1,050
10-N27-SU³	STAGE UP	\$ 1,475

Ti (N29)

10-N29-EC	EXCITATION	\$ 350
32-N29-EC	EXCITATION – 32 mm	\$ 350
10-N29-EM	EMISSION	\$ 415
35-N29-TL	TRANSMITTED – 35 mm	\$ 350
LG-N29¹	LIGHT GUIDE	\$ 815
LG-N29-LF	LIGHT GUIDE – Large Format	\$ 1,050
10-N29-SU²	STAGE UP	\$ 1,890
10-N29-SB³	STAGE UP – Bracket only	\$ 665
MA-N29⁴	MOSAIC	\$ 2,600

¹ Replaces the epi-illuminator

² Contact Sutter for details

³ Places wheel in infinity path below the dichroic cassette

⁴ For use with Mosaic and TIRF attachment

**Please contact Sutter to discuss solutions and early model Nikon scope adapters.*



MICROSCOPE ADAPTERS

NIKON (CONTINUED)

Ti2 (N31)	
10-N31-EC	EXCITATION \$ 350
32-N31-EC	EXCITATION – 32 mm \$ 350
10-N31-EM	EMISSION \$ 415
35-N31-TL	TRANSMITTED – 35 mm \$ 350
LG-N31¹	LIGHT GUIDE \$ 815
LG-N31-LF	LIGHT GUIDE – Large Format \$ 1,050
LG-N31-SF	LIGHT GUIDE – Small Format \$ 815
10-N31-SB³	STAGE UP – Bracket only \$ 665
E400 & E600 (N40)	
10-N40-EC⁴	EXCITATION \$ 580
32-N40-EC⁴	EXCITATION – 32 mm \$ 350
10-N40-EM	EMISSION \$ 415
LG-N40⁵	LIGHT GUIDE \$ 580
LG-N40-R⁶	LIGHT GUIDE \$ 560
AZ 100 (N50)	
LG-N50	LIGHT GUIDE \$ 580
FN1 (N65)	
10-N65-EC	EXCITATION \$ 350
32-N65-EC	EXCITATION – 32 mm \$ 350
10-N65-EM	EMISSION \$ 415
LG-N65-LF	LIGHT GUIDE – Large Format \$ 415
E800 & E1000 (N80)	
10-N80-EC	EXCITATION \$ 350
32-N80-EC	EXCITATION – 32 mm \$ 350
10-N80-EM	EMISSION \$ 415
LG-N80	LIGHT GUIDE \$ 580
50i / 80i / 90i / Ni(N85)	
10-N85-EC	EXCITATION \$ 465
32-N85-EC	EXCITATION – 32 mm \$ 465
10-N85-EM⁷	EMISSION \$ 415
10-N85-IN⁸	EMISSION – INFINITY \$ 795
LG-N85	LIGHT GUIDE \$ 700
LG-N85-LF	LIGHT GUIDE – Large Format \$ 1,050
35-N85-TL	TRANSMITTED – 35 mm \$ 415

¹ Replaces the epi-illuminator

² For use in conjunction with standard Nikon 70 mm stage up kit (MED532000)

³ For use with infinity path emission wheel applications only. Not applicable for any other applications.

⁴ We'll need to know which epi-illuminator you have

⁵ For use with sliding dichroic illuminator

⁶ For use with rotating dichroic illuminator

⁷ Compatible with trinocular head that uses the Y-T photo tube. All other need infinity emission adapter.

⁸ Puts filter wheel in emission infinity path



MICROSCOPE ADAPTERS

ZEISS

AXIOSKOP 2 & 2 FS (Z25)

10-Z25-EC	EXCITATION	\$ 250
10-Z25-EM¹	EMISSION	\$ 470
35-Z25-TL	TRANSMITTED – 35 mm	\$ 350
LG-Z25	LIGHT GUIDE	\$ 580

AXIOVERT 35 and 100 series (Z30)

10-Z30-EC	EXCITATION	\$ 250
LG-Z30²	LIGHT GUIDE	\$ 580
10-Z30-KP	KELLER PORT	\$ 415
10-Z30-KP-M	KELLER PORT (100M SCOPE)	\$ 415
10-Z30-SP	SIDE PORT	\$ 470
10-Z30-TH	TRINOCULAR HEAD	\$ 470
10-Z30-TH-M	TRINOCULAR HEAD (135M SCOPE)	\$ 445

AXIOVERT 200 (Z35)

10-Z35-EC	EXCITATION	\$ 250
32-Z35-EC	EXCITATION – 32 mm	\$ 350
10-Z35-EM	EMISSION (side port on left)	\$ 700
10-Z35-EM-M	EMISSION – motorized	\$ 700
35-Z35-TL	TRANSMITTED – 35 mm	\$ 350
10-Z35-KP	KELLER PORT	\$ 580
LG-Z35	LIGHT GUIDE	\$ 580
LG-Z35-LF	LIGHT GUIDE – Large Format	\$ 1,050

AXIO OBSERVER (Z40)

10-Z40-EC	EXCITATION	\$ 250
32-Z40-EC	EXCITATION – 32 mm	\$ 350
10-X10-EM³	EMISSION (adapter only)	\$ 110
10-X20-EM	EMISSION (with relay optical system)	\$ 3,395
LG-Z40²	LIGHT GUIDE	\$ 580
LG-Z40-LF	LIGHT GUIDE – Large Format	\$ 1,050
25-Z40-TL	TRANSMITTED – 25 mm	\$ 395
35-Z40-TL	TRANSMITTED – 35 mm	\$ 395

AXIO IMAGER (Z45)

AXIO EXAMINER

10-Z45-EC	EXCITATION	\$ 250
32-Z45-EC	EXCITATION – 32 mm	\$ 350
10-X10-EM³	EMISSION (adapter only)	\$ 110
10-X20-EM	EMISSION (with relay optical system)	\$ 3,395
LG-Z45	LIGHT GUIDE	\$ 580
LG-Z45-LF	LIGHT GUIDE – Large Format	\$ 1,050
25-Z45-TL	TRANSMITTED – 25 mm	\$ 395
	TRANSMITTED – 35 mm	<i>Phone Sutter</i>

AXIOPLAN 2 (Z50)

Please contact Sutter to discuss your needs

¹ Please specify standard or ergonomic trinocular head

² Replaces the epi-illuminator

³ Will need to be used with a relay optical system



MICROSCOPE ADAPTERS

LEICA

DMR (L10)		
10-L10-EC	EXCITATION	\$ 350
32-L10-EC	EXCITATION – 32 mm	\$ 350
10-L10-EM	EMISSION	\$ 580
LG-L10	LIGHT GUIDE	\$ 795
DMIRB & DMIRE2 (L20)		
10-L20-EC	EXCITATION	\$ 350
32-L20-EC	EXCITATION – 32 mm	\$ 350
10-L20-EM¹	EMISSION	\$ 580
LG-L20¹	LIGHT GUIDE	\$ 795
LG-L20-LF	LIGHT GUIDE – Large Format	\$ 1,050
DM 4000/5000/6000 (L30)		
10-L30-EC	EXCITATION	\$ 350
32-L30-EC	EXCITATION – 32 mm	\$ 350
10-L30-EM	EMISSION	\$ 580
LG-L30	LIGHT GUIDE	\$ 795
LG-L30-LF	LIGHT GUIDE – Large Format	\$ 1,050
DM 6000 FS (L35)		
10-L35-EC	EXCITATION	\$ 350
32-L35-EC	EXCITATION – 32 mm	\$ 350
10-L35-EM	EMISSION	\$ 580
LG-L35	LIGHT GUIDE	\$ 795
LG-L35-LF	LIGHT GUIDE – Large Format	\$ 1,050
DMI 4000/5000/6000 (L40)		
10-L40-EC	EXCITATION	\$ 350
32-L40-EC	EXCITATION – 32 mm	\$ 350
10-L40-EM	EMISSION	\$ 580
35-L40-TL	TRANSMITTED – 35 mm	\$ 350
LG-L40²	LIGHT GUIDE	\$ 795
LG-L40-LF	LIGHT GUIDE – Large Format	\$ 1,050
DMi8		
10-L45-EC	EXCITATION	\$ 350
32-L45-EC	EXCITATION – 32 mm	\$ 350
10-L45-EM	EMISSION	\$ 580
35-L45-TL	TRANSMITTED – 35 mm	\$ 350
LG-L45	LIGHT GUIDE	\$ 795
LG-L45-LF	LIGHT GUIDE – Large Format	\$ 1,050

