CUSTOMER SERVICE

For phone orders, quotation requests, and technical support:

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

For correspondence by mail:

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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.
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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 MICROPETTE 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 0.03µm
- Optimized velocity sensing circuit for maximized sensitivity and reproducibility*
- Operating life of the CO₂ 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 pipettes. For applications requiring a low noise glass, users will find that quartz is the lowest noise glass available. Quartz contains none of the metals used in conventional glasses. 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 1.2mm in outside diameter. Larger diameter glass can be used with the P-2000/G (up to 1.5mm quartz and 1.8mm conventional glass), but the performance is best with glass that is 1.2mm 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 0.125mm to 0.6mm, 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 10nm to more than 5µm. Please consult our technical staff for further information.

1, 2, 3, 4 References listed on page 8
MICROPIPETTE FABRICATION

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

CLASS I LASER PRODUCT

REFERENCES  P-2000


**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.*

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>P-2000/G</strong></td>
<td>Laser-based puller, outfitted for use with glass GREATER than 0.6mm outer diameter</td>
<td>$18,075</td>
</tr>
<tr>
<td><strong>P-2000/F</strong></td>
<td>Laser-based puller, outfitted for use with glass LESS than 0.6mm outer diameter</td>
<td>$19,190</td>
</tr>
</tbody>
</table>

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

---

**ACCESSORIES  P-2000**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FPS</strong></td>
<td>Spacer for special procedures</td>
<td>$29</td>
</tr>
<tr>
<td><strong>GS-I</strong></td>
<td>Glass stop (Imperial)</td>
<td>$80</td>
</tr>
<tr>
<td><strong>GLA</strong></td>
<td>Glass loading aid</td>
<td>$158</td>
</tr>
<tr>
<td><strong>CTS</strong></td>
<td>Ceramic tile for scoring glass</td>
<td>$22</td>
</tr>
<tr>
<td><strong>PET</strong></td>
<td>Pipette examining tile</td>
<td>$18</td>
</tr>
<tr>
<td><strong>BX10</strong></td>
<td>Pipette storage box (holds 10)</td>
<td>$22</td>
</tr>
<tr>
<td><strong>BX20</strong></td>
<td>Pipette storage box (holds 20)</td>
<td>$22</td>
</tr>
<tr>
<td><strong>O730350</strong></td>
<td>Mirrored tile</td>
<td>$22</td>
</tr>
<tr>
<td><strong>PR</strong></td>
<td>Protective ruler (used with P-2000/F)</td>
<td>$342</td>
</tr>
<tr>
<td><strong>PBS</strong></td>
<td>Puller bar hard stop</td>
<td>$29</td>
</tr>
</tbody>
</table>

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](image)

![Glass Stop](image)

![Glass Loading Aid](image)
## P-1000 NEXT GENERATION MICROPIPETTE PULLER

<table>
<thead>
<tr>
<th>FEATURES</th>
<th>P-1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color touch screen display</td>
<td>Record of last two pull results</td>
</tr>
<tr>
<td>Safe heat mode to protect and extend filament life</td>
<td>Ramp test more easily accessed and is stored and referenced within each program. Helps to establish program heat settings and protect filament.</td>
</tr>
<tr>
<td>Pipette Cookbook program directory</td>
<td>Two symmetrical pipettes with each pull</td>
</tr>
<tr>
<td>Pre-heat mode improves stability</td>
<td>Self-contained air supply with filtration system and humidity control chamber</td>
</tr>
<tr>
<td>Line repeat mode simplifies multi-line programming</td>
<td>Memory storage for up to 100 programs</td>
</tr>
<tr>
<td>Help topics and error detection</td>
<td>Two cooling modes: Time and Delay</td>
</tr>
<tr>
<td>Glossary defines micropipette and puller terminology</td>
<td>Use with single or multi-barrel glass</td>
</tr>
<tr>
<td>Copy &amp; paste function for writing new programs</td>
<td></td>
</tr>
</tbody>
</table>
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
- Sharp electrodes
- Pronuclear injection
- Zebrafish injection
- Insect Egg microinjection
- Aspiration pipettes

SPECIFICATIONS  P-1000

- **Dimensions**: 21in x 14in x 12in
  53cm x 36cm x 30cm
- **Weight**: 41lbs
  18.59kg
- **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 2.5mm x 2.5mm box filament (FB255B) unless an alternative filament is requested.

$ 9,285
### ACCESSORIES  P-1000

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>FPS</td>
<td>Fire polishing spacer</td>
<td>$29</td>
</tr>
<tr>
<td>GS-M</td>
<td>Glass stop (Metric)</td>
<td>$80</td>
</tr>
<tr>
<td>GS-I</td>
<td>Glass stop (Imperial)</td>
<td>$80</td>
</tr>
<tr>
<td>GC-M</td>
<td>Glass clamps with grips (Metric) set of 2</td>
<td>$52</td>
</tr>
<tr>
<td>GC-I</td>
<td>Glass clamps with grips (Imperial) set of 2</td>
<td>$52</td>
</tr>
<tr>
<td>CTS</td>
<td>Ceramic tile for scoring glass</td>
<td>$22</td>
</tr>
<tr>
<td>PET</td>
<td>Pipette examining tile</td>
<td>$18</td>
</tr>
<tr>
<td>BX10</td>
<td>Pipette storage box (holds 10)</td>
<td>$22</td>
</tr>
<tr>
<td></td>
<td>4 3/4 x 3 5/8 x 3/4 inches</td>
<td></td>
</tr>
<tr>
<td>BX20</td>
<td>Pipette storage box (holds 20)</td>
<td>$22</td>
</tr>
<tr>
<td></td>
<td>7 x 3 5/8 x 3/4 inches</td>
<td></td>
</tr>
<tr>
<td>FILAMENT</td>
<td>Custom platinum/iridium filament</td>
<td>$65</td>
</tr>
<tr>
<td>V400103</td>
<td>Replacement Drierite (1lb)</td>
<td>$24</td>
</tr>
</tbody>
</table>

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
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 0.1µm
- 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 0.1µm and typically is ~0.06µm
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** 21in x 16in x 12in
  53cm x 40.6cm x 30cm
- **Weight** 50lbs
  23kg
- **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.


Glass Stop

Fire Polishing Spacer
### 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. | $8,870 |

*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 2.5mm box filament unless an alternative filament is requested.*

### ACCESSORIES  P-97

| **FPS** | Fire polishing spacer | $29 |
| **GS-M** | Glass stop (Metric) | $80 |
| **GS-I** | Glass stop (Imperial) | $80 |
| **GC-M** | Glass clamps with grips (Metric) | $52 |
| **GC-I** | Glass clamps with grips (Imperial) | $52 |
| **CTS** | Ceramic tile for scoring glass (large tips 20-200 microns) | $22 |
| **PET** | Pipette examining tile | $18 |
| **BX10** | Pipette storage box (holds 10) 4 3/4 x 3 5/8 x 3/4 inches | $22 |
| **BX20** | Pipette storage box (holds 20) 7 x 3 5/8 x 3/4 inches | $22 |
| **FILAMENT** | Custom platinum/iridium filament | $65 |
| **V400103** | Replacement Drierite (1lb) | $24 |

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.
P-30 VERTICAL MICROPIPETTE PULLER

**FEATURES P-30**

- Pulls electrodes with tip diameters down to 0.3µm, 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 0.3µm and moderate taper lengths (6mm to 10mm). 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**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>18in x 10in x 9in</th>
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<tbody>
<tr>
<td></td>
<td>46cm x 25cm x 23cm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Weight</th>
<th>35lbs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>16kg</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Electrical</th>
<th>115/230 Volts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50/60 Hertz power line</td>
</tr>
</tbody>
</table>

**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.*

<table>
<thead>
<tr>
<th>P-30/P</th>
<th>Vertical micropipette puller with platinum/iridium filament</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$4,120</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>P-30/N</th>
<th>Vertical micropipette puller with Nichrome filament</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$4,120</td>
</tr>
</tbody>
</table>

*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**

<table>
<thead>
<tr>
<th>P-30-NFL/M</th>
<th>Nichrome filament block assembly</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$235</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>P-30-PFL/M</th>
<th>Platinum/iridium filament block assembly</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$235</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PET</th>
<th>Pipette examining tile</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$18</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BX10</th>
<th>Pipette storage box (holds 10)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$22</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BX20</th>
<th>Pipette storage box (holds 20)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$22</td>
</tr>
</tbody>
</table>

1 *Only necessary when changing filament configuration*
2 *Minimum order of any 2 boxes*
## MICROPIPETTE PULLER COMPARISON CHART

<table>
<thead>
<tr>
<th>Features</th>
<th>P-1000</th>
<th>P-97</th>
<th>P-2000</th>
<th>P-30</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Heat Source</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Platinum Filament with Safe Heat Mode</td>
<td>✔️</td>
<td></td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td>Platinum Filament</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>CO₂ Laser</td>
<td>❌</td>
<td>❌</td>
<td>✔️</td>
<td>❌</td>
</tr>
<tr>
<td>Platinum or Nichrome Filament</td>
<td>❌</td>
<td>❌</td>
<td>❌</td>
<td>✔️</td>
</tr>
<tr>
<td><strong>Glass Type</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Borosilicate and Aluminosilicate</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Quartz Glass or Fiber¹</td>
<td>❌</td>
<td>❌</td>
<td>✔️</td>
<td>❌</td>
</tr>
<tr>
<td><strong>Max. Glass Size (OD)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4mm</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>2mm</td>
<td>❌</td>
<td>❌</td>
<td>✔️</td>
<td>❌</td>
</tr>
<tr>
<td>1.65mm Quartz, 1.8mm Borosilicate</td>
<td>❌</td>
<td>❌</td>
<td>✔️</td>
<td>❌</td>
</tr>
<tr>
<td><strong>Tip Size</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.06µ - 3µ</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>0.01µ - 5µ (Fiber)</td>
<td>❌</td>
<td>❌</td>
<td>✔️</td>
<td>❌</td>
</tr>
<tr>
<td>0.03µ - 5µ (Glass)</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>0.30µ - 2µ</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td><strong>Max. Taper Length</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1cm</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>1.8cm</td>
<td>❌</td>
<td>❌</td>
<td>✔️</td>
<td>❌</td>
</tr>
<tr>
<td>2cm</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td><strong>Program Lines</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>1 Stage or 2 Stage with manual adjustment</td>
<td>❌</td>
<td>❌</td>
<td>✔️</td>
<td>❌</td>
</tr>
<tr>
<td>4 plus Line Repeat Mode</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td><strong>Type of Cooling</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compressed Dry Air with Humidity Control Chamber</td>
<td>✔️</td>
<td>✔️</td>
<td>❌</td>
<td>❌</td>
</tr>
<tr>
<td>NA (Laser On/Off)</td>
<td>❌</td>
<td>❌</td>
<td>✔️</td>
<td>❌</td>
</tr>
<tr>
<td>None</td>
<td>❌</td>
<td>❌</td>
<td>✔️</td>
<td>❌</td>
</tr>
<tr>
<td><strong>Usable Pipettes/Pull</strong></td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td><strong>Price²</strong></td>
<td>$9,285</td>
<td>$8,870</td>
<td>$18,075 (Glass)</td>
<td>$19,190 (Fiber)</td>
</tr>
</tbody>
</table>

1. Outer diameters < 600µm require P-2000/F.
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 1.0mm to 1.5mm larger than the outside diameter of the glass that you will be using.

For IVF and ICSI applications, a 2.5mm x 4.5mm box filament (FB245B) is recommended. For pronuclear injection work, we recommend a 2.5mm x 2.5mm 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 1.2mm OD. If very short tapers are required for patch electrodes or for microinjection, a 2.5mm or 3mm box filament is recommended.

*Sutter pre-programs the P-1000 and P-97 with a 2.5mm x 2.5mm 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

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Width</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>FB215B</td>
<td>2.0mm square box filament, 1.5mm wide</td>
<td></td>
<td>$44</td>
</tr>
<tr>
<td>FB220B</td>
<td>2.0mm square box filament, 2.0mm wide</td>
<td></td>
<td>$44</td>
</tr>
<tr>
<td>FB230B</td>
<td>2.0mm square box filament, 3.0mm wide</td>
<td></td>
<td>$44</td>
</tr>
<tr>
<td>FB255B</td>
<td>2.5mm square box filament, 2.5mm wide</td>
<td></td>
<td>$44</td>
</tr>
<tr>
<td>FB245B</td>
<td>2.5mm square box filament, 4.5mm wide</td>
<td></td>
<td>$44</td>
</tr>
<tr>
<td>FB315B</td>
<td>3.0mm square box filament, 1.5mm wide</td>
<td></td>
<td>$44</td>
</tr>
<tr>
<td>FB320B</td>
<td>3.0mm square box filament, 2.0mm wide</td>
<td></td>
<td>$44</td>
</tr>
<tr>
<td>FB330B</td>
<td>3.0mm square box filament, 3.0mm wide</td>
<td></td>
<td>$44</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Width</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>FT315B</td>
<td>1.5mm wide trough filament</td>
<td></td>
<td>$44</td>
</tr>
<tr>
<td>FT320B</td>
<td>2.0mm wide trough filament</td>
<td></td>
<td>$44</td>
</tr>
<tr>
<td>FT330B</td>
<td>3.0mm wide trough filament</td>
<td></td>
<td>$44</td>
</tr>
<tr>
<td>FT345B</td>
<td>4.5mm wide trough filament</td>
<td></td>
<td>$44</td>
</tr>
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</table>

P-30 FILAMENTS

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Width</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>PF30T15</td>
<td>1.5mm wide trough filament</td>
<td></td>
<td>$44</td>
</tr>
<tr>
<td>PF30T20</td>
<td>2.0mm wide trough filament</td>
<td></td>
<td>$44</td>
</tr>
<tr>
<td>PF30T30</td>
<td>3.0mm wide trough filament</td>
<td></td>
<td>$44</td>
</tr>
<tr>
<td>PF30N2</td>
<td>Nichrome filament (3 turns)</td>
<td></td>
<td>$44</td>
</tr>
<tr>
<td>PF30N-4</td>
<td>Nichrome filament (4 turns)</td>
<td></td>
<td>$44</td>
</tr>
</tbody>
</table>

P-77A LOOP FILAMENTS
(Serial number 160 and above)

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Width</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>FL315A</td>
<td>3.0mm loop filament, 1.5mm wide</td>
<td></td>
<td>$44</td>
</tr>
<tr>
<td>FL320A</td>
<td>3.0mm loop filament, 2.0mm wide</td>
<td></td>
<td>$44</td>
</tr>
<tr>
<td>FL325A</td>
<td>3.0mm loop filament, 2.5mm wide</td>
<td></td>
<td>$44</td>
</tr>
</tbody>
</table>

(Serial number below 160)

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Width</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>FL315X</td>
<td>3.0mm loop filament, 1.5mm wide</td>
<td></td>
<td>$44</td>
</tr>
<tr>
<td>FL320X</td>
<td>3.0mm loop filament, 2.0mm wide</td>
<td></td>
<td>$44</td>
</tr>
<tr>
<td>FL325X</td>
<td>3.0mm loop filament, 2.5mm wide</td>
<td></td>
<td>$44</td>
</tr>
</tbody>
</table>

ACCESSORIES

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>FILAMENT</td>
<td>Custom platinum/iridium filament</td>
<td>$65</td>
</tr>
<tr>
<td>FPS</td>
<td>Fire polishing spacer (P-2000, P-97, P-87)</td>
<td>$29</td>
</tr>
<tr>
<td>FS1875</td>
<td>Platinum/iridium sheet, 18mm x 75mm x 0.05mm (40µ)</td>
<td>$388</td>
</tr>
<tr>
<td>CTS</td>
<td>Ceramic tile for scoring glass (large tips 20-200 microns)</td>
<td>$22</td>
</tr>
<tr>
<td>BX10</td>
<td>Pipette storage box (holds 10)</td>
<td>$22</td>
</tr>
<tr>
<td>BX20</td>
<td>Pipette storage box (holds 20)</td>
<td>$22</td>
</tr>
</tbody>
</table>

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 (2-3cm) and 3) use aluminosilicate glass. If you need to pull very short tapers, the P30N is recommended.
BV-10
MICROELECTRODE BEVELER

(FV-10-D with optional 80X stereo microscope)

FEATURES  BV-10

- Vibration-free, magnetically coupled beveling surface
- Abrasive surface optically flat to a half wave (250nm)
- 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 and 100µm. 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 (250nm), 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 80X 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, 0-100, 0-500 MΩhm). 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.
**MICROPIPETTE FABRICATION**

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

**OPTIONS**

- 80X stereo microscope
- Impedance meter for real-time measurement of tip impedance

**SPECIFICATIONS BV-10**

(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.*

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BV-10-B</strong></td>
<td>Micropipette beveler basic system</td>
<td>$3,605</td>
</tr>
<tr>
<td><strong>BV-10-C</strong></td>
<td>BV-10-B with electrode impedance meter</td>
<td>$4,675</td>
</tr>
<tr>
<td><strong>BV-10-D</strong></td>
<td>BV-10-B with 80X stereo microscope</td>
<td>$4,675</td>
</tr>
<tr>
<td><strong>BV-10-E</strong></td>
<td>BV-10-B with impedance meter and 80X stereo microscope</td>
<td>$5,768</td>
</tr>
</tbody>
</table>

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

### ACCESSORIES BV-10

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BVM-CE</strong></td>
<td>Electrode impedance meter with active and reference lead</td>
<td>$1,658</td>
</tr>
<tr>
<td><strong>BV-10S</strong></td>
<td>80X stereo microscope</td>
<td>$1,110</td>
</tr>
<tr>
<td><strong>104C</strong></td>
<td>Diamond abrasive plate – coarse (5.0µm to 50µm tip sizes)</td>
<td>$179</td>
</tr>
<tr>
<td><strong>104D</strong></td>
<td>Diamond abrasive plate – fine (2.0µm to 20µm tip sizes)</td>
<td>$179</td>
</tr>
<tr>
<td><strong>104E</strong></td>
<td>Diamond abrasive plate – very fine (0.7µm to 2.0µm tip sizes)</td>
<td>$179</td>
</tr>
<tr>
<td><strong>104F</strong></td>
<td>Diamond abrasive plate – extra fine (0.2µm to 1.0µm tip sizes)</td>
<td>$179</td>
</tr>
<tr>
<td><strong>007</strong></td>
<td>Degreaser (bottle)</td>
<td>$19</td>
</tr>
<tr>
<td><strong>008</strong></td>
<td>Beveler pedestal oil</td>
<td>$19</td>
</tr>
</tbody>
</table>

### REPLACEMENT PARTS BV-10

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>101</strong></td>
<td>6-inch reference lead (body to meter)</td>
<td>$19</td>
</tr>
<tr>
<td><strong>102</strong></td>
<td>2-inch active lead (platinum to pipette)</td>
<td>$19</td>
</tr>
<tr>
<td><strong>X050300</strong></td>
<td>Reference wick</td>
<td>$16</td>
</tr>
<tr>
<td><strong>M100019</strong></td>
<td>Reference wick holder</td>
<td>$39</td>
</tr>
<tr>
<td><strong>H906100</strong></td>
<td>Drive belt</td>
<td>$29</td>
</tr>
<tr>
<td><strong>O740130</strong></td>
<td>Reticle grid for BV-10S scope 5mm scale / 100 divisions</td>
<td>$127</td>
</tr>
<tr>
<td><strong>PEDESTAL</strong></td>
<td>Pedestal plates (top and bottom)</td>
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</table>
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

The Flaming/Brown™ Micropipette Puller: Its Background, Design and Underlying Principles

Techniques for Examining and Measuring Micropipette Tips by Scanning Electron Microscopy

Evaluation of Flaming/Brown Micropipette Puller

A Theory of Micropipette Tip Formation: Quantitative Prediction and Validation of the Effects of Capillary Wall Thickness Upon Tip Size

Effects of a Fused Internal Fiber (Omega Dot) Upon Micropipette Tips

Minimizing Tip Size With Borosilicate Tubing

Beveling Micropipette Tips: Techniques and Applications

Filling Micropipettes: Techniques and Solutions Advancing Micropipettes Through Tissues and Into Cells

Ancillary Techniques for Conducting Intracellular Research

Evaluation of Improved Intracellular Recording Techniques in Vertebrate Photoreceptors

Evaluation of Tubing Designs for Intracellular Work

The Structure Properties of Glasses for Fabricating Micropipettes

Dual-Channel Micropipettes

The Burgeoning Field of Patch Clamping

Extension of the Flaming/Brown Micropipette Puller to Patch Clamping and Conveniently Handling Aluminosilicate Glass

References

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

$ 49
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 1µl 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. The custom pipettes are considered non-sterile and are manufactured for research applications and non-human use. Please contact Sutter Instrument for further details.

BOROSILICATE (CORNING 7740)

The most commonly used glass is borosilicate. Sutter Instrument offers only TYPE I-CLASS A borosilicate as described by ASTM Standard 3.1.2. 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 5-6mm. 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 0.5mm and 0.75mm 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.

### THICK / STANDARD WALLED BOROSILICATE GLASS

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### HEAVY POLISHED THICK / STANDARD AND THIN WALLED GLASS

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<td>$61</td>
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<tr>
<td>B150-86-10HP</td>
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<td>0.86mm</td>
<td>10cm</td>
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<td>1.10mm</td>
<td>10cm</td>
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<td>$61</td>
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1 Useful for added protection of gaskets and wire in headstages.

### THIN WALLED BOROSILICATE GLASS

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<td>$52</td>
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### MULTI-BARREL BOROSILICATE GLASS

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<td>75</td>
<td>$67</td>
</tr>
<tr>
<td>4B100-75-10</td>
<td>4 barrels</td>
<td>1.00/0.75</td>
<td>10cm</td>
<td>75</td>
<td>$70</td>
</tr>
</tbody>
</table>

---

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

### QUARTZ GLASS

#### WITH FILAMENT

<table>
<thead>
<tr>
<th>Catalog Number</th>
<th>Outside Diameter</th>
<th>Inside Diameter</th>
<th>Overall Length</th>
<th>Pieces Per Package</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>QF100-50-7.5</td>
<td>1.00mm</td>
<td>0.50mm</td>
<td>7.5cm</td>
<td>100</td>
<td>$132</td>
</tr>
<tr>
<td>QF100-60-7.5</td>
<td>1.00mm</td>
<td>0.60mm</td>
<td>7.5cm</td>
<td>100</td>
<td>$132</td>
</tr>
<tr>
<td>QF100-60-10</td>
<td>1.00mm</td>
<td>0.60mm</td>
<td>10cm</td>
<td>100</td>
<td>$182</td>
</tr>
<tr>
<td>QF100-70-7.5</td>
<td>1.00mm</td>
<td>0.70mm</td>
<td>7.5cm</td>
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<td>$152</td>
</tr>
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<td>QF100-70-10</td>
<td>1.00mm</td>
<td>0.70mm</td>
<td>10cm</td>
<td>100</td>
<td>$182</td>
</tr>
<tr>
<td>QF100-70-15</td>
<td>1.00mm</td>
<td>0.70mm</td>
<td>15cm</td>
<td>100</td>
<td>$200</td>
</tr>
<tr>
<td>QF120-60-7.5</td>
<td>1.20mm</td>
<td>0.60mm</td>
<td>7.5cm</td>
<td>100</td>
<td>$153</td>
</tr>
<tr>
<td>QF120-60-10</td>
<td>1.20mm</td>
<td>0.60mm</td>
<td>10cm</td>
<td>100</td>
<td>$189</td>
</tr>
<tr>
<td>QF120-90-10</td>
<td>1.20mm</td>
<td>0.90mm</td>
<td>10cm</td>
<td>100</td>
<td>$136</td>
</tr>
<tr>
<td>QF150-75-7.5</td>
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<td>0.75mm</td>
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<td>100</td>
<td>$136</td>
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<td>0.75mm</td>
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<td>100</td>
<td>$150</td>
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#### WITHOUT FILAMENT

<table>
<thead>
<tr>
<th>Catalog Number</th>
<th>Outside Diameter</th>
<th>Inside Diameter</th>
<th>Overall Length</th>
<th>Pieces Per Package</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q100-30-7.5</td>
<td>1.00mm</td>
<td>0.30mm</td>
<td>7.5cm</td>
<td>100</td>
<td>$137</td>
</tr>
<tr>
<td>Q100-30-15</td>
<td>1.00mm</td>
<td>0.30mm</td>
<td>15cm</td>
<td>100</td>
<td>$144</td>
</tr>
<tr>
<td>Q100-50-7.5</td>
<td>1.00mm</td>
<td>0.50mm</td>
<td>7.5cm</td>
<td>100</td>
<td>$132</td>
</tr>
<tr>
<td>Q100-50-10</td>
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<td>0.50mm</td>
<td>10cm</td>
<td>100</td>
<td>$176</td>
</tr>
<tr>
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<td>0.70mm</td>
<td>7.5cm</td>
<td>100</td>
<td>$123</td>
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<tr>
<td>Q100-70-10</td>
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<td>0.70mm</td>
<td>10cm</td>
<td>100</td>
<td>$176</td>
</tr>
<tr>
<td>Q120-40-7.5</td>
<td>1.20mm</td>
<td>0.40mm</td>
<td>7.5cm</td>
<td>100</td>
<td>$207</td>
</tr>
<tr>
<td>Q120-60-7.5</td>
<td>1.20mm</td>
<td>0.60mm</td>
<td>7.5cm</td>
<td>100</td>
<td>$182</td>
</tr>
<tr>
<td>Q120-90-7.5</td>
<td>1.20mm</td>
<td>0.90mm</td>
<td>7.5cm</td>
<td>100</td>
<td>$156</td>
</tr>
<tr>
<td>Q120-90-10</td>
<td>1.20mm</td>
<td>0.90mm</td>
<td>10cm</td>
<td>100</td>
<td>$200</td>
</tr>
<tr>
<td>Q150-50-7.5</td>
<td>1.50mm</td>
<td>0.50mm</td>
<td>7.5cm</td>
<td>100</td>
<td>$189</td>
</tr>
<tr>
<td>Q150-75-7.5</td>
<td>1.50mm</td>
<td>0.75mm</td>
<td>7.5cm</td>
<td>100</td>
<td>$132</td>
</tr>
<tr>
<td>Q150-75-10</td>
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<td>10cm</td>
<td>100</td>
<td>$142</td>
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<td>100</td>
<td>$207</td>
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<td>Q165-115-10</td>
<td>1.65mm</td>
<td>1.15mm</td>
<td>10cm</td>
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<td>$182</td>
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</table>
## SOLID QUARTZ ROD

