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Ralph Abate
Business Manager, **Warner Instruments**



Cell Biology Research Catalog



NEW CL-200 Dual Channel Bipolar Temperature Controller, p. 111



NEW RC-49FS Perfusion Chamber with Field Stimulation, p. 54



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1125 Dixwell Avenue
Hamden, CT 06514 USA

phone **800.599.4203 (toll-free)**
203.776.0664

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Domestic Orders*

Harvard Apparatus

84 October Hill Road
Holliston, MA 01746-1388 USA

phone **800.272.2775 (toll-free)**
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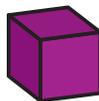
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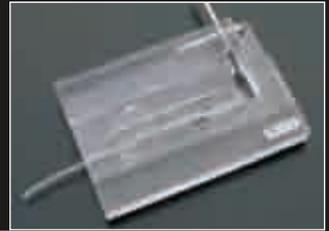
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Oocyte Recording Chambers,
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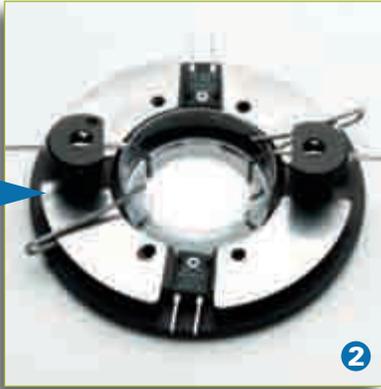
Series 20 & Series 30
Stage Adapters,
see page 64



Chambers, Perfusion and Temperature Control for Live Cell Imaging

Chambers

an integrated systems approach



Imaging and Recording Chambers



Series 40 imaging and recording chambers
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Stage Adapters
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Inline solution heater and coolers
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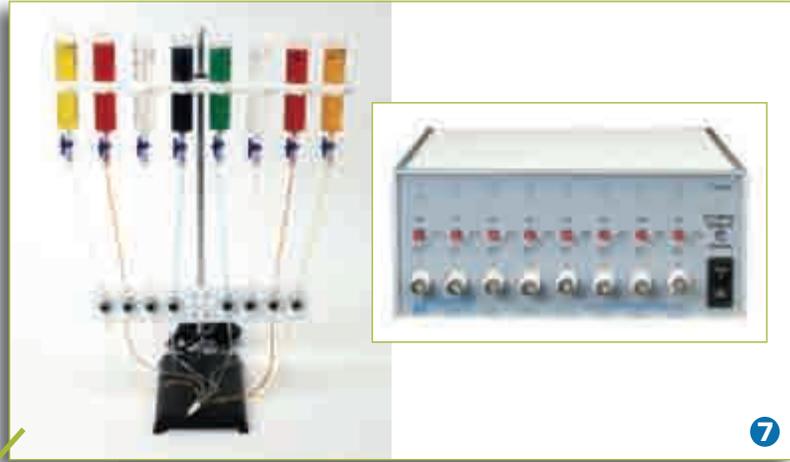
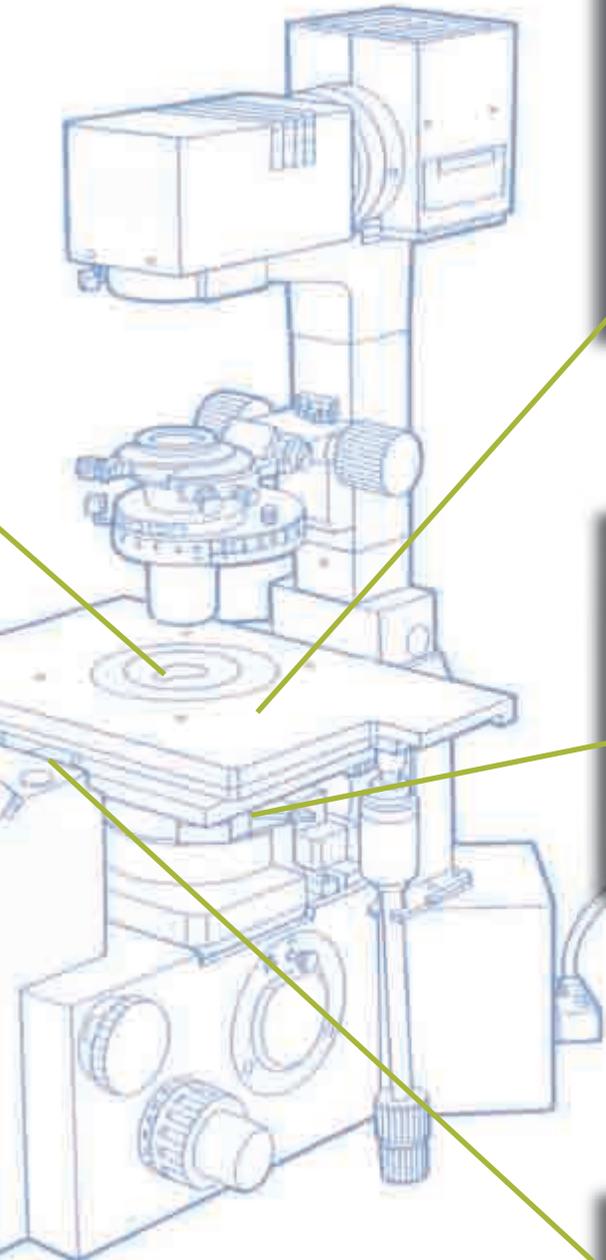
Typical, complete package

for use with 35 mm culture dishes and Warner quick change chambers includes chamber, temperature control, Inline solution heater and stage adapter

Model	Product
1 RC-40LP	Quick Change Chamber 25 mm Low Profile
2 QE-1	Quick Exchange Heated Base
3 SA-NIK	Stage Adapter for 108 mm stage insert
4 SH-27B	Solution Heater
5 CC-28	Cable Assembly for Heater Platforms
6 TC-344B	Dual Channel Heater Controller
7 VC-8	Eight Channel Perfusion Valve Controller
8 OW Series	Objective Warmer
TC-124	Temperature Controller
9 Spill Sensor	Solution Leak Detector



systems approach



Perfusion Systems, page 89



Objective Warmers, page 122



Spill Sensors, page 105

	open bath	closed bath	small volume (< 100 µl)	medium volume	large volume (> 300 µl)	patch studies	tissue or slice studies	oocyte studies	epithelial or ussing studies	special design	micro-incubation chamber system	35 mm culture dish	50 mm culture dish	field stimulation	upright microscopy	platforms
Oocyte Chambers	RC-1Z	●	●					●							●	
	RC-3Z	●	●	●				●							●	
RC Series Chambers	RC-10	●		●	●	●		●							●	
	RC-16	●		●	●	●		●							●	
Quick Coverslip Exchange Chambers	RC-40LP	●			●	●	●	●			●				●	OE-1
	RC-40HP	●		●	●	●	●	●			●				●	OE-1
	RC-41LP	●		●		●	●	●			●				●	OE-1
	RC-42LP	●			●	●	●	●			●				●	OE-1
	RC-43C	●			●	●	●	●			●				●	OE-1
	RC-46SLP	●			●	●	●	●			●				●	OE-1
	RC-46SNLP	●		●		●	●	●			●				●	OE-1
	RC-47FSLP	●			●		●	●			●			●	●	OE-1
RC-48LP	●		●			●	●			●					OE-1	
Culture Dish Inserts 35 mm dishes	RC-33DM	●		●								●				
	RC-33DL	●		●								●				
	RC-33SN	●			●							●				
	RC-33SL	●			●							●				
	RC-37W	●			●							●				
	RC-37WC	●			●							●				
	RC-37WS	●			●							●				
	RC-37F	●			●							●				
	RC-37FC	●			●							●		●		
	RC-37FS	●			●							●		●		
	RC-61T-01	●			●							●				
	RC-61T-02	●			●							●				
RC-61T-03	●			●							●					
RC-61T-04	●		●								●					
RC-61T-05	●			●							●					
RC-61T-06	●				●						●					
Culture Dish Platforms	OE-1	●									●					
	OE-2	●									●		●			
Micro-incubation	DH-35	●									●					
	DH-35iL	●									●					
	DH-40iL	●									●					
	DH-50	●									●		●			

Heating of Warner Imaging and Recording Chambers Application Fundamentals

Why Heat?

Researchers have long understood the importance of temperature regulation in the study of cellular function. For example, a recent PubMed search using the keywords “temperature” and “cell” produced over 29,000 references since 1995, most addressing the effect of temperature on the biophysical and metabolic function of cells. In addition, the performance of imaging system optics is exquisitely sensitive to variations in temperature as revealed by a shifting focal plane as the temperature of the objective changes. Therefore, for the scientist studying cellular function in an imaging and recording environment, the importance of tight thermal control cannot be overstated.

A number of issues confront the researcher attempting to control cellular temperature. These include maintaining a constant and uniform bath temperature under various flow rates and controlling for changes in the ambient temperature of the environment. In addition, effects resulting from the introduction of cold drugs or solution to the perfusion path, and heat sinks due to microscope optics and stage adapters must be addressed.

General Issues

Sources of Heat Flux

Heat flux pathways can be generally characterized as either conductive, convective, or radiative. Traditionally, the greatest effort is directed towards controlling conductive pathways, followed by convective pathways. We define a conduction heat pathway as one wherein heat energy is transmitted through a continuous intervening material. These include the microscope stage or objective, the perfusion solution, the chamber platform and other physical elements of the working environment. Heat flux through convective pathways are generally less significant but include evaporation or condensation and heat transfer due to the movement of air across the imaging chamber. Radiative pathways are, in general, easily controlled and will only be briefly considered here.

Space and Time Considerations in Uneven Heat Conduction

We first consider sources of uneven heat distribution in the spatial regime. These include poor heat conduction across the chamber bath or from the platform to the chamber. Poor heat conduction across the bath is manifest as a temperature gradient within the bathing solution. A gradient of this type is often induced by an immersion objective placed in direct apposition (either above or below) to the sample. Heat flux through this pathway can be significant, resulting in as much as a 10°C temperature change within 3-5 mm. Another, less dramatic, temperature gradient can be generated in the bath by restricting the application of heat to just the chamber platform. Since the platform applies heat only along the edge of a chamber, a temperature gradient will be established due to the heat capacity of water coupled with flow of relatively cold solution into the chamber.

Uneven heating in the temporal regime can be generated by varying the rate at which cool perfusion solution is introduced into a heated platform, or by introducing drugs or solution (into the perfusion path) at a temperature different than that currently being perfused. These considerations will be addressed in greater detail below.

Outgassing

Another significant issue related to the application of heat to perfusion solutions is termed outgassing. Under standard conditions, atmospheric gas in contact with a liquid solubilizes into solution and tends towards an

equilibrium determined in part by the gasses partial pressure and the temperature of the liquid. Generally speaking, cold liquids are capable of solubilizing a greater volume of gas than a warm liquid. Therefore, as the temperature of a liquid increases, dissolved gasses come out of solution resulting in the appearance of bubbles.

Heating Methods

A number of approaches are used by investigators to regulate the temperature of a sample under study. These include warming the chamber platform and/or microscope objective using resistive, Peltier, or liquid based application devices, channeling warm air across the imaging chamber and/or optical components, and regulating the temperature of the perfusing solution. Techniques for regulating the temperature of perfusates include preheating the solution reservoir and/or using an inline solution heater in the perfusion pathway. Each strategy has its strengths and weaknesses and are discussed below.

How Temperature is Sensed

In general, temperature is measured using a thermistor or similar device and fed back into a temperature controller which adjusts power to the heating element. When regulating temperature it is important to account for the response time of the feedback loop since this can cause the system to oscillate.

Control and Regulation

Warner Instruments temperature controllers utilizes two thermistors per channel to provide monitoring and feedback information to the controller. One thermistor is placed within the heated element (e.g., chamber platform, in-line heater, etc.) to measure the temperature of the heater block. Information from this thermistor is fed back to the control mechanism which applies sufficient power to the heater to maintain the controller set point.

The second thermistor is usually placed in the solution path close to the sample and measures the temperature at the sample. Information from this thermistor is used by the researcher to adjust the set point of the controller and to monitor the performance of the system.

This approach is very effective in providing tight thermal control (± 0.1 C) of the heating element, and consequently the perfusion solution, as long as the feedback loop is sufficiently optimized. Warner Instrument temperature controllers are provided with user selectable feedback

Heating of Warner Imaging and Recording Chambers

Application Fundamentals (continued)

response time constants allowing the instrument to accommodate different operating conditions

Methodology

In-line Solution Heating

The simplest and most direct approach for the application of heat to a sample is to preheat the solution immediately prior to its delivery to the chamber. The warmed perfusate washes over the sample and maintains a uniform temperature at the sample, even with variable flow rates. This method works well as long as solution continues to flow through the heater into the chamber.

A number of considerations are important when using this approach. First, it is important to minimize the distance between the heater and chamber. If too much heat is lost en route, the user can attempt to raise the heater controller set point above the boiling point of the solution. In addition, variations in the flow rate can change the quantity of heat lost as the solution moves from heater to chamber.

Chamber Platform Heating

Another strategy is to heat the chamber platform. This is usually achieved by using a resistive element and this approach is provided for in Warner chambers. A slightly more sophisticated tactic would be to supply heat to the platform using either a Peltier or liquid based heating element. Regardless of the method employed, this strategy is best suited for conditions where the solution flow rate is extremely slow or nonexistent.

A number of considerations are important when using this approach. First, the perfusing solution receives heat energy only after entering the chamber, possibly generating a temperature gradient within the bath. Second, since the platform applies heat only to the edges of the chamber, the rate of transfer to the solution is slow. However, this approach excels for conditions where solution flow is nonexistent, such as maintaining a constant temperature while loading cells with indicator dyes.

In all cases, it is recommended that the chamber platform be thermally isolated from the microscope stage as this can be a significant heat sink, second only to the microscope objective. This is most readily achieved by the use of a plastic stage adapter. While the primary purpose of a stage adapter is to mate a platform to the specific microscope stage, the plastic material used can also provide the desired thermal isolation.

Solution Reservoir Heating

Heating the solution reservoir is not generally considered a successful strategy for maintaining temperature in the bath since most, if not all, of the heat energy is lost en route to the chamber. However, this technique is important if outgassing of solutions is a problem. Since the gas load of a solution is dependent on partial pressure and temperature, preheating the solution at atmospheric pressure before delivery to the final heater will minimize the occurrence of bubbles in the bath, even if the solution cools en route. Therefore, solution reservoir heating is best used in combination with other heating techniques as described below.

Microscope Objective Heating

While necessary, the use of immersion objectives in imaging presents a difficult problem for the researcher attempting to maintain temperature at the sample. Since the objective is in direct contact with the solution or the chamber, and is placed immediately above or below the sample, it presents a significant conduction pathway within the system.

Heated objective collars are commercially available and are designed to minimize heat flux through the optics. However, many researchers indicate that small variations in temperature, as the collar cycles off and on, induces an oscillating shift in the focus plane. Warner Instruments has an objective warmer which specifically addresses this issue. The heated collar does not come into direct contact with the objective but instead relies on a slower radiative heat transfer between the heater and the objective. The capacitive thermal properties of the intervening air, coupled with tight heating control by the temperature controller, removes any abrupt changes in the temperature of the objective and stabilizes the system against shifts in the focal plane.

As a final note, many researchers have expressed concerns about deep thermal cycling an objective between uses. Some investigators have addressed this issue by maintaining the objective warmer, and hence the objective, at a constant temperature, even when not in use.

Heated Enclosures

Another strategy currently in use is to encase the imaging chamber and microscope optics within a heated enclosure. The main advantage of this approach is that both the chamber and objective are maintained at a stable and uniform temperature. Heat is usually applied to the environment by the introduction of warmed air to the enclosure. Some disadvantages are slow responses to changes in the thermal set point, possible introduction of airborne contaminants from the blower system, and the requirement for bulky equipment on or about the imaging system.

Discussion

Each heating strategy discussed above has strengths and weaknesses making it an incomplete solution for issues encountered with heating. However, most experimental difficulties can be solved by using these strategies in combination.

For example, platform heating alone is not sufficient to stably heat a perfusing solution, but is necessary if solution flow is to be interrupted for any reason. In addition, the most effective method of heating a perfusion solution is via an in-line heater. Therefore, an optimal combination for experiments where tight thermal control is desired under variable, very slow, or interrupted flow conditions would be a combination of in-line and platform heating.

If solutions are stored cold and used before reaching operating temperature, or if the temperature is changed during an experiment, then outgassing at the sample can be a problem. This is addressed by including reservoir preheating in the experimental setup. However, reservoir heating is unable to supply heated solutions to the chamber and is best used in combination with an in-line solution heater.

Finally, recall that an objective warmer reduces the thermal gradient between the microscope and sample. This, in turn, increases the efficiency of any heating method employed. Of course, all described approaches can be used in combination to provide efficient thermal regulation under virtually any condition.

Warner Instruments provides high quality single and dual channel temperature controllers, solution reservoir heaters, chamber platform heaters, in-line solution heaters, stage adapters, and the aforementioned objective warmer. We invite you to call our technical support staff and we will be glad to aid you in determining the best application of these heating strategies to your experimental setup.

oocyte chambers

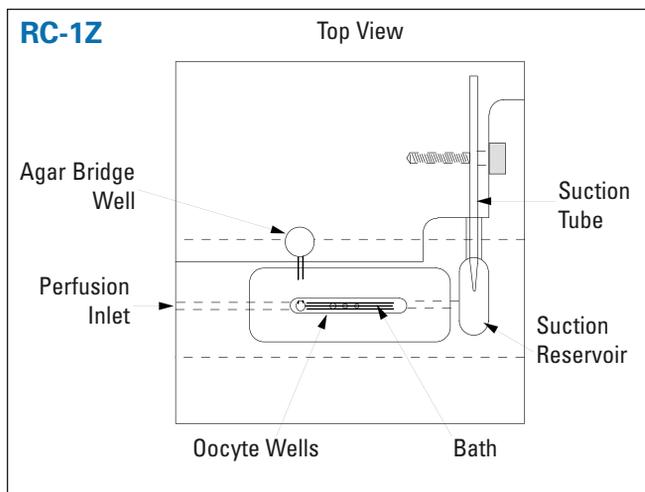
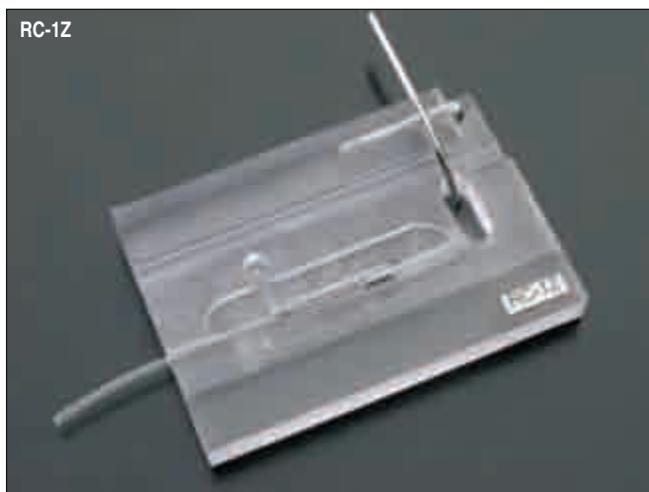
RC-1Z

Oocyte Recording Chamber

Chambers

oocyte chambers

A simple, low cost oocyte perfusion chamber



- Specially designed for oocyte studies
- Unique slotted bath
- Dimpled bottom aids oocyte impalement

The RC-1Z chamber features a unique slot-shaped bath for applications requiring rapid perfusion.

The chamber is constructed using a two-piece design. The top piece forms the chamber body and contains a solution aspiration reservoir. An agar bridge well with connecting channel to the input side of the bath is also provided. An isolated well is provided on the downstream side of the bath, however, most users place the sense electrode directly into the suction well.

The bottom piece forms the floor of the chamber and houses the oocyte work area. To aid in securing the oocyte into position during impalement, the chamber bottom has three dimples with dimple diameters: 0.8, 1.0, and 1.2 mm. Three grooves milled into the chamber bottom (parallel to the direction of solution flow) aid in bathing the bottom side of the oocyte during perfusion.

Solutions are removed from the suction well via an adjustable suction tube and bath solution height is adjusted by raising or lowering the suction tube. The perfusion input accepts standard 1/16" OD (PE-160) polyethylene tubing.

Each chamber includes 10 feet of polyethylene (PE-160) tubing.

Specifications

Material	Polycarbonate
Footprint (L x W)	7.7 x 5.1 cm
Bath Dimensions (L x W x H)	25 x 3.5 x 2.5 mm
Volume, by Depth	85 µl/mm
Chamber Floor Insert	25 x 75 x 3 mm, polycarbonate
Input Tubing (ID x OD)	1.14 x 1.57 mm (PE-160)
Aspirator Coupling	1.67 mm OD

Order # Model Product

W4 64-0318 RC-1Z Oocyte Chamber

Optional Accessories

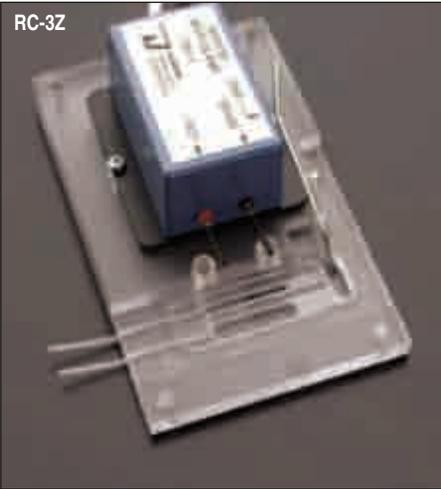
W4 64-1586	BPM-1	Base Plate Magnetic Steel
W4 64-0206	MP-2	Perfusion Manifold, 2 Inputs
W4 64-0207	MP-3	Perfusion Manifold, 3 Inputs
W4 64-0208	MP-4	Perfusion Manifold, 4 Inputs
W4 64-0209	MP-5	Perfusion Manifold, 5 Inputs
W4 64-0210	MP-6	Perfusion Manifold, 6 Inputs
W4 64-0211	MP-8	Perfusion Manifold, 8 Inputs
W4 64-0755	PE-160/10	Polyethylene Tubing

oocyte chambers

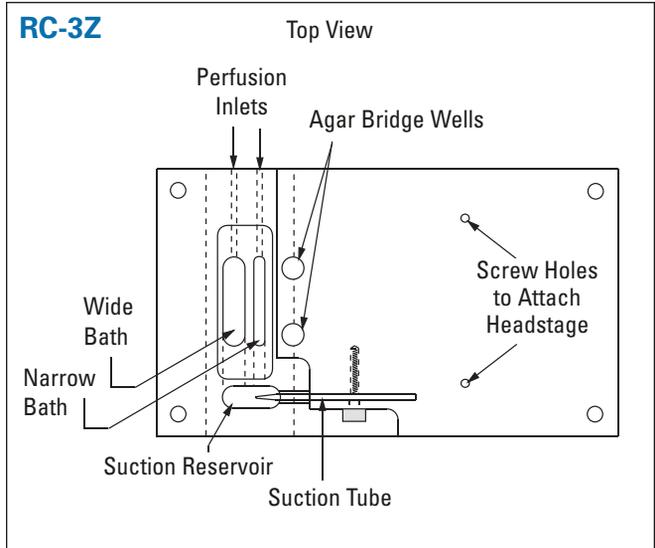
RC-3Z

Oocyte Recording Chamber

A simple, low-cost chamber for studies of oocytes and other large cell structures



RC-3Z Chamber shown with the Warner 7251 I Bath Clamp Headstage



- Specially designed for oocyte studies
- Features two slot-shaped bath wells
- Allows fast solution exchange and easy cell access
- Adjustable solution height

The RC-3Z features two slotted bath wells; a narrow bath for applications requiring rapid solution exchange, and a wider bath allowing good electrode access. The chamber is constructed using a two-piece design. The top piece forms the chamber body and contains a solution aspiration reservoir. The bottom piece forms the floor of the chamber and houses the oocyte work area. An agar bridge well with connecting channel to the input side of the bath is also provided. An isolated well is provided on the downstream side of the bath, however, most users place the sense electrode directly into the suction well.

The perfusion inputs accept standard polyethylene tubing (PE-160). Solutions are removed from the suction well via an adjustable suction tube and solution height is set by raising or lowering this suction tube. The suction tube out-port connects to 1.67 mm ID tubing. Threaded holes are incorporated in the chamber body for mounting of the OC-725C bath headstage.

Each chamber includes 10 feet of polyethylene (PE-160) tubing.

Specifications

Chamber material	Polycarbonate
Footprint (L x W)	13 x 7.7 cm (5.1 x 3 in)
Chamber floor insert (L x W x H)	75 x 25 x 1 mm, polycarbonate
Narrow bath dimension (L x W x H)	27 x 3.2 x 3.2 mm
Narrow bath volume, by depth	85 µl/mm
Wide bath dimension (L x W x H)	27 x 6.3 x 3.2 mm
Wide bath volume, by depth	170 µl/mm
Input tubing (ID x OD)	1.14 x 1.57 mm (PE-160)
Aspirator coupling	1.67 mm (OD)

BPM-1

Steel Base Plate



BPM-1 shown with components of our TEV-700 Oocyte voltage clamp workstation

This solid steel plate provides a stable platform for mounting micromanipulators mounted on magnetic bases. A highly durable powder coating applied to the surface makes it impervious to most common spills in the lab.

Specifications

Dimensions	30.5 x 61.0 x 0.95 cm (12 x 24 x 3/8 inch)
Weight:	14.06 kg (31 lb)

Order #	Model	Product
W4 64-0319	RC-3Z	Oocyte Chamber
Optional Accessories		
W4 64-0755	PE-160/10	Polyethylene Tubing
W4 64-1586	BPM-1	Base Plate Magnetic Steel
W4 64-0206	MP-2	Perfusion Manifold, 2 Inputs
W4 64-0207	MP-3	Perfusion Manifold, 3 Inputs
W4 64-0208	MP-4	Perfusion Manifold, 4 Inputs
W4 64-0209	MP-5	Perfusion Manifold, 5 Inputs
W4 64-0210	MP-6	Perfusion Manifold, 6 Inputs
W4 64-0211	MP-8	Perfusion Manifold, 8 Inputs

RC series-legacy design

RC-10, RC-11, RC-13 and RC-16

RC Series Recording Chambers

Legacy, large bath chambers suitable for oocyte studies



These chambers are open bath chambers suitable for physiological experiments performed with inverted or dissecting microscopes, including patch and oocyte recording, isolated perfused tubule, and cell impalement studies. RC chambers have also been used with fluorescence microscopy.

RC Series chambers are made from polycarbonate. A #2 thickness coverslip (24 x 60 mm, user attached) becomes the floor of the bath. The coverslip can be attached with vacuum grease or more permanently with Sylgard or RTV cement. Models vary in bath diameter.

Solution can be introduced via gravity-feed and removed via suction, or alternatively, input and output can be pump-controlled. Flow rates can exceed 10 ml/min with gravity feed. The perfusion input accepts standard 1.57 mm OD polyethylene tubing (PE-160). Solutions are removed from a separate suction reservoir to minimize noise in the recording chamber. The suction tube height is adjustable to control the bath solution level.

Multiple perfusion lines can be connected using an MP series manifold, see page 101, in place of the single-line connector supplied with the chamber. An isolated reservoir is provided for an agar bridge in the recording ground circuit.

RC-10

This small chamber with 10 mm diameter bath is recommended where small volumes and fast solution exchange is important. Bath volume is 160 μ l at 2 mm solution height. A single agar bridge well is supplied.

RC-11, RC-13 and RC-16

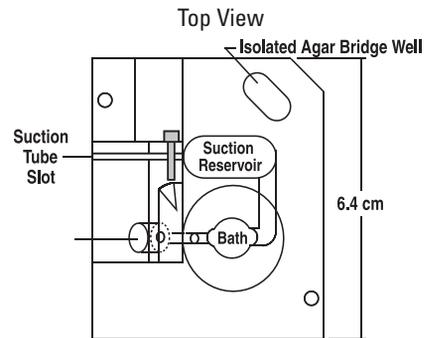
These larger bath chambers are used for studies of slices, oocytes, or other large preparations. Models RC-13 and RC-16 may also be used in patch clamp experiments where cultured coverslips are placed in the chamber.* The RC-13 accepts 12 mm diameter coverslips and the RC-16 accepts 15 mm diameter coverslips. A groove is milled in the chamber underside to hold the coverslip in place.

* Note: The double thickness of glass (bottom + sample coverslips) may not be compatible with some short working distance microscope objectives.

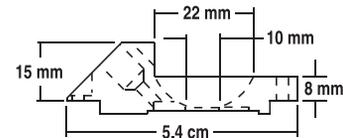
Mounting the Chamber

RC Series chambers are mounted onto a microscope using one of the stage adapters on the following page. Each chamber is supplied with one single input perfusion connector, one suction tube and one package of #2 coverslips (24 x 60 mm). See page 70 for additional coverslips.

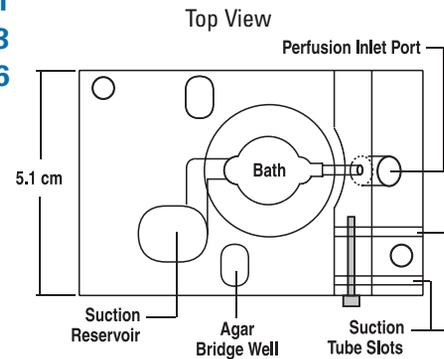
RC-10



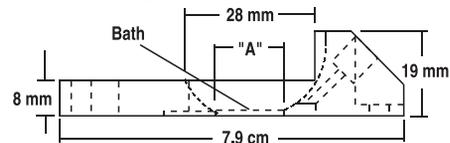
Side View



RC-11 RC-13 RC-16



Side View

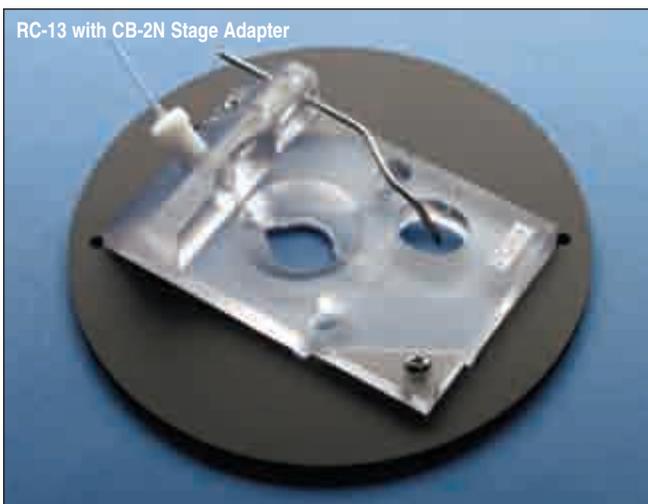


RC-11: A=11 mm, Vol.= 190 μ l
RC-13: A=13 mm, Vol.= 260 μ l
RC-16: A=16 mm, Vol.= 400 μ l

Order #	Model	Product
W4 64-0306	RC-10	Open Bath Chamber/10 mm Bath
W4 64-0307	RC-11	Open Bath Chamber/11 mm Bath
W4 64-0308	RC-13	Open Bath Chamber/13 mm Bath
W4 64-0309	RC-16	Open Bath Chamber/16 mm Bath

RC series-legacy design

RC Series Stage Adapters



RC Series stage adapter bases are made for a variety of microscopes. Standard models fit the most commonly used stage on the microscope model cited. However, microscopes are often fitted with optional or special purpose stages. Refer to the outline drawings to determine the correct adapter for your microscope. Modified or special size adapters can be ordered, call our technical support department for details. Material is polycarbonate.

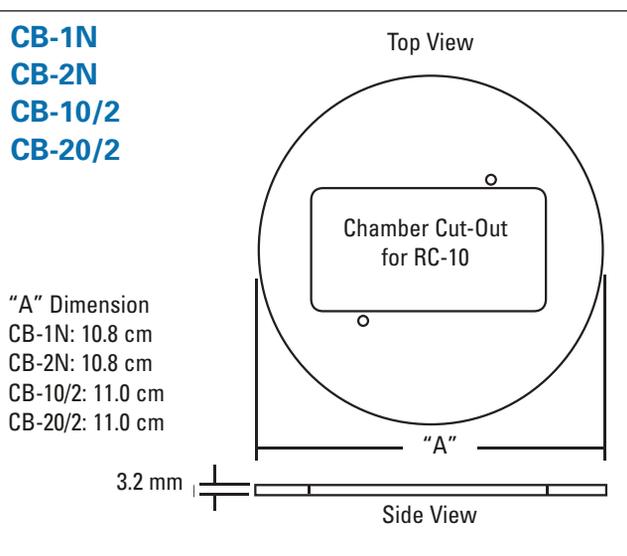
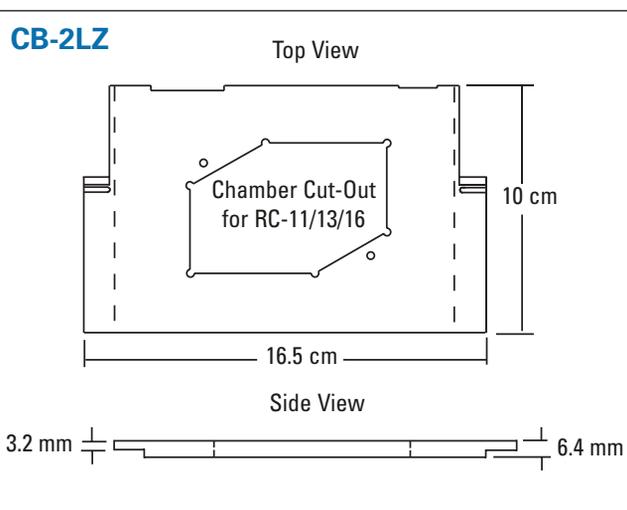
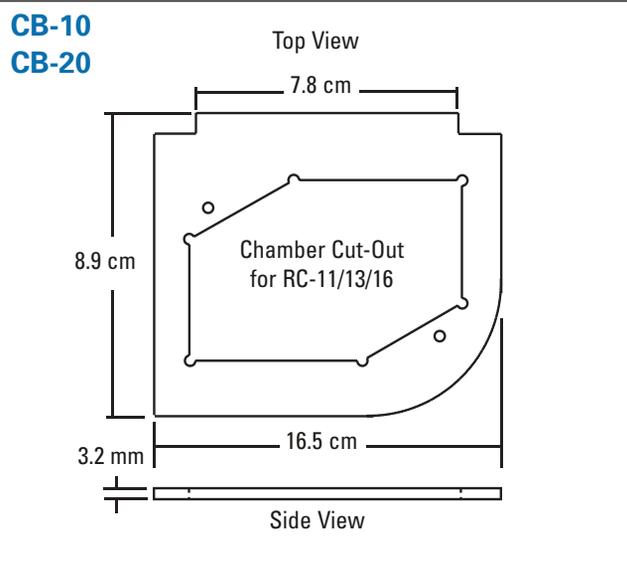
Order #	Model	Product
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RC-10 Adapters

W4 64-0311	CB-1N	Nikon for Diaphot/TE200/TE300
W4 64-0312	CB-10	Olympus for IMT
W4 64-0313	CB-10/2	Olympus for IMT-2/IX-50/IX-70

RC-11/13/16 Adapters

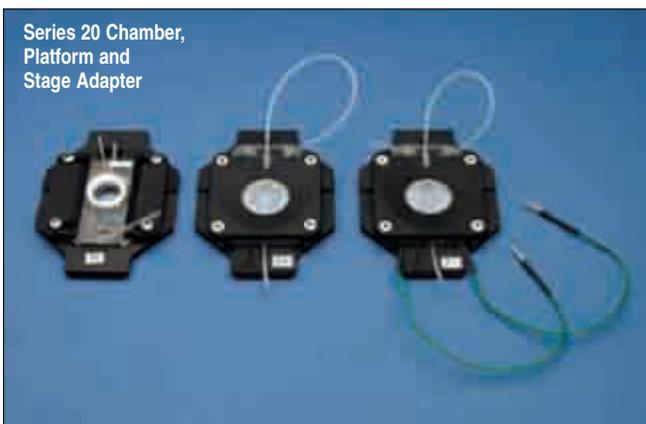
W4 64-0314	CB-2N	Nikon for Diaphot/TE200/TE300
W4 64-0315	CB-20	Olympus for IMT
W4 64-0316	CB-20/2	Olympus for IMT-2/IX-50/IX-70
W4 64-0317	CB-2LZ	Zeiss for Axiovert



series 20 chambers

Series 20 Perfusion Chambers for Imaging and Recording

General Information



Modular Design

Series 20 chambers are a family of models designed to fill a large number of imaging and recording needs. The modular design of Series 20 chambers consists of two parts; a polycarbonate chamber (insert) and an aluminum platform (holder). The platform clamps onto the chamber providing a seal between the chamber and coverslip. Platforms come in both heater and non-heater styles and heater platforms are used where chamber warming is required. The platform design allows quick removal of the chamber for exchange of the coverslip. A variety of bath sizes and shapes are offered to provide a ready solution to many research requirements. Most models are stocked in depth for fast delivery.

