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**Electrophysiology
& Cell Biology
Research**

Planar Lipid Bilayer

Perfusion/Microfluidics

Oocyte Clamps

Patch Clamps

Microinjectors

Microincubators

Micromanipulators

Ussing/Diffusion Systems

Live Cell Imaging Chambers

Temperature Control Systems

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Dear Researcher:

Warner Instruments is proud to introduce our new Electrophysiology & Cell Biology Catalog. This catalog contains many new products for cell imaging, biosensing, microinjection, and electrophysiology.

NEW Products Featured Include:

- **PLI-100A Picoliter Microinjector** - With three positive and two negative pressure capabilities, the versatile PLI-100A is capable of large injections into capillaries or small injections into mammalian nuclei.
- **BioStat Multi-channel Potentiostat** - The BioStat is a software-driven, multi-mode potentiostat that can be used for measurement of pH, reactive oxygen species, and nitric oxide.
- **Compact Motorized Micromanipulator** - Linear amplifiers, used to drive the stepper motors, eliminate stray electromagnetic radiation; reducing noise and resulting in improved patch clamp and electrophysiology performance.
- **PFC-1 Proflow Chamber** - Computer designed gaskets optimized for well-defined, well-controlled shear-flow.
- **RC-49FS Perfusion Chamber with Field Stimulation** - Uses popular 18 mm round coverslip. The low profile design allows for low entry angle patch electrodes.
- **CL-200 Dual Channel Bipolar Temperature Controller** - Single control temperature adjustment, built-in protection for Peltier devices, open thermistor fault protection.
- **New Zoom Stereo Microscopes** - Versatile, high performance, ergonomically designed microscopes, with multiple stand options.
- **ProgRes® Microscope Cameras** - These CMOS and CCD cameras are suitable for all contrast methods in light microscopy, C-Mount and USB2.0/FireWire interfaces. All ProgRes® cameras include CapturePro® image capture software.

Sincerely,

A handwritten signature in black ink, appearing to read 'Ralph Abate'.

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



NEW PFC-1 Proflow Chamber, p. 57



NEW BioStat Multi-channel Potentiostat, p. 372



NEW Compact Motorized Micromanipulator, p. 297



NEW ProgRes[®] Microscope Cameras, p. 344



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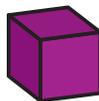
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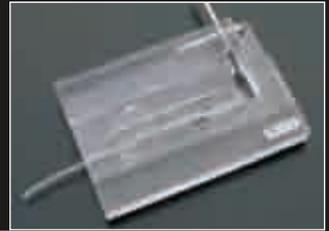
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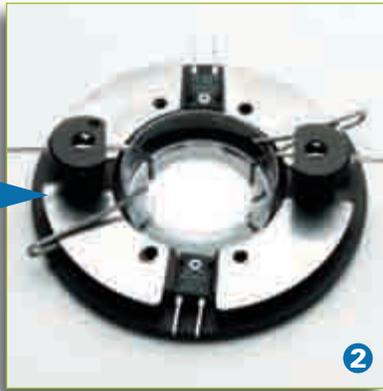
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Chambers, Perfusion and Temperature Control for Live Cell Imaging

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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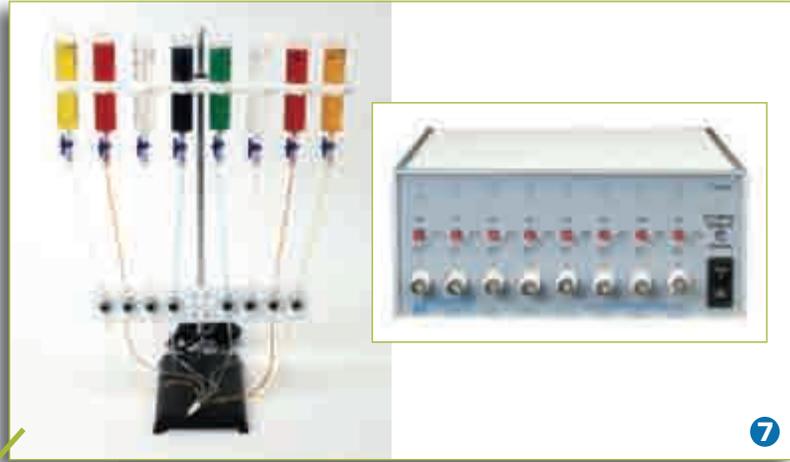
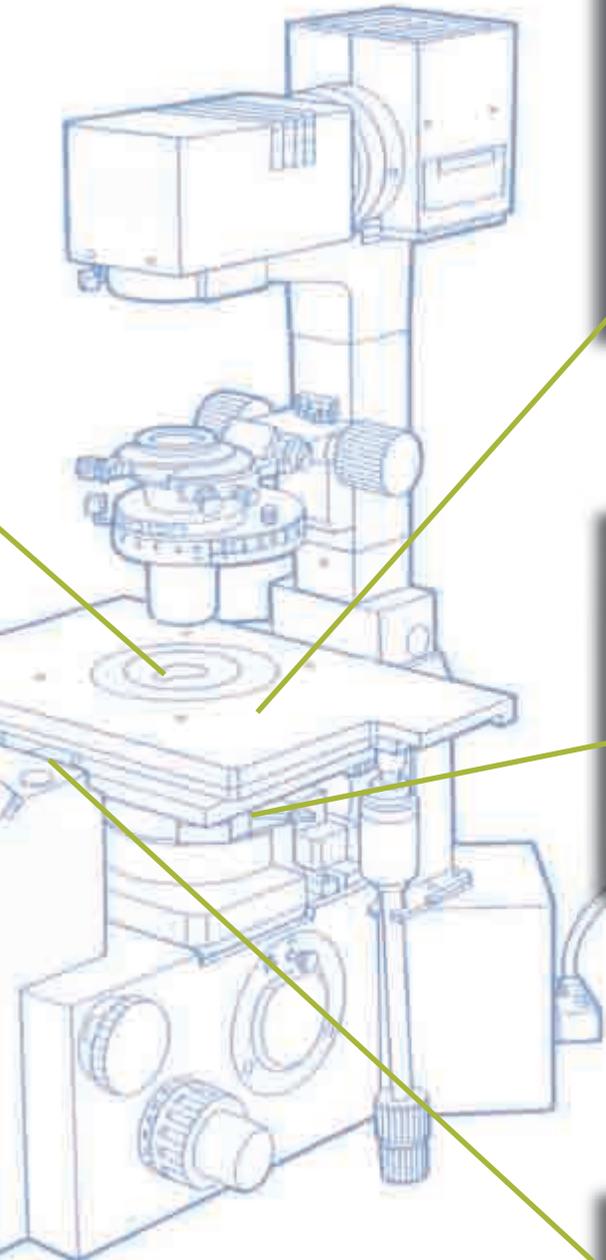
Typical, complete package

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



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TC-324B and TC-344B

Chamber System Temperature Controllers – Single and Dual Channel

Quiet operation optimized for patch clamp electrophysiology!



TC-324B – Single Channel

- Ramped DC power for quiet operation
- Single control temperature adjustment
- Manual DC setpoint
- Ambient to 50°C operation
- High temperature models available

The TC-324B and TC-344B heater controllers have been designed to provide quiet power to a variety of perfusion heating devices including Warner Series 20 heater platforms, solution in-line heaters, and culture dish heaters.

Each channel can supply up to 18 watts into an 8 Ω load. Maintenance of temperature setpoint is controlled automatically via thermistor feedback. A loop-speed selector allows for selection of three feedback speeds to optimize the stability of the thermal response of the device being heated. Temperature setpoint may also be manually set in MANUAL mode.

Ease of Use

In AUTO mode, the desired temperature is set with a single SET TEMPERATURE control. The connected platform, solution heater, or other device is automatically driven to the set temperature. Accuracy is typically better than $\pm 1^\circ\text{C}$, and under ideal conditions will approach $\pm 0.1^\circ\text{C}$.

In MANUAL mode, the controller provides DC output to the heater blocks, adjustable from zero to +12 volts.

Set temperatures range from ambient to 50°C, or from ambient to 65°C for high temperature models.

Quiet Operation in Recording Setups

Highly filtered DC supplies and slow-ramped analog switching circuitry deliver power without adding noise to the system. As such, the TC-324B and TC-344B have been optimized for electrophysiology applications.



TC-344B – Dual Channel temperature controller shown with in-line solution heater and heated platform with connecting cable.

Thermistor Readouts

Each channel reads two thermistors simultaneously: T1 for feedback control of the system, and T2 for any point of interest. Temperatures are displayed on the meter and are also available at front panel outputs for recording devices. Unical thermistors are used throughout and can be replaced without the need for recalibration.

Temperature controllers require the use of an adapter cable (CC-28) to connect to Series 20, Series 30 and QE Series platforms. In-line solution heaters do not require an additional connecting cable.