<table>
<thead>
<tr>
<th>catalog number</th>
<th>outside diameter</th>
<th>inside diameter</th>
<th>overall length</th>
<th>pieces per package</th>
<th>price</th>
</tr>
</thead>
<tbody>
<tr>
<td>QR-100-7.5</td>
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<td>1.00mm</td>
<td>7.5cm</td>
<td>100</td>
<td>$ 85</td>
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<tr>
<td>QR-100-10</td>
<td>solid</td>
<td>1.00mm</td>
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<td>100</td>
<td>$ 85</td>
</tr>
<tr>
<td>QR-100-15</td>
<td>solid</td>
<td>1.00mm</td>
<td>15cm</td>
<td>100</td>
<td>$ 85</td>
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## QUARTZ THETA GLASS

<table>
<thead>
<tr>
<th>catalog number</th>
<th>outside diameter</th>
<th>inside diameter</th>
<th>overall length</th>
<th>pieces per package</th>
<th>price</th>
</tr>
</thead>
<tbody>
<tr>
<td>QT120-90-7.5</td>
<td>1.20/0.9mm</td>
<td>0.15mm</td>
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<td>$ 90</td>
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## MULTI-BARREL GLASS

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<tr>
<th>catalog number</th>
<th>number of barrels</th>
<th>outside/inside diameter</th>
<th>overall length</th>
<th>pieces per package</th>
<th>price</th>
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</thead>
<tbody>
<tr>
<td>7Q033-16-10</td>
<td>7 barrel</td>
<td>1.00/[.33/.16ea]</td>
<td>10cm</td>
<td>50</td>
<td>$ 252</td>
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## ALUMINOSILCATE GLASS

### WITH FILAMENT

<table>
<thead>
<tr>
<th>catalog number</th>
<th>outside diameter</th>
<th>inside diameter</th>
<th>overall length</th>
<th>pieces per package</th>
<th>price</th>
</tr>
</thead>
<tbody>
<tr>
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<td>1.00mm</td>
<td>0.64mm</td>
<td>10cm</td>
<td>100</td>
<td>$ 144</td>
</tr>
<tr>
<td>AF120-77-10</td>
<td>1.20mm</td>
<td>0.77mm</td>
<td>10cm</td>
<td>100</td>
<td>$ 144</td>
</tr>
<tr>
<td>AF120-87-10</td>
<td>1.20mm</td>
<td>0.87mm</td>
<td>10cm</td>
<td>100</td>
<td>$ 144</td>
</tr>
<tr>
<td>AF150-100-10</td>
<td>1.50mm</td>
<td>1.00mm</td>
<td>10cm</td>
<td>100</td>
<td>$ 144</td>
</tr>
</tbody>
</table>

### WITHOUT FILAMENT

<table>
<thead>
<tr>
<th>catalog number</th>
<th>outside diameter</th>
<th>inside diameter</th>
<th>overall length</th>
<th>pieces per package</th>
<th>price</th>
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<td>10cm</td>
<td>100</td>
<td>$ 123</td>
</tr>
<tr>
<td>A120-77-10</td>
<td>1.20mm</td>
<td>0.77mm</td>
<td>10cm</td>
<td>100</td>
<td>$ 123</td>
</tr>
<tr>
<td>A120-87-10</td>
<td>1.20mm</td>
<td>0.87mm</td>
<td>10cm</td>
<td>100</td>
<td>$ 123</td>
</tr>
<tr>
<td>A150-100-10</td>
<td>1.50mm</td>
<td>1.00mm</td>
<td>10cm</td>
<td>100</td>
<td>$ 123</td>
</tr>
</tbody>
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## BOROSILICATE THETA GLASS

<table>
<thead>
<tr>
<th>catalog number</th>
<th>outside diameter</th>
<th>inside diameter</th>
<th>overall length</th>
<th>pieces per package</th>
<th>price</th>
</tr>
</thead>
<tbody>
<tr>
<td>BT-150-10</td>
<td>1.50/1.17mm</td>
<td>0.165mm</td>
<td>10cm</td>
<td>100</td>
<td>$ 105</td>
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## SOLID BOROSILICATE ROD

<table>
<thead>
<tr>
<th>catalog number</th>
<th>outside diameter</th>
<th>inside diameter</th>
<th>overall length</th>
<th>pieces per package</th>
<th>price</th>
</tr>
</thead>
<tbody>
<tr>
<td>BR-100-10</td>
<td>solid</td>
<td>1.00mm</td>
<td>10cm</td>
<td>250</td>
<td>$ 64</td>
</tr>
<tr>
<td>BR-100-15</td>
<td>solid</td>
<td>1.00mm</td>
<td>15cm</td>
<td>250</td>
<td>$ 69</td>
</tr>
</tbody>
</table>
Micromanipulation 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 six 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-245) or it may be configured with an XY-Diagonal configuration (MP-235). 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™**

**THREE-AXIS MICROMANIPULATOR SYSTEM**

*New Feature*

**Features**

- **New:** Now available in thermally stable stainless steel
- Three independent axes – 25mm orthogonal travel in X, Y and Z
- Sub-micron (less than 100nm) resolution
- User selectable angle from 0 - 90 degrees via ROE input
- Fast movement with a top speed of 3mm/sec (while homing)
- Mechanically robust construction for high stability
- Display indicates coordinates in relative or absolute

*TRIO™*

- 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 and RELATIVE
- 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

*(TRIO-245 shown with Sutter IPA® headstage (not included))*
The new TRIO™-245 from Sutter Instrument is a highly stable 3-axis manipulator, with 25mm 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 applications that require 2 pipettes in one setup, or for setups where space is limited.

Sutter pioneered the use of linear drives for low noise patch clamp recording. Our next-generation TRIO manipulators use a combination of state-or-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 quietest manipulators in the industry. This inherent stability ensures that Sutter manipulators are ready to work when you are – saving you valuable hours of research time.

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.

An alternate configuration, the TRIO-235, removes the Z axis, and replaces it with an adjustable diagonal axis. This configuration provides a traditional X and Y axis, with a diagonal axis that can be adjusted in angle with a set screw. 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 diagonal features 50mm of travel, with X and Y axes that have 25mm of travel. The TRIO-235 and TRIO-245 both feature the same precision bearing and lead-screw design.

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. Press Work and Home simultaneously to easily set or modify the 4th axis angle. When you are ready to begin recording data, the motor drive electronics can be put in a super-quiet mode by pressing Lock. 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.

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.

(TRIO-235 shown with Sutter IPA® headstage (not included))
** All measurements are in inches

(TRIO-245S, stainless steel, shown with Sutter IPA® headstage (not included))
**TRIO™ SYSTEMS**

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

### ALUMINUM

- **TRIO-235**
  - 3-axis manipulator (X,Y and diagonal)
  - $6,835

- **TRIO-245-L**
  - 3-axis manipulator (X,Y and Z) – left-handed setup
  - $6,835

- **TRIO-245-R**
  - 3-axis manipulator (X,Y and Z) – right-handed setup
  - $6,835

### STAINLESS STEEL

Stainless steel has a much smaller thermal expansion coefficient as compared to aluminum and offers greatly increased thermal stability. As an added benefit, the very small thermal expansion that does occur, is counteracted by the thermal expansion of the lead screw. As both metals are the same, the thermal expansion cancels, and overall thermal expansion of the manipulator is close to zero. This makes the stainless TRIO-245S one of the most stable micromanipulators ever built.

- **TRIO-245S-L**
  - 3-axis manipulator (X,Y and Z) – left-handed setup
  - $9,340

- **TRIO-245S-R**
  - 3-axis manipulator (X,Y and Z) – right-handed setup
  - $9,340

### FIXED STAGE PLATFORM

- **MT-78-FS**
  - Fixed platform stage with imperial/standard holes, chamber insert and gantry supports
  - $3,860

- **MT-78-FS/M6**
  - Same as above with M6 tapped holes
  - $3,860

### MANIPULATOR COLUMNS

- **MT-75**
  - Standard gantry stand 8.7 to 13.4 in (22.1 to 33.9 cm)
  - $835

- **MT-75S**
  - Short gantry stand 6.7 to 9.6 inches (16.9 to 24.4 cm)
  - $835

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

**ACCESSORIES**

- **285204**
  - 4 inch dovetail extension
  - $64

- **285210**
  - Mounting adapter plate
  - $70

- **225RBI**
  - Rotating base for MP-225
  - $480

- **221165**
  - Z-axis vertical extension
  - $105

- **BR-AW**
  - Rod holding clamp for XenoWorks injectors (for rod OD 2-4mm)
  - $100

- **MP-ROD**
  - Rod holder (for rod OD 6.25mm or larger)
  - $100

- **MP-RISER-0.5**
  - 1/2 inch riser
  - $135

- **MP-RISER-1.0**
  - 1 inch riser
  - $185

*Risers can be combined to achieve desired height.*
QUAD®
FOUR-AXIS
MICROMANIPULATOR SYSTEM

FEATURES

- Four independent axes – 30mm travel in diagonal for coaxial pipette movement, 25mm 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 100nm resolution
- USB interface for computer control
The QUAD® motorized micromanipulator is easy to use and features four independent axes. Each axis has a 25mm 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 30mm of travel that significantly extends the range of travel for the system.

The QUAD is very easy to operate. 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**
  30mm on diagonal 4th axis
  25mm on X, Y and Z axes

- **Control Box Dimensions**
  5.5in x 7.5in x 4in
  14cm x 19cm x 10.2cm

- **Weight**
  2.2lbs
  1.0kg

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

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**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-L 4-axis manipulator – left-handed setup $7,830
- QUAD-R 4-axis manipulator – right-handed setup $7,830

FIXED STAGE PLATFORM

- MT-78-FS Fixed platform stage with imperial/standard holes, chamber insert and gantry supports $3,860
- MT-78-FS/M6 Same as above with M6 tapped holes $3,860

MANIPULATOR COLUMNS

- MT-75 Standard gantry stand 8.7 to 13.4in (22.1 to 33.9cm) $835
- MT-75S Short gantry stand 6.7 to 9.6 inches (16.9 to 24.4cm) $835

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 $64
- 225RBI Rotating base for MP-225 $480
- 221165 Z-axis vertical extension $105
- BR-AW Rod holding clamp for XenoWorks injectors (for rod OD 2 to 4mm) $100
- MP-ROD Rod holder (for rod OD 6.25mm or larger) $100
- MP-RISER-0.5 1/2 inch riser $135
- MP-RISER-1.0 1 inch riser $185

1 Handedness is a convenience. Customer can change orientation as needed.
2 Risers can be combined to achieve desired height.
MICROMANIPULATION

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

(Shown: MPC-385-2)

FEATURES

- 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

PHONE: 1-888-883-0128 • FAX 1-888-883-0900
EMAIL: INFO@SUTTER.COM • WEB: WWW.SUTTER.COM
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.
### Resolution and Full Travel
- Minimal microstep size is 62.5 nanometers per microstep.
- Display has single micron resolution.
- Full travel is 25mm in each axis.

### Maximum Speed
- MP-225 mechanical 3mm/sec.
- MP-285 mechanical 5mm/sec.

### DRIFT
- < 0.5 micron/20hr
- Drive Mechanism

### DIMENSIONS

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

### WEIGHT

| ● Controller | 6.5lbs | 3kg |
| ● ROE | 3.5lbs | 1.6kg |

| ● 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.*

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPC-385</td>
<td>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.*</td>
<td>$ 9,375</td>
</tr>
<tr>
<td>MPC-385-2</td>
<td>Same as the MPC-385, but with two MP-285 manipulator mechanicals.*</td>
<td>$ 15,330</td>
</tr>
<tr>
<td>MPC-385-3</td>
<td>Same as the MPC-385, but with three MP-285 manipulator mechanicals, and two MPC-200 controllers.*</td>
<td>$ 23,165</td>
</tr>
<tr>
<td>MPC-385-4</td>
<td>Same as the MPC-385, but with four MP-285 manipulator mechanicals, and two MPC-200 controllers.*</td>
<td>$ 28,680</td>
</tr>
</tbody>
</table>

## 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.*

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPC-325</td>
<td>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.*</td>
<td>$ 7,830</td>
</tr>
<tr>
<td>MPC-325-2</td>
<td>Same as the MPC-325, but with two MP-225 manipulator mechanicals.*</td>
<td>$ 12,505</td>
</tr>
<tr>
<td>MPC-325-3</td>
<td>Same as the MPC-325, but with three MP-225 manipulator mechanicals, and two MPC-200 controllers.*</td>
<td>$ 18,910</td>
</tr>
<tr>
<td>MPC-325-4</td>
<td>Same as the MPC-325, but with four MP-225 manipulator mechanicals, and two MPC-200 controllers.*</td>
<td>$ 23,115</td>
</tr>
<tr>
<td>MPC-200-ROE</td>
<td>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.</td>
<td>$ 3,860</td>
</tr>
</tbody>
</table>

* 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.*

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MPC-200</strong></td>
<td>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. <strong>Note:</strong> 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.</td>
<td>$3,090</td>
</tr>
<tr>
<td><strong>ROE-200</strong></td>
<td>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.</td>
<td>$1,380</td>
</tr>
<tr>
<td><strong>MP-285/M</strong></td>
<td>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.*</td>
<td>$6,070</td>
</tr>
<tr>
<td><strong>MP-225/M</strong></td>
<td>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.*</td>
<td>$5,245</td>
</tr>
</tbody>
</table>

* *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  $ 64
- 285210  Mounting adapter plate  $ 70
- 285RBI  Rotating base for MP-285  $ 480
- 225RBI  Rotating base for MP-225  $ 480
- 285300  Right angle adapter  $ 105
- 285305  Z-axis vertical extension  $ 105
- 285310  Z-axis horizontal extension  $ 105
- BR-AW  Rod holding clamp for XenoWorks injectors (for rod OD 2mm to 4mm)  $ 100
- MP-ROD  Rod holder (for rod OD 6.25mm or larger)  $ 100
- 285HEA  Hinged headstage mount  $ 405
- M100106  Flat side for controller (each)  $ 41
- MP-RISER-0.5  1/2 inch riser  $ 135
- MP-RISER-1.0  1 inch riser  $ 185

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.
**MP-265/MPC-365**  
**NARROW FORMAT MANIPULATOR SYSTEM**

**FEATURES MP-265/MPC-365**

- Single controller and ROE will run two stepper motor drive manipulators
- Self-detecting, daisy-chain capability allows control of four manipulators from the ROE-200
- User-friendly interface: single button access to all major functions
- New 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, and 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
- Toggle switch selects which manipulator is connected to input device
- LED and display indicate active manipulator
- Low-drift mechanical stability
- Narrow stand with linear slide or rotating base mounting options
Our MP-265/M “narrow format” mechanical is designed for patch-slice manipulator systems that require more than 2 or 3 pipettes as well as for other setups where space is limited.

The MP-265/M mechanical builds on our existing manipulator line in several ways. First, the narrow format means more manipulators can be grouped around a recording chamber. Next, the narrow format MP-265/M allows a high precision manipulator to be inserted into small spaces in existing setups. Finally, travel in the Y-axis is shortened (12.5mm) both to economize on width and because radially oriented manipulators do not require long travel in the transverse axis.

The MP-265/M manipulator was designed specifically for systems requiring 4 or more manipulators. To this end, we have put together systems with special pricing for 4, 5 and 6 manipulators, and 2 or 3 dual manipulator controllers. The optional narrow format stand and linear slide or rotating base is available for mounting the MP-265/M mechanical. With the 150mm throw of the linear slide, the manipulator can be quickly and smoothly moved out to a location where there is easy access to the pipette for replacement. A rotating base can be used for mounting to large platform stages like the Sutter MT-78, or smaller Sutter MD Series platforms.

MPC-365 systems are formed by using the popular Sutter MPC-200 dual manipulator controller and ROE-200, with one or more MP-265/M mechanicals. A single MPC-200 controller and ROE-200 can run one or two MP-265/M manipulators. A single ROE-200, when paired with two MPC-200 controllers can control up to four MP-265/M manipulators. If you require more manipulators in a single setup, you simply duplicate the smaller systems. A new firmware version of the MPC-200 / ROE-200 automatically recognizes the MP-265/M mechanical and adjusts accordingly.
**SPECIFICATIONS MP-265/MPC-365**

- **Resolution**
  Minimal microstep size is 62.5 nanometers per microstep.
  Display has single micron resolution.

- **Maximum Speed**
  MP-265 mechanical 3mm/sec

- **DRIFT**
  <.05 micron/20hr Drive Mechanism

- **Dimensions**
  Controller: 15.75in x 10.75in x 3.5in
  *(MPC-200):* 40cm x 27.3cm x 9cm
  ROE: 10in x 6in x 4in
  25cm x 15cm x 23cm

- **Weight**
  Controller: 6.5lbs/3kg
  ROE: 3.5lbs/1.6kg

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

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**MECHANICAL DRAWINGS OF THE MP-265/MPC-365**

*All measurements are in inches*
**US PRICES**  **MP-265/MPC-365**

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

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPC-365</td>
<td>One MP-265/M manipulator mechanical, one MPC-200 controller and one ROE-200, mounting adapter plate, rod holder, 4 inch dovetail extension, manipulator and ROE connecting cables, power cord and manual.*</td>
<td>$10,150</td>
</tr>
<tr>
<td>MPC-365-2</td>
<td>Same as the MPC-365, but with two MP-265/M mechanicals*</td>
<td>$16,105</td>
</tr>
<tr>
<td>MPC-365-3</td>
<td>Same as the MPC-365, but with three MP-265/M mechanicals, and two MPC-200 controllers.*</td>
<td>$24,265</td>
</tr>
<tr>
<td>MPC-365-4</td>
<td>Same as the MPC-365, but with four MP-265/M MP-265/M mechanicals, and two MPC-200 controllers.*</td>
<td>$30,670</td>
</tr>
<tr>
<td>MPC-365-5</td>
<td>Same as the MPC-365, but with five MP-265/M mechanicals, three MPC-200 controllers, and two ROE-200 user interfaces.*</td>
<td>$39,160</td>
</tr>
<tr>
<td>MPC-365-6</td>
<td>Same as the MPC-365, but with six MP-265/M mechanicals, three MPC-200 controllers, and two ROE-200 user interfaces.*</td>
<td>$44,675</td>
</tr>
</tbody>
</table>

* Indicate right- or left-handed setup when ordering

**COMPONENTS**  **MP-265/MPC-365**

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPC-200</td>
<td>Controller box alone. Purchase this if you intend to daisy-chain two controllers to one ROE-200. In this configuration, up to four 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 cables, power cord and manual.</td>
<td>$3,090</td>
</tr>
<tr>
<td>ROE-200</td>
<td>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.</td>
<td>$1,380</td>
</tr>
<tr>
<td>MP-265/M*</td>
<td>The MP-265 manipulator mechanical alone. Includes mounting adapter plate, rod holder, 4 inch dovetail extension, and cable to connect manipulator to controller.</td>
<td>$6,285</td>
</tr>
</tbody>
</table>

* Indicate right- or left-handed setup when ordering
ACCESSORIES MP-265/MPC-365

- **MT-73**
  - Narrow format stand with linear slide
  - $1,534
- **265RBI**
  - Rotating base for MP-265
  - $480
- **M100106**
  - Flat side panel for controller (each)
  - $41
- **MP-RISER-0.5**
  - 1/2 inch riser
  - $135
- **MP-RISER-1.0**
  - 1 inch riser
  - $185

1. Suitable for upright scopes.
2. Useful with Sutter MD stand and large platform stages such as the MT-78-FS, MP-78 and MPC-78.
3. Risers can be combined to achieve desired height.
MULTI-LINK™
POSITION CONTROL SOFTWARE

Features of MULTI-LINK™

- 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
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 µManager. 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 to 25000µm. 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

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)
The flagship in our line of precision micromanipulators, the motorized 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, your choice of one of two manual controls: joystick or rotary optical encoder (ROE), assures a comfortable experimentation environment, customized to the scientist. 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

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

1) Rotary Optical Encoder (ROE). 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.

2) Joystick. Our joystick is a modified three-axis game controller. The degree of handle deflection determines the velocity of movement of each axis. In pulse mode, a button commands the manipulator to take a single step in the axis selected by joystick deflection.
MP-285/R
Includes manipulator, rack mount controller unit, cables, rod holder, hinged headstage mount, 4 inch dovetail extension, mounting adapter plate, choice of input device, power cord, and manual

MP-285/T
Includes manipulator, table top controller unit, cables, rod holder, hinged headstage mount, 4 inch dovetail extension, mounting adapter plate, choice of input device, power cord, and manual

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

Choose one input device
Rotary Optical Encoder 285ROE
Joystick 285JOY

Select the manipulator handedness
Right-handed setup RIGHT
Left-handed setup LEFT

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

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.

ACCESSORIES MP-285

285204 4 inch dovetail extension $ 64
285210 Mounting adapter plate $ 70
285RBI Rotating base for MP-285 $ 480
285300 Right angle adapter $ 105
285305 Z-axis vertical extension $ 105
285310 Z-axis horizontal extension $ 105
BR-AW Rod holding clamp for XenoWorks injectors (for rod OD 2mm to 4mm) $ 100
MP-ROD Rod holder (for rod OD 6.25mm or larger) $ 100
285HEA Hinged headstage mount $ 405
M100106 Flat side panel for controller (each) $ 41

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

<table>
<thead>
<tr>
<th>Features</th>
<th>MPC-385/325</th>
<th>MPC-365</th>
<th>MP-285</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manipulator per Controller</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Manipulator per ROE</td>
<td>4</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Memory Moves</td>
<td></td>
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</tr>
<tr>
<td>500 and home</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>2 (Home and Work)</td>
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</tr>
<tr>
<td>Travel</td>
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</tr>
<tr>
<td>25mm on all three axes</td>
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</tr>
<tr>
<td>25mm on X and Z axes</td>
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</tr>
<tr>
<td>12.5mm on Y axis</td>
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</tr>
<tr>
<td>Interface</td>
<td>USB</td>
<td>USB</td>
<td>Serial</td>
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<tr>
<td>Expandable</td>
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<td>Yes</td>
<td>No</td>
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<tr>
<td>Step Size</td>
<td>62.5nm</td>
<td>62.5nm</td>
<td>40nm and 200nm</td>
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<td>Selectable Speeds</td>
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<td>6</td>
<td>14</td>
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<tr>
<td>Maximum Speed</td>
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<tr>
<td>5mm/sec</td>
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<td>5mm/sec (w/MP-285 manipulator)</td>
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<tr>
<td>3mm/sec</td>
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<td>3mm/sec (w/MP-225 manipulator)</td>
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<td>2.9mm/sec</td>
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</tr>
<tr>
<td>2mm/sec</td>
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<td></td>
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</tr>
<tr>
<td>Type of Bearings</td>
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<tr>
<td>Cross Roller</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Cross Roller (w/MP-285 manipulator)</td>
<td></td>
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</tr>
<tr>
<td>Ball Bearing</td>
<td></td>
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<tr>
<td>Ball Bearing (w/MP-225 manipulator)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Price(^\text{†})</td>
<td>$9,375 (MPC-385)</td>
<td>$10,150</td>
<td>$9,720</td>
</tr>
<tr>
<td></td>
<td>$7,830 (MPC-325)</td>
<td></td>
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</tr>
</tbody>
</table>

**MP-85**

**HUXTLEY-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**: 0.1mm on all axes
- **Fine X resolution**: 0.01mm
- **Ultrafine (Huxley) Resolution**: 0.2µm
- **Huxley Excursion**: ~2mm maximum in each axis
- **Dimensions**: 10in x 10in x 12in, 25cm x 25cm x 28cm
- **Weight**: *Manipulator*: 15lbs, 7kg
### 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**

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP-85/R</td>
<td>Right-handed – Includes manipulator, coarse movement MM-33 micromanipulator, and rotating base</td>
<td>$6,895</td>
</tr>
<tr>
<td>MP-85/L</td>
<td>Left-handed – Includes manipulator, coarse movement MM-33 micromanipulator, and rotating base</td>
<td>$6,895</td>
</tr>
</tbody>
</table>

**Accessories MP-85**

<table>
<thead>
<tr>
<th>Accessory</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holder/MP85</td>
<td>Headstage adapter</td>
<td>$177</td>
</tr>
<tr>
<td>RBI</td>
<td>Rotating base for MP-85</td>
<td>$935</td>
</tr>
<tr>
<td>MAG-85</td>
<td>Magnetic feet (set of 3)</td>
<td>$54</td>
</tr>
<tr>
<td>85AX200'</td>
<td>Headstage adapter for MP-85</td>
<td>$305</td>
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<tr>
<td>X850600</td>
<td>15 degree wedges (each)</td>
<td>$104</td>
</tr>
<tr>
<td>X850700</td>
<td>1 inch increment spacer</td>
<td>$142</td>
</tr>
<tr>
<td>X700115</td>
<td>MP-85 to MT stand adapter plate</td>
<td>$105</td>
</tr>
</tbody>
</table>

1 *Suitable for Sutter IPA®, Axopatch 200 and Heka EFC-10.*
MM-33
MICROMANIPULATOR

**FEATURES MM-33**
- Compact design allows use in tight environments
- Cross-loaded roller bearings for smooth, low friction movement
- Rack and pinion drive gives stable movement with minimal backlash
- Vertical axis lock

**OPTIONS MM-33**
- Rotating base allows horizontal rotation and vertical tilting
- Tilting mount for fine X-axis
- Magnetic feet

(Shown: MM-33 – open profile)
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 0.10mm increments and the fine micrometer adjustment for the X-axis thrust is calibrated at 0.01mm with estimates to 5µm.