Single Coverslip Design

A common feature of Series 20 chambers is the use of a disposable coverslip as the bottom or floor of the chamber. In many cases, this same coverslip will contain the cells to be studied. Thus, when used with an inverted microscope, the image is viewed through a single coverslip (#1 thickness, nominally 0.15 mm).

Laminar Flow-Fast Exchange

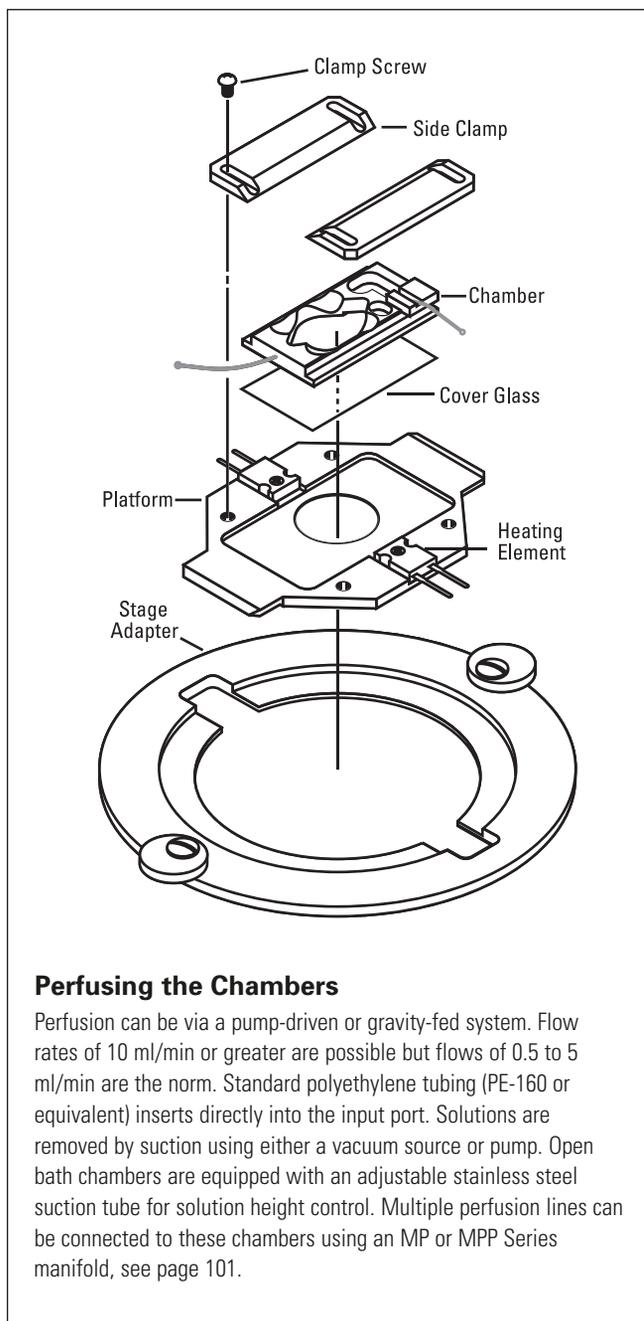
A diamond-shape bath is incorporated into many Series 20 chambers (models thru RC-26) to provide linear solution flow. Studies performed at both Yale and Stanford Universities have shown that this shape produces a laminar flow across the bath. The general shape is shown on p. x and specific dimensions are provided in each chamber specification. In general, the lower the ratio of bath width (W) to bath length (L), the better the flow characteristics. Models with small bath volumes can have exchange times measured in seconds even with flow rates less than 1 ml/min. Larger models, starting with the RC-27, use a slotted bath shape. These chambers are designed for slice studies and other applications requiring a larger volume bath.

Chamber Materials

In addition to the traditional polycarbonate construction of Series 20 chambers, Warner now provides select chambers fabricated in polysulfone and silicone. This polysulfone has the same high-quality machining characteristics as polycarbonate but is more resistant to solvents, and more importantly, is autoclavable.

Assembly of Chamber

The chamber is prepared by applying a thin layer of vacuum grease to the chamber bottom. The sample coverslip (sample side up) is then attached to the chamber. This assembly is then placed in the platform and clamped to provide a seal between coverslip and chamber. Mounting on the microscope is done with the appropriate stage adapter. The installation is completed by connecting the perfusion lines and any heater cabling required. Assembly of the closed type chambers includes installation of the top coverslip which precedes the steps outlined above.



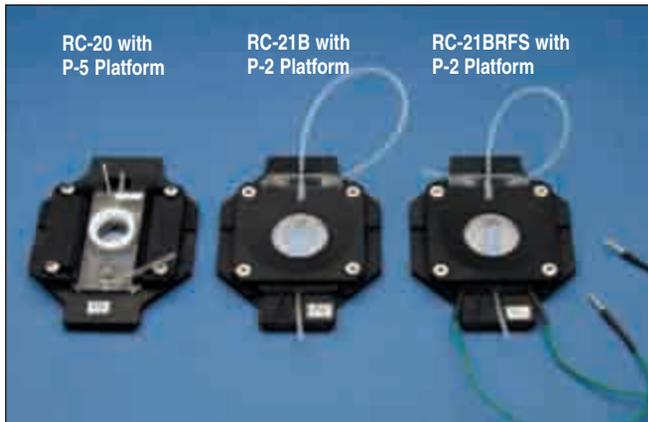
Perfusing the Chambers

Perfusion can be via a pump-driven or gravity-fed system. Flow rates of 10 ml/min or greater are possible but flows of 0.5 to 5 ml/min are the norm. Standard polyethylene tubing (PE-160 or equivalent) inserts directly into the input port. Solutions are removed by suction using either a vacuum source or pump. Open bath chambers are equipped with an adjustable stainless steel suction tube for solution height control. Multiple perfusion lines can be connected to these chambers using an MP or MPP Series manifold, see page 101.

series 20 chambers

Series 20 Perfusion Chambers for Imaging and Recording

General Information (continued)



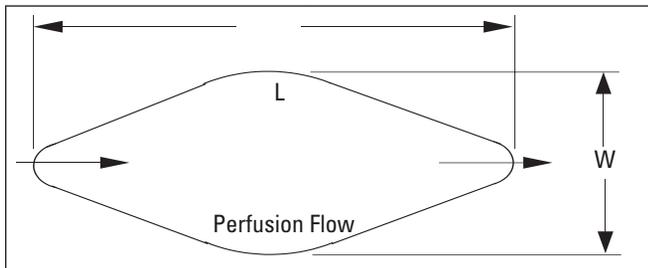
Closed Bath Design

Series 20 Closed Bath Chambers use coverslips at both the top and bottom to enclose the bath area. The closed bath promotes a uniform solution exchange and eliminates changes in focus due to alterations in bath height. In addition, studies involving physiological bicarbonate buffers can be performed with no gas loss at the chamber interface. Closed chambers have been used in fluorescent, calcium and time-lapse imaging studies.

Open Bath Design

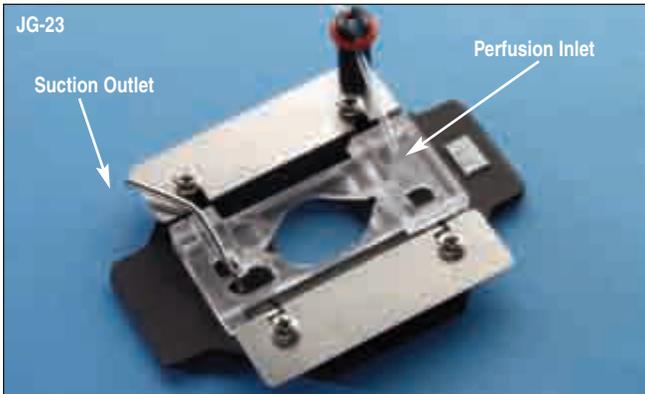
Open bath models are designed for electrophysiological recording and/or optical imaging, and are used in applications including patch clamp, oocyte clamp, and physiological measurements on cell cultures and tissue preparations. The low profile design permits good electrode access to the bath. Agar bridge wells for reference electrodes are provided.

Laminar Flow Geometry



All Series 20 chambers equipped with a stainless steel suction tube now include a suction tube clamp. This insures the adjustable tube will not move once the solution height is set.

Sloped inflow allows for a smooth delivery of solution to the chamber



Using the JG-23 chamber this image of an isolated colonic crypt was acquired on a Zeiss spinning disk confocal. The crypt was loaded with BCECF to measure intracellular pH. Image courtesy of John Geibel.

- Eliminates vibration associated with solution exchange
- Incorporates Warner's diamond fluidics
- Multiplexes solution delivery without switching artifacts

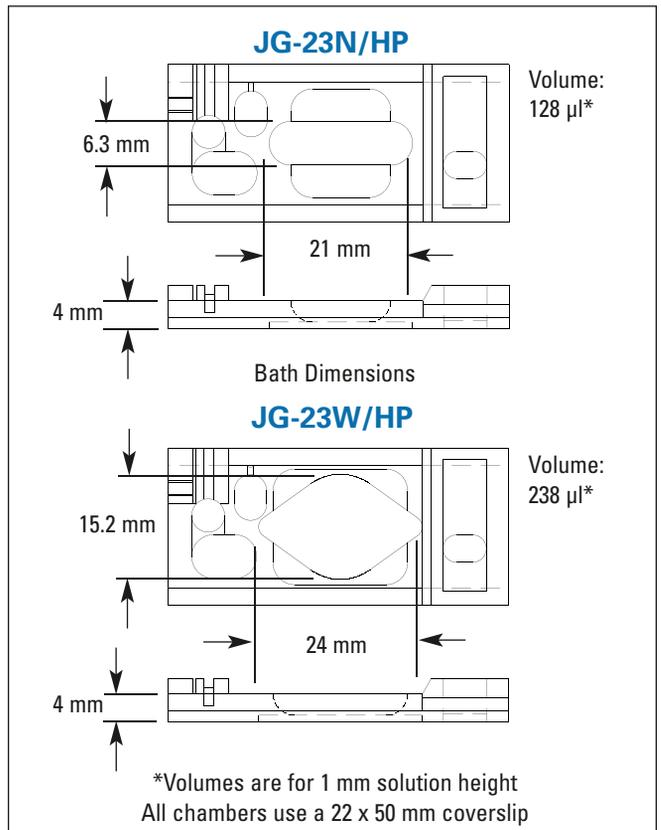
The JG-23 has been designed especially for researchers planning multiple solution changes while attempting to maintain a tight optical focus on the specimen during an experiment. The design of this chamber eliminates vibrations associated with solution delivery that could cause specimens or optical fields to fluctuate during recordings.

The JG-23 Series chambers incorporate the same advanced design as the Series 20 diamond shaped chambers. A large imaging field allows for maximal observation of biological specimens with the addition of a sloped input. The advantage of this system over other chambers is the addition of a sloped inflow which allows for a smooth and "ultra-quiet" delivery of solution to the chamber.

The sloped input allows I-V type infusion lines to be used that can deliver fixed drops per sec to the chamber without the introduction of noise to the specimen field. In addition, multiplexed solution delivery is possible without solution switching artifacts.

Each chamber includes two magnetic plates, a magnetic perfusion tube holder, one pack of #1 thickness coverslips (CS-22/50, 22x50 mm, 85/pkg), and 10 ft of polyethylene (PE-160) tubing.

Slice anchors are available for both the JG-23W/HP and JG-23W/LP. See page 71 for details.



Order #	Model	Product
W4 64-1486	JG-23N/HP	Ultra-quiet Chamber High Profile, Narrow Bath
W4 64-1487	JG-23W/HP	Ultra-quiet Chamber High Profile, Wide Bath
W4 64-1488	JG-23W/LP	Ultra-quiet Chamber Low Profile, Wide Bath

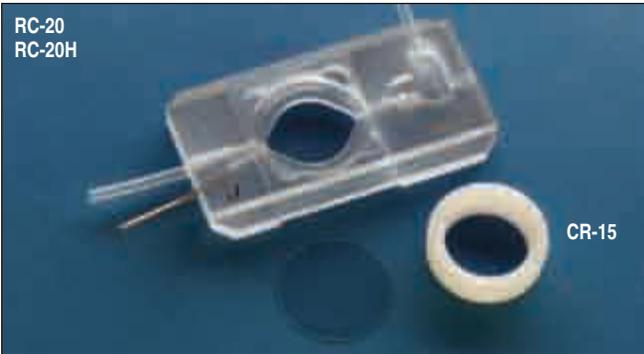
Order #	Model	Product
Accessories and Replacement Parts		
W4 64-0277	P-1	Platform, non-heated
W4 64-0284	PH-1	Platform, heated
W4 64-1526	PM-1	Platform, heated magnetic
W4 64-0253	SHD-26GH/10	Slice Anchor for RC-26G (1.0 mm)
W4 64-0254	SHD-26GH/15	Slice Anchor for RC-26G (1.5 mm)
W4 64-0255	SHD-26GH/20	Slice Anchor for RC-26G (2 mm)
W4 64-0708	CS-22/50	Coverslips, 22 x 50 mm
W4 64-0755	PE-160/10	Polyethylene Tubing

series 20 chambers

RC-20 and RC-20H

Small Volume Closed Bath Imaging Chambers

Polycarbonate chambers featuring fast solution exchange and linear solution flow



- Closed bath design
- Our smallest volume, closed bath chambers
- Ideal for fluorescent, calcium, and time-lapse imaging studies

The RC-20 and RC-20H are very small volume imaging chambers featuring fast perfusion exchange and short working distance. The smaller and narrower RC-20 insures linear solution flow and fast exchange while the RC-20H features a larger viewing area. An access port (Hamilton syringe compatible)* at the bath input may be used to inject substances into the solution flow or to remove gas bubbles.

Two 15 mm round coverslips enclose the bath. The distance between the top and bottom coverslips is 1 mm. The top coverslip is secured into place with a retainer ring.

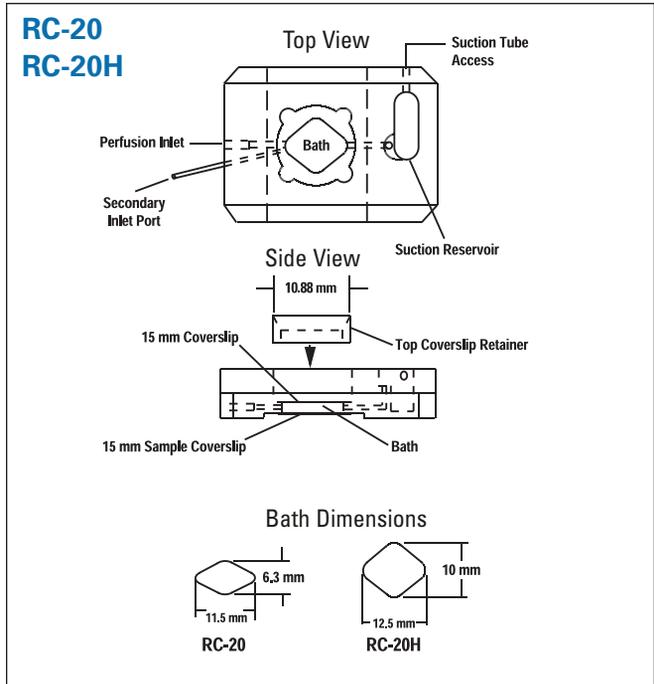
Studies involving physiological bicarbonate buffers can be performed with these chambers with no gas loss at the chamber interface. In addition, the closed design allows the use of permeable supports. With laminar flow, minimal distortion of the sample will occur during perfusion.

RC-20 and RC-20H chambers require a platform (P-5, PH-5, or PM-5) and stage adapter to complete the assembly for mounting onto a microscope.

Each chamber is supplied with a package of #1 thickness glass coverslips (CS-15R, 15 mm diameter, 100/pkg), 10 feet of PE-160 tubing, and a CR-15 top coverslip retaining ring.

* 25 gauge (0.45 mm OD) needle

Specifications	RC-20	RC-20H
Material	Polycarbonate	Polycarbonate
Bath dimensions (L x W)	11.5 x 6.3 mm	12.5 x 10 mm
Volume, by depth	48 μ l	90 μ l
Top coverglass	15 mm round	15 mm round
Bottom coverglass	15 mm round	15 mm round
Injection port (ID x OD)	0.56 x 0.91 mm, stainless steel	0.56 x 0.91 mm, stainless steel
Input tubing (ID x OD)	1.14 x 1.57 mm (PE-160)	1.14 x 1.57 mm (PE-160)
Output tubing (ID x OD)	1.14 x 1.57 mm (PE-160)	1.14 x 1.57 mm (PE-160)



Order #	Model	Product
W4 64-0222	RC-20	Small Volume Imaging Chamber
W4 64-0223	RC-20H	Small Volume Imaging Chamber
W4 64-0281	P-5	Platform, non-heated
W4 64-0288	PH-5	Platform, heated
W4 64-1564	PM-5	Platform, heated magnetic
Accessories and Replacement Parts		
W4 64-0755	PE-160/10	Polyethylene Tubing
W4 64-0703	CS-15R	Coverslips, 15 mm
W4 64-0276	CR-15	Replacement Coverslip Retainer
W4 64-0274	RH-2	Heater Elements (2) for PH (Heater) Platforms with Mounting Pads and Screws
W4 64-0273	SS-3	Slice Support for RC-27L and RC-29
W4 64-0271	TS-30G	Glass Thermistor (Alternate to TS-70B)
W4 64-0269	TS-60P	Probe Thermistor for CC-28 Cable
W4 64-0270	TS-70B	Bead Thermistor for CC-28 Cable

RC-21B and RC-21BR series 20 chambers

Large Closed Diamond Bath

Large viewing area and good access for microscope objectives

Chambers

series 20 chambers



- Closed bath 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

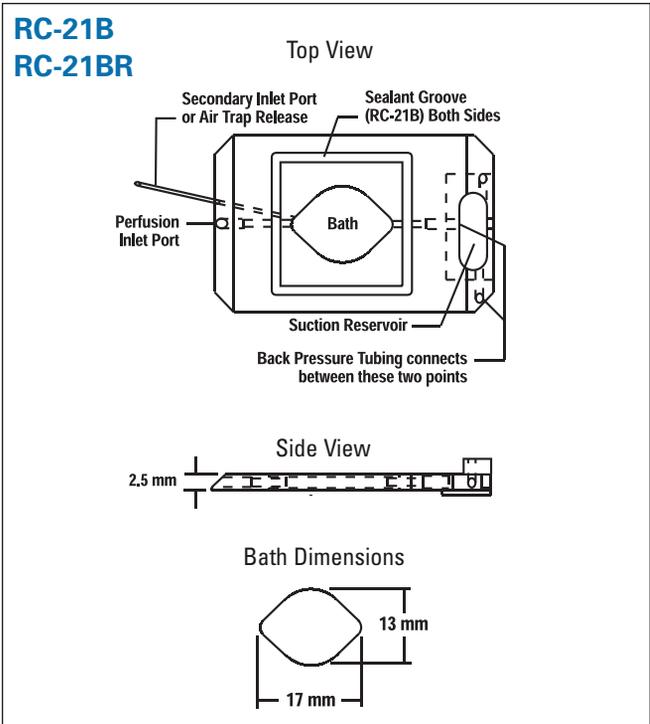
The RC-21B and RC-21BR chambers feature a closed bath, short working distance, and linear solution flow. Separation between the top and bottom coverslip is 2.5 mm and total bath volume is 358 μ l. At the bath output, a length of tubing is used as a back pressure control to insure smooth flow. An additional stainless steel port at the bath input fits a standard Hamilton microliter syringe.* This port is useful for injecting substances or for removing air bubbles from the sealed chamber.

Studies involving physiological bicarbonate buffers can be performed with these chambers with no gas loss at the chamber interface. With laminar flow, minimal distortion of the sample occurs during perfusion.

RC-21B and RC-21BR chambers require a platform (P-2, PH-2, or PM-2) and stage adapter to complete the assembly for mounting onto a microscope.

Each chamber is supplied with a package of #1 thickness glass coverslips (CS-22S and CS-25R, respectively, 100/pkg) and 10 feet of PE-160 polyethylene tubing.

* 25 gauge (0.45 mm OD) needle



Specifications	RC-21B	RC-21BR
Material	Polycarbonate or polysulfone*	Polycarbonate or polysulfone*
Bath dimensions (L x W x H)	17 x 13 x 2.5 mm	17 x 13 x 2.5 mm
Volume	358 μ l	358 μ l
Top coverglass	22 mm square	25 mm round
Bottom coverglass	22 mm square	25 mm round
Injection port (ID x OD)	0.56 x 0.91 mm, stainless steel	0.56 x 0.91 mm, stainless steel
Input tubing (ID x OD)	1.14 x 1.57 mm (PE-160)	1.14 x 1.57 mm (PE-160)
Output tubing (ID x OD)	1.14 x 1.57 mm (PE-160)	1.14 x 1.57 mm (PE-160)

* Please call for price and availability of polysulfone chambers.

Order #	Model	Product
W4 64-0224	RC-21B	Large Bath Imaging Chamber
W4 64-0225	RC-21BR	Large Bath Imaging Chamber
W4 64-0278	P-2	Platform, non-heated
W4 64-0285	PH-2	Platform, heated
W4 64-1561	PM-2	Platform, heated magnetic

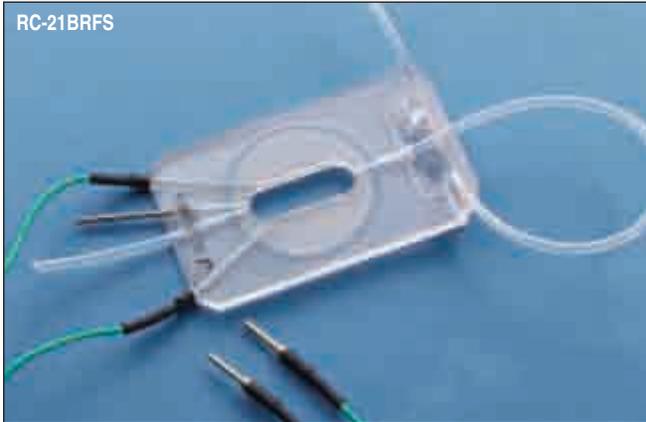
Accessories and Replacement Parts

W4 64-0755	PE-160/10	Polyethylene Tubing
W4 64-0704	CS-22S	Coverslips, 22 mm, square
W4 64-0705	CS-25R	Coverslips, 25 mm, round

RC-21BRFS series 20 chambers

Chamber with Slotted Bath for Field Stimulation

Imaging chamber designed for field stimulation studies



- Designed for field stimulation studies involving cardiac myocytes
- Closed bath design
- Small volume with slotted bath
- Ideal for fluorescent, calcium, and time-lapse imaging studies

The RC-21BRFS is a small volume, closed bath imaging chamber designed for field stimulation studies. It uses a pair of 25 mm round coverslips to form the top and bottom of the chamber, and the total bath volume is 263 μ l. Separation between top and bottom coverslips is 2.3 mm. Two platinum wire electrodes are attached to the parallel sides of the oval-shaped bath. The connecting wires are 15 cm long and are terminated in 1 mm pins.

An additional stainless steel port at the bath input fits a standard Hamilton microliter syringe.* This port may be used to inject substances into the flow path or to remove air bubbles from the sealed chamber. At the bath output, a length of tubing is used as a back pressure control to insure smooth flow.

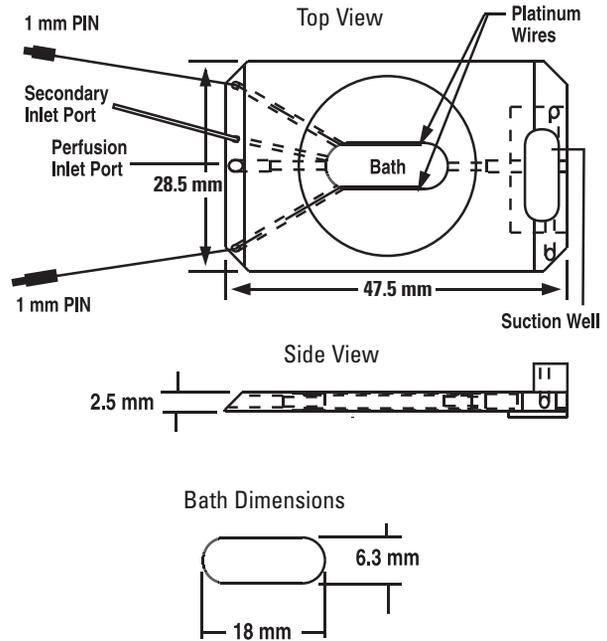
The RC-21BRFS chamber requires a platform (P-2, PH-2, or PM-2) and stage adapter to complete the assembly for mounting onto a microscope.

Each RC-21BRFS chamber is supplied with a package of CS-25R glass coverslips (#1 thickness, 25 mm diameter, 100/pkg) and 10 feet of PE-160 polyethylene tubing.

* 25 gauge (0.45 mm OD) needle

The SIU-102 is a bipolar stimulator designed for use with field stimulation chambers. This instrument features constant current and constant voltage modes, as well as bipolar, pulse, and DC modes. Optical coupling is used to electronically isolate the stimulator from the pulse source. Currents up to 100 mA and voltages up to 100 V are also supported. See page 247 for details.

RC-21BRFS



Specifications

Material	Polycarbonate or polysulfone
Bath dimensions (L x W x H)	18.0 x 6.3 x 2.3 mm
Volume	263 μ l
Electrodes	Platinum wire, 15 cm leads with 1 mm pins
Top coverglass	25 mm round
Bottom coverglass	25 mm round
Injection port (ID x OD)	0.56 x 0.91 mm, stainless steel
Input tubing (ID x OD)	1.14 x 1.57 mm (PE-160)
Output tubing (ID x OD)	1.14 x 1.57 mm (PE-160)

Order #	Model	Product
W4 64-0226	RC-21BRFS	Imaging Chamber with Field Stimulation
W4 64-0278	P-2	Platform, non-heated
W4 64-0285	PH-2	Platform, heated
W4 64-1561	PM-2	Platform, heated magnetic

Accessories and Replacement Parts

W4 64-0755	PE-160/10	Polyethylene Tubing
W4 64-0705	CS-25R	Coverslips, 25 mm round #1 thick, Box of 100

series 20 chambers

RC-21BDW

Open Diamond Bath

Chambers

series 20 chambers

Open, diamond shaped bath with wicked solution removal



RC-21BDW shown in a P-2 platform

- Designed for physiological measurements on cell cultured coverslips
- Identical to the RC-21BRW except for a diamond shaped bath
- Uses a 25 mm round coverslip as the chamber floor
- Diamond shaped bath provides laminar solution flow
- Quiet operation
- Wicked solution removal from bath
- Can be used with upright or inverted microscopes

The low profile design of the RC-21BDW permits good electrode access to the chamber bath. Constant solution level and quiet operation are assured with the use of a wick between the chamber bath and suction well. With laminar flow, the sample is minimally distorted during perfusion. Bath volume is 143 μ l for each mm of solution height.

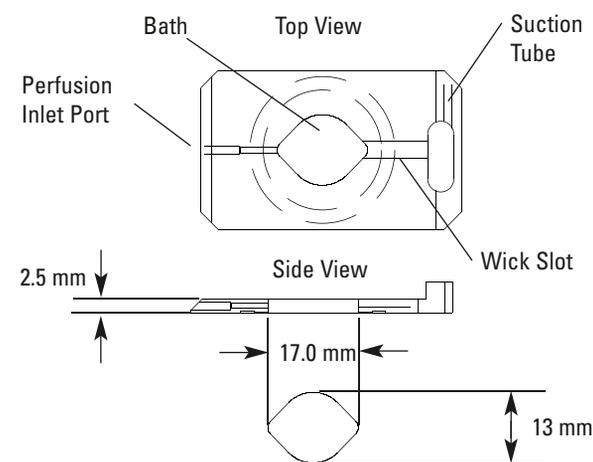
The RC-21BDW chamber requires a platform (P-2, PH-2, or PM-2) and stage adapter to complete the assembly for mounting onto a microscope.

Each RC-21BDW chamber is supplied with a package of #1 thickness glass coverslips (CS-25R, 25 mm diameter, pkg. of 100) and 10 feet of PE-160 polyethylene tubing.

Specifications

Material	Polycarbonate
Bath dimensions (L x W x H)	17 x 13 x 2.5 mm
Volume, by depth	143 μ l/mm
Bottom coverglass	25 mm round
Input tubing (ID x OD)	1.14 x 1.57 mm (PE-160)
Output tubing (ID x OD)	1.14 x 1.57 mm (PE-160)

RC-21BDW

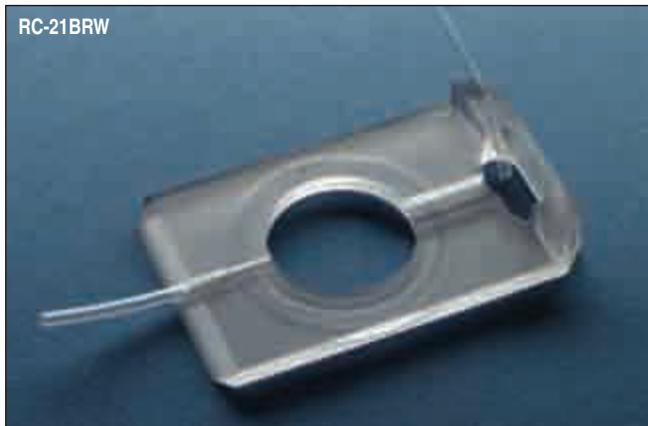


Order #	Model	Product
W4 64-0362	RC-21BDW	Open Chamber for 25 mm Round Coverslips
W4 64-0278	P-2	Platform, non-heated
W4 64-0285	PH-2	Platform, heated
W4 64-1561	PM-2	Platform, heated magnetic

Accessories and Replacement Parts

W4 64-0755	PE-160/10	Polyethylene Tubing
W4 64-0705	CS-25R	Coverslips, 25 mm round, #1 thick, Box of 100

Large round, open bath for maximum imaging area



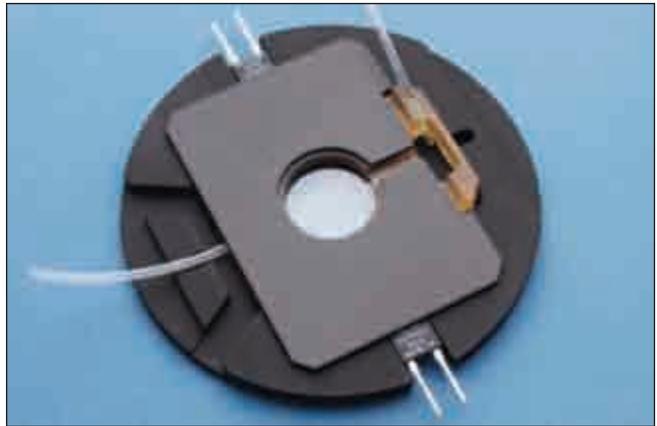
- Designed for physiological measurements on cell cultured coverslips
- Uses a 25 mm round coverslip as the chamber floor
- Quiet operation
- Broad imaging area
- Wicked solution removal from bath
- Can be used with upright or inverted microscopes

The RC-21BRW is an open bath recording chamber using a 25 mm round coverslip as the chamber bottom. The wide, round aperture of the RC-21BRW maximizes the viewing area on the coverslip and enables excellent access for electrodes. Constant solution level and quiet operation are assured with the use of a wick between the chamber bath and suction well. Bath volume is 240 µl for 1 mm solution height.

The low profile design of the RC-21BRW and its platform are useful for use with large objectives and will accommodate either upright or inverted microscopes. The large imaging area (17 mm diameter) increases the likelihood of viewing cell features located along the periphery of the chamber.

The RC-21BRW chamber requires a platform (P-2, PH-2 or PM-2) and stage adapter to complete the assembly for mounting on a microscope.

Each chamber includes a pack of #1 thickness glass coverslips (CS-25R, 25 mm diameter, 100/pkg) and 10 feet of PE-160 tubing.



RC-21BRW shown in a PM-2 platform

RC-21BRW

Dimensions of the RC-21BRW are the same as the RC-21BDW (see facing page) except bath is 17.4 mm round.