TC-324B and TC-344B

Chamber System Temperature Controllers – Single and Dual Channel (continued)



Specifications (per channel)

Max. Output Voltage	12 V DC
Max. Output Current	1.5 Amps
Max. Output Power	18 W (8 Ω load)
Manual Voltage Range	0 to 12 V
Temperature Range	Ambient to 50°C or ambient to 65°C
Recorder Outputs	T1 (Control Thermistor) 100 mV/°C T2 (Monitor Thermistor) 100 mV/°C
Inputs	Rear Panel BNC for T2 (TA-29 Thermistor Cable assembly)
Meter	3 1/2 digit LED display of: Set Temperature, 50°C maximum T1 (Control Thermistor) temperature T2 (Monitor Thermistor) temperature Heater Voltage, 12 V maximum
Power Requirements	100-130/220-240 VAC, 50/60 Hz, 70 VA
Enclosure Dimensions (H x W x D):	
TC-324B	8.9 x 20 x 25.4 cm; Shipping weight 3.6 kg
TC-344B	8.9 x 43 x 25.4 cm; Rack Mount hardware included; Shipping weight 6.8 kg
Warranty	Two years, parts & labor

Order # Model Product

W4 64-0100	TC-324B	Heater Controller, Single Channel
W4 64-0101	TC-344B	Heater Controller, Dual Channel
W4 64-1453	TC-324BHT	Perfusion Heater Controller Single Channel with High Temp Modification, 65°C
W4 64-1454	TC-344BHT	Perfusion Heater Controller Dual Channel with High Temp Modification, 65°C

Accessories and Replacement Parts

W4 64-0106	CC-28	Cable Assembly for Series 20 Heater Platforms
W4 64-0109	CC-35	Cable Assembly with Unterminated Outboard End

CL-100

Bipolar Temperature Controller

Optimized for the SC-20 In-line Solution Heater/Cooler



ACC-1 – Adapter cable for 8 pin Din heaters

- Quiet operation
- Built-in protection for Peltier devices
- Single control temperature adjustment
- Freeze alert
- External inputs for computer control

The CL-100 Temperature Controller is an automatic single channel controller capable of accurately maintaining a Peltier device between 0° and 50°C. The CL-100 will also maintain a resistive heater from ambient to +65°C.

While the instrument has several uses, it is specifically designed to control the Warner SC-20 Dual In-line Solution Heater/Cooler. When coupled with the SC-20, the CL-100 provides efficient control of perfusion solution temperatures.

The unit is simple to use with a single control for temperature adjustment and a loop speed switch to optimize the response of the system. Power for the instrument is provided by an ultra low noise power supply making it suitable for use in sensitive electrophysiology applications.

Built-in circuitry limits the maximum temperature of the Peltier to prevent damage and a freeze alert indicates when the cold side of the Peltier reaches 0°C.

Specifications

Max. Output Voltage	±15 V DC
Max. Output Current	2.4 A
Max. Output Power	36 W (8 Ω load)
Manual Voltage Range	0 to ±15 V
Temperature Range	0 to 50°C Peltier, ambient to +65°C resistive
Recorder Outputs:	
Control Temp Out	100 mV/°C
Monitor Temp Out	100 mV/°C
Inputs:	
Front Panel BNC	for external thermistor
Rear Panel BNC	for external set temperature
Rear Panel BNC	for external voltage set
Rear Panel	15 pin female "D"
Meter (3-1/2 digit LED display of):	
Peltier Set Temperature	0 to 50°C maximum
Control Temperature	
Monitor Temperature	
Output	Voltage, ±15 V maximum
Power Requirements	100-130/220-240 VAC, 50/60 Hz, 80 VA, user selectable
Enclosure Dimensions	8.9 x 20.0 x 25.4 cm (H x W x D)
Shipping weight	5.6 kg
Warranty	Two years, parts & labor

Order #	Model	Product
W4 64-0352	CL-100	Bipolar Temperature Controller

Accessories and Replacement Parts

W4 64-0353	SC-20	Solution Heater/Cooler Two Line
W4 64-1430	SHM-828	Solution Heater Eight Line No Manifold
W4 64-1427	ACC-1	Adapter Cable for 8 pin Din Heaters
W4 64-0107	TA-29	Cable with Bead Thermistor for Heater Controllers

NEW CL-200

Dual Channel Bipolar Temperature Controller



- Single control temperature adjustment
- Built-in protection for Peltier devices
- Open thermistor fault protection
- Heat loss compensation mode
- Quiet operation

The CL-200 Dual Temperature Controller is an automatic two channel controller capable of accurately maintaining two Peltier devices between -6° and 65°C. Power for the instrument is provided by a low noise power supply making it suitable for use in sensitive electrophysiology applications.

While the instrument has broad compatibility, it is specifically designed to control the SC-20 Dual In-line Solution Heater/Cooler in combination with any of our heated and cooled stage chambers.

The CL-200 is simple to use with a single control for temperature adjustment. While total automatic control is provided in the automatic mode, a manual control mode is also available. A loop-speed selector is available to optimize the feedback response of the system to the intrinsic thermal delay characteristics of the setup.

In addition, the CL-200 has a new heat-loss compensation control that allows the instrument to control the temperature at a location downstream from the temperature source.

A feedback thermistor switch allows the user to select which thermistor is used for feedback control. Choosing T1 (control thermistor) uses the built-in thermistor attached to the peripheral device. Selecting T2 (monitor thermistor) allows control at the user selected location of the monitor thermistor (T2).

Built-in circuitry limits the maximum temperature of the Peltier to prevent thermal damage, and a freeze alert/alarm indicates when the cold side of the Peltier reaches 0°C.

Specifications

Max. Output Voltage	±15V Heat/Cool, 0-15V Heat-Only
Max. Output Current	5.0 Amps DC each channel
Max. Output Power	75 Watts @ 3Ω load each channel
Set-Temperature Range	-6 °C to 65 °C Heat/Cool ambient to 65 °C resistive
Recorder Outputs, each channel	Control Temperature, 100mV/°C Monitor Temperature, 100mV/°C
Inputs, each channel	Monitor Thermistor, 10KΩ @25 °C 100KΩ @25 °C (switchable) External Temp Set (auto mode) External Voltage Set (manual mode)
I/O Connector, each channel	15-pin "D" connector
Panel Meter, each channel	3-digit LED display of: Heat Loss Compensation Temp Set Temperature Control Temperature Monitor Temperature Output Voltage Output Current
Panel Meter Resolution	0.1 °C / 0.01 V / 0.01 A
Power Requirement	97-265 VAC / 200VA Max
Weight	4.54 kg
Dimensions (HxWxD)	8.9 x 42.6 x 29.2 cm (H x W x D)
Warranty	One year, parts & labor

Order #	Model	Product
W4 64-1708	CL-200	Dual Channel Bipolar Temperature Controller

Accessories and Replacement Parts

W4 64-0353	SC-20	Solution Heater/Cooler Two Line
W4 64-1659	QE-1HC	Quick Exchange Stage Incubator
W4 64-1632	TB-3 CS	Thermal Insert for Prior NanoScanZ and chamber slides
W4 64-1636	TB-3 CCD	Thermal Insert for Prior NanoScanZ and 35 mm Petri dishes

Model LCS-1 Liquid Cooling System



- Complete self contained liquid cooling system
- Designed for use with all Peltier driven devices from Warner Instruments
- Electrically and mechanically quiet

The LCS-1 Liquid Cooling System from Warner Instruments is a versatile and simple to use thermal control accessory. This apparatus circulates water through a fan/radiator housing and is designed to easily and quietly remove excess heat from the Peltier portion of all Warner devices employing this technology.

This heat exchanger can also be used with any apparatus, allowing the quiet removal of heat energy via the movement of circulating water. A great deal of effort has been dedicated towards making this system both mechanically and electrically quiet.

The LCS-1 is supplied with 20 feet of 1/8" ID x 1/4" OD Tygon tubing, one bottle of antifreeze, and a desktop power supply with line cord.

Specifications

Pump rate	4201/hr (111 gal/hr)
Power Input	Universal Input 100-240 VAC 50/60Hz
Power Output	12 VDC 540 mA
Power Connector Type	15 pin Male "D"
Physical Dimensions:	
Chassis Size (D x W x H)	49.5 x 21.3 x 9.5 cm
Weight	3.63 kg (81 lbs)
Chassis material	Aluminum
Water Jacket Ports	Male thread to 1/8" Barb Fittings
Warranty	One Year

Order # Model Product

W4 64-1922	LCS-1	Liquid Cooling System
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Replacement Parts

W4 64-1704	ANT-1	Replacement antifreeze Propylene Glycol non-toxic 2oz
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Compatible with these items

W4 64-0353	SC-20	Solution Heater/Cooler
W4 64-0450	BLM-TC	Bilayer Thermocycler System
W4 64-1632	TB-3 CS	Thermal Insert for Chambered Slides
W4 64-1636	TB-3 CCD	Thermal Insert for 35 mm Dishes
W4 65-0043	PDMI-2	Open Perfusion Micro-Incubator
W4 65-0044	PSMI	Patch Slice Micro-Incubator
W4 65-0101	CSMI	Chambered Slide Micro-Incubator

TC-202A

Bipolar Temperature Controller

Works with all Harvard Apparatus Micro-Incubation and Tissue Slice Chambers



- Low Noise
- Bipolar or monopolar operation
- Temperature control from 0° to 50°C
- Digital display
- Excellent stability

The TC-202A Bipolar Temperature Controller is the next generation of the TC-102 Monopolar Temperature Controller. This instrument operates with all Harvard Apparatus micro-incubators to provide both heating and cooling functions for life science research purposes.