OTHER ADAPTERS

YOKOGAWA CSU-X1(J15)		
10-J15-EM³	EMISSION	\$ 1,100
SUTTER LAMBDA VF-5/VF-1		
10-X20-EM	EMISSION (with relay optical system)	\$ 3,395
CARV (J20)		
CARV II	<i>Please contact Sutter to discuss your needs.</i>	

¹ Please specify standard or ergonomic trinocular head

² Replaces the epi-illuminator

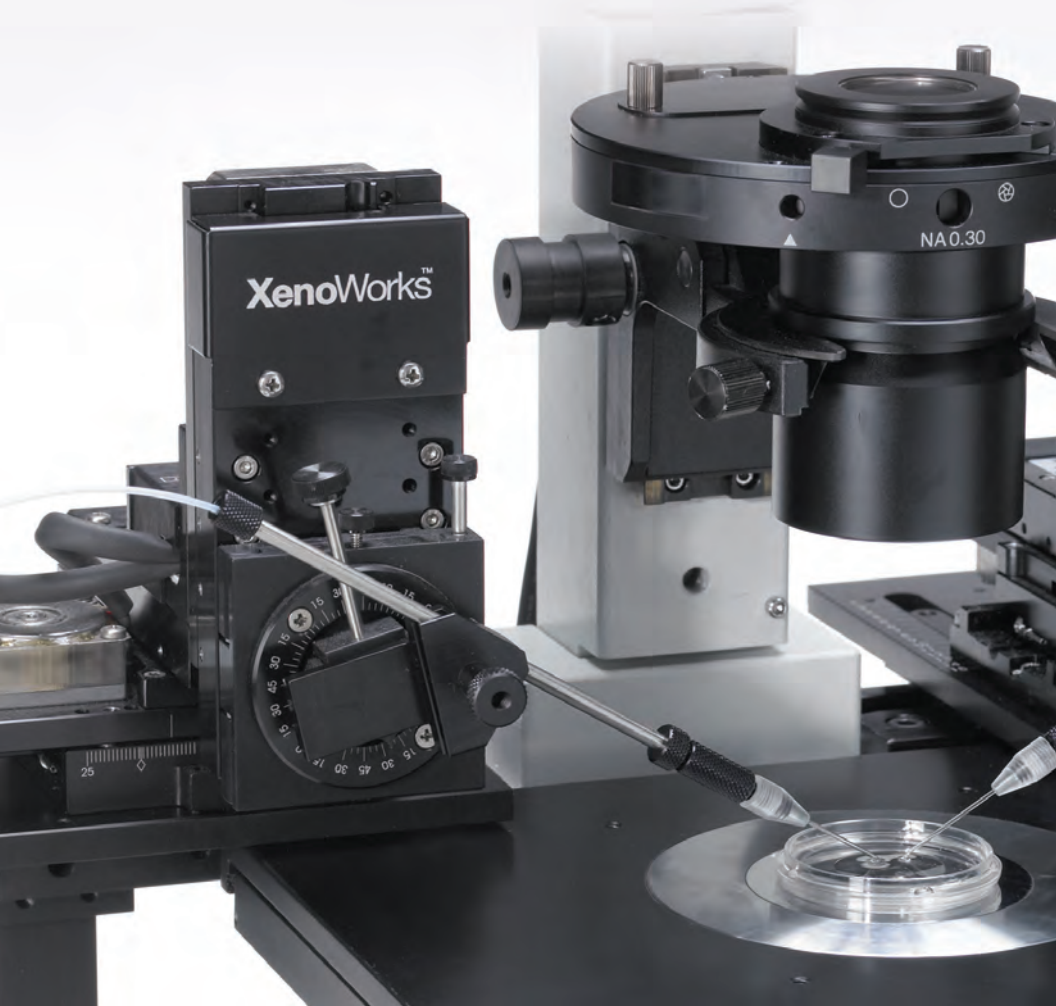
³ Fits both emission ports

MICROINJECTION

XenoWorks® is a modular microinjection system designed to meet a wide variety of application needs. Our experience with precision motor control has culminated in this state-of-the-art system.

The XenoWorks Micromanipulator uses a classic inverted joystick design for excellent ergonomics, intuitively linking the user with the micropipette. Combined with our smooth, responsive stepper-motor drives, the XenoWorks Manipulator provides exceptional mechanical stability, sensitivity, and range of movement.

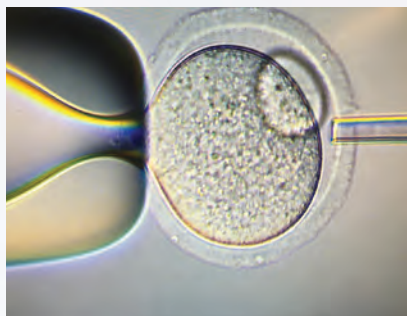
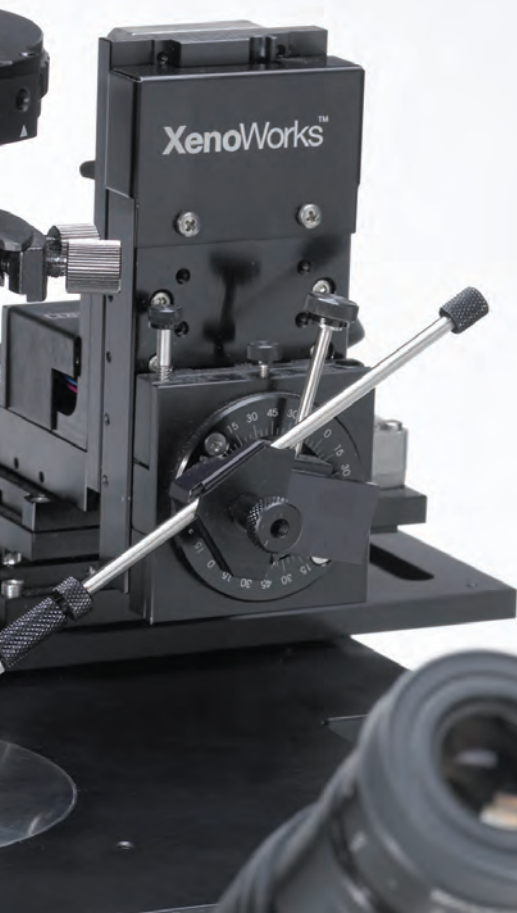
The XenoWorks Digital Microinjector was designed for precision manipulation of cells via an easy-to-use interface. The Digital Microinjector employs two pressure ports, one for holding suspended cells, and a second channel is available for both high-pressure injection and gentle positive/negative pressure for transfer of embryonic stem cells. Both injection duration and pressure are easily selectable using rotary knobs on the remote interface. The built-in compressor removes the need for an external pressure supply.



The XenoWorks family also includes the Analog Microinjector for simple cell holding and transfer applications, which incorporates the same smooth response and ergonomic design of our other XenoWorks products.

