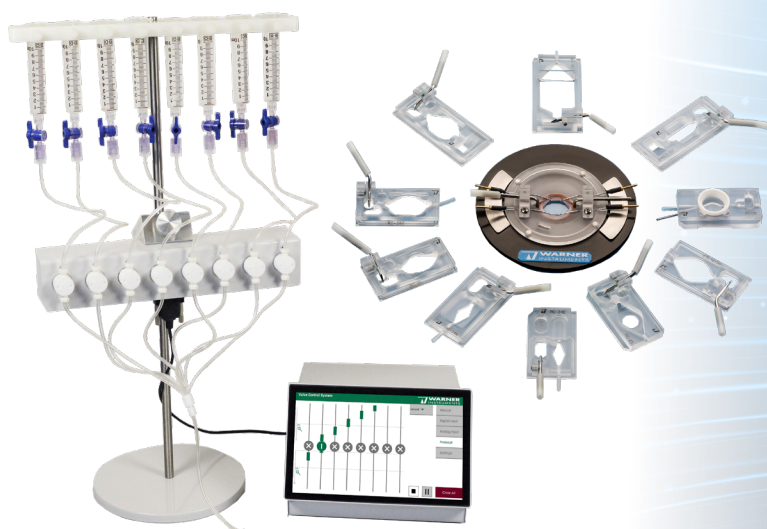


Electrophysiology & Live-Cell Imaging

Chambers • Perfusion • Temperature Control
Patch Clamp Electrophysiology



Instruments for Electrophysiology & Live-Cell Imaging

Leveraging the combined expertise of three industry-leading brands (Warner Instruments, HEKA Elektronik, and Multi Channel Systems), Harvard Bioscience is proud to offer a wide range of versatile, integrated solutions designed to address the needs of electrophysiology & live cell imaging research.

We are happy to assist you in finding the right instruments for your application and to help in assembling the best products for a complete rig. For convenience, most of these products can be accessed at www.warneronline.com or www.heka.com.

Warner Instruments offers almost everything you may need for patch clamp on or around the microscope, and Heka offers state of the art amplifiers and data acquisition well optimized for electrophysiological applications.

An Integrated Systems Approach

The Complete Rig

Our expert application scientists will consult with you to identify the best components needed to assemble a complete rig.



Faraday Cage and Table



Microscope and Stage



Amplifier and DAQ



Recording Chambers and Slice Anchors



Heated Platforms



Stage Adapters



Perfusion Systems



Inline Solution Heaters



Temperature Controllers

Recording

HEKA EPC 10 USB Amplifier and PATCHMASTER NEXT



Warner Instruments can now provide the state-of-the-art in the field of patch clamp amplifiers, the HEKA EPC 10 USB.

Combining it with our new amplifier control, acquisition, and analysis software, PATCHMASTER NEXT, the EPC 10 USB creates a complete patch clamp system that allows data collection from a wide variety of recording configurations:

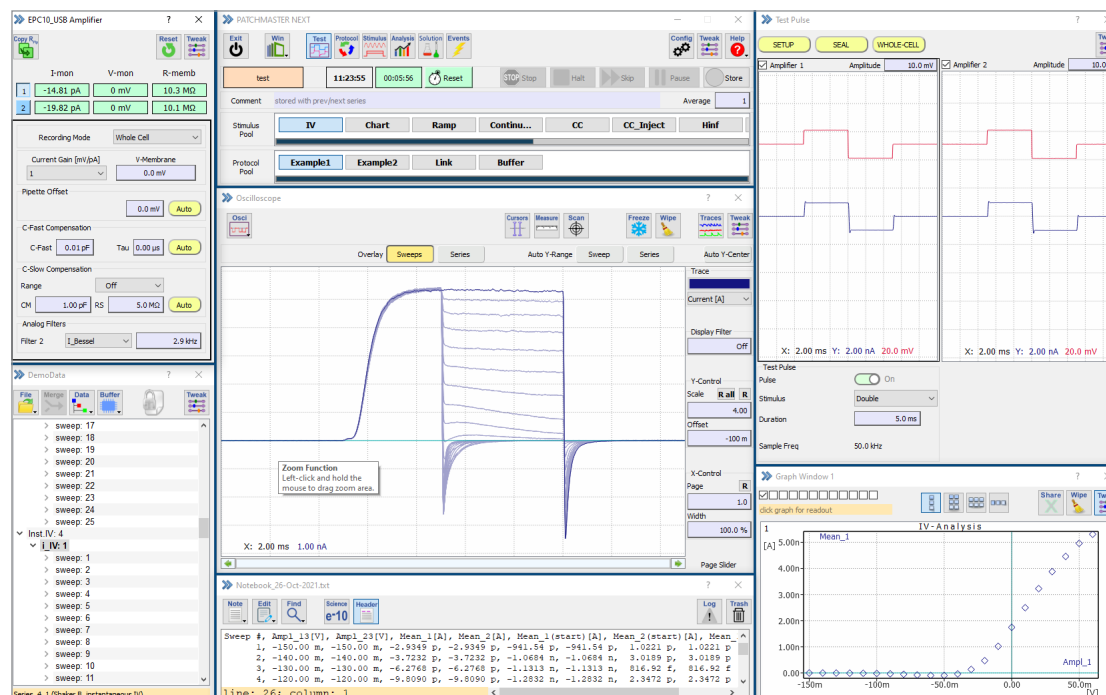
- Whole cell recordings (conventional and perforated)
- Single channel recordings
- Loose Patch recordings
- Intracellular voltage recordings with high resistance electrodes

The main technical features of the EPC 10 USB making it a unique instrument include:

- Integrated acquisition board for low noise and easy setup
- Fully computer controlled; allows complete automation of experiments
- Optional small S-Probe headstage, only 49 x 17 x 14.5 mm, 25 g
- Optional bath sense for amperometry
- Versions with 1–4 amplifiers and headstages
- Two EPC 10 USB can be linked to supply up to 8 headstages
- 3 feedback resistors per headstage
- Onsite, user-performed calibration

HEKA Patchmaster Next

The complete solution for amplifier control, data acquisition, and data analysis.



PATCHMASTER NEXT provides all the same functionality as the older PATCHMASTER but with a new, restructured, and more modern user interface. This improved version of PATCHMASTER is much easier to program and use. As before, PATCHMASTER NEXT provides amplifier control and data acquisition and analysis capabilities. It also allows the user to automate their entire experiment and features built-in functionality for many other extensions (LockIn, imaging, spectroscopy, photometry). This makes PATCHMASTER NEXT the most versatile patch clamp software available.

Both software packages feature:

- Extended real time analysis
- Comfortable data management
- Solution management
- Export of data to e.g. Matlab, Igor, ASCII and others
- Software updates are always free of charge.

Contact sales for more information on iOS compatibility and additional imaging functionality through SmartLux.

ORDER #	PRODUCT NAME
89-5273	EPC 10 USB System with Red Star Headstage
89-5274	EPC 10 USB Double System with Red Star Headstages
89-5275	EPC 10 USB Triple System with Red Star Headstages
89-5276	EPC 10 USB Quadro System with Red Star Headstages
89-5277	EPC 10 USB System with S-Probe Headstage
89-5278	EPC 10 USB Double System with S-Probe Headstages
89-5279	EPC 10 USB Triple System with S-Probe Headstages
89-5280	EPC 10 USB Quadro System with S-Probe Headstages

*Contact sales for information about units without software included.

