PLI-100,
see page 320

Vibratome® 1000 Classic,
see page 334

SZM 180,
see page 338

Intralux 5100,
see page 340

Introduction to Microinjection

The use of Glass Needle (Fine Glass Microcapillary Pipette) based techniques for intracellular/extracellular microinjection and perfusion has become a popular procedure in numerous areas of experimental biology research (e.g. In vitro fertilization, transgenics, etc.). These techniques can best be described as micro surgical procedures that are conducted on a single cell using either a single or multiple barrel glass micropipette a precision positioning device (micromanipulator) and a microinjector or microperfusor. The micropipettes used in these procedures are formed using a Pipette Puller. The capillary glass tubing is heated to its softening point and 'pulled' to create the proper size tip diameter and taper for the desired application. The small tip diameters (as low as 0.2 µm) of these micropipettes combined with the high precision of the Micromanipulator and Microinjection/Perfusion Apparatus, allows for precise and accurate delivery. This precision allows for accurate and repeatable injections down to the sub-picoliter liter range into or around various types and sizes of cells with accuracy to 0.1 micron. The process of extruding substances through these micropipettes is accomplished through the use of either direct hydrostatic pressure (Pressure Injection) or by moving charged ions that are the result of an applied electric field (Iontophoresis) without the use of hydraulic flow.

Applications of microinjection range from assisted (In vitro) cell fertilization techniques to the transport of molecular and cellular elements. These substances are typically injected into the cell to manipulate and/or monitor the fundamental biochemistry of a specific living cell. Substance that can be injected include, cellular organelles, kinases, histochemical markers (such as horseradish peroxidase or lucifer yellow), proteins, metabolites, microbeads, ions, antibodies, genes, molecular biology mRNA and DNA, etc. The precise delivery (microperfusion) of small volumes (picoliter to milliliter) of various agents and drugs to a cell or group of cells for applications such as pharmacological drug testing can also be accomplished using these techniques.

In order for the researcher to conduct any of the above experiments and get meaningful results, the tools (equipment) used in these experiments must provide not only the specific functionality, but they also need to be of the highest quality and provide the necessary reliability, accuracy and repeatability to insure proper results. Harvard Apparatus, Inc. manufactures and sells the complete range of product that are needed to successfully microinject and/or microperfuse.

Warner and Harvard Apparatus Clark Capillary Glass, pages 236 to 241

Harvard Apparatus/Medical Systems Picoliter Injectors, pages 319 to 323

Harvard/Apparatus Medical Systems NeuroPhore, see pages 325 to 329

Pressure Injection Systems, pages 332 and 333

Pipette Pullers, pages 243 and 245

Micromanipulators, pages 267 to 276

PLS-1

Pico Injection/Micromanipulator System

The PLS-1 Pico Injection/Micromanipulator System combines our popular PLI-100 pico injector, a motorized micromanipulator, and magnetic base in a single package.

The PLI-100 Pico-Injector delivers a wide range of volumes through micropipettes by applying a regulated pressure for a set period of time. The system features 5 pressures: inject, balance, clear, fill, and hold. The injector comes complete with input and output hoses, foot switch and pipette holder.

For precise and convenient movement of the electrode our three axes motorized micromanipulator and push button controller are included. This micromanipulator features hands free spatial resolution of 0.5 µm which enables positioning in the sub-micro range. Flexible motor coupling ensures no vibration of probe during movement.

The MB/B magnetic base provides a convenient position device for the micromanipulator.

Order #	Model	Product
W3 64-1608	PLS-1	Pico-Injector Micromanipulator System
W3 65-0002	PLI-100 Plus	Pico Injector
W3 60-0571		Right-handed motorized micromanipulator
W3 60-0577		Push button controller
W3 64-0060		MB/B Magnetic base

PLI-100

Medical Systems Pico-Injector

A full featured workhourse microinjector

W3 65-0001 PLI-100 Pico-Injector

- 5 pressures: inject, balance, clear, fill and hold
- Reliable
- Femtoliter to microliter injections
- Reproducible performance
- Easy to use
- Popular applications:
  - Injection of mouse, frog, zebrafish and other oocytes
  - Extracellular brain injections
  - Injection of DNA, mRNA, microbeads, neurotransmitters, kinases and other proteins
- Most Published Injector

The PLI-100 Pico-Injector reliably delivers a wide range of volumes through micropipettes by applying a regulated pressure for a digitally set period of time. Compressed gas allows the user to deliver desired volumes from femtoliters to microliters while simultaneously holding a cell. Whether you need to do large injections into capillaries or very small injections into mammalian nuclei, the PLI-100 is well suited for your experiment.

The PLI-100 has become a favorite of prestigious national microinjection workshops like Cold Spring Harbor Laboratories and other researchers worldwide. Other companies have tried to design similar systems, but the PLI-100 remains unparalleled in terms of ease of use, durability, precision, and cost.

Researchers Say:

"The PLI-100 is very robust, in constant use in our lab."

"Most importantly, the PLI-100 valves prevent cytosol and yolk backflow into my pipette after oocyte injection."

"It's very easy to control."

"The PLI-100 is heavily used on a daily basis, and works great."

"I like the fact that I can use the PLI-100 with TTL pulses."

"It works great in conjunction with my imaging system."

"The balance pressure is a good option."

"My injection pipettes rarely clog."

Easy to Use

Inject with the touch of a button or a tap of the foot switch — it's as easy as that!

Reproducible

Pressure to the pipette is controlled precisely through a multi-turn regulator, and is reported digitally for easy repeat. Injection time is digitally controlled in 10 msec steps between 0.01 to 0.99 seconds (and in 1 second steps between 1 to 99 seconds). Pipette tip diameter, and hence delivered volume, are easy determinations once the timing and pressure are known.

Versatile

Deliver volumes from femtoliters to microliters with the same instrument, resulting in a wide range of applications.

Pressure Capabilities

The PLI-100 features two negative and three positive pressure pneumatic capabilities.

The negative, or vacuum functions allow the user to:

1. Fill micropipettes from their tips, reducing wastage of valuable injectables.
2. Provide a means to secure and manipulate a cell using a holding pipette.

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PLI-100

Medical Systems Pico-Injector (continued)

The positive pressures allow the user to:

1. Eject precise amounts of fluids.
2. Create a balance pressure which prevents backflow into the micropipette following an injection.
3. Clear a micropipette of material in it.

Unique Features

The PLI-100's important 'Balance', 'Hold' and 'Clear' functions are not found on other microinjection units.

Balance

In addition to the ejection pressure, the Pico-Injector offers a secondary balance pressure. This secondary balance maintains a positive pressure on the injection pipette before and after injections. This eliminates dilution caused by capillary action and aids in the prevention of clogging. Wasteful continuous injection, which often occurs when no separate balance pressure is offered by an injection device, is avoided.

Fill/Hold

There are two built-in vacuum generators to fill a micropipette from the tip and to hold suspended cells. Filling the pipette from the tip is easier than back filling. Suspended cells can be held with a second (holding) pipette. The holding vacuum's range accommodates most cell types.

Clear

A high-pressure pulse can be used for clearing a pipette, should it happen to clog. This is particularly useful when working with pipettes sized for smaller volumes.

Electrical Connectors

BNC type connectors are available at the front panel to ease integrating the Pico-Injector with other equipment. Synchronization of injections to other stimulations or recordings is therefore possible.

Selection Guidelines

The PLI-100 is available in three packages: Plus, Basic and Deluxe. The basic unit is supplied with an input hose, output hose, holding hose, power cord and instruction manual. The plus unit also includes a foot switch, pipette holder and input hose adapter. The deluxe unit includes all the previously mentioned accessories plus an additional foot switch and one pipette holder.

Accessories

Available accessories for the PLI-100 Injection Systems are located on page 320.

Specifications

Input Gas Pressure	70 to 105 p.s.i. (480 to 720 kPa)
Injection Pressure	0.2 to 60 p.s.i. (413 kPa), regulated, multi-turn control
Balance Pressure	0.1 to 3.5 p.s.i. (68.9 kPa), regulated, multi-turn control, other ranges available upon request
Fill Vacuum	Internally produced, -12.0 p.s.i. (-82 kPa), unregulated
Holding Vacuum	Internally produced, 0 to 3 in H_2O (0 to 0.75 kPa or 0 to 0.1 p.s.i.), regulated
Clearing Pressure	Input gas pressure, unregulated
Injection Timer Pulse Width	0.01 to 0.99 sec in 10 msec steps; 1 to 99 sec in 1 sec steps
Injection Count Display	Digital, 0 through 9999
Duration Mode	Internally timed or externally gated
Time Trigger	Front panel, foot switch, or external TTL pulse (BNC)
Pressure Units	p.s.i./kPa; switch selectable
Pressure Monitor	BNC connector, 10 mV/p.s.i.
Pressure Readout	Inject, balance, clear, output port
Line Voltage	100/110/220/240 VAC
Power Usage	220 W
Meter Accuracy	0.1% full scale
Foot Switches	Inject, fill, hold, and gated; provided in plus and deluxe pkgs.
Weight	6.8 kg (15 lb)
Dimensions, H x W x D	11 x 38 x 25.5 cm (5 x 15 x 10 in)
Accessories Supplied	Input, output and holding hoses

Order #	Model	Product
W3 65-0001	PLI-100	PLI-100 Basic Pico Injector with Injection, Balance, Clear, Filling and Holding Pressures; Comes with Input Hose, Output Hose, Holding Hose, Power Cord and Instruction Manual
W3 65-0002	PLI-100 Plus	PLI-100 Plus Pico Injector with Injection, Balance, Clear, Filling and Holding Pressures; Comes with Input Hose, Output Hose, Holding Hose, Power Cord, Instruction Manual, Foot Switch (W3 65-0029), Pipette Holder (W3 65-0013) and Input Hose Adapter
W3 65-0003	PLI-100 Deluxe	PLI-100 Deluxe Pico-Injector with Injection, Balance, Clear, Filling and Holding Pressures, Comes with Input Hose, Output Hose, Holding Hose, Power Cord, Instruction Manual, Two Foot Switches, Two Pipette Holders and Input Hose Adapter

PLI-90

Medical Systems Pico-Injector

Precise and reproducible injection

W3 65-0004 PLI-90 Pico-Injector

- 3 pressures — inject, balance, and clearing
- Eliminates backflow into pipette after injection
- Reproducibly delivers femtoliters to microliters
- Easy to use
- Economical
- Precise

The PLI-90 Pico-Injector, like the reliable PLI-100 Pico-Injector, controls the precise and reproducible regulation of injection pressure and time.

Simplicity

Because the PLI-90 features only the injection, balance, and clearing pressures, it is a lower cost alternative to the PLI-100. This simplicity makes it even easier to use than the PLI-100.

Selection Guidelines

The PLI-90 is ideal for the user who does not require vacuum for filling pipette barrels or if using a holding pipette for holding cells is not essential to your application.

The PLI-90 is available in two packages: Basic and Plus. The basic model includes an input and output hose, handle, power cord and instruction manual. The plus model is supplied with all of the same parts as the basic model but also includes a Footswitch, Pipette Holder, and Input Hose Adapter.

Specifications

Input Gas Pressure	70 to 105 p.s.i. (480 to 720 kPa)
Injection Pressure	0.2 to 60 p.s.i. (413 kPa), regulated, multi-turn control
Balance Pressure	0.1 to 3.5 p.s.i. (68.9 kPa), regulated, multi-turn control, other ranges available upon request
Clearing Pressure	Input gas pressure, unregulated
Injection Time	0.01 to 0.99 sec in 10 msec steps; 1 to 99 sec in 1 sec steps
Pressure Display	Digital, three and a half digits
Duration Mode	Internally timed or externally triggered
Trigger Mode	Foot or panel switch
Pressure Readout	Inject, balance, clear, output port
Line Voltage	100/110/220/240 VAC
Power Usage	220 W
Foot Switch(es)	Optional inject and gating
Accessories Supplied	Input hose, output hose and power cord
Weight	6.8 kg (15 lb)
Dimensions, H x W x D	11 x 38 x 25.5 x cm (5 x 15 x 10 in)

Order #	Model	Product
W3 65-0004	PLI-90 BASIC	Pico-Injector with Injection, Balance and Clear Pressures; Includes Input Hose (PLI-IHN) and Output Hose (PLI-OHN), Handle, Power Cord and Instruction Manual. Applications: Basic setups that do not need suction.
W3 65-0005	PLI-90 PLUS	Pico-Injector Basic Model and Acces-sories (Shown Above), Plus One Each PLI-FS Foot Switch, PLI-PH1 Pipette Holder and PLI-IHA Input Hose Adapter

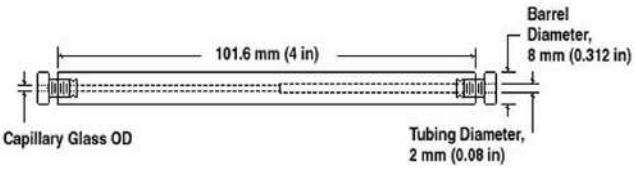
PLI-100 and PLI-90

PLI-100 and PLI-90 Accessories

Order #	Model	Product
Accessories		
W3 65-0029	PLI-FS	Footswitch for Inject, Hold, Fill or Gate (Order more than one if frequent use of footswitch is needed for more than one of these functions.)
W3 65-0030	PLI-RM	Frame to Mount PLI-90 or PLI-100 in 19-in. Wide Instrument Rack
Hosing		
W3 65-0006	PLI-IHA	Input Hose Adapter (¼ in Male W3T Pipe Thread) Gas Bottle Regulator Fitting; Connects with PLI-IHO/N
W3 65-0007	PLI-IHO	Gas Input Hose (Tygon Tubing), 9 ft x 0.250 in (6.35 mm) x 0.125 in (3.18 mm) x 0.062 in (1.57 mm) (L x OD x ID x Wall Thickness); Connects to PLI-IHA and PLI 90/100 Gas Input, Brass Screw Fitting Type - Old
W3 65-0008	PLI-IHN	Gas Input Hose (Tygon Tubing) 9 ft L x 0.250 in (6.35 mm) OD x 0.125 in (3.18 mm) ID x 0.062 in (1.57 mm) Wall Thickness; Connects to PLI-IHA and PLI 90/100 Gas Input, Quick Connect/Disconnect Type - New
W3 65-0009	PLI-OHO	Output Hose (Tygon Tubing) 9 ft L x 0.071 in (1.80 mm) OD x 0.039 in (1 mm) ID x 0.016 in (0.41 mm) Wall Thickness; Connects to MSC Pipette Holders, Brass Screw Fitting Type - Old
W3 65-0010	PLI-OHN	Output Hose (Tygon Tubing) 9 ft L x 0.071 in (1.80 mm) OD x 0.039 in (1 mm) ID x 0.016 in (0.41 mm) Wall Thickness; Connects to MSC Pipette Holders and PLI 90/100 Gas Output, Quick Connect/Disconnect Type - New
W3 65-0011	PLI-HHO	Holding Hose with Cell Release Bulb; 9 ft L x 0.071 in (1.80 mm) OD x 0.039 in (1 mm) ID x 0.016 in (0.41 mm) Wall Thickness; Connects to MSC Pipette Holders and PLI-100 Hold Output, Brass Screw Fitting Type - Old
W3 65-0012	PLI-HHN	Holding Hose with Cell Release Bulb; 9 ft L x 0.071 in (1.80 mm) OD x 0.039 in (1 mm) ID x 0.016 in (0.41 mm) Wall Thickness. Connects to MSC Pipette Holders and PLI-100 Hold Output, Quick Connect/Disconnect Type - New