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.
INDIVIDUAL EXCURSIONS ARE AS FOLLOWS:

X-axis coarse movement: 37mm

X-axis fine movement: 10mm

Y-axis horizontal movement: 20mm

Z-axis vertical movement: 20mm

(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*)  
  $1,375

- **MM-33/L**  
  Left-handed micromanipulator with vertical lock  
  (with 1/2 inch rod clamps*)  
  $1,375

- **MM-33A/R**  
  Right-handed micromanipulator with tilting mount  
  for fine X-axis, vertical lock, rotating base, and two base clamps  
  $2,150

- **MM-33A/L**  
  Left-handed micromanipulator with tilting mount  
  for fine X-axis, vertical lock, rotating base, and two base clamps  
  $2,150

*12mm rod clamps available upon request*

### ACCESSORIES MM-33

- **MM-33000**  
  Right-handed tilting mount for fine X-axis  
  $194

- **MM-33001**  
  Left-handed tilting mount for fine X-axis  
  $194

- **MM-33002**  
  Rotating base with two base clamps  
  $660

- **MM-33005**  
  Stationary mounting base  
  $116

- **MM-33006**  
  Rod mounting bracket for use with stands  
  $338

- **H102905**  
  12mm rod clamp  
  $62

- **H102910**  
  1inch rod clamp  
  $62

- **H102925**  
  Electrode holder  
  $66

- **MAG-33**  
  Magnetic feet for rotating base (set of 3)  
  $54

- **X850447**  
  Vertical lock  
  $195

- **X330105**  
  Base clamps (2) for clamping rotating base  
  $49

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

- 22mm of travel in X & Y
- 40nm resolution displayed in submicrons (MP-285)
- 62.5nm 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**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Baseplate Dimensions</strong></td>
<td>8in x 15.25in x 2.25in</td>
</tr>
<tr>
<td></td>
<td>200mm x 375mm x 55mm</td>
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<tr>
<td><strong>Maximum Travel</strong></td>
<td>22mm</td>
</tr>
<tr>
<td><strong>Minimal Microstep Size</strong></td>
<td>50nm (MP-285 controller)</td>
</tr>
<tr>
<td></td>
<td>78nm to 125nm (MPC-200 controller)</td>
</tr>
<tr>
<td><strong>Minimal Display Resolution</strong></td>
<td>50nm (MP-285 controller)</td>
</tr>
<tr>
<td></td>
<td>1 micron (MPC-200 controller)</td>
</tr>
<tr>
<td><strong>Maximum Load</strong></td>
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<td></td>
<td>50kg</td>
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<td><strong>Weight</strong></td>
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<tr>
<td></td>
<td>16kg</td>
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<tr>
<td><strong>Mechanical Controller</strong></td>
<td>11lbs</td>
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<tr>
<td></td>
<td>4.5Kg</td>
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</tbody>
</table>
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/Y51\(^1\) MT-1000 for the Olympus BX51WI $6,510
- MT-1000/Y53\(^1\) MT-1000 for the Olympus BX53/63 $6,510
- MT-1000/Y71\(^1\) MT-1000 for the Olympus IX71 $6,510
- MT-1000/Z25\(^1\) MT-1000 for the Zeiss Axioskop 2 FS $6,510
- MT-1000/Z45\(^1\) MT-1000 for the Zeiss Axio Examiner $6,510
- MT-1000/N65\(^1\) MT-1000 for the Nikon FN1 $6,510
- MT-1000/L30\(^1\) MT-1000 for the Leica DMLFS $6,510
- MT-1000/L35\(^1\) MT-1000 for the Leica DM6000 FS $6,510

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/Y51\(^1\) MT-2200 for the Olympus BX51WI $12,025
- MT-2200/Y51/FD\(^1,2\) MT-2200 with focus drive for the Olympus BX51WI $13,675
- MT-2200/Y53\(^1,2\) MT-2200 for the Olympus BX53/63 $12,025
- MT-2200/Z25\(^1\) MT-2200 for the Zeiss Axioskop 2 FS $12,025
- MT-2200/Z45\(^1\) MT-2200 for the Zeiss Axio Examiner $12,025
- MT-2200/N65\(^1\) MT-2200 for the Nikon FN1 $12,025
- MT-2200/L30\(^1\) MT-2200 for the Leica DMLFS $12,025
- MT-2200/L35\(^1\) MT-2200 for the Leica DM6000 FS $12,025

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/Y51\(^1\) MT-2000 for the Olympus BX51WI $11,580
- MT-2000/Y51/FD\(^1,2\) MT-2000 with focus drive for the Olympus BX51WI $13,240
- MT-2000/Y53\(^1\) MT-2000 for the Olympus BX53/63 $11,580
- MT-2000/Z25\(^1\) MT-2000 for the Zeiss Axioskop 2 FS $11,580
- MT-2000/Z45\(^1\) MT-2000 for the Zeiss Axio Examiner $11,580
- MT-2000/N65\(^1\) MT-2000 for the Nikon FN1 $11,580
- MT-2000/L30\(^1\) MT-2000 for the Leica DMLFS $11,580
- MT-2000/L35\(^1\) MT-2000 for the Leica DM6000 FS $11,580

\(^1\) Please specify chamber type when ordering.
\(^2\) Please contact Sutter for availability of focus drive on other microscope makes & models.
## Components

### Manual X-Y Translator

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>MT-500/Y50</td>
<td>Manual Translator for Olympus BX50WI</td>
<td>$4,305</td>
</tr>
<tr>
<td>MT-500/Y51</td>
<td>Manual Translator for Olympus BX51WI</td>
<td>$4,305</td>
</tr>
<tr>
<td>MT-500/Y53</td>
<td>Manual Translator for Olympus BX53/63</td>
<td>$4,305</td>
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<tr>
<td>MT-500/Y71</td>
<td>Manual Translator for Olympus IX71</td>
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<tr>
<td>MT-500/N65</td>
<td>Manual Translator for Nikon FN1</td>
<td>$4,305</td>
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<tr>
<td>MT-500/L30</td>
<td>Manual Translator for Leica DMLFS</td>
<td>$4,305</td>
</tr>
<tr>
<td>MT-500/L35</td>
<td>Manual Translator for Leica DM6000 FS</td>
<td>$4,305</td>
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<td>MT-500/Z20</td>
<td>Manual Translator for Zeiss Axioskop FS</td>
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<tr>
<td>MT-500/Z25</td>
<td>Manual Translator for Zeiss Axioskop 2 FS</td>
<td>$4,305</td>
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<tr>
<td>MT-500/Z45</td>
<td>Manual Translator for Zeiss Axio Examiner</td>
<td>$4,305</td>
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### Motorized X-Y Translator with MPC-200 controller and ROE

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>MT-820/Y51</td>
<td>Translator for Olympus BX51WI</td>
<td>$9,930</td>
</tr>
<tr>
<td>MT-820/Y51/FD</td>
<td>Translator for BX51WI with focus drive</td>
<td>$11,580</td>
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<tr>
<td>MT-820/Y53</td>
<td>Translator for Olympus BXBX53/63</td>
<td>$9,930</td>
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<tr>
<td>MT-820/Z25</td>
<td>Translator for Zeiss Axioskop 2 FS</td>
<td>$9,930</td>
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<td>MT-820/Z45</td>
<td>Translator for Zeiss Axio Examiner</td>
<td>$9,930</td>
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<tr>
<td>MT-820/N65</td>
<td>Translator for Nikon FN1</td>
<td>$9,930</td>
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<tr>
<td>MT-820/L30</td>
<td>Translator for Leica DMLFS</td>
<td>$9,930</td>
</tr>
<tr>
<td>MT-820/L35</td>
<td>Translator for Leica DM6000 FS</td>
<td>$9,930</td>
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### Motorized X-Y Translator with MP-285 controller and ROE

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>MT-800/Y51</td>
<td>Translator for Olympus BX51WI</td>
<td>$9,380</td>
</tr>
<tr>
<td>MT-800/Y51/FD</td>
<td>Translator for BX51WI with focus drive</td>
<td>$11,030</td>
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<tr>
<td>MT-800/Y53</td>
<td>Translator for Olympus BX53/63</td>
<td>$9,380</td>
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<td>MT-800/Z25</td>
<td>Translator for Zeiss Axioskop 2 FS</td>
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<td>MT-800/L30</td>
<td>Translator for Leica DMLFS</td>
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<tr>
<td>MT-800/L35</td>
<td>Translator for Leica DM6000 FS</td>
<td>$9,380</td>
</tr>
</tbody>
</table>

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) $887
- **MT-150/W20R**: Chamber column for Warner Series 20 (round) $887
- **MT-150/ALA35**: Chamber column for ALA 35mm chamber $887
- **MT-150/ALA-MS**: Chamber column for ALA MS $887
- **MT-150/CUST**: Chamber column for non-standard recording chamber $1,005
- **MT-150/PT**: Chamber column for petrie dish or lid $887
- **MT-150/AUTO**: Chamber column for Automate round stage adapter $887

MANIPULATOR COLUMNS

- **MT-75**: Standard gantry stand 8.7 to 13.4in (22.1 to 33.9cm) $835
- **MT-75S**\(^1\): Short gantry stand 6.7 to 9.6 inches (16.9 to 24.4cm) $835
- **MT-75T**: Tall gantry stand 10.7 to 15.4 inches (27.1 to 39.1cm) $950
- **MT-75XT**: Extra tall gantry stand 14.7 to 18.5 inches (37.4 to 47cm) $950
- **MT-75/LS**\(^1\)**: Standard gantry stand with linear slide $1,428
- **MT-75S/LS**\(^1\)**: Short gantry stand with linear slide $1,428
- **MT-75T/LS**: Tall gantry stand with linear slide $1,540
- **MT-75XT/LS**: Extra tall gantry stand with linear slide $1,540

\(^1\) 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**
  - 8in x 15.25in x 2.25in
  - 200mm x 375mm x 55mm

- **Maximum Travel**
  - 1in
  - 25mm

- **Resolution**
  - 0.0002in
  - 5µm

- **Maximum Load**
  - 70lbs
  - 32kg

- **Weight**
  - 35lbs
  - 16kg

(MT-1078 shown with MPC-385-2. Headstages and microscopes not included)
### COMPLETE SYSTEMS

**MT-1078**  
Includes the MT-500 manual X-Y translator, and MT-78-FS fixed stage platform

- **MT-1078/Y51**  
  MT-1078 for the Olympus BX51WI  
  $7,610

- **MT-1078/Y53**  
  MT-1078 for the Olympus BX53/63  
  $7,610

- **MT-1078/Y71**  
  MT-1078 for the Olympus IX71  
  $7,610

- **MT-1078/Z25**  
  MT-1078 for the Zeiss Axioskop 2 FS  
  $7,610

- **MT-1078/Z45**  
  MT-1078 for the Zeiss Axio Examiner  
  $7,610

- **MT-1078/N65**  
  MT-1078 for the Nikon FN1  
  $7,610

- **MT-1078/L30**  
  MT-1078 for the Leica DMLFS  
  $7,610

- **MT-1078/L35**  
  MT-1078 for the Leica DM6000 FS  
  $7,610

**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/Y51**  
  MT-2278 for the Olympus BX51WI  
  $13,125

- **MT-2278/Y51/FD**  
  MT-2278 with focus drive for the Olympus BX51WI  
  $14,780

- **MT-2278/Y53**  
  MT-2278 for the Olympus BX53/63  
  $13,125

- **MT-2278/Z25**  
  MT-2278 for the Zeiss Axioskop 2 FS  
  $13,125

- **MT-2278/Z45**  
  MT-2278 for the Zeiss Axio Examiner  
  $13,125

- **MT-2278/N65**  
  MT-2278 for the Nikon FN1  
  $13,125

- **MT-2278/L30**  
  MT-2278 for the Leica DMLFS  
  $13,125

- **MT-2278/L35**  
  MT-2278 for the Leica DM6000 FS  
  $13,125

**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/Y51**  
  MT-2078 for the Olympus BX51WI  
  $12,575

- **MT-2078/Y51/FD**  
  MT-2078 with focus drive for the Olympus BX51WI  
  $14,230

- **MT-2078/Y53**  
  MT-2078 for the Olympus BX53/63  
  $12,575

- **MT-2078/Z25**  
  MT-2078 for the Zeiss Axioskop 2 FS  
  $12,575

- **MT-2078/Z45**  
  MT-2078 for the Zeiss Axio Examiner  
  $12,575

- **MT-2078/N65**  
  MT-2078 for the Nikon FN1  
  $12,575

- **MT-2078/L30**  
  MT-2078 for the Leica DMLFS  
  $12,575

- **MT-2078/L35**  
  MT-2078 for the Leica DM6000 FS  
  $12,575

1Please specify chamber type and standard or M6 tapped holes when ordering.
**PLATFORM CHAMBER INSERTS**

- **X040500**
  - Warner Series 20 (round) for PM platform – aluminum
  - $116

- **X040503**
  - Warner Series 20 (round) for PM platform – stainless
  - $116

- **X040505**
  - Warner Series 20 (octagonal) for P & PH – aluminum
  - $116

- **X040507**
  - Warner Series 20 (octagonal) for P & PH – stainless
  - $116

- **X040510**
  - 50mm round – aluminum
  - $116

- **X040512**
  - 50mm round – stainless steel
  - $116

- **X040497**
  - Blank insert – aluminum
  - $116

- **X040498**
  - Blank insert – stainless steel
  - $116

- **SI-SLIDE**
  - Insert with slide holders
  - $116

- **SI-PETRI**
  - Insert for petri dish and slides
  - $326

- **SI-W30**
  - Warner Series 30 platform insert – aluminum
  - $116

- **SI-W30ST**
  - Warner Series 30 platform insert – stainless steel
  - $116

- **SI-ALA-MS**
  - ALA MS series insert – aluminum
  - $116

- **SI-CUSTOM**
  - Custom stage insert
  - $357

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

**INSERT DRAWINGS**

![Insert Drawings]

---

**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.
## INDIVIDUAL COMPONENTS

| Component Code | Description                                                                 | Price  
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MT-78-FS</td>
<td>Fixed platform stage with imperial/standard holes, chamber insert and gantry supports</td>
<td>$3,860</td>
</tr>
<tr>
<td>MT-78-FS/M6</td>
<td>Same as above with M6 tapped holes</td>
<td>$3,860</td>
</tr>
<tr>
<td>MT-78-CS</td>
<td>Platform stage with 12.5mm manual micrometer movement, chamber insert, and gantry supports</td>
<td>$5,738</td>
</tr>
<tr>
<td>MT-78-CS/M6</td>
<td>Same as above with M6 tapped holes</td>
<td>$5,738</td>
</tr>
</tbody>
</table>

## MANUAL X-Y TRANSLATOR

| Component Code | Description                                                                 | Price  
<table>
<thead>
<tr>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>MT-500/Y50</td>
<td>Manual Translator for Olympus BX50WI</td>
<td>$4,305</td>
</tr>
<tr>
<td>MT-500/Y51</td>
<td>Manual Translator for Olympus BX51WI</td>
<td>$4,305</td>
</tr>
<tr>
<td>MT-500/Y53</td>
<td>Manual Translator for Olympus BX53/63</td>
<td>$4,305</td>
</tr>
<tr>
<td>MT-500/Y71</td>
<td>Manual Translator for Olympus IX71</td>
<td>$4,305</td>
</tr>
<tr>
<td>MT-500/N65</td>
<td>Manual Translator for Nikon FN1</td>
<td>$4,305</td>
</tr>
<tr>
<td>MT-500/L30</td>
<td>Manual Translator for Leica DMLFS</td>
<td>$4,305</td>
</tr>
<tr>
<td>MT-500/L35</td>
<td>Manual Translator for Leica DM6000 FS</td>
<td>$4,305</td>
</tr>
<tr>
<td>MT-500/Z20</td>
<td>Manual Translator for Zeiss Axioskop FS</td>
<td>$4,305</td>
</tr>
<tr>
<td>MT-500/Z25</td>
<td>Manual Translator for Zeiss Axioskop 2 FS</td>
<td>$4,305</td>
</tr>
<tr>
<td>MT-500/Z45</td>
<td>Manual Translator for Zeiss Axio Examiner</td>
<td>$4,305</td>
</tr>
<tr>
<td>MT-500/N65</td>
<td>Manual Translator for Nikon FN1</td>
<td>$4,305</td>
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<tr>
<td>MT-500/L30</td>
<td>Manual Translator for Leica DMLFS</td>
<td>$4,305</td>
</tr>
<tr>
<td>MT-500/L35</td>
<td>Manual Translator for Leica DM6000 FS</td>
<td>$4,305</td>
</tr>
</tbody>
</table>

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

| Component Code | Description                                                                 | Price  
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MT-820/Y51</td>
<td>Translator for Olympus BX51WI</td>
<td>$9,930</td>
</tr>
<tr>
<td>MT-820/Y51/FD</td>
<td>Translator for BX51WI with focus drive</td>
<td>$11,580</td>
</tr>
<tr>
<td>MT-820/Y53</td>
<td>Translator for Olympus BX53/63</td>
<td>$9,930</td>
</tr>
<tr>
<td>MT-820/Z25</td>
<td>Translator for Zeiss Axioskop 2 FS</td>
<td>$9,930</td>
</tr>
<tr>
<td>MT-820/Z45</td>
<td>Translator for Zeiss Axio Examiner</td>
<td>$9,930</td>
</tr>
<tr>
<td>MT-820/N65</td>
<td>Translator for Nikon FN1</td>
<td>$9,930</td>
</tr>
<tr>
<td>MT-820/L30</td>
<td>Translator for Leica DMLFS</td>
<td>$9,930</td>
</tr>
<tr>
<td>MT-820/L35</td>
<td>Translator for Leica DM6000 FS</td>
<td>$9,930</td>
</tr>
</tbody>
</table>

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

| Component Code | Description                                                                 | Price  
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>MT-800/Y51</td>
<td>Translator for Olympus BX51WI</td>
<td>$9,380</td>
</tr>
<tr>
<td>MT-800/Y51/FD</td>
<td>Translator for BX51WI with focus drive</td>
<td>$11,030</td>
</tr>
<tr>
<td>MT-800/Y53</td>
<td>Translator for Olympus BX53/63</td>
<td>$9,380</td>
</tr>
<tr>
<td>MT-800/Z25</td>
<td>Translator for Zeiss Axioskop 2 FS</td>
<td>$9,380</td>
</tr>
<tr>
<td>MT-800/Z45</td>
<td>Translator for Zeiss Axio Examiner</td>
<td>$9,380</td>
</tr>
<tr>
<td>MT-800/N65</td>
<td>Translator for Nikon FN1</td>
<td>$9,380</td>
</tr>
<tr>
<td>MT-800/L30</td>
<td>Translator for Leica DMLFS</td>
<td>$9,380</td>
</tr>
<tr>
<td>MT-800/L35</td>
<td>Translator for Leica DM6000 FS</td>
<td>$9,380</td>
</tr>
</tbody>
</table>

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
- 25mm motorized travel in X & Y
- 40nm or 62.5nm 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, eletrophysiology
  - Multi-site, inverted (or other large microscope) electrophysiology
The 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 used in the MP-78 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 MP-78 top plate is a 4X6 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**
  - 8in x 15.25in x 2.25in
  - 200mm x 375mm x 55mm
- **Maximum Travel**
  - 1in
  - 25mm
- **Resolution**
  - 0.625µm/step
  - Displayed in microns
- **Maximum Load**
  - 110lbs
  - 50kg
- **Weight**
  - 35lbs
  - 16kg
- **Interface**
  - USB

---

SPECIFICATIONS MP-78
LARGE MOVING STAGE PLATFORM

- **Baseplate Dimensions**
  - 8in x 15.25in x 2.25in
  - 200mm x 375mm x 55mm
- **Maximum Travel**
  - 1in
  - 25mm
- **Resolution**
  - Low: 0.2µm/step
  - High: 0.04µm/step
  - Displayed in submicrons
- **Maximum Load**
  - 110lbs
  - 50kg
- **Weight**
  - 35lbs
  - 16kg
- **Interface**
  - RS-232, 9600 baud
## INDIVIDUAL COMPONENTS

<table>
<thead>
<tr>
<th>Item</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPC-78</td>
<td>$13,240</td>
</tr>
<tr>
<td>MPC-78/M6</td>
<td>$13,240</td>
</tr>
<tr>
<td>MP-78</td>
<td>$12,025</td>
</tr>
<tr>
<td>MP-78/M6</td>
<td>$12,025</td>
</tr>
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## INDIVIDUAL COMPONENTS

<table>
<thead>
<tr>
<th>Item</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPC-78/Y51/FD</td>
<td>$14,890</td>
</tr>
<tr>
<td>MP-78/Y51/FD</td>
<td>$13,675</td>
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## ACCESSORIES

MP-78 and MPC-78 CHAMBER INSERTS (Diagrams on page 86)

<table>
<thead>
<tr>
<th>Item</th>
<th>Price</th>
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<td>X040500</td>
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<td>X040503</td>
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<td>X040507</td>
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<td>X040510</td>
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<td>X040512</td>
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<td>X040497</td>
<td>$116</td>
</tr>
<tr>
<td>X040498</td>
<td>$116</td>
</tr>
<tr>
<td>SI-SLIDE</td>
<td>$116</td>
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<tr>
<td>SI-PETRI</td>
<td>$326</td>
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<tr>
<td>SI-W30</td>
<td>$116</td>
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<tr>
<td>SI-W30ST</td>
<td>$116</td>
</tr>
<tr>
<td>SI-ALA-MS</td>
<td>$116</td>
</tr>
<tr>
<td>SI-CUSTOM</td>
<td>$357</td>
</tr>
</tbody>
</table>

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

(Shown: 3DMS-200, chamber not included)

FEATURES  3DMS

■ Highly stable for experiments intolerant of pipette drift
■ Continuous display (in microns) of axes positions
■ Sub-micron resolution and integrated coarse positioning
■ Switch between continuous or single step movement
■ 1 inch of motorized travel on all three axes
■ Absolute and relative origins
■ Adjustable speed and resolution allows optimization for your experimental setup
■ Remote computer control
■ When used with the MP-285 controller, programmable robotics for complex motion sequences
■ 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 25mm of movement in X, Y and Z axes with sub-micron precision.

The stage shown carries a Warner Instruments’ RC style chamber and PM-1 holder (not included). Other chambers can be accommodated. Please consult our technical staff for further information.
### MICROMANIPULATION

#### SPECIFICATIONS 3DMS

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Travel</strong></td>
<td>1 inch, 25mm on all three axes</td>
</tr>
<tr>
<td><strong>Resolution (with MP-285 Controller)</strong></td>
<td>Low: 0.2µm/step, High: 0.04µm/step</td>
</tr>
<tr>
<td><strong>Maximum Speed</strong></td>
<td>2.9mm/sec</td>
</tr>
<tr>
<td><strong>Long Term Stability</strong></td>
<td>&lt;10nm/hour at 24deg C</td>
</tr>
<tr>
<td><strong>Drive Mechanism</strong></td>
<td>Precision worm gear capstan drive</td>
</tr>
<tr>
<td><strong>Serial Interface</strong></td>
<td>RS-232, 9600 baud, (1 start bit, 8 data bits, 1 stop bit)</td>
</tr>
<tr>
<td><strong>Dimensions</strong></td>
<td><strong>Mechanical:</strong> 4.5in x 6in x 6.25in</td>
</tr>
<tr>
<td></td>
<td>11cm x 15cm x 16cm</td>
</tr>
<tr>
<td></td>
<td><strong>Controller:</strong> 4in x 16in x 12.25in</td>
</tr>
<tr>
<td></td>
<td>10cm x 40.5cm x 31cm</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td><strong>Manipulator:</strong> 3.85lb</td>
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<tr>
<td></td>
<td>1.7kg</td>
</tr>
<tr>
<td></td>
<td><strong>Controller:</strong> 10lb 11oz</td>
</tr>
<tr>
<td></td>
<td>4.5kg</td>
</tr>
<tr>
<td><strong>Electrical</strong></td>
<td>115/230 Volts, 50/60 Hertz power line</td>
</tr>
</tbody>
</table>
### 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.*

<table>
<thead>
<tr>
<th>3DMS-285</th>
<th>Includes rack mount MP-285 controller, 3-axis motorized stage for microscope and ROE user interface</th>
<th>$9,270</th>
</tr>
</thead>
<tbody>
<tr>
<td>3DMS-200</td>
<td>Includes rack mount MPC-200 controller, 3-axis motorized stage for microscope and ROE user interface</td>
<td>$9,930</td>
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### Components 3DMS

<table>
<thead>
<tr>
<th>3DMS/M</th>
<th>3-axis motorized stage mechanical only</th>
<th>$6,620</th>
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<tbody>
<tr>
<td>285DMS</td>
<td>Stage bracket mount (converts MP-285 to stage)</td>
<td>$550</td>
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<tr>
<td>M100106</td>
<td>Flat side panel for controller (each)</td>
<td>$41</td>
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### MOTORIZED MICROSCOPE STAGE AND TRANSLATOR COMPARISON CHART

<table>
<thead>
<tr>
<th></th>
<th>MT-2000 / 2078</th>
<th>MT-2200 / 2278</th>
<th>MP-78</th>
<th>MPC-78</th>
<th>3DMS</th>
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<tbody>
<tr>
<td><strong>DESCRIPTION</strong></td>
<td>Microscope translator and table mounted stands and/or fixed stage for multi-patch</td>
<td></td>
<td>Large moving platform stage</td>
<td></td>
<td>3-dimensional motorized stage</td>
</tr>
<tr>
<td><strong>USES</strong></td>
<td>Multi-electrode recording and imaging in slices or other preparations</td>
<td>Simultaneous 2-Photon Imaging and electrophysiology</td>
<td>Tissue sample or whole animal and multiple manipulators are supported on a large, moving stage. 25mm 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.</td>
<td>Built-in Z focus drive, compact form factor, compatible with upright or inverted microscopes, 25mm 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.</td>
<td></td>
</tr>
<tr>
<td><strong>FEATURES</strong></td>
<td>25mm 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.</td>
<td></td>
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</table>

### Features

<table>
<thead>
<tr>
<th><strong>Features</strong></th>
<th><strong>Travel</strong></th>
<th><strong>Focus</strong></th>
<th><strong>Control</strong></th>
<th><strong>Interface</strong></th>
<th><strong>Price</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Travel</strong></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>25mm in X, Y, and Z</td>
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<tr>
<td>22mm in X and Y</td>
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<tr>
<td><strong>Focus</strong></td>
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<tr>
<td>Built-in</td>
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<tr>
<td>Option for Olympus BX51 Wi</td>
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<tr>
<td><strong>Control</strong></td>
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<td>ROE or PC</td>
<td>ROE or PC</td>
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<tr>
<td><strong>Interface</strong></td>
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<tr>
<td>With MPC-200</td>
<td>USB</td>
<td>USB</td>
<td>USB</td>
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<td></td>
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<tr>
<td>With MP-285</td>
<td>Serial</td>
<td>Serial</td>
<td>Serial</td>
<td></td>
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<tr>
<td><strong>Price</strong></td>
<td>$11,580 to $14,780</td>
<td>$12,025 (MP-78)</td>
<td>$9,270 to $9,930</td>
<td>$13,240 (MPC-78)</td>
<td></td>
</tr>
</tbody>
</table>

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 5/8 inches to a maximum height of 12 1/2 inches. The MT-75S is suitable for most upright scopes, and can be adjusted from 6 5/8 inches to 9 1/2 inches. These systems are very stiff, deflecting approximately 2µm per 25mm rise with a 1.5kg 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 (25mm) 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  
  6in x 6in x .75in  
  153mm x 153mm x 19mm

■ Cantilever Dimensions  
  2.5in x 8in x .75in  
  64mm x 204mm x 19mm

■ Weight  
  MT-75:  
  11lbs 7oz  
  5.2kg  
  MT-75S:  
  9lbs 14oz  
  4.5kg
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.