HEKA EPC 800 USB



The EPC 800 USB is a hybrid amplifier that can either be operated remotely with the appropriate HEKA software or in manual mode using the front panel controls.

In contrast to many other manually controlled amplifiers, the EPC 800 USB provides automatic compensation of pipette capacitance, cell capacitance and serial resistance, as well as all offsets.

The EPC 800 USB technology is similar to the EPC 10 USB, but it does not include a built-in data acquisition board. As such, the EPC 800 USB can be paired with any data acquisition system suitable for patch clamp recordings.

ORDER #	PRODUCT
89-5004	EPC 800 USB patch clamp amplifier, Single

Acquisition Hardware and Software

HEKA LIH 8+8 and Patchmaster Next



LIH 8+8

The PATCHMASTER NEXT data acquisition system is recognized as a premier DAQ for electrophysiological applications. PATCHMASTER NEXT requires the HEKA LIH 8+8 for operation.

While the HEKA EPC10 USB amplifiers feature an integrated acquisition board, amplifiers from other manufacturers require an external acquisition system for recording and stimulation.

The LIH 8+8 data acquisition board samples up to 200 kHz per channel and two LIH digitizers can be linked to increase the available number of recording channels.

Order #	Product
89-5035	LIH 8+8
89-5245	Patchmaster Next

Microelectrode Holders

Precision made microelectrode holders from Warner Instruments and Heka are ideal for any application that use fluid filled glass microelectrodes and micropipettes.

Microcapillary electrodes provide the important link between live cells and high impedance amplifiers in applications such as patch clamp, intracellular, and extracellular recordings, as well as iontophoresis and ion specific measurements.

Warner Holders



Order #	Model	Product
64-0827	QSW-B15P	Q Series holder, port, straight style, fits 1.5 mm capillary, Ag wire (Heka)
64-0839	QSW-T15P	Q Series holder, port, straight style, fits 1.5 mm, Ag wire (Axon)

Standard holders from Warner are made with either acrylic and/or polycarbonate and are annealed by vapor polishing. Warner holders are also available with many options of ports/venting, body style, and electrical coupling.

Glass Size

To insure a high-quality fit, Warner holders are bored to match the OD of the glass and will accommodate bores of 1.0, 1.2, 1.5, and 2.0 mm. Tightening the threaded end cap compresses a silicone rubber gasket providing a tight seal around the capillary.

Headstage Connections

Warner holders are available for most commercially available headstages including Axon, HEKA, Warner, Dagan, and others.

Warner's wide selection of microelectrode holders can be seen at www.warneronline.com

HEKA Holders



Order #	Product
89-5229	Pipette holder BNC Type 1.5mm
89-5150	Pipette holder SMA Type 1.5mm (for S-Probe)

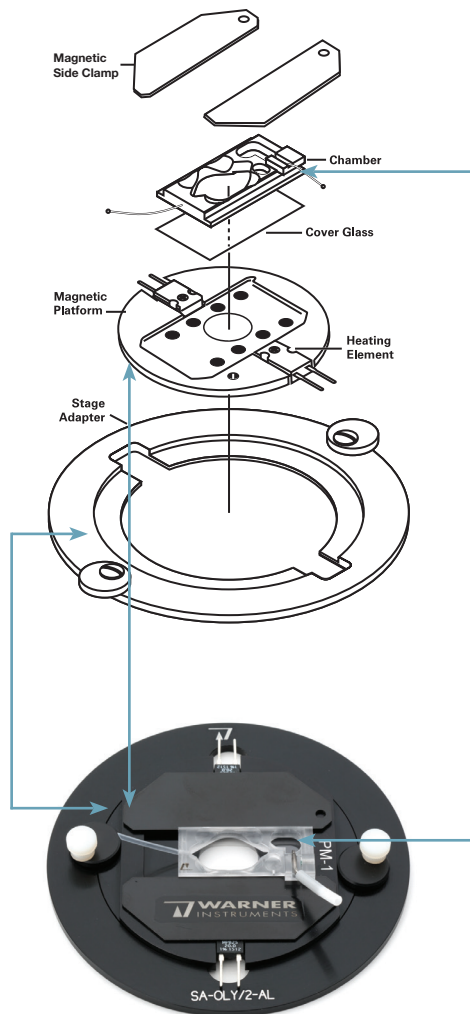
HEKA's pipette holders are made of extremely low-noise polycarbonate material and offers two major improvements that virtually eliminate pipette movement and air leakage by elongating the holder's cap and the addition of a third O-ring.

The longer cap allows for the insertion of a small polycarbonate cylinder, keeping the first O-ring firmly in place, even after removal of the cap for cleaning purposes.

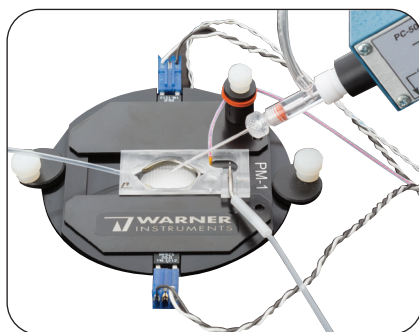
The second O-ring is nestled at the other end of the short cylinder featuring a precision mill cut that holds it in place.

The design provides the highest pipette stability, eliminates air leaks, and extends the life time of O-rings. Most importantly, this holder will increase the rate of successful recordings and increase productivity.

Recording and Imaging Chambers



Chamber and platform with Olympus inverted stage adapter



RC-26 chamber with slice anchor and patch electrode

Good to know:

Warner Instruments is the industry standard when it comes to imaging and recording chambers. We offer a wide variety of specialty chambers accommodating many applications. We also provide stage adapters to match almost every microscope stage.

Several components are needed for the proper use of an imaging and recording chamber:

- Chamber and coverslip
- Platform
- Stage adapter

The image on the left illustrates how the components assemble to form a system.

The sample containing coverslip is sealed to the chamber bottom and chamber is placed into a platform. Warner has two platform styles available, with the magnetic design being simpler in design and more convenient to use.

The chamber/platform assembly is then placed into a stage adapter which allows all Warner products to be placed onto a microscope stage.

If using slice preparations, the slice is held in place using a slice anchor (or hold-down) specifically designed for the chamber in use. Those hold-downs are press-fit into the respective chamber and are not weight dependent.

Open bath chambers allow direct access to the chamber bath by either recording electrodes or microscope objectives.

Closed bath chambers do not permit direct access to the bath but are very well suited for imaging studies.

The basic composition of a Warner chamber includes:

- An imaging/recording zone
- A perfusion input
- A suction regulated output tube

Most Warner chambers incorporate a diamond-shaped fluidics reservoir yielding laminar flow throughout the bath.

Low profile open bath chambers allow excellent electrode access without interfering with the optical equipment used in slice work.

Open Bath Chambers

RC-26, RC-26G, and RC-26GLP



The RC-26, RC-26G, and RC-26GLP provide a large volume in a diamond shaped, open bath chamber capable of accommodating large specimens such as slice preparations. These chambers are also well optimized for assays using adherent cultured cells.