Because the TC-202A is bipolar, it is ideally suited for use with Peltier devices such as those built into our PDMI-2 Open Perfusion Micro-incubator, PSMI Patch Slice Micro-incubator, and CSMI Chambered Slide Micro-incubator.

While the unit has multiple uses, it has been designed as an ideal companion for Harvard Apparatus/Medical Systems Peltier-based micro-incubators. In its monopolar mode, the TC-202A efficiently controls microincubators that use resistive heaters such as the Leiden Micro-incubator Systems and the BSC-BU Brain/Tissue Slice Chamber units.

Specifications

Temperature Setting Range	0 to 50°C
Temperature Regulation	±0.2°C
Temperature Display	0.1°C resolution
Chamber Temperature Sensor	Thermoliner type, 36 KΩ nominal at 25°C
Voltage Range	0 to ±5 V
Current Range	0 to ±6 A DC
Case Size (W x H x D)	48.3 x 8.9 x 33.7 cm (19 x 3.5 x 13.25 in), 19 in. rack mountable
Weight	5.7 kg (12.5 lb)
Power	150 W, 120/230 VAC, 50/60 Hz, user selectable

Flexible

The TC-202A allows the researcher to control the command temperature from alternative locations. In the case of the PDMI-2, PSMI, and CSMI micro-incubators, temperature is controlled either from a thermistor placed in the bath, or from a second thermistor permanently positioned on the plate containing the regulated surface of the Peltier devices.

Accurate

Accurate thermal control (±0.2°C) is achieved by sensing temperature with a miniature thermistor, digitizing the thermistor signals, and then proportionally regulating a low noise DC current output. Current output is also regulated to match the thermal time constants of small systems (such as micro-incubators), thus minimizing initial overshoot and oscillations about the set point.

Other Features

- Low electrical noise for sensitive electrophysiology recordings
- Stable long term operation
- Excellent temperature stability at user selectable set points
- Easy to use, digitally set command temperatures
- Versatile monopolar or bipolar operation (heat only or heat and cool)
- Temperature profile monitoring capability
- Over-temperature shut down

Order #	Model	Product
W4 65-0045	TC-202A	Bipolar Temperature Controller for use with PDMI-2, PSMI, CSMI, LU-CB-1, LU-CPC-CEH, and BSC-BU. Includes BSC-T3 Thermistor

Accessories and Replacement Parts

W4 65-0057	BSC-T3	Bath Thermistor for use with PDMI-2, PSMI, LU-CB1, and TC-202A (36 KW total)
W4 65-0056	BSC-T3A	Bath Thermistor for use with LU-CPC-CEH
W4 65-0098	BSC-T2	Old Style Bath Thermistor for Obsolete TC-102
W4 65-0016	BSC-T2A	Old Style Bath Thermistor for use with LU-CPC-CEH and TC-102

TC-124A Temperature Controller

Designed for use with Warner OW Series Objective Warmers and SWS Series Syringe Warmers



TC-124A shown with warmed platforms for 35 mm Petri dishes



BAC-1 – Battery adapter cable

- Easy to use
- Command temperatures digitally set
- Ambient to 65°C temperature range
- Can be powered from 12 volt battery for sensitive electrophysiology applications

The TC-124A Temperature Controller from Warner Instruments is a simple, low cost device designed for use with our microscope objective warmers and the SWS Series syringe warmers.

This unit is a basic on-off controller with slowly ramped switching speeds making it ideal for large mass devices where the temperature changes slowly.

The LED display reports the actual temperature of the connected device. Adjustment of the set temperature using either the heat up or heat down buttons causes the display to momentarily report the set temperature.

This compact instrument takes up very little space and may be powered from the 12 VDC wall power supply (included), or a 12 volt battery for low noise applications.

Specifications

Input Voltage Range	9 to 16 VDC
Max. Output Current	1.2 A
Max. Output Power	13 W
Temperature Ranges (4)	Set by DIP Switch: Ambient to +65°C
Meter	3-Digit LED display
Meter Resolution	0.1°C
Panel Indicators	Red: Heat-up Condition Green: Heat-down Condition Yellow: Displaying Set-Temperature
Features	Pushbutton entry of Set-Temperature Set-Temperature displayed for 3 seconds after adjustment
Enclosure Dimensions	2.1 x 6.6 x 11.1 cm (H x W x D)
Weight	92 grams
Warranty	One year, parts & labor

Order #	Model	Product
W4 64-1545	TC-124A	Temperature Controller, 120 VAC US
W4 64-1545E	TC-124AE	Temperature Controller, 240 VAC Europe
W4 64-1606	BAC-1	Battery Adapter Cable

Model TC-144 Dual Temperature Controller



- Ambient to 65°C temperature range
- Compatible with Warner's objective warmer, syringe warmers, and warmed stage insert
- Can be powered from 12 volt battery for sensitive electrophysiology applications
- Large, easy to read LED display

The TC-144 Dual Temperature Controller from Warner Instruments is a simple, low cost device designed for use with our microscope objective warmer or the SWS Series syringe warmers. This device is capable of driving two objective warmers simultaneously.

This compact instrument is a basic on-off controller with a slowly ramped switching speed, making it ideal for large mass devices where the temperature changes slowly.

The LED display reports the actual or set temperature of either channel. Front panel LED's indicate the currently displayed information.

Supplied with universal input voltage power supply and plug kit for major countries.



Specifications

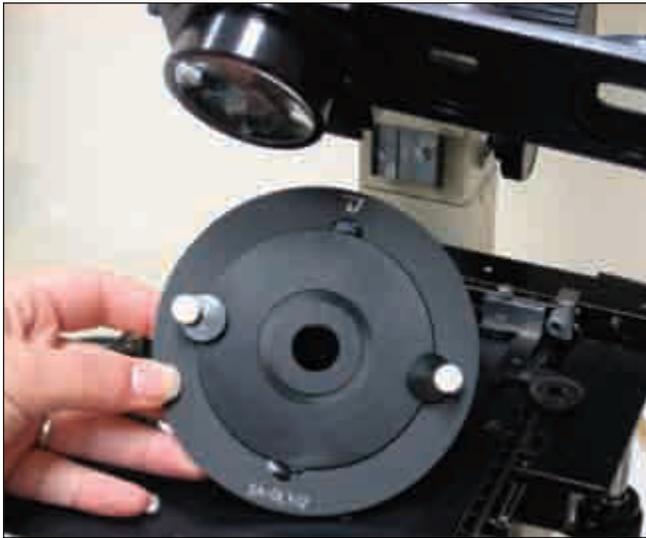
Input Voltage Range	9 to 16 VDC
Maximum Output Current	1.2 A (per channel)
Maximum Output Power	13 W (per channel)
Temperature Ranges (4)	Set by DIP switch: ambient to +65C
Meter Resolution	0.1 °C
Display	LED, 3 digit, 10 mm (0.4 in) high
Panel Indicators:	
Red	Heat-up condition
Green	Heat-down condition
Yellow	Displaying set-temperature or view temperature
Features	Pushbutton entry of modes, dust-proof, splash-proof case
Physical Dimensions:	
Case Size	2.1 x 6.6 x 11.1 cm (H x W x D)
Shipping Weight	0.5 kg
Warranty	One year, parts & labor

Order #	Model	Product
W4 64-1655	TC-144	Temperature Controller Dual

Accessories/Replacement Parts

W4 64-1606	BAC-1	Battery Adapter Cable
W4 64-1665	OW-1	Objective Warmer for 23-28 mm Objectives
W4 64-1662	WP-10	Warmed Platform 10 mm Aperture
W4 64-1663	WP-16	Warmed Platform 16 mm Aperture
W4 64-1584	SWS-10	Syringe Heater for 10 cc Syringes
W4 64-1560	SWS-60	Syringe Heater for 60 cc Syringes
W4 64-1585	SWS-140	Syringe Heater for 140 cc Syringes

Model WP-10 and WP-16 Warmed Platforms for 35 mm Petri Dishes



- Temperature control from 25 to 65 C
- Stage adapters for all major brand microscopes
- Low Cost Systems available

Warner Instruments warmed platforms are designed to maintain the temperature of 35 or 50 mm Petri dishes and glass or chambered slides.