Specifications

Material	Polycarbonate
Bath dimension (D x H)	17.4 x 2.5 mm
Volume, by depth	240 µl/mm
Bottom coverglass	25 mm round
Input tubing (ID x OD)	1.14 x 1.57 mm (PE-160)
Output tubing (ID x OD)	1.14 x 1.57 mm (PE-160)

Order #	Model	Product
W4 64-0227	RC-21BRW	Open Chamber for 25 mm Round Coverslip
W4 64-0278	P-2	Platform, non-heated
W4 64-0285	PH-2	Platform, heated
W4 64-1561	PM-2	Platform, heated magnetic

Accessories and Replacement Parts

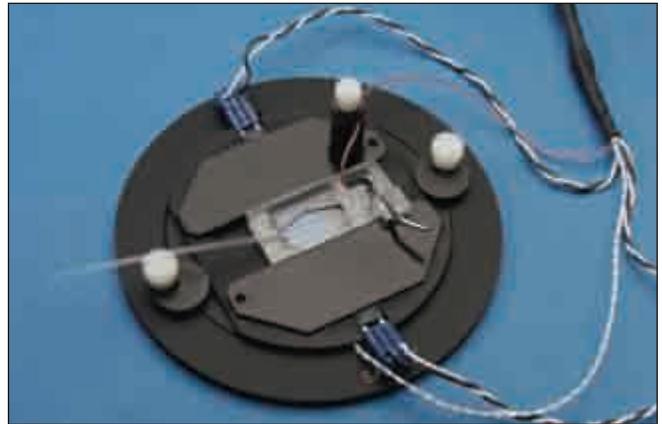
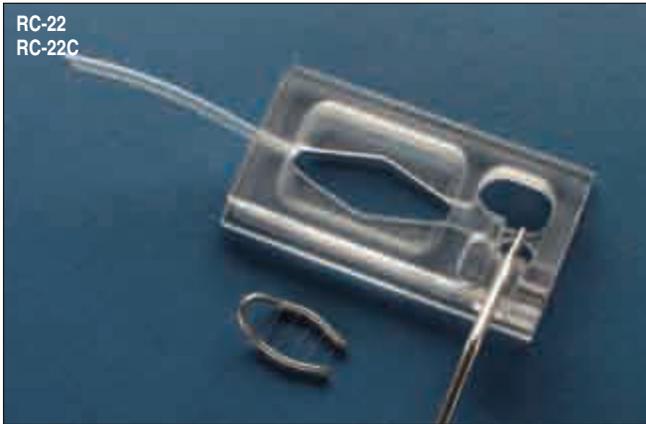
W4 64-0755	PE-160/10	Polyethylene Tubing
W4 64-0705	CS-25R	Coverslips, 25 mm round, #1 thick, Box of 100

series 20 chambers

RC-22 and RC-22C

Open Diamond Bath for Tissue Slice Studies

Small volume, open bath recording chambers designed for tissue and brain slice studies



RC-22 shown in a PM-1 heated platform

- Designed for tissue slice or cultured cell studies
- Applications include patch clamp, intracellular/extracellular recordings, and imaging
- Diamond shaped bath provides laminar solution flow
- Small bath volume facilitates rapid solution exchange
- Slice anchor included

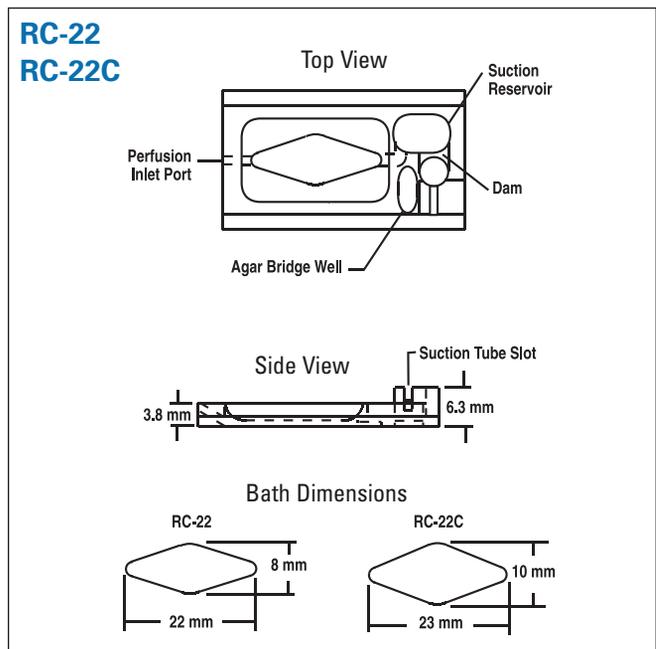
The RC-22 and RC-22C are small volume, open bath recording chambers designed for tissue and brain slice studies. The diamond shaped chamber bath facilitates laminar solution flow.

Slices are secured via a supplied stainless steel anchor (or harp). The RC-22 comes with an SHD-22L/15 anchor, and the RC-22C comes with an SHD-22CL/15 anchor harp. Threads are made of Lycra and have a spacing of 1.5 mm. While anchor mass (typically 300 milligrams) is sufficient to secure a slice into place, Warner anchors rely on a close fit between the anchor body and the chamber sidewall. This feature can reduce stress on the anchored slice.

Solution aspiration is via a stainless steel suction tube which is secured by a clamp insuring the adjustable-height suction tube will not move once set by the user. Each chamber has an agar bridge well for reference electrodes and the working volume of the RC-22 and RC-22C is 115 μ l and 138 μ l, respectively. Chamber sidewalls have a height of 1.2 mm to assist with electrode access and placement.

The RC-22 and RC-22C chambers require a platform (P-1, PH-1, or PM-1) and stage adapter to complete the assembly for mounting onto a microscope. The bottom-forming coverslip is 22 x 40 mm.

Each chamber is supplied with a slice anchor, a swatch of nylon mesh, a pack of #1 thickness glass coverslips (CS-22/40, 22 x 40 mm, 50/pkg) and 10 feet of PE-160 tubing.



Specifications	RC-22	RC-22C
Material	Polycarbonate or polysulfone*	Polycarbonate or polysulfone*
Bath dimensions (L x W x H)	22 x 8 x 3.8 mm	23 x 10 x 3.8 mm
Volume, by depth	115 μ l/mm	138 μ l/mm
Bottom coverglass	22 x 40 mm	22 x 40 mm
Input tubing (ID x OD)	1.14 x 1.57 mm (PE-160)	1.14 x 1.57 mm (PE-160)
Aspirator coupling	1.67 mm (OD)	1.67 mm (OD)

* Please call for price and availability of polysulfone chambers.

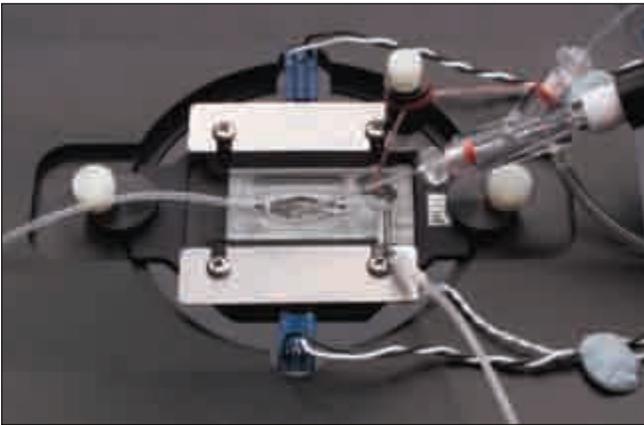
series 20 chambers

RC-22 and RC-22C

Open Diamond Bath for Tissue Slice Studies (continued)



Shown above is a typical complete system, which includes an RC-22 chamber, heated platform, dual channel temperature controller, in-line solution heater, connecting cable and a stage adapter.



RC-22 chamber with slice anchor and patch electrode

Order #	Model	Product
W4 64-0228	RC-22	Recording Chamber for Tissue Slice with SHD-22L/15 Anchor
W4 64-0229	RC-22C	Recording Chamber for Tissue Slice with SHD-22CL/15 Anchor
W4 64-0277	P-1	Platform, non-heated
W4 64-0284	PH-1	Platform, heated
W4 64-1526	PM-1	Platform, heated magnetic
Accessories and Replacement Parts		
W4 64-0755	PE-160/10	Polyethylene Tubing
W4 64-0707	CS-22/40	Coverslips, 22 x 40 mm #1, 50/box
W4 64-0246	SHD-22L/15	Slice Anchor, 1.5 mm
W4 64-0247	SHD-22CL/15	Slice Anchor, 1.5 mm
W4 64-0198		Nylon mesh, 12 pieces, 7 x 7 cm
Slice Anchor Kits		
W4 64-0263	SHD-22Kit	Slice Anchor Kit
W4 64-0264	SHD-22CKit	Slice Anchor Kit

series 20 chambers

RC-24 and RC-24E

Fast Exchange Open Diamond Bath Chambers

Our smallest, open bath chambers for very fast solution times



- Designed for physiological measurements of cell cultured coverslips
- Applications include patch clamp, imaging and intracellular/extracellular recordings
- Diamond shaped bath provides laminar solution flow
- Both perfusion and aspiration ports on same side of chamber
- Very small bath volume facilitates very fast solution exchange

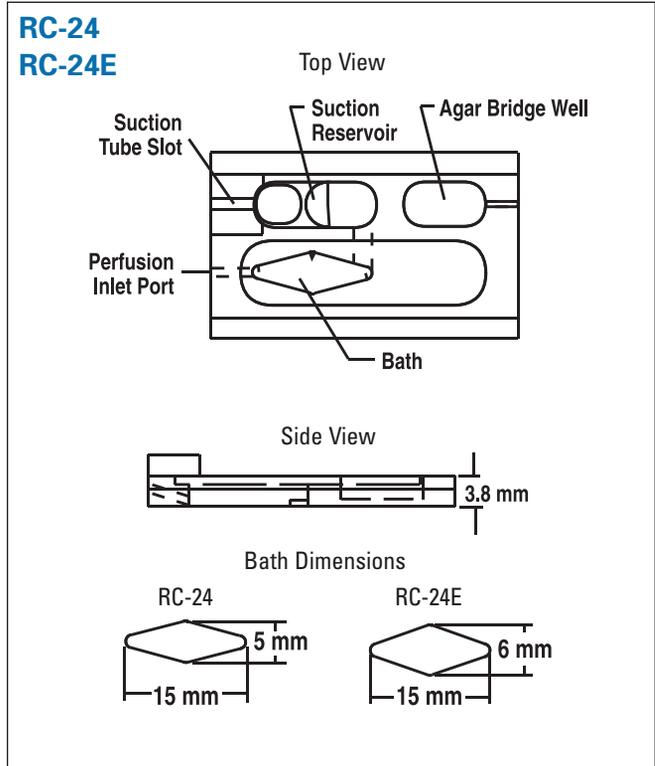
The bath volume in these models is among the smallest of the open style chambers. This enables very fast solution exchange for a variety of applications, including patch clamp and electrophysiology studies. The small bath volumes are especially useful when using drugs in small quantities.

The RC-24 and RC-24E have an unusual characteristic in that both the perfusion inlet and aspiration outlet is on the same side of the chamber. This allows the associated perfusion lines to be conveniently placed on only one side and facilitates electrode placement.

An agar bridge well for reference electrodes is provided, as is an aspiration well. The aspiration well is equipped with a stainless steel aspiration tube (1.67 mm OD) together with a tube clamp. The clamp insures that the adjustable suction tube will not move once the height is set by the user.

The floor of each chamber can be formed from either a 22 mm square coverslip or from a 22 x 40 mm rectangular coverslip. Each chamber requires a platform (P-1, PH-1, or PM-1) and a stage adapter to complete the assembly for mounting on a microscope.

Each chamber is supplied with a package of #1 thickness glass coverslips (CS-22/40, 22 x 40 mm, 50/pkg) and 10 feet of PE-160 tubing.



Specifications	RC-24	RC-24E
Material	Polycarbonate	Polycarbonate
Bath dimensions (L x W x H)	15 x 5 x 3.8 mm	15 x 6 x 3.8 mm
Volume, by depth	40 μ l/mm	50 μ l/mm
Bottom coverglass	22 x 40 mm	22 x 40 mm
Input tubing (ID x OD)	1.14 x 1.57 mm (PE-160)	1.14 x 1.57 mm (PE-160)
Aspirator coupling	1.67 mm (OD)	1.67 mm (OD)

Order #	Model	Product
W4 64-0230	RC-24	Fast Exchange Recording Chamber
W4 64-0231	RC-24E	Fast Exchange Recording Chamber
W4 64-0277	P-1	Platform, non-heated
W4 64-0284	PH-1	Platform, heated
W4 64-1526	PM-1	Platform, heated magnetic

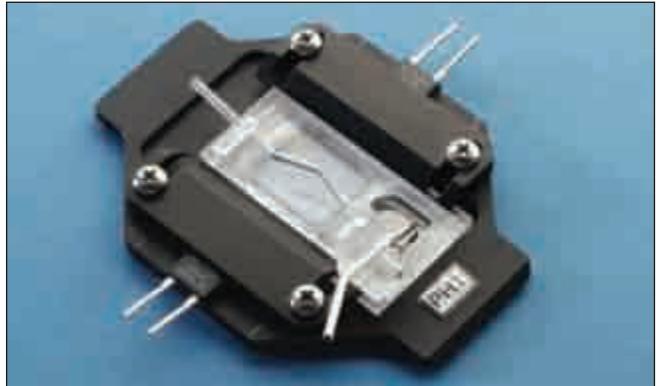
Accessories and Replacement Parts		
W4 64-0755	PE-160/10	Polyethylene Tubing
W4 64-0707	CS-22/40	Coverslips, 22 x 40 mm #1, Box of 50
W4 64-0704	CS-22S	Coverslips, 22 x 22 mm

RC-24N

series 20 chambers

Open Diamond Bath for Fast Fluid Exchange

A small, open bath chamber with diamond shaped fluidics



RC-24N shown in a PH-1 heated platform

- Designed for physiological measurements of cell cultured coverslips
- Applications include patch clamp, intracellular/extracellular recordings, and imaging
- Diamond shaped bath provides laminar solution flow
- Very small bath volume facilitates very fast solution exchange

The RC-24N chamber design is taken from the RC-24 and improves the flow characteristics by providing a linear path. The bath volume in this model is among the smallest of the open style chambers. This enables very fast solution exchange for a variety of applications, including patch clamp and electrophysiology studies. The small bath volume is especially useful when using drugs in small quantities.

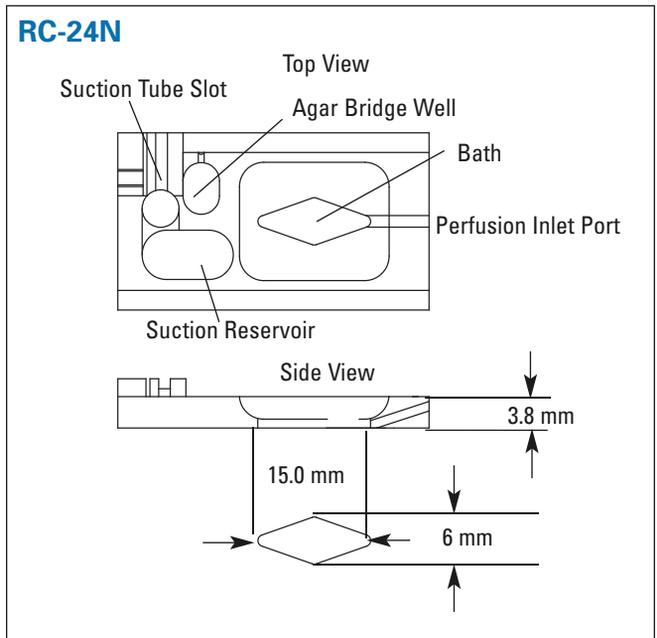
An agar bridge well for reference electrodes is provided, as is an aspiration well. The aspiration well is equipped with a stainless steel aspiration tube (1.67 mm OD) together with a tube clamp. The clamp insures that the adjustable suction tube will not move once the height is set by the user. The chamber floor is formed from a 22 x 40 mm rectangular coverslip.

The RC-24N requires a platform (P-1, PH-1, or PM-1) and stage adapter to complete the assembly for mounting on a microscope.

Each chamber is supplied with a package of #1 thickness glass coverslips (CS-22/40, 22 x 40 mm, 50/pkg) and 10 feet of PE-160 tubing.

Specifications

Material	Polycarbonate
Bath dimensions (L x W x H)	15 x 6 x 3.8 mm
Volume, by depth	54 µl/mm
Bottom coverglass	22 x 40 mm
Input tubing (ID x OD)	1.14 x 1.57 mm (PE-160)
Aspirator coupling	1.67 mm (OD)



Order #	Model	Product
W4 64-0381	RC-24N	Fast Exchange Recording Chamber
W4 64-0277	P-1	Platform, non-heated
W4 64-0284	PH-1	Platform, heated
W4 64-1526	PM-1	Platform, heated magnetic

Accessories and Replacement Parts

W4 64-0755	PE-160/10	Polyethylene Tubing
W4 64-0707	CS-22/40	Coverslips, 22 x 40 mm #1, Box of 50

series 20 chambers

RC-25 and RC-25F

Round Coverslip Chambers

Open diamond bath polycarbonate recording chambers designed for round coverslips

Chambers

series 20 chambers



- Designed for physiological measurements of cell cultured coverslips
- Applications include patch clamp, intracellular/extracellular recordings and imaging
- Uses 12 or 15 mm round coverslips as the chamber floor
- Diamond shaped bath provides laminar solution flow
- Small bath volume facilitates fast solution exchange

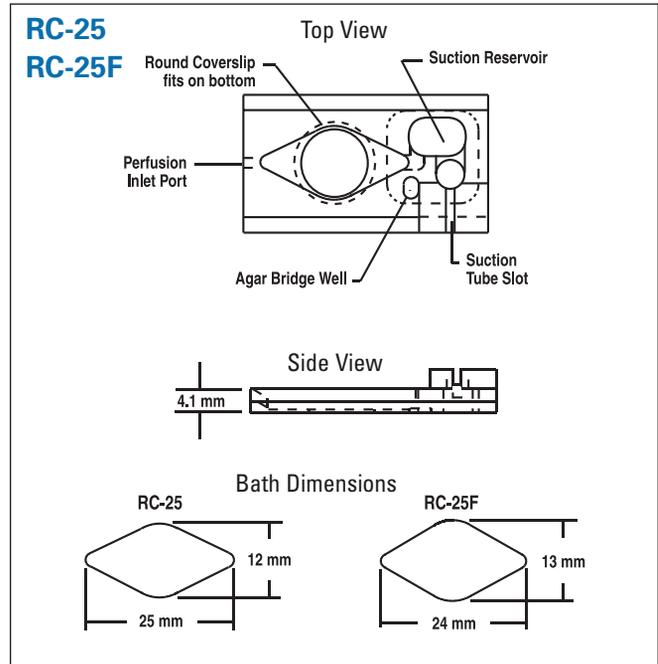
The design of the RC-25 and RC-25F chambers incorporates a diamond-shaped bath which has been shown to produce a laminar flow. Since the bath volumes of these chambers is small (90 $\mu\text{l}/\text{mm}$ and 133 $\mu\text{l}/\text{mm}$ for the RC-25 and RC-25F, respectively), fluid exchange times are measured in seconds even when flow rates are less than 1 ml/min.

The RC-25 works equally well with either 12 or 13 mm diameter coverslips while the RC-25F uses 15 mm coverslips. In general, these coverslips are used to form the bottom of the chamber bath.

NOTE: These chambers are not designed for insertion of coverslips from the top.

The RC-25 requires a platform (P-3, PH-3, or PM-3) and the RC-25F requires a platform (P-4, PH-4, or PM-4). Both chambers require a stage adapter to complete the assembly for mounting onto a microscope.

Each chamber is supplied with a package of #1 thickness glass coverslips (CS-12R; 12 mm round for the RC-25, CS-15R; 15 mm round for the RC-25F; 100/pkg) and 10 feet of polyethylene (PE-160) tubing.



Specifications

	RC-25	RC-25F
Material	Polycarbonate or polysulfone*	Polycarbonate or polysulfone*
Bath dimensions (L x W x H)	25 x 12 x 4.1 mm	24 x 13 x 4.1 mm
Volume, by depth	90 $\mu\text{l}/\text{mm}$	133 $\mu\text{l}/\text{mm}$
Bottom coverglass	12 or 13 mm round	15 mm round
Input tubing (ID x OD)	1.14 x 1.57 mm (PE-160)	1.14 x 1.57 mm (PE-160)
Aspirator coupling	1.67 mm (OD)	1.67 mm (OD)

* Please call for price and availability of polysulfone chambers.

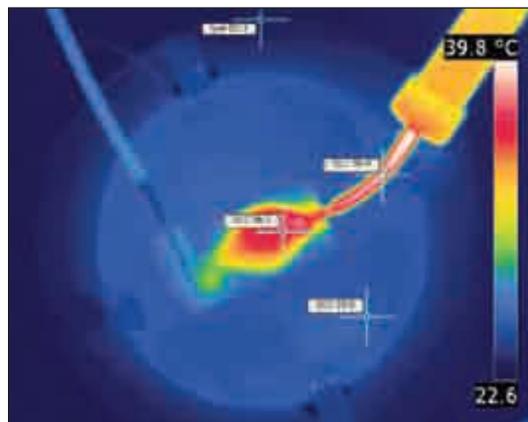
Order # Model Product

W4 64-0232	RC-25	Round Coverslip Recording Chamber
W4 64-0233	RC-25F	Round Coverslip Recording Chamber
W4 64-0279	P-3	Platform, non-heated, for RC-25
W4 64-0286	PH-3	Platform, heated, for RC-25
W4 64-1562	PM-3	Platform, heated magnetic, for RC-25
W4 64-0280	P-4	Platform, non-heated, for RC-25F
W4 64-0287	PH-4	Platform, heated, for RC-25F
W4 64-1563	PM-4	Platform, heated magnetic, for RC-25F

Accessories and Replacement Parts

W4 64-0755	PE-160/10	Polyethylene Tubing
W4 64-0702	CS-12R	Coverslips, 12 mm
W4 64-0703	CS-15R	Coverslips, 15 mm

Designed for studies of cell cultured coverslips on upright microscopes



Thermograph demonstrating bath temperature of RC-26GLP with in-line heater. Platform heaters turned off, and the flow rate set to 2 ml/min.

- Applications include patch clamp, intracellular/extracellular recordings and imaging
- Extra-low profile facilitates electrode access
- Diamond shaped bath provides laminar solution flow
- Broad optical imaging area
- Can be used with either upright or inverted microscopes

The RC-26GLP is a low profile version of the RC-26G recording chamber. The sides of this chamber have been milled to a height of only 2 mm and the lower profile provides extra clearance for upright microscopes, water immersion objectives and permits good electrode access to the chamber bath.

The chamber floor is comprised of a 22 x 40 mm coverslip. The working volume is 234 μ l per 1.0 mm of solution height. The chamber is equipped with a stainless steel suction tube together with clamp. The clamp insures that the adjustable aspirator tube will not move once the height is set by the user.

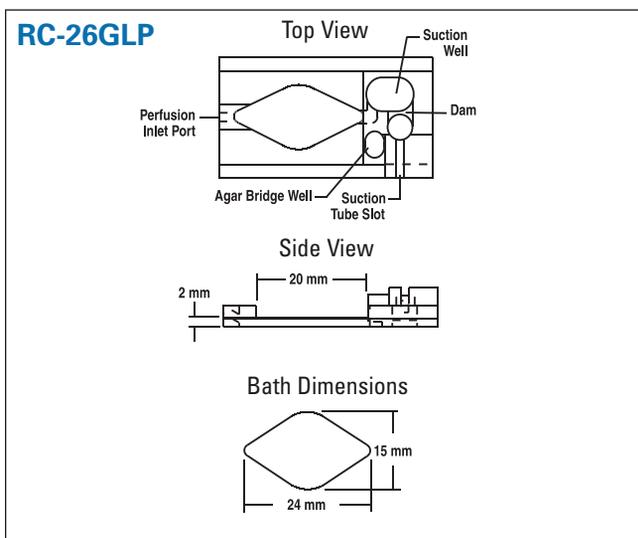
The RC-26GLP chamber requires a platform (P-1, PH-1 or PM-1) and stage adapter to complete the assembly for mounting onto a microscope.

Each RC-26GLP chamber is supplied with a package of CS-22/40 glass coverslips (#1 thickness, 22 x 40 mm, 100/pkg) and 10 feet of PE-160 tubing.

Specifications

Material	Polycarbonate or polysulfone*
Bath dimensions (L x W x H)	24 x 15 x 2 mm
Volume, by depth	234 μ l/mm
Bottom coverglass	22 x 40 mm
Input tubing (ID x OD)	1.14 x 1.57 mm (PE-160)
Aspirator coupling	1.67 mm (OD)

* Please call for price and availability of polysulfone chambers.



Order #	Model	Product
W4 64-0236	RC-26GLP	Low Profile Large Bath Recording Chamber
W4 64-0277	P-1	Platform, non-heated
W4 64-0284	PH-1	Platform, heated
W4 64-1526	PM-1	Platform, heated magnetic

Accessories and Replacement Parts

W4 64-0755	PE-160/10	Polyethylene Tubing
W4 64-0707	CS-22/40	Coverslips, 22 x 40 mm

Optional Slice Anchors

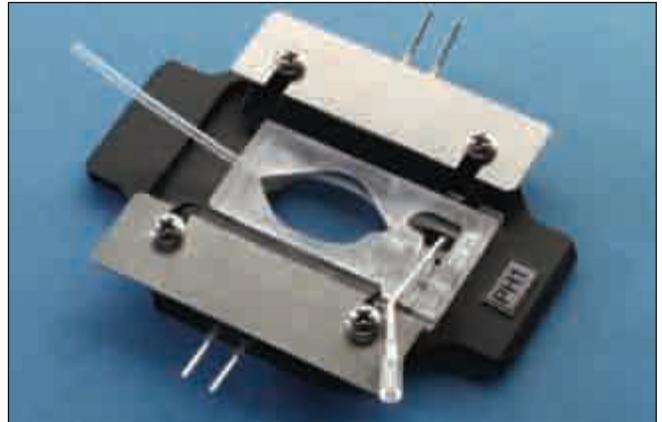
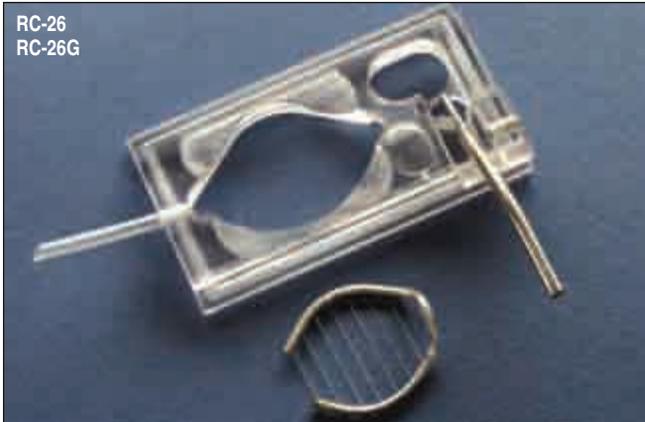
W4 64-0253	SHD-26H/10	Slice anchor for RC-26G (1.0 mm)
W4 64-0254	SHD-26H/15	Slice anchor for RC-26G (1.5 mm)
W4 64-0255	SHD-26GH2	Slice anchor for RC-26G and RC-26GLP (2 mm)

series 20 chambers

RC-26 and RC-26G

Chambers with Coverslip Insertion Option

Supports greater bath depth than the RC-26GLP



RC-26 shown in a PH-1 heated platform

- Designed for patch clamp studies
- Can be used with tissue slice samples or cell cultured coverslips
- Tissue slice anchors available
- Applications include patch clamp, intracellular/extracellular recordings and imaging
- Diamond shaped bath provides laminar solution flow
- Large imaging area
- Can be used with upright or inverted microscopes

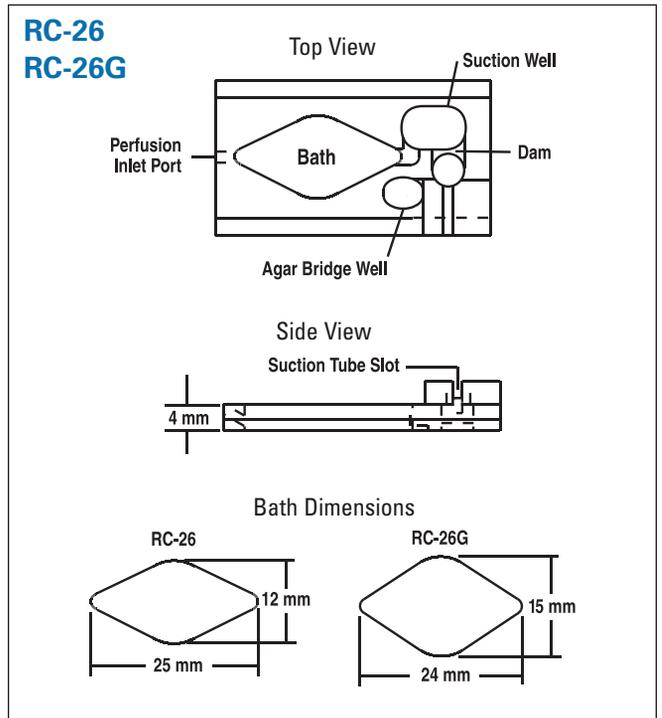
The RC-26 and RC-26G chambers are designed to be used with cells cultured onto glass coverslips or with tissue and brain slice samples. The broad imaging area of these chambers (12 x 25 mm and 15 x 24 mm for the RC-26 and RC-26G, respectively) provides excellent access for both electrodes and water-immersion objectives. The diamond shaped geometry facilitates laminar solution flow throughout the bath area.

The large bath of these chambers allows coverslips to be inserted into the top opening and removed at the end of the experiment. The RC-26 and RC-26G chambers can accept a 12 or 15 mm diameter coverslip, respectively. The working volumes, for 1 mm solution height, of the RC-26 and RC-26G model chambers are 170 and 234 μ l, respectively.

Large tissue samples can also be placed directly into the chamber. Slice anchor hold downs are available for tissue slice studies. Anchors are available with Lycra thread spacing at 1.0, 1.5, and 2.0 mm.

Both chambers require a platform (P-1, PH-1, or PM-1) and stage adapter to complete the assembly for mounting on a microscope. The chamber floor consists of a 22 x 40 mm coverslip.

Each chamber is supplied with a package of #1 thickness glass coverslips (CS-22/40, 22 x 40 mm, 50/pkg) and 10 feet of PE-160 tubing.



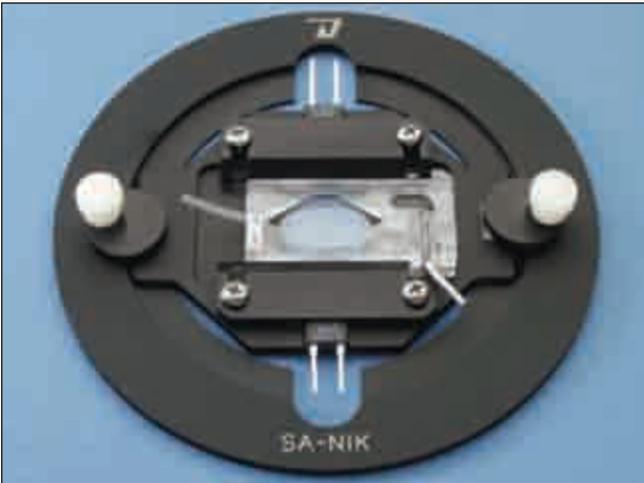
Specifications	RC-26	RC-26G
Material	Polycarbonate or polysulfone*	Polycarbonate or polysulfone*
Bath dimensions (L x W x H)	25 x 12 x 4 mm	24 x 15 x 4 mm
Volume, by depth	170 μ l/mm	234 μ l/mm
Bottom coverglass	22 x 40 mm	22 x 40 mm
Input tubing (ID x OD)	1.14 x 1.57 mm (PE-160)	1.14 x 1.57 mm (PE-160)
Aspirator coupling	1.67 mm (OD)	1.67 mm (OD)

* Please call for price and availability of polysulfone chambers.

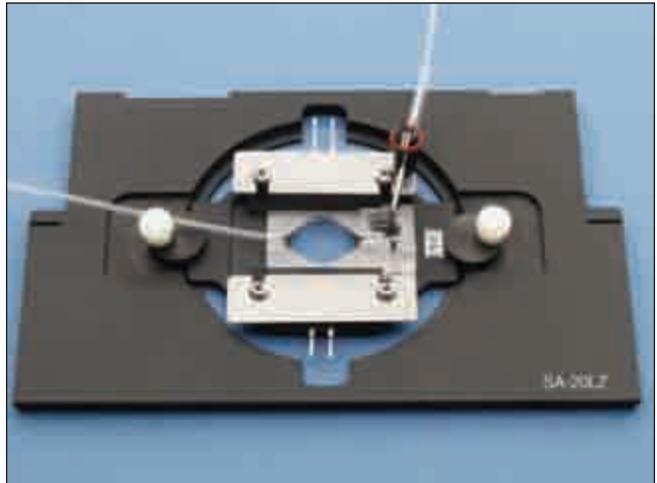
series 20 chambers

RC-26 and RC-26G

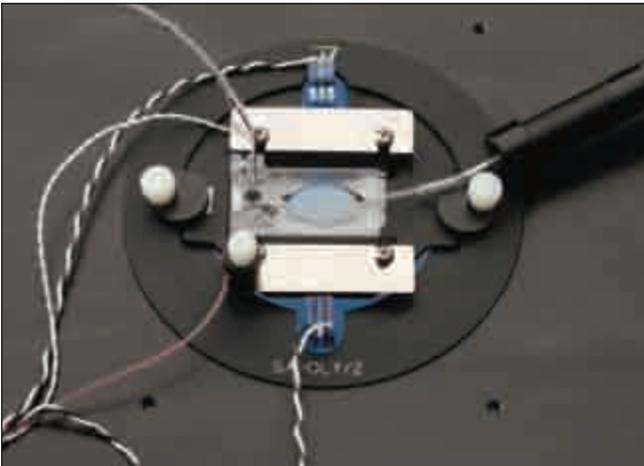
Chambers with Coverslip Insertion Option (continued)



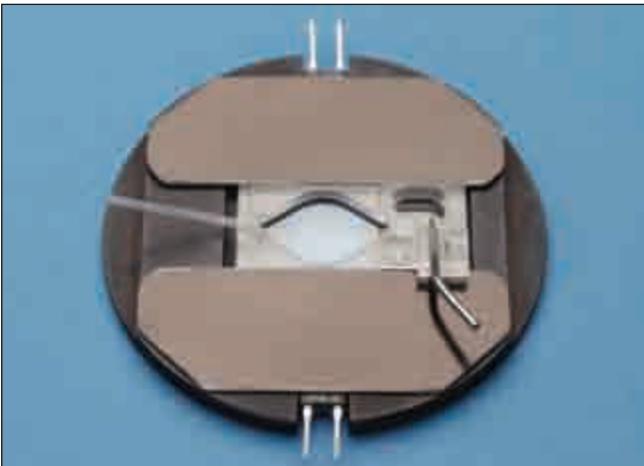
Model RC-26G chamber shown in a PH-1 heated platform on a stage adapter for a Nikon inverted microscope.



Model RC-26G chamber shown in a PH-1 heated platform with optional magnetic platform clamps on a stage adapter for a Zeiss inverted microscope.



Model RC-26G chamber on a microscope stage with in-line heater and CC-28 cable with thermistor feedback, (a typical set-up).



New PM-1 Heated platform with magnetic clamps, no screws needed to secure chamber to platform.

Modular Design

The modular design of all Warner Series 20 chambers permit them to be mounted on just about any microscope stage, including those with a weight restriction.