Order #	Model	Product
Pipette Holder/Adapter/Parts		
W3 65-0013	PLI-PH1	Stainless Steel Pipette Holder, 130 mm L for 1 to 1.5 mm OD Glass Pipettes
W3 65-0014	PLI-PH1A	Stainless Steel Pipette Holder, 80 mm L for 1 to 1.5 mm OD Glass Pipettes
W3 65-0017	PLI-SRG	Silicone Rubber Gasket Replacement for use with PLI-PH1 and PLI-PH1A, 10.2 cm (12 in)
W3 65-0015	PLI-SRG1.5	Silicone Rubber Gasket Replacement for use with 1.5 mm Glass Pipettes
W3 65-0018	PLI-SSB	Stainless Steel Bushing Replacement for use with PLI-PH1 and PLI-PH1A Pipette Holders
W3 65-0019	PLI-PC	Stainless Steel Pipette Cap Replacement for use with PLI-PH1 and PLI-PH1A Pipette Holders
W3 65-0020	PLI-HN	Stainless Steel Hose Nut Replacement for use with PLI-PH1 and PLI-PH1A Pipette Holders
W3 65-0021	PLI-PH-KIT	Pipette Holder Hardware Replacement Kit for use with PLI-PH1 and PLI-PH1A Pipette Holders, Includes 1 each PLI-SSB, PLI-PC, PLI-HN and PLI-SRG
W3 65-0022	PLI-PHA	Stainless Steel Pipette Holder (PLI-PH series) Adapter for Eppendorf ECET FEMTOTIP

Optional "Easy Insert" Acrylic Pipette Holder



W3 64-1626	AO16 1.0	Acrylic Pipette Holder for 1.0 mm Pipettes
W3 64-1627	AO16 1.2	Acrylic Pipette Holder for 1.2 mm Pipettes
W3 64-1628	PLI-PPH	Acrylic Pipette Holder for 1.5 mm Pipettes
W3 64-1629	AO16 1.2	Acrylic Pipette Holder for 2 mm Pipettes

Model Air-1 Ultra Low Noise Air Compressor

- Suitable for installation directly at point of use
- Lowest noise and vibration level in the market 45dB(A) you won't even know it's on
- Complete compressed air package
- Ideal for use with our microinjection systems

When a reliable supply of clean and quiet compressed air is required, this oil-lubricated compressor is the perfect choice. The noise level is 45 dB(A) - far below the level of normal conversation. Quiet, vibration-free and reliable this compressors compact design easily allows mounting at the place of use.

The oil-lubricated piston compressor is supplied ready for use. The unique synthetic SJ-27 oil designed especially for AIR-1 optimizes the lubrication of the compressor.

Furthermore, the internal motor is mounted in a closed motor house, reducing the noise level even further. Due to the design of the motor, the oil is also used for cooling the motor.

The motor is mounted on springs inside the motor housing, which means that hardly any vibrations are imparted to the surroundings. Two noise reduction chambers on the intake side and two noise reduction chambers on the pressure side ensure absorption of the noise. The compressor is also supplied with rubber feet, preventing vibrations from imparting to the mounting bolts and foundation. The noise level of the oil-lubricated compressor is 45 dB (A) – below the noise level of a refrigerator.

The oil minimizes the wear and tear of the vital parts in the compressor, prolonging the lifetime and at the same time ensuring low maintenance costs.

Specifications

Input Voltage Range	120 or 230 VAC specify at time or order
Maximum Current	6.2A@ 120 VAC 2.9A@ 230 VAC
Motor	0.54 HP / 0.40kW
Displacement	60 l/min or 2.12 CFM
FAD @ 8 bar	32 l/min or 1.13 CFM
Max. Pressure	8 bar / 120 psi
Tank Size	4 liters / 1.1 gallon
Noise Level	45 dB(A)
Physical Dimensions:	
Size, H x W x D	382 x 300 x 334 mm (15 x 11.8 x 13.2 in)
Weight	23 kg (50.6 lb)
Warranty	One year, parts & labor

Order #	Model	Product
W3 64-1701	AIR-1 U	Ultra low noise 120VAC
W3 64-1702	AIR-2	Ultra low noise 230VAC

Harvard Neuro Phore BH-2 System

Micro-Iontophoresis and Micro Injection

Harvard Neuro Phore BH-2 System

In the past few decades, the application of drugs and other dissolved agents from multibarrel electrodes/pipettes has evolved into a practical method of testing their effects on cells or cellular systems. The versatile Neuro Phore BH-2 System is designed to facilitate controlled ejection of fluids from multibarrel micropipettes. Extracellular ejections of minute volumes can be delivered using up to five pumps in serial or parallel. The ejection schedule for each pump can be independently programmed for sequential or simultaneous output. Ejection cycles can be internally timed, triggered manually, or synchronized to external events.

This flexible system allows the use of iontophoretic pump modules, pneumatic pump modules, or a combination of both. By interchanging the IP-2 Iontophoresis Pump Module with a PPM-2 pneumatic pressure pump, the overall system capability can be expanded for simultaneous pressure and iontophoretic injection of drugs from a multibarrel pipette.

The Neuro Phore BH-2 System was developed under the guidance of active researchers with extensive experience in iontophoresis techniques. These researchers needed a system to provide precise stimulation and quantitative control for ejection of drugs in their pharmacological studies of drug evoked responses such as neurosynaptic discharges, contraction, and changes in chemical concentration. What emerged was a reliable, accurate, easy to use, Neuro Phore BH-2 system that is capable of accommodating high impedance multi-barreled micro-electrode pipettes.

The Neuro Phore BH2 System Unit pictured contains three IP-2 Pump Modules and two PPM-2 Pump Modules and one BM-2 Control and Balance Module

- Used by leading researchers for over 20 years
- Modular
- Minimal noise
- Up to 6 channels
- Digitally controlled eject and pause timing
- Mix and match pump types

Features

- Successfully utilized in key laboratories around the world for over 20 years, with many journal articles published as a result
- Modular design; buy what you need now and add additional modules later as your protocol evolves
- Accommodates 7 barrel micropipettes, supports the most complex and demanding injection and recording protocols
- Extremely low noise, ±105 volts compliance, allows rapid iontophoretic injection with even the smallest micropipette tips
- Automatic current neutralization for minimal electrical artifacts
- Digitally controlled eject and pause timing utilizes easy to read and set digital panel switches on each iontophoretic or pressure module/channel
- Unbalance and out of compliance indicators are a great aid in troubleshooting clogged pipettes and other problems
- External analog input control allows external programming of complex, or closed loop injection protocols
- Current and electrode resistance readout with large bright easy to read digital displays

System Configuration

The Neuro Phore BH-2 System is modular and is comprised of the following components (all ordered separately):

- One BH-2 Mainframe Chassis, W3 65-0600 that can accommodate 1 to 5 Iontophoretic Pump and/or Pressure Pump Modules; Mainframe Chassis can be rack mounted or set on table
- One BM-2 Control and Balance Module, W3 65-0602
- IP-2 Iontophoretic Pump Modules, W3 65-0603 and/or
- PPM-2 Pressure Pump Modules, W3 65-0604
- One low noise MS-2 Power Supply, W3 65-0601
- Blank Panel DP-1 Dummy Module, W3 65-0605 used to maintain timing if less than 5 Pump Modules are installed
- One Model OC-01 output cable, W3 65-0215
- One Model NL-952 lemo cable, W3 65-0285

Harvard Neuro Phore BH-2 System

Micro-Iontophoresis and Micro Injection (continued)

BH-2 Mainframe Chassis

The BH-2 Mainframe Chassis is pre-wired to accept one Control and Balance module and five Iontophoretic Pump Modules and/or Pneumatic Pump Modules. The selected modules are specified by the researcher and depend on applications. Although all components are ordered separately, the unit is assembled, calibrated, and balanced by Harvard Apparatus before shipping.

BM-2 Balance Module: Balance and More

In addition to providing current neutralization (automatic feedback and control of inverse sum of all pump currents), the balance module has independent capability of current pump settings with a working range of 0 to 500 nanoamperes. The Balance Module includes a digital display, time clock, provisions for electrical and manual cycle start/stop and single cycle/recycle switch, trigger, and gate input terminals to initiate externally controlled eject pumping action of respective modules. Analog input for balance or drive with override capability. Analog output for monitoring of unbalance currents.

**Brain Slice Chambers are available in a variety of formats. Please visit our website for more information.*

Order #	Product
W3 65-0600	BH-2 Mainframe Chassis (Does Not Include BM-2 Balance Module, see Below)
W3 65-0602	BM-2 Control and Balance Module with OC-01 and NL-952

Specifications

Neutralization (balance) Pump Range	Max. ±2500 nA automatically controlled
Current Pump	Compliance ±105 V linear constant current source; manually adjustable 0 to 500 nA by pump control; polarity selected +/OFF/- switch
Digital Meter Display	3 digits and sign
Unbalance Current/Current	Pump Switch:
Unbalance	Digital display reads unbalance (ground going) current in nA
Current Mode	In this mode, automatic current neutralization is provided
Current Pump Mode	Automatic balance feature is switched off; display reads amount of current in nanoamperes passed through balance barrel as adjusted by pump control
Single Cycle Mode	In single cycle mode, start switch or external trigger initiates each cycle
Recycle Mode	In recycle mode, once start switch or external trigger is actuated, repetitive cycles commence automatically
Time Unit Switch	Two basic time units can be selected, 10 msec or 1 sec. In 10 msec position, Eject and Pause time switches of IP-2 Modules can be set to cover time range from 10 to 990 msec with 10 msec resolution. In 1 sec position, time scale is expanded from 1 to 99 sec with 1 sec resolution.
Inputs	Cycle start, stop, trigger/gate #1 through #5; banana jacks terminals, floating input, optically coupled; input voltage ±5 to ±15 V TTL compatible
Analog Input	Lemo miniature receptacle, ground referenced 5 mV/nA; input impedance 100 kΩ
Analog Output	Lemo miniature receptacle, 5 mV/nA ground referenced
Sync Output	Lemo miniature receptacle, TTL pulse
Output Connector	7-pin miniature connector, mates with ultra flexible cable leading to micro-electrode holder
Dimensions, H x W x D	21 x 47 x 35 cm (8.75 x 19 x 14 in)
Weight	8.2 kg (18 lb)

Application Note: Working Unit:

One (1) each of BH-2 Main-Frame, MS-2 power supply, BM-2 Control & Balance module and any combination of one (1) to five (5) modules selected from IP-2 and/or PPM-2. If less than five (5), DP-1 module is required to fill the spaces.

MS-2 Power Supply

The AC power supply is self contained in a rack-mounted cabinet and provides all voltages required to operate the Neuro Phore System. The power supply interconnects with the mainframe via flexible cable. The supply works with 115 or 220 VAC, 50/60 Hz mains source.

Specifications

Outputs	±125 V at 0.1 A ±15 V at 0.5 A -5 V at 3 A Line operated 115 to 220 VAC, 50/60 Hz
Dimensions, H x W x D	13 x 47 x 35 cm (5-1/4 x 19 x 14 in)
Weight	11 kg (24 lb)

Order #	Product
W3 65-0601	MS-2 Power Supply with Power Cord

Harvard Neuro Phore BH-2 System

Micro-Iontophoresis and Micro Injection (continued)

Specifications

Cycle Start, Cycle Stop, Trigger/Gate Inputs	Push-button, and banana jack terminals; floating input, optically coupled
Input Voltage	±5 to ±15 V
Minimum Trigger Pulse Width	5 µsec at 5 V
Sync Out	Lemo miniature connector TTL pulse
Single Cycle Mode	In single cycle mode, start switch or external trigger initiates each cycle
Recycle Mode	In recycle mode, once start switch or and external trigger is actuated, repetitive cycles will continue until stopped
Time Unit Switch	Two basic time units can be selected: 10 msec or 1 sec. In 10 msec position, Eject and Pause time switches of PPM-2 Modules can be set to cover time range from 10 to 990 msec with 10 msec resolution. In 1 sec position, time scale is expanded to 1 to 99 sec with 1 sec resolution
Power	115 VAC, 50/60 Hz (100 or 220 VAC optional)
Dimensions, H x W x D	21 x 47 x 35 cm (8.75 x 19 x 14 in)
Weight	5.5 kg (12 lb) PPS-2 Mini-Frame System: mainframe, power supply and CM-1 Control Panel. PPM-2 Modules not included.

PPS-2 Mini-Frame

The rack mountable PPS-2 Mini-Frame was designed as a less expensive alternative to the BH-2 for those applications that require pressure injections only. The PPS-2 is a multichannel pneumatic pumping system, designed especially for short-term pressure ejection of small quantities of fluids through micropipettes. The system can operate with up to four PPM-2 Pump Modules. Each module can be programmed to its own schedule of ejection and pause times, coordinated with the other modules. Ejection and pause times cover a range of 10 to 990 milliseconds with 10 millisecond resolution and 1 to 99 seconds with 1 second resolution. Continuous and cyclical modes of operation are also available.

System Configuration

The PPS-2 system (Order # W3 65-0606) includes a Control Module and a power supply. It is pre-wired to accept up to four PPM-2 Pneumatic Pressure Modules (Order # W3 65-0604) which are ordered separately.

The Control Module CM-1 includes a time clock. Panel mounted push-buttons as well as TTL electrical inputs are provided to control the following functions: Cycle Start/Cycle Stop, Trigger (each PPM-2), and Gate (each PPM-2). In essence, the CM-1 Control Module provides all necessary signals to operate the sequential and single shot timing for the installed PPM-2 Pneumatic Pump Modules.

A Self Cycle mode control switch controls independent self timing action of each of the pneumatic pump modules. The self-timing action permits each PPM-2 Pump Module to eject and pause for a predetermined period. Actuating any of the self cycle control switches causes the respective PPM-2 Module to be engaged into the self timing mode. The push buttons at the corresponding trigger/gate terminals initiate the self cycle timing action.