APPLICATIONS

- Pronuclear microinjection of DNA into mouse zygote
- Embryonic stem cell transfer into blastocysts
- Somatic cell nuclear transfer (ES cell)
- Intracytoplasmic sperm injection (ICSI)
- Piezo-assisted sperm-mediated transgenesis Nuclear transfer (NT)
- Adherent cell microinjection
- Drosophila injection
- C. elegans injection
- Zebrafish injection
- Contact Sutter for suitability of XenoWorks for applications not listed here





XENOWORKS®

MICROMANIPULATOR



FEATURES XENOWORKS® MICROMANIPULATOR

- Height and tension adjustable inverted joystick for optimal ergonomics
- Exceptionally smooth and responsive micropipette movement
- “Home” position for fast micropipette exchange
- User-definable memory positions, including “Work” and Z-axis lower limit
- Y-axis lock-out for pure X-axis travel
- 25 mm of travel in all three axes
- Touch declutch mechanism
- 6 speeds from coarse to ultra-fine
- USB interface



The XenoWorks® Micromanipulator has been designed around our hugely-successful MP-285 electrophysiology micromanipulator, with the addition of a smooth-moving adjustable inverted joystick. Because the motor drive is based on an electrophysiology design, the XenoWorks Micromanipulator is extremely stable and resistant to ambient vibration. This stability also makes this manipulator an ideal platform for use in conjunction with the PrimeTech PMM-4G or PMM-150FU Piezo Impact Drive, for applications such as mouse nuclear transfer and intracytoplasmic sperm injection.

The joystick offers an unprecedented level of user comfort during operation. The use of an inverted joystick in conjunction with an almost zero-profile base allows the operator to rest their hands and forearms on the bench surface, providing ease of use and added ergonomics. The function keys and declutch mechanism can be located and activated by touch, removing the need to look away from the microscope, which will save time. Another time saving feature is the "Setup" function. Activating the setup function places the micromanipulator in the optimum position prior to beginning work (halfway on the Y-axis, three-quarters down on the Z-axis and three-quarters inwards on the X-axis). Once the manipulator is in the default setup position, the micropipette tip will be positioned within the microscope's optical path, reducing the time required find the pipette tip through the microscope. The setup function also ensures an adequate travel range in all axes of motion prior to starting work.

The manipulator uses a pre-programmed "Home" position for fast micropipette exchange, and the ability to determine a "Work" position so the pipette can be repositioned with the press of a button. A Y-axis lockout function allows X-only axial movement for maximum control during injections, and a Z-limit memory position is used to prevent the pipette from colliding with the bottom of the dish.

The XenoWorks joystick is designed to allow the user to immediately develop an intuitive feel that makes it easy to precisely control position. Movement of the joystick is directly converted to a proportional movement of the manipulator. Speed control, center of travel, and programmable positions are right at your fingertips. One unique feature of the joystick is the declutch mechanism that allows for rapid repositioning of the joystick without moving the pipette. Combining this advanced joystick with the proven Sutter MP-285 manipulator technology creates an ideal system for intensive microinjection.





SPECIFICATIONS
XENOWORKS® MICROMANIPULATOR

■ Travel	25 mm on all three axes	
■ Maximum Resolution	62.5 nm/microstep	
■ Maximum Speed	5.5 mm/sec	
■ Range	X & Y Axis (1 joystick swing)	Z Axis (1 rotation)
	C 12,700 µm	3,200 µm
	1 3,300 µm	800 µm
	2 880 µm	400 µm
	3 400 µm	200 µm
	4 200 µm	100 µm
	5 100 µm	50 µm
■ Joystick	• Inverted joystick with touch declutch • Height and resistance adjustable • Independent axis-polarity switches • 6 speed settings • 'Setup' function • 1 user-defined set point ('Work'), • 1 user-defined axis limit ('Z-floor'), • 2 preset points ('Home' and 'Setup') • Y-axis lockout	
■ Dimensions	<i>Motor drive:</i> 112 mm x 185 mm x 145 mm <i>Joystick:</i> 265 mm x 240 mm x 226 mm <i>Control:</i> 407 mm x 280 mm x 101 mm	
■ Electrical	120/240 Volts 50/60 Hertz power line	



(Shown: MT-81-DOV8.)

**US PRICES****XENOWORKS® MICROMANIPULATOR**

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

■ BRML	XenoWorks® Micromanipulator (Left) Includes: 3 axis motor drive (left-hand configuration), motor drive base plate, controller, joystick user-interface, connecting cables, and manual	\$ 16,450
■ BRMR	XenoWorks Micromanipulator (Right) Includes: 3 axis motor drive (right-hand configuration), motor drive base plate, controller, joystick user-interface, connecting cables, and manual	\$ 16,450

XENOWORKS MICROSCOPE ADAPTERS

All microscope adapters are positionally independent and single-sided unless otherwise specified.

■ BR-L20	Leica DMIRB/E/IRE2 adapter	\$ 505
■ BR-L30	Leica DMIL adapter	\$ 505
■ BR-L30-H	Leica DMIL adapter with moving stage	\$ 505
■ BR-L40	Leica DMI 4/5/6000 adapter (single and double-sided)	\$ 555
■ BR-N10	Nikon TMD adapter	\$ 505
■ BR-N25	Nikon TE200/300 adapter	\$ 505
■ BR-N27	Nikon TE2000 adapter	\$ 505
■ BR-N29	Nikon Ti adapter	\$ 505
■ BR-N29-M	Nikon Ti adapter for scopes with motorized stage	\$ 505
■ BR-N31	Nikon Ti2 adapter	\$ 505
■ BR-N31-2	Nikon Ti2 adapter (double-sided)	\$ 1,010
■ BR-Y50	Olympus IX50/70 adapter	\$ 505
■ BR-Y51	Olympus IX51/71/81 adapter	\$ 505
■ BR-Y51-FL	Olympus IX51/71/81 adapter with ZDC autofocus, left	\$ 580
■ BR-Y51-FR	Olympus IX51/71/81 adapter with ZDC autofocus, right	\$ 580
■ BR-Y73	Olympus IX53/73/83 adapter	\$ 505
■ BR-Y73-2	Olympus IX53/73/83 adapter (double-sided)	\$ 1,010
■ BR-Z30	Zeiss Axiovert 100/135 adapter	\$ 505
■ BR-Z35	Zeiss Axiovert 200 adapter	\$ 505
■ BR-Z40	Zeiss Axio Observer adapter	\$ 505
■ BR-Z50	Zeiss Axiovert A1 adapter	\$ 505
■ BR-CUST	Custom microscope adapter	\$ 1,035

ACCESSORIES

■ BR-AW	Rod holding clamp (for rod OD 2 mm–4 mm)	\$ 101
■ MT-81-DOV8¹	MT-81 stand with 8 inch dovetail	\$ 626
■ MT-81-DOV12¹	MT-81 stand with 12 inch dovetail	\$ 626
■ MAG-MT	Magnetic feet (set of 4)	\$ 70
■ BR-HEA-CV²	Swing gate conversion for MP-285 / MP-225	\$ 455

¹ Useful with stereo or dissection scopes.

² Factory installation required. No charge when when ordered with manipulator.

XENOWORKS®

DIGITAL MICROINJECTOR



FEATURES

XENOWORKS® DIGITAL MICROINJECTOR

- Built-in compressor with remote user interface
- Two independent pressure channels
- Negative and positive pressure
- Two injection modes: pulse and continuous
- Four functions: Hold, Transfer, Inject, Clear
- Transfer channel provides compensation pressure for high pressure injection
- Five range settings for transfer/compensation pressure
- Rotary controls for continuous pressure adjustment
- ON-OFF key for Hold channel
- Standby mode for transfer/compensation channel
- USB port



The XenoWorks® Digital Microinjector is designed for transgenic mammal workstations, and adherent cell, *C. elegans*, *drosophila*, zebrafish, *xenopus* and sea urchin injections. It is capable of holding oocytes and embryos while simultaneously providing a separate pressure channel for pronuclear microinjection of DNA or the gentle control of embryonic stem cells as they are transferred into blastocysts. The microinjector employs two independent pressure channels: Hold and Inject/Transfer, which are controlled via the remote user interface.