Order #	Model	Product
W4 64-0234	RC-26	Large Bath Recording Chamber
W4 64-0235	RC-26G	Large Bath Recording Chamber
W4 64-0277	P-1	Platform, non-heated
W4 64-0284	PH-1	Platform, heated
W4 64-1526	PM-1	Platform, heated magnetic

Accessories and Replacement Parts

W4 64-0250	SHD-26H/10	Slice Anchor for RC-26 (1.0 mm)
W4 64-0251	SHD-26H/15	Slice Anchor for RC-26 (1.5 mm)
W4 64-0252	SHD-26H/20	Slice Anchor for RC-26 (2.0 mm)
W4 64-0253	SHD-26GH/10	Slice Anchor for RC-26G (1.0 mm)
W4 64-0254	SHD-26GH/15	Slice Anchor for RC-26G (1.5 mm)
W4 64-0255	SHD-26GH/20	Slice Anchor for RC-26G (2.0 mm)
W4 64-0755	PE-160/10	Polyethylene Tubing
W4 64-0707	CS-22/40	Coverslips, 22 x 40 mm

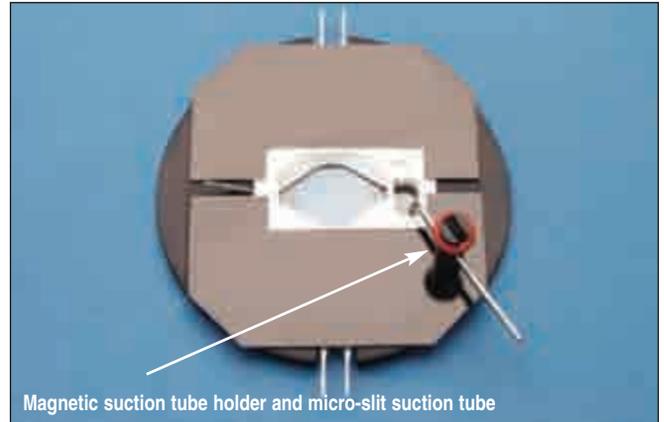
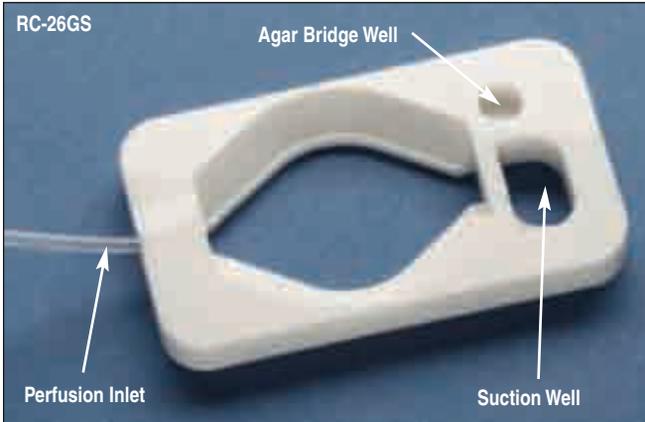
RC-26GS series 20 chambers

Silicone Imaging Chamber

Chambers

series 20 chambers

The classic RC-26G chamber offered in a disposable silicone format



RC-26GS shown in a PM-8 platform

- Eliminates the need for a grease seal
- Incorporates Warner's diamond fluidics
- Low cost for disposable applications

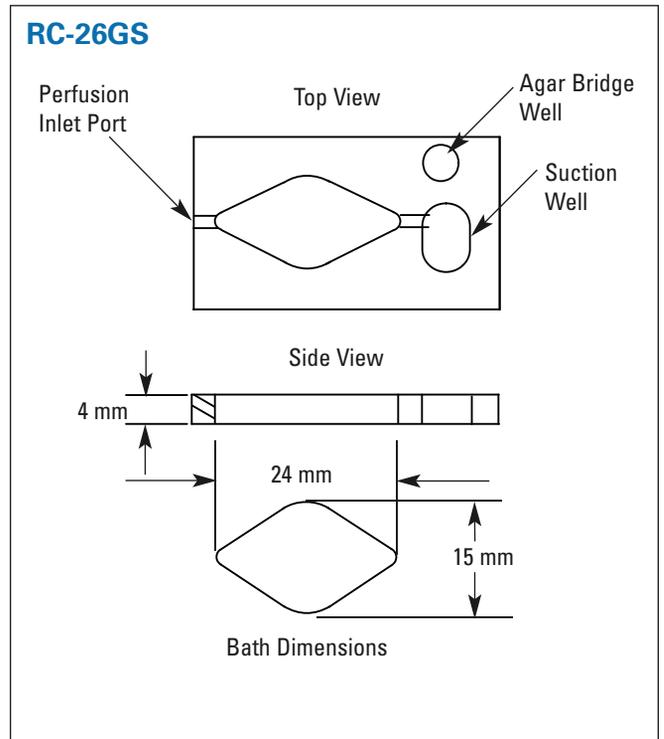
The RC-26G chamber has been one of Warner Instruments most popular recording and imaging chambers. We now offer this classic chamber in a disposable silicone-based format. While disposable, the RC-26GS can be cleaned and reused until it becomes contaminated or the material fails. This feature minimizes the cost-per-use of this chamber. The format of this new chamber carries with it all of the features of the classic RC-26G design, including the use of a 22 x 40 mm coverslip for the chamber floor.

A special PM-8 magnetic platform is required to secure the RC-26GS silicone chamber and coverslip together. The new platform also features several new innovations. See pages 59 and 60 for details.

The RC-26GS silicone chamber enables excellent access for both water-immersion objectives and for electrodes when used with an upright microscope. The bath volume of the RC-26GS is 234 μ l/mm. The large diamond-shaped bath area (15 x 24 mm) allows for the insertion and removal 15 mm round coverslips. Large samples can also be directly placed into this chamber.

The RC-26GS silicone chamber and platform requires a stage adapter to complete the assembly for mounting onto a microscope.

Chambers are packaged in lots of two and are supplied with an ST-3 suction tube, a MAG-2 magnetic clamp (for suction tubes), a pack of #1 thickness glass coverslips (CS-22/40, 22x40 mm, 50/pkg.), and 10 feet of PE-160 tubing.



Specifications

Material	Medical grade silicone
Bath dimensions (L x W x H)	24 x 15 x 4 mm
Volume, by depth	234 μ l/mm
Bottom coverglass	22 x 40 mm
Input tubing (ID x OD)	1.14 x 1.57 mm (PE-160)
Aspirator coupling	1.67 mm (OD)

Order #	Model	Product
W4 64-1534	RC-26GS	Chamber Large Bath Silicone pack of 2
W4 64-1531	PM-8	Chamber Platform Magnetic

Accessories and Replacement Parts

W4 64-0359	MAG-2	Magnetic Clamp for suction tubes
W4 64-1406	ST-3	Suction Tube micro slit design
W4 64-0707	CS-22/40	Coverslips #1 thickness 22 x 40 mm
W4 64-0755	PE-160/10	Polyethylene Tubing

The RC-26 with the addition of two agar bridge wells for oocyte work



RC-26Z shown in a P-1 platform

- Designed for TEV oocyte recording
- Diamond shaped bath provides laminar solution flow
- Large optical imaging area
- Can be used with either upright or inverted microscopes
- Tissue slice anchors available

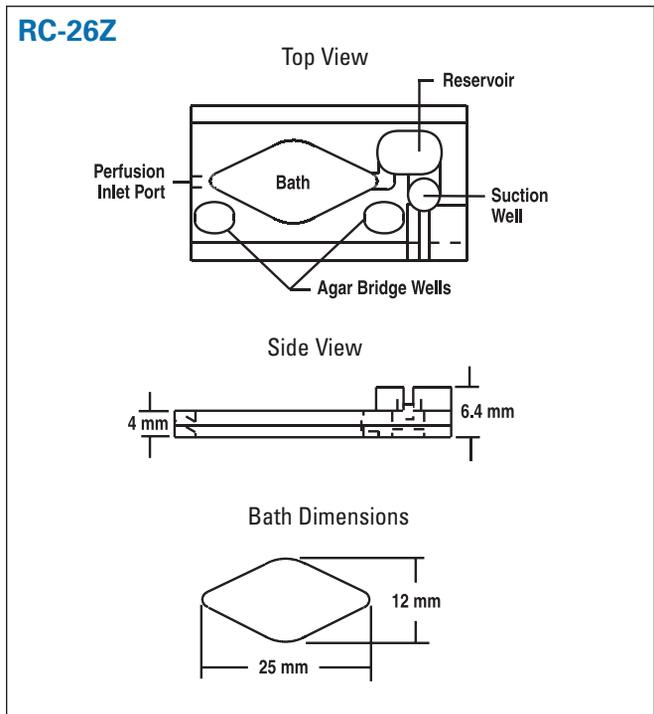
The RC-26Z is a polycarbonate chamber, similar in design to the RC-26, having two additional features specific for two-electrode oocyte recording: Namely, the dam height in the suction well is increased to 2.5 mm to provide an adequate solution level in the bath, and a second agar bridge well has been added to accommodate bath clamp electrodes.

The RC-26Z can also accommodate larger tissue slices and preparations, and permits excellent access for electrodes. The working volume is 170 µl/mm. The chamber floor consists of a 22 x 50 mm coverslip.

The chamber is equipped with a stainless steel suction tube (1.67 mm OD) together with a suction tube clamp. This insures the adjustable height suction tube will not move once the height is set by the user.

The RC-26Z chamber requires a platform (P-1, PH-1, or PM-1) and stage adapter to complete the assembly for mounting onto a microscope.

Each RC-26Z is supplied with a package of #1 thickness glass coverslips (CS-22/50, 22 x 50 mm, 50/pkg) and 10 feet of PE-160 tubing.



Specifications

Material	Polycarbonate
Bath dimensions (L x W x H)	25 x 12 x 4 mm
Volume, by depth	170 µl/mm
Bottom coverglass	22 x 50 mm
Input tubing (ID x OD)	1.14 x 1.57 mm (PE-160)
Aspirator coupling	1.67 mm (OD)

Order #	Model	Product
W4 64-0237	RC-26Z	Large Bath Oocyte Recording Chamber
W4 64-0277	P-1	Platform, non-heated
W4 64-0284	PH-1	Platform, heated
W4 64-1526	PM-1	Platform, heated magnetic
Accessories and Replacement Parts		
W4 64-0755	PE-160/10	Polyethylene Tubing
W4 64-0708	CS-22/50	Coverslips, 22 x 50 mm

RC-27

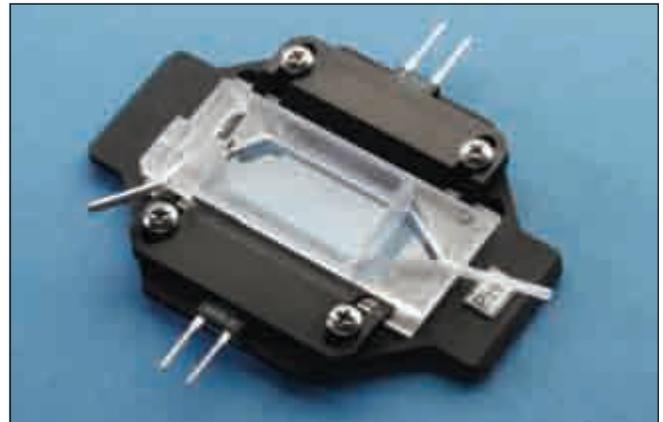
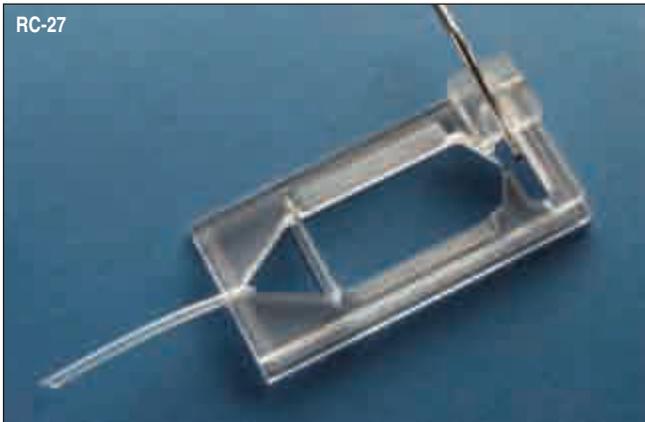
series 20 chambers

Large Rectangular Open Bath Chamber

A large bath chamber with a large viewing area designed for tissue sections

Chambers

series 20 chambers



RC-27 shown in a PH-6 platform

- Designed for large tissue sections or brain slice studies
- Large rectangular bath area accommodates insertion of coverslips up to 12 x 24 mm
- Large optical imaging area
- Can be used with either upright or inverted microscopes
- Slice anchors available

The RC-27 is a large bath chamber ideal for large tissue or brain slice studies. The large imaging area increases the likelihood of viewing desired features and the angled sides of the chamber facilitate electrode placement.

The chamber floor consists of a 24 x 50 mm rectangular coverslip and the bath area is 12 x 24 mm. These dimensions are useful for organotypic slice culture studies. An adjustable spreader plate at the bath input facilitates uniform solution flow. The working volume of the RC-27 is 413 μ l per mm of solution height. The chamber is equipped with a stainless steel aspiration tube together with a clamp.

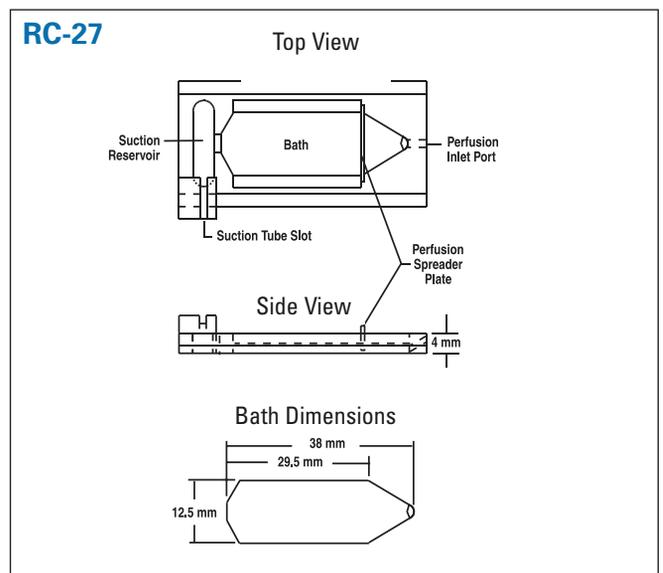
Designed for brain or tissue slice studies, several optional slice anchors are offered with Lycra thread spacing of 1.0, 1.5, and 2.0 mm. An anchor kit is also available containing slice anchors (1 each) in each available thread spacing.

The RC-27 requires a platform (P-6, PH-6, or PM-6) and stage adapter to complete the assembly for mounting onto a microscope.

Each chamber is supplied with a package of #1 thickness glass coverslips (CS-24/50, 24 x 50 mm, 50/pkg) and 10 feet of PE-160 tubing. Slice anchors sold separately, see page 71.

Specifications

Material	Polycarbonate
Bath dimensions (L x W x H)	38 x 12.5 x 4 mm
Volume, by depth	413 μ l/mm
Bottom coverglass	24 x 50 mm
Input tubing (ID x OD)	1.14 x 1.57 mm (PE-160)
Aspirator coupling	1.67 mm (OD)



Order #	Model	Product
W4 64-0238	RC-27	Very Large Bath Recording Chamber
W4 64-0282	P-6	Platform, non-heated
W4 64-0289	PH-6	Platform, heated
W4 64-1527	PM-6	Platform, heated magnetic

Accessories and Replacement Parts

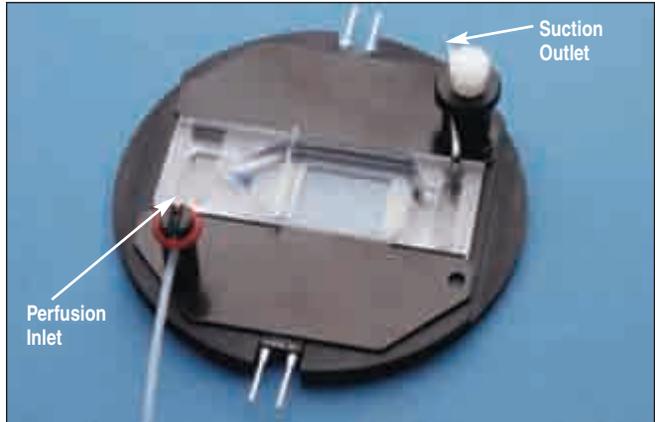
W4 64-0755	PE-160/10	Polyethylene Tubing
W4 64-0709	CS-24/50	Coverslips, 24 x 50 mm
W4 64-0267	SHD-27KIT	Slice Anchor Kit
W4 64-0194	SHD-27H/10	Slice Anchor, 1.0 mm
W4 64-0193	SHD-27H/15	Slice Anchor, 1.5 mm
W4 64-0192	SHD-27H/20	Slice Anchor, 2.0 mm
W4 64-1451	CPS-27	Perfusion Spreader Plate

series 20 chambers

RC-27D and RC-27LD

Ultra-quiet Imaging Chamber for Slice Studies

The RC-27L with a special input for applications requiring ultra quiet solution delivery



RC-27LD shown in a PM-7D heated platform

- Designed for tissue slice studies
- RC-27LD includes slice support
- Eliminates vibration associated with solution exchange
- Allows multiplexed solution delivery without solution switching artifacts

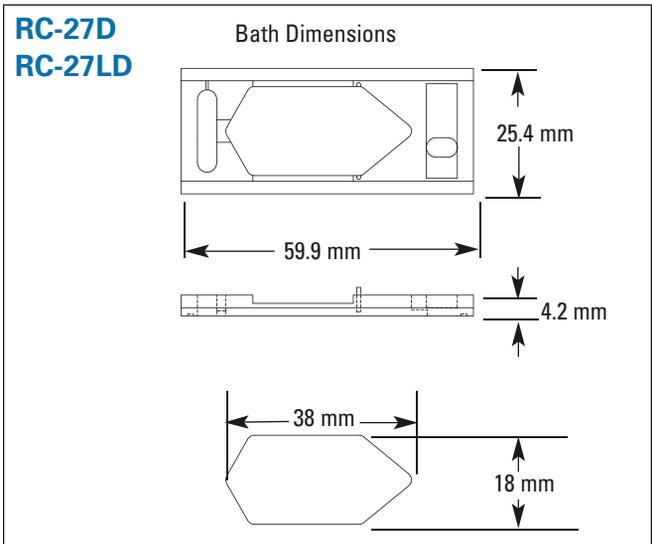
The RC-27D and RC-27LD chambers are designed with tissue slice studies in mind. A large imaging field allows for maximal observation of biological specimens. Advantages of this system over other chambers includes the presence of a sloped inflow channel which allows for smooth and "ultra-quiet" solution delivery.

The sloped input of these chamber allows I-V type infusion lines to deliver drops at a fixed rate without the transfer of noise to the specimen field. In addition, multiplexed solution delivery is now possible without the potential for solution switching artifacts. This new technology provides the capability of ultra-quiet solution exchange without transferring noise to either the system or to the image.

Measurement from tissue slices is provided for by the inclusion of slice support in the RC-27LD chamber. Slices are supported 0.5 mm above the chamber floor. Support threads are made of Lycra and thread spacing is 0.5 mm.

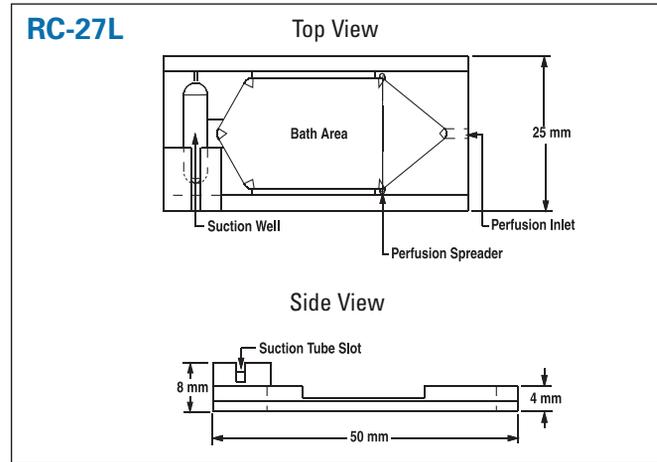
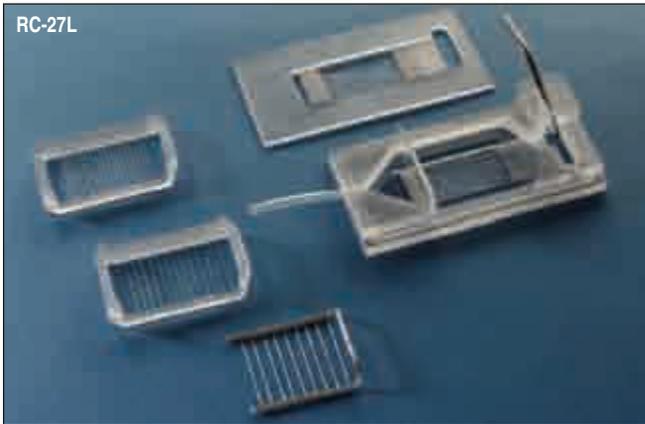
The RC-27D requires a PM-7 platform and the RC-27LD requires a PM-7D platform. Both chambers also require a stage adapter to complete the assembly for mounting onto a microscope

Each chamber is supplied with a MAG-2 magnetic clamp for suction tubes, a magnetic perfusion tube holder, a package of #2 thickness glass coverslips (CS-24/60), 40/pkg, and 10 feet of PE-160 polyethylene tubing. The RC-27LD also includes a slice support. Slice anchors are sold separately, see page 71.



Order #	Model	Product
W4 64-1548	RC-27D	Slice Chamber, Ultra-quiet
W4 64-1532	RC-27LD	Slice Chamber, Ultra-quiet with tissue slice support
W4 64-1529	PM-7	Chamber Platform for RC-27D
W4 64-1530	PM-7D	Chamber Platform for RC-27LD
Accessories and Replacement Parts		
W4 64-1550	SS-4-500V	Slice Support 500 Micron
W4 64-1551	SS-4-500H	Slice Support 500 Micron
W4 64-0256	SHD-27LH/10	Metal Slice Hold Down, 1 mm
W4 64-0257	SHD-27LH/15	Metal Slice Hold Down, 1.5 mm
W4 64-0258	SHD-27LH/20	Metal Slice Hold Down, 2 mm
W4 64-0259	SHD-27LP/10	Plastic Slice Hold Down, 1 mm
W4 64-0260	SHD-27LP/15	Plastic Slice Hold Down, 1.5 mm
W4 64-0261	SHD-27LP/20	Plastic Slice Hold Down, 2 mm
W4 64-0710	CS-24/60	Coverslips, 24 x 60 mm

A large bath chamber specifically designed for tissue slice studies



- 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

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

The slice support is fabricated in polycarbonate. Slice anchors are available in polycarbonate or stainless steel. Both slice supports and slice anchors use fine Lycra threads to secure the slice in place, allowing maximum access to the preparation. Thread spacing on the slice support is 1 mm and available thread spacing on slice anchors are 1.0, 1.5, and 2.0 mm. Polycarbonate or stainless steel anchor kits containing slice anchors (1 each) in each available thread spacing are also available.

While the weight of the metal harp is sufficient to hold a slice in place, the plastic harp relies on a close apposition between itself and the chamber side walls to secure it into position. This approach can reduce pressure on the slice from the supports.

The RC-27L requires a platform (P-6D, PH-6D, PM-6D)*; Also fits P-6 platform without slice support) and stage adapter to complete the assembly for mounting onto a microscope.

Each chamber is supplied with an SS-3 slice support, 10 feet of PE-160 polyethylene tubing, and a package of #1 thickness glass coverslips (CS-24/50, 24 x 50 mm, pkg. of 50).

* Slice anchors sold separately, see page 71.

* Also fits P-6 Platform without slice support.

Specifications

Material	Polycarbonate or polysulfone*
Bath dimensions (L x W x H)	38 x 18 x 3 mm
Volume, by depth	560 µl/mm
Bottom coverglass	24 x 50 mm
Slice support	24 x 50 x 0.5 mm thick, polycarbonate, Lycra threads at 1 mm
Input tubing (ID x OD)	1.14 x 1.57 mm (PE-160)
Aspirator coupling	1.67 mm (OD)

* Please call for price and availability of polysulfone chambers.

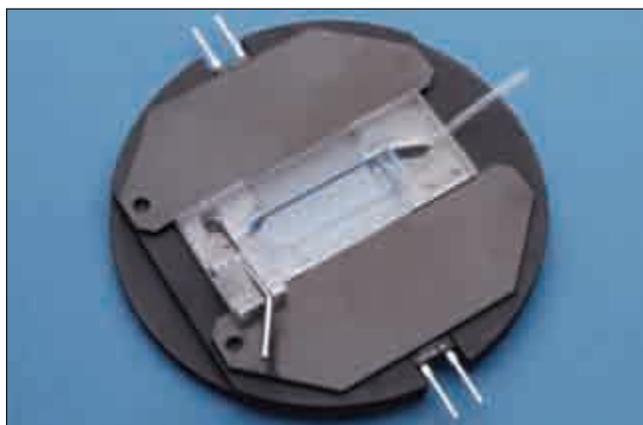
Order #	Model	Product
W4 64-0241	RC-27L	Large Bath Chamber
W4 64-0283	P-6D	Platform, non-heated
W4 64-0290	PH-6D	Platform, heated
W4 64-1528	PM-6D	Platform, heated magnetic
Accessories and Replacement Parts		
W4 64-0755	PE-160/10	Polyethylene Tubing
W4 64-0709	CS-24/50	Coverslips, 24 x 50 mm
W4 64-0273	SS-3	Slice Support
W4 64-1533	SS-3G	Grid
W4 64-0190	SHD-27LPKIT	Plastic Slice Anchor Kit
W4 64-0259	SHD-27LP/10	Plastic Slice Hold-Down, 1.0 mm
W4 64-0260	SHD-27LP/15	Plastic Slice Hold-Down, 1.5 mm
W4 64-0261	SHD-27LP/20	Plastic Slice Hold-Down, 2.0 mm
W4 64-0268	SHD-27LKIT	Stainless Steel Slice Anchor Kit
W4 64-0256	SHD-27LH/10	Stainless Steel Slice Hold-Down, 1 mm
W4 64-0257	SHD-27LH/15	Stainless Steel Slice Hold-Down, 1.5 mm
W4 64-0258	SHD-27LH/20	Stainless Steel Slice Hold-Down, 2 mm
W4 64-1450	CPS-27L	Perfusion Spreader Plate

RC-27N

series 20 chambers

Narrow Rectangular Bath Chamber

The RC-27 design in a narrow bath configuration



RC-27N shown in a PM-6 platform

- Rectangular, open bath chamber
- Narrow bath
- Accommodates tissue or brain slice specimens
- Applications include patch clamp, and measurements on cultured cells and tissue preparations
- Slice anchors available

The RC-27N recording chamber is a modified version of the RC-27 with a narrower bath and smaller volume. The narrow bath can stabilize solution flow at high flow rates and the smaller volume improves exchange times.

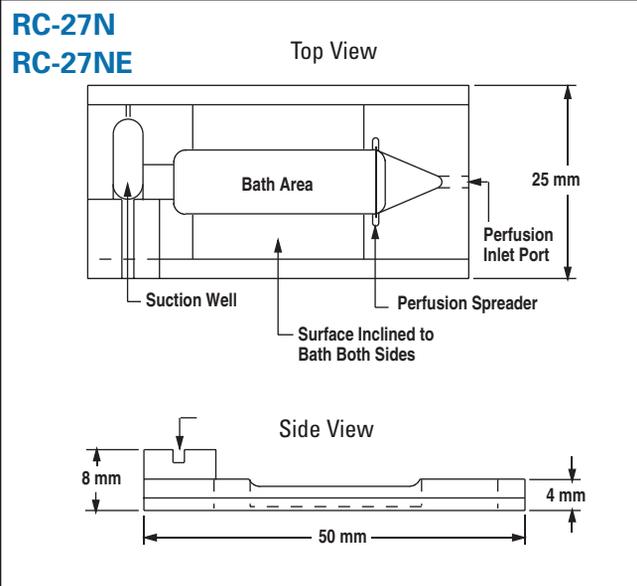
The specimen area is 28 x 8 mm. The height of the bath area side walls is 2 mm, and the sides of the chamber slope away from the bath at an angle of 15° from the horizontal. The low profile design and inclined surfaces permit good electrode access to the specimen area.

The RC-27N chamber requires a platform (P-6, PH-6, or PM-6) and stage adapter to complete the assembly for mounting onto a microscope. The chamber body is manufactured from polycarbonate and the chamber floor is formed from a 24 x 50 mm coverslip.

Each chamber is supplied with a package of #1 thickness glass coverslips (CS-24/50, 24 x 50 mm, pkg. of 50) and 10 feet of PE-160 polyethylene tubing.

Specifications

Material	Polycarbonate
Bath dimensions (L x W x H)	37 x 8 x 2 mm
Volume, by depth	305 µl/mm
Bottom coverglass	24 x 50 mm
Input tubing (ID x OD)	1.14 x 1.57 mm (PE-160)
Aspirator coupling	1.67 mm (OD)



Order #	Model	Product
W4 64-0239	RC-27N	Narrow Bath Recording Chamber
W4 64-0282	P-6	Platform, non-heated
W4 64-0289	PH-6	Platform, heated
W4 64-1527	PM-6	Platform, heated magnetic

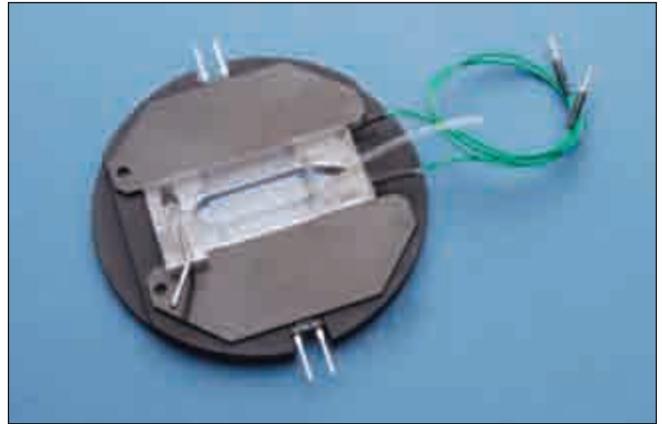
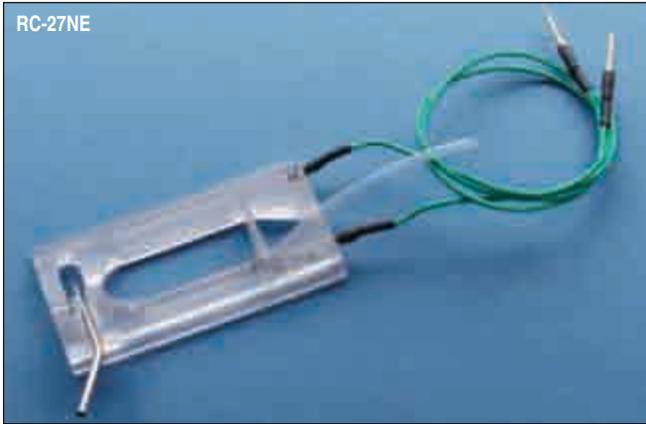
Accessories and Replacement Parts

W4 64-0755	PE-160/10	Polyethylene Tubing
W4 64-0709	CS-24/50	Coverslips, 24 x 50 mm
W4 64-0191	SHD-27NKIT	Slice Anchor Kit
W4 64-0197	SHD-27N/10	Metal Slice Anchor, 1.0 mm
W4 64-0196	SHD-27N/15	Metal Slice Anchor, 1.5 mm
W4 64-0195	SHD-27N/20	Metal Slice Anchor, 2.0 mm
W4 64-1452	CPS-27N	Perfusion Spreader Plate

RC-27NE series 20 chambers

Narrow Bath Chamber with Field Stimulation

A narrow-bath RC-27 with platinum field stimulation electrodes



RC-27NE shown in a PM-6 heated platform

- Designed for field stimulation studies
- Rectangular open-bath chamber
- Narrow bath
- Accommodates tissue or brain slice specimens
- Applications include patch clamp and physiological measurements on cultured cells and tissue preparations

The RC-27NE recording chamber is a modified version of the RC-27 with a narrower bath and smaller volume designed for applications requiring electric field stimulation. Laminar solution flow is more stable in this chamber than in the wider RC-27 chamber.

The working specimen area is 28 x 8 mm and there are inclined surfaces on both sides (from 2.0 mm to 3.1 mm height). The low profile design and inclined surfaces permits good electrode access to the specimen area.

The chamber is supplied with a pair of platinum wire electrodes installed along the long parallel sides of the bath. Electrode leads are approximately 16 cm long and terminate with 1 mm diameter pins.

The RC-27N chamber requires a platform (P-6, PH-6, or PM-6) and stage adapter to complete the assembly for mounting onto a microscope. The chamber body is manufactured from polycarbonate and the chamber floor is formed from a 24 x 50 mm coverslip.

Each chamber is supplied with a package of #1 thickness glass coverslips (CS-24/50, 24 x 50 mm, pkg. of 50) and 10 feet of PE-160 polyethylene tubing.

The SIU-102 is a bipolar stimulator designed for use with field stimulation chambers. This instrument features constant current and constant voltage modes, as well as bipolar, pulse, and DC modes. Optical coupling is used to electronically isolate the stimulator from the pulse source. Currents up to 100 mA and voltages up to 100 V are also supported. See page 247 for details.

Specifications

Material	Polycarbonate
Bath dimensions (L x W x H)	37 x 8 x 2 mm
Volume, by depth	305 µl/mm
Electrodes	Platinum wire, 15 cm cables with 1 mm pins
Bottom coverglass	24 x 50 mm
Input tubing (ID x OD)	1.14 x 1.57 mm (PE-160)
Aspirator coupling	1.67 mm (OD)

Order #	Model	Product
W4 64-0240	RC-27NE	Narrow Bath Recording Chamber with Field Stimulation
W4 64-0282	P-6	Platform, non-heated
W4 64-0289	PH-6	Platform, heated
W4 64-1527	PM-6	Platform, heated magnetic

Accessories and Replacement Parts		
W4 64-0755	PE-160/10	Polyethylene Tubing
W4 64-0709	CS-24/50	Coverslips, 24 x 50 mm

Excised Patch Chamber with Two Slotted Open Baths

Permits solution exchange around a membrane patch without contaminating the associated cell population



- Designed for excised patch studies
- Open chamber design
- Dual slotted baths in two sizes
- Baths separated by a controllable dam

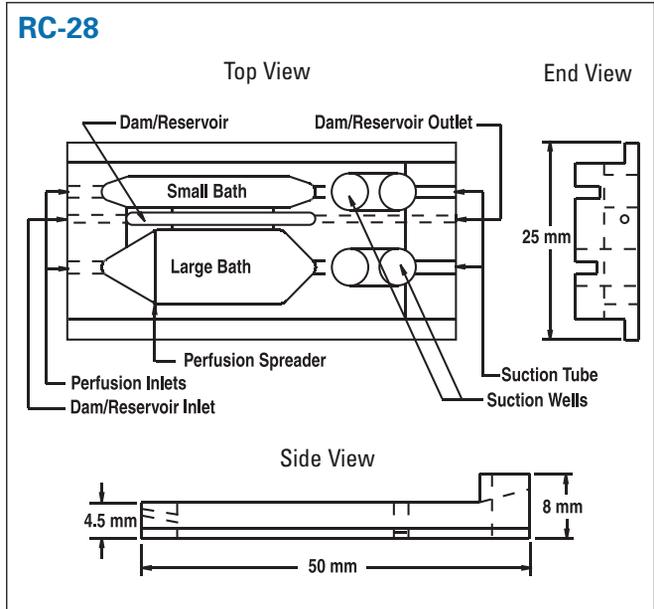
The RC-28 is a special chamber containing two bath compartments separated by an adjustable dam. The dam functions both as a gate and barrier between the two main baths. The composition and flow rate of each bath can be independently controlled, and each bath has a separate stainless steel suction tube for perfusion.

The dual slotted, open bath design allows for the exchange of solution surrounding an isolated membrane patch without contaminating or modifying the rest of the cell population. Raising the solution level in the dam area joins the two baths, while lowering the solution level isolates the two baths. After patching onto a cell in the large bath compartment, the dam is flooded, enabling secure transfer of the electrode attached cell to the smaller compartment. The dam is then drained, isolating the relocated cell.

For the larger chamber, the bath area is 21 x 9.5 mm and the working volume is 243 µl per mm of solution height. For the smaller chamber, the area is 28 x 3.8 mm and the volume is 111 µl.

A platform (P-6, PH-6, or PM-6) and stage adapter are required to complete the assembly for mounting onto a microscope. The chamber bottom is formed by a 24 x 50 mm coverslip.

The RC-28 is supplied with a pack of #1 thickness glass coverslips (CS-24/50, 24 x 50 mm, 50/pkg) and 10 feet of PE-160 polyethylene tubing.