Available with aperture sizes of 10 and 16 mm, these aluminum platforms provide excellent mechanical access from below and very good heat conductivity. Platforms are finished in black anodize for corrosion protection and to minimize stray light reflectance. A groove in the top surface of the platform allows Petri dishes with a raised bottom to achieve full contact with the platform heated surface.

Control of platform heating is provided by our TC-124A and TC-144 temperature controllers. Complete systems are available for Nikon microscopes using a 108 mm stage insert and for Olympus microscopes using a 110 mm insert.

Complete systems include a warmed platform (choice of aperture), a TC-124A temperature controller (select line voltage), and a SA-NIK stage adapter for the Nikon systems or a SA-OLY/2 stage adapter for the Olympus systems.

Stage adapters are available for all major microscopes; the warmed platforms use Warner's series 20 stage adapters. Please see page 64 for detailed information regarding the stage adapters.

Specifications

Temperature Range	25° to 65°C
Accuracy	±0.1°C
Feedback Thermistor	Built in Unical 10kΩ at 25°C
Controller	TC-124A / TC-144 Single and Dual Channel Controllers

Specifications (continued)

Physical Dimensions:	
Warmed Platforms (D x L)	79.4 x 3.2 mm
Aperture Size (D)	10 mm- WP-10, 16 mm- WP-16
Weight	50 g
Cable Length	2.4 m
Connector Type	4 pin Male RJ-22
Warranty	One Year

Order #	Model	Product
W4 64-1662	WP-10	Warmed Platform 10 mm Aperture
W4 64-1662D	WP-10D	Warmed Platform 10 mm Aperture for use with TC-324B/TC-344B Temperature Controllers
W4 64-1663	WP-16	Warmed Platform 16 mm Aperture
W4 64-1663D	WP-16D	Warmed Platform 16 mm Aperture for use with TC-324B/TC-344B Temperature Controllers

Systems Below Include TC-124A Temperature Controller, Warmed Platform, and Stage Adapter

W4 64-1666	WPN-10	Warmed Platform for Nikon 10 mm Aperture
W4 64-1667	WPN-16	Warmed Platform for Nikon 16 mm Aperture
W4 64-1668	WPN-10E	Warmed Platform for Nikon 10 mm Aperture (for 240 VAC)
W4 64-1669	WPN-16E	Warmed Platform for Nikon 16 mm Aperture (for 240 VAC)
W4 64-1670	WPO-10	Warmed Platform for Olympus 10 mm Aperture
W4 64-1671	WPO-16	Warmed Platform for Olympus 16 mm Aperture
W4 64-1672	WPO-10E	Warmed Platform for Olympus 10 mm Aperture (for 240 VAC)
W4 64-1673	WPO-16E	Warmed Platform for Olympus 16 mm Aperture (for 240 VAC)

SH-27B, SH-27G and SF-28

In-line Solution Heaters

Quiet Temperature Control for Flowing Solutions



- Quiet operation
- Ambient to 50°C
- Fast or slow flow
- Designed to work with the TC-324B and TC-344B Temperature Controllers

In-line solution heating is the simplest and most effective method of warming perfusion solutions. The heater is connected to the chamber with a short length of tubing such that the warmed perfusate flows directly into the chamber bath. Depending on bath volume and other factors, in-line solution heating by itself may be sufficient for many applications.

The model SH-27B will accommodate flow rates up to 10 ml/min while the model SF-28 is designed for slower flow rates of 2 ml/min or less.

Both models feature a straight flow path for easy cleaning. The stainless steel flow channel in both models may be lined with polyethylene tubing (PE-50) when exposing compounds to metal is a problem.

These In-line Solution Heaters require either the TC-324B single or the TC-344B dual channel temperature controller. See pages 108 and 109.

Each heater is supplied with a thermistor cable assembly (p/n TA-29) which allows for monitoring the actual bath temperature during use (T2 output on heater controllers TC-324B/TC-344B).

Specifications

Heater Resistance	10 Ω
Voltage Requirement	Variable to 12 V max.
Maximum Temperature	50°C
Internal Dead Volume	262 μl
Perfusion Lines	Type 316 Stainless Steel 0.083 in OD x 0.067 in ID, 2.1 mm x 1.70 mm
Maximum Flow Rate at 37°C:	
SF-28	2 ml/min
SH-27B/SH-27G	10 ml/min
Temperature of 37°C can be maintained at ±1°C under following conditions: a) Solution temperature at input (nominally 21°C) varies no more than ±10%; b) Solution flow rate varies no more than 25%	
Physical Dimensions:	
Body (D x L)	12.5 mm x 12.5 cm
Cable Length	1.9 m
Warranty	One year

Order #	Model	Product
W4 64-0103	SF-28	Slow Flow Solution Heater
W4 64-0102	SH-27B	Solution Heater
W4 64-1503	SH-27G	Solution Heater with Banana Connectors

Accessories and Replacement Parts

W4 64-0107	TA-29	Replacement Cable with Bead Thermistor
W4 64-0108	TA-30	Replacement Cable with Glass Thermistor
W4 64-0100	TC-324B	Heater Controller, Single
W4 64-0101	TC-344B	Heater Controller, Dual

solution heaters

SC-20

Dual In-line Solution Heater/Cooler

Bipolar Temperature Control for Flowing Solutions



- Heats and cools from 0° to 50°C
- Compatible with Warner Series 20 Chambers
- Optimized for use with the CL-100 Bipolar Temperature Controller

In-line solution heating has proven to be one of the most effective methods of maintaining the temperature of perfusion solutions. The SC-20 Dual In-line Solution Heater/Cooler utilizes Peltier thermoelectric devices to regulate temperature both above and below ambient levels.

The SC-20 is designed to thermally regulate one or two solutions at the same temperature. Solution temperature can be maintained at 0°C at flow rates of 2 ml/min., 5°C at 5 ml/min., or as high as 50°C at 5 ml/min.

An integral water jacket is used to remove excess heat from the SC-20 peltier device. Running water either from a tap or a large reservoir can be used. Flow rates as low as 4 liters per hour are sufficient to maintain cooling efficiency.

The SC-20 can be used with either one or two discrete perfusate solutions, or with a solution/gas combination. When coupled with a PHC Series Imaging Chamber Heater/Cooler Jacket, the SC-20 provides an effective means of temperature control in a Warner chamber, even in the absence of solution flow.

Each SC-20 is supplied with a TA-29 Thermistor Cable Assembly for monitoring the bath temperature during use, 10 feet of PE-160 tubing and 10 feet of 1/8" I.D. x 1/4" O.D. Tygon tubing.

Specifications

Minimum Temperature	0°C (2 ml/min. max flow)
Maximum Temperature	50°C
Maximum Flow Rate at 5°C	5 ml/min.
Accuracy	±0.1°C
Internal Dead Volume	330 µl
Perfusion Lines	Type 316 Stainless Steel 0.032 in ID x 0.062 in OD
Water Jacket Ports	Type 316 Stainless Steel 0.12 in ID x 0.147 in OD
Controller	Model CL-100 Bipolar Controller
Physical Dimensions:	
Body (D x L)	21 x 165 mm
Weight	109 g
Cable Length	1.9 m
Connector Type	15 pin Male "D"
Warranty	One year

Order # Model Product

W4 64-0353 SC-20 Solution Heater/Cooler Two Line

W4 64-0352 CL-100 Bipolar Temperature Controller

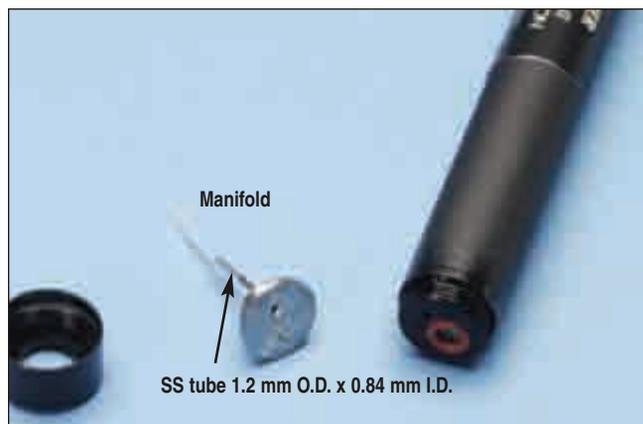
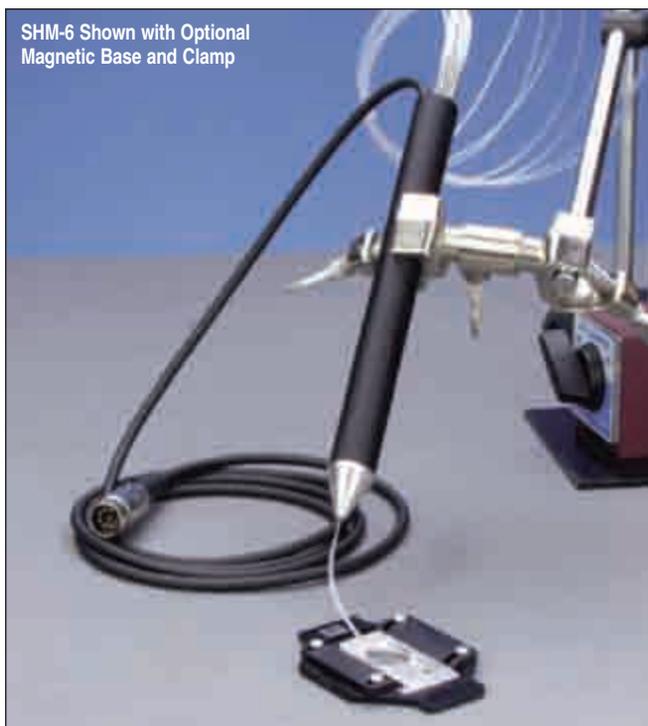
Replacement part