Application Note:
Working Unit
Mini-Frame, Power Supply, and Control Panel plus four (4) modules selected from PPM-2 and DP-1

Order #	Product
W3 65-0606	PPS-2 Mini-Frame with Power Supply, Control Module and NL-952 Power Cord and Manual
W3 65-0604	PPM-2 Pneumatic Pump Module with OH-01 and IH-01, PPS-2 System Can Support 1 to 4 Modules
W3 65-0605	DP-1 Dummy Module (to Maintain Timing) PPS-2 System Can Support 1 to 4 Modules
W3 65-0210	Model SC-01, Tygon Flexible Hose Micropipette Interface Coupling for Pneumatic (PPM-2) Use
W3 65-0211	Model SC-02, Tygon Flexible Hose Micropipette Interface Coupling for Current (IP-2)/Pneumatic (PPM-2) Use
W3 65-0212	Model IH-01, Input Hose 2.7 m (9 ft) Coupling to PPM-2
W3 65-0213	Model OH-01, Output Hose 2.7 m (9 ft) Including SC-01 Coupling
W3 65-0214	Model OH-02, Output Hose 2.7 m (9 ft) Including SC-02 Coupling
W3 65-0215	Model OC-01, Output Cable 2.7 m (9 ft) with (7) Seven-Pin Lemo Connector
W3 65-0285	Model NL-952, Cable 2 m (6.5 ft) with Lemo Miniature Connector at One End and Tinned Leads at Other (Sync. Output or Analog Input/Output Cable)

Harvard Neuro Phore BH-2 System

Micro-Iontophoresis and Micro Injection (continued)

IP-2 Iontophoresis Pump Module

Each IP-2 Module includes controls for precise settings of current magnitude and polarity (retention 0 to 50 nanoamperes, ejection 0 to 500 nanoamperes). The actual current and polarity is continuously displayed digitally and can be externally monitored at the analog output terminal.

Operating Modes

Ejection Timing and Mode Switch

The mode switch provides five push-button controls which include operations such as cycle, trigger, gate, continuous, and termination.

Cycle Mode

In the cycle mode by virtue of selecting single or recycle operation on the BM-2 Module an incoming trigger or cycle start push-button will initiate the current ejection pumping action. In this mode each succeeding Pump Module is automatically triggered after the pause time of the preceding event has been completed. Both eject and pause times can be preset to cover a range from 10 to 990 milliseconds with a 10 millisecond resolution and 1 to 99 seconds with a 1 second resolution.

Trigger Mode

When the TRIG. switch is energized the eject time interval will be started by virtue of the incoming trigger pulse applied to the respective inputs on the BM-2 Balance Module. Eject timing interval can be preset covering a range from 10 to 990 milliseconds with a 10 millisecond resolution and 1 to 99 seconds with a 1 second resolution.

Gate Mode

When the GATE switch is energized the eject current will be started by virtue of a gate input signal applied to the respective trigger/gate terminals on the BM-2 Balance Module. The eject and pause time settings are not operative in this mode, since the eject time function is slaved to the duration of the gate input.

Continuous Mode

When the CONT. switch is energized the ejection pump current is continuously maintained.

Termination Mode

When the TERM. switch is energized the output is automatically diverted from the preparation into an internal 'dummy load' (100 MΩ). This function is particularly useful for testing of possible instability in the preparation pipette.

Analog Input

The analog input terminal is available to facilitate externally controlled current pumping action. An external voltage applied to the input will generate a pumping current at a ratio of 5 millivolts/nanoamperes. This current will be summated with any preset pump current governed by both the retention and ejection controls. The combined magnitude and sign of the summated pumping current is displayed on the digital display of each corresponding Pump Module. This input can be connected to a computer D/A converter when external programming is desired.

Analog Output

The analog output terminal provides a buffered voltage which is proportional in magnitude and polarity to the actual current passed from the current pump into the pipette. The conversion ratio is 5 mV/nA. This output can be polygraphically recorded to monitor progress of the experiment.

Sync Output

The sync output provides a TTL pulse that coincides with the eject time. This output is provided to trigger external devices such as a computer, event counter, etc.

Specifications

Current Pump	Compliance ±105 V, linear constant current source
Ejection Current	Pulsing controlled by Ejection Timing Mode Switch; amplitude adjustable by 10-turn ejection control and range switch from 0 to 50 or 0 to 500 nA; polarity is selected by polarity switch; accuracy of ±l nA
Ejection Indicator	Red LED lamp indicates Eject time period; green LED lamp indicates pause time period
Retention Current	Amplitude adjustable by front panel dial from 0 to 50 nA; polarity automatically set opposite to ejection current polarity, socket (x3)
Analog Input	Lemo miniature receptacle, ground referenced 5 mV/nA; input impedance 100 kΩ , socket (x3)
Analog Output	Lemo miniature receptacle, ground referenced 5 mV/nA, socket (x3)
Sync Output	Lemo miniature receptacle, TTL pulse time incident with eject pulse
Current and Resistance	Digital Meter Display 3 digits and sign Metering System
Resistance/Current Switch:	
Current Mode	Switch in center 'nA' position, digital display reads total current in nA passed through micro-electrode pipette (sum of retention and ejection current)
Resistance Mode	Switch in either (pos) or (neg) MΩ position, digital display reads actual electrode barrel resistance in MΩ derived by passing positive or negative constant current (50 nA) through electrode pipette
Compliance Exceeded Indicator	Digital display will flash whenever electrode barrel resistance exceeds working range of current pump (i.e., when electrode resistance times current exceeds compliance of ±105 V)
Voltage Readout Switch	Depressing switch will cause digital display to read voltage across pipette

Order #	Product
W3 65-0603	IP-2 Iontophoresis Pump Module

Harvard Neuro Phore BH-2 System

Micro-Iontophoresis and Micro Injection (continued)

PPM-2 Pneumatic Pump Module

Designed specifically for pressure injection of drugs in pharmacological studies of drug evoked responses (i.e. synaptic discharges, contraction, etc.) Emphasis has been given to pressure control and regulation (0 to 30 p.s.i.; optional 0 to 10 or 0 to 90 p.s.i.) as well as precise timing. The PPM-2 Module is comprised of a precise pressure regulator, digital display, transducer, and a timing mode switch. It connects to an external pressure source (such as a compressed bottle of N2) which can be set to provide continuous or periodic pressure pulses ranging from 0 to 30 p.s.i. Outputs include (0 to 1 volt) proportional to output pressure as well as a sync pulse coincident with pressure cycle.

Operating Modes

Ejection Timing and Mode Switch

The mode switch provides five push-button controls which include operations such as cycle, trigger, gate, continuous, and termination.

Cycle Mode

In the cycle mode, after selecting single or recycle operation, the start push-button will initiate the ejection pumping action. In this mode each succeeding pump module is automatically triggered after the pause time of the preceding event has been completed. Both eject and pause times can be preset to cover a range from 30 to 990 milliseconds with a 10 millisecond resolution and 1 to 99 seconds with a 1 second resolution.

Trigger Mode

When the TRIG. switch is energized the eject time interval will be started by virtue of an externally applied trigger pulse fed to the respective inputs on the CM-I control panel. Eject timing intervals can be preset to cover a range from 30 to 990 milliseconds with a 10 millisecond resolution and 1 to 99 seconds with a 1 second resolution.

Gate Mode

When the GATE switch is energized pumping action will be started by virtue of a gate input signal applied to the respective trigger/gate terminals on the CM-I control panel. The eject and pause time settings are not operative in this mode, since the eject time function is slaved to the duration of the gate input.

Continuous Mode

Eject pump action is continuously maintained when CONT. switch is energized.

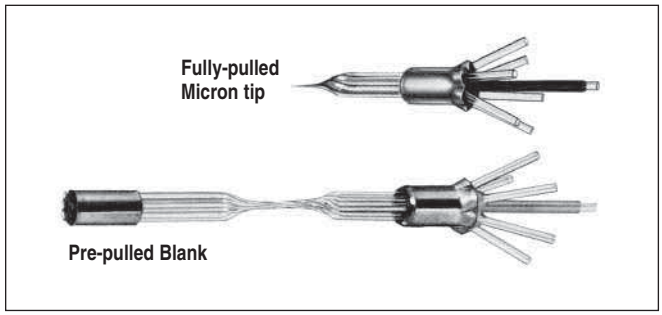
Termination Mode

When the TERM. switch is energized, the output pressure is automatically diverted from the preparation. This function is particularly useful for setting up the desired pressure range and timing while preventing ejection of any drug from the pipette.

Specifications

Source Gas	Air or Nitrogen recommended (no explosive or combustible gases)
Input Pressure	125 p.s.i.g. (7.8 kg/cm2) maximum
Input Filter	5 µm element
Output Pressure	0 to 99.9 p.s.i.g. (0 to 7 kg/ cm2), 30 p.s.i. standard
Output Pressure Display	Three decimal digits
Pressure Pulse Width:	
Minimum	30 msec
Maximum	99 sec (990 sec optional)
Gas Input and Output Couplings	Quick disconnect type
Analog Output	Lemo miniature connector, voltage proportional to output pressure, 0 to -999 mV full scale in p.s.i.g. setting; 0 to -700 mV full scale in kg/cm2 setting
Sync Output	Lemo miniature connector TTL pulse, time incident with output pressure pulse
Eject Time Indicator	Red LED
Pause Time Indicator	Green LED

Order #	Product
W3 65-0604	PPM-2 Pneumatic Pump Module with Input/Output Hose



- Easy filling
- Minimal tip resistance
- Minimal leakage
- Available pre-pulled or fully-pulled

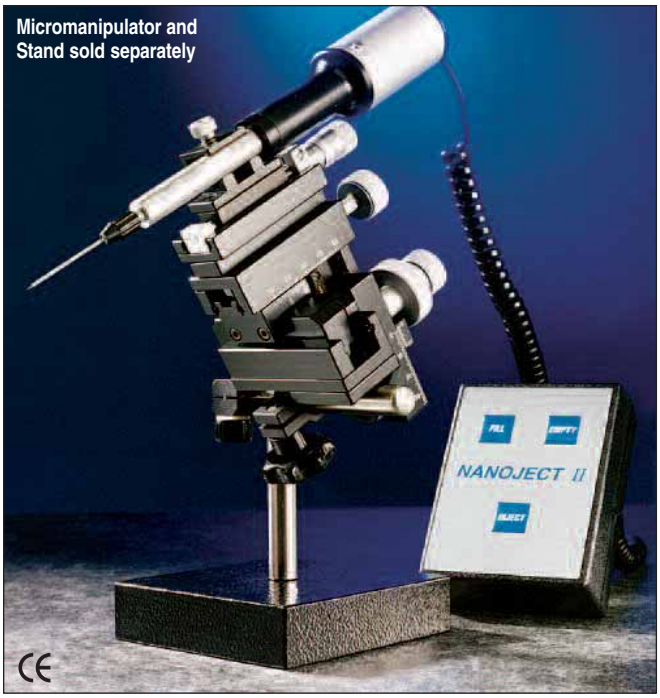
7-Barrel Iontophoresis Micropipette

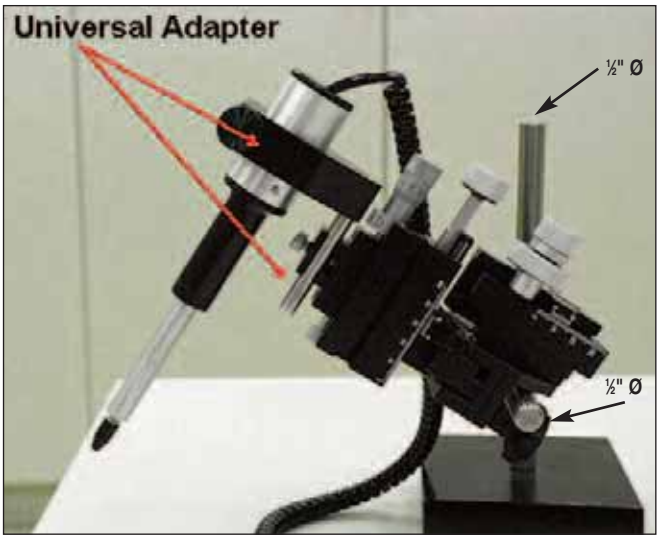
The MS-7P Micropipette has been designed for iontophoretic use as well as pneumatic ejection of drugs. The standard blank consists of seven barrels, Pyrex Omegadot tubing, 1.5 mm outer diameter and 1.2 mm inner diameter, pre-pulled to 2 mm formation as shown. For complete details, see our Warner Instruments Cell Biology Catalog.

Order #	Model	Micropipettes
W3 65-0207	MS-7PB	Micropipette 7-Barrel, 1.5 mm OD Borosilicate Glass, Pre-Pulled Plank, 20 per box
W3 65-0208	MS-7MT	Micropipette 7-Barrel, 1.5 mm OD Borosilicate Glass, Fully-Pulled Approx. 20 µm Tip, 10 per box

Nanoject II

Auto Nanoliter Injector





Needs Micromanipulator to attach to Support Stand

- Lower volume (2.3 nl) capability
- Positive displacement technology
- 2.3 to 69.0 nl range of volumes
- Minimal vibration
- New improved high torque motor
- Membrane key pad
- Improved micropipette holder
- Two speed injection/fill rates
- Auto 'Home' capability

The Nanoject II is the latest development in the Nanoject family of microinjectors. One unique features of the Nanoject II is the use of a high torque motor to provide smooth operation resulting in substantially reduced tip movement. A new collect configuration holds the micropipette more securely thereby reducing air infiltration and oil leakage. The two-speed fill/inject mode allows the user to fill and inject at half speed, facilitating the use of smaller micropipettes. The handling of more viscous samples is also improved. All of the above factors enhance the precise delivery of sample.

Volumes for the Nanoject II range from 2.3 nl to 69 nl. The smaller tips and smaller injection volumes of the Nanoject II allow users to perform injections into other specimens/applications that previously could not be performed.

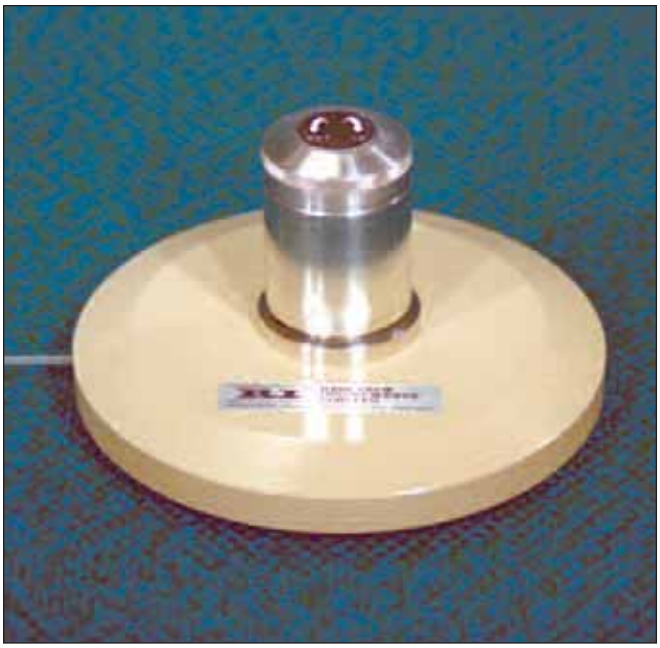
Positive displacement technology and the use of precision micropipettes, eliminate the need for tedious calibration when the viscosity of the sample changes. Contaminants in the sample do not hinder or change the injection volume as with some other injectors. An optional universal mounting adapter provides easy mounting of the Nanoject II to a variety of micromanipulators and stereotaxic frames.