Specifications

Material	Polycarbonate
Small Bath Dimensions (L x W x H)	28.0 x 3.8 x 4.5mm
Large Bath Dimensions (L x W x H)	28.0 x 9.5 x 4.5 mm
Small Bath Volume, by depth	111 µl
Large Bath Volume, by depth	243 µl
Small Bath Specimen Area (L x W)	28 x 3.8 mm
Large Bath Specimen Area (L x W)	21 x 9.5 mm
Bottom coverglass	24 x 50 mm
Input tubing (ID x OD)	1.14 x 1.57 mm (PE-160)
Aspirator coupling	1.67 mm (OD)

Order #	Model	Product
W4 64-0243	RC-28	Excised Patch Recording Chamber
W4 64-0282	P-6	Platform, non-heated
W4 64-0289	PH-6	Platform, heated
W4 64-1527	PM-6	Platform, heated magnetic

Accessories and Replacement Parts

W4 64-0755	PE-160/10	Polyethylene Tubing
W4 64-0709	CS-24/50	Coverslips, 24 x 50 mm

RC-29

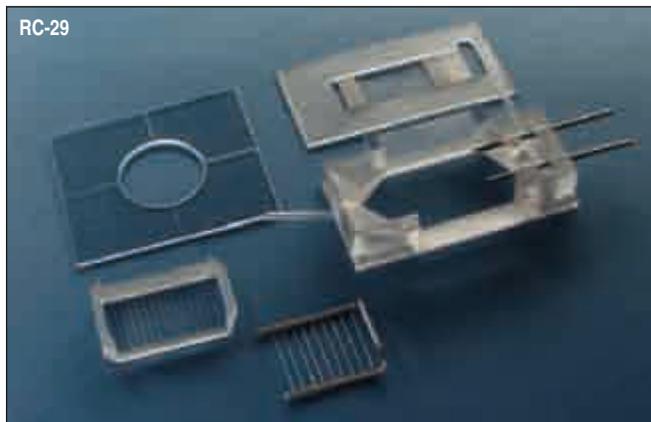
series 20 chambers

Very Large Rectangular Open Bath Chamber for Slice Studies with Atmospherics

Designed for slice studies requiring controlled atmospheric conditions

Chambers

series 20 chambers



- Designed for tissue slice studies
- Gas perfusion ports allow for controlled atmospheric conditions
- Provides for perfusate flow both above and below a tissue slice
- Provides good access for immersion optics and electrodes
- Used with either upright or inverted microscopes
- Large imaging area
- Slice anchors available

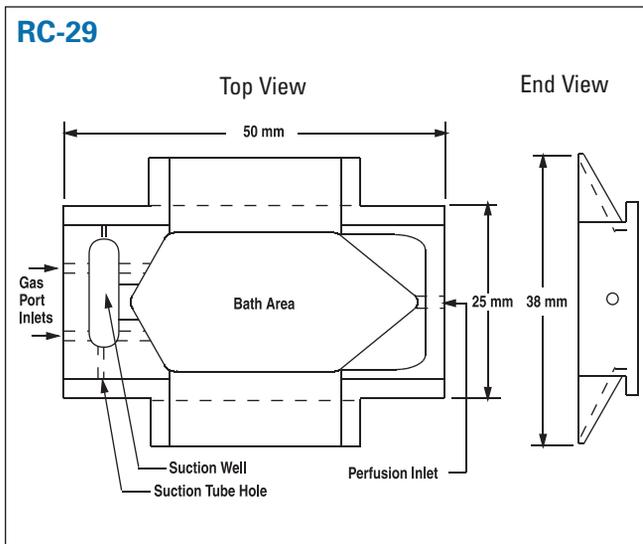
The RC-29 chamber is modeled after the RC-27L (in that it enables solution flow both above and below the tissue slice) with the added feature of atmospheric control.

Similar to the RC-27L, the tissue slice rests on a plastic slice support 0.5 mm above the coverslip floor and is held in place by an optional slice anchor. Slice supports and slice anchors use fine Lycra threads to secure the slice into place allowing maximum access to the preparation. Thread spacing is 1 mm on the slice support and are 1.0, 1.5, and 2.0 mm for the slice anchors. Anchors are purchased separately and are available in polycarbonate and stainless steel. Warner also offers anchor kits containing slice anchors (1 each) in each available thread spacing.

The RC-29 has tall sides with sloping surfaces to allow for an atmospheric space. Gas input ports are constructed into the chamber walls and a chamber top (with access port) is also provided. Continuous gas flow into the chamber establishes positive pressure within the chamber maintaining the atmospheric environment.

This chamber requires a platform (P-6D, PH-6D, or PM-6D) and stage adapter to complete the assembly for mounting on a microscope. The chamber bottom is formed by a 24 x 50 mm coverslip.

The chamber is supplied with a plastic SS-3 slice support, 10 feet of PE-160 polyethylene tubing, a chamber cover, and one pack of #1 thickness coverslips (CS-24/50, 24 x 50 mm, pkg. of 50).



Specifications

Material	Polycarbonate
Bath dimensions (L x W x H)	38 x 18 x 6 mm
Volume, by depth	629 µl/mm
Bottom coverglass	24 x 50 mm
Slice support	24 x 50 mm, polycarbonate, Lycra threads at 1 mm
Input tubing (ID x OD)	1.14 x 1.57 mm (PE-160)
Aspirator coupling	1.67 mm (OD)
Gas perfusion ports	Stainless steel, 1.67 mm (OD)

Order #	Model	Product
W4 64-0244	RC-29	Chamber with Slice Support
W4 64-0283	P-6D	Platform, non-heated
W4 64-0290	PH-6D	Platform, heated
W4 64-1528	PM-6D	Platform, heated magnetic

Accessories and Replacement Parts

W4 64-0755	PE-160/10	Polyethylene tubing
W4 64-0709	CS-24/50	Coverslips, 24 x 50 mm
W4 64-0273	SS-3	Slice Support
W4 64-0256	SHD-27LH/10	Metal Slice Hold Down, 1.0 mm
W4 64-0257	SHD-27LH/15	Metal Slice Hold Down, 1.5 mm
W4 64-0258	SHD-27LH/20	Metal Slice Hold Down, 2.0 mm
W4 64-0259	SHD-27LP/10	Plastic Slice Hold Down, 1.0 mm
W4 64-0260	SHD-27LP/15	Plastic Slice Hold Down, 1.5 mm
W4 64-0261	SHD-27LP/20	Plastic Slice Hold Down, 2.0 mm

series 30 chambers

RC-30, RC-30HV and RC-30WA

Confocal Imaging Chambers

Low profile, closed bath chambers designed for confocal imaging on upright and inverted microscopes



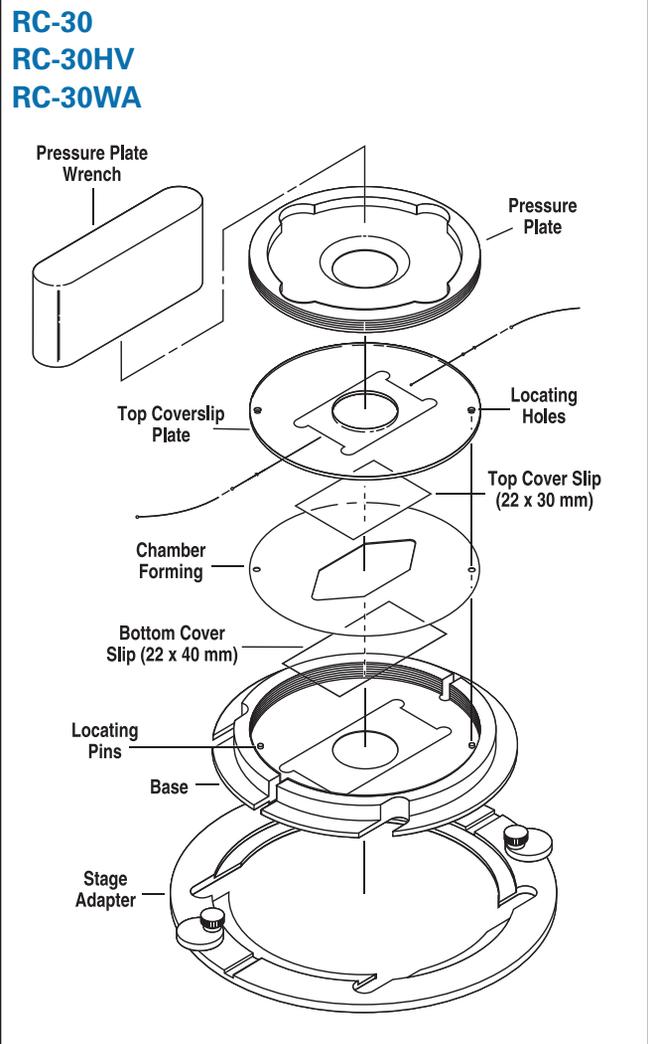
- Option of confocal imaging with continuous perfusion
- Accommodates both upright and inverted microscopes
- 17.7 mm diameter viewing aperture (RC-30, RC-30HV)
- 25.0 mm diameter viewing aperture (RC-30WA)
- User-defined cross-sectional viewing area
- User-defined bath volume with fast fluid exchange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

The RC-30 and RC-30HV are closed bath, low profile chambers incorporating special features for confocal imaging. These features include user defined bath geometry and total volume, and a large viewing area. A 22 x 30 mm (#1 thickness) glass coverslip forms the top of the chamber, while a 22 x 40 mm coverslip (also #1 thickness) forms the chamber bottom, creating a closed bath. This design enables the chamber to be inverted in the mounting platform allowing it to be used with both inverted or upright microscopes. The final viewing aperture is 17.7 mm.

The RC-30WA is a wide aperture version of the RC-30HV. It uses a 40 mm diameter coverslip for its bottom surface and a 30 mm diameter coverslip for its top. The final viewing aperture is 25 mm. The chamber bottom is beveled to permit maximum access to the bottom coverslip.

Variable Bath Volume/Fast Perfusate Exchange

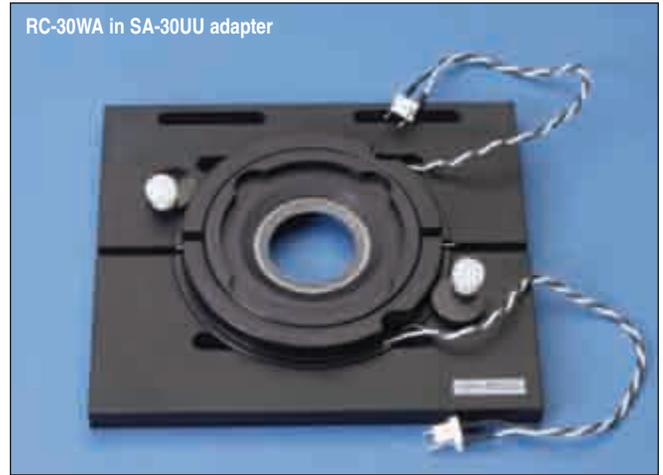
The side walls of the bath are formed by silicone gaskets sandwiched between the top and bottom coverslips. Wall height (i.e., spacing between the two coverslips) can range from 150-1000 μm and is defined by the total thickness of the gaskets used. Blank gaskets are supplied with the chamber allowing the development of the customized bath geometry required for unique applications.



series 30 chambers

RC-30, RC-30HV and RC-30WA

Confocal Imaging Chambers (continued)



Pre-cut gaskets are supplied with the chamber; one cut wide to allow full use of the aperture window and a narrow, slotted version for fast solution exchange. The bath volumes for these two pre-cut, 250 μ m thick gaskets are 26 μ l for the slotted style and 133 μ l for the wide style.

Heater Version

The RC-30HV and RC-30WA include a pair of resistive heater elements mounted onto the chamber base. These resistors are compatible with Warner TC-324B and TC-344B Temperature Controllers which can be ordered separately along with a CC-28 cable.

All versions of the confocal imaging chambers require special microscope stage adapters which must be ordered separately.

Confocal imaging chambers are supplied with six pre-cut 250 μ m thick gaskets: two large area bath gaskets (GS-30L/10, 133 μ l volume), two slotted bath gaskets (GS-30S/10, 25.6 μ l volume), and two blank gaskets (GS-30B/10) for user customized chamber areas. Also included is a special tool used for mounting the top plate, polyethylene tubing (PE-90/10, 10 feet.), and 22 x 30 mm and 22 x 40 mm #1 glass coverslips (CS-22/30 and CS-22/40, pkg. of 50). The RC-30WA includes one box each of 30 mm round coverslips (CS-30R) and 40 mm round coverslips (CS-40R).

Warner Instruments offers 150, 250, 375 μ m thick gaskets which are listed on the facing page.



Viewing Aperture	Top	Bottom
RC-30/30 HV	25.4 mm	17.8 mm
RC-30 WA	34.5 mm	25.4 mm

Specifications

Physical Dimensions (H x D)	9.5 x 82 mm
Weight	< 90 g, assembled with optional heaters
Base and Pressure Plate	Aluminum, black anodized
Top Coverslip Plate	Polycarbonate
Gaskets	Silicone rubber
Input/Output Tubing	PE-90
Coverslips for RC-30, RC-30HV	Top: 22 x 30 mm; Bottom: 22 x 40 mm
Coverslips for RC-30WA	Top: 30 mm round; Bottom: 40 mm round

series 30 chambers

RC-30, RC-30HV and RC-30WA

Confocal Imaging Chambers (continued)



Order #	Model	Product
W4 64-0320	RC-30	Confocal Imaging Chamber
W4 64-0321	RC-30HV	Confocal Imaging Chamber
W4 64-0321WA	RC-30WA	Confocal Imaging Chamber
Series 30 Stage Adapters		
W4 64-0322	SA-30NIK	Nikon Diaphot/TE200/TE300/TE2000
W4 64-0324	SA-30TMS/9	Nikon TMS with 9 x 13 cm Cut-Out
W4 64-0325	SA-30/OLY2	Olympus IMT-2/IX-50/IX-70/BX-50WI
W4 64-0326	SA-30LZ	Zeiss Axiovert 211 x 230 Specimen Stage
W4 64-0327	SA-30KZ	Zeiss Axiovert 85 x 130 Mechanical (K) Stage
W4 64-0328	SA-30L3P	Leica Dmirb/E with 3-Plate Mechanical Stage
W4 64-0329	SA-30PLI	Prior & Ludl Motorized Stage
W4 64-0377	SA-30GALVOZ	Leica Galvo Z Upright Stage
W4 64-0379	SA-30UUZ	Zeiss LSM510
W4 64-0380	SA-30UU	Nikon E400/E600/E800
W4 64-1456	SA-30GALVZi	Leica Galvo Z Inverted Stage
Accessories and Replacement Parts		
W4 64-0330	GS-30L/10	Replacement Gaskets, Large Bath, 250 µm thickness, pkg. of 10
W4 64-0331	GS-30L/15	Replacement Gaskets, Large Bath, 375 µm thickness, pkg. of 10
W4 64-0332	GS-30S/10	Replacement Gaskets, Slotted Bath, 250 µm thickness, pkg. of 10
W4 64-0333	GS-30S/15	Replacement Gaskets, Slotted Bath, 375 µm thickness, pkg. of 10
W4 64-0334	GS-30B/10	Replacement Gaskets, Blank, 250 µm thickness, pkg. of 10
W4 64-0335	GS-30B/15	Replacement Gaskets, Blank, 375 µm thickness, pkg. of 10
W4 64-0341	GS-30B/4	Replacement Gaskets, Blank, 150 µm thickness, pkg. of 10
W4 64-0342	GS-30L/4	Replacement Gaskets, Large Bath, 150 µm thickness, pkg. of 10
W4 64-0343	GS-30S/4	Replacement Gaskets, Slotted Bath, 150 µm thickness, pkg. of 10
W4 64-1464	RC30TCP	Replacement Top Coverslip Plate
W4 64-1464WA	RC30TCPWA	Replacement Top Coverslip Plate for RC-30 WA
W4 64-0706	CS-22/30	Coverslips #1 Thickness (50)
W4 64-0707	CS-22/40	Coverslips #1 Thickness (50)
W4 64-1499	CS-30R	Coverslips #1.5 Thickness (90)
W4 64-1500	CS-40R	Coverslips #1 Thickness (60)
W4 64-1559	RH-3	Replacement Heating Elements, 2/pkg.

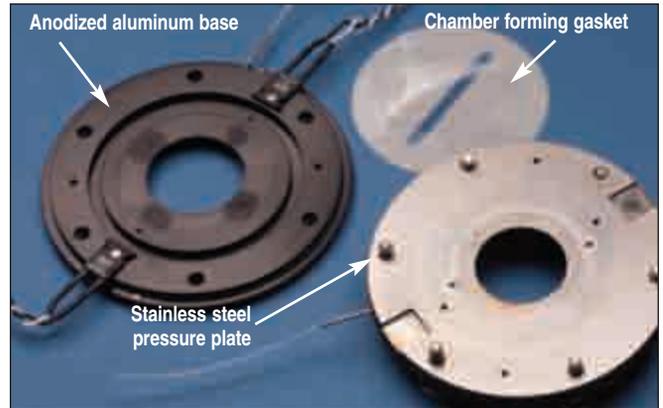
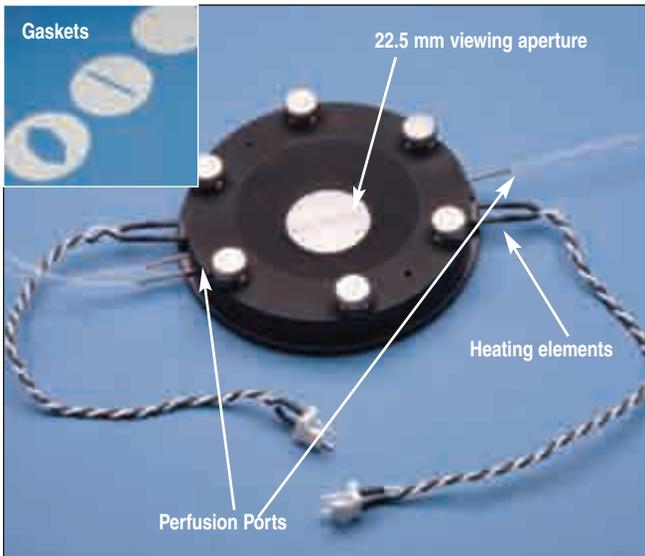
series 30 chambers

NEW Model RC-31

A Low Profile, Parallel Plate Flow Chamber

Chambers

series 30 chambers



Pre-cut gaskets are supplied with the chamber; one cut wide to allow full use of the aperture window (17.7 mm diameter) and a narrow, slotted version (4 x 37 mm) for fast solution exchange and blank gaskets for customized bath shapes.

The bath volumes for these pre-cut, 250 μm thick gaskets are 26 μl for the slotted cut and 133 μl for the wide cut.

- Adjustable distance between upper and lower coverslips, 50 μm to 350 μm
- Optimal control of culture conditions and cellular environment
- Compatible with both upright and inverted microscopes
- Amenable for long term studies using live cells

The RC-31 is closed bath low profile chamber incorporating special features for microscopic confocal imaging.

These features 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 coverslip forms the bottom, respectively, creating a closed bath. The closed design allows the chamber to be inverted in the mounting platform enabling its use with both inverted or upright microscopes. The final viewing aperture is 25 mm diameter.

Variable Bath Volume/Fast Perfusate Exchange:

The side walls of the RC-31 bath is formed by a silicone gasket sandwiched between the top and bottom coverslips. Wall height (i.e. spacing between the two coverslips) can range from 50-350 μm and is defined by the thickness and number of gaskets used. Blank gaskets are supplied with the chamber permitting the development of the customized bath geometry required for individual applications.

Order #	Model	Product
W4 64-1685	RC-31	Confocal Imaging Chamber
W4 64-0330	GS-30L/10	Replacement Gaskets, Large Bath, 250 μm thickness, pkg. of 10
W4 64-0331	GS-30L/15	Replacement Gaskets, Large Bath, 375 μm thickness, pkg. of 10
W4 64-0332	GS-30S/10	Replacement Gaskets, Slotted Bath, 250 μm thickness, pkg. of 10
W4 64-0333	GS-30S/15	Replacement Gaskets, Slotted Bath, 375 μm thickness, pkg. of 10
W4 64-0334	GS-30B/10	Replacement Gaskets, Blank, 250 μm thickness, pkg. of 10
W4 64-0335	GS-30B/15	Replacement Gaskets, Blank, 375 μm thickness, pkg. of 10
W4 64-0341	GS-30B/4	Replacement Gaskets, Blank, 125 μm thickness, pkg. of 10
W4 64-0342	GS-30L/4	Replacement Gaskets, Large Bath, 125 μm thickness, pkg. of 10
W4 64-0343	GS-30S/4	Replacement Gaskets, Slotted Bath, 125 μm thickness, pkg. of 10
W4 64-1499	CS-30R	Coverslips #1.5 Thickness (90)
W4 64-1500	CS-40R	Coverslips #1 Thickness (60)

CV-30 CytoViva™ Environment Chamber

Confocal Imaging Chambers

The RC-30 specifically adapted for the CytoViva Imaging System



- Designed for the CytoViva™ high resolution imaging system
- Allows long-term studies of live cells
- Supports oil immersion contact with the CytoViva high resolution illumination system
- Simultaneous observation of fluorescent and non-fluorescent samples

The CV-30 Live Cell Imaging Chamber is a low profile chamber designed specifically for the CytoViva™ Imaging System. This closed-bath chamber incorporates special features for imaging and is compatible with any microscope stage capable of accepting a multi-well plate. The CV-30 also can attach to microscope stages having a standard microscope slide adapter.

The CV-30 Live Cell Imaging Chamber features a user defined bath geometry, volume, and large viewing area. A #1.5 thickness glass coverslip, (0.17 mm) forms the top of the chamber while a 1 mm thick round coverslip forms the bottom. This allows the CV-30 to be used with CytoViva™'s high resolution adapter.

The side wall of the bath is formed by use of silicone gaskets sandwiched between the upper and lower coverslips. Wall height (or spacing between the coverslips) can range from 250 to 1000 µm and is defined by the thickness and number of gaskets used.

Blank gaskets are supplied permitting the development of customized bath geometries as required by your application. Pre-cut gaskets are also supplied with the chamber; one cut wide to allow full use of the large diameter aperture window and a narrow, slotted version targeted towards fast solution exchange.

Included components

The CV-30 comes complete with the following components: CV-30 chamber with universal slide holder connector, a pressure plate wrench, a lift-out tool, one package of #1.5 thickness, 30 mm round coverslips, one package of 1 mm thick, 40 mm round coverslips, one 10 pack, each, of blank, narrow slotted, and wide slotted gaskets in both 250 and 375 µm thicknesses, and 10 feet of PE-90 tubing.

CV-30 Specifications

Physical Dimensions (H x W x D)	9.4 x 85.6 x 128 mm
Weight	240 g
Base and Pressure Plate	Aluminum, black anodized
Top Coverslip Plate	Polycarbonate
Gaskets	Silicone rubber
Input/Output Tubing	PE-90 (0.86 x 1.27 mm)
Coverslips	Top 30 mm dia. x #1.5 Bottom 40 mm dia. x 1.1 mm

Order # Model Product

W4 64-1637	CV-30	Imaging Chamber for CytoViva™
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Accessories/Replacement Parts

W4 64-1499	Coverslips 30 mm Dia. #1.5 90/ pk
W4 64-1638	Coverslips 40 mm Dia. x 1.1 mm 10/ pk
W4 64-0330	Large bath gasket, 250µm thick
W4 64-0331	Large bath gasket, 375µm thick
W4 64-0332	Slotted bath gasket, 250µm thick
W4 64-0333	Slotted bath gasket, 375µm thick
W4 64-0334	Blank bath gasket, 250µm thick
W4 64-0335	Blank bath gasket, 375µm thick

The CV-30 chamber is compatible with Warner TC-324B and TC-344B Temperature Controllers which can be ordered separately along with a CC-28 cable.

culture dish inserts

RC-33DL, RC-33DM, RC-33SM, RC-33SN, RC-33/KIT

Disposable Perfusion Inserts for 35 mm Dishes

Chambers

culture dish inserts

Chamber inserts for 35 mm culture dishes



- Low cost disposable chamber inserts for 35 mm dishes
- Slot-shaped bath for applications requiring rapid perfusion
- Warner's diamond-shaped bath in the large bath versions
- Both temperature and perfusion control are possible when used with QE-1 Quick Exchange Platform

The RC-33DL, RC-33DM, RC-33SM, and RC-33SN chambers are designed to drop into a 35 mm dish to create a low cost perfusion chamber. A thin coating of silicone grease forms a seal between the insert and dish.

The low volume of the RC-33SM and RC-33SN slotted bath chambers and the natural laminar flow allows rapid exchange of solution, facilitating drug application studies.

The diamond shaped baths of the RC-33DL and RC-33DM provide a larger working area while maintaining good flow characteristics. A suction well is incorporated into all inserts to insure quiet operation.

Chambers are sold six to a package. A twelve pack is also available containing three of each chamber type.

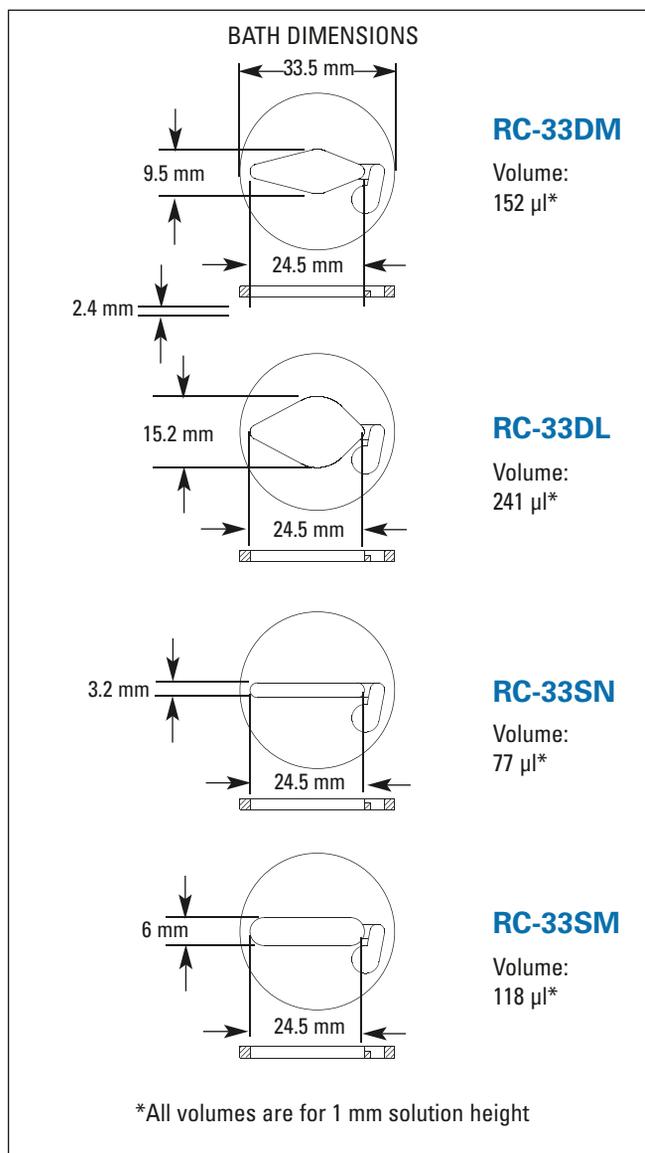
NOTE: Verify the inner diameter of your culture dish before ordering.

Disposable Perfusion Insert Fit:

Nunc

Corning

MatTek (Corning glass bottom)



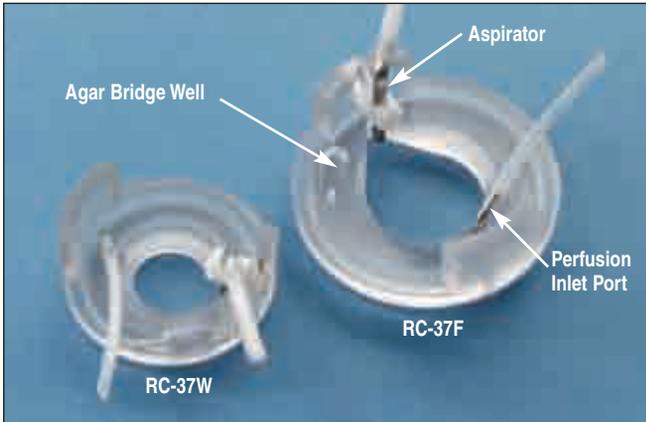
Order #	Model	Product
W4 64-1482	RC-33DL	Chamber Insert Diamond Large Bath, 6 Pack
W4 64-1481	RC-33DM	Chamber Insert Diamond Medium Bath, 6 Pack
W4 64-1484	RC-33SM	Chamber Insert Slotted Large Bath, 6 Pack
W4 64-1483	RC-33SN	Chamber Insert Slotted Narrow Bath, 6 Pack
W4 64-1485	RC-33Kit	Chamber Inserts Assortment 12 Pack, 3 of each type

culture dish inserts

RC-37F and RC-37W

Cell Culture Dish Perfusion Chamber Insert

Chamber inserts with perfusion for 35 mm culture dishes



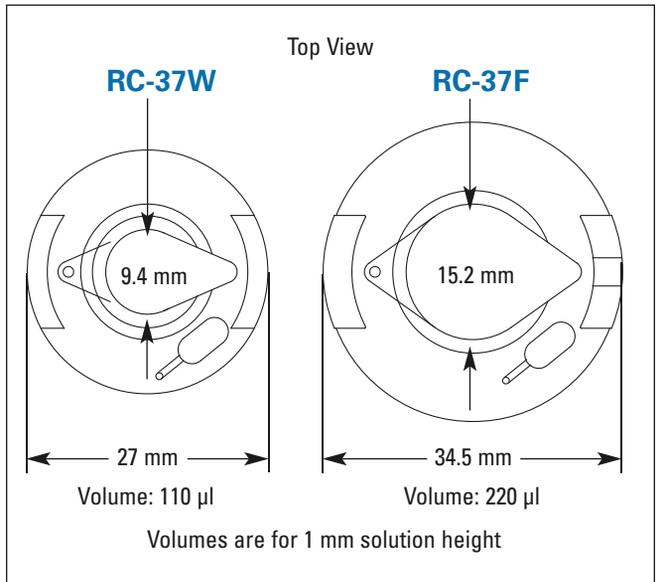
- Designed for glass bottom 35 mm culture dishes
- Permits imaging, recording, and perfusion in the culture dish
- Open and closed bath designs
- Incorporates Warner's diamond fluidics
- Ideal for rapid screening assays

The introduction of thin glass bottom culture dishes has expanded the use of these popular tools dramatically. Applications such as live cell imaging, confocal microscopy and time-lapsed photography are now possible. The ability to exchange the extracellular environment by perfusion 35 mm dishes has been difficult at best, until now.

The RC-37 Perfusion Chamber Inserts for cell culture dishes makes perfusion within these dishes a simple matter. Fluid is delivered to a perfusion inlet port and removed from the chamber by means of a height adjustable aspirator. A thin coating of silicone grease forms a seal between the insert and dish.

Inserts are available to fit the Willco Wells, Corning, MatTek, Nunc and Falcon 35 mm dishes. The chamber is compatible with the DH-35i and DH40i Culture Dish Incubators and the QE-1 Quick Exchange Platform.

Each chamber is supplied with 1 foot of C-Flex tubing and 10 feet of PE-160 tubing.

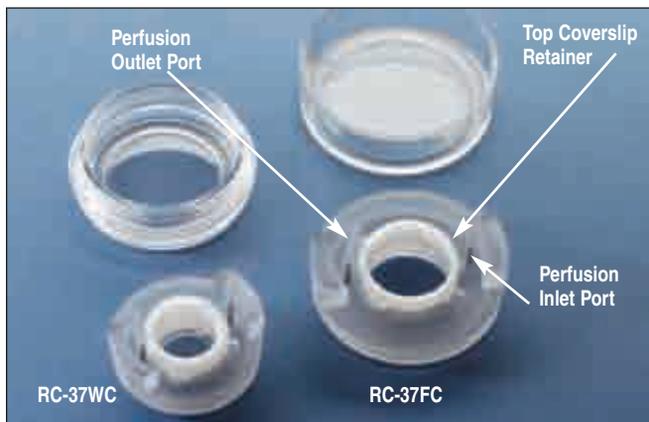


Order #	Model	Product
W4 64-0348	RC-37F	Chamber Insert for Corning, MatTek, Nunc, and Falcon 35 mm Dishes
W4 64-0347	RC-37W	Chamber Insert for Willco 35 mm Dishes

RC-37FC and RC-37WC culture dish inserts

Closed Bath Chambers

Closed bath chamber inserts with perfusion for 35 mm culture dishes



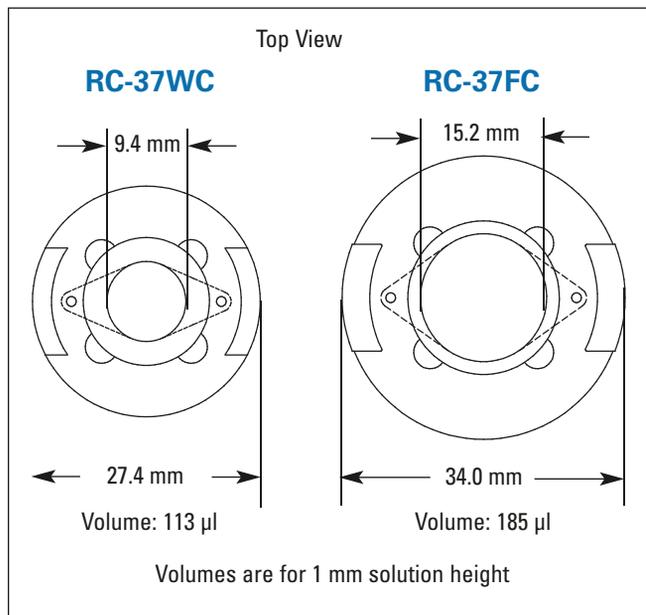
- Designed for glass bottom 35 mm dishes
- Permits imaging and perfusion in the cell culture dish
- Incorporates Warner's diamond fluidics
- Ideal for rapid screening assays

The RC-37 family of perfusion chamber inserts makes perfusion of cell culture dishes a simple matter. The closed bath promotes an even solution exchange and eliminates changes in focus due to alterations in bath height. In addition, studies involving physiological bicarbonate buffers can be performed with no gas loss at the chamber interface.

Fluid is delivered to a 18 gauge perfusion inlet port and removed from the chamber by means of an outlet port of the same gauge. The top coverslip is held in place with a retainer and the dish becomes the chamber bottom. A thin coating of silicone grease forms the seal between chamber and dish. The distance between top and bottom coverslips is 1 mm. The RC-37WC uses 15 mm top coverslips and the RC-37FC works with 18 mm coverslips.

The RC-37WC fits in the Willco Wells dishes while the RC-37FC fits Nunc, Falcon, MatTek or Corning 35 mm dishes. Warner's DH-35 Culture Dish Heater may be used to heat the Corning, MatTek and Willco Wells 35 mm culture dishes. Warner's DH-35i and DH-40i Culture Dish Incubators and the QE-1 Quick Change Heated Base are compatible with all 35 mm culture dishes.

The RC-37WC is supplied with one box of #1 thickness coverslips (CS15R, 15 mm round, 100/pkg) and the RC-37FC is supplied with one box of #1 thickness coverslips (CS18R, 18 mm round, 100/pkg). Both chambers are supplied with 10 feet of PE-160 polyethylene tubing and tools to remove the top coverslip retainer.