W4 64-0107 TA-29 Cable with Bead Thermistor for Heater Controllers

SHM-6 and SHM-8

solution heaters

Multi-Line In-Line Solution Heaters



- Six-line and eight-line models
- Single outflow line
- Plugs into TC-324B and TC-344B Heater Controllers
- Removable manifold for easy cleaning
- Low dead volume

In-line solution heating is the simplest and most effective method of warming perfusion solutions. The minimal dead space manifold (see right image) at the output allows this heater to be used in any application where from 2 to 8 perfusion lines are connected to a chamber or other device. The manifold dead volume is 30 μ l.

The heater is connected to the chamber using a short length of tubing such that the warmed perfusate flows directly into the chamber bath. Connections are made by press fitting (PE-160) tubing onto the 18 gauge stainless steel hypodermic tubes. Cap plugs are supplied to block any unused inputs.

Depending on bath volume and other factors, in-line solution heating itself may be sufficient for many applications. The heaters will accommodate flow rates up to 5 ml/min. Solution reservoir heaters from Warner are recommended if outgassing of solutions is a problem.

These solution heaters require either a single or dual channel temperature controller. See pages 108 to 116.

Each heater is supplied with a TA-29 thermistor cable assembly which allows for monitoring the actual bath temperature (T2 output on heater controllers TC-324B/TC-344B), and 3 meters of PE-160 tubing, a three way valve and replacement O-rings.

Specifications

Heater Resistance	10 Ω
Voltage Requirement	Variable to 12 V max
Maximum Temperature	50°C
Internal Heater Volume	94 μ l/line
Manifold Dead Volume	30 μ l (input of manifold to output tip)
Maximum Flow Rate at 37°C	5 ml/min

Temperature of 37°C can be maintained at $\pm 2^\circ\text{C}$ under following conditions:
a) Solution temperature at input (nominally 21°C) varies no more than $\pm 10\%$;
b) Solution flow rate varies no more than 25% with 3 ml/min max flow rate

Physical Dimensions:

Body (D x L)	16.5 x 165 mm
Weight	104 g
Cable Length	1.9 m
Warranty	One year

Order # Model Product

W4 64-0104	SHM-6	Six-Line Solution Heater
W4 64-0105	SHM-8	Eight-Line Solution Heater

Accessories and Replacement Parts

W4 64-0107	TA-29	Replacement Cable with Bead Thermistor
W4 64-0108	TA-30	Replacement Cable with Glass Thermistor
W4 64-0755	PE-160/10	Polyethylene Tubing, 3 m (10 ft.)
W4 64-0060	MB/B	Magnetic Base
W4 64-0564	U9404	3-Prong Clamp
W4 64-0100	TC-324B	Heater Controller Single
W4 64-0101	TC-344B	Heater Controller Dual

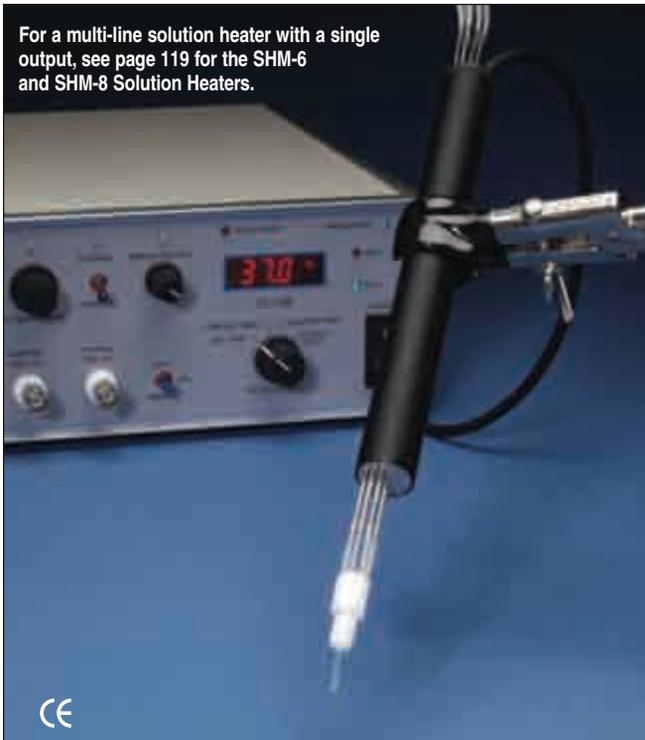
solution heaters

SHM-828

Eight Line In-Line Solution Heater

Warms up to eight independent perfusion lines to the same temperature

For a multi-line solution heater with a single output, see page 119 for the SHM-6 and SHM-8 Solution Heaters.



- Straight flow path for all eight lines
- Connects to the CL-100 Bipolar Temperature Controller
- Easily cleaned
- Perfusion lines remain independent

The SHM-828 is an eight line solution heater designed for superfusion. Construction is such that all eight lines can be used simultaneously. The solution is heated as it flows through 21.5 cm of 18 gauge type 316 stainless steel tubing. The straight flow path allows for easy cleaning.

If contact with stainless steel tubing is undesirable, polyethylene tubing (PE-50) can be drawn through the heater tubes. This eliminates metal contact and reduces the dead volume of the tubes.

For single output applications an MP-8 Perfusion Manifold can be connected directly to the 18 gauge tubes. An ML-8 Miniature Manifold may be used if PE-50 polyethylene tubing is pulled inside the heater tubes.

Solution temperatures can be maintained at 37°C for flow rates up to 5 ml/min., or 50°C at 3 ml/min., per line. Higher flow rates at any given temperature can be achieved if fewer lines are used.

Each heater is supplied with a TA-29 Thermistor Cable Assembly which allows for monitoring the actual bath temperature and 3 meters of PE-160 Tubing. This heater requires the CL-100 Bipolar Temperature Controller; see page 110.

Specifications

Heater Resistance	6.7 Ω
Voltage Requirement	Variable to 15 V max
Maximum Temperature	50°C
Internal Dead Volume	157 μ l / line
Perfusion Lines Type	316 Stainless steel 1.2 mm OD x 0.84 mm ID
Maximum Flow Rate at 37°C	5 ml/min (with all eight lines flowing)
Temperature	37°C can be maintained at $\pm 0.2^\circ\text{C}$
Physical Dimensions:	
Body (D x L)	18 x 168 mm
Tube Length	215 mm
Weight	98 g
Cable Length	1.9 m
Warranty	One year

Order #	Model	Product
W4 64-1430	SHM-828	Solution Heater Eight Line, No Manifold
W4 64-1430L	SHM-828LP	Solution Heater Eight Line Low Power, No Manifold
W4 64-0352	CL-100	Bipolar Temperature Controller
Accessories and Replacement Parts		
W4 64-0755	PE-160/10	Polyethylene Tubing PE-160, 10 ft.
W4 64-0752	PE-50/10	Polyethylene Tubing PE-50, 10 ft.
W4 64-0107	TA-29	Replacement Cable with Bead Thermistor
W4 64-0108	TA-30	Replacement Cable with Glass Thermistor
W4 64-0211	MP-8	Perfusion Manifold MP Series 8 to 1
W4 64-0199	ML-8	Perfusion Manifold ML Series 8 to 1