MT-75T
8in post

MT-75
6in post

MT-75S
4in post

BASEPLATE OPTIONS

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

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

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

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 13.4 in (22.1 to 33.9 cm) - $835
- **MT-75S**: Short gantry stand 6.7 to 9.6 in (16.9 to 24.4 cm) - $835
- **MT-75T**: Tall gantry stand 10.7 to 15.4 in (27.1 to 39.1 cm) - $950
- **MT-75XT**: Extra tall gantry stand 14.7 to 18.5 in (37.4 to 47 cm) - $950
- **MT-75/LS**: Standard gantry stand with linear slide - $1,428
- **MT-75S/LS**: Short gantry stand with linear slide - $1,428
- **MT-75T/LS**: Tall gantry stand with linear slide - $1,540
- **MT-75XT/LS**: Extra tall gantry stand with linear slide - $1,540

**MT-81 MICROINJECTION SERIES**

- **MT-81-DOV8**: MT-81 stand with 8 in dovetail - $620
- **MT-81-DOV12**: MT-81 stand with 12 in dovetail - $620

*Useful for low profile stereoscopes and microinjection.

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**ACCESSORIES  MT-75 SERIES**

- **MT-7004**: Linear slide cantilever (no stand) - $770
- **MAG-MT**: Magnetic feet (set of 4) - $69
- **X700080**: Thin baseplate – 5 in x 5 in x 0.3 in thick - $120
- **X700095**: Narrow baseplate – 3 in x 5 in x 0.75 in thick - $120
- **X700100**: Square baseplate – 6 in x 6 in x 0.75 in thick - $120
- **X750090**: 12 in dovetail - $380

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

2 **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
- Individual components provide a variety of mounting options
- Adjustable height cantilever available
- Accomodates a variety of special layouts
- Suitable for upright and inverted microscopes
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 3/4in thick aluminum baseplate and then fitted with a 5/16in 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 25mm 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**
  - 6in x 6in x .75in
  - 153mm x 153mm x 19mm

- **Mounting Plate Dimensions**
  - 5in x 5in x 5/16in
  - 128mm x 128mm x 8mm

- **Total Stand Height**
  - depending on configuration
  - 4 1/16in to 13 1/16in
  - 104mm to 333mm

- **Weight**
  - depending on configuration
  - 3lbs 11oz to 8lbs 5oz
  - 1.7kg to 3.8kg

**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  
  $312

- **MT-70-6**  
  Same as above with 6 inch tower  
  $342

- **MT-70-9**  
  Same as above with 9 inch tower  
  $380

- **MT-70-12**  
  Same as above with 12 inch tower  
  $408

*(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  
  $375

- **MT-71-6**  
  Same as above with 6 inch tower  
  $408

- **MT-71-9**  
  Same as above with 9 inch tower  
  $440

- **MT-71-12**  
  Same as above with 12 inch tower  
  $475

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

### ACCESSORIES  MT-70 / MT-71 STANDS

- **MT-7001**  
  Cantilever mounting assembly  
  $164

- **MAG-MT**  
  Magnetic feet (set of 4)  
  $69

- **X700080**  
  Thin baseplate—5in x 5in x 0.3in thick  
  $120

- **X700095**  
  Narrow baseplate – 3in x 5in x 0.75in thick  
  $120

- **X700100**  
  Square baseplate – 6in x 6in x 0.75in thick  
  $120

- **X700102**  
  Mounting plate – 5in x 5in x 0.3in thick  
  $90

- **X700115**  
  MP-85 adapter plate  
  $105
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
For those who wish to use the MP-285 or MP-225 manipulator in conjunction with an inverted microscope, Sutter Instrument has designed a series of Microscope Dependent (MD) stands. 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 (1/4-20 on 1 inch centers) and our MDM part numbers indicate a metric hole pattern (M6 tapped holes on 25mm centers). The last digit of the MD and MDM part number identifies a single-sided platform (–1), 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.

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
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<tbody>
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<td>MD-80-1</td>
<td>Olympus IX 50/70</td>
<td>$505</td>
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<td>MD-80-2</td>
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<tr>
<td>MD-81-1</td>
<td>Olympus IX 51/71/81</td>
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<td>MD-81-2</td>
<td></td>
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<tr>
<td>MD-81-1ZDC</td>
<td>Olympus IX 51/71/81 with zero drift stage</td>
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<tr>
<td>MD-81-2ZDC</td>
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<td>MD-73-1</td>
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<tr>
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**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.

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<td>MDM-55-SP</td>
<td>15mm spacer for Nikon Ti2 with motorized stage (set of 4)</td>
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</table>
**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.*

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<th>Leica</th>
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<td>Leica DMi 8</td>
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</tr>
<tr>
<td>MD-63-1/R</td>
<td></td>
<td>$505</td>
</tr>
<tr>
<td>MDM-63-1L</td>
<td>Leica DMi 8 (metric tap)</td>
<td>$505</td>
</tr>
<tr>
<td>MDM-63-1R</td>
<td></td>
<td>$505</td>
</tr>
<tr>
<td>MDM-63-1L/M</td>
<td>Motorized (metric tap)</td>
<td>$505</td>
</tr>
<tr>
<td>MDM-63-1R/M</td>
<td></td>
<td>$505</td>
</tr>
<tr>
<td>MD-63-2</td>
<td>Leica DMi 8</td>
<td>$1,010</td>
</tr>
<tr>
<td>MDM-63-2</td>
<td>Leica DMi 8 (metric tap)</td>
<td>$1,010</td>
</tr>
<tr>
<td>MDM-63-2/M</td>
<td>Motorized (metric tap)</td>
<td>$1,010</td>
</tr>
</tbody>
</table>
IPA® and DOUBLE IPA®
INTEGRATED PATCH AMPLIFIERS
WITH DATA ACQUISITION SYSTEM

New: 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

Tissue slice recordings

Cultured cell experiments

Cell line studies from adherent or dispersed cells

In vivo patch clamp

Network studies

Optogenetics

COMMON APPLICATIONS IPA® / DOUBLE IPA®
Sutter Instrument introduces the IPA® family of Integrated Patch Amplifiers, which enables efficient, low-noise whole-cell recordings. The IPA systems, available in either a single headstage (IPA) or dual headstage (DOUBLE IPA) version, 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 7 (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 500 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 amplifier 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 1.4pA in a 0.1-10kHz bandwidth
- 500MΩ headstage feedback resistor provides a maximal range of ±20nA
- Fast pipette capacitance compensation and whole-cell compensation
  - Pipette capacitance compensation up to 25pF
  - Whole-cell compensation: Cm from 1-100pF; Rs from 1-100MΩ
- Onboard automatic compensation routines
- Series resistance prediction and correction (0-100MΩ)
- Four-pole Bessel low-pass filter (cutoff = 0.5-20kHz)
- Output gain: 1, 2, 5, 10, 20, 50, 100
- Holding potential ±1000mV
- 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 data acquisition and amplifier
- Up to 6 or 8 input channels (1-50kHz sampling rate per channel)
- Up to 400kHz aggregate sampling rate (1-10kHz 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 (±10V)
  - 2 analog output channels (±10V)
  - 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 7 (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)
**SPECIFICATIONS IPA® / DOUBLE IPA®**

### Dimensions

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

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

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

### Weight

**IPA®:**
- 9lbs
- 4kg

**DOUBLE IPA®:**
- 8.1lbs
- 3.7kg

**PATCH PANEL:**
- 3.5lbs
- 1.6kg

### Electrical

- 100/240 Volts
- 50/60 Hertz power line

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 (76cm) connector cable and replaces the standard cable that ships with the IPA system.

![IPA-PCH Patch Panel](image)

IPA-PCH Patch Panel for tidy, convenient connection of peripherals at the front of the rack
### 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; and SutterPatch® software suite with Igor Pro 7 license. **$13,900**

- **IPA-2**
  - Includes: DOUBLE IPA® system with two headstages, two EH-P170 pipette holders; and SutterPatch software suite with Igor Pro 7 license. **$17,900**

### ACCESSORIES IPA® / DOUBLE IPA®

#### PATCH PANEL
- **IPA-PCH¹**
  - Patch panel with 8 digital out / 4 aux. in / 2 aux. out **$595**

#### PIPETTE HOLDERS
- **EH-P170²**
  - Polycarbonate holder 1.0 to 1.7mm O.D. **$169**

- **EH-Q170²**
  - Quartz holder 1.0 to 1.7mm O.D. **$495**

¹ Provides convenient access to data acquisition capabilities

² 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.
**SUTTERPATCH®**

**DATA ACQUISITION, MANAGEMENT AND ANALYSIS SOFTWARE**

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**New Feature**

**FEATURES SUTTERPATCH®**

- **New:** Multi-amplifier mode for any combination of two IPA® or Double IPA® devices. Up to 16 input channels supported.

- 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

---

Screen shot of SutterPatch software
SutterPatch® software is a full-featured electrophysiology data acquisition, management and analysis application for Windows or Mac OS computers. SutterPatch comes bundled with the Sutter Instrument IPA® Integrated Patch Amplifiers. 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 500 metadata parameters. Built within the newly released version 7 of Igor Pro by WaveMetrics, Inc., SutterPatch provides immediate access to Igor’s powerful scientific and engineering analysis tools.

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 is 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 help configuring 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, reanalysis after the experiment allows performing the most sophisticated analysis procedures. SutterPatch adds application-specific capabilities on top of the expansive analysis feature set that is native to Igor Pro 7. 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
  - 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

- 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
  - Multi-amplifier mode: A combination of any two IPA® or Double IPA® Amplifiers can be connected, providing up to 16 input channels
  - 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 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
- 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 7 analysis features

Support for 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

- **Minimum Hardware**
  - Central Processing Unit (CPU): Dual-core
  - Random Access Memory (RAM): 3 GB
  - Hard Disk Free Space: 500 MB
  - Display Resolution: 1024 x 768 (XGA)

- **Recommended Hardware**
  - Random Access Memory (RAM): 16 GB
  - Display Resolution: 1920 x 1080 (Full HD)

US PRICES SUTTERPATCH®

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

  Included with IPA® and DOUBLE IPA® System
AIR TABLES & FARADAY CAGES
VIBRATION ISOLATION SYSTEMS

FEATURES

- 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 25mm 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 25mm centers) or imperial (¼-20 on 1in 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 inch NPT fittings (adapters included)

PATCH CLAMP / ELECTROPHYSIOLOGY AND MICROINJECTION AIR TABLES

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

IMAGING / OPTICAL AIR TABLES

<table>
<thead>
<tr>
<th>Model</th>
<th>AT-48</th>
<th>AT-58</th>
<th>AT-510</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions¹</td>
<td>96in x 48in x 36in</td>
<td>96in x 59in x 36in</td>
<td>120in x 59in x 36in</td>
</tr>
<tr>
<td></td>
<td>244cm x 122cm x 91cm</td>
<td>244cm x 150cm x 91cm</td>
<td>305cm x 150cm x 91cm</td>
</tr>
<tr>
<td>Load Capacity²</td>
<td>1500lbs / 680kg</td>
<td>1800lbs / 590kg</td>
<td>1200lbs / 544kg</td>
</tr>
<tr>
<td>Table Top Height</td>
<td>8in / 20cm</td>
<td>8in / 20cm</td>
<td>8in / 20cm</td>
</tr>
<tr>
<td>Table Const.</td>
<td>Plated steel honeycomb core</td>
<td>Plated steel honeycomb core</td>
<td>Plated steel honeycomb core</td>
</tr>
<tr>
<td>Table Hole Pattern³</td>
<td>M6 on 25mm centers or ¼-20 on 1in centers</td>
<td>M6 on 25mm centers or ¼-20 on 1in centers</td>
<td>M6 on 25mm centers or ¼-20 on 1in centers</td>
</tr>
</tbody>
</table>

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.
STANDARD AIR TABLES

**AT-3036**
30in x 36in x 2in thick (75cm x 90cm x 5cm thick) table top, perimeter enclosure, and sliding side shelf

- **AT-3036-ST** 30in x 36in Air Table, ¼-20 threaded top $4,985
- **AT-3036-M6** 30in x 36in Air Table, M6 tapped hole top $4,985
- **AT-3036-ST-F** 30in x 36in Air Table, ¼-20 threaded top, and Faraday cage with roll-up door $6,635
- **AT-3036-M6-F** 30in x 36in Air Table, M6 tapped hole top, and Faraday cage with roll-up door $6,635

**AT-3648**
Includes 36in x 48in x 2in thick (90cm x 120cm x 5cm thick) table top, perimeter enclosure, and sliding side shelf

- **AT-3648-ST** 36in x 48in Air Table, ¼-20 threaded top $5,610
- **AT-3648-M6** 36in x 48in Air Table, M6 tapped hole top $5,610
- **AT-3648-ST-F** 36in x 48in Air Table, ¼-20 threaded top, and Faraday cage with roll-up door $7,525
- **AT-3648-M6-F** 36in x 48in Air Table, M6 tapped hole top, and Faraday cage with roll-up door $7,525

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

- **AT-48-ST**
  - 4ft x 8ft Air table, ¼-20 threaded top
  - $10,715
- **AT-48-M6**
  - 4ft x 8ft Air table, M6 tapped hole top
  - $10,715
- **AT-48-ST-C**
  - 4ft x 8ft Air table, ¼-20 threaded top, and casters
  - $11,350
- **AT-48-M6-C**
  - 4ft x 8ft Air table, M6 tapped hole top, and casters
  - $11,350

#### AT-58
Includes 5ft x 8ft x 8in thick (152cm x 244cm x 20cm thick) table top and legs

- **AT-58-ST**
  - 5ft x 8ft Air table, ¼-20 threaded top
  - $11,675
- **AT-58-M6**
  - 5ft x 8ft Air table, M6 tapped hole top
  - $11,675
- **AT-58-ST-C**
  - 5ft x 8ft Air table, ¼-20 threaded top, and casters
  - $12,310
- **AT-58-M6-C**
  - 5ft x 8ft Air table, M6 tapped hole top, and casters
  - $12,310

#### AT-510
Includes 5ft x 10ft x 8in thick (152cm x 305cm x 20cm thick) table top and legs

- **AT-510-ST**
  - 5ft x 10ft Air table, ¼-20 threaded top
  - $14,175
- **AT-510-M6**
  - 5ft x 10ft Air table, M6 tapped hole top
  - $14,175
- **AT-510-ST-C**
  - 5ft x 10ft Air table, ¼-20 threaded top, and casters
  - $14,810
- **AT-510-M6-C**
  - 5ft x 10ft Air table, M6 tapped hole top, and casters
  - $14,810
FOR ALL AIR TABLES

- **AT-ARM**: Padded arm rests (set of 2) - $120
- **AT-CASTER**: Casters for non-optical air tables (set of 4) - $525
- **AT-COMP-110**: Air compressor – 110V, 60 Hz - $1,130
- **AT-COMP-220**: Air compressor – 220V, 50 Hz - $1,130

FOR AT-3036 30X36IN AIR TABLE

- **AT-30-OSF**: U-shaped shelf (for Faraday cage) - $265
- **AT-30-FC**: Faraday cage - $1,650

FOR AT-3648 36X48IN AIR TABLE

- **AT-36-OSF**: U-shaped shelf (for Faraday cage) - $295
- **AT-36-FC**: Faraday cage - $1,915

FARADAY CAGES – BENCH TOP

Stand-alone cage with stainless steel base plate. Breadboards with threaded or tapped holes sold separately. Phone Sutter for detail.

- **AT-3036-FCB**: Faraday cage, 30in x 36in solid stainless steel - $1,860
- **AT-3048-FCB**: Faraday cage, 30in x 48in solid stainless steel - $2,030
- **AT-3648-FCB**: Faraday cage, 36in x 48in solid stainless steel - $2,200

- **AT-MOUNT-ST**: Mounting kit for stand-alone cage – imperial - $95
- **AT-MOUNT-M6**: Mounting kit for stand-alone cage – metric - $95

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

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

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

## SAN FRANCISCO

<table>
<thead>
<tr>
<th>Translator</th>
<th>Manipulator</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MT-1000</td>
<td>MPC-325-2</td>
<td>1000-325-(scope suffix)</td>
</tr>
<tr>
<td>MT-2200</td>
<td>MPC-325-2</td>
<td>2200-325-(scope suffix)</td>
</tr>
</tbody>
</table>

### Three Towers

<table>
<thead>
<tr>
<th>Translators</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MT-150</td>
<td>1000-325-(scope suffix)</td>
</tr>
<tr>
<td>MT-75 (2)</td>
<td>1000-385-(scope suffix)</td>
</tr>
</tbody>
</table>

## ALCATRAZ

<table>
<thead>
<tr>
<th>Translator</th>
<th>Manipulator</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MT-1078</td>
<td>MPC-325-2</td>
<td>1078-325-(scope suffix)</td>
</tr>
<tr>
<td>MT-2278</td>
<td>MPC-325-2</td>
<td>2278-325-(scope suffix)</td>
</tr>
</tbody>
</table>

### Fixed Platform Stage

<table>
<thead>
<tr>
<th>Translators</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MT-78-FS</td>
<td>1078-325-(scope suffix)</td>
</tr>
</tbody>
</table>

## LONG ISLAND

<table>
<thead>
<tr>
<th>No Translator</th>
<th>Manipulator</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MT-78-FS</td>
<td>MPC-325-2</td>
<td>78-325</td>
</tr>
</tbody>
</table>

### Motorized Platform Stage

<table>
<thead>
<tr>
<th>Translators</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MT-78-FS</td>
<td>78-325</td>
</tr>
</tbody>
</table>

---

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

<table>
<thead>
<tr>
<th>Microscope</th>
<th>Manufacturer</th>
<th>Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z25</td>
<td>Zeiss Axioskop 2 FS</td>
<td>L30</td>
</tr>
<tr>
<td>Z45</td>
<td>Zeiss Axio Examiner</td>
<td>L35</td>
</tr>
<tr>
<td>Y51</td>
<td>Olympus BX51WI</td>
<td>N65</td>
</tr>
<tr>
<td>Y51-FD</td>
<td>Olympus BX51WI (includes focus drive)</td>
<td>N65</td>
</tr>
</tbody>
</table>

2. The Long Island has no translator and is appropriate when the microscope must be stationary.
### MICROSCOPE MODELS - Use this scope suffix when ordering

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Zeiss</th>
<th>Leica</th>
<th>Olympus</th>
<th>Nikon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z25</td>
<td>Zeiss Axioskop 2 FS</td>
<td>Axioskop 2 FS</td>
<td>DM LFS</td>
<td>BX51WI</td>
<td>Axio Examiner</td>
</tr>
<tr>
<td>Z45</td>
<td>Zeiss Axio Examiner</td>
<td></td>
<td>DM6000 FS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y51</td>
<td>Olympus BX51WI</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y51-FD</td>
<td>Olympus BX51WI (includes focus drive)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y53</td>
<td>Olympus BX53/63</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### SAN FRANCISCO

**MT-1000 with manual X-Y translator, micromanipulators**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>MP-225</th>
<th>MP-285</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000-325-(scope suffix)</td>
<td>With two MP-225 manipulators</td>
<td>$18,440</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1000-385-(scope suffix)</td>
<td>With two MP-285 manipulators</td>
<td>$21,190</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**MT-2200 with motorized X-Y translator, micromanipulators**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>MP-225</th>
<th>MP-285</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>2200-325-(scope suffix)</td>
<td>With two MP-225 manipulators</td>
<td>$23,790</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2200-385-(scope suffix)</td>
<td>With two MP-285 manipulators</td>
<td>$24,440</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### ALCATRAZ

**MT-1078 with manual X-Y translator, micromanipulators**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>MP-225</th>
<th>MP-285</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1078-325-(scope suffix)</td>
<td>With two MP-225 manipulators</td>
<td>$20,445</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1078-385-(scope suffix)</td>
<td>With two MP-285 manipulators</td>
<td>$23,185</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**MT-2278 with motorized X-Y translator, micromanipulators**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>MP-225</th>
<th>MP-285</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>2278-325-(scope suffix)</td>
<td>With two MP-225 manipulators</td>
<td>$25,795</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2278-385-(scope suffix)</td>
<td>With two MP-285 manipulators</td>
<td>$28,540</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### LONG ISLAND

**MT-78 with motorized platform stage, and micromanipulators**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>MP-225</th>
<th>MP-285</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>78-325</td>
<td>With two MP-225 manipulators</td>
<td>$26,940</td>
<td></td>
<td></td>
</tr>
<tr>
<td>78-385</td>
<td>With two MP-285 manipulators</td>
<td>$28,540</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*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,
A 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®**

Objective moves 22mm 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

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

### FEATURES 

- **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

### COMMON APPLICATIONS 

- 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 3mm galvo scanners have been upgraded to either 6mm 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 3mm or 6mm 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 MScan2.0 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 conventional scanning version of 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 is the strong support from the ScanImage community. As of 2014, Vidrio became the principle vehicle for support and new development of ScanImage including a resonant version (SI 5) compatible with the MOM. Later this year, Vidrio will release ScanImage 2015a, and b and users will be able to purchase prerelease versions through Sutter as well as all the necessary data acquisition hardware to use ScanImage 2015 with new or existing Sutter MOMs.

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 3mm or 6 mm mirrors or resonant with 5mm 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, Sigmann 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**  
  22mm on all three axes

- **Resolution**  
  - MP-285 controller  
    - Low: 0.2µm/step  
    - High: 0.04µm/step  
  - MPC-200 controller  
    - 0.0625µm/step

- **Maximum Speed**  
  - MP-285 controller  
    - 2.9mm/sec  
  - MPC-200 controller  
    - 5.0mm/sec

- **Long Term Stability**  
  1-2µ/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
MOM® BASIC SYSTEM FOR 2-PHOTON MICROSCOPY

Includes Movable Objective Microscope®, 2 channel detector with multalkali 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-3MM**: MOM System with 3mm XY scanners
  - Price: $114,240

- **MOM-6MM**: MOM System with 6mm XY scanners
  - Price: $117,300

- **MOM-RES-MCS**: MOM System with Resonant scanners and MScan 2.0 software
  - Price: $137,700

- **MOM-RES-SIP**: MOM System with Resonant scanners and ScanImage Premium
  - Price: $147,900

MOM ACCESSORIES

- **MOM-SETUPKIT-M**: Basic table optics for laser routing
  - Price: $2,315

- **MOM-ALIGNTOOL**: MOM alignment tool
  - Price: $1,575

---

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
- 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.
- Optimized to allow *in vivo* and *in vitro* experimentation on one setup
- Standard configuration accepts RMS thread objectives. Contact Sutter for additional options.
- Free Multi-Link™ software coordinates movement with micropipette positioning of MPC-200
- Transmitted IR and EPI fluorescent imaging modes
- Flexible excitation port easily allows addition of secondary sources for photostimulation
- 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®**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Travel</strong></td>
<td>25mm on all three axes</td>
</tr>
<tr>
<td><strong>Resolution</strong></td>
<td>MP-285 controller</td>
</tr>
<tr>
<td></td>
<td>Low: 0.2µm/step</td>
</tr>
<tr>
<td></td>
<td>High: 0.04µm/step</td>
</tr>
<tr>
<td></td>
<td>MPC-200 controller</td>
</tr>
<tr>
<td></td>
<td>0.0625µm/step</td>
</tr>
<tr>
<td><strong>Maximum Speed</strong></td>
<td>MP-285 controller</td>
</tr>
<tr>
<td></td>
<td>2.9mm/sec</td>
</tr>
<tr>
<td></td>
<td>MPC-200 controller</td>
</tr>
<tr>
<td></td>
<td>5.0mm/sec</td>
</tr>
<tr>
<td><strong>Drive Mechanism</strong></td>
<td>Precision worm gear capstan drive</td>
</tr>
<tr>
<td><strong>Communication</strong></td>
<td>MP-285: RS-232 Serial</td>
</tr>
<tr>
<td></td>
<td>MPC-200: USB</td>
</tr>
<tr>
<td><strong>Electrical</strong></td>
<td>115/230 Volts</td>
</tr>
<tr>
<td></td>
<td>50/60 Hertz power line</td>
</tr>
</tbody>
</table>

(Shown: SOM-T-QUAD with additional QUAD®)
### SOM® BASIC SYSTEM

- **SOM-T**
  - SOM Microscope system with MPC-200 controller and ROE, mounted on tall (MT-75T) tower.
  - **Price:** $15,760

- **SOM-XT**
  - SOM Microscope system with MPC-200 controller and ROE, mounted on extra tall (MT-75XT) tower.
  - **Price:** $15,760

### SOM ACCESSORIES

- **SOM-COND**
  - SOM OCC condensor with TLED
  - **Price:** $4,470

### SOM BUNDLED SYSTEMS

- **SOM-T-QUAD**
  - SOM-T with QUAD® 4-axis manipulator
  - **Price:** $35,995

- **SOM-T-285**
  - SOM-T with MP-285 mechanical manipulator
  - **Price:** $32,854

- **SOM-T-225**
  - SOM-T with MP-225 mechanical manipulator
  - **Price:** $32,070

- **SOM-XT-QUAD**
  - SOM-XT with QUAD 4-axis manipulator
  - **Price:** $35,995

- **SOM-XT-285**
  - SOM-XT with MP-285 mechanical manipulator
  - **Price:** $32,854

- **SOM-XT-225**
  - SOM-XT with MP-225 mechanical manipulator
  - **Price:** $32,070

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**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.
MCS
MOM COMPUTER SYSTEM AND MSCAN 2.0 SOFTWARE

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
- Immunology
- Deep tissue imaging
- Embryology
- Neurophysiology
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 3.0 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 25nm x 25nm x 25mm 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, queriable 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:
20.5in x 8.25in x 20in
52cm x 21cm x 51cm
Monitor:
26in x 10in x 19in
67cm x 24cm x 48cm

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

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.*

<table>
<thead>
<tr>
<th>System</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOM-MCS</td>
<td>System includes preinstalled MScan 2.0 software, Windows 7 workstation, data acquisition boards, USB 3.0 camera</td>
<td>$18,855</td>
</tr>
</tbody>
</table>

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.*

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOM-DAQ</td>
<td>MOM® data acquisition system (includes NI 6110E)</td>
<td>$5,590</td>
</tr>
<tr>
<td>MPC-200-ROE</td>
<td>Includes MPC-200 controller and ROE-200</td>
<td>$3,860</td>
</tr>
</tbody>
</table>

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

- 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 freely available and open source 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.