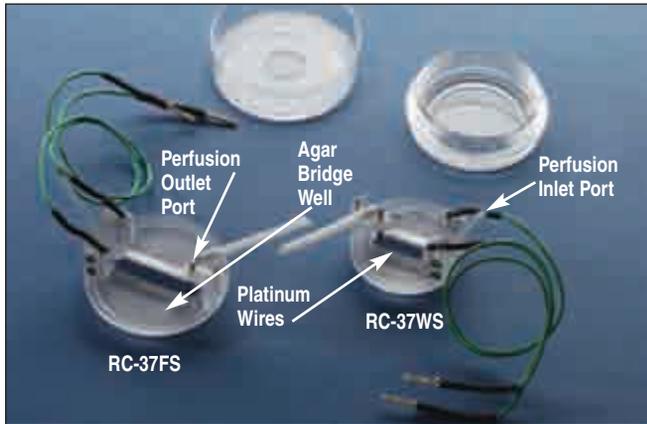
Order #	Model	Product
W4 64-0364	RC-37FC	Chamber Insert Closed for Corning, MatTek, Nunc or Falcon 35 mm Dishes
W4 64-0363	RC-37WC	Chamber Insert Closed for Willco 35 mm Dishes
Accessories and Replacement Parts		
W4 64-0703	CS-15R	Coverslips 15 mm diameter #1 Thickness – Box of 100
W4 64-0384	CS-18R	Coverslips 18 mm diameter #1 Thickness – Box of 100
W4 64-0758	D3522P	Glass Bottom Cell Culture Dishes – 20/Pouch
W4 64-0762	D3522B	Glass Bottom Cell Culture Dishes – Pkg of 120
W4 64-0378	111-KIT	Silicone Grease Kit with Brushes and Pallets
W4 64-0110	DH-35	35 mm Culture Dish Heater
W4 64-0349	DH-35i	Culture Dish Incubation System
W4 64-0388	DH-40i	Culture Dish Incubation System
W4 64-0375	QE-1	Quick Exchange Heated Base w/Perfusion and Adapter Ring Kit

culture dish inserts

RC-37FS and RC-37WS

Perfusion Chamber Inserts with Field Stimulation

Chamber inserts with perfusion for 35 mm culture dishes allowing field stimulation



- Designed for glass bottom 35 mm dishes
- Permits imaging and perfusion in the cell culture dish
- Platinum field stimulation electrodes
- Ideal for rapid screening assays

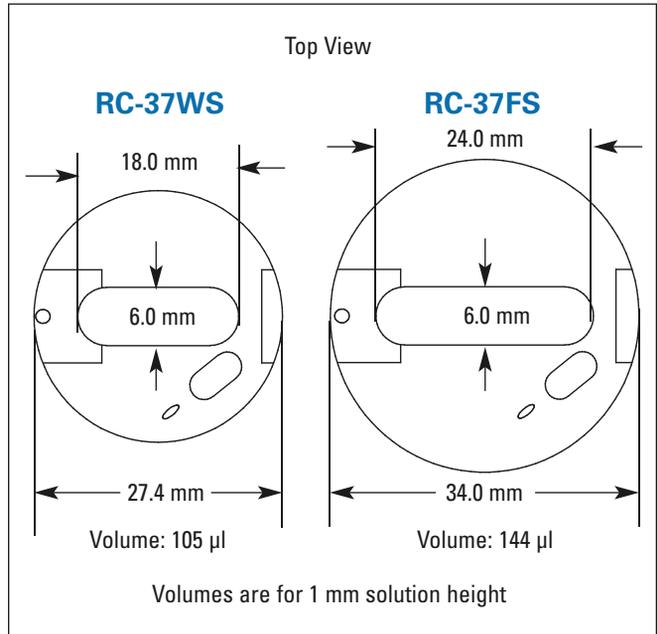
The latest member of the RC-37 family of perfusion chamber inserts is designed for applications requiring field stimulation and includes a pair of platinum electrodes. Both versions feature a slotted bath to promote a laminar solution flow and to ensure an even electrical field.

These models include a perfusion inlet port and a 16 gauge, height adjustable aspirator. An agar bridge well has been added to accommodate a bath ground electrode. A thin coating of silicone grease forms the seal between dish and chamber.

The RC-37WS fits in the Willco Wells dishes; the RC-37FS fits the Nunc, Corning, MatTek and Falcon 35 mm dishes. Warner's DH-35 Culture Dish Heater may be used to heat the Corning, MatTek and Willco Wells 35 mm culture dishes. All 35 mm dishes, including Falcon 35 mm dishes, are compatible with Warner's DH-35i and DH-40i Culture Dish Incubators and the QE-1 Quick Change Heated Base.

Chambers are supplied with 10 feet of PE-160 polyethylene tubing.

The SIU-102 is a bipolar stimulator designed for use with field stimulation chambers. This instrument features constant current and constant voltage modes, as well as bipolar, pulse, and DC modes. Optical coupling is used to electronically isolate the stimulator from the pulse source. Currents up to 100 mA and voltages up to 100 V are also supported. See page 247 for details.



Order #	Model	Product
W4 64-0366	RC-37FS	Chamber Insert Closed for Corning, MatTek, Nunc or Falcon 35 mm Dishes
W4 64-0365	RC-37WS	Chamber Insert Closed for Willco 35 mm Dishes
Accessories and Replacement Parts		
W4 64-0758	D3522P	Willco Wells Glass Bottom Cell Culture Dishes – 20/Pouch
W4 64-0762	D3522B	Willco Wells Glass Bottom Cell Culture Dishes – Pkg of 120
W4 64-0378	111-KIT	Silicone Grease Kit with Brushes and Pallets
W4 64-1424	SIU-102	Stimulus Isolation Unit
W4 64-1425	CC-102	Cable, Male Banana to 1 mm jacks (for use with Warner Field Stimulation Chambers)
W4 64-0110	DH-35	35 mm Culture Dish Heater
W4 64-0349	DH-35i	Culture Dish Incubation System
W4 64-0388	DH-40i	Culture Dish Incubation System
W4 64-0375	QE-1	Quick Exchange Heated Base w/Perfusion and Adapter Ring Kit

series 40 chambers

RC-40 Series Chambers

Quick Change Coverslip Bottom Imaging Chambers

Imaging chambers designed to fit the QE-1 and DH Series heated platforms

Chambers

series 40 chambers



- O-ring seals permit quick exchange of coverslips
- Anodized aluminum base ensures good heat transfer
- Open and closed bath designs
- Use standard #1 or #1.5 thickness coverslips
- Ideal for rapid screening assays

Warner Instruments recognized the need for chambers designed for rapid screening of cells grown on coverslips. The innovative design of RC-40 chambers uses O-rings to seal the coverslip to the polycarbonate chamber. Therefore little or no silicone grease is needed and mechanical fasteners are not required for coverslip mounting.

Chambers are available for use with 12, 15, 18, and 25 mm round coverslips. Round, low profile chambers maximize the viewing area and provide optimal access for electrodes. Slotted bath chambers allow rapid solution exchange. A version which includes platinum wires may be used to study cardiac myocytes and other applications requiring field stimulation. The RC-40HP High Profile Chamber allows for a deep bath.

The Series 40 chambers are designed to be compatible with the Warner QE-1 Quick Exchange Platform and the DH-35i and DH-40i Culture Dish Incubators.

QE-1 Quick Exchange Platform

The Warner QE-1 Quick Exchange Platform is a versatile base for the RC-40 Series chambers, as well as many popular 35 mm glass bottom dishes. Removable perfusion and suction tubes allow solution exchange in any of the RC-40 Series open bath chambers or 35 mm dishes. The platform may be heated using any of the Warner temperature controllers. The QE-1 can be mounted on most microscopes by using the Warner Series 20 stage adapters. See page 172 for more information on the QE-1.



series 40 chambers

RC-40LP, RC-41LP, RC-42LP, RC-48LP

Low Profile Chambers for 12, 15, 18 and 25 mm Coverslips

Open bath chambers for round coverslips



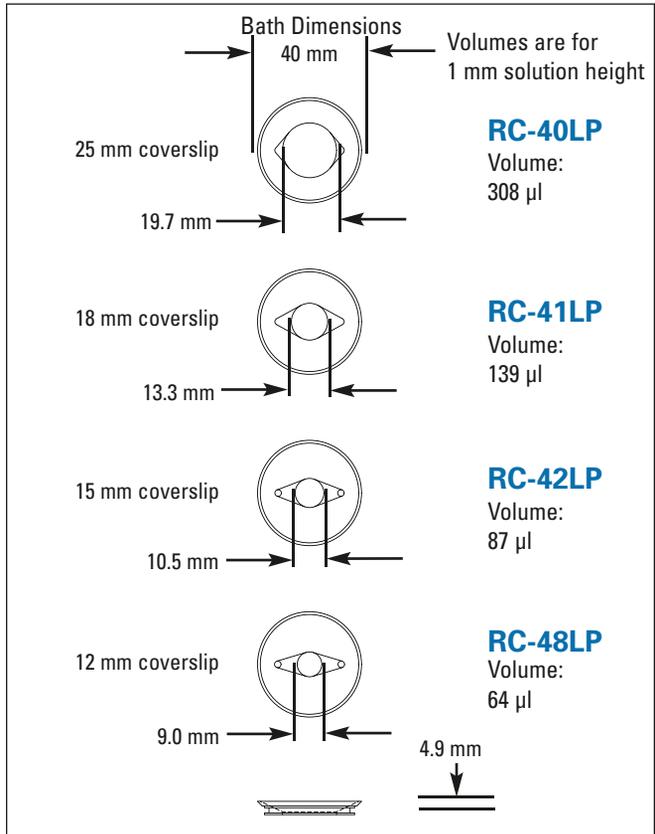
- Low profile design permits low entry angle of electrodes
- Excellent optical and mechanical access to cells and tissue
- When used with QE-1 Quick Exchange Platform, both temperature and perfusion control are possible

The Series 40 family of chambers was designed for research requiring fast exchange of coverslips. The chamber design consists of two parts: a polycarbonate chamber and a 40 mm diameter aluminum base. O-rings are used to seal the coverslip to the polycarbonate chamber and to hold the chamber securely in the aluminum base.

Open bath models are designed for electrophysiological recording and/or optical imaging, and are used in applications including patch clamp, oocyte clamp, and physiological measurements on cell cultures and tissue preparations. The low profile design permits good electrode access to the bath.

The RC-40LP, 41LP, 42LP and 48LP chambers use 25, 18, 15 and 12 mm round coverslips, respectively, in a round bath design to provide maximum viewing area. These chambers work equally well with both water and oil immersion objectives.

The RC-40LP, 41LP, 42LP and 48LP Chambers are supplied with one package of #1.5 coverslips each (25, 18, 15 and 12 mm round, respectively) and spare O-rings. Slice anchors available for RC-40, RC-41 and RC-42, see page 71.



Order #	Model	Product
W4 64-0367	RC-40LP	Quick Change Chamber 25 mm Low Profile
W4 64-0368	RC-41LP	Quick Change Chamber 18 mm Low Profile
W4 64-0369	RC-42LP	Quick Change Chamber 15 mm Low Profile
W4 64-0387	RC-48LP	Quick Change Chamber 12 mm Low Profile

Accessories and Replacement Parts

W4 64-0375	QE-1	Quick Exchange Heated Base for RC-40 Series
W4 64-0702	CS-12R	Coverslips 12 mm dia. #1, Box /100
W4 64-0703	CS-15R	Coverslips 15 mm dia. #1, Box /100
W4 64-0384	CS-18R	Coverslips 18 mm dia. #1, Box /100
W4 64-0705	CS-25R	Coverslips 25 mm dia. #1, Box /100
W4 64-0712	CS-12R15	Coverslips 12 mm dia. #1.5, Box /100
W4 64-0713	CS-15R15	Coverslips 15 mm dia. #1.5, Box /100
W4 64-0714	CS-18R15	Coverslips 18 mm dia. #1.5, Box /100
W4 64-0715	CS-25R15	Coverslips 25 mm dia. #1.5, Box /100

RC-40HP and RC-43C

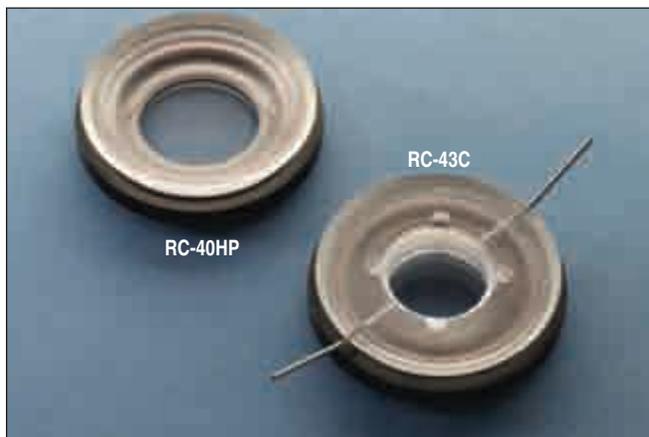
High Profile and Closed Bath Chambers

series 40 chambers

Chambers

series 40 chambers

Closed bath chamber for round coverslips



- O-ring seals permit quick exchange of coverslips
- Anodized aluminum base ensures good heat transfer
- Open and closed bath designs
- Use standard #1 or #1.5 thickness coverslips
- Ideal for rapid screening assays

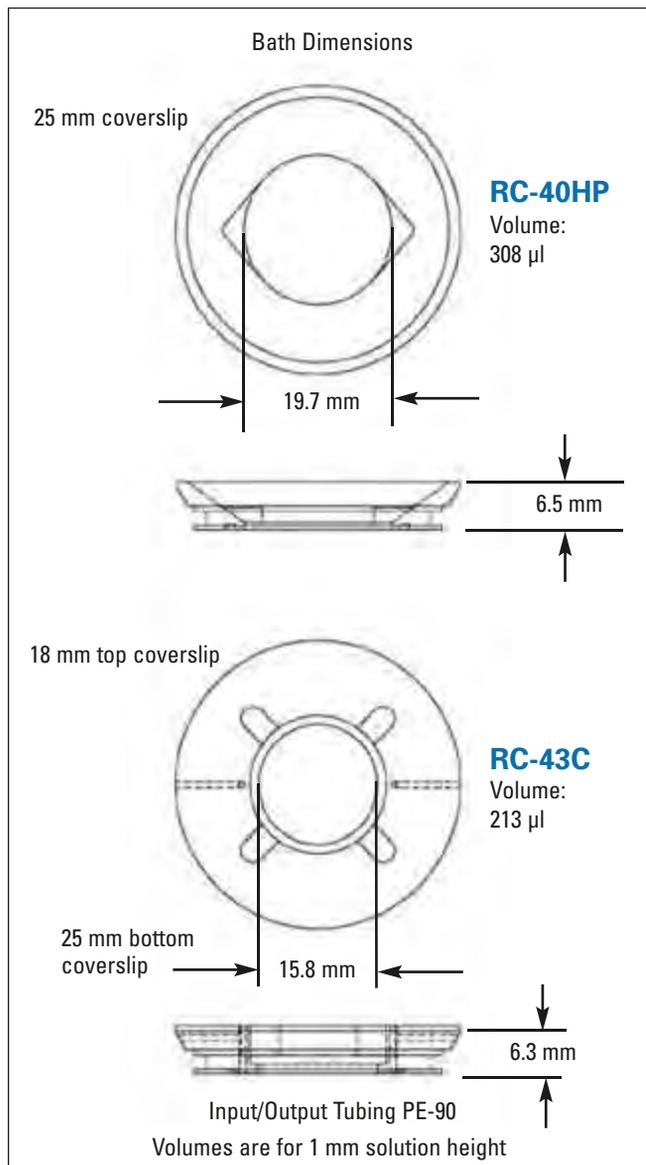
The RC-40HP uses a 25 mm coverslip to form the chamber bottom. The 6.5 mm tapered interior sides provide clearance for pipettes, injectors, etc. and allow for a greater bath depth than the 40LP Series.

The RC-40HP Chamber is supplied with one package of 25 mm diameter #1.5 coverslips.

The RC-43C is the closed bath member of the Series 40 family. The closed bath design promotes an even solution exchange and eliminates changes in focus due to alterations in bath height. Studies involving physiological bicarbonate buffers can be performed with no gas loss at the chamber interface.

Fluid is delivered to a 20 gauge stainless steel perfusion inlet port and removed from the chamber by means of a similar outlet port. The top coverslip is held in place with a retainer. A thin coating of silicone grease forms the seal between chamber and coverglass. The distance between top and bottom coverslips is 1 mm.

The RC-43C Chamber is supplied with one package each of #1.5 coverslips (25 and 18 mm round, respectively) and spare O-rings. Additionally, the RC-43C is supplied with 10 feet of PE-160 and PE-90 polyethylene tubing. Slice anchors available for RC-40, see page 71.



Order #	Model	Product
W4 64-0370	RC-40HP	Quick Change Chamber, High Profile
W4 64-0371	RC-43C	Quick Change Chamber, Closed Bath
Accessories and Replacement Parts		
W4 64-0375	QE-1	Quick Exchange Heated Base
W4 64-0384	CS-18R	Coverslips 18 mm Dia. #1, Box /100
W4 64-0705	CS-25R	Coverslips 25 mm Dia. #1, Box /100
W4 64-0714	CS-18R15	Coverslips 18 mm Dia. #1.5, Box /100
W4 64-0715	CS-25R15	Coverslips 25 mm Dia. #1.5, Box /100
W4 64-0754	PE-90/10	Polyethylene Tubing
W4 64-0755	PE-160/10	Polyethylene Tubing

series 40 chambers

RC-46SLP, RC-46SNLP and RC-47FSLP

Slotted Bath Low Profile Chambers

Slotted bath with and without field stimulation



- Low profile design permits low entry angle for electrodes
- Slotted bath for applications requiring rapid perfusion
- Platinum electrodes for applications requiring field stimulation
- When used with QE-1 Quick Exchange Platform, both temperature control and perfusion are possible

The RC-46SLP, RC-46SNLP, and RC-47FSLP chambers use a 25 mm round coverslip in a slotted bath design to provide rapid solution exchange. O-rings seal the coverslip to the polycarbonate chamber and hold the chamber securely in the aluminum base.

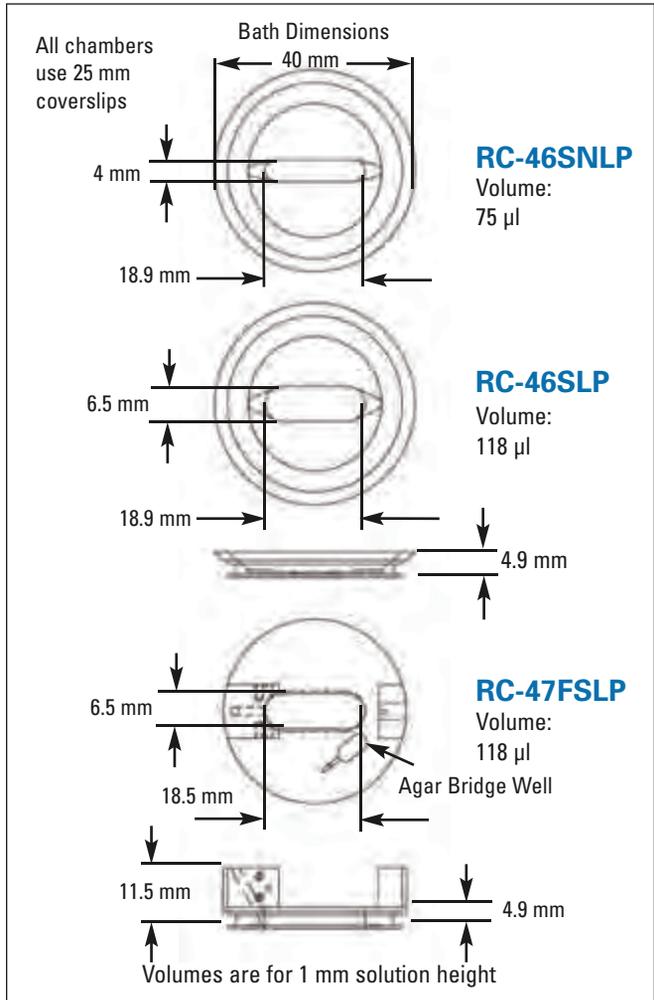
The low volume of these slotted bath chambers and the natural laminar flow allows rapid exchange of solution, facilitating drug application studies.

The RC-47FSLP includes a pair of platinum wires placed onto the parallel sides of the oval shaped bath. The 15 cm long connecting wires are terminated in 1 mm pins. This model includes a perfusion inlet port and a 16 gauge adjustable suction tube. An agar bridge well has been added to accommodate a bath ground electrode.

All chambers mount into the QE-1 Quick Exchange and DH Series Platforms and feature a 19.7 mm diameter aperture in the aluminum base.

Chambers are supplied with one box of #1.5 thickness, 25 mm coverslips and spare O-rings. Additionally, RC-47FSLP is supplied with 10 feet of PE-160 polyethylene tubing.

The SIU-102 is a bipolar stimulator designed for use with field stimulation chambers. This instrument features constant current and constant voltage modes, as well as bipolar, pulse, and DC modes. Optical coupling is used to electronically isolate the stimulator from the pulse source. Currents up to 100 mA and voltages up to 100 V are also supported. See page 247 for details.



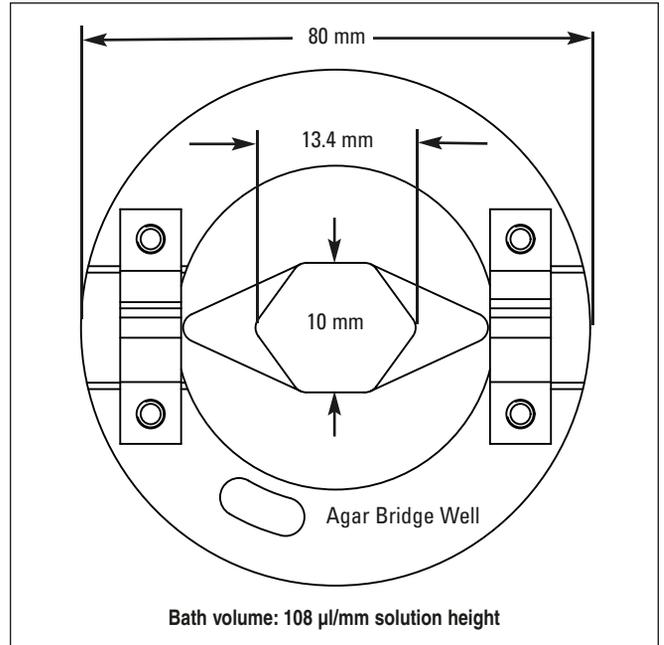
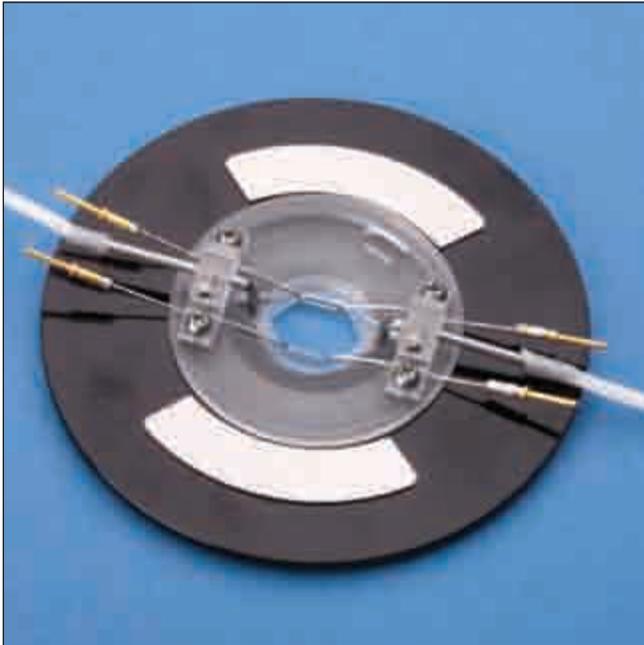
Order #	Model	Product
W4 64-0372	RC-46SLP	Quick Change Chamber Slotted Bath
W4 64-0373	RC-46SNLP	Quick Change Chamber Narrow Slotted Bath
W4 64-0374	RC-47FSLP	Quick Change Chamber w/ Field Stimulation

Accessories and Replacement Parts		
W4 64-0375	QE-1	Quick Exchange Heated Base
W4 64-0705	CS-25R	Coverslips 25 mm Dia. #1 Box/100
W4 64-0715	CS-25R15	Coverslips 25 mm Dia. #1.5 Box/100
W4 64-1424	SIU-102	Stimulus Isolation Unit
W4 64-1425	CC-102	Cable, male banana to 1 mm jacks (for use with Warner field stimulation chambers)
W4 64-0755	PE-160/10	Polyethylene Tubing

series 40 chambers

NEW RC-49FS

Perfusion Chamber with Field Stimulation for 18mm Coverslips



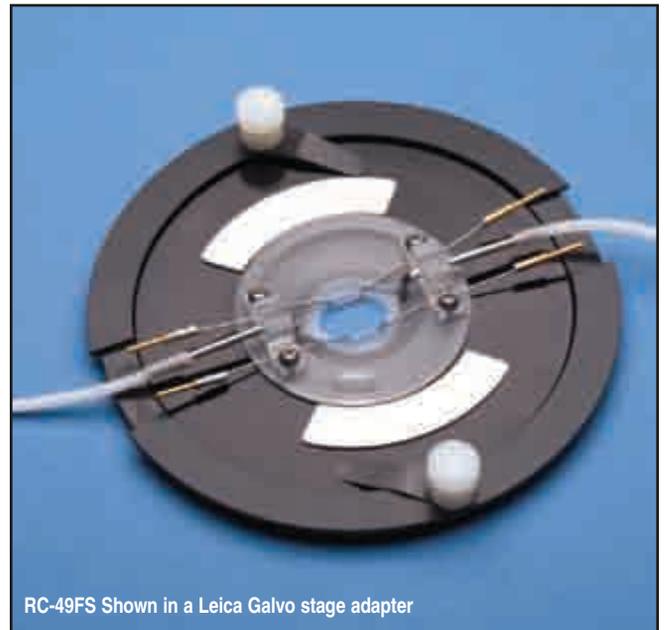
- O-Ring seal permits quick exchange of coverslips
- Low profile design allows low entry angle electrodes
- Platinum field stimulation electrodes
- Uses popular 18 mm round coverslips

The latest member of our family of field stimulation chambers is designed to maximize electrode access. The RC-49FS features a diamond shaped bath to promote laminar solution flow and a pair of easy to remove platinum field stimulation electrodes.

The low volume and natural laminar flow allows rapid exchange of solution, facilitating drug application studies. O-rings on the chamber base form a quick seal on a standard 18 mm, #1.5 thickness coverslip.

A replaceable pair of platinum wires are terminated in 1 mm gold pins on both ends for easy connection to a field stimulator. The RC-49FS uses Warner's Series 20 Stage Adapters for mounting onto a microscope.

The RC-49FS includes suction and perfusion tubes, a package of #1.5 thickness coverslips (CS-18R15), 10 feet of PE-160 polyethylene tubing, and spare o-rings.



RC-49FS Shown in a Leica Galvo stage adapter

Order #	Model	Product
W4 64-1709	RC-49FS	Imaging / recording chamber with removable electrodes
W4 64-1710	SE-49	Replacement stimulation electrodes
W4 64-0714	CS-18R15	Coverslips, 18 mm dia. #1.5, Box/100
W4 64-0755	PE-160/10	Polyethylene Tubing
W4 64-1424	SIU-102	Stimulus Isolation Unit
W4 64-1425	CC-102	Cable, male banana to 1 mm jacks (for use with Warner field stimulation chambers)

A low profile, horizontally mounted Ussing chamber for imaging



- Custom round or slotted apertures to accommodate a variety of tissues sizes
- Excellent optical access
- Accommodates both upright and inverted microscopes

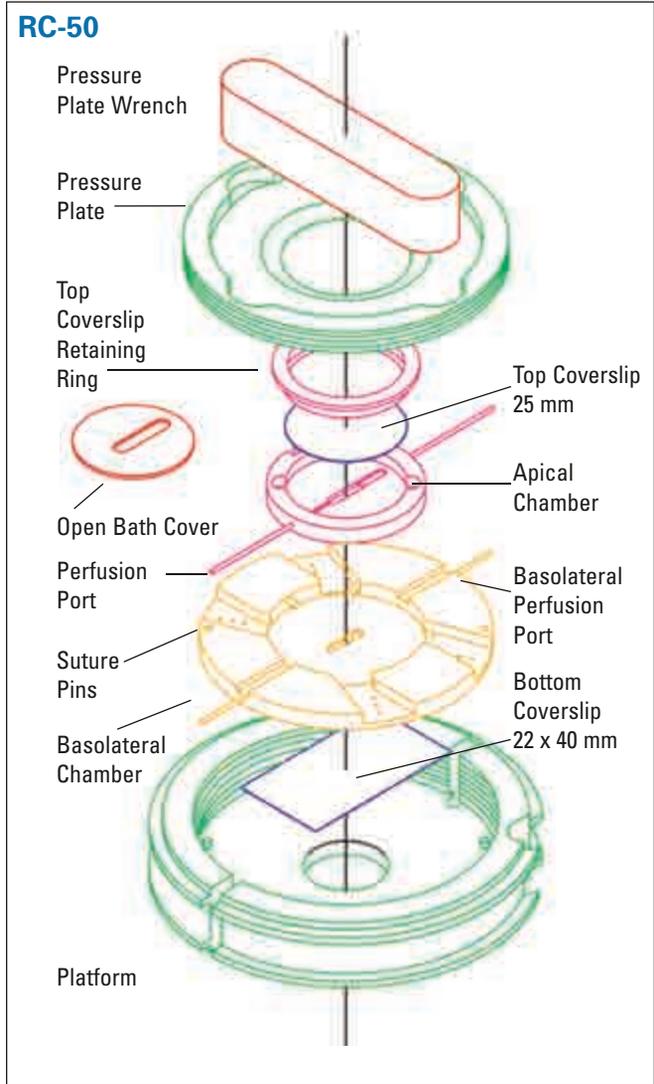
The RC-50 is a low profile, horizontally mounted Ussing chamber incorporating special features for confocal imaging. In particular, the chamber can be configured to use either gravity or pump driven perfusion. In addition, the apical (upper) chamber can be assembled in either an open or closed configuration. The basolateral chamber has been designed to facilitate placement and stretching of hard to handle tissue such as trachea. Suture pins are provided to act as anchor points for suture lines.

A #1 glass coverslip forms both the top and bottom of the chamber, allowing it to be used with both inverted and upright microscopes. While the chamber bottom is beveled to permit maximum access to the bottom coverslip, the chamber body can also be inverted to allow access to the other side. The viewing aperture in the chamber basolateral section is 17.7 mm in diameter and the viewing aperture in the chamber apical section is 22.8 mm.

The RC-50 includes a pair of resistive heater elements mounted to the chamber base. Heater elements are compatible with Warner TC-324B and TC-344B Heater Controllers.

The RC-50 requires the use of a Series 30 Stage Adapter for mounting onto a microscope, see next page.

The RC-50 is supplied with a package of #1 thickness bottom coverslips (CS-22/40, 22 x 40 mm, 100/pkg), a package of #1 thickness top coverslips (CS-25R, 25 mm round, 100/pkg), a suction tube with magnetic clamp, and 10 feet each of PE-90 and PE-160 polyethylene tubing.



Specifications

Physical Dimensions	12.4 mm H x 82 mm D
Weight	<110 g, assembled with heaters
Platform and Pressure Plate	Aluminum, black anodized
Coverslip Plates	Polycarbonate
Input/Output Tubing	PE-90
Coverslips (#1) Top: 25 mm; Bottom: 22 x 40 mm	
Aperture (basolateral)	17.7 mm
Aperture (apical)	22.8 mm
Working Distance (basolateral)	0.375 mm
Working Distance (apical) includes coverslip	1.15 mm

Imaging Chambers for Transepithelial Studies (continued)

Order #	Model	Product
W4 64-0605	RC-50	Imaging Chamber for Transepithelial Studies, custom aperture
W4 64-0606	RC-50-R3	Imaging Chamber for Transepithelial Studies, 3 mm round
W4 64-0607	RC-50-R15	Imaging Chamber for Transepithelial Studies, 15 mm round
W4 64-0608	RC-50-S3X7	Imaging Chamber for Transepithelial Studies, 3 x 7 mm slot
W4 64-0609	RC-50-S2.5X10	Imaging Chamber for Transepithelial Studies, 2.5 x 10 mm slot
W4 64-0610	RC-50-D15X10	Imaging Chamber for Transepithelial Studies, 15 x 10 mm diamond

Replacement Imaging Chamber Inserts

W4 64-0611	BA-R3	RC-50 Imaging Chamber Round Insert, 3 mm diameter
W4 64-0612	BA-R15	RC-50 Imaging Chamber Round Insert, 15 mm diameter
W4 64-0613	BA-S3X7	RC-50 Imaging Chamber Slotted Insert, 3 x 7 mm slot
W4 64-0614	BA-S2.5X10	RC-50 Imaging Chamber Slotted Insert, 2.5 x 10 mm slot
W4 64-0615	BA-D15X10	RC-50 Imaging Chamber Diamond Insert, 15 x 10 mm diamond

Accessories and Replacement Parts

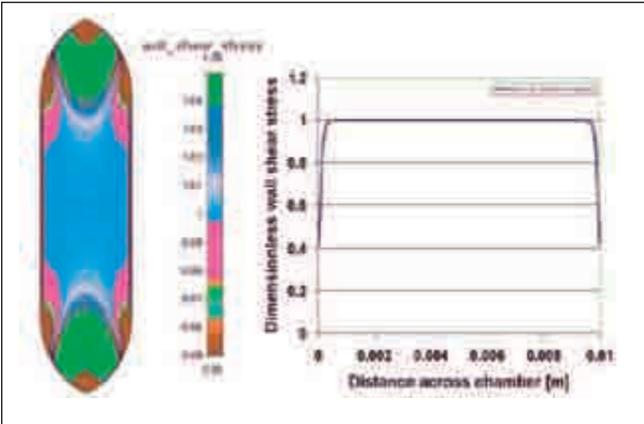
W4 64-0754	PE-90/10	Polyethylene Tubing
W4 64-0755	PE-160/10	Polyethylene Tubing
W4 64-0707	CS-22/40	Coverslips, 22 x 40 mm #1, 50/box
W4 64-0705	CS-25R	Coverslips, 25 mm, round

Series 30 Stage Adapters

W4 64-0322	SA-30NIK	Stage Adapter for Nikon Diaphot / TE200 / TE300
W4 64-0324	SA-30TMS9	Stage Adapter for Nikon TMS with 9 x 13 cm cutout
W4 64-0325	SA-30/OLY2	Stage Adapter for Olympus IMT-2 / IX-50 / IX-70 / BX-50WI
W4 64-0326	SA-30LZ	Stage Adapter for use with Zeiss Axiovert 211 x 230 Specimen Stage
W4 64-0327	SA-30KZ	Stage Adapter for Zeiss Axiovert 85 x 130 Mechanical (K) Stage
W4 64-0328	SA-30L3P	Stage Adapter for Leica Dmirbe/E with 3-Plate Mechanical Stage
W4 64-0329	SA-30PLI	Stage Adapter for Prior & Ludl Motorized Stage
W4 64-0377	SA-30GALVO Z	Stage Adapter for Leica Galvo Z Stage
W4 64-0379	SA-30UUZ	Stage Adapter for Zeiss LSM510
W4 64-0380	SA-30UU	Stage Adapter for use with Nikon E400/E600/E800
W4 64-1456	SA-30GALZi	Stage Adapter for Leica Galvo Z Inverted Stage

shear flow chamber

NEW PFC-1 ProFlow Shear Flow Chamber



- Computer designed gaskets optimized for well-defined, well-controlled shear-flow
- Based on technology developed at Case Western Reserve University
- Single- and dual-flow capable chamber
- Made from polycarbonate for easy cleanup

Warner's new PFC-1 ProFlow chamber is based on the designs of Dr. Melissa Knothe Tate, currently of the Case Western Reserve University.

