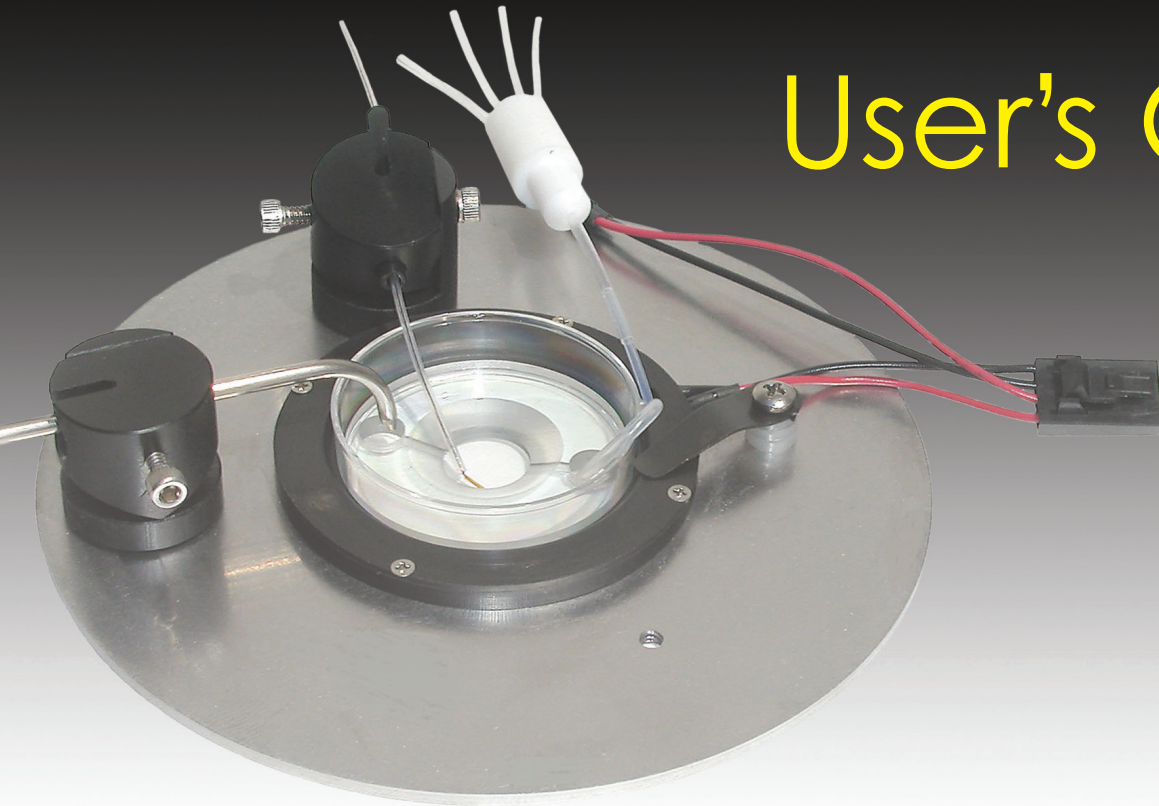# Temperature Control

User's Guide

Liquid Heat Exchange for Peltier Cooling Stages

- Required for deep cooling
- Can cool water reservoirs
- Can be used to cool computer chips
- Quiet operation
- Liquid flow rate up to 500ml/min

Contents

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Specifications

Ports   IN and OUT barbed ports, 1/8 in I.D. (10-32 threaded)

Output circulates liquid at 150ml/min flow rate (can be increased to 500ml/min upon request)

Size (Controller) : 7.9 x 17.3 x 15.8 in

Power Supply
100/240VAC 700W

Introduction

This liquid heat-exchange was designed to bring temperature of the heat sink in Peltier stages down by actively decreasing temperature of liquid (water, for example) running through the sink. Can be used to cool computer chips and water reservoirs. Able to cool 300ml of water from room temperature of 24°C down to 8°C in 10 min, with the temperature of output liquid reaching 5°C. Built-in peristaltic pump to run liquid through the unit. Includes tubing.

Installation Guide

1 Prepare a reservoir filled with water or anti-freeze (ethanol solution in water, for example).

2 Form a circulation loop: Attach tubing to INPUT inlet of BTC-W heat exchanger, and place another end of the tubing inside the reservoir.