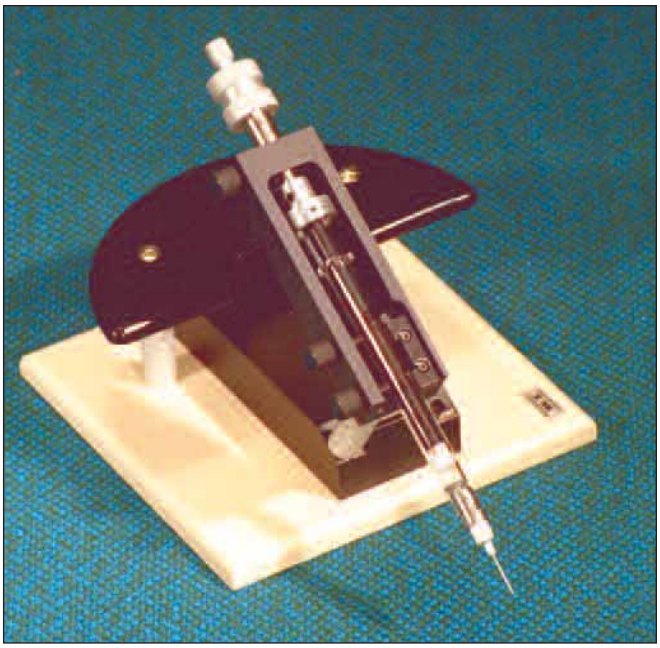
Specifications

Operation	Automatic
Glass Properties	Softening point 780°C
Glass Dimensions	1.14 x 0.053 mm (0.045 x 0.021 in) (OD x ID)
Injection Speed:	Fast: 46 nl/sec; Slow: 23 nl/sec
Fill Speed:	Fast: 46 nl/sec; Slow: 23 nl/sec
Empty Speed	92 nl/sec
Volume Range	2.3 nl to 69.0 nl
Change Volume	Dip switches #1 to #4
Change Inject Speed	Dip switch #5
Weight	99.2 g (3.5 oz)

Order #	Product
W3 69-0130	Nanoject II Nanoliter Injector, 115 V, 60 Hz, US Plug
W3 69-0131	Nanoject II Nanoliter Injector, 230 V, 50 Hz, European Plug
W3 69-0132	Nanoject II Nanoliter Injector, 230 V, 50 Hz, UK Plug
Replacement Parts	
W3 69-0133	Replacement Glass, 88.9 x 1.14 x 0.053 mm (3.5 x 0.045 x 0.021 in) (L x OD x ID), Vial of 100
W3 69-0134	Replacement Glass, 177.8 x 1.14 x 0.053 mm (7 x 0.045 x 0.021 in) (L x OD x ID), Vial of 100
W3 69-0135	Flared Glass, 90 mm (3.5 in), Vial of 100
W3 69-0136	Standard O-Ring
W3 69-0137	Special Flared O-Ring
W3 69-0138	Replacement Wire Plunger
W3 69-0139	Needle, 30 ga x 51 mm (2 in)
Accessories (Must be ordered separately)	
W3 69-0140	Footswitch
W3 69-0141	Support Base
W3 69-0142	Universal Mounting Adapter, see above photo

Screw-Actuated Syringes





- For air-assisted microinjection and microaspiration
- Uncomplicated and easy to use
- Accurate
- Sensitive control
- High suction/pressure

Screw-Actuated Air Syringes

These air-assisted microinjection/microaspiration syringes provide the user with sensitive control and an extremely low dead-air volume. The capacity of the syringe is 10 ml. When required, the syringes can be used to generate high pressure or suction.

The Screw-Actuated Syringe is a small compact unit incorporated into a heavy circular base. Its convenient dimensions enable it to be ergonomically positioned next to the control lever of a micromanipulator to facilitate single-handed operation of both instruments.

The syringe is connected by hard polyethylene tubing to a micropipette, which in turn, may be fitted to a micromanipulator or positioning device. Suction/injection is obtained by turning the metal colored actuator screw-control on the top of the syringe. The syringe provides a solution to the problem of capillary action when working with small micropipettes. A small balance (equilibrating) pressure can be maintained to offset the effects of capillary action. A conveniently situated release-button on-top of the screw-control is provided to achieve equilibration.

Order #	Product
W3 69-0105	Screw-Actuated Air Syringe

- Ideal for oil-filled injection/aspiration
- Easy to use
- Hamilton syringe incorporated
- Accurate
- Sensitive control
- Low dead-air volume
- High suction/pressure
- Easy to exchange or replace the syringe

Screw-Actuated Micrometer Driven Hamilton Syringe

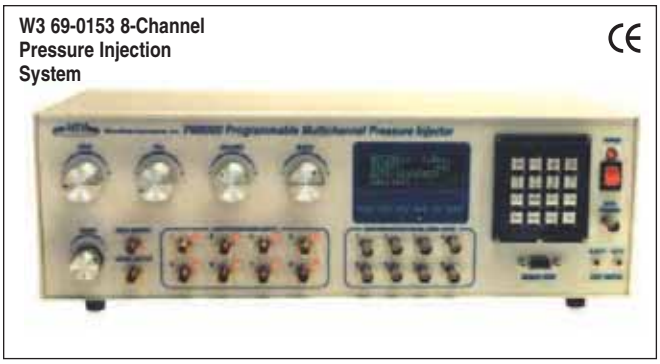
This screw actuated syringe is a micrometer-actuated syringe mechanism mounted on a small base. This syringe is for oil/air-assisted micro-injections and micro-aspirations. Its compact dimensions enable it to be ergonomically positioned next to the control lever of a micromanipulator to facilitate single-handed operation of both instruments.

Suction/injection is achieved by using the rotary-actuator with a fine micrometer-thread, which has a 15 mm movement range. A 1 ml gastight Hamilton glass syringe with a Luer-taper is incorporated. A Luer-taper hypodermic needle is mounted on the taper of the Hamilton syringe. The syringe is connected by hard polyethylene tubing to a micropipette, which in turn, may be fitted to a micromanipulator or similar instrument. The 1 ml Hamilton syringe can be easily exchanged for any other Hamilton 1700 syringe series including the 1000, 500, 200, 100 and 50 µl sizes, visit www.harvardapparatus.com for complete details.

Order #	Product
W3 69-0107	Screw-Actuated Micrometer Driven Hamilton Syringe

PM-8 and PM-4

8- and 4-Channel Pressure Injection Systems



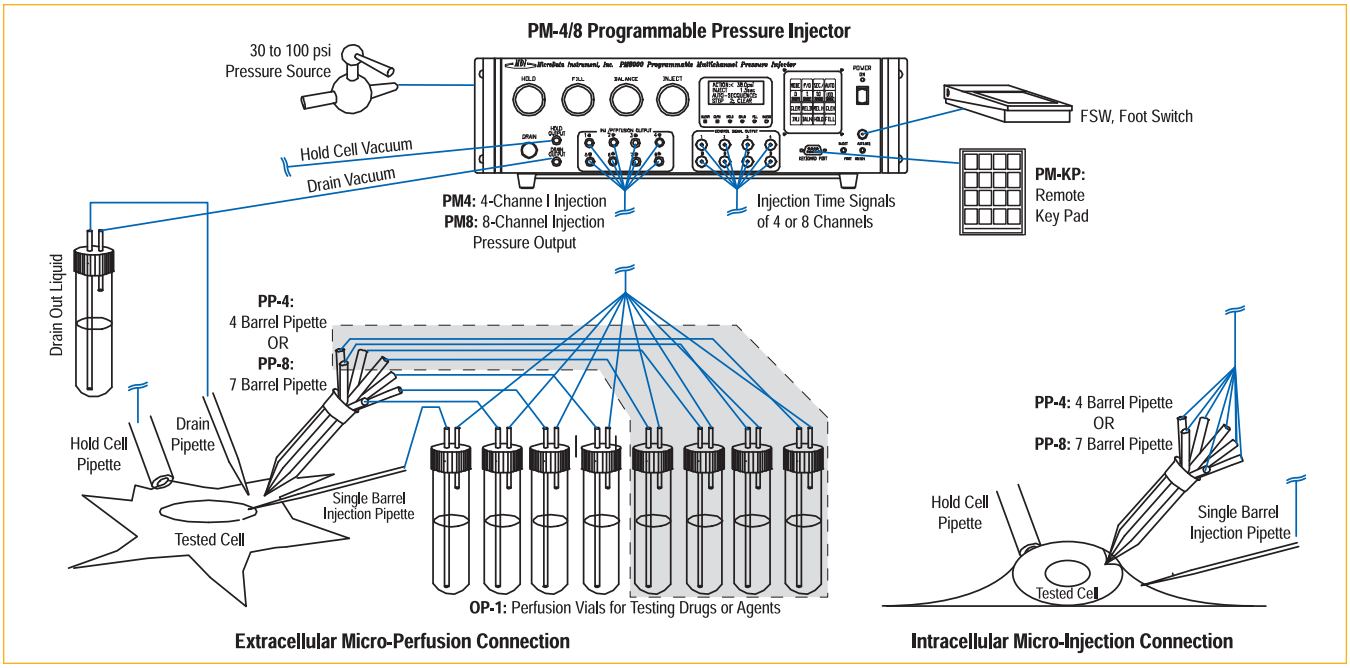
- Multiple function system for micro-injection and perfusion
- Up to 8 injection/perfusion outputs, one hold cell output, and one synchronized drain out channel
- Programmable timers, counters, and step sequences which can be stored for reuse
- Manual control or automatic sequential step cycle operation
- Front panel display for pressures and programming information

The PM-4 and PM-8 programmable 4 and 8-Channel Pressure Injector Systems are designed for one to eight channel intracellular injection and extracellular perfusion. These microinjection and perfusion engines are especially designed for pharmacological drug testing, molecular biological DNA, RNA transferring, intracytoplasmic sperm injection and cell electrophysiological applications.

Combining an advanced micro-controller with precision pneumatic components, these systems can simultaneously control up to eight injection micropipettes or eight perfusion vials, one cell holding pipette, and one drain pipette. The four (PM-4) or eight (PM-8) injection/perfusion output ports can be controlled separately or combined together to perform actions such as injection, capillary action balancing, suction or clear up. The cell holding output port can produce an adjusted gentle suction to hold a cell, eject a pressure to push a cell, or completely clear the holding pipette. Another drain output port can simultaneously produce an adjusted suction to drain and clear out liquid before the next channel micro-perfusion. The PM-4/8 can deliver different quantity agents and drugs from picoliters to continuous perfusion. All output pressures and vacuums can be regulated and can be displayed real-time on the front panel display. Previous pressure readings can also be recovered on the display for setting comparison.

Besides programmable timers and counters, there are 16 programmable and savable injection/perfusion sequences with 32 programmable steps in each sequence. Each sequence can be repeated continuously or triggered manually. The interval time between steps can be programmed for automatic sequential cycle or manual trigger. There are two foot switch connectors for sequential step trigger and injection trigger. A digital remote port can be connected to an optional remote key pad or be controlled by a computer. With exceptional versatility and extremely precise control, either the PM-4 or 8 is an ideal multi-channel injection/perfusion engine.

Connection Diagram for Extracellular Micro-Perfusion and Intracellular Micro-Injection Systems



PM-8 and PM-4

8- and 4-Channel Pressure Injection Systems (continued)

W3 69-0152 4-Channel Pressure Injection System

Below are the components supplied with each of the **Pressure Injection Systems**.

Pressure Injection System		PM-4	PM-8
Order #	**Product**	**Qty.**	**Qty.**
W3 69-0154	IP1 Input Tubing with Connector	1	1
W3 69-0156	OP2 Output Tubing with Connector Only	6	10
W3 69-0157	FSW Foot Switch	1	1
W3 69-0164	PP-4 Pulled 4-Barrel Pipette	1	-
W3 69-0166	HOLD4 Holder for 4-Barrel Pipette	1	-
W3 69-0163	PP-7 Pulled 7-Barrel Pipette	-	1
W3 69-0167	HOLD7 Holder for 7-Barrel Pipette	-	1
-	Power Cord	1	1
-	User's Manual	1	1

Specifications

Output Channels	Four (PM-4) or eight (PM-8) injection / perfusion outputs, one synchronized drain out and one cell hold channel
Input Gas Pressure	30 to 100 p.s.i.
Clearing Pressure	Same as input pressure
Clear Hold Pressure	0 to 3 p.s.i. (regulated)
Injection Pressure	0.05 to 60 p.s.i. (regulated)
Balance Pressure	0.05 to 10 p.s.i. (regulated)
Fill Vacuum	0 to 24 in Hg (regulated)
Hold Vacuum	0 to 30 in of water (regulated)
Drain Vacuum	0 to 30 in of water (regulated)
Repeatability	±0.02 p.s.i.
Display Accuracy	±0.05 p.s.i. for pressure, ±0.2 in for vacuum (< 2 in H_2O)
Timer Setting Range	10 msec to 327.67 sec (10 msec resolution for whole range)
Counter Setting Range	1 to 255
Savable Sequences	16 sequences
Programmable Steps	32 steps for each sequence
Remote Control Ports	DB9 connector for remote key pad, foot switch jack and BNC for negative TTL trigger, jack connector for injection foot switch
Signal Output Ports	Eight BNCs for injection signal on output port 1 to 4
Power Consumption	100, 120 or 220 VAC, 35 W

Order #	Model	Product
W3 69-0152	PM-4	4-Channel Pressure Injection System
W3 69-0153	PM-8	8-Channel Pressure Injection System
Options and Accessories		
W3 69-0154	IP-1	Input Tubing with Connector
W3 69-0155	OP-1	Output Tubing with Connector and 4.5 ml Vial
W3 69-0156	OP-2	Output Tubing with Connector only
W3 69-0157	FSW	Footswitch
W3 69-0158	PM-KP	Remote Key Pad
W3 69-0160	RK-2	Rack Mounting Kit with Handles for PM 4/8
W3 69-0163	PP-7	Pulled Seven Barrel Pipette (each)
W3 69-0164	PP-4	Pulled Four Barrel Pipette (each)
W3 69-0165	HOLD-1	Holder for Single-Barrel Pipette
W3 69-0166	HOLD-4	Holder for Four-Barrel Pipette
W3 69-0167	HOLD-7	Holder for Seven-Barrel Pipette

W3 69-0156 Output Tubing with Connector for use with:
W3 69-0152, see above
W3 69-0153, see above
W3 69-0150, see page 245
W3 69-0151, see page 245

W3 69-0154 Input Tubing with Connector for use with:
W3 69-0152, see above
W3 69-0153, see above
W3 69-0150, see page 245
W3 69-0151, see page 245

W3 69-0164 and **W3 69-0163** Pulled Pipettes for use with:
W3 69-0152, see above
W3 69-0153, see above

W3 69-0155 Output Tubing with Connector and 4.5 ml Vial for use with:
W3 69-0152, see above
W3 69-0153, see above
W3 69-0150, see page 245
W3 69-0151, see page 245

Vibratome®

Tissue Sectioning Systems

W3 69-0353
Vibratome® 1000 Classic

- The world standard for tissue sectioning systems for 30+ years
- Cuts fresh or fixed tissues without distortion
- Patented vibrating blade principal
- Sections as thin as 6 µm (using sapphire blade)
- Less damage than oscillating blade systems
- Automatic and refrigerated models available
- Simple and quiet operation
- Easily maintained
- Secure specimen holding vice
- Stable blade holder insures no unintentional setting changes
- Cool lamp magnifier — minimizes heating effect and provide shadow-free illumination

The Vibratome® series of fresh tissue sectioning systems allows sectioning of fresh or fixed tissue without freezing or embedding. The patented vibrating blade principle moves the sectioning blade edge in a reciprocating arcuate path as it penetrates the specimen. The reduced effective edge angle from the transverse movements, with the lateral distribution of the cutting edge penetrating pressure, minimize elastic deformation of soft tissue specimens that are simply held or capsulated in position during the sectioning operation.