The chamber uses silicone gaskets, similar in approach to our popular RC-30 chamber, to form a closed-bath area sandwiched between two opposing glass coverslips. However, the ProFlow chamber uses specially designed gaskets that optimize the shear-flow dynamics within the bath. This optimized design results in a nearly uniform shear flow across the entire width of the bath. This allows the shear force to be more easily calculated when these gaskets are used.

Precut gaskets are manufactured from medical-grade silicone, are 0.250 mm thick, and can be stacked to achieve bath heights in multiples of a single gasket. Gaskets are supplied in packs of 10 and can be purchased separately.

The system consists of a top plate and two bottom plates. One bottom plate allows the formation of a single-sided flow chamber for use with cultured cells, and the other bottom plate allows the formation of a double-sided flow chamber for use with isolated sections or for conditions where controlled flow is desired on both sides of a structure.

The PFC-1 is designed to fit into our Series 30 stage adapters.

The PFC-1 comes complete with chamber top, two chamber bases, precut gaskets (10 pk), 15 mm round coverslips (# 1.5 thickness, 100 pk, CS-15R15), 25 mm round coverslips (#2 thickness, 50 pk, CS-25R20) and PE-90 tubing (10 ft).

Order #	Model	Product
W4 64-1860	PFC-1	ProFlow Chamber, fit Series 30 stage adapters
W4 64-1861	-	ProFlow Gaskets, 0.250 mm thick, 10 pk
W4 64-0713	CS-15R15	15 mm round coverslip, glass, #1.5 thickness
W4 64-0722	CS-25R20	25 mm round coverslip, glass, #2 thickness
W4 64-0754	PE-90/10	PE-90 tubing, 10 ft

YC-1

Flow Chamber for Yeast Cells

yeast cell chamber

Chambers

yeast cell chamber



- Monitor yeast cell growth using time-lapse microscopy, while changing media
- Cells grow two dimensionally over multiple cell cycles
- Change media in seconds without washing cells out
- Resistive heating or Peltier temperature control options

Research in cell biology often requires scientists to microscopically study individual live cells under various conditions, such as at different temperatures or in the presents of different growth media.

One particular interest is to monitor individual cell growth using time-lapse microscopy while seamlessly and rapidly changing the liquid environment. The YC-1 flow chamber has been developed to allow observation of yeast cells proliferating in a bi-dimensional manner over multiple cell cycles.

The YC-1 overcomes a common problem encountered in standard time-lapse technology: Regular time lapse setups (using agar gel pads) do not allow media to be changed during the experiment. Standard flow chambers do not allow for monitoring multiple cell cycles assay since the progeny is eventually washed out by the flow.

The principle components of the YC-1 microfluidic system include:

1. PDMS flow chamber
2. PDMS coated coverslips
3. Cellulose membranes
4. Temperature controlled platform

Additional components required to complete the system are a temperature controller, fluid delivery system, and a series 20 microscope stage adapter.

The YC-1 is designed for use on an inverted microscope.

The YC-1 is supplied with four PDMS microfluidic chambers, fifty PDMS coated coverslips, fifty cellulose membranes, one chamber platform with resistive heaters, ten feet of PE-50 tubing, and two 23 gauge blunt end syringe needles.

Specifications

Material	PDMS Flow cell (dimensions 50 L x 23 W x 4.5 H mm)
	Platform aluminum black anodized, polycarbonate cover
Bath dimensions (L x W x H)	40 x 0.6 x 0.1 mm
Bath volume	2.4 µl
Coverslips	24 x 50 mm #1 thickness with 40 µm PDMS coating
Cellulose membranes	24 x 50 mm x 30 µm thick
Perfusion ports	0.63 mm OD

Order # Model Product

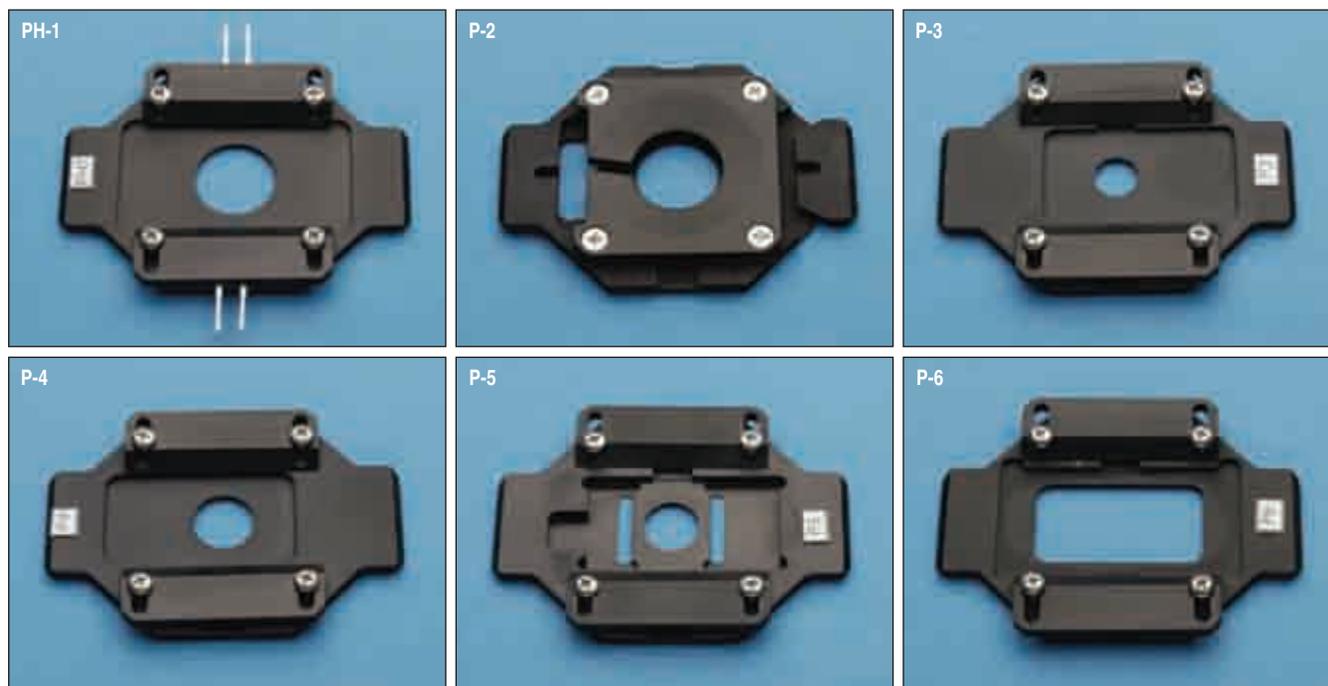
W4 64-1678	YC-1	Flow Chamber for Yeast Cells, Resistive Heaters
W4 64-1679	YC-2	Flow Chamber for Yeast Cells, Peltier Version
W4 64-1680	PH-10	Heated Platform (Resistive)
W4 64-1682	SIC-4	PDMS Chambers (4)
W4 64-1683	SCS-50	PDMS Coated Coverslips (50)
W4 64-1684	CME-50	Cellulose Membranes (50)

Series 20

Classic Series 20 Platforms

culture dish platforms

Anodized aluminum platforms provide clamping between Series 20 chambers and the coverslips



The Warner Series 20 platforms function as a base for Series 20 chambers and provide clamping to make a seal between the chamber and coverslip. Platforms are machined from aluminum and finished with a black anodize. This provides excellent heat conductivity and minimizes stray light reflectance. Platform designs are optimized to provide maximum heat transfer to the coverslip and still afford excellent access for objectives.

Sliding clamps used on most models permit removal of the chamber to change its coverslip. The P-2 Platform uses a one piece clamp secured with 4 screws, while all other models use two clamps each with 2 screws each (i.e. 4 total).

Platforms can be ordered plain or with resistive heaters. Control of platform heating is provided by our TC-324B/TC-344B temperature controllers and a CC-28 cable interface. Heating of perfusate is achieved using our SH-27B or SF-28 In-line Solution Heaters.

Stage adapters are available for all major microscopes; see pages 64 to 65. Custom or modified stage adapters are also available. Call our Technical Support Department for details.

Chamber Model	Aperture	Order #	Plain Platform	Order #	Heater
RC-22/22C/24/24E/24N/ RC-26/26G/26GLP/26Z JG-23N/HP,WHP,WLP	17.8 mm	W4 64-0277	P-1	W4 64-0284	PH-1
RC-21B/21BR/21BDW/21BRFS	17.5 mm	W4 64-0278	P-2	W4 64-0285	PH-2
RC-25	9.5 mm	W4 64-0279	P-3	W4 64-0286	PH-3
RC-25F	13.0 mm	W4 64-0280	P-4	W4 64-0287	PH-4
RC-20/20H	12.0 mm	W4 64-0281	P-5	W4 64-0288	PH-5
RC-27/27N/27NE/RC-28	19 x 35.6 mm	W4 64-0282	P-6	W4 64-0289	PH-6
RC-27L/RC-29	19 x 35.6 mm	W4 64-0283	P-6D	W4 64-0290	PH-6D

culture dish platforms

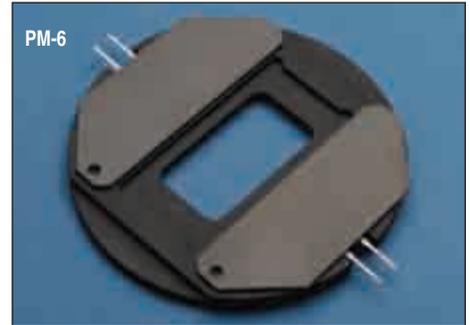
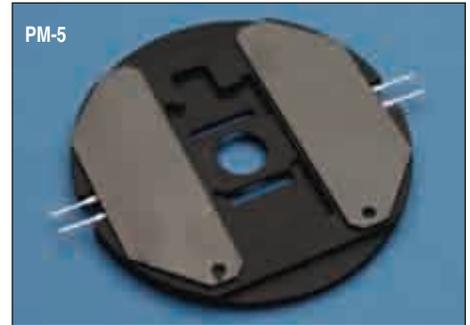
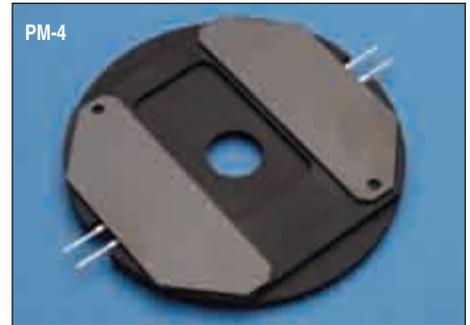
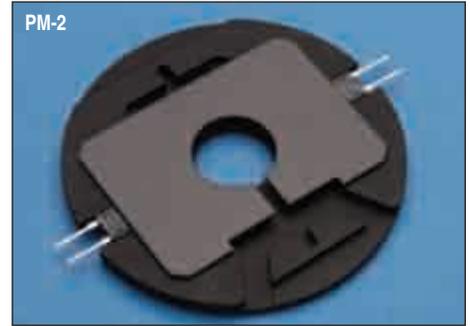
PM Series

Heated Platforms with Magnetic Clamps

Heated platforms provide a base for Series 20 chambers and allow easy clamping of coverslip and chamber

Chambers

culture dish platforms



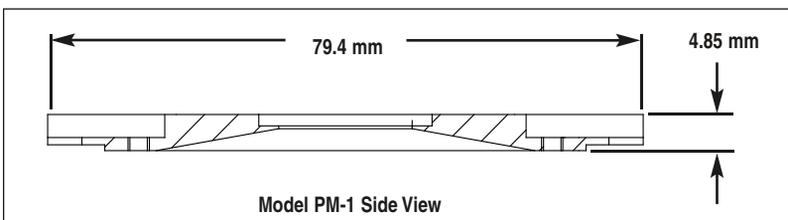
- Permits the small entry angles ideal for patch recording
- No screws needed to secure chamber to platform
- Available for all Series 20 chambers
- Magnetic stainless steel allows use of magnetic holders
- Compatible with all Series 20 stage adapters

The Warner PM Series magnetic platforms function as bases for Series 20 chambers and provide clamping to make a seal between chamber and coverslip. Platforms are machined from aluminum and finished with a black anodize. This provides excellent heat conductivity and minimizes stray light reflectance. Platform designs are optimized to provide maximum heat transfer to the coverslip and still afford excellent access for objectives.

Four nickel-plated magnets on each side of the platform are used to secure the clamps. Magnets are sealed in a corrosion resistant coating. Clamps consist of ferromagnetic stainless steel plates that allow the use of magnetic devices. No screws are needed for assembly, permitting rapid replacement of the chamber even in a darkened room.

Resistive heating of the platforms is provided by our TC-324B/TC-344B temperature controllers and a CC-28 cable interface. Heating of perfusate is achieved using our SH-27B or SF-28 In-line Solution Heaters. All models include resistive heating elements.

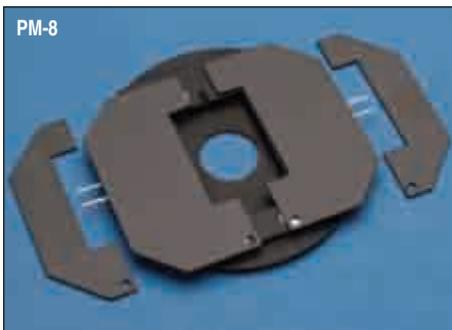
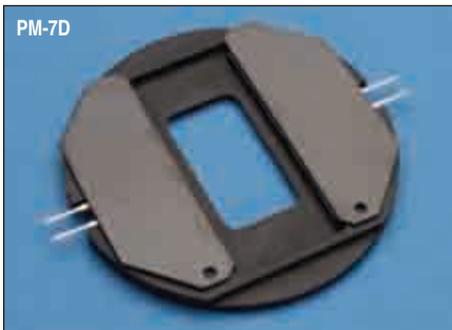
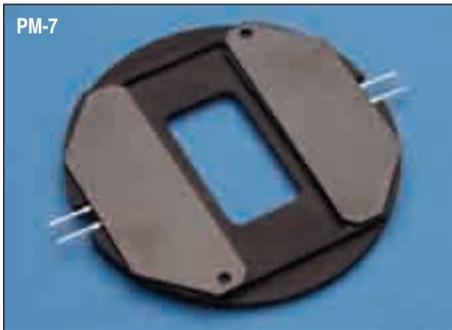
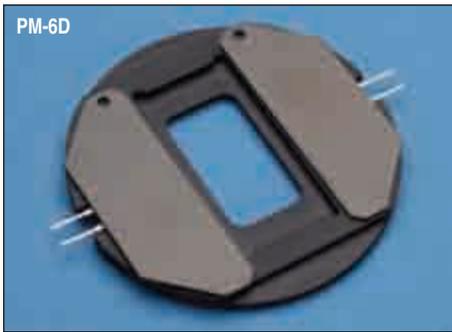
Stage adapters are available for all major microscopes, see pages 64 to 65. Custom or modified stage adapters are also available. Call our Technical Support Department for details.



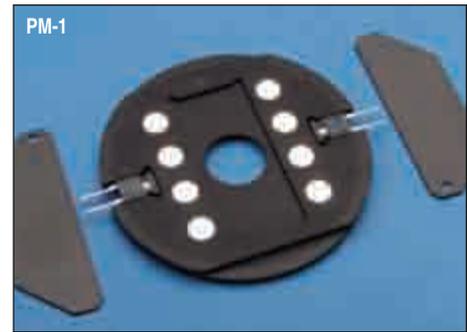
PM Series

Heated Platforms with Magnetic Clamps (continued)

culture dish platforms



Extra clamps with small footprint.



Eight powerful magnets in each platform provide plenty of clamping pressure, ensuring a good seal between chamber and coverslip.



PM-1 w/ RC-22, Nikon stage adapter and CC-28 interface cable

Order #	Model	Aperture Size	For Chamber Model
W4 64-1526	PM-1	17.8 mm	RC-22/22C/24/24E/24N/ RC-26/26G/26GLP/26Z, JG-23N/HP,W/HP,W/LP
W4 64-1561	PM-2	17.5 mm	RC-21B/BR/BDW/BRW/BRFS
W4 64-1562	PM-3	9.5 mm	RC-25
W4 64-1563	PM-4	13.0 mm	RC-25F
W4 64-1564	PM-5	12.0 mm	RC-20/20H
W4 64-1527	PM-6	19.0 x 35.6 mm	RC-27/27N/27NE/28
W4 64-1528	PM-6D	19.0 x 35.6 mm	RC-27L/29
W4 64-1529	PM-7	19.0 x 35.6 mm	RC-27D
W4 64-1530	PM-7D	19.0 x 35.6 mm	RC-27LD
W4 64-1531	PM-8	17.8 mm	RC-26GS

culture dish platforms

Accessories

Chambers

culture dish platforms

Heated platforms provide a base for Series 20 chambers and allow easy clamping of coverslip and chamber

Series 20 Interface Cables and Thermistors



CC-15



CC-28



CC-35



TA-29

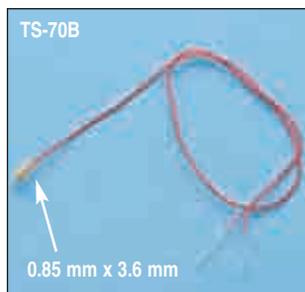


TA-30



TS-60P

1.95 mm x 9 mm



TS-70B

0.85 mm x 3.6 mm



RH-2

Order #	Model	Product
W4 64-0303	CC-15	Interface Cable with connector with tinned leads
W4 64-0106	CC-28	Interface Cable with connector for TC-324B/344B
W4 64-0109	CC-35	Cable with with 8 pin DIN connector for TC-324B/344B
W4 64-0107	TA-29	Cable with Bead Thermistor

Order #	Model	Product
W4 64-0108	TA-30	Cable with Glass Bead Thermistor
W4 64-0269	TS-60P	Replacement Probe Thermistor for CC-28 and CC-15 Cables
W4 64-0270	TS-70B	Replacement Bead Thermistor for CC-28 and TA-29 Cables
W4 64-0274	RH-2	Replacement Heater Elements for PH and PM Platforms

Platform and Chamber Parts

Order #	Model	Product
W4 64-1429	STU-1	Suction Tube Upgrade Kit with Mag-7
W4 64-1506	RPC-1	Replacement Platform Clamps
W4 64-1507	RPC-2	Replacement Clamps for DH35i, DH-40i and QE-1
W4 64-0276	CR-15	Coverslip Retainer for RC-20 and RC-20H



STU-1



RPC-1 Clamps & Screws



RPC-2



CR-15

culture dish platforms

Accessories (continued)

MCK-1 Magnetic Clamp Kit for Series 20 Chambers

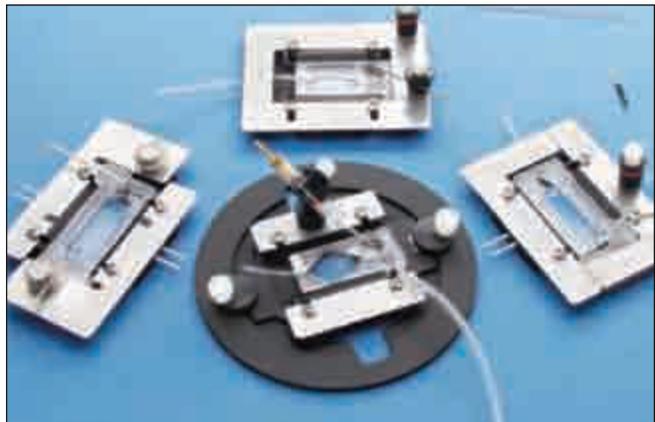


- Useful for simple positioning needs
- Complete kits available for all Series 20 platforms
- Includes a variety of holding tools

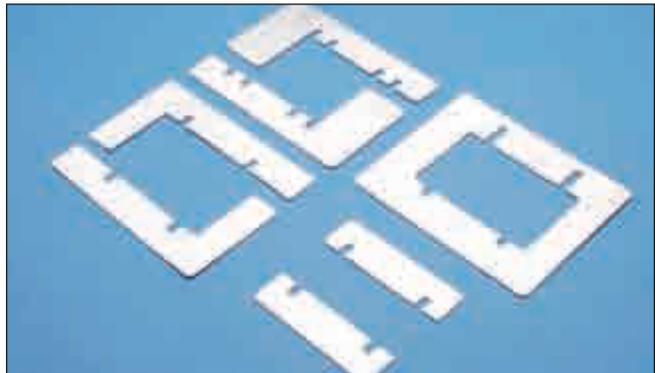
The MCK-1 Magnetic Clamp Kit provides our classic Series 20 chamber users with a convenient method of mounting or clamping accessories to the perfusion chamber. Typical items that may be attached are additional suction or perfusion tubes, ground electrodes, hold down needles, thermistor probes or gas jets.

Each kit comes with 4 sets of magnetic stainless steel mounting plates that fit on all P and PH platforms and 6 magnetic supports. A clamp for mounting 1/4 inch (6.3 mm) diameter devices has a rotating joint with locking knob. This clamp is useful for turning a standard electrode holder into an agar bridge for solution bath grounding. Two included low profile twin magnets with silicone rubber pads can be used for mounting needle holddowns. The kit also includes a mechanical clamp with two slits that can clamp onto small diameter tubing such as a suction tube. The remaining two clamps are designed for securing ground wires or thermistors.

Order #	Model	Product
W4 64-0357	MCK-1	Magnetic Clamp Kit
W4 64-0358	MAG-1	Magnetic Clamp for 1/4 inch (6.3 mm) devices
W4 64-0359	MAG-2	Magnetic Clamp 16 g for suction tubes
W4 64-0360	MAG-3	Magnetic Clamp for wires
W4 64-0361	MAG-4	Magnetic Clamp with twin magnetics



Made from magnetic stainless steel and delrin this kit is easily added to your set-up



Each kit comes with four complete base plate designs, offering considerable versatility.

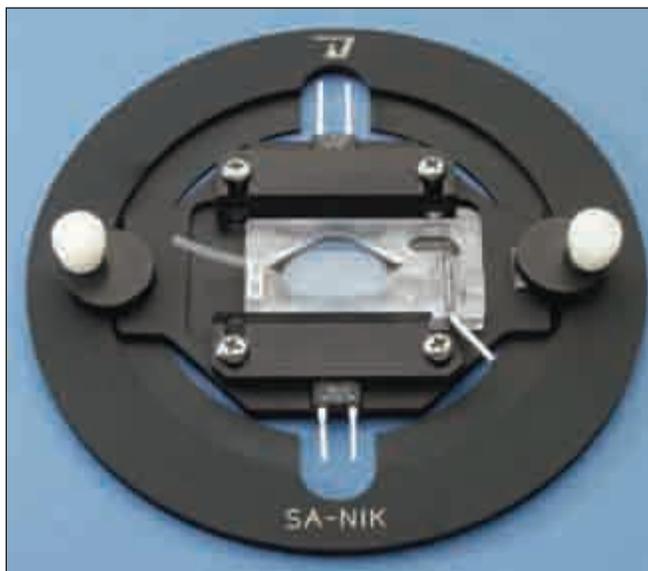


Magnets with just the right amount of force are used in the clamp kit



Suction tube holder

Black Delrin® stage adapters connect Series 20/Series 30 platforms and components with all major brand microscope stages.



Series 20 and Series 30 Stage Adapters each perform exactly the same role with the difference between the two being the size of the internal cutout. Specifically, the Series 30 stage adapter has a larger ID to accommodate the larger diameter Series 30 components. The OD of similarly named stage adapters remains the same.

Design of Stage Adapters

Stage Adapters are designed to allow the mounting of Warner imaging and recording products onto a microscope. We have a wide variety of stage adapters to fit most commonly used microscope stages including stock stages from Nikon, Olympus, Zeiss, and Leica. We also have stage adapters compatible with 3rd party stages from Burleigh, Prior & Ludl, and Marzhauser to name a few. Adapters are machined from high quality Delrin which provides good thermal isolation from the microscope stage. All platforms (e.g., Series 20, Series 30), the QE-1 and the DH-35, DH-35i, and DH-40i microincubators rest upon a 38 mm lip which surrounds the central aperture. Platforms and bases are secured using two plastic button clamps.

Note to Zeiss Axiovert users: Series 20 Platforms fit directly into the Zeiss slide frame (Zeiss p/n 471719) which mounts on the Zeiss 211 x 230 Specimen Stage. However, if a heater platform is used, the metal slide frame is not recommended since it will act as a thermal heat sink. Use stage adapter SA-20LZ for this heating application.

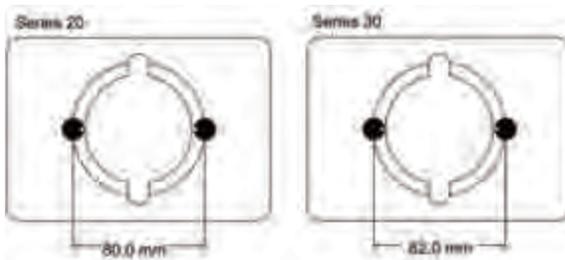
Selecting a Stage Adapter

Consult the table below to identify stage adapters compatible with your microscope stage. Generally speaking, the table lists dimensions that should match the cutout in your microscope stage. Illustrations for the most common stage adapters, along with their dimensions, are also presented below and also in the Product Specs window above.

If your stage is not listed, or if you have questions on adapter compatibility, please contact our technical staff. Custom or modified versions are available.

Stage Adapter Lookup Table

The table (on facing page) lists stage adapter known to be compatible with most common microscope stages. However, since each microscope can support many stages, you should compare the adapter dimensions to the stage cutout before ordering.



Series 20 & Series 30 (continued)

stage adapters

Stage Manufacturer	Adapter Dimensions	Series 20 Stage Adapters	Order Number		Series 30 Stage Adapters	Order Number	
Nikon	10.8 cm Diameter	SA-NIK	W4 64-0291		SA-30NIK	W4 64-0322	
	8 cm x 12 cm	-	-		SA-30TMS/9	W4 64-0324	
	9 cm x 13 cm	SA-TMS/9	W4 64-0293		-	-	
	12.7 cm x 11 cm	SA-TS100	W4 64-0340		-	-	
	23.75 cm x 15.65 cm	SA-20UU	W4 64-0298		SA-30UU	W4 64-0380	
	23.75 cm x 15.65 cm	SA-20Ti	W4 64-1744		SA-30Ti	W4 64-1747	
Olympus	10.3 cm x 8.89 cm	SA-OLY	W4 64-0294		-	-	
	12.7 cm x 11 cm	SA-20UU	W4 64-0298		-	-	
	11 cm diameter	SA-OLY/2	W4 64-0295		SA-30/OLY2	W4 64-0325	
Leica	16.5 cm x 10 cm	SA-20LZ	W4 64-0296		SA-30GALVZi	W4 64-1456	
	14.99 cm x 14.99 cm	SA-20L3P	W4 64-0301		SA-30L3P	W4 64-0328	
	9.66 cm diameter	SA-20GALVO Z	W4 64-0376		SA-30GALVOZ	W4 64-0377	
Zeiss	10.97 cm x 15.98 cm	SA-20KZ	W4 64-0297		SA-30KZ	W4 64-0327	
	16.5 cm x 10 cm	SA-20LZ	W4 64-0296		SA-30LZ	W4 64-0326	
	12.7 cm x 13 cm	SA-20UUZ	W4 64-0336		SA-30UUZ	W4 64-0379	
	14.99 cm x 14.99 cm	SA-20L3P	W4 64-0301		-	-	
Prior & Ludi	16 cm x 11 cm	SA-20PL	W4 64-0299		-	-	
	16 cm x 11 cm	SA-20PLI	W4 64-0300		SA-30PLI	W4 64-0329	
	17.78 cm x 11.76 cm	SA-20PP	W4 64-1746		SA-30PP	W4 64-1745	
Burleigh Gibraltar	11 cm diameter	SA-OLY/2	W4 64-0295		-	-	
	10.96 cm diameter	SA-OLY/3	W4 64-0386		-	-	
Marzhauser	10.97 cm x 15.98 cm	SA-20KZ	W4 64-0297		-	-	
Universal	12.8 cm x 8.6 cm	SA-20MW	W4 64-1645		-	-	

Chambers

stage adapters

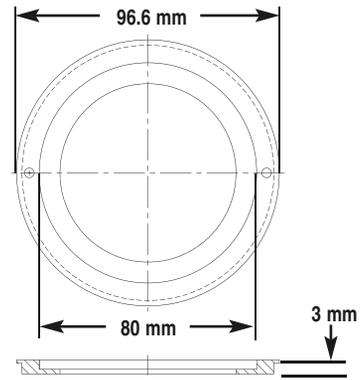
stage adapters

Series 20 & Series 30 (continued)

Chambers

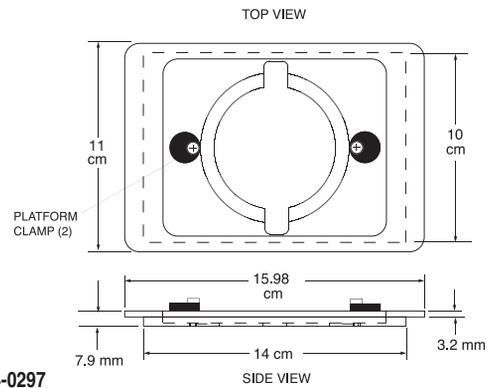
stage adapters

SA-20GALVO Z



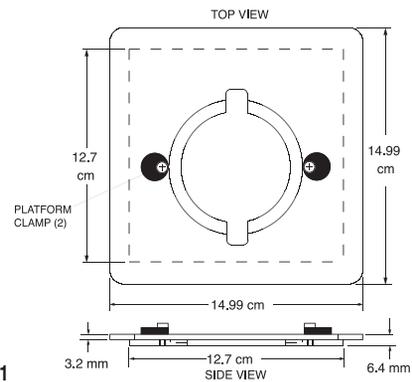
W4 64-0376

SA-20KZ



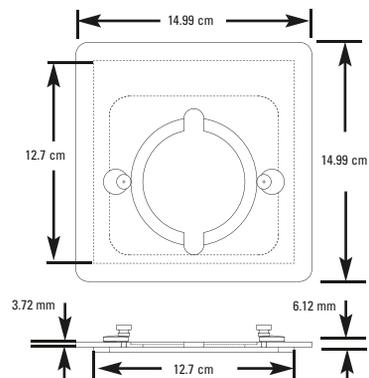
W4 64-0297

SA-20L3P



W4 64-0301

SA-20L3P2



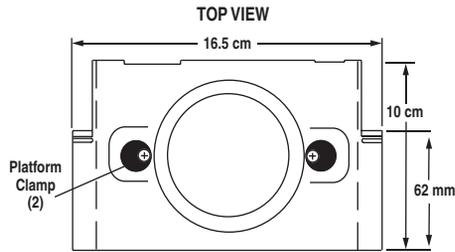
W4 64-0389

Series 20 & Series 30 (continued) stage adapters

SA-20LZ



TOP VIEW



SIDE VIEW

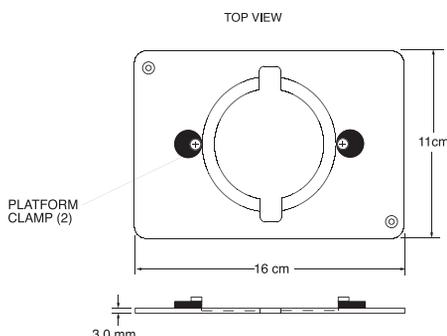


W4 64-0296

SA-20PL



TOP VIEW



SIDE VIEW

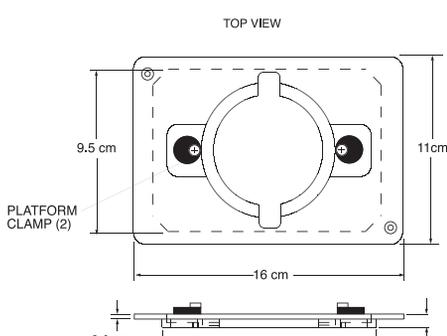


W4 64-0299

SA-20PLI



TOP VIEW



SIDE VIEW

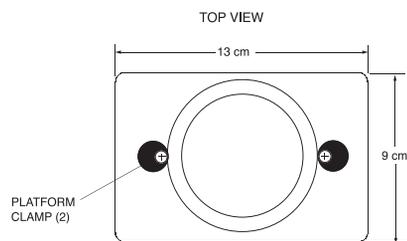


W4 64-0300

SA-20 TS100



TOP VIEW



SIDE VIEW



W4 64-0340

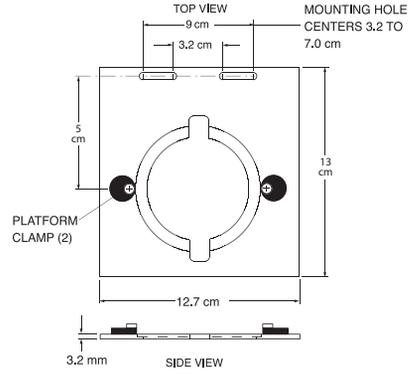
stage adapters

Series 20 & Series 30 (continued)

Chambers

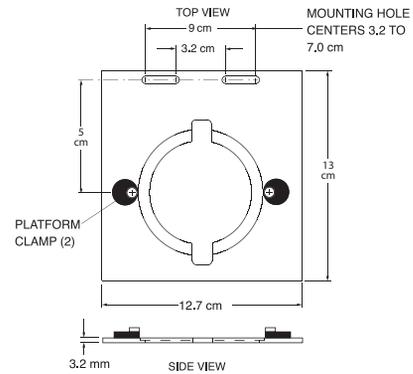
stage adapters

SA-20UU



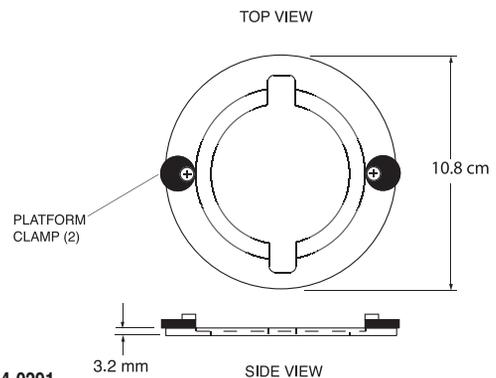
W4 64-0298

SA-20UUZ



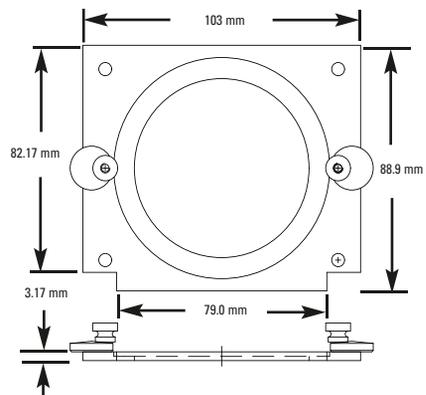
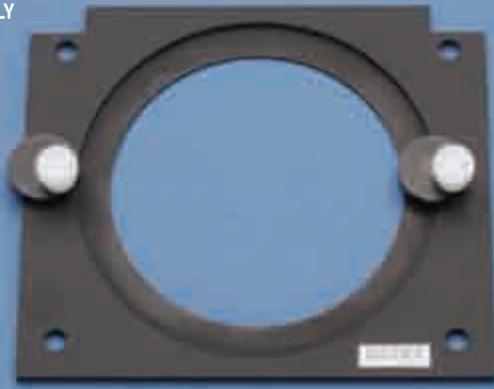
W4 64-0336

SA-NIK



W4 64-0291

SA-OLY



W4 64-0294

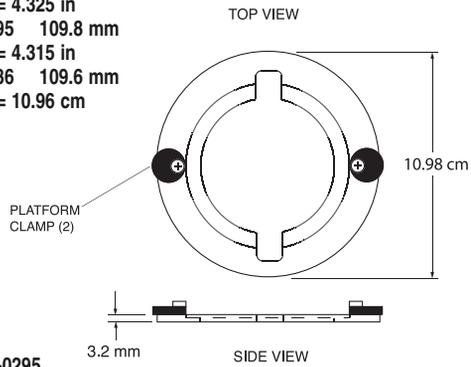
Series 20 & Series 30 (continued) stage adapters

SA-OLY/2



SAOLY/2 = 4.325 in
 W4 64-0295 109.8 mm
 SAOLY/2 = 4.315 in
 W4 64-0386 109.6 mm
 SAOLY/3 = 10.96 cm

TOP VIEW



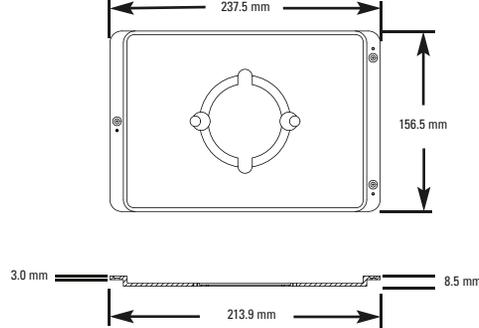
10.98 cm

3.2 mm

SIDE VIEW

W4 64-0295

SA-20TI

237.5 mm

156.5 mm

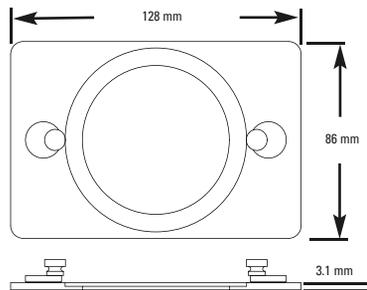
3.0 mm

213.9 mm

8.5 mm

W4 64-1744

SA-20MW

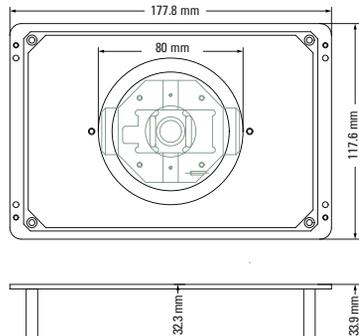
128 mm

86 mm

3.1 mm

W4 64-1645

SA-20PP

177.8 mm

80 mm

117.6 mm

23.9 mm

W4 64-1746

Coverslips chamber accessories

Large selection of high quality coverslips stocked for immediate delivery



Now Available in #1.5 Thickness!