3 Attach another tubing to the OUTPUT of the pump (positioned right above the INPUT inlet), and attach the other end of this tubing to one of the Peltier heat sink inlets.

4 Attach more tubing to another outlet of the heat sink, and place the other end of tubing into the reservoir with liquid.

5   Turn ON BTC-W heat exchanger first, and wait until the unit and the heat sink of the cooling stage are filled with liquid. You will notice this after bubbles stop coming out of the pump OUT tubing. Fill the reservoir with more liquid if empty. You might need to tilt the stage in different directions, until all air is removed.

6   After circulation is established, you can close the tubing loop using luer connectors provided. Note: the liquid inside the loop needs to be replenished periodically (or replaced, if contaminated).

7   Turn the temperature controller ON, but do not start cooling/heating yet. Wait until the temperature of the stage equilibrates while the heat exchanger cools the circulating liquid. Note: if operating small stages, like the objective coolers, it is possible for the temperature of water go close to freezing level. You need to use anti-freeze (ethanol solution, for example) instead of water, in this case.

8   Start cooling.

9   If using large and powerful stages, watch for the temperature of liquid coming out of the Peltier heat sink. If it feels warmer than the room temperature, connect the tubing coming out from the heat sink to the cooling radiator on the front, first, and use some extra tubing to connect the radiator output to the INPUT of BTC-W heat exchanger (use provided luer connectors). The radiator will cool the liquid down to the room temperature, which will help to exchange the heat inside BTC-W faster.

10   The same can be done if the temperature of the cooling stage becomes too low. Connecting output from the heat sink to the radiator will elevate the temperature of the circulating liquid.

IMPORTANT: Do not connect the front radiator unless the temperature of the circulating liquid is ABOVE ROOM TEMPERATURE, or BELOW SET TEMPERATURE of the controller.

Warranty

This product is warranted to be free from defects in material and workmanship for the duration of one year. Normal wear, or damage resulting from abuse, accident, alteration, misuse, service by an unauthorized party or shipping damage, are excluded from this warranty and are not covered. Bioscience Tools will repair or replace the defective product covered by this warranty free of charge if it is returned, postage prepaid, to Bioscience Tools, ph: 1-877-853-9755.

Cooling/Heating Elements
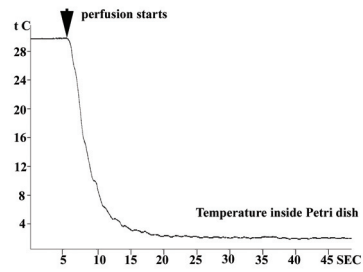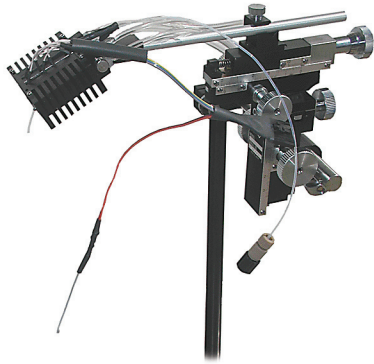
Miniature Perfusion Cooler/Heater Unit TC-RD

Controls temperature of perfusion solutions in the range from 0 to 150°C. A small heating/cooling element is designed to mount on a manipulator next to your sample to provide fast temperature changes by streaming the solution directly onto the sample. Monitoring and control temperature by data acquisition systems through BNC connectors on the back panel. Set temperature either manually or using your data acquisition interface, to generate ramps, for example. Optimized for patch clamp applications: no electrical noise.
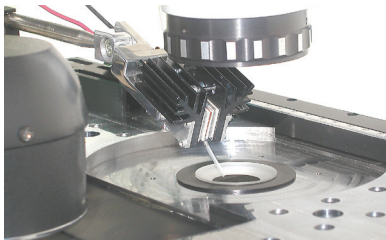
On the right is an example of fast temperature change inside a petri dish. Experimental conditions: TC-RD system was set at 0°C; the petri dish was set at 30°C using another TC-1 controller and TC-PCP heating stage; two flow control CFPS-1U66 units were used - one for solution suction from the dish, through PDI insert inside the dish; and another CFPS-1U66 to cool heat sink of TC-RD unit; the third CFPS-1U unit was used to perfuse the dish; a slow temperature sensor was used to simulate temperature change in the whole dish; the actual temperature change in the point of solution application is much faster. Item#: TC-RD