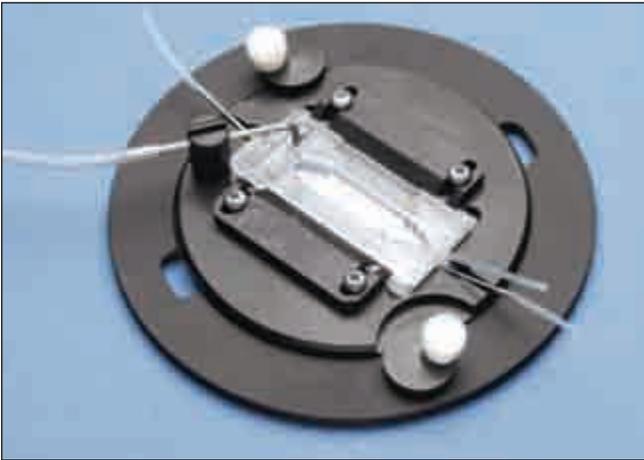


other coolers/warmers

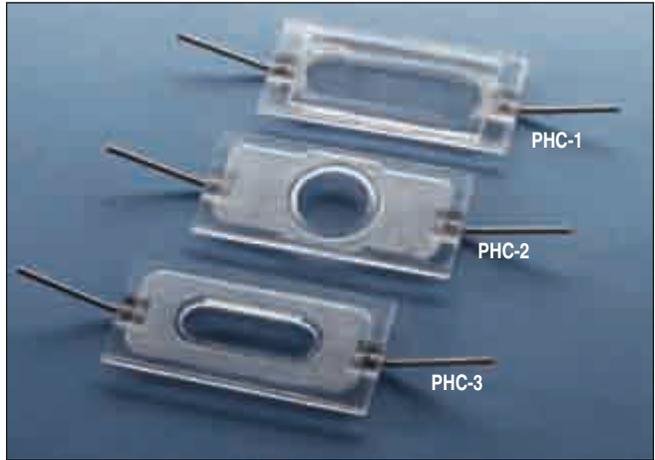
PHC Series

Heater/Cooler Jackets

Maintains temperature in both perfused and static baths



Model PHC-3 shown with mounting platform and mounted in a Nikon stage adapter



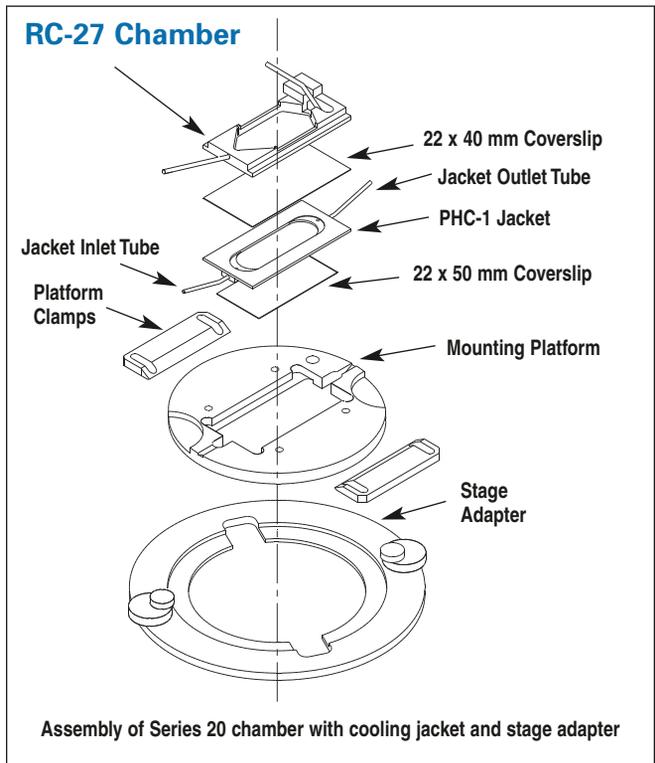
Individual heater/cooler jackets shown without mounting platform

- Designed for Series 20 chambers
- Optimized for the SC-20 In-line Solution Heater/Cooler
- Jackets available for both upright and inverted microscopes
- Includes Series 20 platform

The Warner PHC Heater/Cooler Jackets are designed to bring heating and cooling to our classic Series 20 Imaging and Recording Chambers. Accurate temperature control from 5° to 50°C can be achieved using the PHC jackets in concert with the SC-20 Dual In-line Solution Heater/Cooler. Heated or chilled water flows from the SC-20 into a PHC jacket which is in direct thermal contact with the chamber bottom coverslip.

The PHC-1 is used for upright microscopes and provides a thermal barrier between the chamber-forming coverslip and the local environment. The PHC-2 and PHC-3 are designed for inverted microscopes and provide either rectangular or round openings.

Heater/Cooler Jackets are provided with a mounting platform, which replaces the standard platforms used with Series 20 chambers. The platform functions as a base for the jacket/chamber sandwich and provides the clamping pressure to make a tight seal. Mounting platforms are machined from black Delrin and are compatible with all Series 20 stage adapters, see pages 64 to 69.



Assembly of Series 20 chamber with cooling jacket and stage adapter

Model	Aperture Size	For Chamber Model
PHC-1	17.0 x 37 mm	RC-22/22C/24N/26/26G/26GLP/26Z RC-27/27N/27NE/28/RC-27L/RC-29
PHC-2	15 mm diameter	RC-22/22C/24N/26/26G/26Z/26GLP
PHC-3	8.0 x 25 mm	RC-27/27N/27NE

Order #	Model	Product
W4 64-0354	PHC-1	Heater/Cooler Jacket, Upright
W4 64-0355	PHC-2	Heater/Cooler Jacket, Inverted
W4 64-0356	PHC-3	Heater/Cooler Jacket, Inverted

Other coolers/warmers

OW Series Objective Warmers

Reduces the thermal gradient between objective and specimen



Systems include heated collar and temperature controller

- Reduces thermal gradient between objective and sample
- No direct contact between warmer and objective
- Heated collar warms the surrounding air which then gently warms the objective
- Fits microscope objectives from most manufactures
- Can be powered from Warner's low noise TC-324B/TC344B temperature controller or a 12 volt battery for sensitive electrophysiology applications

A common problem with immersion optics is the loss of thermal control of the solution directly adjacent to the microscope objective. The need to keep a sample at a temperature different from ambient during observation is directly compromised by the heat-sink character of the microscope objective.

The OWS Series Objective Warmer from Warner Instruments provides a simple and effective method for maintaining a stable temperature within a microscope objective. This in turn reduces the thermal gradient between the lens and sample.

A thermally controlled collar attaches to the microscope objective via soft silicone rings. The collar incorporates a resistive heater and thermistor which allows the included electronic controls to maintain the objective warmer at a constant and well maintained temperature.

Heat generated by the isolated collar is not directly communicated to the objective but is instead distributed around the objective via a conducting sleeve.

The conducting sleeve warms the surrounding air, which in turn gently warms the objective. This approach allows the apparatus to take full advantage of the thermal characteristics of the surrounding air. The warmer achieves its task without directly contacting or exposing the objective to significant stresses associated with temperature gradients.

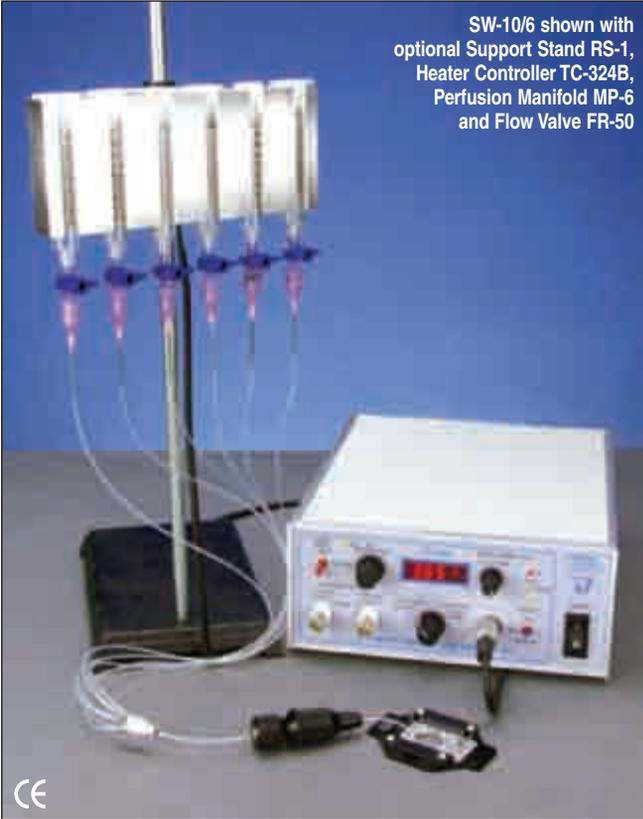
Collars are available to fit objectives from most microscope manufacturers and custom designs are available.