High quality Coverslips are essential for microscopy imaging. At high resolutions (40X, 60X or 100X), choosing the correct coverslip is critical for good performance. Warner has recently expanded its line of coverslips to include German borosilicate glass at #1.5 thickness. Except CS-40R, CS-30R and CS-24/60.

Stocked in depth in the sizes used with RC Series, Series 20 and the new Series 40 chambers. Consult the chart to select the correct cover glass for your chamber.

Order #	Model	Quantity	Dimension	Chamber Used With
Coverslip Thickness #1: 0.15 mm (0.006 in.)				
W4 64-0720	CS-3R	100	3 mm D	
W4 64-0700	CS-5R	100	5 mm D	Fits inside 96-well culture plate
W4 64-0701	CS-8R	100	8 mm D	Fits inside 24-well culture plate
W4 64-0702	CS-12R	100	12 mm D	RC-25, RC-48LP
W4 64-0703	CS-15R	100	15 mm D	RC-20, RC-20H, RC-25F, RC-37WC, RC-37FC
W4 64-0384	CS-18R	100	18 mm D	RC-37WC, RC-41LP, RC-43C
W4 64-0704	CS-22S	100	22 x 22 mm	RC-21B
W4 64-0705	CS-25R	100	25 mm D	RC-21BR, RC-21BRFS, RC-21BRW, RC-21BDW, RC-40LP, RC-40HP, RC-43C, RC-46SNLP, RC-46SLP, RC-47FSLP, RC-50
W4 64-1500	CS-40R	60	40 mm D	RC-30WA
W4 64-0706	CS-22/30	50	22 x 30 mm	RC-30, RC-30HV
W4 64-0707	CS-22/40	50	22 x 40 mm	RC-22, RC-22C, RC-24, RC-24E, RC-24N, RC-26, RC-26G, RC-26GLP, RC-26GS, RC-30, RC-50
W4 64-0708	CS-22/50	50	22 x 50 mm	RC-26Z, JG-23N/HP, JG-23W/HP, JG-23W/LP
W4 64-0709	CS-24/50	50	24 x 50 mm	RC-27, RC-27L, RC-27N, RC-27NE, RC-28, RC-29
Coverslip Thickness #1.5: 0.17 mm (0.0067 in.)				
W4 64-0718	CS-10R15	100	10 mm D	
W4 64-0712	CS-12R15	100	12 mm D	RC-25, RC-48LP
W4 64-0713	CS-15R15	100	15 mm D	RC-20, RC-20H, RC-25F, RC-42LP, RC-37WC
W4 64-0714	CS-18R15	100	18 mm D	RC-37FC, RC-41LP, RC-43C
W4 64-0719	CS-22R	100	22 mm D (Round)	
W4 64-0721	CS-22S15	100	22 mm D (Square)	
W4 64-0715	CS-25R15	100	25 mm D	RC-21BR, RC-21BRFS, RC-21BRW, RC-21BDW, RC-40LP, RC-40HP, RC-43C, RC-46SNLP, RC-46SLP, RC-47FSLP, RC-50
W4 64-1499	CS-30R	90	30 mm D	RC-30WA
W4 64-0716	CS-22/3015	50	22 x 30 mm	
W4 64-0717	CS-22/4015	50	22 x 40 mm	RC-22, RC-22C, RC-24, RC-24E, RC-24N, RC-26, RC-26G, RC-26GLP
Coverslip Thickness #2: 0.22 mm (0.0086 in.)				
W4 64-0710	CS-24/60	40	24 x 60 mm	RC-10, RC-11, RC-13, RC-16, RC-27D, RC-27LD

chamber accessories

Slice Anchors for Series 20 and 40 Chambers

Provides ability to use tissue sections in most RC Series chambers



Slice anchors are available for most open bath chambers in the 20 and 40 Series family except for field stimulation chambers. Anchors are constructed for an easy push-in fit into the chamber's bath area. This allows the user to control the anchor pressure applied to slice. Most anchors are made from type 316 stainless steel and Lycra® and finished with a plastic coating. Plastic anchors are available for the RC-27L Chamber.

Order #	Model	Product
W4 64-0246	SHD-22L/15	For RC-22 Chamber, 1.5 mm
W4 64-0247	SHD-22CL/15	For RC-22C Chamber, 1.5 mm
W4 64-0248	SHD-22L/10	For RC-22 Chamber, 1.0 mm
W4 64-0249	SHD-22CL/10	For RC-22C Chamber, 1.0 mm
W4 64-0250	SHD-26H/10	For RC-26 Chamber, 1.0 mm
W4 64-0251	SHD-26H/15	For RC-26 Chamber, 1.5 mm
W4 64-0252	SHD-26H/2	For RC-26 Chamber, 2.0 mm
W4 64-0253	SHD-26GH/10	For RC-26G Chamber, 1.0 mm
W4 64-0254	SHD-26GH/15	For RC-26G Chamber, 1.5 mm
W4 64-0255	SHD-26GH/2	For RC-26G Chamber, 2.0 mm
W4 64-0256	SHD-27LH/10	For RC-27L & RC-29, 1.0 mm
W4 64-0257	SHD-27LH/15	For RC-27L & RC-29, 1.5 mm
W4 64-0258	SHD-27LH/2	For RC-27L & RC-29, 2.0 mm
W4 64-0194	SHD-27H/10	For RC-27 Chamber, 1.0 mm
W4 64-0193	SHD-27H/15	For RC-27 Chamber, 1.5 mm
W4 64-0192	SHD-27H/2	For RC-27 Chamber, 2.0 mm
W4 64-0197	SHD-27N/10	For RC-27N Chamber, 1.0 mm

Order #	Model	Product
W4 64-0196	SHD-27N/15	For RC-27N Chamber, 1.5 mm
W4 64-0195	SHD-27N/20	For RC-27N Chamber, 2.0 mm
W4 64-1411	3SHD-22F/15	Flat for RC-22 Chamber, 1.5 mm
W4 64-1412	SHD-22F/10	Flat for RC-22 Chamber, 1.0 mm
W4 64-1413	SHD-22CF/15	Flat for RC-22C Chamber, 1.5 mm
W4 64-1414	SHD-22CF/10	Flat for RC-22C Chamber, 1.0 mm
W4 64-1415	SHD-40/2	Flat for RC-40 Chamber, 2.0 mm
W4 64-1416	SHD-40/15	Flat for RC-40 Chamber, 1.5 mm
W4 64-1417	SHD-40/10	Flat for RC-40 Chamber, 1.0 mm
W4 64-1418	SHD-41/15	Flat for RC-41 Chamber, 1.5 mm
W4 64-1419	SHD-41/10	Flat for RC-41 Chamber, 1.0 mm
W4 64-1420	SHD-42/15	Flat for RC-42 Chamber, 1.5 mm
W4 64-1421	SHD-42/10	Flat for RC-42 Chamber, 1.0 mm
W4 64-0259	SHD-27LP/10	Plastic for RC-27L, RC-27LD & RC-29, 1.0 mm
W4 64-0260	SHD-27LP/15	Plastic for RC-27L, RC-27LD & RC-29, 1.5 mm
W4 64-0261	SHD-27LP/2	Plastic for RC-27L, RC-27LD & RC-29, 2.0 mm

Slice Anchor Kits and Supports for Series 20 Chambers

Provides ability to use tissue sections in most RC Series chambers

Slice Anchor Kits

Slice Anchor Kits are available for all Series 20 tissue slice recording chambers. Kits for RC-26, RC-26G, RC-27, and RC-27L, (large bath chambers) contain three anchors with 0.1 mm thick Lycra® threads at 1.0, 1.5, and 2.0 mm spacing. Kits are available with plastic anchors or stainless steel.

Kits for the RC-22 and RC-22C (smaller slice chambers) contain two stainless steel anchors with Lycra® threads at 1.0 mm and 1.5 mm spacing. The stainless steel material allows the anchors to be adjusted for a closer or looser fit in chamber.

All kits come with nylon mesh in two sizes (112 micron and 160 micron) that may be cut and used in conjunction with the slice anchor.



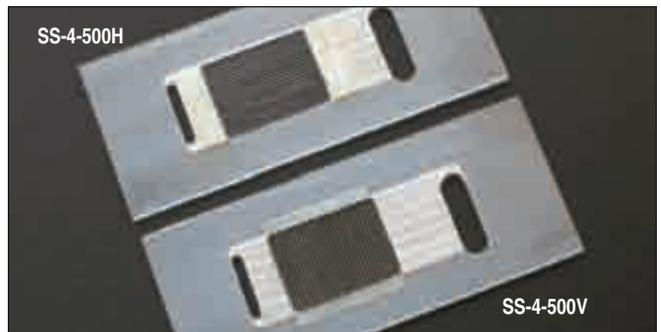
Order #	Model	Product
W4 64-0263	SHD-22KIT	Slice Anchor Kit for RC-22
W4 64-0264	SHD-22CKIT	Slice Anchor Kit for RC-22C
W4 64-0265	SHD-26KIT	Slice Anchor Kit for RC-26
W4 64-0266	SHD-26GKIT	Slice Anchor Kit for RC-26G
W4 64-0267	SHD-27KIT	Slice Anchor Kit for RC-27
W4 64-0268	SHD-27LKIT	Slice Anchor Kit for RC-27L and RC-29
W4 64-0190	SHD-27LPKIT	Plastic Slice Anchor Kit for RC-27L and RC-29 Chambers
W4 64-0191	SHD-27NKIT	Slice Anchor Kit for RC-27N

Slice Support with Nylon Grid

The SS-3G is a version of our standard SS-3 providing additional support by replacing the Lycra strands with a nylon mesh. The support is machined from 0.5 mm polycarbonate and the mesh is 112 micron x 0.1 micron thick.

The SS-4, SS-4-500V and SS-4-500H with Lycra thread provide additional slice support by using strands on a narrower 500 micron spacing. The support is machined from 0.5 mm polycarbonate and the Lycra strands are available in either horizontal or vertical configurations.

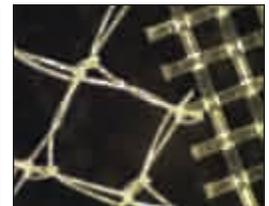
Order #	Model	Product
W4 64-1533	SS-3G	Slice Support for RC-27L Chamber with grid
W4 64-1550	SS-4-500V	Vertical Slice Support for RC-27D and RC-27LD Drip Chambers
W4 64-1551	SS-4-500H	Horizontal Slice Support for RC-27D and RC-27LD Drip Chambers



Nylon Mesh Kit

Ideal for supporting and holding slices in recording and imaging chambers, this nylon mesh can be used in conjunction with Warner slice anchors or other holders. Each kit comes with nylon mesh in two sizes 0.3 mm and 1.13 mm mesh opening and are 0.2 and 0.12 mm thick respectively. Five 7 x 7 cm squares of each size are supplied.

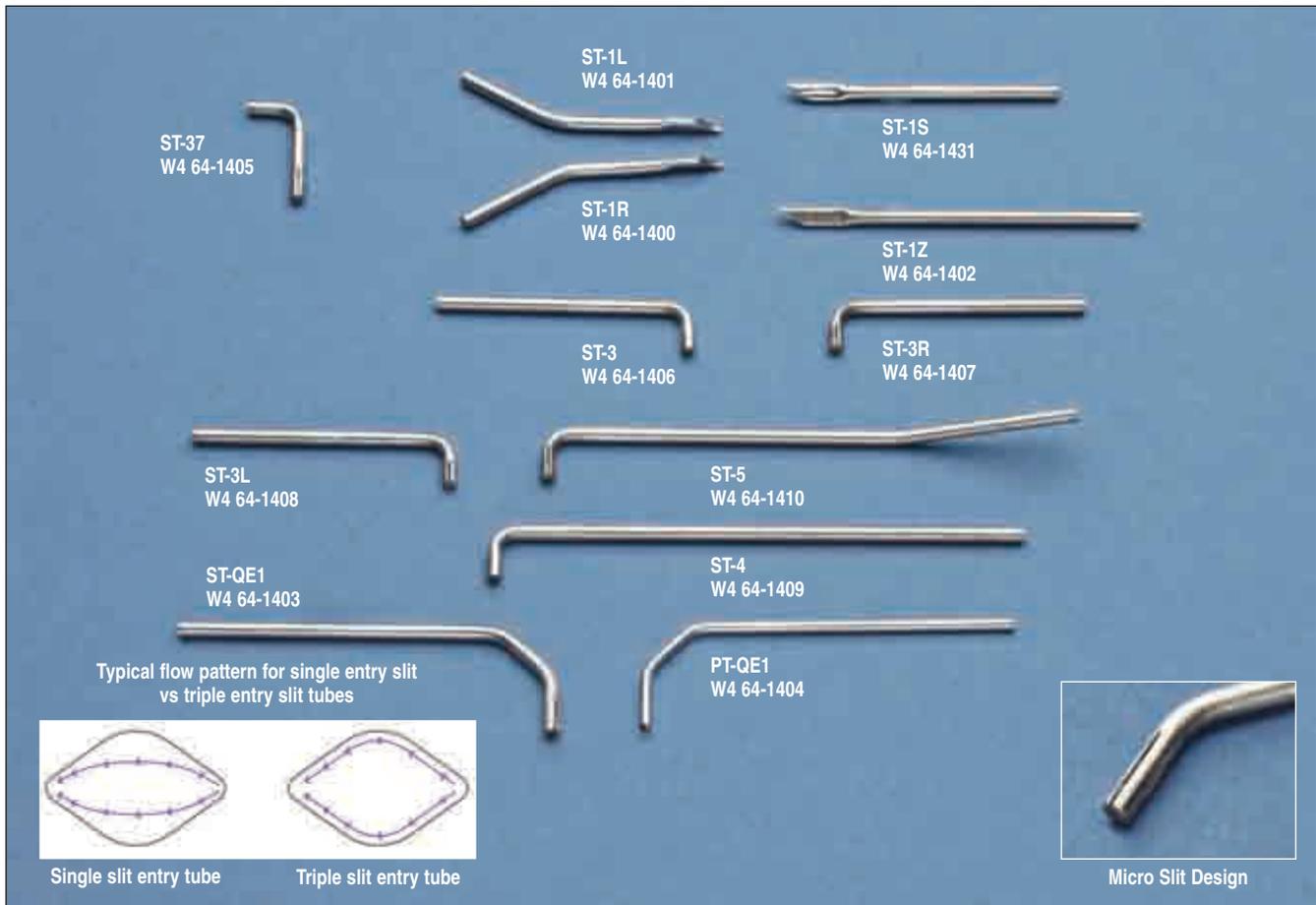
Order #	Model	Product
W4 64-0198	NYL/MESH	Nylon Mesh Kit – 10 pieces



chamber accessories

Replacement Suction and Perfusion Tubes

Replacement parts and accessories for Series 20 chambers



Warner Instruments produces suction tubes designed to make it easier to set and maintain the bath solution height. The innovative tube design has three equally spaced micro-slits at the front entry face and one micro-slit on the rear side of the sipper for air entry. This design helps eliminate tidal action in the bath and works equally well in all chambers, but excels in the larger bath chambers. All suction tubes are manufactured with 16 gauge type 316 stainless steel (1.65 mm OD x 1.19 mm ID). The PT-QE1 perfusion tube is 18 gauge type 316 stainless steel (1.27 mm OD x 0.83 mm ID).

Order #	Model	Product	For Chamber Model
W4 64-1431	ST-1S	Suction Tube, Series 20 Classic Design, Straight	RC-24, RC-24E, RC-28
W4 64-1400	ST-1R	Suction Tube, Series 20 Classic Design, Right Hand	RC-22/22C, RC-25/25F, RC-26/26G/26GLP/26Z
W4 64-1401	ST-1L	Suction Tube, Series 20 Classic Design, Left Hand	RC-27, RC-27L, RC-27N, RC-27NE
W4 64-1402	ST-1Z	Suction Tube, Classic Design, Straight	RC-1Z Chamber
W4 64-1403	ST-QE1	Suction Tube, Micro Slit Design	QE-1, DH-40i
W4 64-1404	PT-QE1	Perfusion Tube	QE-1, DH-40i
W4 64-1405	ST-37	Suction Tube, Micro Slit Design	RC-37W/37F, RC-37WS/37FS, RC-47FS
W4 64-1406	ST-3	Suction Tube, Micro Slit Design, Straight Front & Back Slits	RC-10, RC-24/24E, RC-28, RC-29
W4 64-1407	ST-3R	Suction Tube, Micro Slit Design, Right Hand Side Slits	RC-22/22C, RC-25/25F, RC-26/26G/26GLP/26Z*
W4 64-1408	ST-3L	Suction Tube, Micro Slit Design, Left Hand Side Slits	RC-27, RC-27L, RC-27N, RC-27NE*
W4 64-1409	ST-4	Suction Tube, Micro Slit Design, Front & Back Slits	RC-1Z, RC-11, RC-13, RC-16
W4 64-1410	ST-5	Suction Tube, Micro Slit Design, Side Slits	RC-3Z Chamber

* For upgrade of existing Series 20 chambers to micro slit design, see page 75.

chamber accessories

Electrode Kits and Magnetic Clamps

Replacement parts and accessories for Series 20 chambers

Agar Bridge Reference Electrode Kit

Developed for use in low volume recording chambers. The ABR-1 Agar Bridge Reference Electrode Kit consists of a 1 mm diameter silver wire electrode mounted in a modified pipette tip that can be filled with a 3 M KCl agar mixture. An included magnetic clamp with flexible holder for the pipette tip is perfect for positioning the electrode at any angle in the chamber. In addition, the pipette tips can be cut to length or shaped using a heat gun. The silver wire electrode comes with 1 meter of flexible wire terminated in a 2 mm pin. Includes a 2 mm to 1 mm pin adapter for use with 1 mm jacks.



ABR-1 Kit Components



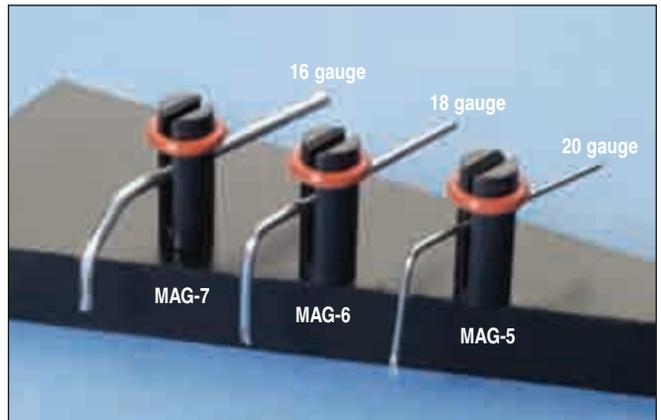
ABR-1 Shown mounted to a QE-1 Heated Base

Order #	Model	Product
W4 64-1426	ABR-1	Agar Bridge Reference Electrode Kit
W4 64-1428	LPE-10	Replacement Pipette Tips, pkg. of 10
W4 64-1323	PJ2-5	2 mm jack (5 pack)
W4 64-0360	MAG-3	Magnetic Clamp

Mini Magnetic Clamps

These miniature magnetic clamps offer a quick and easy method of positioning perfusion and suction tubes in chambers equipped with a magnetic platform. Sized to fit 20, 18, and 16 gauge tubes, they can also be used to hold PE tubing for applications requiring metal free solution delivery. Height: 16.6 mm, Ø: 6.4 mm.

Order #	Model	Product
W4 64-1552	MAG-5	Mini Mag for 20 gauge tubing
W4 64-1553	MAG-6	Mini Mag for 18 gauge tubing
W4 64-1554	MAG-7	Mini Mag for 16 gauge tubing



MAG-7 is for Suction, MAG-6 is for Perfusion, MAG-5 is for Skinny Suction Tubes

Suction/Perfusion Tubes

	A	
	A	B
ST-3	28.5 mm	6.5 mm
ST-3R	28.5 mm	6.5 mm
ST-QE1	40.0 mm ±	13.0 mm ±
PT-QE1	39.5 mm ±	12.7 mm ±

Tubing, Silicone Grease Kit and Suction Tube Upgrade Kit

Replacement parts and accessories for Series 20 chambers

PE (Polyethylene) Tubing

PE tubing is the most commonly used tubing in perfusion systems.

We stock the sizes compatible with our chambers and other perfusion devices. Consult the chart below to select the proper size tubing for your perfusion device.



Order #	Model	Product	length (m)	O.D. (mm)	I.D. (mm)	Where Used (examples)
W4 64-0750	PE-10/10	Polyethylene Tubing	3	0.61	0.28	MM Series Manifolds
W4 64-0751	PE-10/100	Polyethylene Tubing	30	0.61	0.28	MM Series Manifolds
W4 64-0752	PE-50/10	Polyethylene Tubing	3	0.97	0.58	MM & ML Series Manifolds
W4 64-0753	PE-50/100	Polyethylene Tubing	30	0.97	0.58	MM & ML Series Manifolds
W4 64-0754	PE-90/10	Polyethylene Tubing	3	1.27	0.86	RC-30, 30HV, 30VA, RC50
W4 64-0755	PE-160/10	Polyethylene Tubing	3	1.57	1.14	Series 20 Chambers
W4 64-0756	PE-160/100	Polyethylene Tubing	30	1.57	1.14	MP & MPP Manifolds, Most Solution Heaters, FR-50, FR-55S

Silicone Grease Kit

We have determined that an effective tool for applying silicone lubricant (used to form a seal between the coverslip and chamber) is an artist's acrylic brush. With that in mind, we have put together a convenient package that includes #2 and #4 brushes, several pallets to aid in applying the grease, and a tube of Dow Corning® 111 Valve Lubricant & Sealant.

Order #	Model	Product
W4 64-0378	111-Kit	Silicone Grease Kit with Brushes and Pallets
W4 64-0275	111	Replacement Grease



Recommended for all Warner Chambers

Suction Tube Upgrade Kit for Series 20

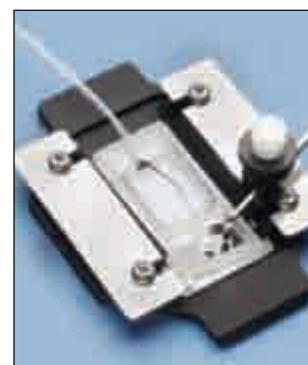
An economical version of our popular MCK-1 Magnetic Clamp Kit, the STU-1 upgrade kit includes a MAG-7 Magnetic Clamp for suction tubes and two magnetic strips that fit perfectly on top of Series 20 Platform Clamps. This kit makes upgrading to the new micro-slit suction tubes possible. Kit works with all models of Series 20 Platforms except P-2 and PH-2.

Order #	Model	Product
W4 64-1429	STU-1	Suction Tube Upgrade Kit for Series 20 Platforms



1/4 inch 4-40 screws

STU-1 Kit Components



Kit mounted to P-1 Platform

Petri Dish Adapter with Clamps & Spring Clamp Set

Replacement parts and accessories for Series 20 chambers

Chambers

chamber accessories



Shown with a 35 mm Petri dish in Nikon stage adapter



Model MSC-1 Magnet Spring Clamp Set

The MSC-1 presents a selection of clamp pairs, each pair has a different bend angle. Magnetic stainless steel plates supplied with the clamp set can be fastened to a chamber or to a stage using double sided tape. This allows the use of light duty clamps for perfusion tubes or ground wires in addition to clamping cell culture plastic ware.

You'll find dozens of uses in your lab for these light and easy-to-use clamps.

Model MDA-1 Petri Dish Adapter with Clamps

This Petri dish adapter is ideal for holding 35 mm dishes, as well as Warner's series 40 chambers, on your microscope stage. Designed for non heated imaging applications. Supplied with 2 sets of adjustable clamps for mounting dishes or chambers. A magnetic stainless steel perimeter allows use of magnetic holders. The addition of a Series 20 stage adapter allows mounting on any microscope stage.

Specifications

Physical Dimensions:	
MDA-1 (D x L)	79.4 x 3.2 mm
Aperture Size (D)	30 mm
Maximum Dish Diameter	40 mm

Order #	Model	Product
W4 64-1675	MDA-1	Miniture dish adapter with clamps

Specifications

Physical Dimensions (Distance from magnet to bottom edge):

Red	2.5 mm
Green	5.0 mm
Yellow	7.8 mm
Blue	9.0 mm
Magnetic Stainless	16 x 40 mm

Order #	Model	Product
W4 64-1653	MSC-1	Magnetic spring clamp set

contact information

Sales Subsidiaries & Authorized Distributors

Subsidiaries

CANADA



Harvard Apparatus Canada
Attn: Sales Department
6010 Vanden Abeele
Saint-Laurent, Quebec H4S 1R9, Canada
phone **514.335.0792, 800.361.1905** (CAN only)
fax **514.335.3482**
e-mail **sales@harvardapparatus.ca**
website **www.harvardapparatus.ca**

FRANCE



Harvard Apparatus, S.A.R.L.
Attn: Sales Department
6 Avenue des Andes, Miniparc - Bat. 8
91952 Les Ulis Cedex, France
phone **33.1.64.46.00.85** fax **33.1.64.46.94.38**
e-mail **info@harvardapparatus.fr**
website **www.harvardapparatus.fr**

GERMANY



**Hugo Sachs Elektronik
Harvard Apparatus, GmbH**
Gruenstrasse 1
D-79232 March-Hugstetten, Germany
phone **49.7665.92000** fax **49.7665.920090**
e-mail **info@hugo-sachs.de**
website **www.hugo-sachs.de**

SPAIN



Panlab, S.L., Harvard Apparatus Spain
C/Energia, 112
08940 Cornellà, Barcelona, Spain
phone **34.934.750.697** (Intl. Sales)
phone **934.190.709** (Sales in Spain)
fax **34.934.750.699**
e-mail **info@panlab.com**
website **www.panlab.com**

UNITED KINGDOM



Harvard Apparatus, Ltd.
Attn: Sales Department, Fircroft Way,
Edenbridge, Kent TN8 6HE, United Kingdom
phone **44.1732.864001** fax **44.1732.863356**
e-mail **sales@harvardapparatus.co.uk**
website **www.harvardapparatus.co.uk**

UNITED STATES



Coulbourn Instruments
Attn: Sales Department
5583 Roosevelt Street
Whitehall, Pennsylvania 18052, USA
phone **610.395.3771** fax **610.395.1333**
e-mail **sales@coulbourn.com**
website **www.coulbourn.com**

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ETC Internacional S.A.
Allende 3274, (C1417BMV) Ciudad Autónoma de Buenos Aires, Argentina
phone **(+54 11) 4639 3488**
fax **(+54 11) 4639 6771**
e-mail **etcventa@etcint.com.ar**
danielr@etcint.com.ar
página web **www.etcint.com.ar**

AUSTRALIA



SDR Clinical Technology
213 Eastern Valley Way,
Middle Cove, NSW 2068, Australia
phone **61.02.9958.2688** fax **61.02.9958.2655**
e-mail **sdr@sdr.com.au**
website **www.sdr.com.au**

BELGIUM / FRENCH SWITZERLAND



Harvard Apparatus, S.A.R.L.
6 Ave des Andes, Miniparc - Bat 8
91952 Les Ulis Cedex
phone **(33) 1 64 46 00 85**
fax **(33) 1 64 46 94 38**
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BRAZIL



Sellex, Inc.
R. Cardoso de Almedia 788-114/S-1
05013-001 São Paulo - SP Brazil
phone **55.11.3872.2015**
fax **55.11.3872.1024**
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website **www.sellex.com**

CHILE



Del Carpio Analisisy Asesorias Ltda
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phone **56.2.269.1348** fax **56.2.341.5397**
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CHINA (BEIJING)



DL Instruments, Inc.
A59-2-126 West 4th Ring Middle Road, Beijing
phone **(010) 6818 9642** fax **(010) 6822 2702**
e-mail **azou@dongeonline.com**
website **www.dongleonline.com,**
www.dongleonline.com.cn

CHINA (GUANGZHOU)

Bioprobes Ltd. (Guangzhou office)
Room 116, JinXia Bldg., No.15 Shi You Xin
Er Heng Road, Wu Yang Xin Cheng,
Guangzhou, China
phone **20-87357072, 20-87357737**
fax **20-87357072**
e-mail **info@bioprobeschina.com**
website **www.bioprobeschina.com**
DL Instruments, Inc. (Guangzhou office)
4 Siyou New Road
Great Wall Building, Rm 612, Guangzhou
phone **(020) 8765 6735, (020) 8765 6736**
fax **(020) 8765 6737**
e-mail **azou@dongeonline.com**
website **www.dongleonline.com,**
www.dongleonline.com.cn

CHINA (WUHAN)

DL Instruments, Inc.
288 Zhenxing Road, Room 301-1-302, Wuhan
phone **(027) 8356 9708** fax **(027) 8356 9700**
e-mail **azou@dongeonline.com**
website **www.dongleonline.com,**
www.dongleonline.com.cn

DENMARK



Scandidact Biogimaterie
Oldenvej 45
3490 Kvistgaard, DK-3490, Denmark
phone **(+45) 49 13 93 33**
fax **(+45) 49 13 83 85**
email **admin@scandidact.dk**

HONG KONG



Bioprobes Ltd. (Hong Kong office)
14/F. Highgrade Building
117 Chatham Road South
Tsimshatsui, Kowloon, Hong Kong
phone **852.2723.9888** fax **852.2724.2633**
e-mail **info@bioprobes.imsbiz.com.hk**
website **www.bioprobeshk.com**

INDIA



Marsap Services Pvt. Ltd.
29/31 Ujagar Ind. Estate, WTP Marg Rd.
Deonar, Mumbai, India 400 088
phone **91.22.2551.6908**
fax **91.22.2556.3356**
e-mail **info@marsap.com**

ISRAEL



New Biotechnology Ltd.
P.O. Box 8662, Jerusalem, 91086, Israel
phone **972.2.6732001**
fax **972.2.6731611**
e-mail **nbtsales@nbtLtd.com**
website **www.nbtLtd.com**

ITALY



Crisel Instruments Srl
Crisel Instruments Srl
Via Mattia Battistini, 177
00167 Roma, Italy
phone **39.06.35402933**
fax **39.06.35402879**
e-mail **becattini@crisel-instruments.it**
website **www.crisel-instruments.it**

JAPAN



Take-In Incorporated
Kyosu Building 3-31-11 Amanuma
Suginami, Tokyo 167-0032, Japan
phone **81.3.3597.1911**
fax **81.3.5833.5596**
e-mail **take-in@labtak.com**
website **www.ha-j.com**

MEXICO



Intecs Instrumentación S.A de C.V.
Prolongacion de la 15 Poniente #3123
Colonia La Paz
Puebla, Puebla 72160, Mexico
phone **52-222-756-2900**
fax **52-222-231-5166**
e-mail **ventas@intecssa.com.mx**
website **marcop@intecssa.com.mx**

NEW ZEALAND



Alphatech Systems Limited
P O Box 62613, Kalmia St
Auckland 1544, New Zealand
phone **+64 9 580 1959**
fax **+64 9 580 2044**
e-mail **sales@alphatech.co.nz**
website **www.alphatech.co.nz**

PAKISTAN



Meditech Private Limited
Meditech House, 114 G/1 M. A. Johar Town
Lahore, Pakistan
phone **+92 42 5302643 thru 46 (4 lines)**
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PORTUGAL/ SPAIN



Izasa S.A.
C/ Aragon 90, 0815 Barcelona, Spain
phone **34.902.20.30.80**
fax **34.902.20.30.81**
e-mail **dac2@izasa.es**
website **www.izasa.es**

RUSSIA



Science Pribor
23/15 Avtozavodskaya str
Moscow, Russia, 115280
email **orders@sciencepribor.ru**
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SINGAPORE



Prime Bioscience Pte Ltd
Blk 431, Clementi Avenue 3, #01-358
Singapore 120431
phone **65-6364-0391**
fax **65-6269-0745**
e-mail **info@primebioscience.com**

SOUTH KOREA



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phone **82-2-564-8766**
fax **82-2-561-1603**
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Scitech Korea

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fax **82 2 986 4429**
e-mail **scitech00@scitechkorea.co.kr**

GERMAN



SWITZERLAND
**Hugo Sachs Elektronik-Harvard
Apparatus, GmbH**
Gruenstrasse 1, D-79232 March-Hugstetten
phone **(49) 7665 92000**
fax **(49) 7665 920090**
e-mail **info@hugo-sachs.de**

TAIWAN



Major Instruments Co. Ltd.
9th Floor No. 69-3
Chung-Cheng E. Rd., Sec. 2
Tan-Shui, Taipei, Taiwan, ROC
phone **(02) 2808-1452**
fax **(02) 2808-2354**
e-mail **major@ms6.hinet.net**
website **major@major.com.tw**

TURKEY



Commat
Cetin Emec Blv 74.Sk No 4/9 Ovecler
Ankara, 6460, Turkey
phone **+90 312 472 74 17**
fax **+90 312 472 74 18**
e-mail **info@commat.com.tr**

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Holliston, MA 01746-1388 USA

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HARVARD
APPARATUS

84 October Hill Road
Holliston, MA 01746-1388 USA
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