- **Dimensions:** 1 x 2 x 2in
- **Temperature stability:** better than 0.1°C, built-in sensor
- **Sink:** water cooling for very low temperatures
- **Feedback:** Selectable Stage, or External sensor (Bath)

Cooling & Heating Microscope Stage for coverslips BTC-S-35

- **Dimensions:** 120x120x23mm
- **Optical aperture:** 22mm
- **Temperature stability:** 0.1°C, built-in sensor
- **Sink:** liquid cooling for very low temperatures, optional water cooler unit BTC-W

- **Solution Pre-heater/cooler:** Replaceable/Removable Teflon tubing, easy to wash
- **Microscope adapter:** Fits to 74mm cutout of standard microscope adapters

Can be used with: Standard 35mm disposable Petri dishes; CSC chambers for replaceable coverslip chambers. Requires BTC-100 controller. Requires a microscope adapter (specify microscope model). Item#: BTC-S

Cooling & Heating microscope stage for slides, BTC-SL

- **Dimensions:** 120x120x23mm
- **Temperature stability:** 0.1°C, built-in sensor
- **Sink:** liquid cooling for very low temperatures, optional water cooler unit BTC-W

- **Optical aperture: 40x**22mm
- **Microscope adapter:** Fits to 74mm cutout of standard microscope adapters

Can be used with: Standard 1 in. (25mm) wide disposable slides and chambered coverglasses. Built-in temperature sensor for stable operation. Can be used with perfusion systems. Top surface can be used to attach miniature holders for custom accessories: from solution delivery lines to electrodes and sensors. Click on image to enlarge. Requires a microscope adapter (specify microscope model when ordering), and BTC-100 temperature controller.   Item#: BTC-SL

Cooling & Heating microscope stage for 50mm dishes, BTC-S50

- **Dimensions:** 145x145x23mm
- **Temperature stability:** better than 0.1°C, built-in sensor
- **Sink:** water cooling for very low temperatures, optional water cooler unit BTC-W

- **Optical aperture:** 33mm
- **Microscope adapter:** Fits to 74mm cutout of standard microscope adapters

Can be used with wider up to 59mm disposable dishes, including Willco 50mm glass bottom dishes. Comes with reducing adapter for 50mm dishes. Built in lines to cool heat sink for deep cooling. 30mm clearance. Click on image to enlarge. Consider a different cooling stage for rectangular slides. Requires a microscope adapter (specify microscope model when ordering), and a temperature controller.   Item#: BTC-S50

Cooling & Heating microscope incubator for petri dishes, BTC-S

- **Dimensions:** 120x120x23mm
- **Optical window:** 22mm aperture
- **Temperature stability:** 0.1°C, built-in sensor

- **Sink: optional** water cooling for very low temperatures, requires BTC-W unit
- **Microscope adapter:** Fits to 74mm cutout of standard micro-

Can be used with: Standard 35mm disposable Petri dishes (petri dish adapters TC-PA might be required), or glass bottom dishes (TC-PA-W or TC-PA-F adapter is required); and replaceable coverslip chambers CSC. Built-in temperature sensor for stable operation. Can be used with high optical quality glass cover with ports for gas input, to control CO2 or hypoxia. Built-in lines to cool sink during deep cooling. Consider a different cooling stage for rectangular slides below. Requires a temperature controller TC2-80-150-C. Requires a microscope adapter (specify microscope model). Item#: BTC-S

Cover-incubator for Cooling & Heating microscope stage for petri dishes and coverslip chambers, BTC-SI

- **Dimensions:** 63mm diameter
- **Optical window:** 44mm double glass window
- **Thickness:** 3mm

- **Ports: x2 barbed gas ports**

If placed on top of BTC-100 stage, will form a closed system to control gas composition inside. Incorporates two high optical quality glass covers and ports for gas input, to control CO2 or hypoxia.   Item#: BTC-SI

Cover-incubator for Cooling & Heating microscope stages for slides, BTC-SLI

- **Dimensions:** 38x88mm
- **Optical window:** 22x57mm double glass window

- **Thickness:** 3mm
- **Ports: x2 barbed gas ports**

Can be used with BTC-SL stages for standard 1 in. (25mm) wide disposable slides and chambered coverglasses. Incorporates two high optical quality glass covers and ports for gas input, to control CO2 or hypoxia.. Item#: BTC-SLI