- Optimized for patch clamp studies
- Can be used for tissue slice samples or with cell cultured coverslips
- Large imaging area
- Supports both upright and inverted microscopes
- Slice anchors available
- Fits PM-1 or PH-1 Series 20 platforms

Order #	Product
64-0234	RC-26, 170 μ L volume
64-0235	RC-26G, 234 μ L volume
64-0236	RC-26GLP, Low profile, large bath recording chamber

RC-27L

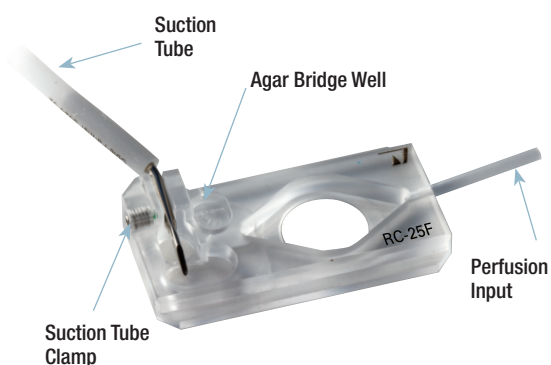


The RC-27L is designed with tissue slice studies in mind. The tissue slice rests on a slice support and is held in place by a slice anchor (also known as a harp). This design allows the tissue slice to be perfused from both above and below, which can increase the sample's viability. The slice support rests 0.5 mm above the coverslip floor and are included with the RC-27L.

- Designed for tissue slice studies
- Permits solution flow both above and below a tissue slice
- Provides good access for immersion optics and electrodes.
- Can be used with either upright or inverted microscopes
- Slice anchors available
- Requires a platform (PM-6D, PH-6D or P-6D) and Series 20 stage adapter

Order #	Product
64-0241	RC-27L, Large bath chamber for slice studies, does not include slice hold down

RC-25 and RC-25F



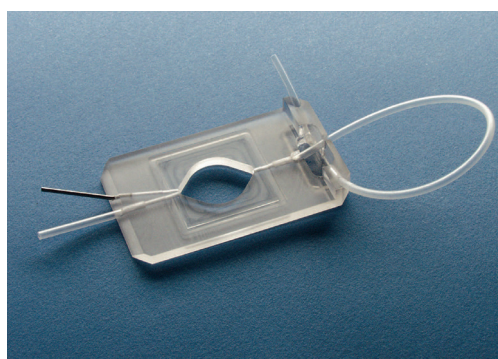
The RC-25 and RC-25F chamber.

- Designed for physiological measurement of cell cultured coverslips
- Diamond-shaped bath for laminar solution flow
- Applications such as patch clamp, intracellular/extracellular recordings and imaging
- Small bath volume facilitates fast solution exchange
- Uses 12mm (RC-25) or 15mm (RC-25F) round coverslips

Order #	Product
64-0232	RC-25, 90 μ L volume
64-0233	RC-25F, 133 μ L volume

Closed Bath Chambers

RC-21BR



The RC-21BR chambers features a closed bath, short working distances, and linear solution flow. Distance between the top and bottom coverslip is 2.5 mm and total bath volume is 358 μ L.

- Closed bath chamber design
- Diamond fluidics
- Ideal for fluorescent, calcium, and time-lapse imaging studies
- Uses 22 mm square or 25 mm round coverslips
- Large optical imaging area
- Good access for upright or inverted microscopes
- Requires a platform (PM-2, PH-2 or P-2) and Series 20 stage adapter

Order #	Product
64-0232	RC-25, 90 μ L volume
64-0233	RC-25F, 133 μ L volume

RC-30 Confocal Imaging

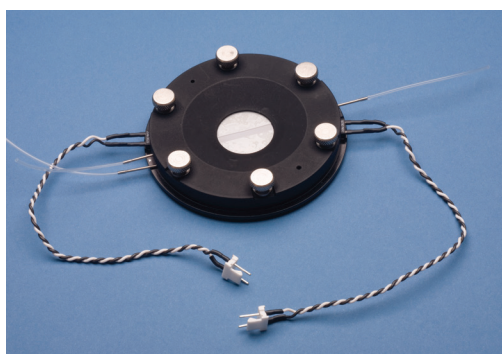


The RC-30 is a low profile, closed bath chamber specifically designed for confocal imaging applications. Compatible with either upright or inverted microscopes.

- Option of confocal imaging with continuous perfusion
- Accommodates both upright and inverted microscopes
- 17.7 mm diameter viewing aperture (RC-30HV)
- 25.0 mm diameter viewing aperture (RC-30WA)
- User defined cross-sectional viewing area
- User defined bath volume with fast fluid exchange
- Three available gasket thicknesses
- Resistive heating on chamber base
- Fits Warner's Series 30 stage adapters

Order #	Product
64-0321	RC-30HV confocal imaging chamber, with heaters
64-0321WA	RC-30WA wide aperture confocal imaging chamber

RC-31A

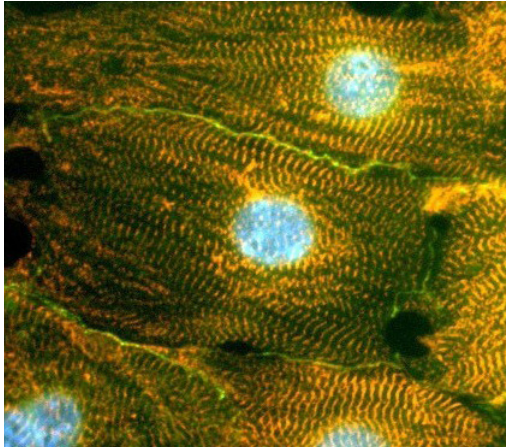


Similar to the RC-30, unique features of the RC-31A include user defined bath geometry and a large viewing area. A 30 mm, #1.5 glass coverslip forms the top of the chamber, while a 40 mm, #1.5 coverslip forms the bottom, respectively, creating a closed bath. The closed design permits cells to be cultured on either the top or bottom coverslips allowing the chamber to be used with either inverted or upright microscopes. The final viewing aperture is 25 mm diameter.

- Adjustable distance between upper and lower coverslips, 125 μ m to 375 μ m
- Optimal control of culture conditions and cellular environment
- Compatible with both upright and inverted microscopes
- Amenable for long term studies using live cells
- Fits Warner's Series 30 stage adapters

Order #	Product
64-1685	RC-31A, Confocal imaging chamber (uses Series 30 platforms)

Field Stimulation Chambers

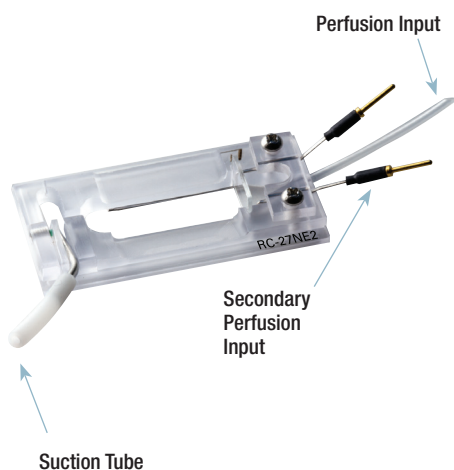


Warner Instruments provides a wide selection of field stimulation chambers.

All chambers are equipped with platinum electrodes that are attached to the sides of the bath. The cables are terminated with 1 mm pins.