ScanImage - https://openwiki.janelia.org/wiki/display/ephus/ScanImage
COMMON APPLICATIONS

- Two-photon imaging
- Deep tissue imaging
- Complex neurophysiology experimentation control
### US PRICES

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.

<table>
<thead>
<tr>
<th>COMPONENTS</th>
<th>DESCRIPTION</th>
<th>PRICE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RESSCAN-MOM</strong></td>
<td>Resonant Scanner for Sutter MOM – Stand Alone</td>
<td>$13,760</td>
</tr>
<tr>
<td><strong>RESSCAN-GEN</strong></td>
<td>Resonant Scanner for 60mm cage based microscope – Stand Alone</td>
<td>$13,760</td>
</tr>
<tr>
<td><strong>SIP-SOFT</strong></td>
<td>ScanImage Premium software</td>
<td>$11,030</td>
</tr>
<tr>
<td><strong>DAQ-FPGA</strong></td>
<td>Basic National Instruments Flex-RIO Data Acquisition system compatible with SI 5 freeware and ScanImage Premium software</td>
<td>$16,370</td>
</tr>
<tr>
<td><strong>CO-O040335</strong></td>
<td>FEMTO DHPCA-100 preamplifier</td>
<td>$4,140</td>
</tr>
<tr>
<td><strong>CO-O040337</strong></td>
<td>FEMTO power supply</td>
<td>$316</td>
</tr>
</tbody>
</table>

### BUNDLED SYSTEMS

Includes SI2015-SOFT, RESSCAN-MOM or RESSCAN-GEN, preconfigured NI-FLEX RIO data acquisition system, and two FEMTO DHPCA-100 fast preamps with power supplies.

<table>
<thead>
<tr>
<th>BUNDLED SYSTEMS 1</th>
<th>DESCRIPTION</th>
<th>PRICE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RES-MOM-SIP</strong></td>
<td>Resonant Scanner for Sutter MOM® w/ ScanImage Premium software</td>
<td>$50,065</td>
</tr>
<tr>
<td><strong>RES-GEN-SIP</strong></td>
<td>Resonant Scanner for 60mm cage based microscope w/ ScanImage Premium software</td>
<td>$50,065</td>
</tr>
</tbody>
</table>

### SI 5 BUNDLED SYSTEMS

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

<table>
<thead>
<tr>
<th>BUNDLED SYSTEMS 1</th>
<th>DESCRIPTION</th>
<th>PRICE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RES-MOM-SI5</strong></td>
<td>Resonant Scanner for Sutter MOM w/ SI 5</td>
<td>$39,035</td>
</tr>
<tr>
<td><strong>RES-GEN-SI5</strong></td>
<td>Resonant Scanner for 60mm cage based microscope w/ SI 5</td>
<td>$39,035</td>
</tr>
</tbody>
</table>

### SCANIMAGE PREMIUM

Includes SI2015-SOFT, RESSCAN-MOM or RESSCAN-GEN, preconfigured NI-FLEX RIO data acquisition system, and two FEMTO DHPCA-100 fast preamps with power supplies.

<table>
<thead>
<tr>
<th>SCANIMAGE PREMIUM</th>
<th>DESCRIPTION</th>
<th>PRICE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RES-MOM-SIP</strong></td>
<td>Resonant Scanner for Sutter MOM® w/ ScanImage Premium software</td>
<td>$50,065</td>
</tr>
<tr>
<td><strong>RES-GEN-SIP</strong></td>
<td>Resonant Scanner for 60mm cage based microscope w/ ScanImage Premium software</td>
<td>$50,065</td>
</tr>
</tbody>
</table>
RESSCAN
SUTTER RESONANT SCAN BOX

(Shown: RESSCAN-MOM)

**FEATURES**

- 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
- 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 new Sutter Resonant Scan box (RESSCAN) is a general purpose resonant scan box using the industry standard Cambridge Technologies CRS 8KHz resonant scanner for fast X scanning and a second Cambridge galvo scanner (6215 5mm) 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 60mm 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 60mm 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 R10 data acquisition packages to use with SI 5.
### Dimensions

*Resonant Scan Box:*
- 5in x 4in x 2in
- 13cm x 10cm x 5cm

*Controller:*
- 16in x 11in x 3.5in
- 41cm x 28cm x 9cm

### Weight

*Resonant Scan Box:*
- 2.0lbs
- 1kg

*Controller:*
- 6.5lbs
- 3kg

### Electrical

- 115/230 Volts
- 50/60 Hertz power line
**RESSCAN BASIC SYSTEM**

**Resonant Scan Box for Sutter MOM® or Researcher-built Microscope**
Includes: Cambridge CRS 8KHz Resonant Scanner and 6215, 5mm 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 60mm cage (drawings available).

- **RESSCAN-MOM**
  Resonant Scanner for Sutter MOM – Stand Alone
  $13,760

- **RESSCAN-GEN**
  Resonant Scanner for 60mm cage based microscope – Stand Alone
  $13,760

**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 3.0 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
  $41,978

- **RES-GEN-MCS**
  Resonant Scanner for 60mm cage based microscope – Bundle Version
  $41,978

**SCANIMAGE PREMIUM BUNDLED VERSION**
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
  $50,065

- **RES-GEN-SIP**
  Resonant Scanner for 60mm cage-based microscope – ScanImage Premium Bundle version
  $50,065

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 +/-12VDC (two outlets) and +/-5VDC (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.
### 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 0-1000V

### Voltage and Current of rear panel outputs
- PS-2 PMT High Voltage output: 0 to -1250VDC, current 0.6mA
- PS-2/LV PMT Module output: constant +15VDC as well as control Vref supplied by module
- Preamp/Auxiliary power outputs: +/-12VDC, 200mA per side
- +/-5VDC, 200mA per side

### Dimensions
- 16in x 11in x 3.5in
- 4cm x 28cm x 9cm

### Weight
- 6.5lbs
- 3kg

### 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). $3,530

- **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). $3,530
**DF-SCOPE™ MULTIPHOTON IMAGING PACKAGE FOR OLYMPUS BX51WI MICROSCOPES**

- 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.

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(Olympus parts not included)

**FEATURES** **DF-SCOPE™**

- 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 photomanipulation 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 showing high voltage 0-1000V

- **Voltage and Current of rear panel outputs**
  - PS-2 PMT High Voltage output: 0 to -1250VDC, current 0.6mA
  - PS-2/LV PMT Module output: constant +15VDC as well as control Vref supplied by module
  - Preamp/Auxiliary power outputs: +/-12VDC, 200mA per side
  - +/-5VDC, 200mA per side

- **Dimensions**
  - 16in x 11in x 3.5in
  - 41cm x 28cm x 9cm

- **Weight**
  - 6.5lbs
  - 3kg

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

---

RoHS2 2011/65/EU
**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.

<table>
<thead>
<tr>
<th>Package</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF-3MM</td>
<td>DF-Scope package with 3mm scanners</td>
<td>$89,130</td>
</tr>
<tr>
<td>DF-6MM</td>
<td>DF-Scope package with 6mm scanners</td>
<td>$92,360</td>
</tr>
<tr>
<td>DF-RES</td>
<td>DF-Scope package with Resonant scanners, MCS Computer System and MScan 2.0 software</td>
<td>$113,800</td>
</tr>
<tr>
<td>DF-3MM</td>
<td>MOM-DETCT-S1-M MOM® short path #1 detector</td>
<td>$12,454</td>
</tr>
<tr>
<td>DF-LOWER</td>
<td>DF-Scope lower detector mounting</td>
<td>$7,140</td>
</tr>
<tr>
<td>PS-2</td>
<td>PMT power supply and mating connectors for all outputs (suitable for RG357 or like PMT’s)</td>
<td>$3,530</td>
</tr>
<tr>
<td>PS-2/LV</td>
<td>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).</td>
<td>$3,530</td>
</tr>
<tr>
<td>CO-O040368</td>
<td>PMT amplifier C7319</td>
<td>$705</td>
</tr>
<tr>
<td>LB-SC</td>
<td>Lambda SC control unit, serial, USB cable, power cord and manual</td>
<td>$842</td>
</tr>
<tr>
<td>IQ25-SA</td>
<td>25mm SmartShutter® with stand alone housing</td>
<td>$1,185</td>
</tr>
<tr>
<td>MOM-SETUPKIT-M</td>
<td>Basic table optics for laser routing</td>
<td>$2,315</td>
</tr>
<tr>
<td>MOM-BEAMSPLITTER</td>
<td>MOM Beam Splitter</td>
<td>$2,525</td>
</tr>
<tr>
<td>MPC-78/Y51/FD</td>
<td>MPC-78 with focus drive for the Olympus BX51WI</td>
<td>$14,890</td>
</tr>
<tr>
<td>MP-78/Y51/FD</td>
<td>MP-78 with focus drive for the Olympus BX51WI</td>
<td>$13,675</td>
</tr>
</tbody>
</table>

1 When ordering please specify 1/4-20 or M6 tapped holes, and chamber insert (see page 91).
**BOB OPEN-DESIGN UPRIGHT MICROSCOPE**

**FEATURES**

- 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
- Optional MPC-88 motorized XY stage with MPC-200 controller.
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 \textit{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, configured with an optional motorized XY stage, 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.
**SPECIFICATIONS BOB**

- **Dimensions**
  - 9.1in x 10.8in x 20.4in
  - 23.1cm x 27.5cm x 51.9cm

- **Weight**
  - **BOB**: 23.9lbs, 10.8kg
  - **BOB-TL**: 29.3lbs, 13.3kg

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

**ACCESSORIES BOB**

- **MPC-88**
  - Moving platform stage plate with motorized gantry supports, MPC-200 controller and ROE, cables and manual
  - $13,480

- **MPC-88/M6**
  - Same as MPC-78 except with M6 tapped holes
  - $12,290

- **MP-88**
  - Moving platform stage plate with motorized gantry supports, MP-285 controller and ROE, cables and manual
  - $12,290

- **MP-88/M6**
  - Same as MP-78 except with M6 tapped holes
  - $1,185

**MP-88 / MPC-88 Chamber inserts**

- **X040500**
  - Warner Series 20 (round) – aluminum
  - $116

- **X040503**
  - Warner Series 20 (round) – stainless steel
  - $116

- **X040505**
  - Warner Series 20 (octagonal) – aluminum
  - $116

- **X040507**
  - Warner Series 20 (octagonal) – stainless steel
  - $116

- **X040510**
  - 50mm round – aluminum
  - $116

- **X040512**
  - 50mm round – stainless steel
  - $116

- **X040497**
  - Blank insert – aluminum
  - $116

- **X040498**
  - Blank insert – stainless Steel
  - $116

- **SI-SLIDE**
  - Insert with slide holder
  - $116

- **SI-PETRI**
  - For petri dish and slides
  - $326

- **SI-W30**
  - Warner Series 30 platform – aluminum
  - $116

- **SI-W30ST**
  - Warner Series 30 platform – stainless steel
  - $116

- **SI-ALA-MS**
  - ALA MS series insert – aluminum
  - $116

- **SI-CUSTOM**
  - Custom stage insert
  - $357

1 Please specify chamber type when ordering.
2 No charge when ordered with MP-88 or MPC-88.
BOB
Open-design Upright Microscope
BOB basic system.

- **BOB** BOB microscope $18,990
- **BOB-TRTL** BOB with triocular head and transmitted light $24,990
- **BOB-TR** BOB with triocular head $20,900
- **BOB-TL** BOB with transmitted light $20,900

**ACCESSORIES BOB**

- **DIC-COND** DIC condensor option
  Phone Sutter for details

**Objectives**
The BOB uses a standard Olympus turret. You can select from this list, use your own objectives, or submit an Olympus part number to us for a quote.

- **OBJ-Y524** UPLFLN10X2; U PLAN FLUORITE 10X OBJECTIVE; NA 0.3, WD 10MM $763
- **OBJ-Y587** LUMPLFLN40X/W; U M PLAN FLN 40X/W NA0.8 WD3.3MM,IR,ECO $2,556
- **OBJ-Y592** LUMPLFLN60X/W; U M PLAN FLN 60X/W NA1.0 WD2.0MM,IR,ECO $3,007
- **OBJ-Y672** LUMFLN60X/W; LUMFLN60X/W NA1.1WD1.5MM 25 ANGLE,IR, CC,ECO $9,267

**Filter Cubes**

- **CUBE-CY3** Filter Cube – CY3 $1,220
- **CUBE-GFP** Filter Cube – GFP $1,220
- **CUBE-YFP** Filter Cube – YFP $1,220

**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.
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 25mm 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 to 900nm in nanometer increments.

When the Lambda 10 was first introduced, most imaging systems could not keep up with its 55msec 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 0.5msec.

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 8msec 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 filte 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.
**LAMBDA LS**  
STAND-ALONE XENON ARC LAMP AND POWER SUPPLY

(Shown with optional light guide and lens tube)

<table>
<thead>
<tr>
<th>FEATURES</th>
<th>LAMBDA LS</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Xenon lamps provide light levels which exceed those of standard microscope fluorescence lamps</td>
<td>- Modular construction allows use of optional liquid light guide for flexible direction of light output</td>
</tr>
<tr>
<td>- Equipped with a cold mirror to eliminate IR heating of downstream optical components</td>
<td>- Easily accommodates Sutter Instrument filter wheels or SmartShutter® within the body of the lamp.</td>
</tr>
<tr>
<td>- Compact stand-alone lamp housing power supply enclosure</td>
<td>- 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.</td>
</tr>
<tr>
<td>- Pre-aligned bulb eliminates common focusing problems</td>
<td></td>
</tr>
<tr>
<td>- Integrated hour meter for convenient monitoring of lamp life</td>
<td></td>
</tr>
</tbody>
</table>

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PHONE: 1-888-883-0128 • FAX: 1-888-883-0900  
EMAIL: INFO@SUTTER.COM • WEB: WWW.SUTTER.COM
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 330nm to a cutoff of 650nm determined by the cold mirror. An optional enhanced UV bulb produces output much lower into the UV (cut off near 200nm). 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**  
  - 330nm to 650nm – Ozone free
  - 200mm to 650mm – 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 (175W lamp)
  - 4.5 Watts (300W 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**  
  - 10.5in x 9.5in x 10in
  - 26.7cm x 24.1cm x 25.4cm

- **Weight**  
  - 10.5lbs
  - 4.8kg

- **Electrical**  
  - 120/240 Volts
  - 50/60 Hertz power line

---

**Optical Instruments**

**Output Range**

- 330nm to 650nm – Ozone free
- 200mm to 650mm – 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 (175W lamp)
- 4.5 Watts (300W 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**

- 10.5in x 9.5in x 10in
- 26.7cm x 24.1cm x 25.4cm

**Weight**

- 10.5lbs
- 4.8kg

**Electrical**

- 120/240 Volts
- 50/60 Hertz power line
(There is additional depth when second filterwheel is attached)
LAMBDA LS BASIC SYSTEM
Includes a xenon lamp, cold mirror, power supply and lamp housing, support base with mounting rods, drop-in filter holder and manual.

- **LB-LS/OF30** Lambda LS with 300 Watt ozone free lamp $5,500
- **LB-LS/FS30*** Lambda LS with 300 Watt full spectrum lamp $5,500
- **LB-LS/OF17** Lambda LS with 175 Watt ozone free lamp $5,250
- **LB-LS/FS17*** Lambda LS with 175 Watt full spectrum lamp $5,250
- **LB-LS/OF30R** Lambda LS with 300 Watt ozone free lamp and cold mirror that reflects to 780nm $5,550
- **LB-LS/OF30IR** Lambda LS with 300 Watt ozone free lamp and cold mirror that reflects to 1100nm $5,550
- **LB-LS/FS30UV*** Lambda LS with 300 Watt full spectrum lamp and cold mirror that reflects to 275nm $5,550

*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-NWIQ/LS** 10 position 25mm filter wheel with SmartShutter® $3,900
- **LB10-NW** 10 position 25mm filter wheel (can be mounted inside Lambda LS or outside if used as a second wheel) $3,080
- **IQ-25/LS** 25mm SmartShutter for mounting in Lambda LS $1,260

**Will need to purchase additional controller if using as a second wheel.
ACCESSORIES

- **LLG**
  Liquid light guide and coupling adapter
  (2 meters, 3mm dia.), C-mount, lens and lens tube
  $1,470

- **LLG/380**
  Liquid light guide and coupling adapter
  (2 meters, 3mm dia.), C-mount, lens and lens tube
  $1,470

- **LLG/2000**
  Liquid light guide and coupling adapter
  (2 meters, 3mm dia.), C-mount, lens and lens tube
  $1,470

- **LLG/250**
  Liquid light guide (2 meters, 3mm dia.),
  C-mount, lens and lens tube
  $1,470

- **LLGPLUS**
  Liquid light guide (2 meters, 3mm dia.), Heatsink,
  C-mount, lens and lens tube
  $1,678

- **LLGPLUS/380**
  Liquid light guide (2 meters, 3mm dia.), Heatsink,
  C-mount, lens and lens tube
  $1,678

- **LLGPLUS/2000**
  Liquid light guide (2 meters, 3mm dia.), Heatsink,
  C-mount, lens and lens tube
  $1,678

- **DROP-IN**
  Drop-in filterholder (25mm)
  $80

- **O777655**
  Replacement 3mm light guide (300 series)
  $645

- **O777651**
  Replacement 3mm light guide (380 series)
  $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. **Supports transmission into near IR.**
2. **Supports transmission into near IR. No output below 420nm**
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 340nm)
  $704

- **O661175**
  Full spectrum 175 Watt xenon bulb
  $704

- **O661301**
  Ozone free 300 Watt xenon bulb
  (attenuated output below 340nm)
  $704

- **O661300**
  Full spectrum 300 Watt xenon bulb
  $704

- **O661115**
  Housing and heat sink for bulb (bulb will be installed when ordering at same time as housing)
  $300

*Full spectrum bulbs produce ozone. Please be certain that you have ventilation. Contact Sutter for details.
LAMBDA HPX
LIQUID COOLED LED LIGHT SOURCE

FEATURES  LAMBDA HPX

- Pre-filled liquid cooling
- 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

- Fluorescent microscopy
- Optogenetics
The Lambda HPX represents the latest generation of liquid-cooled high-output LED light sources. Designed around a single 90W 4.25mm LED die, the Lambda HPX provides light output comparable to a 200W 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 28KHz, 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 430nm to 700nm. A cool white LED is available. Special order units are available with 630nm, 530nm, 460nm, 405nm, 385nm, and 365nm 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

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Output Range</strong></td>
<td>White light (430nm - 700nm)</td>
</tr>
<tr>
<td><strong>Shuttering</strong></td>
<td>Turn on time: 10µs</td>
</tr>
<tr>
<td></td>
<td>Turn off time: 10µs</td>
</tr>
<tr>
<td><strong>LED Life</strong></td>
<td>&gt;50,000 hours</td>
</tr>
<tr>
<td><strong>Noise/Short Term Stability</strong></td>
<td>0.02%</td>
</tr>
<tr>
<td><strong>PWM Frequency</strong></td>
<td>28 KHz</td>
</tr>
<tr>
<td><strong>Input/Output</strong></td>
<td>TTL &amp; Analog</td>
</tr>
<tr>
<td><strong>Standard White LEDs</strong></td>
<td>Cool White</td>
</tr>
<tr>
<td><strong>Optional LEDs</strong></td>
<td>630nm, 530nm, 460nm, and 405nm</td>
</tr>
<tr>
<td><strong>Dimming</strong></td>
<td>PWM or Current Control</td>
</tr>
<tr>
<td><strong>Dimensions</strong></td>
<td></td>
</tr>
<tr>
<td>Control Box</td>
<td>12.25in x 9in x 5.25in</td>
</tr>
<tr>
<td></td>
<td>311mm x 229mm x 133mm</td>
</tr>
<tr>
<td>Head (attaches to scope)</td>
<td>2.5in x 3in x 5in</td>
</tr>
<tr>
<td></td>
<td>64mm x 76mm x 127mm</td>
</tr>
<tr>
<td><strong>Length of cabling</strong></td>
<td></td>
</tr>
<tr>
<td>between Head and Control Box</td>
<td>4ft</td>
</tr>
<tr>
<td></td>
<td>1.2m</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>12.5lbs</td>
</tr>
<tr>
<td></td>
<td>5.7kg</td>
</tr>
<tr>
<td><strong>Electrical</strong></td>
<td>120/240 Volts</td>
</tr>
<tr>
<td></td>
<td>50/60 Hertz power line</td>
</tr>
<tr>
<td></td>
<td>150 Watts max.</td>
</tr>
</tbody>
</table>
## LAMBDAX HPX
Includes the Lambda HPX LED light source, microscope adapter, and cables.

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>HPX-Y</td>
<td>Lambda HPX LED light source for Olympus</td>
<td>$6,580</td>
</tr>
<tr>
<td>HPX-N</td>
<td>Lambda HPX LED light source for Nikon</td>
<td>$6,580</td>
</tr>
<tr>
<td>HPX-Z</td>
<td>Lambda HPX LED light source for Zeiss</td>
<td>$6,580</td>
</tr>
<tr>
<td>HPX-L</td>
<td>Lambda HPX LED light source for Leica</td>
<td>$6,580</td>
</tr>
</tbody>
</table>

### AVAILABLE WAVELENGTHS
- **WC-HPX**: LED, Cool White
- **460-HPX**: LED, 460nm
- **530-HPX**: LED, 530nm
- **630-HPX**: LED, 630nm

## LAMBDAX HPXUV
Includes the Lambda HPXUV Ultraviolet LED light source, microscope adapter, and cables.

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>HPXUV-Y</td>
<td>Lambda HPX UV LED light source for Olympus</td>
<td>$6,785</td>
</tr>
<tr>
<td>HPXUV-N</td>
<td>Lambda HPX UV LED light source for Nikon</td>
<td>$6,785</td>
</tr>
<tr>
<td>HPXUV-Z</td>
<td>Lambda HPX UV LED light source for Zeiss</td>
<td>$6,785</td>
</tr>
<tr>
<td>HPXUV-L</td>
<td>Lambda HPX UV LED light source for Leica</td>
<td>$6,785</td>
</tr>
<tr>
<td>HPXUV-C</td>
<td>Lambda HPX UV LED light source with C-mount</td>
<td>$6,785</td>
</tr>
</tbody>
</table>

### AVAILABLE WAVELENGTHS
- **365-HPX**: UV LED, 365nm
- **385-HPX**: UV LED, 385nm
- **405-HPX**: UV LED, 405nm

## LAMBDAX HPX-DC*
Includes the Lambda HPX LED light source with cool white LED, Lambda FLED with Ultraviolet LED, and cables.

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>HPX-DC-Y</td>
<td>Lambda HPX and FLED for Olympus</td>
<td>$9,550</td>
</tr>
<tr>
<td>HPX-DC-N</td>
<td>Lambda HPX and FLED for Nikon</td>
<td>$9,550</td>
</tr>
<tr>
<td>HPX-DC-Z</td>
<td>Lambda HPX and FLED for Zeiss</td>
<td>$9,550</td>
</tr>
<tr>
<td>HPX-DC-L</td>
<td>Lambda HPX and FLED for Leica</td>
<td>$9,550</td>
</tr>
</tbody>
</table>

* Suitable for additional DAPI channel.

## ACCESSORIES LAMBDAX HPX

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRIGGER</td>
<td>USB trigger box</td>
<td>$520</td>
</tr>
</tbody>
</table>

1 Select one wavelength when ordering.

2 Compatible with Micro-Manager software
**LAMBDA HPX-L5**
HIGH-OUTPUT LED LIGHT SOURCE

- 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**
- 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 that the liquid-cooled direct mount version. Designed around a single 90W 3mm LED die, the Lambda HPX-L5 provides light output comparable to a 150W Xenon arc lamp when using the same light guide. The Lambda HPX-L5 is optimized for coupling to an optional 5mm 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 28KHz, 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 430nm to 700nm. Special order units are available with 630nm, 530nm, 460nm, and 405nm 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.
Output Range
White light (430nm - 700nm)

Shuttering
Turn on time: 10µs
Turn off time: 10µs

LED Life
>50,000 hours

Noise/Short Term Stability
0.02%

PWM Frequency
28KHz

Input/Output
TTL & Analog

Standard White LEDs
Cool White

Optional LEDs
405nm, 460nm, 530nm, and 630nm

Dimming
PWM or Current Control

Dimensions
Control Box:
12.25in x 9in D 5.25in
311mm x 229mm x 133mm

Head (attaches to scope):
2.5in x 3in x 5in
64mm x 76mm x 127mm

Length of cabling between Head and Control Box:
4ft
1.2m

Weight
8.8lbs
4kg

Electrical
120/240 Volts
50/60 Hertz power line
150 Watts max.
**LAMBDA HPX-L5**

Includes the Lambda HPX-L5 LED light source, liquid light guide, and cables (select one wavelength when ordering).

- **HPX-L5**
  - Lambda HPX-L5 LED light source $5,595
  - **AVAILABLE WAVELENGTHS**
    - WC-HPX-L5 LED, Cool White
    - 460-HPX-L5 LED, 460nm
    - 530-HPX-L5 LED, 530nm
    - 630-HPX-L5 LED, 630nm

**LAMBDA HPX-L5UV**

Includes the Lambda HPX-L5UV LED light source, and cables. liquid light guide, and cables.

- **HPX-L5UV**
  - Lambda HPX-L5UV LED light source $6,320
  - **AVAILABLE WAVELENGTHS**
    - 405-HPX-L5 LED, 405nm

**LAMBDA HPX-L5DC**

Includes the Lambda HPX-L5 LED light source with cool white LED, Lambda FLED with UV LED, and cables.

- **HPX-L5DC-Y**
  - Lambda HPX and FLED for Olympus $8,570
- **HPX-L5DC-N**
  - Lambda HPX and FLED for Nikon $8,570
- **HPX-L5DC-Z**
  - Lambda HPX and FLED for Zeiss $8,570
- **HPX-L5DC-L**
  - Lambda HPX and FLED for Leica $8,570

* Suitable for additional DAPI channel.