Uniform sections can be made of delicate soft, tissue specimens. Sections are free of observable compressive distortion in the direction of cut, as would be typical with conventional microtomes using oscillating blade actions. Preservation of ultrastructure is maintained in the sections from a lack of cellular damage on their surfaces. Sectioning takes place in a liquid bath. The liquid serves to lubricate the sectioning blade, to maintain specimen temperature, enhance or preserve desirable characteristics of the specimen, and facilitate the easy retrieval of the sections generated.

Using the technique described, the Vibratome® series of microtomes deliver superior performance using ordinary injector type razor blades. Sectioning of uniform fresh tissue sections can be cut from 20 µm up, although thinner sections may be realized, depending on the type of tissue involved, and operator technique. For conventional use, expensive blades made from exotic materials are not required, cutting the costs of normal operation and maintenance. If a more precise and finer tissue slice is required, use a sapphire blade which provides slices as thin as 6 µm. All Vibratomes® can work with standard, glass, sapphire or injector knife holders.

Typical applications include: Enzyme histochemistry, tissue pathology, autoradiology, water soluble compounds, immunocytochemistry, immunohistochemistry, fluorescent microscopy, tissue pathology, botanical studies, preparation step prior to Electron Microscopy, invaluable teaching aid, etc. Five different Vibratomes® available to fit your applications and your budget.

Vibratome® 1000 Classic

The original Vibratome® semi-automatic fresh or fixed tissue sectioning system has maintained a long reputation as a rock solid tissue sectioning system. Researchers from around the globe have relied on the Vibratome® 1000 Classic for their fresh tissue sectioning needs for over 30 years.

Vibratome® 1000 Plus

The Vibratome® 1000 Plus utilizes the same mechanical sectioning components with enhanced specifications and features such as: smaller section thickness increments, increased sectioning speed, faster return stroke speed, increased maximum sectioning range, drain function, standard dual bath, and finer height adjustment. A stroke pause switch and adjustable light and magnifier are also part of the Vibratome® 1000 Plus system. The Vibratome® 1000 Plus is a solid addition to the Vibratome® family of products.

Vibratome® 3000 Plus

The Vibratome® 3000 Plus sectioning system provides a versatile means of sectioning fresh or fixed, animal, or plant tissues. This system employs a vibrating blade principle which allows sectioning without freezing or embedding. The creation of artifacts, the alteration of morphology, the destruction of enzyme activities, and other deleterious effect inherent in freezing or embedding procedures are thus avoided. The Vibratome® 3000 Plus incorporates a full english text display for added ease and usability. The 3000 Plus utilizes the Vibratome® Companies "ZERO-Z" Technology which dramatically reduced z-axis vibrations. This system also has a dynamic stability system and deluxe bath system as standard. The Vibratome® 3000 Plus provides the best quality section in the Vibratome® product line.

Vibratome® 3000 Deluxe

The Vibratome® 3000 Deluxe includes all the enhanced features of the 3000 Plus sectioning system plus a built in thermoelectric cooling device for the specimen bath. The refrigeration is a great benefit for those researchers trying to maintain constant temperature and constant chemical makeup of buffer solution.

Warner Instruments • Phone (203) 776-0664 • Toll Free U.S. (800) 599-4203 • Fax (203) 776-1278 • **www.warneronline.com**

Vibratome®

Tissue Sectioning Systems (continued)

Vibratome® 3000

Vibratome® 1500

The Vibratome® 1500 is the newest member of the Vibratome® family and features a fully automatic tissue sectioning system. Users can simply enter the number of sections and thickness required and the Vibratome® 1500 does the rest. Through the use of an easy to read LED display and simple controls, the Vibratome® 1500 makes serial sectioning an easy task.

All Vibratomes® are supplied complete with: Blade Angle Indicator, Vice-Type Specimen Holder, Specimen Mounting Blocks, Bath (146 x 146 x 50 mm, 5.75 x 5.75 x 2 in), Black Buffer Bath, Dust Cover, Magnifying Lamp, Fluorescent Tube, Specimen Adhesive, Razor Blades, Spare Fuse and Operating Instructions. All Vibratomes® have an Adjustable Specimen Angle Range of 0-50 degrees and can be used with Standard, Glass, Sapphire or Injector Knife Holders. Other optional accessories include: Rotating Stage Assembly, Specimen Mounts, V-Block Adapter, Section Mounting Device, Specimen Tray, Sapphire Knife, Glass Knife Adapter and Specimen Retrievers.

Specifications

	Vibratome® 1000 Classic	Vibratome® 1000 Plus	Vibratome® 1500	Vibratome® 3000 Plus	Vibratome® 3000 Deluxe
New Zero Z Technology	No	No	No	Yes	Yes
Adjustable Frequency*	No	No	No	Yes	Yes
Dynamic Stability System	No	No	No	Yes	Yes
Total Vertical Specimen Stroke	10 mm	15 mm	15 mm	15 mm	15 mm
Adjustable Sectioning Window	No	Yes	Yes	Yes	Yes
Section Thickness Increments	10 µm	5 µm	5 µm	5 µm	5 µm
Maximum Specimen Size	25 x 25 x 10 mm	60 x 40 x 15 mm	60 x 40 x 15 mm	60 x 40 x 15 mm	60 x 40 x 15 mm
Sectioning Speed adjustable	0 - 1.25 mm/s	0 - 5 mm/s adjustable	0 - 5 mm/s adjustable	0 - 5 mm/s adjustable	0 - 5 mm/s
Return Stroke Speed	1.25 mm/s	5.0 mm/s max	5.0 mm/s max	5.0 mm/s max	5.0 mm/s max
Maximum Sectioning Range	30 mm	40 mm	40 mm	40 mm	40 mm
Drain	No	Yes	Yes	Yes	Yes
New Deluxe Dual Bath System	Optional	Optional	Optional	Standard	Standard
Multi Specimen Sectioning	Optional	Optional	Optional	Standard	Standard
Repeatable Height Adjustment	10 µm	5 µm	5 µm	1 µm	1 µm
Use Disposable Microtome Blades	Yes	Yes	Yes	Yes	Yes
Rotating Specimen Mount	Yes	Yes	Yes	Yes	Yes
Stroke Pause Switch	No	Yes	Yes	Yes	Yes
Separately Adjustable Light and Magnifier	No	Yes	Yes	Yes	Yes
Arcuate Blade Path Adjustment	Yes - 1.25 mm	Yes - 1.5 mm	Yes - 1.5 mm	Yes - 2.0 mm	Yes - 2.0 mm
Foot Switch	No	Optional	Optional	Standard	Standard
Fully Automatic Operation	No	No	Yes	Yes	Yes
Insulated Bath	No	Yes	Yes	Yes	Yes
Built In Refrigeration	Optional	Optional	Optional	Optional	Standard
Cumulative Section Counter	No	No	No	Yes	Yes
Full Text LCD Display	No	No	No	Yes	Yes
0.01 Increment Sections	No	No	No	Yes	Yes
Specimen Auto-Bypass	No	No	No	Yes	Yes
110 VAC	**W3 69-0353**	**W3 69-0350**	**W3 69-0446**	**W3 69-0442**	**W3 69-0444**
220/230/240 VAC	**W3 69-0354**	**W3 69-0351**	**W3 69-0447**	**W3 69-0443**	**W3 69-0445**

** Zero Z technology includes an adjustable frequency mode*

Vibratome®

Tissue Sectioning System Accessories

Order #	Product
W3 69-0368	Replacement Fluorescent Tube
W3 69-0376	Specimen Adhesive, 1/3 oz. Bottle
W3 69-0377	Blade, Single Edge Injector, pkg. of 10

Vibratome® Care Package

Order #	Product
W3 69-0382	The Vibratome® Care Package; Includes 10 Vibratome® Feather Blades, 1 bottle of Specimen Adhesive, 3 Specimen Mounting Blocks, a Specimen Tray, 2 fuses and 1 Spare Fluorescent Bulb.

Vibratome® The Works

Order #	Product
W3 69-0383	The Works; Includes everything from the Vibratome® Care Package plus Rotating Stage, 0.5 inch Specimen Mounts, Replacement Rotating Mounts, Storage Block, Specimen Retrievers, and Section Mounting Device
W3 98-2528	Feather Blades

Listed below and to the right are optional accessories to the Vibratome Tissue Sectioning System. Select your options based on your tissue slicing requirements

Sapphire Knife

This sapphire microtomy knife makes it possible for the first time to cut thin Vibratome® sections with microscopic resolution similar to that obtained with thick 1 µm plastic sections. The sapphire knife allows routine serial sectioning with a Vibratome® 1000 Plus of a thickness in the 6 to 10 µm range, revealing sub-cellular features never before seen. With a Vibratome® 3000, sections of mildly fixed tissue as thin as 2 µm may be obtained. The sapphire knife can be re-sharpened.

Order #	Product
W3 69-0378	Sapphire Knife

Specimen Mounting Blocks

These Specimen Blocks are utilized for mounting specimens and placing in the Vibratome® holding vice. The blocks are annodized black for easy specimen viewing and can be reused.

Order #	Product
W3 69-0370	Specimen Mounting Block

Specimen Mounts 1⁄2 inch Head

Specimen mounts are designed to allow for the rotation of the specimen in the Vibratome® vice assembly for sectioning at different horizontal orientations.

Order #	Product
W3 69-0372	Specimen Mount 1⁄2 inch Head

Specimen Retriever

This is a perfect tool for retrieving free floating sections from the bath.

Order #	Product
W3 69-0380	Specimen Retrievers, pkg. of 5

V-Block Adapter

Adapter for holding special specimen mounts in the Vibratome® vice, black anodized.

Order #	Product
W3 69-0371	V-Block Adapter

Section Mounting Device

A simple device designed to mount floated histological sections onto standard glass slides. This product facilitates the mounting of all types of thin (2 µm to 100 µm) tissue slices. It is especially useful for mounting tissue slices not supported by embedding material, such as those produced with a Vibratome®, freezing microtome (cryostat) or sliding microtome. It also simplifies the mounting of tissue sections embedded in a water-miscible supporting medium such as polyethylene glycol (PEG).

Order #	Product
W3 69-0381	Section Mounting Device

Specimen Tray

This tray holds the tissue in an appropriate buffer. Replaces the standard mounting block. Surrounded by ice in the bath, it will keep the buffer cold without disturbing the sections. The tray saves buffer, allows easier clean up and keeps contamination to a minimum. A rectangular projection on the bottom of the tray fits directly into the specimen vice. Inside dimensions 76 x 55 x 9.5 mm (3 x 2.1875 x 9.375 in).

Order #	Product
W3 69-0369	Specimen Tray

Deluxe Specimen Bath

The Deluxe Specimen Bath mounts inside the existing black Vibratome® bath. This large removable bath allows for the separation of buffer and ice kept in the original black bath. The Bath can be sterilized and has round mounting disks that can be easily removed for mounting specimens. The disks and bath surface are marked with degrees of rotation for the repeatable placement and measurement of specimens.

Order #	Product
W3 69-0440	Deluxe Specimen Bath

Glass Knife Adapter

The glass knife adapter allows you to routinely cut 20 µm sections of fresh tissue and even thinner sections of fixed tissue. Simply replace the standard razor blade holder with our special glass knife adapter and use ordinary 1 in-wide glass knives. The entire assembly is black anodized aluminum.

Order #	Product
W3 69-0379	Glass Knife Adapter

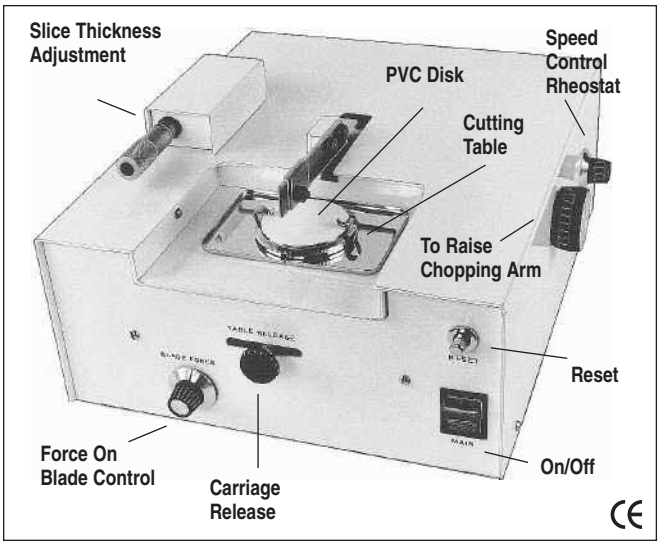
Rotating Stage Assembly

This assembly allows a specimen to be oriented to the blade after it has been affixed to the specimen mount. At a 20° blade angle, the rotating stage assembly will adjust up to 15°, still allowing 10 mm clearance. Replaces the standard Vibratome® vice assembly. Everything is black anodized aluminum.

Order #	Product
W3 69-0373	Rotating Stage Assembly

McIlwain

Mechanical Tissue Chopper



- Less disturbance of cell structure than homogenizers or blenders
- Slices up to 1 mm thick and cubes or prisms up to 1 mm cross section
- Designed to prepare tissue for metabolic experiments

This McIlwain tissue chopper has been designed to prepare pieces of tissue for metabolic experiments. It is especially suited for small and irregular specimens from biopsy or small organs. The Tissue Chopper causes much less disturbance of the cell structure than homogenizers or blenders, and is applicable to fragments which would be difficult or impossible to cut. It has been applied to liver, kidney and various parts of the central nervous system.