- Designed for field stimulation studies involving cardiac myocytes
- Available in open and closed bath chamber design
- Ideal for fluorescence, calcium and time lapse imaging studies

RC-27NE2



The RC-27NE2 is a modified version of the RC-27 with a narrower bath and smaller volume.

- Narrow open bath design
- Rectangular shape
- Accommodates tissue and brain slice specimens
- For applications such as patch clamp and physiological measurements on cultured cells

Order #	Product
64-0240R2	RC-27NE2 narrow bath for field stimulation

RC-49MFSH

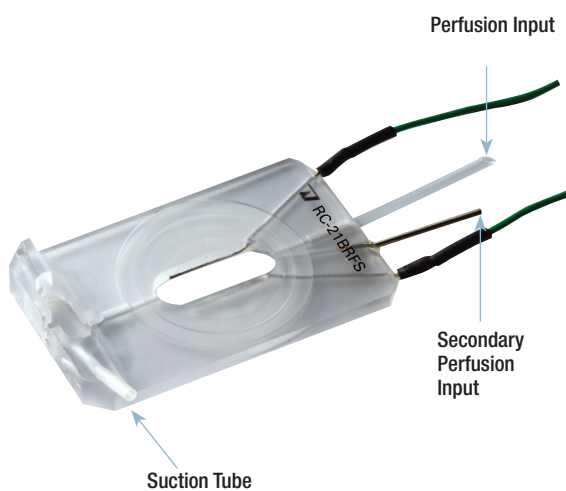


The RC-49MFSH is designed quick exchange of coverslips in field stimulation applications

- O-Ring seal permits quick exchange of coverslips
- Low profile design allows low entry angle electrodes
- Platinum field stimulation electrodes
- Uses popular 18 mm round coverslips
- Embedded heating elements

Order #	Product
64-1725	RC-49MFSH magnetic imaging/recording chamber with removable electrodes for field stimulation and heating elements

RC-21BRFS



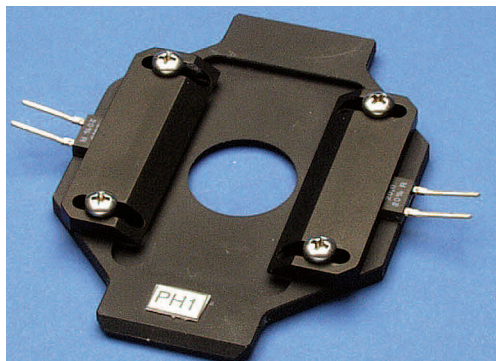
The RC-21BRFS is a modified version of the RC-21.

- Closed bath design
- Small bath volume with slotted bath
- Requires 25mm round cover glasses for top and bottom of the chamber
- Volume of 263 μ l
- Gas tight design at chamber interface

Order #	Product
64-0226	RC-21BRFS for field stimulation

Chamber Platforms

PM and PH Series



Warner platforms function as base for the Series 20 chambers and provide easy clamping to make a secure seal between the chamber and coverslip.

Platforms are available in the classic PH Style and the improved magnetic PM Style.

Each chamber fits only a single platform version (eg, PH-1 or PM-1), but a single platform can accept several different chambers. Each chamber specifies which platform to which it is designed.

- Allows small entry angles ideal for patch recordings
- No tools needed to secure chamber to platform
- Available for all Series 20 Chambers
- Magnetic stainless steel allows use of magnetic holders
- Compatible with all Series 20 stage adapters
- Platforms come with heating elements

Stage Adapters



All Warner Series 20 platforms have the same outer dimension, and a stage adapter is used to mount the platform onto a microscope stage.

The cutout of the microscope stage determines the corresponding adapter and Warner adapters support stage cutouts from all manufacturers, including:

Please visit our website to find a suitable adapter.

Stage Manufacturer	Adapter Dimensions	Series 20 Stage Adapters	Order Number	Series 30 Stage Adapters	Order Number
Warner Hybrid Stage	11 cm diameter	SA-OLY/2-AL	64-2411	SA-30/OLY2	64-0325
Multiwell Plate Cutout	12.8 x 8.6 cm	SA-20MW-AL	64-2416	SA-30MW-AL	64-2417
	12.7 x 8.5 cm	SA-20MW-AL-NFits newer Nikon MW stages.	64-2420	SA-30MW-AL-NFits newer Nikon MW stages.	64-2421
Nikon	10.8 cm diameter	SA-NIK-AL	64-2410	SA-30NIK	64-0322
	9 x 13 cm	SA-20TS/100	64-0340		
	12.7 x 11 cm	SA-20UU-AL	64-2412		
	23.75 x 15.65 cm	SA-20Ti Does not fit newer Nikon Ti2 stages. (see below)	64-1744	SA-30Ti Does not fit newer Nikon Ti2 stages.(see below)	64-1745
	23.6 x 15.5 cm	SA-20Ti-2Fits newer Nikon Ti2 stages.	64-3073	SA-30Ti-2 Fits newer Nikon Ti2 stages.	64-3074
	12.7 x 8.5 cm	SA-20MW-AL-NFits newer Nikon MW stages.	64-2420	SA-30MW-AL-N Fits newer Nikon MW stages.	64-2421
Olympus	12.7 x 11 cm	SA-20UU-AL	64-2412		
	11.0 cm diameter	SA-OLY/2-AL	64-2411	SA-30/OLY2	64-0325
Zeiss	10.97 x 15.98 cm	SA-20KZ-AL	64-2415	SA-30KZ-AL	64-2418
	16.5 x 10 cm	SA-20LZ-AL	64-2413	SA-30LZ	64-0326
	12.7 x 13 cm	SA-20UUZ	64-0336		
Leica	16.5 x 10 cm	SA-20LZ-AL	64-2413	SA-30LZ	64-0326
	9.66 cm diameter	SA-20GALVOZLeica insert #158004118 is needed to mount adapter to Galvo stage.	64-0376		
Scientifica	11.0 cm diameter	SA-OLY/2-AL	64-2411	SA-30/OLY2	64-0325
Prior & Ludl	16 x 11 cm	SA-20PL	64-0299	SA-30PL	64-1748
	15.95 x 10.95 cm	SA-20PLIXR-AL	64-2414		
Burleigh Gibraltar	11.0 cm diameter (steel top stage only)	SA-OLY/2-AL	64-2411	SA-30/OLY2	64-0325
	10.96 cm diameter	SA-OLY/3	64-0386	SA-30/OLY3	call
Marzhauser	10.97 x 15.98 cm	SA-20KZ-AL	64-2415	SA-30KZ-AL	64-2418
HEKA EIProScan	10.97 x 15.98 cm	SA-20KZ-AL	64-2415	SA-30KZ-AL	64-2418

Quick Release Chambers

QR-40 and RC-40 Series



The QR-40 and RC-40 Series chambers are designed for research requiring the fast exchange of round cover slips.

The RC-40 Series chambers use a rubber o-ring to create a seal between and hold the chamber top and bottom together. By comparison, the QR-40 Series use strong neodymium magnets to create the seal and hold. In both cases, a soft rubber o-ring creates a watertight seal between the chamber top and the coverslip in use.

The QR-40 and RC-40 Series imaging chambers are compatible with the QE-1 quick exchange platform, as well as the DH-35iL and DH-40iL culture dish incubators.