The hold port is a self-contained vacuum channel for gentle suspension-cell holding and can be switched on and off as needed. The responsive rotary control is used to dial the pressure up or down according to the degree of hold required.

The injector/transfer port is a second channel for delivering both high-pressure for femtoliter to microliter volume injections, and gentle positive/negative pressure for embryonic stem (ES) cell transfer. The transfer channel has five range settings to optimize the system to each application and user preference. It also includes a Clear function which can be used if the pipette gets clogged. Two modes of injection, Continuous or Pulse, in combination with a balance pressure, are available on this channel. In the Continuous mode, the inject pressure is applied to the micropipette tip for as long as the hand- or foot-switch is held down. In the Pulse mode, the inject pressure is applied for a precisely timed duration, which can be set in 0.01 second increments. Both injection duration and pressure are easily selectable using rotary controls on the remote interface. Injections are executed using the inject key on the remote interface or the footswitch.

Optimal ergonomics are again a prime consideration. The remote interface unit provides access to all keys and rotary controls necessary to manipulate the parameters of the two pressure channels, while the separate compressor controller can be positioned away from the microscope to eliminate vibration.

In addition to pronuclear injection, the XenoWorks Digital Microinjector can be used for a variety of intracellular and extracellular applications including adherent and suspended cell microinjection.



SPECIFICATIONS

XENOWORKS® DIGITAL MICROINJECTOR

- Hold Function** *Hold pressure:*
–350 to +350 hPa in 1 hPa increments
- Inject Function** *Inject modes:* Continuous or Pulse
Inject pressure: 0 to 5600 hPa in 7 hPa increments
Compensation pressure: Adjustable in 1 hPa increments
Inject time: 0 to 10 seconds in 0.01 sec increments
Clear pressure: 6700 hPa (97 psi)
Inject command: Remote interface or foot switch
- Transfer Function** *Transfer pressure:*
–175 to +175 hPa (Range setting 1) in 1 hPa increments
Adjustable using range setting dial
- Maximum Injection Pressure** 5600 hPa (80 psi)
- Controls** Tactile keys, rotary optical encoders
3 x 7 segment LED display
- Micropipette Holder** *Rod Diameter:*
4 mm
Compatible with:
1mm capillary glass
(1.2 mm and 1.5 mm available upon request)
2.4 m ETFE tubing (2 additional sets included)
- Electrical** 115/230 Volts
50-60 Hertz power line
- Dimensions** *Compressor module:*
407 mm x 440 mm x 150 mm
User interface module
164 mm x 123 mm x 70 mm
- Weight** *Compressor module:*
1504 g
User interface module:
42 g



**US PRICES****XENOWORKS® DIGITAL MICROINJECTOR**

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

■ BRE	XenoWorks® Digital Microinjector. Includes: compressor module, footswitch, remote user interface, 2 micropipette holders with 2.4 m ETFE tubing and fittings, spare tubing, connecting cables, and manual	\$ 8,810
--------------	---	-----------------

ACCESSORIES

■ BR-DT	XenoWorks digital tubing kit	\$ 86
■ BR-MH¹	XenoWorks micropipette holder and tip	\$ 186
■ BR-MH1.0	Micropipette replacement tip (1.0 mm OD glass)	\$ 50
■ BR-MH1.2	Micropipette replacement tip (1.2 mm OD glass)	\$ 50
■ BR-MH1.5	Micropipette replacement tip (1.5 mm OD glass)	\$ 50
■ V001104	1/16 in clear ferrule for tubing	\$ 11
■ V300450	1.0 - 1.2 mm O-ring (package of 6)	\$ 30
■ V300455	1.5 mm O-ring (package of 6)	\$ 30

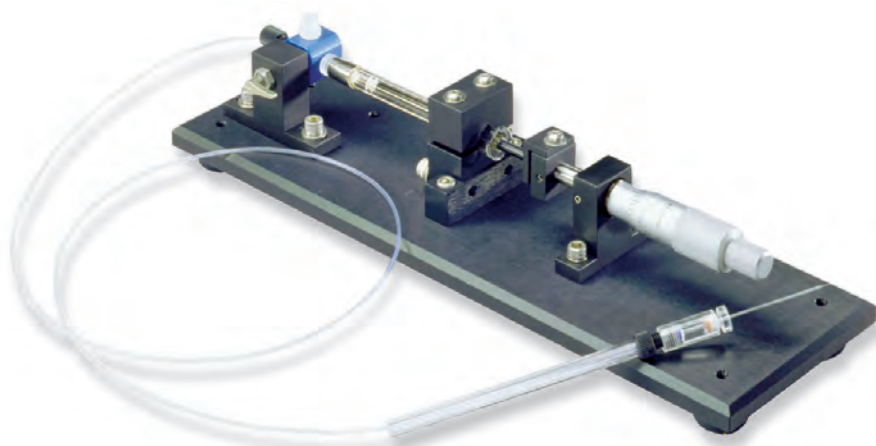
¹ Please specify tip size when ordering



(Remote user interface)



MANUAL MICROINJECTOR



The Manual Injector is a manual syringe driver for pneumatic or hydraulic control of injection needles or holding pipettes. It is suitable for injecting volumes in the nanoliter to microliter range. It is also widely used as a fluid control device for applications requiring sensitive manual control of the displacement of microneedle contents. The system is constructed from the highest quality parts. The base assembly is black anodized aluminum. A non-rotating Mitutoyo micrometer provides the drive to the gas-tight syringe¹. A precision 3-way valve provides a convenient method for filling the fluid line and clearing air bubbles from the line. Teflon tubing, chromatography connectors and a pipette holder² complete the system. The injection resolution is dependent on the volume of the syringe that is installed, as outlined in the table below. For example, with a 25 μl syringe installed, one complete rotation of the micrometer (25 divisions) yields a displacement equivalent to a volume of 267 nl and turning the micrometer one division (0.001 in) yields 10.6 nl.

SYRINGE VOLUME	VOLUME PER REVOLUTION	VOLUME PER DIVISION
10 μl	106 nl	4.2 nl
25 μl	267 nl	10.6 nl
50 μl	529 nl	21.2 nl
100 μl	1.06 μl	42.3 nl
250 μl	2.65 μl	105.8 nl
500 μl	5.29 μl	211.7 nl
1000 μl	10.58 μl	423.4 nl

¹ Please specify the syringe volume that you will be using. For animal IVF applications, 500 μl and 1000 μl syringes are commonly used.

² Unless specified otherwise, a pipette holder for 1 mm outside diameter glass will be supplied. The diameter of the pipette holder is 0.25 inches (6.4 mm). For micromanipulators that cannot accept this size holder, an adapter is optionally available. Please contact us for further information.