Order #	Model	Product
W4 64-1664	OWS-1	Objective Warmer System for 23-30 mm Lens Includes TC-124A Controller
W4 64-1676	OWS-2	Objective Warmer System for 30-35 mm Lens Includes TC-124A Controller
W4 64-1664E	OWS-1E	Objective Warmer System for 23-30 mm Lens Includes TC-124A Controller (240VAC)
W4 64-1676E	OWS-2E	Objective Warmer System for 30-35 mm Lens Includes TC-124A Controller (240VAC)
Accessories / Replacement Parts		
W4 64-1665	OW-1	Objective Warmer Collar for 23-30 mm Lens; Requires a TC-124A Controller
W4 64-1674	OW-2	Objective Warmer Collar for 30-35 mm Lens; Requires a TC-124A Controller
W4 64-1665D	OW-1D	Objective Warmer Collar for 23-30 mm Lens; Requires a TC-324B/344B Controller
W4 64-1674D	OW-2D	Objective Warmer Collar for 30-35 mm Lens; Requires a TC-324B/344B Controller
Temperature Controllers		
W4 64-1545	TC-124A	Temperature Controller 100-120 VAC
W4 64-1545E	TC-124AE	Temperature Controller 240 VAC
W4 64-1655	TC-144	Temperature Controller Dual Channel Universal Input Voltage

syringe warmers

SW-10/6 Syringe Warmers

Eliminates the need for a large heated water bath



- Accommodates 6 x 10 cc syringes
- Compact design
- Quiet operation in recording setups
- Compatible with TC-324B and TC-344B Heater Controllers

Solution reservoir heating is an important technique used to eliminate outgassing of solutions in a heated perfusion chamber. Since the gas load of a solution has dependence on pressure and temperature, preheating a solution at the final pressure before delivery to the chamber will minimize the occurrence of bubbles in the bath, even if the solution is allowed to cool en route. Solution reservoir heaters from Warner Instruments are designed for applications where the use of a large heated water bath is inconvenient.

Designed to accommodate six 10 cc syringes, the SW-10/6 heater housing is made of anodized aluminum which is both corrosion resistant and serves as an excellent conductor. These heaters may be mounted on any 3/8" or 1/2" diameter lab rod. Solutions will reach set temperature approximately 15 minutes after the application of power.

Each unit is supplied with a cable assembly for connection to Warner's TC-324B or TC-344B heater controllers, see pages 108 and 109. Also supplied is a TA-29 thermistor for monitoring the temperature within any syringe.

Specifications

Syringe Size	10 cc
Heater Resistance	10 Ω
Voltage Requirement	Variable to 12 V maximum
Temperature Range	Ambient to 50°C
Temperature Accuracy	$\pm 1^\circ\text{C}$
Physical Dimensions:	
Body (H x W x D)	7.5 x 17.8 x 2.5 cm
Cable Length	1.9 m
Weight	680 g
Warranty	One year

Order # Model Product

W4 64-0111 SW-10/6 Six 10 cc Syringe Heater

Accessories and Replacement Parts

W4 64-0165 SL-6 Stopcock with Luer Connector, pkg. of 6

W4 64-0162 RS-1 Support Stand

W4 64-0220 FR-50 Flow Valve

W4 64-0221 FR-55S Flow Valve with On-Off Switch

W4 64-0210 MP-6 6 to 1 Perfusion Manifold

W4 64-0755 PE-160/10 Polyethylene Tubing

syringe warmers

SW-61

Syringe Warmers

Eliminates the need for separate water bath

SW-61 Syringe Warmer



- Compatible with TC-324B and TC-344B Heater Controllers
- Accommodates a single 60 cc syringe
- Particularly useful for applications where use of a water bath is undesirable (e.g. a shared facility)

Solution reservoir heating is an important technique used to eliminate outgassing of solutions in a heated perfusion chamber. Since the gas load of a solution has dependence on pressure and temperature, preheating a solution at the final pressure before delivery to the chamber can minimize the occurrence of bubbles in the bath, even if the solution is allowed to cool en route.

Solution reservoir heaters from Warner Instruments are designed for applications where the use of a large heated water bath is inconvenient.

Designed to accommodate one 60 cc syringe, the SW-61 Heater housing is made of anodized aluminum which is both corrosion resistant and serves as an excellent conductor. These heaters may be mounted on any 3/8" or 1/2" diameter lab rod, and each unit is supplied with a cable assembly for connection to Warner's TC-324B or TC-344B heater controllers, see pages 108 and 109.

Also supplied is a TA-29 thermistor for monitoring the temperature within any syringe. Solutions will reach set temperature approximately 15 minutes after the application of power.

Specifications

Syringe Size	60 cc
Heater Resistance	10 Ω
Voltage Requirement	Variable to 12 V maximum
Temperature Range	Ambient to 50°C
Temperature Accuracy	$\pm 1^\circ\text{C}$
Physical Dimensions:	
Body (H x W x D)	14.8 x 8.1 x 6.4 cm
Cable Length	1.9 m
Weight	900 g
Warranty	One year

Order # Model Product

W4 64-0112 SW-61 60 cc Syringe Heater

Accessories and Replacement Parts

W4 64-0165 SL-6 Stopcock with Luer Connector, pkg. of 6

W4 64-0162 RS-1 Support Stand

W4 64-0182 PS-560 Syringe Heater Stand*

*see page 129.

TC-324B & TC-344B Heater Controllers

One or two heater blocks may be powered from the single channel **TC-324B** or dual channel **TC-344B** heater controller, respectively. See pages 108 and 109 for details on these models.

Dual Channel TC-344B Heater Controller, see page 108



Single Channel TC-324B Heater Controller, see page 109



syringe warmers

SW-60 and SW-707 Syringe Heating System

Independent temperature control for multiple syringes



Specifications

Syringe Heater	SW-60
Syringe Size	60 cc
Heater Resistance	6.67 Ω
Temperature Range	Ambient to 50°C
Input Voltage	12 V nominal, 16 V max
Physical Dimensions	14.8 x 8.1 x 6.4 cm (H x W x D)
Weight	900 g
Warranty	One year
Syringe Heater Stand	PS-560
Dimensions:	
Base, H x W x D	2.5 x 30.4 x 30.4 cm
Main Pole, D x H	1.9 x 91.4 cm
Sub Poles, D x L	1.2 x 30.4 cm
Weight	3.7 kg

Order #	Model	Product
W4 64-0179	SW-60	Syringe Heater for 60 cc Syringe
W4 64-0182	PS-560	Syringe Heater Stand
W4 64-0181	SW-707	Power Controller

Solution reservoir heating is an important technique used to eliminate outgassing of solutions in a heated perfusion chamber. 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 is allowed to cool en route.



The ability to independently control each heater block allows the researcher to control the initial temperature of each solution without influencing other nearby solutions. This system is available to fit 60 cc syringes. The heater housing is made of anodized aluminum which is both corrosion resistant and serves as

an excellent conductor of heat. Heater blocks can be mounted on any 9.5 mm (3/8 inch) diameter metal rod with an insulating bushing supplied with each SW-60. If multiple SW-60 heaters are to be mounted, the stand must have a heavy base for stability.

PS-560 Syringe Heater Stand

Having a large base for stability, the syringe heater stand will accommodate up to eight syringe heaters. Mounting rods are thermally non-conducting plastic. The 90 cm long vertical rod permits a wide range of height adjustment.

SW-707 Syringe Power Controller



As many as six SW-60's can be controlled with the model **SW-707** Power Controller. When used in the local mode, the SW-707 allows the temperature of each

syringe block to be independently set. A master mode allows all syringe blocks to be set to the same temperature. Both the set temperature and the actual temperature of each syringe block can be displayed on the LED meter.

Specifications

Temperature Range	Ambient to 50°C
Max. Output	12 VCD, 144 W
LED Display	Monitor to set and read temperatures
Power Requirements	100-130 or 220-250 VAC, 50/60Hz
Physical Size	9 x 22 x 26 cm (H x W x D)
Warranty	2 years

SWS-10, SWS-60 and SWS-140

Syringe Warmers

Independent temperature control for individual syringes



SWS-60 mounted on a Harvard Apparatus Pump 33 Dual Syringe Pump

- Designed for use on a syringe pump or support stand
- Accommodates 10, 60 and 140 cc syringes
- Scale marking ports permit volume monitoring during use
- Can be powered from 12 volt battery for sensitive electrophysiology applications

The SWS-Series Syringe Warmers provide a simple and effective method for maintaining a stable temperature within a syringe. The compact design of this warmer allows it to be used either with a syringe pump or mounted on a support stand.

The thermally controlled heater housing slides onto a 10, 60, or 140 cc syringe and is held in place with a self adjusting friction band. The housing incorporates a resistive element and thermistor, which when connected to a TC-124 temperature controller, allows the syringe warmer to be maintained at a constant temperature.

The heater housing is made of anodized aluminum which is both corrosion resistant and serves as an excellent thermal conductor. Solutions usually reach the set temperature approximately 15 minutes after application of power.

Be sure to order the TC-124 temperature controller with your syringe warmer.