**ACCESSORIES**

- **0777648**
  - Liquid light guide (2 meters, 5mm diameter) $645
- **TRIGGER**
  - USB trigger box $520

1 You will need a mounting adapter for your microscope
2 Compatible with Micro-Manager software

Mounting adapters for Nikon, Zeiss, 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**
- > 50,000 hour lifetime
- < 25µsecs On-Off time
- TTL control (with polarity switch)
- Very stable output
- Compact stand-alone design
- Easy installation

**COMMON APPLICATIONS**
- 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 <25µsecs 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 65mm in outside diameter. The ring light itself is composed of a circular assembly of many white light LEDs that provides even and direct illumination of the sample.
## SPECIFICATIONS  LAMBDA TLED / TLED+

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Output Range</strong></td>
<td>White light (400nm - 700nm)</td>
</tr>
<tr>
<td><strong>LED Life</strong></td>
<td>&gt; 50,000 hours</td>
</tr>
<tr>
<td><strong>Noise/Short Term Stability</strong></td>
<td>0.01%</td>
</tr>
<tr>
<td><strong>Control Box Dimensions</strong></td>
<td>TLED  3in x 3.5in x 4.1in 7.6cm x 8.9cm x 10.2cm+</td>
</tr>
<tr>
<td></td>
<td>TLED+ 4in x 3.25in x 4.1in 10.2cm x 8.3cm x 10.2cm+</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>2.2lbs 1kg</td>
</tr>
<tr>
<td><strong>Electrical</strong></td>
<td>120/240 Volts 50/60 Hertz power line 75 Watts max</td>
</tr>
</tbody>
</table>

## ACCESSORIES  LAMBDA TLED / TLED+

<table>
<thead>
<tr>
<th>Accessory</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TRIGGER</strong></td>
<td>USB trigger box</td>
<td>$ 520</td>
</tr>
</tbody>
</table>

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.*

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLED-N</td>
<td>Lambda TLED for Nikon</td>
<td>$2,015</td>
</tr>
<tr>
<td>TLED-N40</td>
<td>Lambda TLED for Nikon E400/E600</td>
<td>$2,015</td>
</tr>
<tr>
<td>TLED-N50</td>
<td>Lambda TLED for Nikon AZ100</td>
<td>$2,015</td>
</tr>
<tr>
<td>TLED-N65</td>
<td>Lambda TLED for Nikon FN1</td>
<td>$2,015</td>
</tr>
<tr>
<td>TLED-Y</td>
<td>Lambda TLED for Olympus</td>
<td>$2,015</td>
</tr>
<tr>
<td>TLED-Z</td>
<td>Lambda TLED for Zeiss</td>
<td>$2,015</td>
</tr>
<tr>
<td>TLED-L</td>
<td>Lambda TLED for Leica</td>
<td>$2,015</td>
</tr>
<tr>
<td>TLED-C</td>
<td>Lambda TLED with C-mount</td>
<td>$2,015</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLEDPLUS-N</td>
<td>Lambda TLED+ for Nikon</td>
<td>$2,335</td>
</tr>
<tr>
<td>TLEDPLUS-N25</td>
<td>Lambda TLED+ for Nikon TE/300,Diaphot 200/300</td>
<td>$2,335</td>
</tr>
<tr>
<td>TLEDPLUS-Y</td>
<td>Lambda TLED+ for Olympus</td>
<td>$2,335</td>
</tr>
<tr>
<td>TLEDPLUS-Z</td>
<td>Lambda TLED+ for Zeiss</td>
<td>$2,335</td>
</tr>
<tr>
<td>TLEDPLUS-L</td>
<td>Lambda TLED+ for Leica</td>
<td>$2,335</td>
</tr>
<tr>
<td>TLEDPLUS-C</td>
<td>Lambda TLED+ with C-mount</td>
<td>$2,335</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLED-RGB-N</td>
<td>Lambda TLED-RGB for Nikon</td>
<td>$2,230</td>
</tr>
<tr>
<td>TLED-RGB-Y</td>
<td>Lambda TLED-RGB for Olympus</td>
<td>$2,230</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLED-RL</td>
<td>Lambda TLED-RL reflected light illuminator</td>
<td>$1,600</td>
</tr>
</tbody>
</table>

*Custom mounting adapters are available for all models at an additional cost. Contact Sutter for details.*

* Replaces the epi-illuminator.
LAMBDA FLED
FLUORESCENT LIGHT SOURCE

FEATURES    LAMBDA FLED

- >50,000 hour lifetime
- <25µsecs On-Off time
- TTL control (with polarity switch)
- Very stable output
- Compact stand-alone design
- 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 25µsecs 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 365nm to 940nm. 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.

<table>
<thead>
<tr>
<th>Product</th>
<th>Current (A)</th>
<th>Wavelength options (nm)*</th>
<th>External Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLED</td>
<td>6</td>
<td>340, 365, 385, 410, 440, 460, 480, 506, 530, 561, 590, 630, 660, 740, 850, 940</td>
<td>Digital (BNC) / Analog (SMA)</td>
</tr>
</tbody>
</table>

* 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 (400nm to 700nm)
- **LED Life**  >50,000 hours
- **Noise/Short Term Stability**  0.01%
- **Control Box Dimensions**  FLED
  4in x 3.25in x 4.1in
  10.2cm x 8.3cm x 10.2cm
- **Weight**  2.2lbs
  1kg
- **Control Box Dimensions**  120/240 Volts
  50/60 Hertz power line
  75 Watts max

**ACCESSORIES LAMBDA FLED**

- **TRIGGER**
  USB trigger box  $520

  *Compatible with Micro-Manager software*
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  $2,835
- **FLED-N25**  Lambda FLED for Nikon TE200/E300, Diaphot 200/300  $2,835
- **FLED-Y**  Lambda FLED for Olympus  $2,835
- **FLED-Z**  Lambda FLED for Zeiss  $2,835
- **FLED-L**  Lambda FLED for Leica  $2,835
- **FLED-C**  Lambda FLED with C-mount  $2,835

**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 one wavelength combination when ordering.

- **FLED-DC-N**  Dual Channel Lambda FLED and 2 controllers for Nikon  $5,770
- **FLED-DC-Y**  Dual Channel Lambda FLED and 2 controllers for Olympus  $5,770
- **FLED-DC-Z**  Dual Channel Lambda FLED and 2 controllers for Zeiss  $5,770
- **FLED-DC-L**  Dual Channel Lambda FLED and 2 controllers for Leica  $5,770
- **FLED-DC-C**  Dual Channel Lambda FLED and 2 controllers with C-mount  $5,770

**AVAILABLE WAVELENGTH COMBINATIONS**  (in nm)
White and 385  385 and 530  530 and 630
White and 460  460 and 630
White and 740  480 and 561

*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

New Features

New: USB support
New: Built-in SmartShutter® control
New: 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 0.5msec

FEATURES
LAMBDA DG-4 / DG-5 PLUS
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 0.5msec, 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 880nm 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 25mm interference filters. The Lambda DG-5 PLUS, a five filter version, accommodates three 18mm and two 25mm filters. While the switching time between any two wavelengths is done in less than 0.5msec, 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
- Calcium imaging
- FURA
- Optogenetics
- Ultra high speed wavelength selection

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 330nm to 650nm – Ozone free 200nm to 650nm – 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, 25mm (1 inch) DG-5 PLUS: Two, 25mm (1 inch) and Three 18mm
- Dimensions 10in x 10in x 19in 25cm x 25cm x 48cm
- Light Guide 2 meters long 3mm diameter
- Weight 45lbs 20kg
- 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 500µs. 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.
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.

APPLICATIONS

- Fluorescence microscopy
- Ratio imaging
- Fura 2
- Optogenetics
- Mosaic® / PAGFP
- Mosaic Channel Rhodopsin

(View of back panel)
**DG-4 / DG-5 PLUS**  
**BASIC SYSTEM WITH IMPROVED GALVOS**  
Includes main unit with 300W pre-aligned xenon arc bulb, 4 slide-in filter holders (25mm), 1 neutral density filter holder (25mm), power cord, serial and parallel cables, liquid light guide, spanner wrench, and manual. (DG-5 PLUS includes an additional 18mm filter holder and flat wrench. Three positions are 18mm, and two are 25mm in diameter).

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>DG-4PLUS/OF30</td>
<td>DG-4 PLUS with 300 Watt ozone-free bulb</td>
<td>$22,615</td>
</tr>
<tr>
<td>DG-4PLUS/FS30</td>
<td>DG-4 PLUS with 300 Watt full spectrum bulb</td>
<td>$22,615</td>
</tr>
<tr>
<td>DG-5PLUS/OF30</td>
<td>DG-5 PLUS with 300 Watt ozone-free bulb</td>
<td>$22,615</td>
</tr>
<tr>
<td>DG-5PLUS/FS30</td>
<td>DG-5 PLUS with 300 Watt full spectrum bulb</td>
<td>$22,615</td>
</tr>
</tbody>
</table>

**SPECIALTY DG-4**

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>DG-4/T</td>
<td>DG-4 PLUS with tungsten bulb</td>
<td>$24,490</td>
</tr>
</tbody>
</table>

*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**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>O661176</td>
<td>Ozone free 175 Watt xenon bulb</td>
<td>$704</td>
</tr>
<tr>
<td></td>
<td>(useful wavelength range 330-700nm)</td>
<td></td>
</tr>
<tr>
<td>O661301</td>
<td>Ozone free 300 Watt xenon bulb</td>
<td>$704</td>
</tr>
<tr>
<td></td>
<td>(useful wavelength range 330-700nm)</td>
<td></td>
</tr>
<tr>
<td>O661175</td>
<td>Full spectrum 175 Watt xenon bulb</td>
<td>$704</td>
</tr>
<tr>
<td></td>
<td>(useful wavelength range 300-700nm)</td>
<td></td>
</tr>
<tr>
<td>O661300</td>
<td>Full spectrum 300 Watt xenon bulb</td>
<td>$704</td>
</tr>
<tr>
<td></td>
<td>(useful wavelength range 300-700nm)</td>
<td></td>
</tr>
<tr>
<td>O661115</td>
<td>Housing and heat sinks for bulb (bulb will be</td>
<td>$300</td>
</tr>
<tr>
<td></td>
<td>installed when ordered at the same time as housing</td>
<td></td>
</tr>
<tr>
<td>IQ25-DG</td>
<td>25mm SmartShutter® to fit Lambda DG-4 / DG-5</td>
<td>$1,627</td>
</tr>
<tr>
<td></td>
<td>(requires controller)</td>
<td></td>
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<tr>
<td>DG-IF</td>
<td>Interference filter holder (25mm)</td>
<td>$100</td>
</tr>
<tr>
<td>DG-IF/18</td>
<td>Interference filter holder (18mm)</td>
<td>$100</td>
</tr>
<tr>
<td>DG-ND</td>
<td>Neutral density filter holder</td>
<td>$100</td>
</tr>
<tr>
<td>X100160</td>
<td>Retaining ring (25mm)</td>
<td>$18</td>
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<tr>
<td>X100150</td>
<td>Filter spacer (25mm)</td>
<td>$18</td>
</tr>
<tr>
<td>X100120</td>
<td>Interference filter cup (25mm)</td>
<td>$25</td>
</tr>
<tr>
<td>X664162</td>
<td>Neutral density filter cup (25mm)</td>
<td>$37</td>
</tr>
<tr>
<td>X100158</td>
<td>Retaining ring (18mm)</td>
<td>$20</td>
</tr>
<tr>
<td>X100148</td>
<td>Filter spacer (18mm)</td>
<td>$20</td>
</tr>
<tr>
<td>X100118</td>
<td>Interference filter cup (18mm)</td>
<td>$52</td>
</tr>
<tr>
<td>CMAC</td>
<td>Serial cable for Mac</td>
<td>$105</td>
</tr>
<tr>
<td>X664176</td>
<td>18mm brass spanner key</td>
<td>$59</td>
</tr>
<tr>
<td>X100560</td>
<td>25mm spanner wrench</td>
<td>$105</td>
</tr>
</tbody>
</table>

*175W 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._
New Features

- **New**: Now supported by the Lambda 10-3 with special programming
- **New**: Patented white light output capability
- Wavelength range as wide as 338-900nm
- Access any center-wavelength in nanometer increments
- Images pass through filters making it suitable for both excitation and emission
- Easily switch between fluorophore 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 338nm to 900nm. 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 430nm to 800nm. For excitation applications, we suggest installing the 5 filters with the shortest wavelengths covering 338 to 620nm. 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 8mm x 16mm; 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™**
  - 2.8in x 2.8in x 4.4in
  - 7cm x 7cm x 11cm
  - 3.3lbs
  - 1.5kg

- **Lambda VF-5™**
  - 9.4in x 6in x 5in
  - 23.8cm x 15.2cm x 12.7cm
  - 11.7lbs
  - 5.3kg

- **Lambda VF-10**
  - 7.2in x 5in x 4in
  - 18.3cm x 12.7cm x 10.2cm
  - 7.3lbs
  - 3.3kg

- **Controller**
  - 8.2in x 5.9in x 5.1in
  - 14.9cm x 20.8cm x 13cm
  - 2.6lbs
  - 1.1kg

- **Electrical**
  - 120/240 Volts
  - 50/60 Hertz power line
  - 75 Watts max

(Shown: Lambda VF-1)
**OPTICAL INSTRUMENTS**

**BASIC SYSTEM**

- **VF-1**: Includes the Lambda VF-1™, a single VersaChrome® filter, Lambda 10-B control unit, serial and USB cables, power cable and manual
  - **Price**: $5,050

- **VF-5**: Includes the Lambda VF-5™, five VersaChrome® filters, Lambda 10-B control unit, serial and USB cables, power cable and manual
  - **Price**: $14,320

- **VF-10**: Lambda VF-10, eight special VersaChrome® filters, Lambda 10-3 control unit, beam shift compensator, serial and USB cables, power cable and manual
  - **Price**: $16,575

**VERSACHROME® FILTERS² – ORIGINAL SERIES**

- **CO-O573380**: Tunable filter, 380-338nm with 16nm bandwidth
  - **Price**: $1,275

- **CO-O573440**: Tunable filter, 440-388nm with 16nm bandwidth
  - **Price**: $1,275

- **CO-O573490**: Tunable filter, 490-429nm with 15nm bandwidth
  - **Price**: $1,275

- **CO-O573550**: Tunable filter, 550-487nm with 15nm bandwidth
  - **Price**: $1,275

- **CO-O573620**: Tunable filter, 620-547nm with 14nm bandwidth
  - **Price**: $1,275

- **CO-O573700**: Tunable filter, 700-615nm with 13nm bandwidth
  - **Price**: $1,275

- **CO-O573800**: Tunable filter, 800-699nm with 12nm bandwidth
  - **Price**: $1,275

**VERSACHROME® FILTERS² – EXTENDED OVERLAP SERIES**

- **CO-O573400**: Tunable filter, 402-357nm with 16nm bandwidth
  - **Price**: $1,275

- **CO-O573449**: Tunable filter, 451-398nm with 15nm bandwidth
  - **Price**: $1,275

- **CO-O573501**: Tunable filter, 503-446nm with 15nm bandwidth
  - **Price**: $1,275

- **CO-O573561**: Tunable filter, 564-498nm with 14nm bandwidth
  - **Price**: $1,275

- **CO-O573628**: Tunable filter, 632-557nm with 14nm bandwidth
  - **Price**: $1,275

- **CO-O573784**: Tunable filter, 708-623nm with 13nm bandwidth
  - **Price**: $1,275

- **CO-O573790**: Tunable filter, 794-696nm with 12nm bandwidth
  - **Price**: $1,275

- **CO-O573900**: Tunable filter, 900-787nm with 11nm bandwidth
  - **Price**: $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®
VERSACHROME® FILTERS’ – 8 X 16mm – FOR VF-10 ONLY²

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO-O574400</td>
<td>Tunable filter, 402-357nm with 16nm bandwidth</td>
<td>$1,275</td>
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<tr>
<td>CO-O574449</td>
<td>Tunable filter, 451-398nm with 15nm bandwidth</td>
<td>$1,275</td>
</tr>
<tr>
<td>CO-O574501</td>
<td>Tunable filter, 503-446nm with 15nm bandwidth</td>
<td>$1,275</td>
</tr>
<tr>
<td>CO-O574561</td>
<td>Tunable filter, 564-498nm with 14nm bandwidth</td>
<td>$1,275</td>
</tr>
<tr>
<td>CO-O574628</td>
<td>Tunable filter, 632-557nm with 14nm bandwidth</td>
<td>$1,275</td>
</tr>
<tr>
<td>CO-O574704</td>
<td>Tunable filter, 703-627nm with 13nm bandwidth</td>
<td>$1,275</td>
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<tr>
<td>CO-O574790</td>
<td>Tunable filter, 794-696nm with 12nm bandwidth</td>
<td>$1,275</td>
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<tr>
<td>CO-O574900</td>
<td>Tunable filter, 900-787nm with 11nm bandwidth</td>
<td>$1,275</td>
</tr>
</tbody>
</table>

ACCESSORIES

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Price</th>
</tr>
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<tbody>
<tr>
<td>O629950</td>
<td>Male-to-male C-mount adapter for mounting SmartShutter® to Lambda VF-5™ / VF-1™</td>
<td>$69</td>
</tr>
<tr>
<td>VF5-WL</td>
<td>Lambda VF-5 white light kit</td>
<td>$1,885</td>
</tr>
<tr>
<td>VF5-EMMSN-ADP</td>
<td>Emission adapter</td>
<td>$4,180</td>
</tr>
</tbody>
</table>

¹ 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.
² These filters are for the VF-10 ONLY. The sizing is unique to the VF-10. They are not meant as options for the VF-1 or VF-5 changers.
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 <400nm to more than 1100nm. 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.

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:**
    - 5.6in x 2.8in x 4.4in
    - 14cm x 7cm x 11cm
  - **Weight:**
    - 6.6lbs
    - 3kg

- **Controller**
  - **Dimensions:**
    - 8.2in x 5.9in x 5.1in
    - 14.9cm x 20.8cm x 13cm
  - **Weight:**
    - 2.6lbs
    - 1.1kg

- **Electrical**
  - 120/240 Volts
  - 50/60 Hertz power line
  - 75 Watts max
### BASIC SYSTEM

- **VF-1 EDGE™**
  - 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
  
  **$9,765**

### VERSACHROME® EDGE FILTERS

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO-O575448-L</td>
<td>Edge Tunable longpass filter, 453-394nm</td>
<td>$1,275</td>
</tr>
<tr>
<td>CO-O575448-S</td>
<td>Edge Tunable shortpass filter, 453-397nm</td>
<td>$1,275</td>
</tr>
<tr>
<td>CO-O575501-L</td>
<td>Edge Tunable longpass filter, 508-441nm</td>
<td>$1,275</td>
</tr>
<tr>
<td>CO-O575501-S</td>
<td>Edge Tunable shortpass filter, 507-445nm</td>
<td>$1,275</td>
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<tr>
<td>CO-O575561-L</td>
<td>Edge Tunable longpass filter, 568-449nm</td>
<td>$1,275</td>
</tr>
<tr>
<td>CO-O575561-S</td>
<td>Edge Tunable shortpass filter, 568-448nm</td>
<td>$1,275</td>
</tr>
<tr>
<td>CO-O575628-L</td>
<td>Edge Tunable longpass filter, 636-552nm</td>
<td>$1,275</td>
</tr>
<tr>
<td>CO-O575628-S</td>
<td>Edge Tunable shortpass filter, 635-557nm</td>
<td>$1,275</td>
</tr>
<tr>
<td>CO-O575704-L</td>
<td>Edge Tunable longpass filter, 713-619nm</td>
<td>$1,275</td>
</tr>
<tr>
<td>CO-O575704-S</td>
<td>Edge Tunable shortpass filter, 712-623nm</td>
<td>$1,275</td>
</tr>
<tr>
<td>CO-O575790-L</td>
<td>Edge Tunable longpass filter, 799-692nm</td>
<td>$1,275</td>
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<tr>
<td>CO-O575790-S</td>
<td>Edge Tunable shortpass filter, 800-699nm</td>
<td>$1,275</td>
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<tr>
<td>CO-O575887-L</td>
<td>Edge Tunable longpass filter, 898-778nm</td>
<td>$1,275</td>
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<tr>
<td>CO-O575887-S</td>
<td>Edge Tunable shortpass filter, 898-784nm</td>
<td>$1,275</td>
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<tr>
<td>CO-O575995-L</td>
<td>Edge Tunable longpass filter, 1007-872nm</td>
<td>$1,275</td>
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<tr>
<td>CO-O575995-S</td>
<td>Edge Tunable shortpass filter, 1007-881nm</td>
<td>$1,275</td>
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<tr>
<td>CO-O5751116-L</td>
<td>Edge Tunable longpass filter, 1130-979nm</td>
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<tr>
<td>CO-O5751116-S</td>
<td>Edge Tunable shortpass filter, 1129-988nm</td>
<td>$1,275</td>
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</tbody>
</table>

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 40msec between adjacent filters (10 position wheel)
- As fast as 30msec between adjacent filters (4 position wheel)
- As fast as 28msec 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 25mm, 32mm & 50mm 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 40msec 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 25mm wheel, a lighter 4 position 25mm wheel, a 10 position 32mm wheel, 5 position 50mm 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 40msec switching time with the traditional 25mm filter wheel as well as our newer, high-speed 32mm version. The 4 position wheel (LB10-NWHS4) provides additional speed and can achieve switching times of less than 33msec. 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 1mm to 9mm 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 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 2mm 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 25mm and 32mm 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.
Control Box Dimensions
15.75in x 11in x 4in
40cm x 28cm x 10.2cm

Weight
20lbs
11kg

Electrical
120/240 Volts
50/60 Hertz power line
75 Watts max

MECHANICAL DRAWINGS LAMBDA 10-NWIQ

(Shown with optional Smart Shutter®)
## CONTROLLER

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Price</th>
</tr>
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<tbody>
<tr>
<td><strong>LB10-3</strong></td>
<td>Includes one Lambda 10-3 controller unit, serial, parallel and USB cables, power cable and manual</td>
<td><strong>$ 2,675</strong></td>
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## WHEELS

### 25mm Filter Wheels – 10 position

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<th>Item</th>
<th>Description</th>
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<tr>
<td>LB10-NW</td>
<td>10 position 25mm filter wheel without shutter</td>
<td><strong>$ 3,080</strong></td>
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<tr>
<td>LB10-NWIQ</td>
<td>10 position 25mm filter wheel with SmartShutter®</td>
<td><strong>$ 3,900</strong></td>
</tr>
<tr>
<td>LB10-NWS</td>
<td>10 position 25mm filter wheel with Uniblitz® shutter</td>
<td><strong>$ 3,715</strong></td>
</tr>
<tr>
<td>LB10-NWE</td>
<td>10 position 25mm filter wheel set up for emission</td>
<td><strong>$ 2,785</strong></td>
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### 25mm Filter Wheels – 4 position

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Price</th>
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</thead>
<tbody>
<tr>
<td>LB10-WHS4</td>
<td>4 position 25mm filter wheel without shutter</td>
<td><strong>$ 3,130</strong></td>
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<tr>
<td>LB10-WHS4IQ</td>
<td>4 position 25mm filter wheel with SmartShutter</td>
<td><strong>$ 3,960</strong></td>
</tr>
<tr>
<td>LB10-WHS4E</td>
<td>4 position 25mm filter wheel set up for emission</td>
<td><strong>$ 3,130</strong></td>
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### Thin Filter Wheels – 10 position

<table>
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<tr>
<th>Item</th>
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<tbody>
<tr>
<td>LB10-TW</td>
<td>10 position 25mm thin wheel without shutter</td>
<td><strong>$ 3,080</strong></td>
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<tr>
<td>LB10-TWIQ</td>
<td>10 position 25mm thin wheel with SmartShutter</td>
<td><strong>$ 3,900</strong></td>
</tr>
<tr>
<td>LB10-TWE</td>
<td>10 position 25mm thin wheel set up for emission</td>
<td><strong>$ 2,785</strong></td>
</tr>
<tr>
<td>LB10-TW32</td>
<td>10 position 32mm thin wheel without shutter</td>
<td><strong>$ 3,345</strong></td>
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### 25mm Dual Filter Wheels

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<th>Item</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>LB10-WD</td>
<td>Back to back mounting of two 25mm filter wheels without shutter. No drop-in filter holders</td>
<td><strong>$ 6,130</strong></td>
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<tr>
<td>LB10-WDIQ</td>
<td>Back to back mounting of two 25mm filter wheels with SmartShutter and one slide-in filter holder</td>
<td><strong>$ 7,065</strong></td>
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<tr>
<td>LB10-WDS</td>
<td>Back to back mounting of two 25mm filter wheels with one Uniblitz shutter and one slide-in filter holder</td>
<td><strong>$ 6,960</strong></td>
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### 32mm Filter Wheels – 10 position

<table>
<thead>
<tr>
<th>Item</th>
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</tr>
</thead>
<tbody>
<tr>
<td>LB10-W32</td>
<td>10 position 32mm filter wheel without shutter</td>
<td><strong>$ 3,345</strong></td>
</tr>
<tr>
<td>LB10-W32IQ</td>
<td>10 position 32mm filter wheel with SmartShutter</td>
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</tr>
<tr>
<td>LB10-W32S</td>
<td>10 position 32mm filter wheel with Uniblitz shutter</td>
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</tr>
<tr>
<td>LB10-TW32</td>
<td>10 position 32mm thin wheel without shutter</td>
<td><strong>$ 3,345</strong></td>
</tr>
<tr>
<td>LB10-W32-Y73</td>
<td>32mm emission wheel for Olympus IX73/83</td>
<td><strong>$ 4,515</strong></td>
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### 50mm Filter Wheel – 5 position

<table>
<thead>
<tr>
<th>Item</th>
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<tbody>
<tr>
<td>LB10-W50</td>
<td>5 position 50mm filter wheel without shutter</td>
<td><strong>$ 3,900</strong></td>
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### Specialty Wheels

<table>
<thead>
<tr>
<th>Item</th>
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<tbody>
<tr>
<td>LB10-W12</td>
<td>10 position 12.5mm filter wheel without shutter</td>
<td><strong>$ 2,870</strong></td>
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<tr>
<td>LB4-W</td>
<td>Belt drive 4 position 25mm filter wheel without shutter</td>
<td><strong>$ 3,130</strong></td>
</tr>
<tr>
<td>LB10-NWE-N29B</td>
<td>10 position 25mm emission for bottom port of Nikon Ti</td>
<td><strong>$ 3,375</strong></td>
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<tr>
<td>LB5-W32-N31</td>
<td>5 position 32mm wheel for infinity path of Nikon Ti2</td>
<td><strong>$ 3,495</strong></td>
</tr>
</tbody>
</table>