SPECIFICATIONS MANUAL MICROINJECTOR

■ Dimensions	12 in x 3.75 in x 4 in 30 cm x 9.5 cm x 10 cm
■ Weight	2.5 lbs 1 kg

US PRICES MANUAL MICROINJECTOR

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

■ MANUAL	Manual injector with non-rotating micrometer, 3-way valve, precision 50 µl gas-tight syringe, teflon tubing, connectors and MI-10010 pipette holder assembly for 1.0 mm capillary tubing*	\$ 1,510
-----------------	---	-----------------

** Other syringe volumes, and pipette holder sizes are available upon request.*

ACCESSORIES MANUAL MICROINJECTOR

■ MI-10010	Pipette holder assembly for 1.0 mm OD glass (includes holder and mounting rod)	\$ 65
■ MI-10012	Pipette holder assembly for 1.2 mm OD glass (includes holder and mounting rod)	\$ 65
■ MI-10015	Pipette holder assembly for 1.5 mm OD glass (includes holder and mounting rod)	\$ 65
■ BR-OIL	Oil for injector (100 ml)	\$ 45
■ V200050	Teflon tubing	\$ 9 per ft.
■ V001180	10 µl gas-tight syringe	\$ 121
■ V001181	25 µl gas-tight syringe	\$ 121
■ V001182	50 µl gas-tight syringe	\$ 121
■ V001183	100 µl gas-tight syringe	\$ 121
■ V001184	250 µl gas-tight syringe	\$ 121
■ V001185	500 µl gas-tight syringe	\$ 121
■ V001186	1000 µl gas-tight syringe	\$ 121



PRIME TECH PMM-4G

PIEZO IMPACT DRIVE



FEATURES PMM-4G

- Smooth insertion of microcapillary into cell membrane
- Precise movement of micromanipulator within range of travel
- Inertial force from piezo-electric control minimizes damage of biomembranes
- Touch screen display
- Smaller piezo drive unit is adjustable on rod
- High resolution and precise positioning (minimum controllable dimensions)
- 3 Modes: Standard, Piezo ICSI, and Expert
- 8 memory program positions
- Compact design



Delicate perforation of the membranes and easy operation are essential for micromanipulation. With Prime Tech's knowledge and well established experience in microinjection, and their long-standing expertise in Piezo technology demonstrated in the very popular PMM-150FU, Prime Tech has created the new Piezo PMM4G. The improvements introduced in the Piezo PMM4G include; a smaller and more effective drive unit with improved transmission efficiency of force to pipette, 3 programmable modes: Standard, Piezo-ICSI and Expert to optimize manipulation for specific protocols, and an enhanced Piezo design that provides a more gentle and effective impact. The advanced user interface with a touch screen display provides ease of input and displays the current injection settings in a compact design that fits easily around the microscope. In addition, the new controller gives the user the ability to more precisely adjust the driving force.

Prime Tech is very pleased to introduce the new Piezo PMM4G where the new design features and functions allow the user to attain a level of micromanipulation that is "Gentle for both Oocyte and Operator." The PMM4G is user-friendly to both the beginner and the expert!

Drive unit [MB-D]

The new MB-D drive unit easily mounts to the manipulator and has greater durability and performance. PMM4G enables the injection to be performed more gently through improvements to the drive unit.

Interface Module [TS-1]

The PMM4G touch screen interface displays the various "mode" choices and settings. The Interface Module is compact so it can easily be situated next to the user. Settings can be selected or an on/off switch used to control the entire unit.

PMAS-CT4G

The MPAS-CT4G controller includes a power saving function and has been reduced in size compared to the previous model PMAS-CT150. The new controller remains compatible with the PMM-150HJ/FU Operating Box [OP-15].

The PMM-4G is designed for multiple micromanipulation applications including:

- ICSI
- Enucleation
- Nuclear Transfer
- ES Cell Injection
- Assisted Hatching



SPECIFICATIONS PMM-4G

■ Piezo Impact Drive Unit (MB-D)	Moving range: ~5 mm Traveling resolution: ~0.1 μ m Traveling speed: 0.04 mm/s max
■ Operation Box	Touch screen display 3 modes of operation: Standard, Piezo-ICSI, Expert Expert mode has 8 program positions 1/2 + 2/3 power options
■ Foot Switch	Mode A/B selection Activation of Piezo
■ Dimensions	<i>Controller:</i> 9.5 in x 13 in x 5.5 in 240 mm x 340 mm x 140 mm <i>Operation Box:</i> 4 in x 6.3 in x 2.4 in 100 mm x 160 mm x 60 mm <i>Foot Switch:</i> 5.5 in x 5.5 in x 1.5 in 145 mm x 145 mm x 38 mm
■ Weight	<i>Controller:</i> 11 lbs 5 kg <i>Piezo Drive Unit:</i> 0.3 lbs 125 g <i>Operation Box:</i> 1.2 lbs 530 g <i>Foot Switch:</i> 1.8 lbs 820 g
■ Electrical	AC supply of 100-240 Volts 50/60Hz, 50 mA
■ Temperature	Operates at 5° to 40° C Avoid high humidity





US PRICES PMM-4G

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

■ PMM-4G

Includes: controller, operation box,
piezo impact drive and foot switch

**Phone Sutter
for pricing**

*Available from Sutter in the Western Hemisphere.
Please contact Sutter for other international destinations.*



PRIMETECH HDJ-M3 HYDRAULIC MICROINJECTOR



FEATURES HDJ-M3

- A large plunger knob that is extremely light to the touch means that you can operate the HDJ-M3 with a single digit
- Flexible layout accommodates multiple connector configurations
- Airtight, with luer connector and O-ring means that you can expect leakage-free microinjection

DESCRIPTION HDJ-M3

The HDJ-M3 microinjector from PrimeTech is a manual water/oil type pressure injector. The HDJ-M3 will allow you to inject spermatozoa, DNA and/or other solutions into somatic cells, unfertilized eggs or embryos. Manual operation with HDJ-M3 allows maximum sensitivity and optimized performance during micromanipulation.

HDJ-M3 is compatible with other models in the PMM Series, including the PMM-150FU and PMM-4G Piezo impact drive units.



SPECIFICATIONS HDJ-M3

- | | |
|-------------------------|---|
| ■ Syringe Volume | 1.9 ml Screw
Pitch: 0.05 mm
Stroke: 20 mm |
| ■ Dimensions | 2.75 in (W) x 7.2 in (D) x 3.5 in (H)
70 mm (W) x 182.5 mm (D) x 90 mm (H) |
| ■ Weight | 1.9 lbs
0.88 kg |

US PRICES HDJ-M3

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

- | | |
|-----------------|-------------------------|
| ■ HDJ-M3 | Hydraulic Microinjector |
|-----------------|-------------------------|

**Phone Sutter
for pricing**

*Available from Sutter in the Western Hemisphere.
Please contact Sutter for other international destinations.*



PRIMETECH PNJ-T2 PNEUMATIC MICROINJECTOR



FEATURES PNJ-T2

- PNJ-T2 is optimized for use with PMM systems
- Low-maintenance
- Highly responsive pneumatic control

DESCRIPTION PNJ-T2

The PNJ-T2 pneumatic microinjector from PrimeTech is optimized for use with the PMM piezo impact drives. The PNJ-T2 has a smooth motion and positive feel. The pneumatic system requires little maintenance compared to hydraulic units.

Suitable for a wide range of applications.



SPECIFICATIONS PNJ-T2

■ Syringe Volume	5.0 ml Screw Pitch: 2.0 mm Diaphragm Travel: 16 mm
■ Dimensions	2.9 in (W) x 6.55 in (D) x 3.5 in (H) 73 mm (W) x 166.6 mm (D) x 90 mm (H)
■ Weight	2.05 lbs 0.93 kg

US PRICES PNJ-T2

International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.

■ **PNJ-T2** Pneumatic Microinjector

**Phone Sutter
for pricing**

*Available from Sutter in the Western Hemisphere.
Please contact Sutter for other international destinations.*

APPLICATIONS

The configuration of any micro-injection system will depend upon the application for which it is used. Some common applications and system configurations are:

Embryonic Stem Cell Transfer into Blastocysts

Animals, usually mice, can be engineered with a specific gene function reduced or knocked out altogether by introducing genetically altered embryonic stem cells into the cavity of a blastocyst so that the stem cells contribute to the embryo. The resulting live animal is a chimera of both genotypes. Subsequent selective interbreeding of manipulated animals results in pure-bred gene “knock-outs” or “knock-downs” and can be used for subsequent gene function studies. This operation requires two micromanipulators, one for holding the blastocyst and one for transferring the cells. Both holding and transfer functions require gentle positive and negative pressure for which the Digital Microinjector is ideal. Alternatively, two Prime Tech Microinjectors may be substituted.