Specifications

Heater Resistance	18 Ω
Voltage Requirement	Variable to 12 V maximum
Temperature Range	Ambient to 65°C
Temperature Accuracy	$\pm 1^\circ\text{C}$
Cable Length	2.4 m
Warranty	One year

Model	Weight	Length	OD	ID	Syringe Type
SWS-10	32.7 g	38.2 mm	22.2 mm	16.2 mm	Becton Dickinson
SWS-60	76 g	83.7 mm	35.0 mm	29.1 mm	Becton Dickinson
SWS-140	192 g	109.5 mm	51.0 mm	41.4 mm	Monoject

Order #	Model	Product
W4 64-1584	SWS-10	Syringe Heater for 10 cc Syringes
W4 64-1560	SWS-60	Syringe Heater for 60 cc Syringes
W4 64-1585	SWS-140	Syringe Heater for 140 cc Syringes
W4 64-1545	TC-124A	Temperature Controller, 120 VAC US
W4 64-1545E	TC-124AE	Temperature Controller, 240 VAC Europe
W4 64-1655	TC-144	Temperature Controller
W4 64-1606	BAC-1	Battery Adapter Cable

Temperature Control Accessories and Cables

SHH-1, SHH-2, SHH-3 and SHH-4 Holders for In-line Solution Heaters



An ideal tool for holding Warner In-line Solution Heaters close to the chamber. Machined from a solid Delrin block, these sturdy holders can be secured to your microscope stage using gaffer or duct tape.

- The SHH-1 works with both our SH-27B and SF-28 Solution Heaters.
- The SHH-2 mounts our SC-20 In-line Solution Heater/Cooler.
- The SHH-3 is used for the SHM-6, SHM-8, and SHM-828 Multiline In-line Heaters.
- The SHH-4 works with our FR-50 and FR-55S flow valves.

Order #	Model	Product
W4 64-1555	SHH-1	Holder for Solution Heaters Models SH-27B & SF-28
W4 64-1556	SHH-2	Holder for Solution Heaters Model SC-20
W4 64-1557	SHH-3	Holder for Solution Heaters Models SHM-6, SHM-8, SHM-828
W4 64-1558	SHH-4	Holder for Flow Valves Models FR-50 and FR-55S

Cables and Thermistors

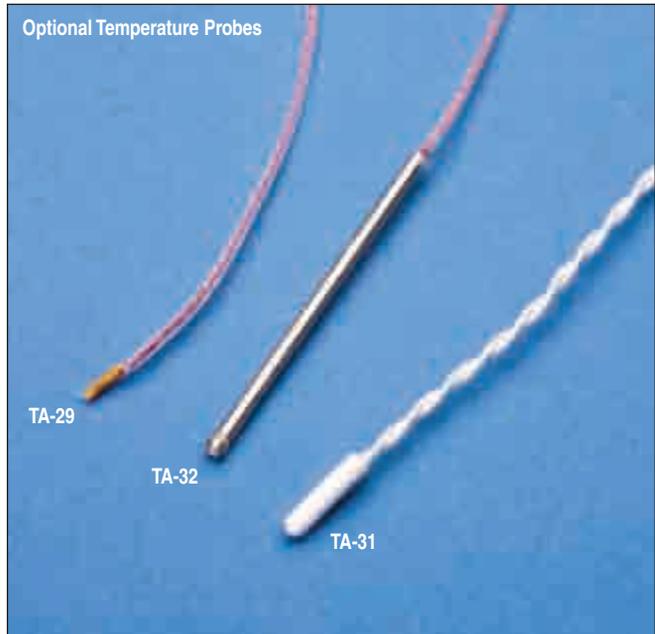


Order #	Model	Product
W4 64-0303	CC-15	Cable Assembly with Connector with Tinned Leads
W4 64-0106	CC-28	Cable Assembly for Series 20 Heater Platforms
W4 64-0109	CC-35	Cable Assembly with Unterminated Outboard End
W4 64-1425	CC-102	Cable Assembly, Male Banana to 1 mm Jacks (for use with Warner Field Stimulation Chambers)
W4 64-0107	TA-29	Replacement Cable with Bead Thermistor
W4 64-0108	TA-30	Replacement Cable with Glass Thermistor

Additional replacement parts are shown on page 62 (Platforms).

Model TM-3 Three-Scale Thermistor Temperature Monitor

Fahrenheit, celsius, Kelvin



Temperature Control accessories

- Celsius, Fahrenheit, or Absolute (Kelvin) scales
- Analog output for data acquisition systems or pen recorders
- Dust-proof, splash-proof and battery powered for use in the field
- Compatible with any 10kΩ unical thermistor
- Large easy to read LCD display

The TM-3 is a portable thermistor thermometer built for lab accurate temperature measurement. Designed to use any 10 KΩ unical thermistor, no recalibration is required when changing probes. The meter features three scales, Celsius, Fahrenheit, and Absolute (Kelvin), pushbutton selectable from the dust-proof and splash-proof front panel interface.

Meter will operate for approximately 100 hours with a single 9 volt alkaline battery or may be powered from the supplied AC wall adapter. A front panel LED indicates low battery condition.

Probe (thermistor) not included. Select from Thermistor Options to the right.

Specifications

Temperature Range:	
Celsius	0 °C to 104 °C
Fahrenheit	2 °F to 220 °F
Absolute (Kelvin)	256 K to 378 K
Accuracy	0.3°C ± 1 digit between 20° to 60°C
Meter Resolution	0.1 degrees
Display	LCD, 4 digit, 10 mm (0.4in) high
Sensor	10kΩ Unical Thermistor
Input & Output Connectors	BNC female
Analog Output	10 mV/°C
Power Requirements	9 Volt transistor alkaline battery or supplied AC wall adapter
Physical Dimensions:	
Case Size	2.4 x 7.9 x 12.8 cm (H x W x D)
Shipping Weight	0.5 kg
Warranty	Two years, parts & labor

Order #	Model	Product
W4 64-1654	TM-3	Three-Scale Temperature Monitor
W4 64-1654E	TM-3	Three-Scale Temperature Monitor 230 VAC

Thermistor Options		
W4 64-0107	TA-29	Bead Thermistor 1 mm Diameter
W4 64-1657	TA-31	Probe Thermistor 2 mm Diameter 10 mm Long Plastic Housing
W4 64-1656	TA-32	Probe Thermistor 1.63 mm Diameter 32 mm Long Stainless Steel Housing

Temperature Control Accessories and Cables

PI-1 Power Interface

The PI-1 Power Interface Module will allow a single syringe warmer to run from a 12 volt battery or power supply. Voltage outputs at 100 mV/°C are provided to monitor both the set and actual temperatures. Fuse protected.

Specifications

Input DC Voltage	12 V nominal 16 V maximum
Connectors	1 mm jacks
Physical Size	2.8 x 5.7 x 2.2 cm (H x W x D)
Warranty	One year
Fuse	1.5A - 3AG

PI-1 Power Interface



Order #	Model	Product
W4 64-0180	PI-1	Power Interface

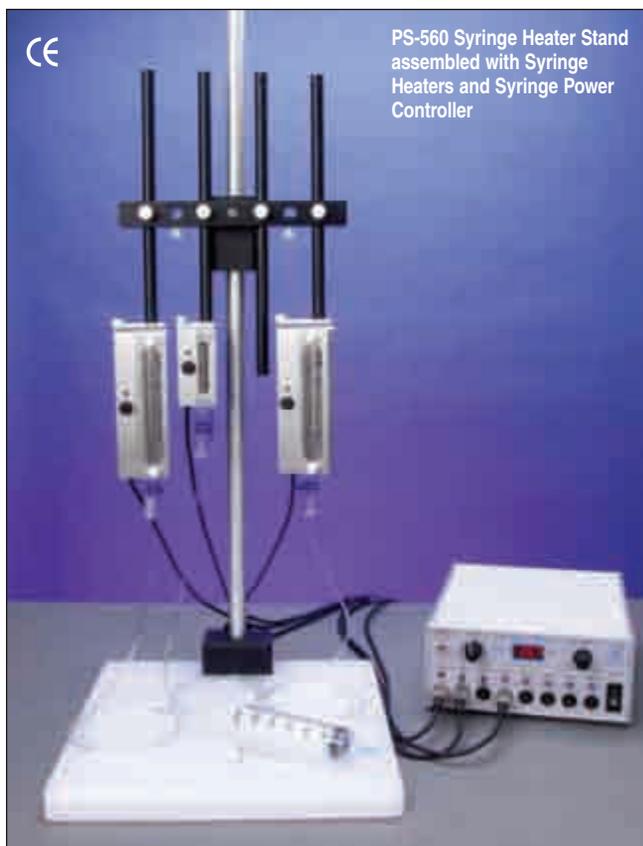
PS-560 Syringe Heater Stand

The PS-560 syringe heater stand will accommodate up to eight syringe heaters. The stand has a large base for stability. Mounting rods are thermally non-conducting plastic. The 90 cm long vertical rod permits a wide range of height adjustment.

Specifications

Dimensions:	
Base, H x W x D	2.5 x 30.4 x 30.4 cm
Main Pole, D x H	1.9 x 91.4 cm
Sub Poles, D x L	1.2 x 30.4 cm
Weight	3.7 kg

Order #	Model	Product
W4 64-0182	PS-560	Syringe Heater Stand



PS-560 Syringe Heater Stand assembled with Syringe Heaters and Syringe Power Controller

controller

Notes:

Temperature
Control

notes

contact information

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