- o-ring seal system enables quick coverslip exchange, ideal for rapid screening assays
- Closed bath design promoting smooth continuous solution exchange as well as stable imaging focus
- Anodized aluminum base guarantees effective heat transfer

Order #	Product
64-1943	QR-40LP for 25 mm coverslip, low profile
64-1944	QR-41LP for 18 mm coverslip, low profile
64-1945	QR-42LP for 15 mm coverslip, low profile
64-1946	QR-48LP for 12 mm coverslip, low profile
64-1947	QR-40HP for 25 mm coverslip, high profile
64-1949	QR-41SLP for 25 mm coverslip, slotted bath
64-1951	QR-47FSLP for 25 mm coverslip for field stimulation

RC-30 Series culture dish inserts

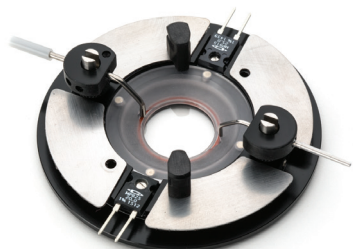


These chambers make perfusion in cell culture dishes a simple matter.

- Fits all 35 mm Corning or Falcon based dishes
- Also fits glass bottomed dishes from MatTek and Willco Wells
- Available in Open bath, closed bath, and field stimulation designs

Order #	Product
64-0365	RC-37WS chamber insert for Willco 35mm cell culture dishes for field stimulation
64-0366	RC-37FS chamber insert for Falcon 35mm cell culture dishes for field stimulation

QE-1 Platform

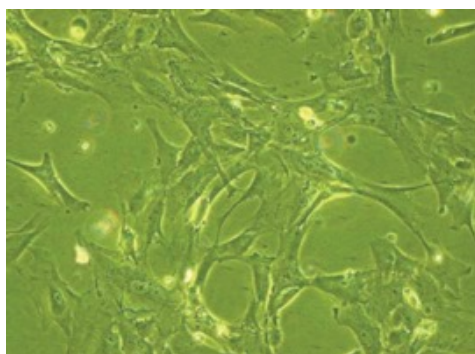


The QE-1 platform is designed to serve as a convenient holder for Warner's QR-40 and RC-40 Series chambers as well as most 35mm culture dishes, with or without glass bottoms.

- Supports inverted and upright microscopes
- Resistive heating elements for temperature control
- Provides the base for our DH-35iL and DH-40iL stage top microincubators:
- Removable perfusion and suction holders
- Adapter ring kit accommodates 35 mm format culture dishes from Willco Wells, Corning, Falcon, NUNC, and others

Order #	Product
64-0375	Quick change platform, heated base, for QR-40 series chambers
64-1542	Quick change chamber, heated base, for 50 mm culture dishes

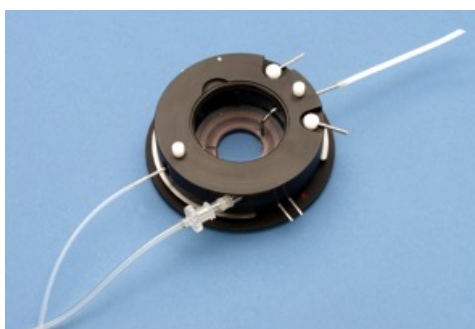
Microincubation System DH-35iL and DH-40iL



Warner Instruments also provides microincubation platforms such as DH-40iL and DH-35iL.

The DH-40iL is designed to support glass-bottomed 35 mm cell culture dishes and the QR/RC-40 family of open bath chambers. The DH-35iL supports glass-bottomed 35 mm cell culture dishes and the RC-30 Series of culture dish inserts.

- DH-platforms provide imaging, temperature, and gas environment control
- Compatible with dishes from Corning, Falcon, MatTek, Nunc, Willco Wells, and WPI (DH-40iL only in open configuration)
- Unique dish clamps provide easy cell access



Order #	Product
64-0349	DH-35iL culture dish incubation system supporting 35 mm quick exchange chambers
64-0388	DH-40iL culture dish incubation system supporting QR- 40 family and 35 mm quick exchange chambers

Chamber Accessories

Coverslips, slice anchors, silicone grease



Warner Instruments provides a number of D265 borosilicate glass coverslips in multiple thicknesses and sizes for microscopy and imaging. Please visit our website to find the right coverslips for your application.

The slice anchors are designed for an easy-press fit into the chamber's bath area. This allows control of the cord line pressure that is applied to the tissue slice. Most anchors are made of a type 316 stainless steel with Lycra® threads and finished with a plastic coating. Some anchors are completely constructed with plastic. Please visit our website to find the right anchor for Series 30 or Series 40 chambers.



Silicone Grease

An artist's acrylic brush is an effective tool for applying silicone lubricant to a glass coverslip and polycarbonate chamber.

By "painting" the grease onto the bottom surface of a polycarbonate chamber, it is easy to evenly spread lubricant and create a water-tight seal.

The silicone grease kit includes:

- Tube of Dow Corning® 111 Valve Lubricant & Sealant
- Two acrylic paint brushes (sized #2 and #4)
- Several pallets

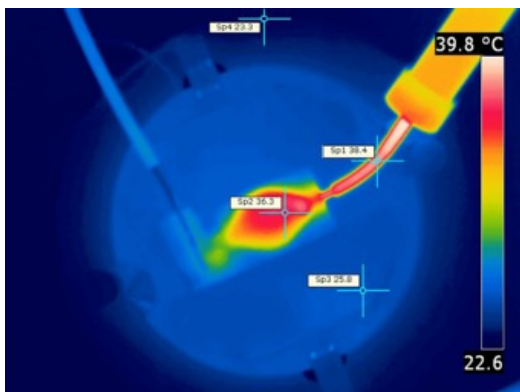


Order #	Product
64-0378	Silicone grease kit, includes brushes and pallets
64-0275	Stopcock grease

Overview: Temperature Control



Single Channel TC-324C Resistive Temperature Controller



Researchers have long understood the importance of temperature regulation in the study of cellular function.

Warner temperature control apparatus have been designed with the demanding noise and precision requirements of electrophysiological applications in mind.

Transmission of thermal energy can happen through the microscope objective, the perfusion solution, the chamber platform, and any other physical elements of the working environment. We provide temperature control of three parts:

- Platform
- Solution
- Microscope objective

Heated platforms transmit heat to the chambers via the sides only, therefore heat applied through a platform only will have a gradient from the sides to the middle of the bath. Heating the perfusing solution is extremely effective if the flow rate is sufficient. Obviously, combining the two approaches will capture the best of both.

Finally, immersion objectives can be a huge heat sink and objective warmers are often used to address this issue.

In-Line Solution Heaters

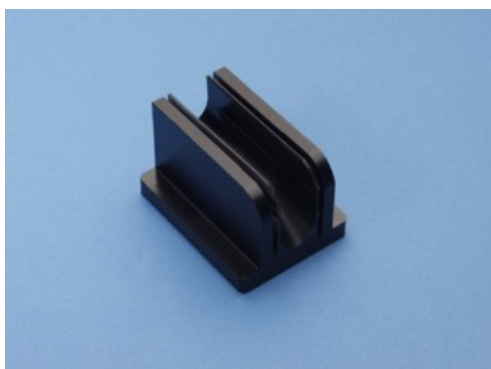


The simplest and most direct approach for the application of heat to a sample is to preheat the perfusion solution immediately prior to its delivery to the chamber. Warner Instruments provides a wide variety of solution heaters including single channel slow-flow and fast-flow models.