Suggested system configuration:

- 1 x Micromanipulator (Right) BRMR
- 1 x Micromanipulator (Left) BRML
- 1 x Digital Microinjector BRE
- or
- 2 x Prime Tech Microinjector
- 2 x Microscope Adapter



Zygote Pronuclear DNA Microinjection

The microinjection of DNA into the pronucleus of a newly-fertilized mammalian egg is now a common and highly efficient method of creating transgenic offspring.

Pronuclear microinjection was first described in the mouse, but now many different transgenic animals have been created in this way. Because the micropipette used for injection has an internal diameter typically less than one micron, relatively high pressure (>3000 hPa) is required to inject the DNA solution. Two micromanipulators are required, one to hold the zygote and one to inject the DNA. Gentle negative pressure is used on the holding side, while pulses of high pressure are used to inject 1–2 picoliters of DNA solution into the pronucleus. The XenoWorks® Digital Microinjector is ideal for this application, having simultaneous holding and high-pressure injecting capabilities.

Suggested system configuration:

- 1 x Micromanipulator (Right) BRMR
- 1 x Micromanipulator (Left) BRML
- 1 x Digital Microinjector BRE
- 2 x Microscope Adapter





APPLICATIONS

The configuration of any micro-injection system will depend upon the application for which it is used. Some common applications and system configurations are:

Somatic Cell Nuclear Transfer

The enucleation of an oocyte followed by the transplantation of a somatic cell is a method of producing genetically identical copies (clones) of the animal from which the donor cell was taken. Generally, two micromanipulators are required: one for holding the oocyte and one for the enucleating and injecting procedures. Each micromanipulator grips a single micropipette holder with a microinjector attached. Oocyte holding, enucleation and somatic cell transplantation require gentle, low positive and negative pressure, making the Prime Tech Microinjector ideal.

Suggested system configuration:

- 1 x Micromanipulator (Right) BRMR
- 1 x Micromanipulator (Left) BRML
- 2 x Prime Tech Microinjector
- 2 x Microscope Adapter



Intracytoplasmic Sperm Injection

Intracytoplasmic sperm injection (ICSI) can be employed for veterinary in-vitro fertilization during rare species preservation or for any veterinary assisted conception. ICSI may also be used as a gene transfer technique when sperm are co-injected with exogenous DNA (see also Piezo-assisted ICSI, below). Typically, two micromanipulators are used, one for oocyte holding and one for sperm aspiration and injection. Each micromanipulator grips a single micropipette holder with a microinjector attached. Since low positive and negative pressures are required for the delicate task of oocyte holding and sperm injection, an ICSI workstation should be configured with two Prime Tech Microinjectors.

Suggested system configuration:

- 1 x Micromanipulator (Right) BRMR
- 1 x Micromanipulator (Left) BRML
- 2 x Prime Tech Microinjector
- 2 x Microscope Adapter





APPLICATIONS

The configuration of any micro-injection system will depend upon the application for which it is used. Some common applications and system configurations are:

Piezo-assisted ICSI

This relatively new technique can be employed for assisted conception in animals in which standard ICSI fails, such as mice. Piezo-assisted micro-injection has also been employed as a gene transfer method, where sperm are coated in exogenous DNA and injected into oocytes. The microinjection workstation required for this technique is very similar to standard ICSI, but with the addition of a piezo impact drive attached to the injecting micropipette holder. The device vibrates the injecting micropipette axially and drills its way into the oocyte. This method has been shown to increase success rates. Because the micropipette is vibrating at minute amplitude but high frequency, it is vital to use a mechanically stable micromanipulator, which will not vibrate in sympathy. The more stable the micromanipulator, the more efficient the energy transfer from the piezo impact drive to the micropipette tip. Some piezo-assisted microinjection protocols currently require a bead of mercury inside injecting micropipette. Please note that mercury should not be used in conjunction with the Digital Microinjector, though the Prime Tech Microinjector is ideal for this purpose.

Suggested system configuration:

- 1 x Micromanipulator (Right) BRMR
- 1 x Micromanipulator (Left) BRML
- 2 x Prime Tech Microinjector
- 2 x Microscope Adapter
- 1 x PMM-150FU or PMM-4G



Microinjection of Cultured, Adherent Cells

Cultured cell lines such as 3T3, CHO and HeLa can be microinjected while attached to a Petri dish. The procedure is best viewed through phase-contrast optics; a single micromanipulator and a single high-pressure microinjection channel are required. The tip of a sharp (inner diameter less than 1 micron) micropipette is brought down on top of a single cell and a pulse of high (100 - 1000 hPa) pressure applied. The cell membrane is ruptured and the cell can be seen to inflate slightly. Volumes injected are typically less than 5% of the cell volume. Success rates vary widely depending upon the type and volume of compound injected, the culture conditions and the cell line used. The high-pressure function of the Digital Microinjector and the smooth, fine control of the micromanipulator are particularly well-suited to this application.

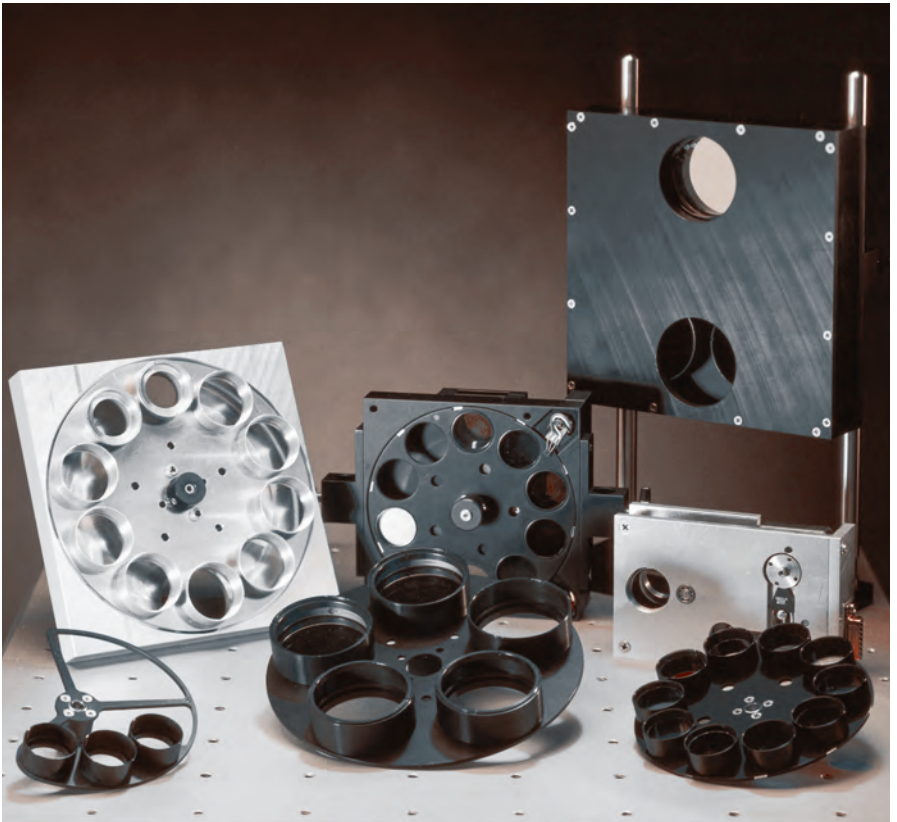
Suggested system configuration:

- 1 x Micromanipulator (Right) BRMR
- 1 x Digital Microinjector BRE
- 1 x Microscope Adapter

Please contact Sutter Instrument for help and advice with these and any other microinjection needs.