This tissue chopper will produce slices up to 1 mm thick Cubes or prisms up to 1 mm in cross section can also be prepared within 30 seconds. The stepless variation of slice thickness from zero to the maximum is controlled by an index clutch in conjunction with a micrometer head. The latter being calibrated in microns.

The action of the machine is as follows: a circular stainless steel table, on which the specimen is placed, is traversed from left to right at a speed which can be varied. At the same time a chopping arm carrying a blade is raised and dropped by its own weight and the tension of a spring, at speeds varying from zero to a maximum of 200 strokes per minute. As the table carrying the tissue passes under the blade it is chopped into the required slices. If prisms are required the table is returned to the left hand side of the machine, turned through 45 degrees, and the process repeated. Cubes are formed by rotating the table 90 degrees. A safety limit switch is provided to prevent the machine overrunning and a quick return mechanism is fitted for the return of the table. All parts coming into contact with the tissues are of stainless steel. Finish is in white powder coat.

Note: The above description is extracted from an article by H. McIlwain and H. L. Buddle in the Biochemical Journal, Vol. 53, No. 3, pp. 412–420, 1953, by their permission.

Operation

1. **Positioning Blade:** Filter papers are placed on the circular table and a blade loosely clamped to the arm. The arm is brought to rest on the stop rod by rotating the handwheel on the motor shaft and the blade pressed down with the fingers. The blade is then securely clamped in this position. The machine is switched on and it will probably cut the top filter paper. This is removed and the machine is ready to take a specimen.
2. **Slice Thickness:** The thickness of slice is adjusted by means of the micrometer head. The maximum thickness is 1 mm. Each division on the thimble is 1 µm. Each small division on the barrel is 25 µm.
3. **Force on Blade:** The force on the cutting arm can be adjusted by the front knob. To increase tension turn in clockwise direction.
4. **Cutting:** Pull out the carriage release knob and slide the table to the left of the machine. Place the specimen on the centre of the table and with the rheostat in the slow position switch on the bottom switch. Increase the rheostat until the desired speed has been attained. After the tissue has been cut into slices it may, if desired, be turned 90 degrees and formed into cubes, after passing under the cutting arm again. The machine automatically switches itself off at the end of its travel. When this limit switch is used it must be reset by means of the top button. The cutting arm is made of stainless steel and may be removed for the purpose of sterilization.
5. **Plastic Cushion:** This machine is now fitted with a plastic cushion held in place by two spring clips on the table. The specimen may be fixed to a suitable filter paper by means of a fixative such as agar, which in turn is cemented to the cushion, and then inserted under the springs. This arrangement holds the specimen firmly down and prevents it sticking to the blade during chopping.

Specifications

Maximum Blade Height	~1 cm
Slice Thickness Settings	1 mm maximum with 1 µm scale resolution
Minimum Section Thickness	Dependent on tissue type
Blade Speed	Zero to 200 strokes/min
Voltages	90/120 VAC, 60 Hz or 210/240 VAC, 50 Hz
Overall Dimensions	30 x 28 x 15 cm (11.8 x 11.0 x 5.9 in)
Weight	6.3 kg (13.9 lbs)

Order #	Product
W3 69-1010	McIlwain Mechanical Tissue Chopper, 115 V, 60 Hz
W3 69-1011	McIlwain Mechanical Tissue Chopper, 230 V, 50 Hz
Replacement Parts	
W3 69-1012	Cutting Blades, pkg. of 10
W3 69-1014	Cutting Table Disk (PVC, Darvik), pkg. of 10
W3 69-1015	Replacement Cutting Table
W3 69-1016	Cutting Table Clips
W3 69-1017	Spanner
W3 69-1013	Blade Holder

SZM 180

Stereo Zoom Microscope

W3 69-3101 Trinocular Zoom Stereo Microscope With Illumination Stand and Video Adapter

W3 69-3102 Trinocular Zoom Stereo Microscope With Boom Stand and Video Adapter

- High performance at an economical price
- Superior optical design with outstanding resolution and brilliantly sharp images
- Rugged all metal construction
- Excellent zoom range from 0.7x to 4.5x
- The parfocal zoom system keeps the image in constant focus while you zoom
- Zoom control knobs are conveniently side-mounted for smooth, comfortable operation
- Trinocular body with comfortable 45° inclination angle for fatigue-free viewing
- Trinocular body may be rotated 360° for group sessions
- Dual diopter adjustment of ±5 diopters enables you and your colleague to precisely set focus according to individual needs
- Interpupillary adjustment range from 55 to 75 mm
- Total magnification range extends from 3.5x to 90x
- Widefield eyepieces of 10x, 25x

Harvard Apparatus SZM 180 Stereo Zoom Microscope provides outstanding quality at an affordable price. It features high-resolution optics and precise optical alignment that assures crisp sharp and flat 3-dimensional images.

Select from two different mounts. The standard mount has top halogen and bottom fluorescent illumination. The boom stand does not have any illumination, but permits working with large objects. You may also order the boom stand separately at a later date should you require it.

The Microscope is supplied complete with the following components: WF10X eyepiece; Trinocular zoom body, zoom range 0.7x – 4.5x; Video adapter with external C-mount, adjustable.

Specifications

Eyepieces	Widefield eyepieces of 10x and 25x
Objectives	Built-in zoom and attachable auxiliary lens
Zoom Range	From 0.7x to 4.5x
Illumination	Top halogen and bottom fluorescent, standard mount only
Video Capabilities	Built-in video and photographic port (lens and adapter required)
Shipping Dimension:	
W3 69-3101	490 x 390 x 275 mm (19 x 15 x 11 in)
W3 69-3102	Box #1 - 520 x 420 x 140 mm (20 x 16 x 5.5 in) Box #2 - 300 x 250 x195 mm (12 x 10 x 8 in)
Shipping Weight:	
W3 69-3101	9.5 kg (21 lbs)
W3 69-3102	Box #1 - 16.5 kg (36 lbs) Box #2 - 2.5 kg (6.5 lbs)

Order #	Product
W3 69-3101	SZM 180 Trinocular Zoom Stereo Microscope with Illumination Stand and Video Adapter
W3 69-3102	SZM 180 Trinocular Zoom Stereo Microscope with Boom Stand and Video Adapter
W3 69-3103	2x Auxiliary Lens for Zoom Stereo Microscopes
W3 69-3104	0.5x Auxiliary Lens for Zoom Stereo Microscopes
W3 69-3105	Adapter for Fiber Optics Ring Light or Fluorescent Ring Light
W3 69-3106	15W Halogen Lamp and Reflector
W3 69-3107	5W Fluorescent
W3 69-3108	Boom Stand for Stereo Microscope
W3 72-4666	Ringlight Adapter, 66 mm OD, for use with Ringlights, see pages 343
W3 69-3111	Microscope for Microforge De Fonbrune includes W3 99-0442 - adapter mounting rod

900 Series

Inverted Microscope

W3 69-3100 Inverted Microscope with Phase Contrast Objectives and Video/Photo Port

Ergonomically designed and precisely manufactured, yet simple to use, the Harvard Apparatus SZM 180 Stereo Zoom Microscope provides versatility and high quality images for brightfield and phase/contrast observation. With standard built-in photographic and video port, the HAI 900 is the ideal instrument for tissue culture and other advanced applications.

Microscope is supplied complete with the following components: stand and observation head; WF10x eyepiece; 11x centering telescope; 4x Long working distance (LWD) plan objective and annulus; 10x LWD phase contrast plan objective and annulus; 25x LWD phase contrast plan objective and annulus; and 40x LWD phase contrast plan objective and annulus.

- Ideal for Tissue Culture and Cell Biology
- Long working distance Plan objectives (4x, 10x, 25x and 40x)
- Long working distance Plan phase objectives (10x, 25x and 40x)
- Optional SLR 35 mm photographic system
- Optional CCTV system
- Large mechanical stage with low position coaxial x-y movement
- Wide selection of filters
- Swing-out condenser to accommodate extra large objects

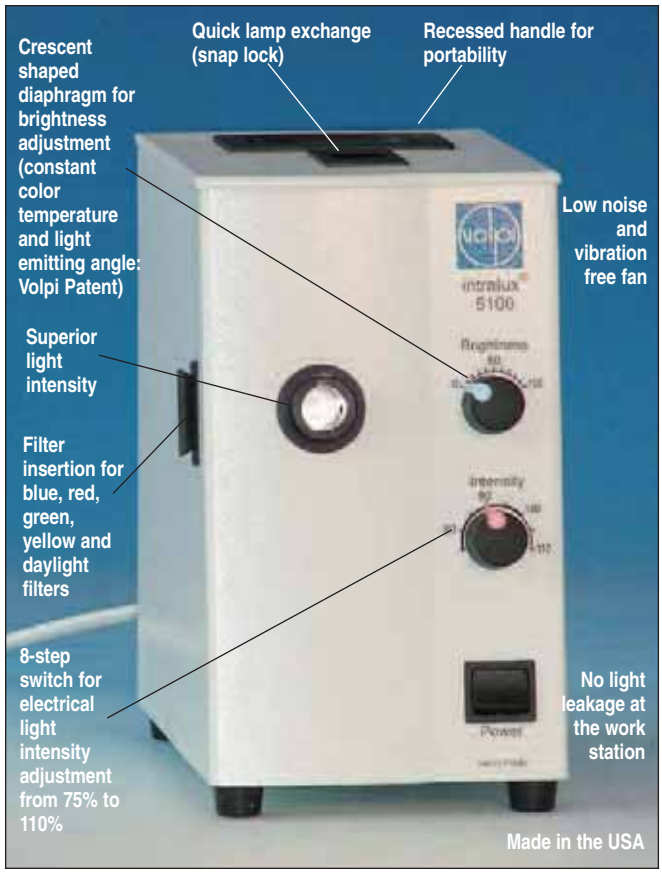
Specifications

Eyepieces	Paired WF10X eyepieces
Objectives	Choice of 10x, 25x and 40x, Plan brightfield long working distance objectives, Plan phase long working distance objective
Video Capabilities	Built-in video and photographic port (lens and adapter required)
Stage	Large graduated mechanical stage with low position x-y movement knob
Condenser	Centerable condenser with iris diaphragm and phase annulas ring slot, swing-out condenser holder with rack and pinion movement and safety stop
Filters	Filter disc with five positions
Diaphragm	Field Diaphragm and condensing lens
Illumination	Built-in 6V, 20W halogen illumination with intensity adjustment and lamp centering device
Shipping Dimensions	229 x 330 x 508 mm (9 x 13 x 20 in)
Shippinig Weight	16.5 kg (36 lbs)

Order #	Product
W3 69-3100	900 Series Inverted Microscope with Phase Contrast Objectives and Video/Photo Port
W3 64-0302	Stage Adapter for HAI 900 Microscope permits use of Series 20 Imaging and Recording Chambers
W3 69-3109	Replacement 6V/20 W Halogen Bulb for Inverted Microscope
W3 69-3110	Replacement Fuse 250V/1.5A for Inverted Microscope

Intralux® 5100

High Intensity Cold Halogen Light Source



- Compatible with all Volpi Fiber Optic Components
- Ergonomic design with small footprint
- Quick bulb replacement, reducing downtime
- Solid metal housing, designed for industrial use
- Certified for electronic and mechanical safety
- 150 watt cold light source with superior illumination intensity and long lamp life

Intralux® light sources have represented the best in Fiber Optic Cold Light Illumination the world for over 25 years. They provide reliable, dependable, high-intensity cold halogen light for use with all Volpi fiber optic components in microscopy applications.

The Intralux Series is equipped with the most advanced features and highest quality components available. It includes InfraRed Reflecting Filters to ensure the coldest light possible and the unique patented Crescent Shaped Diaphragm, which provides constant color temperature and light emitting angle, and continuous intensity adjustment.

Fiber optic components consist of:

- **Ringlights**
- **Goosenecks (sliding Sleeve: Volpi Patent)**
- **Flexible Light Guides**
- **Backlights**

Specifications

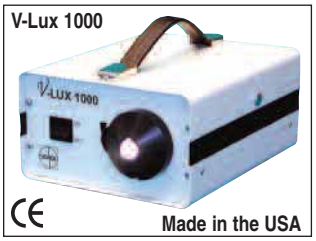
Average Lamp Life (calculated value, in continuous operation at line voltage 230V / 121V / 100V):	
110% Intensity	100 hours
100% Intensity	200 hours
90% Intensity	520 hours
80% Intensity	1700 hours
75% Intensity	3600 hours
Color Temperature at 110% Intensity	3433K
Illumination Intensity at 110% Voltage at Lightguide Input (DIN 58141-10)	12.3 M Lux
Maximum Illuminated Light Guide-Ø	13 mm
Mechanical Light Guide Connector Ø	15 mm
Light Adjustment	electrical, 8-step switch 75 to 110% Crescent shaped diaphragm (Volpi Patent) 16-steps
Halogen Reflector Lamp	EKE 21 V/150 W
Line Voltages ±10%	230 V, 50 Hz or 121 V, 60 Hz or 100 V, 60 Hz
Power Consumption	190 W
Protection Class	1
Weight	4.6 kg (10 lbs)
Housing	Metal, powder coated, color RAL 9002
Approvals	UL61010-1, CAN/CSA 61010-1,CE/Product Safety : IEC/EN 61010-1:2001 EMC: Emission: IEC/CISPR 11, Class B/Immunity: IEC 61000-4-2 to 6 and 11

Manufactured in U.S.A.

Order #	Product
W3 72-6195	Intralux® 5100 Light Source, USA, 121V, 60Hz
W3 72-6196	Intralux® 5100 Light Source, EURO, 230V, 50Hz
W3 72-6198	Intralux® 5100 Light Source, CH, 230V, 50Hz
W3 72-6197	Intralux® 5100 Light Source, JAP, 100V, 60Hz
Accessories and Spares	
W3 72-0227	Halogen Spare Lamp EKE 21V/150W
W3 72-0219	Blank Filter Holder for Intralux 5100/NCL-150
W3 72-0220	Blue Filter for Intralux 5100/NCL-150
W3 72-0221	Red Filter for Intralux 5100/NCL-150
W3 72-0222	Green Filter for Intralux 5100/NCL-150
W3 72-0223	Yellow Filter for Intralux 5100/NCL-150
W3 72-0224	Daylight Filter for Intralux 5100/NCL-150
W3 72-0310	Set of Filters

V-Lux 1000 and NCL-150

Fiber Optic Cold Light Sources



- For Microscope Illumination
- Constant color temperature and light emitting angle
- Continuous intensity adjustment
- Low-cost alternative to the Intralux series
- Use with fiber optic ringlights, goosenecks, and flexible light guides

- 20V/150W
- Constant color temperature
- Continuous intensity adjustment brightness
- High/Low setings
- Filter shot
- Use of DDL or EKE bulbs
- Long lamp life
- Low noise/vibration

V-Lux 1000 Cold Light Source

The V-Lux 1000 is a low-cost quality fiber optic cold light source featuring many high-end features such as compact design, constant color temperature, long lamp life and low noise/vibration. It is ideal for any microscopy applications. The V-Lux 1000 will provide reliable, dependable, high-intensity cold halogen light for use with all Volpi fiber optic components in microscopy applications. Although it is factory equipped with DDL Lamps, EKE bulbs may be easily substituted for slightly more light output. Has integrated resettable fuse transformer. This unit has a fixed power cord.