1. Must be used with Semrock® filters that have Sutter threaded ring.  
2. Includes emission 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**: 12.5mm SmartShutter with stand-alone housing - $1,153
- **IQ12-AN**: 12.5mm hard anodized SmartShutter - $1,245
- **IQ25-SA**: 25mm SmartShutter with stand-alone housing - $1,210
- **IQ25-W**: 25mm SmartShutter with housing to fit filter wheel - $1,210
- **IQ25-WU**: 25mm SmartShutter to retrofit non-shuttered filter wheel - $1,260
- **IQ25-LS**: 25mm SmartShutter with housing to fit Lambda LS - $1,260
- **IQ25-DG**: 25mm SmartShutter to fit in Lambda DG-4/DG-5 - $1,627
- **IQ35-W**: 35mm SmartShutter with housing to fit filter wheel - $1,709
- **IQ35-SA**: 35mm SmartShutter with stand-alone housing - $1,709

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 25mm filter wheel with existing Uniblitz® shutter to SmartShutter.
**CABLES AND ACCESSORIES**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIQ-2</td>
<td>One 25 pin connector to two 9 pin connectors (Allows connection of one stand-alone SmartShutter® to controller)</td>
<td>$105</td>
</tr>
<tr>
<td>SLIDE-IN</td>
<td>Slide-in filter holder for 25mm wheel</td>
<td>$80</td>
</tr>
<tr>
<td>DROP-IN</td>
<td>Drop-in filter holder for 25mm wheel</td>
<td>$80</td>
</tr>
<tr>
<td>DROP-IN/32</td>
<td>Drop-in filter holder for LB10-W32IQ</td>
<td>$80</td>
</tr>
<tr>
<td>X100120</td>
<td>25mm filter cup</td>
<td>$25</td>
</tr>
<tr>
<td>X100145</td>
<td>25mm angled filter spacer</td>
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<td>X100160</td>
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<td>X100122</td>
<td>32mm filter cup</td>
<td>$25</td>
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<td>X100152</td>
<td>32mm spacer</td>
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<tr>
<td>X100162</td>
<td>32mm retaining ring</td>
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<td>X100124</td>
<td>50mm filter cup</td>
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<tr>
<td>X100126</td>
<td>50mm short filter cup</td>
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<tr>
<td>X100154</td>
<td>50mm spacer</td>
<td>$20</td>
</tr>
<tr>
<td>X100164</td>
<td>50mm retaining ring</td>
<td>$20</td>
</tr>
<tr>
<td>LLG</td>
<td>Liquid light guide (2 meters, 3mm diameter) C-mount, lens, and lens tube</td>
<td>$1,470</td>
</tr>
<tr>
<td>SHUTTER</td>
<td>25mm replacement shutter for Uniblitz® shutter (not an upgrade)</td>
<td>$595</td>
</tr>
<tr>
<td>W620005</td>
<td>9 pin male/female serial cable</td>
<td>$32</td>
</tr>
<tr>
<td>W620007</td>
<td>15 pin shielded cable for standard filter wheel</td>
<td>$32</td>
</tr>
<tr>
<td>W620009</td>
<td>25 pin cable for wheels with SmartShutter</td>
<td>$32</td>
</tr>
<tr>
<td>W621520</td>
<td>USB cable</td>
<td>$32</td>
</tr>
<tr>
<td>X100111</td>
<td>35mm replacement Uniblitz shutter (not an upgrade)</td>
<td>$950</td>
</tr>
<tr>
<td>X100208</td>
<td>8 inch guide rod for stand (each)</td>
<td>$54</td>
</tr>
<tr>
<td>X100210</td>
<td>12 inch guide rod for stand (each)</td>
<td>$59</td>
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<tr>
<td>X100212</td>
<td>22 inch guide rod for stand (each)</td>
<td>$69</td>
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<tr>
<td>X100560</td>
<td>25mm spanner wrench</td>
<td>$105</td>
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<tr>
<td>X100555</td>
<td>25mm thin wheel spanner wrench</td>
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<tr>
<td>X100565</td>
<td>32mm spanner wrench</td>
<td>$39</td>
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<tr>
<td>X100558</td>
<td>32mm thin wheel spanner wrench</td>
<td>$39</td>
</tr>
<tr>
<td>X100567</td>
<td>50mm spanner wrench</td>
<td>$39</td>
</tr>
</tbody>
</table>

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.*

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**US PRICES LAMBD A 10-3**

*International prices vary by country. Please contact your local distributor or Sutter Instrument for a quotation. Prices subject to change without notice.*
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 50mm, 32mm and 25mm filters. Our technical staff will be happy to discuss with you special application requirements.
**LAMBDA 10-2**

**OPTICAL FILTER CHANGER**

---

**FEATURES LAMBDA 10-2**

- 55msec between adjacent filters
- Parallel and serial interfaces
- Simultaneous and independent control of up to two wheels and two shutters
- Dual integral shutter drivers
- Linear power supply

---

**OPTIONS LAMBDA 10-2**

- Additional filter wheel
- Built-in shutter
- Dual wheels mounted in series
- Slide-in filter holders
- Microscope mounting adapters
- Table-top controller box
- Liquid light guide
The Lambda 10-2 is the ideal choice for researchers whose applications are intolerant of electrical noise. The low-noise linear electronics of the controller assure that only DC voltages are present on the motor windings when the wheels are not moving.

The Lambda 10-2 is capable of independently operating up to two filter wheels and two Uniblitz® shutters. The reliable, smooth operation of the Lambda 10-2 has made it highly suitable for research applications involving fluorescence microscopy, ratio imaging, spectrophotometry, and visual physiology.

The controller electronics are designed around three embedded chips: one slave for each wheel and a master for control and communication.

The Lambda 10-2 system can hold up to ten optical filters (25mm in diameter and up to 9mm thick) which are easily loaded through an access port on the housing. Additional filters (e.g. heat and/or neutral density filters) may be inserted manually at two other locations in the optical path. The optical ports on both sides of the unit are internally threaded as C-mounts (32 threads per inch). When mounted in an upright position, the center of the optical port can be positioned from 11cm to 53cm above the mounting surface. Slide-in filter holders are optionally available for inverted configurations. A second wheel can be added to the system with no need for additional mechanical or electronic changes.

Eight user selectable speeds are provided. Filter to adjacent filter time can be set from 55msec to 1200msec, depending on the number and the weight of the filters mounted in the wheel. Integral shutter drivers will open the optional shutter in 10msec. The use of a direct drive stepper-motor with advanced microstepping technology and intelligent acceleration and deceleration algorithms assures the fastest possible moves for a given inertial load, while minimizing vibrations.

The Lambda 10-2 consists of a 10-position filter wheel, a rack mountable controller, a support base and mounting rods, a controller/filter wheel interface cable, parallel and serial interface cables, two drop-in filter holders, spanner wrench, and manual. Microscope adapters for most Nikon, Olympus, Zeiss, and Leica scopes can be purchased separately.

An optional liquid light guide output is available for applications requiring absolute vibration isolation, and/or uniform spatial illumination. The two meter long guide mounts directly onto the output port of the wheel. Transmission through the guide is better than 70% from 375nm to 575nm. Adapters to connect the light guide to your microscope port are available as an option.
**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 2mm 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 25mm and 32mm 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.

**OTHER MODELS**

The Lambda 10-232, was designed to remedy the problem of vignetting that may occur with a 25mm filter format in certain microscope systems. The system features a modified Lambda 10-2 controller, but includes a ten position wheel that accommodates 32mm diameter filters, up to 9mm thick. The best filter to adjacent filter switching speed in this system is achieved in 75msec. A shutter for the system is optionally available. A T-mount format is used for mounting the wheel onto your microscope. Contact Sutter Instrument for information on available T-mount adapters.

**OEM WHEELS AVAILABLE**

For OEM applications, the Lambda 10-2 can readily be modified to meet your specific requirements. By utilizing the 10-2 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 50mm, 32mm and 25mm filters. Our technical staff will be happy to discuss with you special application requirements.
COMMON APPLICATIONS LAMBDA 10-2

- Fluorescent microscopy
- Calcium imaging
- FURA
- Optogenetics
- High speed wavelength selection

SPECIFICATIONS LAMBDA 10-2

- **Filter Diameter**
  - 1in
  - 25mm
  - 35mm (for Lambda 10-232)

- **Dimensions**
  - **Controller:**
    - 16in x 11in x 3.5in
    - 41cm x 28cm x 9cm
  - **Filter wheel:**
    - 5in x 5in x 2.25in
    - 13cm x 13cm x 6cm

- **Weight**
  - 25lbs
  - 11kg

- **Electrical**
  - 120/240 Volts
  - 50/60 Hertz power line

COMMON APPLICATIONS LAMBDA 10-2

- Fluorescent microscopy
- Calcium imaging
- FURA
- Optogenetics
- High speed wavelength selection
## SYSTEMS

**LB10-2**  
Includes one 25mm filter wheel without shutter, support base with mounting rods, rack mount controller unit with wheel drive cable, parallel and serial interface cables for connection to PC, two drop-in filter holders, spanner wrench, 10 blanking discs, power cord, and manual  
$5,710

**LB10-2S**  
Same as above – with Uniblitz® shutter assembly and two slide-in filter holders  
$6,415

**LB10-232**  
Same as LB10-2 except with 32mm, T-mount threaded filter wheel (no drop-in filters) and modified 10-2 controller  
$6,015

**LB10-232S**  
Same as LB10-232 except with Uniblitz shutter (no drop-in or slide-in filters) and modified 10-2 controller  
$7,165

**LB10-250**  
Same as LB10-2 except with 50mm, 5 position wheel  
$6,585

## WHEELS

### 25mm Filter Wheels – 10 position

**LB10-NW**  
10 position 25mm filter wheel without shutter  
$3,080

**LB10-NWS**  
10 position 25mm filter wheel with Uniblitz shutter  
$3,715

**LB10-NWE**  
10 position 25mm filter wheel set up for emission  
$2,785

**LB10-NWE-N29B**  
10 position 25mm emission for bottom port of Nikon Ti  
$3,375

### Thin Filter Wheels – 10 position

**LB10-TW²**  
10 position 25mm thin wheel without shutter  
$3,080

**LB10-TWE²**  
10 position 25mm thin wheel set up for emission  
$2,785

**LB10-TW32²**  
10 position 32mm thin wheel without shutter  
$3,345

### 25mm Dual Filter Wheels

**LB10-WD**  
Back to back mounting of two 25mm filter wheels without shutter. No drop-in filter holders  
$6,130

**LB10-WDS**  
Back to back mounting of two 25mm filter wheels with one Uniblitz shutter and one slide-in filter holder  
$6,960

### 32mm Filter Wheels – 10 position

**LB10-W32**  
10 position 32mm filter wheel without shutter  
$3,345

**LB10-W32S**  
10 position 32mm filter wheel with Uniblitz shutter  
$4,646

**LB10-W32-Y73³**  
32mm emission wheel for Olympus IX73/83  
$4,515

### 50mm Filter Wheel – 5 position

**LB10-W50**  
5 position 50mm filter wheel without shutter  
$3,900

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1. Tabletop controller box available on request.
2. Must be used with Semrock filters that have Sutter threaded ring.
3. Includes emission adapter.

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US PRICES  LAMBDA 10-2

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

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PHONE: 1-888-883-0128  •  FAX: 1-888-883-0900
EMAIL: INFO@SUTTER.COM  •  WEB: WWW.SUTTER.COM
## CABLES AND ACCESSORIES

<table>
<thead>
<tr>
<th>Item Code</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLIDE-IN</td>
<td>Slide-in filter holder for 25mm wheel</td>
<td>$80</td>
</tr>
<tr>
<td>DROP-IN</td>
<td>Drop-in filter holder for 25mm wheel</td>
<td>$80</td>
</tr>
<tr>
<td>X100120</td>
<td>25mm filter cup</td>
<td>$25</td>
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<tr>
<td>X100145</td>
<td>25mm angled filter spacer</td>
<td>$25</td>
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<td>X100150</td>
<td>25mm spacer</td>
<td>$18</td>
</tr>
<tr>
<td>X100160</td>
<td>25mm retaining ring</td>
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<tr>
<td>X100122</td>
<td>32mm filter cup</td>
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<td>X100152</td>
<td>32mm spacer</td>
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<td>X100162</td>
<td>32mm retaining ring</td>
<td>$19</td>
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<tr>
<td>X100124</td>
<td>50mm filter cup</td>
<td>$25</td>
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<tr>
<td>X100126</td>
<td>50mm short filter cup</td>
<td>$20</td>
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<tr>
<td>X100154</td>
<td>50mm spacer</td>
<td>$20</td>
</tr>
<tr>
<td>X100164</td>
<td>50mm retaining ring</td>
<td>$20</td>
</tr>
<tr>
<td>LLG</td>
<td>Liquid light guide (2 meters, 3mm diameter), C-mount, lens, and lens tube</td>
<td>$1,470</td>
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<td>CLAM10</td>
<td>25 pin breakout to BNC cable</td>
<td>$105</td>
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<td>CSHUTTER</td>
<td>Shutter breakout cable</td>
<td>$105</td>
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<tr>
<td>SHUTTER</td>
<td>25mm replacement shutter for Uniblitz® shutter (not an upgrade)</td>
<td>$595</td>
</tr>
<tr>
<td>W620005</td>
<td>9 pin male/female serial cable</td>
<td>$32</td>
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<tr>
<td>W620007</td>
<td>15 pin shielded cable for standard filter wheel</td>
<td>$32</td>
</tr>
<tr>
<td>X100111</td>
<td>35mm replacement Uniblitz shutter (not an upgrade)</td>
<td>$950</td>
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<tr>
<td>X100208</td>
<td>8 inch guide rod for stand (each)</td>
<td>$54</td>
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<tr>
<td>X100210</td>
<td>12 inch guide rod for stand (each)</td>
<td>$59</td>
</tr>
<tr>
<td>X100212</td>
<td>22 inch guide rod for stand (each)</td>
<td>$69</td>
</tr>
<tr>
<td>X100560</td>
<td>25mm spanner wrench</td>
<td>$105</td>
</tr>
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<td>X100555</td>
<td>25mm thin wheel spanner wrench</td>
<td>$39</td>
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<td>X100567</td>
<td>50mm spanner wrench</td>
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</tbody>
</table>

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.

1 Slide-in filter holders are for use with Lambda 10-2 **with shutter.**
2 Drop-in filter holders are for use with Lambda 10-2 **without shutter.**
3 Two spacers are required for each filter position.
LAMBDA 10-B
OPTICAL FILTER CHANGER

As fast as 40msec between adjacent filters (10 position wheel)
As fast as 30msec between adjacent filters (4 position wheel)
As fast as 28msec with a fully loaded wheel using STR filter from Semrock®
Serial and USB interfaces
Can control a variety of 25mm, 32mm, and 50mm 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 40msec between adjacent filters. When used with the high-speed 4 position wheels, the Lambda 10-B achieves switching times of less than 31msec. 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 40msec with our standard 25mm filter wheel as well as our 32mm 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 25mm 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 32mm wheel was designed to remedy the problem of vignetting that may occur with a 25mm filter format in certain microscope systems, and can achieve the same 40msec switching times as our 25mm wheel.
For applications requiring a larger aperture opening, there is a 5 position 50mm filter wheel. If additional speed is required, we offer a high-speed, 4 position 25mm wheel which is capable of achieving 31msec 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 2mm 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 25mm and 32mm 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**
  - 6in x 8.25in x 5.25in
  - 15.2cm x 21cm x 13.3cm

- **Weight**
  - 2.6lbs
  - 1.1kg

- **Electrical**
  - 120/240 Volts
  - 50/60 Hertz power line
  - 75 Watts max
## CONTROLLER

- **LB10-B/IQ**
  - Lambda 10-B control unit, serial and USB cables, power cord and manual
  - $1,705

## WHEELS

### 25mm Filter Wheels – 10 position

- **LB10-NW**
  - 10 position 25mm filter wheel without shutter
  - $3,080

- **LB10-NWIQ**
  - 10 position 25mm filter wheel with SmartShutter®
  - $3,900

- **LB10-NWS**
  - 10 position 25mm filter wheel with Uniblitz® shutter
  - $3,715

- **LB10-NWE**
  - 10 position 25mm filter wheel set up for emission
  - $2,785

### 25mm Filter Wheels – 4 position

- **LB10-WHS4**
  - 4 position 25mm filter wheel without shutter
  - $3,130

- **LB10-WHS4IQ**
  - 4 position 25mm filter wheel with SmartShutter
  - $3,960

- **LB10-WHS4E**
  - 4 position 25mm filter wheel set up for emission
  - $2,785

### Thin Filter Wheels – 10 position

- **LB10-TW**
  - 10 position 25mm thin wheel without shutter
  - $3,080

- **LB10-TWIQ**
  - 10 position 25mm thin wheel with SmartShutter
  - $3,900

- **LB10-TWE**
  - 10 position 25mm thin wheel set up for emission
  - $2,785

### 32mm Filter Wheels – 10 position

- **LB10-W32**
  - 10 position 32mm filter wheel without shutter
  - $3,345

- **LB10-W32IQ**
  - 10 position 32mm filter wheel with SmartShutter
  - $5,020

- **LB10-W32S**
  - 10 position 32mm filter wheel with Uniblitz shutter
  - $4,646

- **LB10-TW32**
  - 10 position 32mm thin wheel without shutter
  - $3,345

- **LB10-W32-Y73**
  - 32mm emission wheel for Olympus IX73/83
  - $4,515

### 50mm Filter Wheel – 5 position

- **LB10-W50**
  - 5 position 50mm filter wheel without shutter
  - $3,900

## Specialty Wheels

- **LB10-W12**
  - 10 position 12.5mm filter wheel without shutter
  - $2,870

- **LB4-W**
  - Belt drive 4 position 25mm filter wheel without shutter
  - $3,130

- **LB10-NWE-N29B**
  - 10 pos. 25mm emission for bottom port of Nikon Ti
  - $3,375

- **LB5-W32-N31**
  - 15 pos. 32mm wheel for infinity path of Nikon Ti2
  - $3,495

---

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.
**OPTICAL INSTRUMENTS**

**SMARTSHUTTER®**

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>IQ12-SA</td>
<td>12.5mm SmartShutter® with stand-alone housing</td>
<td>$1,153</td>
</tr>
<tr>
<td>IQ12-AN</td>
<td>12.5mm hard anodized SmartShutter</td>
<td>$1,245</td>
</tr>
<tr>
<td>IQ25-SA</td>
<td>25mm SmartShutter with stand-alone housing</td>
<td>$1,210</td>
</tr>
<tr>
<td>IQ25-W</td>
<td>25mm SmartShutter with housing to fit filter wheel</td>
<td>$1,210</td>
</tr>
<tr>
<td>IQ25-WU</td>
<td>25mm SmartShutter to retrofit non-shuttered filter wheel</td>
<td>$1,260</td>
</tr>
<tr>
<td>IQ25-LS</td>
<td>25mm SmartShutter with housing to fit Lambda LS</td>
<td>$1,260</td>
</tr>
<tr>
<td>IQ25-DG</td>
<td>25mm SmartShutter to fit in Lambda DG-4/DG-5</td>
<td>$1,627</td>
</tr>
<tr>
<td>IQ35-W</td>
<td>35mm SmartShutter with housing to fit filter wheel</td>
<td>$1,709</td>
</tr>
<tr>
<td>IQ35-SA</td>
<td>35mm SmartShutter with stand-alone housing</td>
<td>$1,709</td>
</tr>
<tr>
<td>IQ50-SA</td>
<td>50mm SmartShutter with stand-alone housing</td>
<td>$1,709</td>
</tr>
</tbody>
</table>

**ACCESSORIES**

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIQ-2</td>
<td>One 25 pin connector to two 9 pin connectors</td>
<td>$105</td>
</tr>
<tr>
<td>FSWITCH</td>
<td>Foot switch with BNC connector – Changes state of shutter with foot press as long as foot press is maintained</td>
<td>$105</td>
</tr>
<tr>
<td>FSTOGGLE</td>
<td>Foot switch with BNC connector – Alternates open/close with each foot press</td>
<td>$105</td>
</tr>
<tr>
<td>W620005</td>
<td>9 pin male/female serial cable</td>
<td>$32</td>
</tr>
<tr>
<td>W620007</td>
<td>15 pin shielded cable for standard filter wheel</td>
<td>$32</td>
</tr>
<tr>
<td>W621512</td>
<td>25 pin cable for wheels with SmartShutter</td>
<td>$32</td>
</tr>
<tr>
<td>W621520</td>
<td>USB cable</td>
<td>$32</td>
</tr>
<tr>
<td>SLIDE-IN</td>
<td>Slide-in filter holder for 25mm wheel</td>
<td>$80</td>
</tr>
<tr>
<td>DROP-IN</td>
<td>Drop-in filter holder for 25mm wheel</td>
<td>$80</td>
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<tr>
<td>DROP-IN/32</td>
<td>32mm drop-in filter holder for LB10-W32IQ</td>
<td>$80</td>
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<tr>
<td>X100120</td>
<td>25mm filter cup</td>
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<tr>
<td>X100145</td>
<td>25mm angled filter spacer</td>
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<td>X100150</td>
<td>25mm spacer</td>
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<tr>
<td>X100160</td>
<td>25mm retaining ring</td>
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<tr>
<td>X100122</td>
<td>32mm filter cup</td>
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<td>X100152</td>
<td>32mm spacer</td>
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<tr>
<td>X100162</td>
<td>32mm retaining ring</td>
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<tr>
<td>X100124</td>
<td>50mm filter cup</td>
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<tr>
<td>X100126</td>
<td>50mm short filter cup</td>
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<tr>
<td>X100154</td>
<td>50mm spacer</td>
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</tr>
<tr>
<td>X100164</td>
<td>50mm retaining ring</td>
<td>$20</td>
</tr>
</tbody>
</table>

1. Where vignetting may be an issue, we recommend the 35mm shutter.
2. For upgrading a 25mm filter wheel with existing Uniblitz® shutter to SmartShutter.
3. Slide-in filter holders are for use with Lambda 10-2 with shutter.
4. Drop-in filter holders are for use with Lambda 10-2 without shutter.
5. Two spacers are required for each filter position.
ACCESSORIES – continued

- **LLG** Liquid light guide (2 meters, 3mm diameter), C-mount, lens, and lens tube $1,470
- **SHUTTER** 25mm replacement shutter for Uniblitz® shutter (not an upgrade) $595
- **X100111** 35mm replacement Uniblitz shutter (not an upgrade) $950
- **X100208** 8 inch guide rod for stand (each) $54
- **X100210** 12 inch guide rod for stand (each) $59
- **X100212** 22 inch guide rod for stand (each) $69
- **X100560** 25mm spanner wrench $105
- **X100555** 25mm thin wheel spanner wrench $39
- **X100565** 32mm spanner wrench $39
- **X100558** 32mm thin wheel spanner wrench $39
- **X100567** 50mm spanner wrench $39

**SHUTTER MOUNTING POST**
Stainless steel 1/2 in diameter. One end is 1/4in-20 (M6) tapped hole. Other end is #8-32 (M4) removable threaded stud. Can be used with 25mm SmartShutter, or 35mm when used with the PMA-IQ35.

- **O620120** 1in / 25mm long post $19
- **O620122** 1.5in / 38mm long post $19
- **O620123** 2in / 50mm long post $19
- **PMA-IQ35** 35mm post mount adapter $105

**POST HOLDER**
holder and spring loaded thumbscrew for mounting post $19

**POST BASE PLATE**
2in x 3in x 3/8in base plate. Suitable for Imperial or Metric tables, posts, and post holders $19

**POST COLLAR**
- **O620150** Slip-on collar, 1in OD x 0.5in ID $19

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.
## FILTER WHEEL CONTROLLER COMPARISON CHART

<table>
<thead>
<tr>
<th>Features</th>
<th>Lambda 10-3</th>
<th>Lambda 10-2</th>
<th>Lambda 10-B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum # of Wheels</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Maximum # of Shutters</td>
<td>3(^1)</td>
<td>2</td>
<td>2(^1)</td>
</tr>
<tr>
<td>Shutter Type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SmartShutter®</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uniblitz®</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Filter Diameter (mm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12/25/32/50(^2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25/32/50(^3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum Switching Time (^a) (ms)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40ms - 25mm wheel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50ms - 32mm wheel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31ms - 4 position 25mm</td>
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<td></td>
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</tr>
<tr>
<td>55ms - 25 or 32mm wheel</td>
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<tr>
<td>33ms - high speed wheel</td>
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<tr>
<td>Power Supply</td>
<td>Chopper</td>
<td>Linear(^b)</td>
<td>Chopper</td>
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<tr>
<td>Computer Interface</td>
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<tr>
<td>USB</td>
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</tr>
<tr>
<td>TTL In/Out</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Price(^6)</td>
<td>$5,755</td>
<td>$5,710</td>
<td>$4,785</td>
</tr>
</tbody>
</table>

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. The controller has to be modified for the larger filter versions of the wheels.
4. Minimum switching time between adjacent filters depends on the filter load. The given values are for a load of 2 filters.
5. Recommended for applications requiring low electrical noise (i.e. electrophysiology).
# LAMBDA OBC
## OPTICAL BEAM COMBINER

(Shown: LB-OBC-LLG)

## FEATURES
- Up to 4 channel ultra high speed LED light source (<25μsec)
- LLG or direct mount connection options for all common microscopes
- Capable of combining any combination of LED’s or any liquid light guide delivered light sources

## LAMBDA OBC
- Easy to reconfigure
- LED’s driven by our proven FLED controllers

## COMMON APPLICATIONS
- Fluorescent microscopy
- Calcium imaging
- FURA

- 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 diagram](image)

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.