If multiple solutions are required, the multi-line solution heater is the best option to be able to quickly change your solution and heat it properly. Our in-line solution heater can heat up to 50° C.

Order #	Product	Max Flow Rate	Inputs	Outputs	Heating/Cooling
64-0103	SF-28 In-Line solution heater	2 ml/min	1	1	H
64-0102	SH-27B In-Line solution heater	5 ml/min	1	1	H
64-0104	SHM-6 6-line solution heater	5 ml/min	6	1	H
64-0105	SHM-8 8-line solution heater	5 ml/minw	8	1	H
64-1430	SHM-828 8-line solution heater	5 ml/min	8	8	H

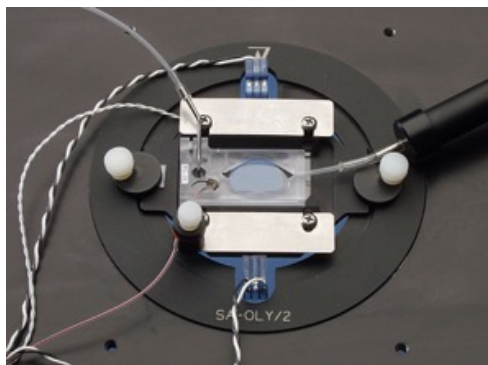
In-Line Solution Heater Holders



We provide the following in-line-solution heater holders:

Order #	Product
64-1555	SSH-1, holder for SH-27B and SF-28
64-1556	SSH2, holder for SC-20
64-1557	Holder for SHM-6, SHM-8, SHM-628
64-1558	Holder for FR-50 and FR-55S flow valves

Platform Heating



Platform heating is the second most efficient method for warming a heating and recording chamber. All Warner platforms come supplied with resistive heat elements, and the platform is connected to the TC-324C/TC-344C temperature controller via a CC-28 cable. The CC-28 also provides feedback thermistors for regulating the controller and informing the user of the precise bath conditions.

Order #	Model No.	Product
64-0106	CC-28	Cable assembly for heater controls to platform
64-0107	TA-29	Cable with bead thermistor
64-0108	TA-30	Cable with glass thermistor
64-0109	CC-35	Cable assembly for heater controllers, unterminated with tinned leads at platform end
64-0303	CC-15	Cable assembly for heater controllers, with tinned leads at connector end

Objective Warmers



Objective heaters are extremely important for immersion optics.

- Reduced thermal gradient between objective and sample
- Have no direct contact between warmer and objective
- Fit microscope objectives from most manufactures

Order #	Product	Product
64-1664	OWS-1	Objective Warmer System, for 23-30 mm objectives, includes TC-124A temperature controller
64-1676	OWS-2	Objective Warmer System, for 30-35 mm objectives, includes TC-124A controller

Bipolar Temperature Control

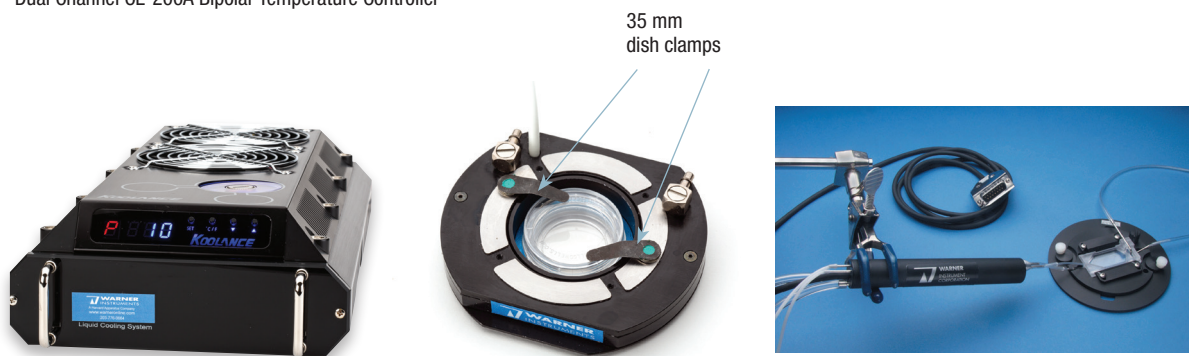
Heating & Cooling

These systems are designed to work with our bipolar temperature controllers (CL-100, CL-200A) to provide both heating and cooling via our SC-20 inline solution heater/cooler and QE-1HC platform.

The use of Peltier-driven, bipolar temperature controlled apparatus require a heat exchanger in order to function properly. We have the LCS-1 Liquid Cooling System for this purpose.



Dual Channel CL-200A Bipolar Temperature Controller



LCS-1 Liquid Cooling Device

Model QE-1HC with 35 mm glass bottom dish

SC-20 In-Line heater/cooler

Order #	Product	
64-1723	CL-200A Bipolar dual channel temperature controller	<ul style="list-style-type: none"> • In-line solution heater/cooler • Stage insert heater/cooler
64-0352	CL-100 Bipolar single channel temperature controller	
64-0353	SC-20 In-Line heater/cooler	5ml/min 2 Inputs, 1 output
64-1659	QE-1HC quick exchange platform	Easy access for imaging
64-1922	LCS-1 Liquid Cooling Device Required accessory for systems using CL-100/200	<ul style="list-style-type: none"> • Used to temperature manage the water jacket • Electrically and mechanically quiet

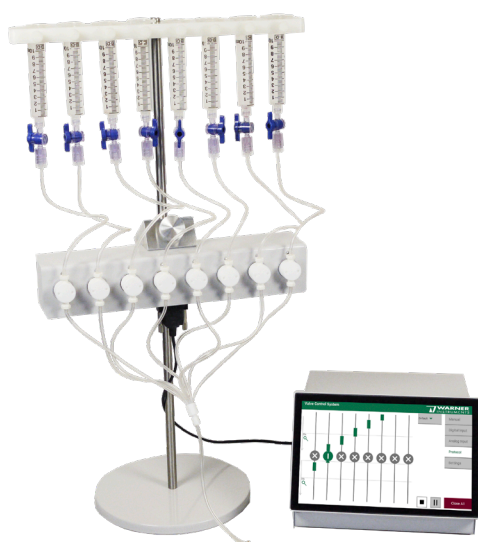
Perfusion Systems

Perfusion is required to keep the specimen alive and can also be used for heating or cooling. Most of the perfusion systems available consist of a set of syringes filled with solution and a valve controller that opens and closes the valves of each syringe. Syringe tubing consolidates in a manifold which is connected to the chamber.

To avoid overflow of the solution, suction must be applied. This is usually done with a vacuum system.

Alternatively, a peristaltic pump can be used for delivering solution as well as for suction.

Touch and PC Software controlled Valve Control Systems



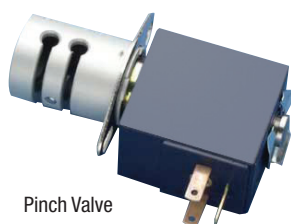
The VCS systems are configured to control up to 8 Pinch -, PTFE -, or Mini - valves. Each valve is individually accessed by a manual touch display, the included PC software, an external analog signal, or an external digital signal (TTL).