Specifications

Uniformly Illuminated Light Guide Diameter	13 mm
Rated Lamp Life	DDL 800 hrs*, EKE 350 hrs*
Constant Color Temperature	DDL 3120°K, EKE 3190°K
Light Adjustment	Crescent shaped diaphragm
Lamp	DDL-20V/150W or EKE-21V/150W
Dimensions, H x W x D	9.5 x 17.1 x 21.0 cm (3.75 x 6.75 x 8.25 in)
Weight	4.5 kg (9.92 lb)

** Average of continuous operation, Manufactured in U.S.A.*

Order #	Product
W3 72-0215	V-Lux 1000, 120 V, USA/Canada
W3 72-0216	V-Lux 1000, 230 V*
W3 72-0217	V-Lux 1000, 230 V**
W3 72-0218	V-Lux 1000, 230 V***
W3 72-0231	V-Lux 1000, 230 V****
W3 72-0232	V-Lux 1000, 230 V*****
Accessories and Spares	
W3 72-0227	Halogen Spare Lamp EKE 21V/150W
W3 72-0219	Blank Filter Holder for Intralux 5100/NCL-150
W3 72-0220	Blue Filter for Intralux 5100/NCL-150
W3 72-0221	Red Filter for Intralux 5100/NCL-150
W3 72-0222	Green Filter for Intralux 5100/NCL-150
W3 72-0223	Yellow Filter for Intralux 5100/NCL-150
W3 72-0224	Daylight Filter for Intralux 5100/NCL-150
W3 72-0310	Set of Filters

* *Argentina/Austria/Belgium/Brazil/China/Denmark/Finland/France/Germany/Indonesia/Netherlands/Norway/Sweden/Switzerland/Thailand/Vietnam*
** *Australia/New Zealand/Fiji*
*** *UK*
**** *South Africa*
***** *Ireland/Italy*

NCL 150 Cold Light Source

Specifications

Rated Lamp Life	DDL 400/1400 hrs*, EKE 100/900 hrs*
Constant Color Temperature	DDL 3280°K/3140°K, EKE 3310°K/3120°K
Light Adjustment	Crescent shaped diaphragm
High/Low Settings	25 dB noise level
Filter Slot	98° F Housing temperature
Lamp	DDL-20V/150W or EKE-21V/150W
Dimensions, H x W x D	10.5 x 21.9 x 21.9 cm (4.125 x 8.625 x 8.625 in)
Weight	4.5 kg (10 lb)

** Average of continuous operation, Manufactured in U.S.A.*

Order #	Product
W3 72-0311	NCL 150, 120V USA/Canada
W3 72-0312	NCL 150, 230V Euro
Accessories and Spares	
W3 72-0226	DDL Lamp, 20V/150W
W3 72-0227	Halogen Spare Lamp, EKE Lamp, 21V/150W
W3 72-0220	Blue Filter
W3 72-0221	Red Filter
W3 72-0222	Green Filter
W3 72-0223	Yellow Filter
W3 72-0224	Daylight Filter
W3 72-0238	Standard/Compact Ringlight
W3 72-0262	Ringpolarizer Set
W3 72-0264	Diffuser
W3 72-0267	Bifurcated Gooseneck, 4.7 mm Ø
W3 72-0266	Bifurcated Gooseneck, 5.4 mm Ø
W3 72-0329	Incident Gooseneck
W3 72-0269	Focusing Lens
W3 72-0273	Polarizing Cap for p/n **W3 72-0270**
W3 72-0342	Backlight, 2"x 2"
W3 72-0287	Single Light Guide 10 mm

All volpi light sources are compatible with all volpi fiber optics.

IntraLED 2020 and Filters

Fiber Optic Cold Light Sources

IntraLED 2020

This high power LED light source represents a viable alternative to halogen light sources. It achieves its high light yield of more than 6 MLux at a total power consumption of just 15W. With a color temperature of 6500K, the IntraLED 2020 emits a very white light that is far superior to halogen lamps. The illumination intensity is controlled manually using keys on the front panel or digitally via an RS 232 interface.

The IntraLED 2020 is suitable for clean room applications and outperforms halogen light sources with respect to bulb life and efficiency.

Specifications

Optical Characteristics:	
Light Source	High Power LED White CIE 1931
Illumination Intensity	>6,000,000 Lux
Efficiency	>440,000 Lux/W
Max. Optical Efficiency	65lm/W
Aperture (Viewing Angle a/2)	10°
Color Temperature Typical	6500K
Color Reproduction Index	80
Degradation Period of LEDs	>50,000h1)
Optical Output	<10mm (2/5 inch)
Regulation of emittance on Vs area illuminated1)	Constant @ Vs =12V ±10% and T = 10°C to 40°C
LED Radiation Class	1M LED Product
Electrical Characteristics:	
Supply Voltage Vs	12V DC
Current Consumption	Approximately 1.250mA
Communication	RS 232
Connector	M8 Male; 4 Poles2)
Mechanical Characteristics:	
Dimension	89mm x 84mm x 159mm (including connectors)
Enclosure	Aluminum body, anodized
Forced Cooling, Fan Noise	39dB(A)
Enclosure Rating	IP 20
Adapter	15mm standard Volpi ferrule
Weight	Approximately 1.1kg
Ambient Conditions:	
Ambient Temperature	Operation: 0°C to 40°C Storage: 0°C to 50°C
Humidity	Maximum 95%, relative not condensing

Order #	Product
W3 72-0322	IntraLED 2020
W3 72-4667	IntraLED 2020 with Schott-Foster Receptacle

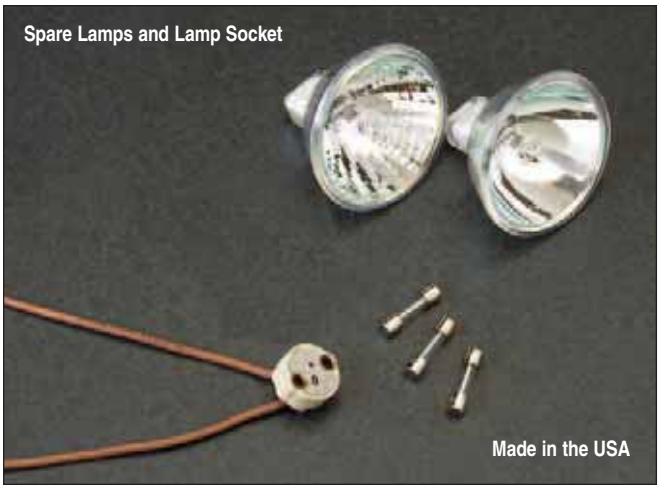
- **Blue Filters** enhance red and yellow objects and lighten blue and green objects
- **Red Filters** will darken blue and green objects and are useful for black and white applications
- **Green Filters** increase contrast for blue and red objects and brighten yellow and green objects
- **Yellow Filters** of specific band widths may be used as a safe light when working with photosensitive materials
- **Daylight Conversion Filters** increase the Kelvin Temperature of the halogen light to 5500°K, which is daylight. Daylight Filters reduce glare from highly reflective material such as muscle tissue and metals

Light Source Filters

Light Source Filters provide contrast enhancement. When the composition of an object is made of two or more colors, a filter may be used to darken the color that is most important and, therefore, be able to observe it better. When the composition of an object is pale, a filter of the opposite or complementary color may enhance the detail. Specifically, when the composition of the object is highly dense and color saturated, a filter of the same color will most likely enhance the detail on the object. Custom filters of a specific band width are also available upon request.

Order #	Product
W3 72-0219	Blank Filter Holder for Intralux 5100/NCL-150
W3 72-0220	Blue Filter for Intralux 5100/NCL-150
W3 72-0221	Red Filter for Intralux 5100/NCL-150
W3 72-0222	Green Filter for Intralux 5100/NCL-150
W3 72-0223	Yellow Filter for Intralux 5100/NCL-150
W3 72-0224	Daylight Filter for Intralux 5100/NCL-150
W3 72-0310	Set of Filters

Light Source Spare Parts and Accessories



Spare Lamps and Power Cords

Order #	Product
W3 72-0227	EKE Spare Lamp for Intralux 5100 /V-Lux 1000/Intralux DC 1100 (21 V/150 W)
W3 72-0226	DDL Spare Lamp for Intralux 5100 /V-Lux 1000 (20 V/150 W)
W3 72-0356	Spare Lamp Socket-Round for Intralux 5100 /V-Lux 1000/Intralux DC 1100/NCL-150
W3 72-0348	Power Cord, United Kingdom
W3 72-0349	Power Cord, France
W3 72-0350	Power Cord, Italy
W3 72-0351	Power Cord, Switzerland
W3 72-0352	Power Cord, Germany
W3 72-0353	Power Cord, The Netherlands
W3 72-0354	Power Cord, Spain/Portugal

Note: *All Volpi Light Sources are compatible with all Volpi Fiber Optic Components.*

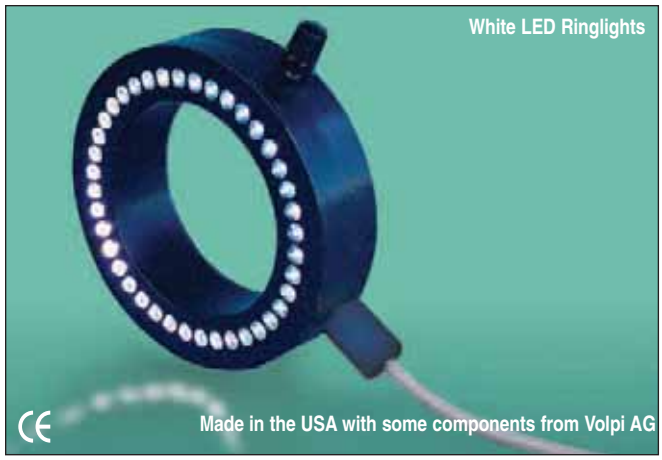
- Ringlight adapters available for all brand microscopes
- Provide direct and indirect mounting
- Low-Cost

Ringlight Adapters

Used with Standard/Compact and 4-Point Standard Ringlights for attachment to all brand microscopes. If your microscope is not listed here, please contact customer service for assistance.

Order #	Product
W3 72-0249	Ringlight Adapter for Leica Classic Stereo Zoom 1-5 without Attachment Lens
W3 72-0250	Ringlight Adapter for Leica New Family SZ4/SZ6/Photo/Plus without Attachment Lens
W3 72-0305	Ringlight Adapter for Leica New Family SZ4/SZ6/Photo/Plus with Attachment Lens
W3 72-0251	Ringlight Adapter for Leica Stereo Zoom 7/GZ7 without Attachment Lens
W3 72-0252	Ringlight Adapter for Leica M3B/C/Z; Leica MZ6 Achromatic 0.32x/0.5x/0.63x/0.8x/1.0x
W3 72-0257	Ringlight Adapter for Olympus SZ/ without Attachment Lens
W3 72-0258	Ringlight Adapter for Olympus SZH9/SZH12 and Nikon SMZ Series without Attachment Lens
W3 72-4666	Ringlight Adapter for SZM 180 Stereo Zoom Microscopes, see page 338

Fiber Optic Ringlights



- Compact, Metal Design
- Flicker-Free Light
- 7,000 to 10,000 LED life
- 7800˚K Temp
- Working Distance Range of 30 to 150 mm
- Adaptable to all microscopes

White LED Ringlights

White Light Emitting Diodes (LEDs) are now available in a ringlight to produce uniform, shadow-free illumination comparable to that of fiber optic ringlights. This exciting new technology is available in 5500˚K Temperature (Daylight) and 7800˚K Temperature for working distances of 30-150 mm. Metal housing design produces minimal heat for cool light illumination. Powered with an 8W/24V DC power supply (included), these ringlights offer flicker-free illumination. The most unique feature of these White LEDs is by far their rated life of 7,000-10,000 hours. White LED ringlights have the standard 66 mm inside diameter and are adaptable to all microscopes and lenses through a series of available ringlight adapters. This ringlight is supplied with slim line power supply

Order #	Product
W3 72-4656	Standard White LED Ringlight, 30-70 mm Working Distance
W3 72-4657	Diffuse Standard White LED Ringlight, 30-90 mm Working Distance
W3 72-4658	Spot/Focused White LED Ringlight, 70-160 mm Working Distance
W3 72-4659	Daylight LED Ringlight-5500°K Temp - Short Working Distance, 30-70 mm Working Distance
W3 72-4660	Daylight LED Ringlight-5500°K Temp - Long Working Distance, 70-160 mm Working Distance
W3 72-4661	Rheostat Accessory for use with all LED Ringlights
W3 72-4662	Ring Polarizer Set with Glass Analyzer for all LED Ringlights
W3 72-0321	Slim Line Power Supply, works with all LED Ringlights

- Twice as bright
- Available with white or yellow LEDs
- Applications:
  - Scratch & Flaw
  - General purpose illumination
  - Inspection (yellow LED)

Twin Row Spot Focused LED Ringlight

Uniform shadow-free illumination. LED light source with extremely stable and homogeneous light output. Optimal working distance 3-6 inches. Includes on/off switch and power supply.

Specifications

Illumination Type High Intensity LED	White 7800K Yellow 6400K
Expected Life	> 10,000 Hours *
Slim Line Power Supply	110V (included)
Maximum Voltage	24 Volt DC
Cable	1.5M
Wiring	Black = GND White = +
Black Anodized Aluminum Body	

** Average of continuous operation*

Order #	W3 72-0319	W3 72-0320	W3 72-0321
Product	Twin Row Spot Focused LED Ringlight White	Twin Row Spot Focused LED Ringlight Yellow	Slim Line Power Supply (included)
Number of LEDs	84	84	
Power Consumption	7.2W	7.2W	
Mounting Diameter	66 mm	66 mm	
Working Distance	75-150 mm (3-6 inches)	75-150 mm (3-6 inches)	

Fiber Optic Ringlights (continued)

- 25 to 90 mm working distance
- Uniform and shadow-free illumination
- Full-circular
- Adaptable to all microscope brands

Standard Ringlight

Full circular glass fiber ringlight provides homogeneous, shadow-free illumination for working distances of 25 to 90 mm. Inside diameter is 66 mm for mounting on all microscopes through a series of ringlight adapters listed on facing page.