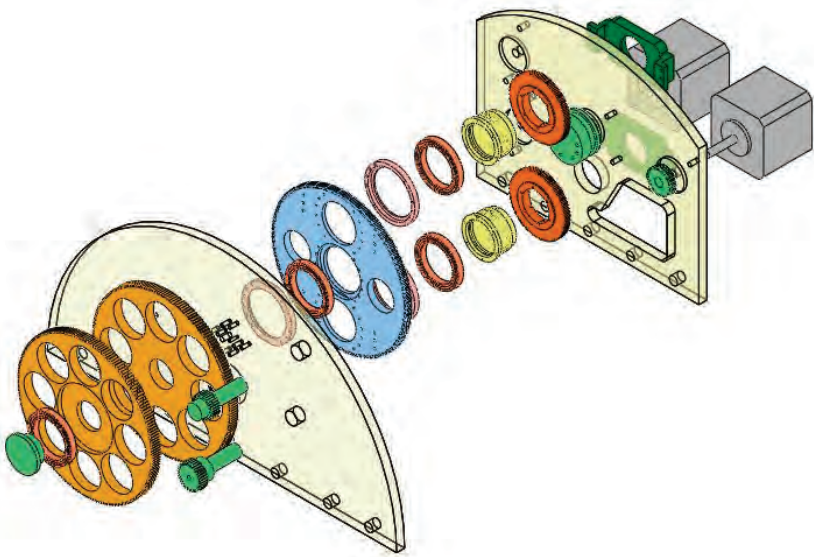
OEM PRODUCTS

Customization of our optical product line for unique applications has become a specialty for Sutter Instrument. Our production facilities include in-house electronic design, circuit board layout, embedded systems programming, and state-of-the-art CNC machining and turning centers for volume production of precision mechanical components. This expertise gives Sutter the ability to provide timely, cost-effective engineering and manufacturing solutions for Original Equipment Manufacturers (OEMs). The proven performance and reliability of our optical filter wheel systems has made them a desirable choice for a range of OEM applications. Examples of custom designs include 5-position and 10-position wheels with 2 inch filters, 12-position arrays, compact belt-driven filterwheels, cryogenic and high vacuum filterwheels, rotating polarizers, an RS-485 serial bus allowing 16 controllers to share a single serial port on a host computer, and mounting adapters for a wide range of microscopes. Sutter currently has several significant OEM contracts and will continue to establish new OEM relationships. Please contact Sutter for more information about custom filter changing devices.





SAMPLE OEM PROJECT



A sample design project shown above: A cryogenic dual wheel with twin adjustable rotating polarizers for use in infrared astronomy.



INTERNATIONAL DEALERS

A complete listing of international distributors and resellers in over 35 countries is available on our web site at **www.sutter.com**. Customers worldwide are welcome to purchase our products directly; however, for overseas sales, Sutter recommends that you purchase through one of our local distributors.

ARGENTINA

Microlat S.R.L.

Carlos Pellegrini 755-9B
Buenos Aires, 1009 Argentina
tel: 54-11-4326-5205
fax: 54-11-4326-2128
email: importaciones@microlat.com.ar
web: www.microlat.com.ar

AUSTRIA

Science Products GmbH

phone: +43 7207 75455
info@science-products.com
web: www.science-products.at

AUSTRALIA

SDR Scientific

206 / 354 Eastern Valley Way
Chatswood NSW 2067
Australia
phone: +61 2 9882 2882
fax: +61 2 9882 6468
email: info@sdr.com.au
web: www.sdr.com.au

BRAZIL

Sellex (S.A.C.)

Sao Paulo, SP
phone: +55-11-4666-4313
email: vendas@sellex.com
web: www.sellex.com

World Precision Instruments Brasil Ltda.

Conselheiro Nebias, 756 sala 2611
Santos - Sao Paulo, 11045-002
Brazil
Tel: +55 13 40629703
mobile: +55 13 981132612 / +55 13 996125678
email: info@brazil.wpiinc.com
web: www.wpi brasil.com.br



CANADA**Carl Zeiss Canada Ltd.**

45 Valleybrook Drive
Toronto, Ontario M3B 2S6
Canada
toll free: (800) 387-8037
fax: (416) 446-3524
web: www.zeiss.ca

Harvard Apparatus Canada

6010 Vanden Abeele
Saint-Laurent QC H4S 1R9
Canada
phone: (514) 335-0792
toll free: (800) 361-1905
fax: (514) 335-3482
email: sales@harvardapparatus.ca
web: www.harvardapparatus.ca

Nikon Canada Inc.

1366 Aerowood Drive
Mississauga, Ontario
Canada L4W 1C1
phone: (905) 625-9910
fax: (905) 602-9953
email: info@nikon.ca
web: www.nikoninstruments.com

Olympus Canada, Inc.

25 Leek Crescent
Richmond Hill, Ontario
Canada L4B 4B3
toll free: (800) 387-0437
phone: (289) 269-0100
fax: (905) 886-7469

CHILE**Importadora y Distribuidora Arquimed Ltd.**

828 Arturo Prat Str.
Santiago de Chile 8330821
tel: +562 2634 62 66
email: karen.casanova@arquimed.cl
web: www.arquimed.cl

CHINA**Chengdu Techman Co., Ltd.
Amplifier Specialist**

Building A9
Chengdu National Economic Zone,
No. 888 Chenglong Avenue,
Chengdu, 610100
China
tel: 028-86381158
fax: 028-86381158 Ext.101
email: market@tme.com.cn
web: www.tme.com.cn

CHINA – continued

CIB International Group Co. Ltd.

A608, Sikuaiyu Business Hotel,
No.7 Tiyyuguan West Rd, Dongcheng District,
Beijing, P.R.China 100061
phone: 010-84832211
fax: 010-84832211
email: lucia@cibchina.com
web: www.cibchina.com

DL Naturegene Life Sciences, Inc. - Beijing

32 North Xizhimen St.,
FengLan International Center, Building A, Room 509,
Beijing 100082
China
phone: 010-62257793/62259284
fax: 010-62254835-230
email: anruo.zou@dlnaturegene.com

DL Naturegene Life Sciences, Inc - Shanghai

Room 1002, Building Lv-di tongchuang,
No 18, Shunyi Road,
Putuo District,
Shanghai 200063
China
phone: 021-52738359
fax: 021-52738360
web: www.dlnaturegene.com

GeneUp, LLC

1419, Great Wall Building,
4 Si You Xin Ma Lu Rd,
Guangzhou, 510600
China
phone: 020-8767 9617
fax: 020-8767 9635
email: info@mapusci.com
web: www.mapusci.com

Upwards Teksystems Ltd.

Room 1806, Kuntai International Mansion Tower A,
No.12B Chao Wai Street, Chao Yang District,
Beijing, China, Postcode: 100020
Tel: 010-58797821
Fax: 010-58790595
e-mail: info@upwardstek.com



FRANCE

DIPSI INDUSTRIE

15 rue Eugène Cahue
35260 Cancale
France
phone: 02 9989 9639
fax: 02 9988 7963
email: dipsi@dipsi.com
web: www.dipsi.com

Scop Pro

25 Rue de la Vallée, lot n°3
91610 Ballancourt-Sur-Essonne
France
tel: +33 (0)1 64 93 94 07
fax: +33 (0)9 71 70 26 99
email: nicolas@scop-pro.fr
web: www.scop-pro.com

World Precision Instruments, Ltd**Authorized Service and Sales Center**

phone: +33 (0)970 44 90 00
fax: +44 (0)1462 424701
email: wpifr@wpi-europe.com
web: www.wpi-europe.com

GERMANY

Rapp Opto Electronic GmbH**Authorized Microscope Sales and Service Center**

Wedel Branch
Kronskamp 110
22880 Wedel
Germany
tel: +49 (0)4103 - 701 89 0
fax: +49 (0)4103 - 701 89 21
email: info@rapp-opto.com
web: www.rapp-opto.com

Science Products GmbH**Authorized Service and Sales Center**

Hofheimer Str. 63
D-65719 Hofheim
Germany
phone: +49 (0) 6192 - 901396
fax: +49 (0) 6192 - 901398
email: info@science-products.com
web: www.science-products.com



HUNGARY

Akadimpex Co. Ltd.