Slides and Chambered Coverglasses Cooling & Heating stage, BTC-SLM

Can be used with: custom devices, disposable slides and coverglasses. Can cool the sample down to -5°C (or heat up to 150°C). Fits 160x110mm cutout of motorized stages, and type K Zeiss stages. The cooling area is an inside cutout 26x79mm (to fit standard slides), with 20x40mm aperture in the middle. The inside cutout is 17mm deep, with 1mm lip to hold the sample. Requires sink cooling and a temperature controller. **Item#: BTC-SLM**

- **Dimensions: 110x160x18mm, 26x79mm cooling/heating area**
- **Optical aperture:** 20x46mm
- **Objective working distance, minimum:** 0mm (for inverted microscopes)
- **Temperature stability:** 0.1°C, built-in sensor
- **Sink: optional** water cooling for very low temperatures, requires BTC-W unit
- **Microscope adapter:** Fits to 74mm cutout of standard microscope adapters IMA-74
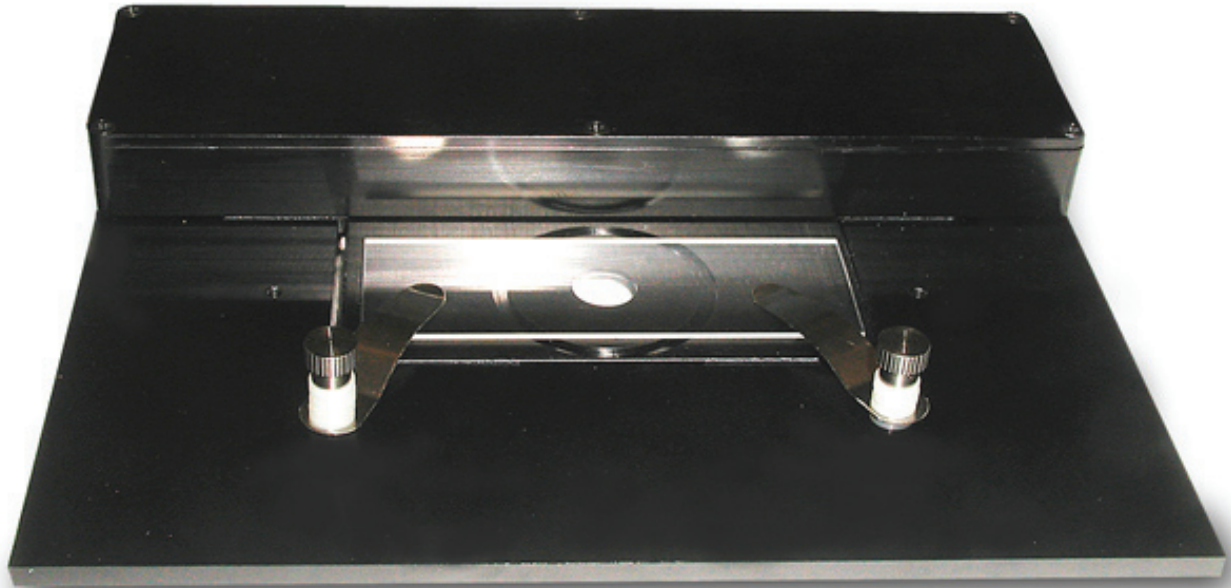

Low-Profile Cooling & Heating plate, BTC-L

Can be used with: standard 35mm disposable Petri dishes, glass bottom dishes, and disposable slides and coverglasses. Can cool the sample down to -2°C (or heat up to 150°C). The cooling area is 40x80mm with 10mm aperture in the middle. The low profile of the stage allows easy access to your samples. Provided clamps will fix the sample in place. Can be placed on upright microscopes. Can be mounted on a microscope stage (specify dimensions of microscope stage cutout, 108mm diameter for Nikon for example). Requires sink cooling and a temperature controller. **Item#: BTC-L**

- **Dimensions:** 120x160mm, 80x40mm cooling/heating area
- **Optical aperture:** 10mm diameter
- **Objective working distance, minimum:** 0mm (for upright microscopes)/ 3mm (for inverted microscopes)
- **Temperature stability:** 0.1°C, built-in sensor
- Heat **Sink: optional** water cooling for low temperatures, requires BTC-W unit
- **Microscope adapter:** Fits to 74mm cutout of standard microscope adapters IMA-74

Low Profile Cooling & Heating stage for Slides and Chambered Coverglasses, BTC-SL-128x86