Order #	Product
W3 72-0238	Standard Ringlight with 750 mm (30 in) flexible length
W3 72-0239	Standard Ringlight with 1200 mm (48 in) flexible length
W3 72-0240	Standard Ringlight with 2400 mm (96 in) flexible length

- Compact design
- 15 to 70 mm working distances
- Uniform and shadow-free illumination
- Adaptable to all microscope brands

Compact Ringlight

Full circular glass fiber ringlight provides homogenous, shadow-free illumination for working distances of 15 to 70 mm. Inside diameter is 66 mm for mounting on all microscopes through a series of ringlight adapters listed on page 347. Standard Flexible length is 750 mm (30 in). Longer lengths available.

Order #	Product
W3 72-0233	M10 Compact Ringlight

- Depth perception
- 70 to 100 mm working distance
- Adaptable to all microscope brands

4-Point Standard Ringlight

Standard ringlight with four fiber points provides illumination with depth perception for working distances of 70 to 100 mm. Inside diameter is 66 mm for mounting on all microscopes through a series of ringlight adapters listed on page 347. Standard Flexible length is 750 mm (30 in). Longer lengths available.

Order #	Product
W3 72-0248	4-Point Standard Ringlight

Fiber Optic Ringlights (continued)

- Small diameter
- Full circular
- 5 to 175 mm working distances
- Shadow-free
- Direct mounting for 20 to 32 mm objectives

Mini Ringlight

Small full circular glass fiber ringlight provides homogeneous, shadow-free illumination for working distances of 5 to 25 mm. Long Working Distance version is available for distances of 25 to 175 mm. Can be used for fiber optic illumination on Compound Microscope objectives. Mounting diameter ranges from 20 to 32 mm with the presence of 3 mounting screws without the need for adapters. Standard Flexible length is 900 mm (40 in). Longer lengths available.

Order #	Product
W3 72-0246	Short Working Distance Mini Ringlight
W3 72-0247	Long Working Distance Mini Ringlight

- Large diameter
- Full circular
- 50 to 120 mm working distance
- Diffuse light
- High intensity

SMD/MAXI Ringlight

Large full circular diameter glass fiber ringlight that provides homogenous, shadow-free illumination for working distances of 50 to 120 mm. Large diameter and shallow fiber angle produces wonderful darkfield effect on large surface areas. Inside diameter is 150 mm and can be adapted to SMD stations and stereomicroscope columns. Standard Flexible length is 480 mm (19 in) with longer lengths available on request.

Order #	Product
W3 72-0245	SMD/MAXI Ringlight

Ringlights and Accessories

- Ergonomic
- Long working distance starting at 100 mm
- Direct mounting to Olympus

Ergo/Olympus SZ/SD Ringlight

Tapered ringlight for direct mounting on Olympus SZ/SD Microscopes with minimum loss of working distance. Flexible length exits at 45˚ angle allowing maximum work space. Long Working distance starting at 100 mm with long flexible lengths available. Adapter included.

Order #	Product
W3 72-0242	Ergo/Olympus SZ/SD Ringlight

- Reduces or eliminates unwanted reflections
- Extends standard ringlight working distance range
- Used with standard, compact and 4-point standard ringlights

Accessories for Standard/Compact and 4-Point Ringlights

Ring Polarizer Set

Eliminates unwanted reflections of highly reflecting materials such as tissue and metallic objects. Glass analyzer is used with plastic polarizer for the best possible cross-polarization effect. Can be used with Standard, Compact, and 4-Point Standard Ringlights.

Toric Lens

Extends the working distance of Standard and Compact Ringlights from 90 to 150 mm. Longer distance ringlights are also available as an alternative.

Diffuser

Reduces unwanted reflections of highly reflecting materials such as tissue and metallic objects. Can be used with Standard, Compact, and 4-Point Standard Ringlights.

Order #	Product
W3 72-0262	Ring Polarizer Set for Standard/Compact Ringlights
W3 72-0265	Toric Lens for Standard/Compact Ringlights
W3 72-0264	Diffuser for Standard/Compact Ringlights

Note: *All Volpi Light Sources are compatible with all Volpi Fiber Optic Components.*

Gooseneck Light Guides

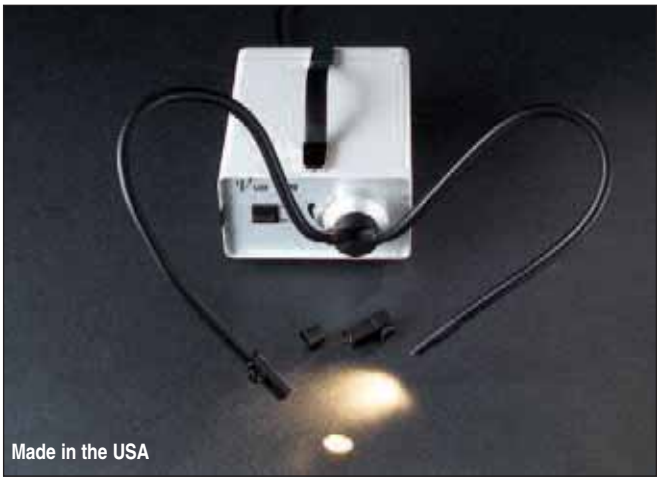
Gooseneck Light Guides

Gooseneck light guides provide fiber optic incident illumination using semi-obedient, self-supporting arms with no spring-back action. You can position each arm independently and with the key system in place, there is no rotation. Single Arm and bifurcated Goosenecks are available with 4.7 mm and 5.4 mm diameter.

Special Volpi Patent: Sliding Sleeve allows fiber bundles to move independently of the outer tubing for minimal fiber breakage over time. Gooseneck Arms are repairable. Light sources are sold separately.

Order #	Product
W3 72-0268*	Single Arm Gooseneck Light Guide, 4.7 mm x 500 mm fiber diameter
W3 72-0309	Single Arm Gooseneck Light Guide, 5.4 mm x 500 mm
W3 72-0267	Bifurcated Gooseneck Light Guide, 4.7 mm x 500 mm fiber diameter (each arm)
W3 72-0266*	Bifurcated Gooseneck Light Guide, 5.4 mm x 500 mm fiber diameter (each arm)

** 20" long, Ferrule diameter = 10mm*



Gooseneck Accessories

Standard Focusing Lens: A spherical lens used to focus light to a concentrated spot.

Polarizing Cap: Fits onto focusing lens.

Order #	Product
W3 72-0269*	Standard Focusing Lens
W3 72-0304	Polarizing Cap for Standard Focusing Lens For Modular Accessory System, see page 350

** Fits on 10mm Ferrule*

Focusing Lens with Polarizing Cap

Made in the USA

Gooseneck Light Guides (continued)

- Bifurcated Gooseneck and flexible light guide combination
- Attachable to columns of all brand microscopes through available adapters
- Great flexibility in the placement of light source
- Available in different lengths
- Uses standard Gooseneck accessories

Incident Gooseneck Light Guides

This combination of a Semi-Obedient Bifurcated Gooseneck and a Flexible Light Guide provides incident illumination. Fiber Optic Incident Goosenecks attach to the columns of microscopes or other work station columns with specialized adapters. Each arm can be positioned and adjusted independently. The flexible length size can vary to allow the placement of the light source away from the microscope and work station.

Utilizes standard Gooseneck accessories such as Focusing Lens W3 72-0269, Polarizing Caps W3 72-0304 and Modular Accessory System found on pages 348 and 350. Light sources are sold separately.

Order #	Product
W3 72-0329	Incident Gooseneck Light Guide, 4.7 mm fiber diameter (each arm), 75 cm (30 in)
W3 72-0330	Incident Gooseneck Light Guide, 4.7 mm fiber diameter (each arm), 100 cm (40 in)
W3 72-0331	Incident Gooseneck Light Guide, 4.7 mm fiber diameter (each arm), 150 cm (60 in)
W3 72-0333	Incident Gooseneck Light Guide Adapter for 20 to 25 mm Round Columns
W3 72-0334	Incident Gooseneck Light Guide Adapter for 32 mm Round Columns
W3 72-0335	Incident Gooseneck Light Guide Adapter for Nikon SM5/6 and SMZ 6/10
W3 72-0336	Incident Gooseneck Light Guide Adapter for Olympus SZX9/12
W3 72-0308	Incident Gooseneck Articulated Arm Support Adapter for Leica G26, MS5, M26, M28, M212

- Point illumination
- Highly flexible
- PVC metal tubing provides durability.
- 3 to 13 mm fiber diameters
- Standard and custom lengths available

Flexible Light Guides

Highly flexible and durable light guides available in 3 to 13 mm of fiber diameters and various standard and custom lengths. Outer tubing is composed of PVC metal tubing to provide both flexibility and protection. Standard single arm and twin arm versions available. Customized versions are available upon request.

Flexible Light Guides

Fiber Diameter (mm)	3	5	8	10	13
Bushing Diameter	**5**	**10**	**10***	**13***	**16***
Single Arm Lengths					
50 cm (20 in)	W3 72-0283	W3 72-0287	W3 72-0291	W3 72-0295	W3 72-0299
100 cm (40 in)	W3 72-0284	W3 72-0288	W3 72-0292	W3 72-0296	W3 72-0300
150 cm (60 in)	W3 72-0285	W3 72-0289	W3 72-0293	W3 72-0297	W3 72-0301
200 cm (80 in)	W3 72-0286	W3 72-0290	W3 72-0294	W3 72-0298	W3 72-0302

* *Does not fit standard focusing lense*

Twin Arm Lengths					
100 cm (40 in)	–	W3 72-0313	W3 72-0316	–	–
150 cm (60 in)	–	W3 72-0314	W3 72-0317	–	–
200 cm (80 in)	–	W3 72-0315	W3 72-0318	–	–

Light Guide Accessories

- Fixed point illumination
- Accurate adjustment for quick, simple and precise positioning
- Unrestricted movement – 220 mm radius of action
- Very durable

Articulating Arm with Heavy Steel Base

Articulating Support Arm provides unrestricted movement and accurate fine adjustment for fixed point illumination. Adjustment is simple and precise with 220 mm radius of action. Articulating Arms are available with M6/M6 and M6/M8 thread ends. Flexible Light Guides can be attached with small (9 to 12 mm OD) and large (11 to 16 mm OD) holders depending on flexible light guide outer ferrule diameters.

3 Components
W3 72-0324
W3 72-0322
W3 72-0325 or W3 72-0326 depending on light grid brushing ø

Order #	Product
W3 72-0323	Articulated Support Arm, M6/M6 Thread
W3 72-0324	Heavy Steel Base for Articulated Support Arm
W3 72-0325	Holder for Articulated Support Arm, ferrule diameter 9 to 12 mm (0.35 to 0.47 in)
W3 72-0326	Holder for Articulated Support Arm, ferrule diameter 11 to 16 mm (0.43 to 0.63 in)

- Use with Goosenecks and up to 8 mm OD Flexible Light Guides
- Allows combination of filters and other accessories
- Very versatile

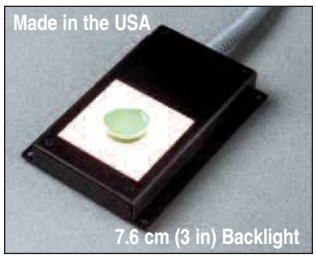
Modular Accessory System

Modular Holder has a 10 mm mounting diameter and attaches onto ends of goosenecks and up to 8 mm OD flexible light guides. Modular Accessory Holder and each of the Modular Accessories are threaded to accept one another. Modular accessories include the Modular color filters, Modular focusing lens, Modular diffuser, Modular polarizing filter, and Modular iris diaphragm. One or all can be attached at any one time. Custom filters are also available upon request.

Order #	Product
W3 72-0270	Modular Accessory Holder
W3 72-0271	Modular Focusing Lens
W3 72-0272	Modular Iris Diaphragm
W3 72-0273	Modular Polarizing Filter
W3 72-0274	Modular Daylight Filter
W3 72-0275	Modular Blue Filter
W3 72-0276	Modular Red Filter
W3 72-0277	Modular Green Filter
W3 72-0278	Modular Yellow Filter
W3 72-0280	Modular Blank Filter
W3 72-0279	Modular Diffuser

Note: *All Volpi Light Sources are compatible with all Volpi Fiber Optic Components.*

Backlights and Base



- Homogeneous, diffuse backlight illumination
- Used in the image processing, brightfield illumination on stereo microscopes, pattern recognition of different transparencies, area recognition of different colors, side illumination, dimensional gauging, shape verification, etc.

Glass Light Fiber Backlights

Glass Fiber Backlights provide homogeneous, diffuse illumination. Glass fiber used is extremely durable and heat tolerant. Can be adapted to most brand microscope bases.

Available in three sizes: 5 x 5 cm (2 x 2 in), 7.6 x 7.6 cm (3 x 3 in), and 12.7 x 12.7 cm (5 x 5 in). Additional specifications listed below.

Specifications

	W3 72-0342	W3 72-0343	W3 72-0344
Product	2 inch Backlight	3 inch Backlight	5 inch Backlight
Homogeneous Illumination Field	5 x 5 cm (2 x 2 in)	7.6 x 7.6 cm (3 x 3 in)	12.7 x 12.7 cm (5 x 5 in)
Dimensions, H x W x D	1.3 x 10.2 x 6.4 cm (0.5 x 4.0 x 2.5 in)	2.3 x 17.2 x 12.1 cm (0.9 x 6.75 x 4.75 in)	2.3 x 22.2 x 17.2 cm (0.9 x 8.75 x 6.75 in)
Uniformity	±10%	±10%	±10%
Fixing Holes (4 each) Diameter	6.3 mm (0.25 in)	6.3 mm (0.25 in)	6.3 mm (0.25 in)
Flexible Light Guide (Met/PVC)	91.4 cm (36 in)	91.4 cm (36 in)	91.4 cm (36 in)
Light Source Adapter	Intralux Series	Intralux Series	Intralux Series

Order #	Product
W3 72-0342	Glass Fiber Backlight, 5 x 5 cm (2 x 2 in)
W3 72-0343	Glass Fiber Backlight, 7.6 x 7.6 cm (3 x 3 in)
W3 72-0344	Glass Fiber Backlight, 12.7 x 12.7 cm (5 x 5 in)

- Transmitted bright/darkfield illumination
- Uses standard/compact ringlight illumination
- Low cost alternative
- Compact design
- Adapts to all brand name microscopes

Brightfield/Darkfield Base

This is a low-cost, intense, contrast-rich, transmitted, light Bright/Darkfield Base used with Standard or Compact Fiber Optic Ringlights. It provides transmitted bright/darkfield illumination. Easily accessible knob allows quick and easy change between brightfield and darkfield. Adapts to all brand name microscopes.

Order #	Product
W3 72-0337	Bright/Darkfield Base
W3 72-0339	Polarizer to Base
W3 72-0340	Diaphragm to Objective, 0.5/0.63X
W3 72-0341	Diaphragm to Objective, 1.5/2.0X

Note: *All Volpi Light Sources are compatible with all Volpi Fiber Optic Components.*

Notes