Gyori Ut 20
 Budapest, H-1123 Hungary
 tel: 36 1 458 3800
 fax: 36 1 458 3811
 email: agnes.sirko@akadimpex.hu
 web: www.akadimpex.hu

INDIA

Medi Analytika India Pvt. Ltd

Authorized Service and Sales Center

6, Adyar Bridge Road
 Adyar
 Chennai - 600 020
 India
 phone: +91-44-24460988/2446 3084/2446 3085
 fax: +91-44-2446 3931
 email: info@medianalytika.com
 web: www.medianalytika.com

Regional Offices**Medi Analytika India Pvt. Ltd**

304, Corporate Towers,
 85A Zamrudpur, Greater Kailash - 1
 New Delhi - 110-048, India
 Mobile : +91-7708063536
 fax: +91-11-49058604
 e-mail : delhi@medianalytika.com

Medi Analytika India Pvt. Ltd

F-150, Dreams The Mall,
 L.B.S.Marg,
 Bhandup (West),
 Mumbai - 400 078, India
 Mobile : +91-7708063540
 fax: +91-22-21660361
 email: mumbai@medianalytika.com

Medi Analytika India Pvt. Ltd

73A, Ganesh Chandra Avenue,
 2nd Floor, Unit 205C,
 Kolkata - 700 013, India
 Mobile : +91-7708063537
 fax: +91-33-22372022
 e-mail : kolkata@medianalytika.com



ISRAEL

Eisenberg Bros. Ltd.

Arava St. Airport City
P.O. Box 1134
Ben-Gurion Airport
Israel 7019802
phone: +972-3-9777017
fax: +972-3-9777001
cell: +972-52-2647606
email: info@EB1.co.il
web: www.eisenbros.co.il

ITALY

Crisel Instruments, SRL

Via Mattia Battistini, 177
Rome 00167
Italy
phone: +39 06 35402933
fax: +39 06 35402879
email: info@crisel-instruments.it
web: www.crisel-instruments.it

JAPAN

Shoshin EM Corporation**Authorized Service and Sales Center**

Shoshin Building, 1-14, Kuranishi,
Akashibuchō, Okazaki, 444-0241
Japan
phone: +81 0564-54-1231
fax: +81 0564-54-3207
email: info@shoshinem.com
web: www.shoshinem.com

S. KOREA

ASK

Room 202, 188,
Janghan-ro, Dongdaemun-gu,
Seoul 02522, Korea
Tel: +82 (0)2466 2545
Fax: +82 (0)2466 2546
Email: ask@askus.co.kr
Web.: www.askus.co.kr

EasyLab. Inc.

302, 113, Doanbuk-ro, Seo-gu,
Daejeon, 35350, Korea
Tel : +82 42 825 0095
Fax : +82 42 825 4429
Email: easylab95@gmail.com

Scitech Korea Inc.

RM 801, Gangbuk Jeonja Gongdan,
74, Deongneung-ro 40-gil, Gangbuk-gu,
Seoul 01138, Korea
phone: +82 2 986 4413 / 4414 / 4415
fax: +82 2 986 4429
email: info@scitechkorea.com
home: www.scitechkorea.com



NETHERLANDS

NIKON INSTRUMENTS EUROPE B.V

Tripolis 100
 Burgerweeshuispad 101
 1076 ER Amsterdam
 Netherlands
 E-mail: microscope.eu@nikon.com
 Enquiries Tel: 0031-(0)-20-7099-000
 web: www.nikoninstruments.com/en_EU

NEW ZEALAND

SDR Scientific

phone: +61 2 9882 2882
 email: info@sdr.com.au
 web: www.sdr.com.au

NORWAY

Inter Instrument AS

Dr. Anja-Rose Strohmaier
 O.H. Bangs vei 51
 1363 Hovik
 Norway
 phone: +47 67 10 79 60
 email: salg@interinst.no
 web: www.interinst.no

POLAND

Science Products GmbH

phone: +48 12 363 8052
 email: info@science-products.com
 web: www.science-products.pl

PORTUGAL

IZASA SCIENTIFIC LDA

Rua do Proletariado, 1
 2790-138 Carnaxide
 Portugal
 phone: 351 21 424 73 18
 web: www.izasascientific.pt

RUSSIA

Biotechnologies Ltd.

Thorez 44 St. Petersburg,
 194223, Russia
 tel: +7812-383 9941
 fax: +7812-2942206
 email: info@biotechnologies.ru
 web: www.biotechnologies.ru



SINGAPORE

Bronjo Medi

20 Woodlands Link #03-08
Singapore 738733
phone: +65 6 4 76 4011
fax: +65 6 7 53 7303
email: bronjo@singnet.com.sg
web: www.bronjo.com

SPAIN

Cibertec, S.A.

San Romualdo 26 5ª Planta
Madrid, Spain 28037
tel: 34 91 3045444
fax: 34 91 7545617
email: info@cibertec.es
Web: www.cibertec.es

IZASA SCIENTIFIC S.L.U.

Plaza de Europa 21-23
08908 L'Hospitalet de Llobregat
Barcelona
Spain
phone: 34 902 20 30 80
fax: 34 902 20 30 81
email: jrecasens@izasascientific.com
web: www.izasascientific.com

SWITZERLAND

Science Products Trading AG

Gewerbeschulstrasse 3b
CH-8620 Wetzikon
phone: +41-43-488 05 61
fax : +41-43-488 05 62
email: info@science-products.com
web: www.science-products.ch

TAIWAN

Major Instruments Company, Ltd.

7 Fl 69-10, Zhongzheng E.Road, Sec. 2,
Danshui Dist., New Taipei City 251, Taiwan
Republic of China
phone: +886 (02) 2808-1452
fax: +886 (02) 2808-2354
email: major@major.com.tw
web: www.major.com.tw

Upwards Biosystems, Ltd.

8F-8, No. 237, Sec. 2, Fuxing S. Rd.
Taipei, Taiwan
phone: 886-2-27555811
fax: 886-2-27557566
email: ubl@ms9.hinet.net
web: www.upwards.com.tw



UNITED KINGDOM

Linton Instrumentation**Authorized Service and Sales Center**

No. 11 Forge Business Centre, Upper Rose Lane,
Palgrave, Diss. Norfolk England IP22 1AP
phone: +44 01379 651344
fax: +44 01379 650970
email: mail@lintoninst.co.uk
web: www.lintoninst.co.uk

World Precision Instruments, Ltd.**Authorized Service and Sales Center**

1 Hunting Gate
Hitchin Hertfordshire, SG4 0TJ
phone: +44 (0) 1462 424700
fax: +44 (0) 1462 424701
email: sales@wpi-europe.com
web: www.wpi-europe.com

PRINTED IN CHINA

Phone	1.888.883.0128
Fax	1.888.883.0900
Intl. Phone	+1.415.883.0128
Intl. Fax	+1.415.883.0572
info@sutter.com	

Sutter Instrument
One Digital Drive
Novato, CA 94949

Our office hours are
8:00 am to 5:00 pm
Pacific Standard time
Monday through Friday



www.sutter.com