- Digital or analog switching for Patch Clamp applications
- UI programmable valve protocols
- Save and load protocols on hard drive
- Download protocols to valve controller for permanent storage
- Run and monitor protocols

VCS Perfusion Systems are comprised of the following:

- Valve control unit with 7" touch display
- Valves
- Valve bracket, including an 8 ft long cable to be connected to valve controlled
- MP series manifold (Pinch and PTFE), ML series (Mini)
- 60cc (10cc for mini-valves) reservoirs (syringes)
- Reservoir holder
- Ring lab stand
- Stopcocks for each reservoir
- Tubing connector

Order #	Product	Channels	Valves	Specialty
64-3084	VCS-6-PINCH	6	pinch	-
64-3085	VCS-6-PTFE	6	PTFE	-
64-3086	VCS-6-Mini	6	mini	-
64-3087	VCS-6-Mini-LT	6	mini	large tubing
64-3080	VCS-8-PINCH	8	pinch	-
64-3081	VCS-8-PTFE	8	PTFE	-
64-3082	VCS-8-Mini	8	mini	-
64-3083	VCS-8-Mini LT	8	mini	large tubing



Pinch Valve



PTFE Valve



Mini Valve

The controllers support three different valves: Pinch, PTFE and Miniature Valves.

Pinch Valves are the simplest valves to maintain as the solution never gets in touch with the valve and tubing can easily be changed. Valves are dual acting (3-way) with both normally open and closed sides. Y connectors at the valve input permit solution flow to waste with the valves off.

PTFE Valves are available for applications where resistance to chemicals is a concern. The valves are 2-way, either on or off.

Miniature Valves are designed for slow flow perfusion systems where smaller diameter tubing is used. The valves mount directly to a compact Delrin manifold. The 3-way valves allow for solutions to flow to waste if desired. These are ideally suited for use with the SF-77C Fast-Step Perfusion Stepper Systems.

Fast-Step Perfusion Systems



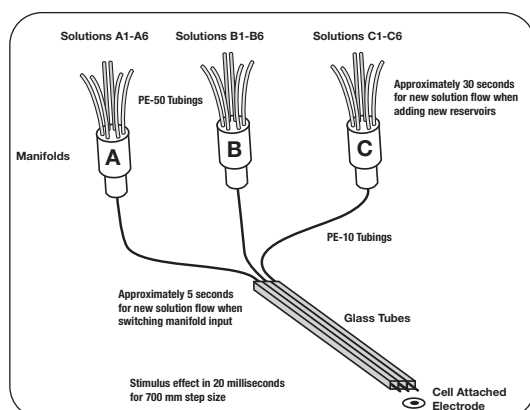
Combining a Warner Mini-perfusion Valve Control System and the SF-77C Fast-Step Perfusion system results in a unique system that enables a user to rapidly select between several perfusion reservoirs, saving time and effort.

Millisecond solution changes between tubes

Solution change within individual ports within 5 seconds

New solutions can be added into any port with a waiting time of no more than 30 seconds

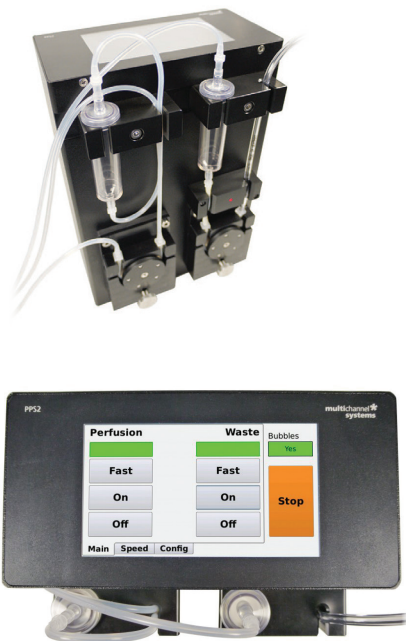
The cell is never required to pass through an intervening solution to get from control to test solution



Order #	Model	
64-3109	VCS-77CSP	Complete VCS-6 Fast-Step Perfusion System, right handed micromanipulator
64-3110	VCS-77CSPL	Complete VCS-6 Fast-Step Perfusion System, left handed micromanipulator
64-3111	VCS-77CSP8	Complete VCS-8 Fast-Step Perfusion System, right handed micromanipulator
64-3112	VCS-77CSP8L	Complete VCS-8 Fast-Step Perfusion System, left handed micromanipulator

Perfusion Accessories for Ephys Applications

Peristaltic Pump PPS2



If only one incoming and suction solution is required, the PPS2 is the perfect device.

- 2 channels (1 in/1 out or 2 in or 2 out)
- Control of instrument via touchscreen
- SW control (requires USB connection to Windows-PC)
- Control using TTL and analog voltage provided by e.g. acquisition board
- Flow rate 0.1 up to 30 ml/min in 0.1 ml/min steps
- Link both channels by percentage, e.g. suction is 105% of incoming solution
- Bubble detector for suction control

If the incoming solution does not need to get changed, the PPS2 replaces a perfusion system and vacuum system for suction.

Order #	Product
89-0688	Peristaltic Pump, 2 channels

Dedicated Workstation Vacuum DWV



The DWV provides suction to prevent solution overflow in the chambers using a perfusion system.

- Completely self-contained liquid waste system
- High quality low-noise vacuum pump, 40 dB(A) maximum
- Dual flask design for improved vacuum stability

Order #	Product
64-1940	Dedicated Workstation Vacuum

Farraday Cages and Tables



The CleanBench™ combines the latest improvements to TMC's table tops with their gimbal piston air vibration isolation system. CleanBench offers more stability, better ergonomics, guided thread lead-ins, and a more compact design. TMC's vibration isolation lab tables are ideal for a wide variety of applications including AFM, confocal microscopy, IVF, patch clamp, interferometry, and metrology.

The CleanBench Advantage

A **unique table top design** combines the best features of TMC's CleanTop® steel honeycomb with an ultra-stiff, damped, layered platform.

Greater stability, especially for small size tables. The low profile, high density tops lower the overall floating center-of-mass ensuring inherent stability, even for relatively top-heavy payloads.

Guided thread lead-ins to align screws with tapped holes. The "bevel" shape eases engagement of the first thread.

Ergonomically optimized for the seated user by minimizing the thickness of the table top.

- Gimbal piston isolators
- Greater stability
- Guided thread lead-ins
- Thin-Wall Rolling Diaphragms
- Aluminum Height Control Valves
- Internal Piston Travel Restrain
- Tiebar Gussets
- Rugged Built-in Leveling Feet
- Choice of tabletops



Order #	Product
60-4742	CleanBench, smooth stainless steel top, 30x36
60-4743	CleanBench, smooth stainless steel top, 30x48
60-4744	CleanBench, threaded (1/4-20 on 1" centers, US) stainless steel top, 30x36
60-4746	CleanBench, threaded (1/4-20 on 1" centers, US) stainless steel top, 30x48
60-4738	CleanBench, threaded (1/4-20 on 1" centers, US) stainless steel top, 36x48
60-4745	CleanBench, threaded (M6 on 25 mm centers) stainless steel top, 30x36
60-4747	CleanBench, threaded (M6 on 25 mm centers) stainless steel top, 30x48
60-4741	CleanBench, threaded (M6 on 25 mm centers) stainless steel top, 36x48
60-4799	Faraday Cage, fits 30x36 in tables
60-4800	Faraday Cage, fits 30x48 in tables
60-4801	Faraday Cage, fits 36x48 in tables
60-4766	BenchTop Faraday Cage, 30x36 in
60-4767	BenchTop Faraday Cage, 30x48 in
60-4768	BenchTop Faraday Cage, 36x48 in

Micromanipulators



Luigs & Neumann

Micromanipulators are required to position the micropipette for recording or injection relative to the specimen. Warner Instruments provides

micromanipulators from Sensapex, Sutter, and Luigs & Neumann*

Micromanipulators from each of these manufacturers are of high precision and have been designed specifically for the electrophysiology workplace. As such, they are all well optimized for both microinjection and patch clamp studies.