This low profile heating/cooling stage designed to fit inside 128x86mm holders for standard multi-well plates. Can be used with: custom devices, disposable slides and coverglasses. Positioned on both sides threaded #4-40 holes can be used to mount optional IMA-MH tubing and probes holders. Can cool the sample down to 0°C (in combination with BTC-W heat exchange unit) or heat up to 150°C. The cooling area is an inside cutout 29x79x1mm (to fit standard slides), with 20x40mm aperture in the middle. Requires a temperature controller. **Item#: BTC-SL-128x86**

- **Dimensions: 128x86mm, 29x79mm cooling/heating area**
- **Optical aperture:** 20x46mm
- **Objective working distance, minimum:** 0mm (for inverted and upright microscopes)
- **Temperature stability:** 0.1°C, built-in sensor
- **Sink: optional** water cooling for very low temperatures, requires BTC-W unit
- **Microscope adapter:** Fits to 128x86mm holders for standard multi-well plates

Cooling & Heating microscope stage for 50mm dishes, BTC-S50

Can be used with wider up to 59mm disposable dishes, including Willco 50mm glass bottom dishes. Comes with reducing adapter for 50mm dishes. Built in lines to cool heat sink for deep cooling. 30mm clearance. Click on image to enlarge. Consider a different cooling stage for rectangular slides. Requires a microscope adapter (specify microscope model when ordering), and a temperature controller. **Item#: BTC-S50**

- **Dimensions:** 145x145x23mm
- **Temperature stability:** better than 0.1°C, built-in sensor
- **Sink:** water cooling for very low temperatures, optional water cooler unit BTC-W
- **Optical aperture:** 33mm
- **Microscope adapter:** Fits to 74mm cutout of standard microscope adapters

Cooling & Heating Microscope Objective, BTC-O

Can be used with any microscope objective (or any cylindrical object). Can cool the objective down to -6°C (or heat up to 150°C). The cooling area should be specified when ordering, for example 22.5mm diameter and 10mm wide for x40 Zeiss objective (technical drawings are required). Built-in clamp will fix the objective in place. Can be placed on upright and inverted microscopes. Requires sink cooling and a temperature controller Item#: **BTC-O**

- **Dimensions:** custom cooling/heating area (22.5x10mm for example)
- **Optical aperture:** custom
- **Objective working distance, minimum:** 0mm (for upright microscopes)/ 0mm (for inverted microscopes)
- **Stability: 0.1°C, built-in sensor**
- **Heat Sink: optional water cooling for low temperatures**

Cooling & Heating stage for 90mm glass dishes, BTC-90

- **Dimensions:** 120x120x35mm, 95mm diameter cutout, 18mm deep
- **Temperature stability:** better than 0.1°C, built-in sensor

- **Sink:** water cooling for very low temperatures, optional water cooler unit BTC-W
- **Fits:** 90mm I.D. glass dishes

This heating/cooling stage was designed to fit 90mm dissecting glass dishes. Provides black background for better visibility. Might require water heat sink circulator BTC-W for cooling to lower temperatures. The cooling area is an inside 95mm cutout. Requires a temperature controller.   **Item#: BTC-S50**

Low Profile Cooling & Heating stage for upright scanning microscopes, BTC-SCAN
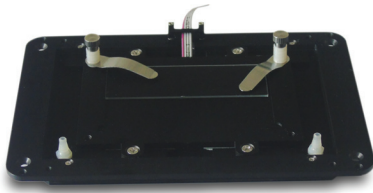
- **Dimensions:** 160x110x11mm, can be elevated with provided 3mm thick spacers
- **Temperature stability:** better than 0.1°C, built-in sensor
- **Sink:** water cooling for very low tempera-

tures, optional water cooler unit BTC-W
- **Optical aperture:** none; 77x55x1mm cutout for slides
- **Working distance, minimum:** 0mm (for upright microscopes)

This heating/cooling stage fits inside 160x110mm cutouts of motorized stages. The low profile allows positioning under scanning heads and objectives of upright microscopes. 1mm deep cutout will fit x2 standard 1x3in slides. Can be used with: custom devices, disposable slides and coverglasses. Positioned on both sides threaded #4-40 holes (x4) can be used to mount stainless steel clamps. Might require BTC-W heat exchange unit for deep cooling. Requires a temperature controller.   **Item#: BTC-S50**