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**SPECIFICATIONS OBC**

- **Output Range**: (330nm to 960nm) Depending the LED’s selected for use
- **Shuttering**: Turn ON/OFF time: <25 µs
- **Noise/Short Term Stability**: 0.01%
- **LED Life**: >50,000 hours
- **Dimensions**:
  - Control Box – FLED: 4in x 3.25in x 4.1in
  - Lambda OBC – with 4 LEDs: 9.65in x 9.25in x 3in
  - Dimensions: 24.5cm x 23.5cm x 7.5cm
- **Weight**:
  - Control Box – FLED: 2.2lbs
  - 1kg
  - Lambda OBC – with 4 LEDs: 4.7lbs
  - 2.13kg
- **Electrical**:
  - 120/240 Volts
  - 50/60 Hertz power line
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 3mm 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)).  
  $1,100

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, 340nm for Optical Beam Combiner  
  $1,195

- **OBC-365**  
  LED, 365nm for Optical Beam Combiner  
  $1,195

- **OBC-380**  
  LED, 380nm for Optical Beam Combiner  
  $1,195

- **OBC-385**  
  LED, 385nm for Optical Beam Combiner  
  $1,195

- **OBC-410**  
  LED, 410nm for Optical Beam Combiner  
  $1,195

- **OBC-440**  
  LED, 440nm for Optical Beam Combiner  
  $1,195

- **OBC-460**  
  LED, 460nm for Optical Beam Combiner  
  $1,195

- **OBC-480**  
  LED, 480nm for Optical Beam Combiner  
  $1,195

- **OBC-506**  
  LED, 506nm for Optical Beam Combiner  
  $1,195

- **OBC-530**  
  LED, 530nm for Optical Beam Combiner  
  $1,195

- **OBC-561**  
  LED, 561nm for Optical Beam Combiner  
  $1,195

- **OBC-590**  
  LED, 590nm for Optical Beam Combiner  
  $1,195

- **OBC-630**  
  LED, 630nm for Optical Beam Combiner  
  $1,195

- **OBC-660**  
  LED, 660nm for Optical Beam Combiner  
  $1,195

- **OBC-740**  
  LED, 740nm for Optical Beam Combiner  
  $1,195

- **OBC-850**  
  LED, 850nm for Optical Beam Combiner  
  $1,195

- **OBC-940**  
  LED, 940nm for Optical Beam Combiner  
  $1,195

- **OBC-W5**  
  LED, White Light for Optical Beam Combiner  
  $1,195
LAMBDA 421
BEAM COMBINING PENTAGON

FEATURES    LAMBDA 421

- 4 channel ultra high speed LED light source (<25µsec)
- 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.

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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.
**Output Range**  (330nm to 960nm) Depending the LED’s selected for use

**Shuttering**  Turn ON/OFF time: <25 µs

**Noise/Short Term Stability**  0.01%

**LED Life**  >50,000 hours

**Control Box Dimensions**  15.75in x 11in x 7.5in

**Dimensions**  40cm x 27.9cm x 19.05cm

**Weight**  17.8lbs

8.07kg

**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.*

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**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**

<table>
<thead>
<tr>
<th>LED Module</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>OBC-340</td>
<td>LED, 340nm for Optical Beam Combiner</td>
<td>$1,195</td>
</tr>
<tr>
<td>OBC-365</td>
<td>LED, 365nm for Optical Beam Combiner</td>
<td>$1,195</td>
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<tr>
<td>OBC-380</td>
<td>LED, 380nm for Optical Beam Combiner</td>
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<tr>
<td>OBC-385</td>
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<td>OBC-410</td>
<td>LED, 410nm for Optical Beam Combiner</td>
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</tr>
<tr>
<td>OBC-440</td>
<td>LED, 440nm for Optical Beam Combiner</td>
<td>$1,195</td>
</tr>
<tr>
<td>OBC-460</td>
<td>LED, 460nm for Optical Beam Combiner</td>
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</tr>
<tr>
<td>OBC-480</td>
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<td>$1,195</td>
</tr>
<tr>
<td>OBC-506</td>
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<td>OBC-660</td>
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<tr>
<td>OBC-740</td>
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<tr>
<td>OBC-850</td>
<td>LED, 850nm for Optical Beam Combiner</td>
<td>$1,195</td>
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<tr>
<td>OBC-940</td>
<td>LED, 940nm for Optical Beam Combiner</td>
<td>$1,195</td>
</tr>
<tr>
<td>OBC-W5</td>
<td>LED, White Light for Optical Beam Combiner</td>
<td>$1,195</td>
</tr>
</tbody>
</table>

Note: Prices are in US dollars and subject to change without notice. Contact your local distributor or Sutter Instrument for international pricing.
LAMBDA SC
SMARTSHUTTER® CONTROLLER

(Shown with IQ35-SA and stand)

FEATURES SMARTSHUTTER

- Robust design
- Life tested to 100 million cycles
- Modular repairable design
- Opening time 8msec from trigger (for 25mm and 35mm versions)
- Continuous operation frequencies as high as 40Hz
- Stand-alone or use with Sutter filter wheel

FEATURES LAMBDA SC

- 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
- 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**: 8.5in x 5.25in x 2in  
  21.6cm x 13.5cm x 5cm
- **Weight**: 1.7lbs  
  0.77kg
- **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  
  $840

**SMARTSHUTTER**

- **IQ12-SA**: 12.5mm SmartShutter® with stand-alone housing  
  $1,153
- **IQ12-AN**: 12.5mm hard anodized SmartShutter  
  $1,245
- **IQ25-SA**: 25mm SmartShutter with stand-alone housing  
  $1,210
- **IQ25-LS**: 25mm SmartShutter with housing to fit Lambda LS  
  $1,260
- **IQ25-DG**: 25mm SmartShutter to fit in Lambda DG-4 / DG-5  
  $1,627
- **IQ35-W**: 35mm SmartShutter with housing to fit filter wheel  
  $1,709
- **IQ35-SA**: 35mm SmartShutter with stand-alone housing  
  $1,709
- **IQ50-SA**: 50mm SmartShutter with stand-alone housing  
  $1,709

---

1 Where vignetting may be an issue, we recommend the 35mm shutter.
### CABLES AND ACCESSORIES

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
<th>Price</th>
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<tr>
<td>W621520</td>
<td>USB cable</td>
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<td>9 pin male/female SmartShutter® (no wheel)</td>
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<tr>
<td>FSWITCH</td>
<td>Foot switch with BNC connector –</td>
<td>$105</td>
</tr>
<tr>
<td></td>
<td>Changes state of shutter with foot press as long as foot press is maintained</td>
<td></td>
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<tr>
<td>FSTOGGLE</td>
<td>Foot switch with BNC connector –</td>
<td>$105</td>
</tr>
<tr>
<td></td>
<td>Alternates open/close with each foot press</td>
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</tr>
</tbody>
</table>

### SHUTTER MOUNT POSTS

Stainless steel 1/2in diameter. One end is 1/4in-20 (M6) tapped hole. Other end is #8-32 (M4) removable threaded stud. Can be used with 25mm SmartShutter, or 35mm when used with the PMA-IQ35.

<table>
<thead>
<tr>
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<td>O620120</td>
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<td>1.5in / 38mm long post</td>
<td>$19</td>
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<tr>
<td>O620123</td>
<td>2in / 50mm long post</td>
<td>$19</td>
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<td>O620124</td>
<td>3in / 76mm long post</td>
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<td>O620117</td>
<td>4in / 100mm long post</td>
<td>$19</td>
</tr>
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<td>O620119</td>
<td>8in / 203mm long post</td>
<td>$19</td>
</tr>
<tr>
<td>PMA-IQ35</td>
<td>35mm post mount adapter</td>
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### POST HOLDER

<table>
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<tr>
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<td>O620125</td>
<td>1in / 25mm holder &amp; spring loaded thumbscrew for post</td>
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<td>O620130</td>
<td>2in / 50mm holder &amp; spring loaded thumbscrew for post</td>
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<td>O620134</td>
<td>4in / 100mm holder &amp; spring loaded thumbscrew for post</td>
<td>$19</td>
</tr>
<tr>
<td>O620136</td>
<td>6in / 152mm holder &amp; spring loaded thumbscrew for post</td>
<td>$19</td>
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</table>

### POST BASE PLATE

Suitable for Imperial or Metric tables, posts, and post holders.

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
<th>Price</th>
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</thead>
<tbody>
<tr>
<td>O620143</td>
<td>1in x 2.3in x 3/8in base plate.</td>
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</tr>
<tr>
<td>O620140</td>
<td>2in x 3in x 3/8in base plate.</td>
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### POST COLLAR

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<tbody>
<tr>
<td>O620150</td>
<td>Slip-on collar, 1in OD x 0.5in ID</td>
<td>$19</td>
</tr>
</tbody>
</table>

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/IQ controller)

---

**FEATURES SMARTSHUTTER®**

- Robust design
- Life tested to 100 million cycles
- Modular repairable design
- Opening time 8msec from trigger (for 25mm and 35mm versions)
- Continuous operation frequencies as high as 40Hz
- 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/IQ)
- Universal power supply
- Patent No. 7,253,575

RoHS Compliant
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 25mm or 35mm version, operates with open/close times of 8msec from the command (3msec 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 25mm version, and 20 Hz for the 35mm model. While the 25mm 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 25mm and 32mm 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.
### CONTROLLER
- **LB10-B/IQ**
  - Lambda 10-B control unit, serial and USB cables, power cord and manual
  - $1,705
- **LB-SC**
  - Includes one Lambda SC control unit, serial and USB cable, power cord and manual
  - $840

### SMARTSHUTTER
- **IQ12-SA**
  - 12.5mm SmartShutter® with stand-alone housing
  - $1,153
- **IQ12-AN**
  - 12.5mm hard anodized SmartShutter
  - $1,245
- **IQ25-SA**
  - 25mm SmartShutter with stand-alone housing
  - $1,210
- **IQ25-W**
  - 25mm SmartShutter with housing to fit filter wheel
  - $1,210
- **IQ25-WU**
  - 25mm SmartShutter to retrofit non-shuttered filter wheel
  - $1,260
- **IQ25-LS**
  - 25mm SmartShutter with housing to fit Lambda LS
  - $1,260
- **IQ25-DG**
  - 25mm SmartShutter to fit in Lambda DG-4 / DG-5
  - $1,627
- **IQ35-W**
  - 35mm SmartShutter with housing to fit filter wheel
  - $1,709
- **IQ35-SA**
  - 35mm SmartShutter with stand-alone housing
  - $1,709
- **IQ50-SA**
  - 50mm SmartShutter with stand-alone housing
  - $1,709

1. Where vignetting may be an issue, we recommend the 35mm shutter.
2. For upgrading a 25mm filter wheel with existing Uniblitz® shutter to SmartShutter.
3. Compatible with Lambda SC controller.

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.

(Shown: IQ25-SA. Visit our website for images of other shutters.)
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) - $105
- **W621520**: USB cable - $32
- **W620005**: 9 pin male/female SmartShutter® (no wheel) - $32
- **FSWITCH**: Foot switch with BNC connector – Changes state of shutter with foot press as long as foot press is maintained - $105
- **FSTOGGLE**: Foot switch with BNC connector – Alternates open/close with each foot press - $105

SHUTTER MOUNT POSTS

Stainless steel 1/2 in diameter. One end is 1/4in-20 (M6) tapped hole. Other end is #8-32 (M4) removable threaded stud. Can be used with 25mm SmartShutter, or 35mm when used with the PMA-IQ35.

- **O620120**: 1in / 25mm long post - $19
- **O620122**: 1.5in / 38mm long post - $19
- **O620123**: 2in / 50mm long post - $19
- **O620124**: 3in / 76mm long post - $19
- **O620117**: 4in / 100mm long post - $19
- **O620119**: 8in / 203mm long post - $19
- **PMA-IQ35**: 35mm post mount adapter - $105

POST HOLDER

- **O620125**: 1in / 25mm holder & spring loaded thumbscrew for post - $19
- **O620130**: 2in / 50mm holder & spring loaded thumbscrew for post - $19
- **O620134**: 4in / 100mm holder & spring loaded thumbscrew for post - $19
- **O620136**: 6in / 152mm holder & spring loaded thumbscrew for post - $19

POST BASE PLATE

Suitable for Imperial or Metric tables, posts, and post holders.

- **O620143**: 1in x 2.3in x 3/8in base plate. - $19
- **O620140**: 2in x 3in x 3/8in base plate. - $19

POST COLLAR

- **O620150**: Slip-on collar, 1in OD x 0.5in ID - $19

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 25mm aperture, and a prefix of 32 for wheels with a 32mm 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.
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

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<tr>
<th>OLYMPUS</th>
<th>IX-70 / IX-50 (Y70)</th>
<th>Please contact Sutter to discuss your needs.</th>
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<td>BX-50 / BX-60 (Y50)</td>
<td><strong>10-Y50-EC</strong> EXCITATION</td>
<td>$408</td>
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<tr>
<td></td>
<td><strong>32-Y50-EC</strong> EXCITATION – 32mm</td>
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<td></td>
<td><strong>10-Y50-EM</strong> EMISSION</td>
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<tr>
<td></td>
<td><strong>LG-Y50</strong> LIGHT GUIDE</td>
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<td><strong>LG-Y50-LF</strong> LIGHT GUIDE – Large Format</td>
<td>$1,040</td>
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<tr>
<td></td>
<td><strong>25-Y50-TL</strong> TRANSMITTED – 25mm</td>
<td>$408</td>
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<td><strong>35-Y50-TL</strong> TRANSMITTED – 35mm</td>
<td>$408</td>
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<td>BX-51 / BX-61 (Y51)</td>
<td><strong>10-Y51-EC</strong> EXCITATION</td>
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<td><strong>32-Y51-EC</strong> EXCITATION – 32mm</td>
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<td>$575</td>
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<td><strong>25-Y51-TL</strong> TRANSMITTED – 25mm</td>
<td>$408</td>
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<td><strong>35-Y51-TL</strong> TRANSMITTED – 35mm</td>
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<td>BX-53 / BX-63 (Y53)</td>
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<td><strong>32-Y53-EC</strong> EXCITATION – 32mm</td>
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<td><strong>Y73-UP</strong> UP/DOWN SCOPE ADAPTER</td>
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1. Replaces the epi-illuminator
2. Contact Sutter for details
### Microscope Adapters

#### Olympus

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<td>OD-Y73-7</td>
<td>Optical Deck – Narrow</td>
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<td>Optical Deck – Wide</td>
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<td>OD-Y73-L</td>
<td>Left Side Extension – 5”X5”</td>
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#### Nikon

TMD (N10)
TS100 (N15)
DIAPHOT 200/300 (N20)
OPTIPHOT (N30)

*Please contact Sutter to discuss your needs.*

#### TE200/300 (N25)

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<td>10-N25-EM</td>
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<td>35-N25-TL*</td>
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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

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**50i / 80i / 90i / Ni(N85)**

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1. Replaces the epi-illuminator
2. For use in conjunction with standard Nikon 70mm 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
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<th>AXIOVERT 35 and 100 series (Z30)</th>
<th>AXIOVERT 200 (Z35)</th>
<th>AXIO OBSERVER (Z40)</th>
<th>AXIO EXAMINER</th>
<th>AXIO IMAGER (Z45)</th>
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Phone Sutter

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

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<td>32-L45-EC</td>
<td>EXCITATION – 32 mm</td>
<td>$347</td>
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<tr>
<td>10-L45-EM</td>
<td>EMISSION</td>
<td>$575</td>
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<tr>
<td>35-L45-TL</td>
<td>TRANSMITTED – 35 mm</td>
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<td>LG-L45</td>
<td>LIGHT GUIDE</td>
<td>$785</td>
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<tr>
<td>LG-L45-LF</td>
<td>LIGHT GUIDE – Large Format</td>
<td>$1,040</td>
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#### OTHER ADAPTERS

<table>
<thead>
<tr>
<th>Model</th>
<th>Type</th>
<th>Price</th>
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<tbody>
<tr>
<td>10-J15-EM?</td>
<td>EMISSION</td>
<td>$685</td>
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SUTTER LAMBDA VF-5/VF-1

<table>
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<tr>
<th>Model</th>
<th>Type</th>
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<tbody>
<tr>
<td>10-X20-EM</td>
<td>EMISSION</td>
<td>$3,360</td>
</tr>
</tbody>
</table>

(with relay optical system)

CARV (J20)

CARV II Please contact Sutter to discuss your needs.

---

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

- 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
- 25mm of travel in all three axes
- Touch declutch mechanism
- 6 speeds from coarse to ultra-fine
- New: 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**
  - 25mm on all three axes

- **Maximum Resolution**
  - 62.5nm/microstep

- **Maximum Speed**
  - 5.5mm/sec

- **Range**
  - X & Y Axis: (1 joystick swing)
  - Z Axis: (1 rotation)
  - C: 12,700µm × 3,200µm
  - 1: 3,300µm × 800µm
  - 2: 880µm × 400µm
  - 3: 400µm × 200µm
  - 4: 200µm × 100µm
  - 5: 100µm × 50µm

- **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**
  - **Motor drive:** 112mm x 185mm x 145mm
  - **Joystick:** 265mm x 240mm x 226mm
  - **Control:** 407mm x 280mm x 101mm

- **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
  - $16,285

- **BRMR**
  - XenoWorks Micromanipulator (Right) Includes: 3 axis motor drive (right-hand configuration), motor drive base plate, controller, joystick user-interface, connecting cables, and manual
  - $16,285

**XENOWORKS MICROSCOPE ADAPTERS**

- **BR-L20**
  - Leica DMIRB/E/IRE2 adapter
  - $500

- **BR-L30**
  - Leica DMIL adapter
  - $500

- **BR-L40**
  - Leica DMI 4/5/6000 adapter (double-sided)
  - $550

- **BR-N10**
  - Nikon TMD adapter
  - $500

- **BR-N25**
  - Nikon TE200/300 adapter
  - $500

- **BR-N27**
  - Nikon TE2000 adapter
  - $500

- **BR-N29**
  - Nikon Ti adapter
  - $500

- **BR-N29-M**
  - Nikon Ti adapter for scopes with motorized stage
  - $500

- **BR-Y50**
  - Olympus IX50/70 adapter
  - $500

- **BR-Y51**
  - Olympus IX51/71/81 adapter
  - $500

- **BR-Y51-FL**
  - Olympus IX51/71/81 adapter with ZDC autofocus, left
  - $575

- **BR-Y51-FR**
  - Olympus IX51/71/81 adapter with ZDC autofocus, right
  - $575

- **BR-Y73**
  - Olympus IX53/73/83 adapter
  - $500

- **BR-Y73-2**
  - Olympus IX53/73/83 adapter (2 sides)
  - $1,000

- **BR-Z30**
  - Zeiss Axiovert 100/135 adapter
  - $500

- **BR-Z35**
  - Zeiss Axiovert 200 adapter
  - $500

- **BR-Z40**
  - Zeiss Axio Observer adapter
  - $500

- **BR-Z50**
  - Zeiss Axiovert A1 adapter
  - $500

- **BR-CUST**
  - Custom microscope adapter
  - $1,025

**ACCESSORIES**

- **BR-AW**
  - Rod holding clamp (for rod OD 2-4mm)
  - $100

- **MT-81-DOV8**
  - MT-81 stand with 8 inch dovetail
  - $620

- **MT-81-DOV12**
  - MT-81 stand with 12 inch dovetail
  - $620

- **MAG-MT**
  - Magnetic feet (set of 4)
  - $69

- **BR-HEA-CV**
  - Swing gate conversion for MP-285 / MP-225
  - $450

1 *Useful with stereo or dissection scopes.*
2 *Factory installation required. No charge 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 +350hPa in 1hPa increments

- **Inject Function**
  - Inject modes: Continuous or Pulse
  - Inject pressure: 0 to 5600hPa in 7hPa increments
  - Compensation pressure: Adjustable in 1hPa increments
  - Inject time: 0 to 10 seconds in 0.01 sec increments
  - Clear pressure: 6700hPa (97psi)
  - Inject command: Remote interface or foot switch

- **Transfer Function**
  - Transfer pressure:
    - -175 to +175hPa (Range setting 1) in 1hPa increments
  - Adjustable using range setting dial

- **Maximum Injection Pressure**
  - 5600hPa (80psi)

- **Controls**
  - Tactile keys, rotary optical encoders
  - 3 x 7 segment LED display

- **Micropipette Holder**
  - Rod Diameter:
    - 4mm
  - Compatible with:
    - 1mm capillary glass
    - (1.2mm and 1.5mm available upon request)
    - 2.4m ETFE tubing (2 additional sets included)

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

- **Dimensions**
  - Compressor module:
    - 407mm x 440mm x 150mm
  - User interface module
    - 164mm x 123mm x 70mm

- **Weight**
  - Compressor module:
    - 1504g
  - User interface module:
    - 42g
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 2.4m ETFE tubing and fittings, spare tubing, connecting cables, and manual

$ 8,720

ACCESSORIES

■ BR-DT
XenoWorks digital tubing kit

$ 85

■ BR-MH
XenoWorks micropipette holder and tip

$ 184

■ BR-MH1.0
Micropipette replacement tip (1.0mm OD glass)

$ 49

■ BR-MH1.2
Micropipette replacement tip (1.2mm OD glass)

$ 49

■ BR-MH1.5
Micropipette replacement tip (1.5mm OD glass)

$ 49

■ V001104
1/16in clear ferrule for tubing

$ 10

■ V300450
1.0-1.2mm O-ring (package of 6)

$ 29

■ V300455
1.5mm O-ring (package of 6)

$ 29

1 Please specify tip size when ordering

(Remote user interface)
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 syringe. 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 holder 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 25µl syringe installed, one complete rotation of the micrometer (25 divisions) yields a displacement equivalent to a volume of 267nl and turning the micrometer one division (0.001in) yields 10.6nl.

<table>
<thead>
<tr>
<th>SYRINGE VOLUME</th>
<th>VOLUME PER REVOLUTION</th>
<th>VOLUME PER DIVISION</th>
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<tbody>
<tr>
<td>10µl</td>
<td>106nl</td>
<td>4.2nl</td>
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<tr>
<td>25µl</td>
<td>267nl</td>
<td>10.6nl</td>
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<tr>
<td>50µl</td>
<td>529nl</td>
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<tr>
<td>100µl</td>
<td>1.06µl</td>
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<td>250µl</td>
<td>2.65µl</td>
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<tr>
<td>500µl</td>
<td>5.29µl</td>
<td>211.7nl</td>
</tr>
<tr>
<td>1000µl</td>
<td>10.58µl</td>
<td>423.4nl</td>
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</table>

1 Please specify the syringe volume that you will be using. For animal IVF applications, 500µl and 1000µl syringes are commonly used.

2 Unless specified otherwise, a pipette holder for 1mm outside diameter glass will be supplied. The diameter of the pipette holder is 0.25 inches (6.4mm). For micromanipulators that cannot accept this size holder, an adapter is optionally available. Please contact us for further information.
### Specifications

**MANUAL MICROINJECTOR**

| **Dimensions** | 12in x 3.75in x 4in
30cm x 9.5cm x 10cm |
| **Weight** | 2.5lbs
1kg |

### 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 50µl gas-tight syringe, teflon tubing, connectors and MI-10010 pipette holder assembly for 1.0mm capillary tubing* |
| **Price** | $1,495 |

*Other syringe volumes, and pipette holder sizes are available upon request.*

### Accessories

**MANUAL MICROINJECTOR**

| **Item** | Description |
| **Price** |
| MI-10010 | Pipette holder assembly for 1.0mm OD glass (includes holder and mounting rod) |
| MI-10012 | Pipette holder assembly for 1.2mm OD glass (includes holder and mounting rod) |
| MI-10015 | Pipette holder assembly for 1.5mm OD glass (includes holder and mounting rod) |
| BR-OIL | Oil for injector (100ml) |
| V200050 | Teflon tubing |
| V001180 | 10µl gas-tight syringe |
| V001181 | 25µl gas-tight syringe |
| V001182 | 50µl gas-tight syringe |
| V001183 | 100µl gas-tight syringe |
| V001184 | 250µl gas-tight syringe |
| V001185 | 500µl gas-tight syringe |
| V001186 | 1000µl gas-tight syringe |
| | $64 |
| | $64 |
| | $64 |
| | $44 |
| | $8 per ft. |
| | $120 |
| | $120 |
| | $120 |
| | $120 |
| | $120 |
| | $120 |
| | $120 |
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
- Enuclation
- Nuclear Transfer
- ES Cell Injection
- Assisted Hatching
SPECIFICATIONS  PMM-4G

- **Piezo Impact Drive Unit (MB-D)**
  - Moving range: ~5mm
  - Traveling resolution: ~0.1µm
  - Traveling speed: 0.04mm/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**
  - **Controller:**
    - 9.5in x 13in x 5.5in
    - 240mm x 340mm x 140mm
  - **Operation Box:**
    - 4in x 6.3in x 2.4in
    - 100mm x 160mm x 60mm
  - **Foot Switch:**
    - 5.5in x 5.5in x 1.5in
    - 145mm x 145mm x 38mm

- **Weight**
  - **Controller:**
    - 11lbs
    - 5kg
  - **Piezo Drive Unit:**
    - 0.3lbs
    - 125g
  - **Operation Box:**
    - 1.2lbs
    - 530g
  - **Foot Switch:**
    - 1.8lbs
    - 820g

- **Electrical**
  - AC supply of 100-240 Volts
  - 50/60Hz, 50mA

- **Temperature**
  - Operates at 5-40° 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  

$12,620

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.
Syringe Volume
- Volume: 1.9ml
- Screw Pitch: 0.05mm
- Stroke: 20mm

Dimensions
- Width: 2.75in (W) x 7.2in (D) x 3.5in (H)
- Depth: 70mm (W) x 182.5mm (D) x 90mm (H)

Weight
- 1.9lbs
- 0.88kg

US PRICES HDJ-M3

| HDJ-M3       | Hydraulic Microinjector | $1,935 |

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

<table>
<thead>
<tr>
<th><strong>Syringe Volume</strong></th>
<th>5.0ml Screw</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Pitch: 2.0mm</td>
</tr>
<tr>
<td></td>
<td>Diaphragm Travel: 16mm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Dimensions</strong></th>
<th>2.9in (W) x 6.55in (D) x 3.5in (H)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>73mm (W) x 166.6mm (D) x 90mm (H)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Weight</strong></th>
<th>2.05lbs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.93kg</td>
</tr>
</tbody>
</table>

### 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.*

<table>
<thead>
<tr>
<th><strong>PNJ-T2</strong></th>
<th>Pneumatic Microinjector</th>
<th>$1,835</th>
</tr>
</thead>
</table>

*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 Analog 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 Analog Microinjector BRI
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 Analog Microinjector ideal.

Suggested system configuration:
1 x Micromanipulator (Right) BRMR
1 x Micromanipulator (Left) BRML
2 x Analog Microinjector BRI
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 **Analog Microinjectors**.

Suggested system configuration:

1 x Micromanipulator (Right) BRMR
1 x Micromanipulator (Left) BRML
2 x Analog Microinjector BRI
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 Analog Microinjector is ideal for this purpose.

Suggested system configuration:
1 x Micromanipulator (Right) BRMR
1 x Micromanipulator (Left) BRML
2 x Analog Microinjector BRI
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 (100–1000hPa) 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.
A sample design project shown above: A cryogenic dual wheel with twin adjustable rotating polarizers for use in infrared astronomy.
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.

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