Please visit our website or contact sales for more information on the features and benefits for each specific manufacturer.

* Luigs & Neumann are available from Warner in North America only.



Sensapex



Sutter

Accessories for Ephys Applications

Microinjector



The use of microcapillary pipette based techniques for intracellular/extracellular microinjection and perfusion has become a popular procedure in numerous areas of experimental biology research.

The PLI Microinjectors feature:

- Injection pressure of 0.2-60 PSI (413 kPa)
- Injection Time of 0.01 to 99.99 seconds
- Injection time accuracy of $\pm 0.01\%$ (Crystal Time Base)
- Injection count display: 0-9999 injections
- All PLI feature Input, Balance, and Clear pressures (positive)
- The PLI-100A also includes Holding and Fill pressures (negative)
- Trigger mode: front panel, footswitch or TTL (Gate In)

We also offer ancillary components needed to complete a microinjection system, including:

- Micromanipulator and magnetic base
- Electrode holder
- Light source
- Microscope

Please contact your sales rep for help configuring your ideal set up.

Order #	Product	Properties
64-1735	PLI-100A	5 pressures
64-1738	PLI-90A	3 pressures
64-1737	PLI-FS Foot switch	–
Accessories		
64-1626	Acrylic pipette holder for 1.0 mm pipettes	
64-1627	Acrylic pipette holder for 1.2 mm pipettes	
64-1628	Acrylic Pipette Holder for 1.5 mm pipettes	
64-1629	Acrylic pipette holder for 2.0 mm pipettes	

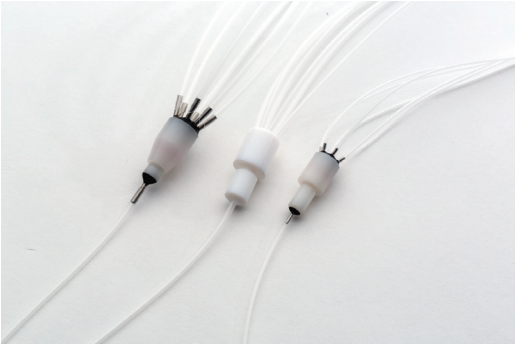
Hybrid Stage



We offer a hybrid stage for patch clamp studies and other experiments. The XY-translator can either be used manually or motorized. The platform is available for inverted or upright microscopes with US or metric threads. It supports the most common microscopes. This part list is not comprehensive, please visit our website for a full list of options.

Order #	Product
Stage with XY translator for Inverted Microscope	
64-2365	Fits Nikon Eclipse T inverted, US thread
64-2373	Fits Nikon Eclipse T inverted, metric thread
64-2366	Fits Leica DMI8 inverted, US thread
64-2374	Fits Leica DMI8 inverted, metric thread
64-2367	Fits Olympus IX-73 inverted, US thread
64-2375	Fits Olympus IX-73 inverted, metric thread
64-2368	Fits Zeiss Axiovert inverted, US thread
64-2376	Fits Zeiss Axiovert inverted, metric thread
Stage with XY translator for Upright Microscope	
64-2369	Fits Nikon E600 FN1 upright, US thread
64-2377	Fits Nikon E600 FN1 upright, metric thread
64-2370	Fits Leica DM LFS upright, US thread
64-2378	Fits Leica DM LFS upright, metric thread
64-2371	Fits Olympus BX-51WI upright, US thread
64-2379	Fits Olympus BX-51WI upright, metric thread
64-2372	Fits Zeiss Axioscop 2FS upright, US thread
64-2380	Fits Zeiss Axioscop 2FS upright, metric thread
Accessories	
64-2384	Stainless steel insert for stage
64-2385	Stainless steel insert, 3 pieces
69-5000	Wheel input device for hybrid stage, requires 69-5001
69-5001	Controller for hybrid stage

Manifolds



Manifold inputs converge to the common output with minimum dead space. They are designed for use with PE-160, PE-50, and PE-10 polyethylene tubing, but they can also be used with other tubings with similar dimensions.

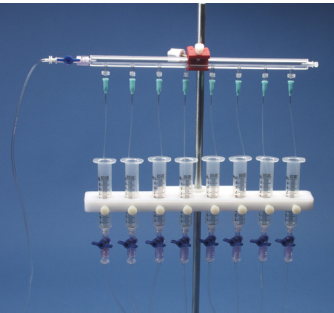
Vacuum and Flow Regulator



The FR-50/FR-55S is a convenient tool to adjust both solution flow rates and vacuum pressure in a variety of applications. The solution flow is adjustable from zero to a maximum of 10 mL/min (measured with a solution head of 30 cm). The units have calibrated adjustment rings to permit returning to a predetermined setting.

Order #	Product
64-0220	FR-50, flow valve
64-0221	FR-50S, flow valve with on/off-switch

Miscellaneous Perfusion Accessories



Warner Instruments also provides the following accessories:

- Syringes, syringe holder
- Tubing
- Valve control parts
- Gas humidification
- system
- Gas bubbler manifolds
- Perfusion pressure kits
- Manifold holder

Please visit our website for a full selection of our accessories.

Microforge-Grinding Center (MFG-5)



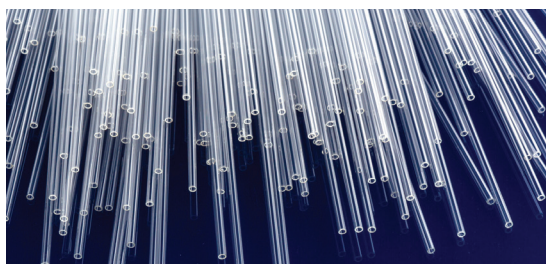
Glass micropipette polishing, shaping, tipping, bending, beveling, and grinding — all in one compact platform.

Rapid and easy switching between microforge and micro-grinder by turning the tool manipulator

Precise, convenient movement controls for heater/grinder, pipette locations and optical focus

Order #	Product
64-1612	Microforge Grinding Center, 110/120 VAC
64-1616	Microforge Grinding Center, 220/240 VAC

Capillary Glass



- Warner Instruments provides a wide range of capillary glass.
- Length 75–150mm
- With and without filament
- Clark borosilicate, aluminosilicate and premium borosilicate glass
- thin wall and standard

Programmable Pipette Puller PMP-102



The PMP-102 is a horizontal puller that pulls two identical pipettes.

- 25 programmable sequences
- Programmable multi-pulling steps
- Pneumatic adjustable pulling force
- 22 pre-programmed sequences for commonly used pipette tips

Order #	Product
69-0151	PMP-102 programmable puller, 110-120 VAC, 60 Hz
69-0151E	PMP-102 programmable puller, 220-240 VAC, 50/60 Hz
69-0172	Replacement heat coil



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