

Warner Instruments
Dual In-Line Heater/Cooler
Model SC-20



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The **SC-20** Dual In-Line Solution Heater/Cooler from Warner Instruments is a versatile and simple to use thermal control device. In-line solution heating has proven to be one of the most effective methods of maintaining the temperature of perfusion solutions. The **SC-20** uses reliable and precise Peltier technology to regulate one or two solutions above or below ambient levels.

Solution temperatures can be maintained at 0 °C at flow rates of 2 ml/min, at 5 °C at 5 ml/min, or as high as 50 °C at 5ml/min. An integral water jacket using running water from a tap or large reservoir is used to remove excess heat from the Peltier electronics within the **SC-20**. Flow rates within the water jacket as low as 4 liters per hour are sufficient to maintain thermal efficiency of the device.

The **SC-20** can be used to control one or two discrete perfusate solutions, or a solution/gas combination. When coupled with a **PHC Series** imaging chamber heater/cooler jacket, the **SC-20** provides an effective means for temperature control in a **Series 20** imaging and recording chamber, even in the absence of solution flow.

THIS EQUIPMENT IS NOT DESIGNED NOR INTENDED
FOR USE ON HUMAN SUBJECTS

GENERAL

In-line solution heating is the simplest and most effective method of warming or cooling perfusion solutions prior to use. The minimal dead space manifold at the heater/cooler output allows it to be used in applications where from 1 to 2 perfusion lines are connected to a chamber or other device.

The **SC-20** Dual In-Line Solution Heater/Cooler is designed for use with the Warner **CL-100** Bipolar Temperature Controller. The compact design of the **SC-20** makes it possible to install the device immediately adjacent to the input port of a perfusion chamber insuring minimal heat loss. The **SC-20** will easily accommodate flow rates up to 5 ml/min.

Each heater/cooler is supplied with a **TA-29** thermistor cable assembly (which allows for monitoring of the actual bath temperature), and 3 meters each of PE-160 and ¼ in OD Tygon® tubing.

SETUP

A general configuration for the **SC-20** is shown below. Note that the illustration here makes use of a **PHC Series** imaging chamber heater/cooler jacket to provide additional thermal control for the imaging and recording chamber.



The **SC-20** has two input ports, and two corresponding output ports, for fluid flow to the sample chamber. These lines are attached to the INPUT and OUTPUT PERFUSION PORTS and are identified above.

The two WATER JACKET INPUT/OUTPUT PORTS are the larger diameter ports on the input side of the **SC-20** and are also identified. The WATER JACKET PORTS are provided for connecting to the INTEGRAL WATER JACKET within the **SC-20**.

NOTE: The use of the INTEGRAL **SC-20** WATER JACKET is mandatory regardless if the unit is being used for heating or cooling..

If you look closely at the routing of the two perfusion flow lines exiting the **SC-20** (the two lines enter into the **Series 20** chamber and platform on the right hand side of the picture), you will see that the upper perfusion line enters into the chamber's input port. This line carries your experimental perfusion solution and would come from your solution reservoir.

The lower perfusion line in the picture enters into the **PHC Series** imaging chamber heater/cooler jacket. This line carries heated/chilled water, comes from a circulating reservoir, and is used to aid to maintain the temperature of the chamber/platform.

Tubing Connections

Solution flow lines

PE-160 tubing (or any other tubing with a 1/16" (1.5 mm) ID) is used to connect to both of the available input and output solution ports on the **SC-20**. Connections are made by press fitting the tubing onto the 18 gauge stainless steel hypodermic tubes. Cap plugs are supplied to block unused inputs.

NOTE: Use a short length of PE tubing between the heater output and perfusion chamber.

Water Jacket flow line

Water is circulated through the **SC-20** WATER JACKET via the two large ports located on the input side of the heater/cooler. Run Tygon® flow lines in a loop from your water source (a sink or water bath) to both ports the **SC-20**. Connections are made to the **SC-20** by press fitting the tubing onto the large-bore stainless steel tubes.

Use of the INTEGRAL WATER JACKET to remove excess heat from the internal Peltier device is critical to the function of the SC-20 and its use is mandatory.

PHC Series Imaging Chamber Heater/Cooler Jacket

The use of a separate water jacket attached to a **Series 20** chamber to aid in maintaining the temperature of the chamber represents an improvement in function for systems using an upright microscope. **PHC Series** water jacket water is passed through the **SC-20** via one of the *solution flow paths* and is channeled to the **PHC Series** water jacket lying under the chamber. Since both the perfusion solution and **PHC Series** water jacket lines are routed through the same heater/cooler, their temperature will be maintained to the same value.

Component Placement

1. Plug the **SC-20** into the rear of the **CL-100** Bipolar Temperature Controller using the attached cable.
2. Attach solution flow lines from the solution reservoir(s) to the input ports of the **SC-20**.
3. Attach the **SC-20** INTEGRAL WATER JACKET flow lines to the **SC-20** WATER JACKET PORTS.
4. Using a support stand, place the **SC-20** in a convenient location, usually adjacent to the sample chamber.
5. Run solution flow lines from the output ports of the **SC-20** to the input ports of the perfusion chamber.
6. The supplied **TA-29** thermistor assembly is used to monitor the temperature at a point of interest. Plug the **TA-29** into the MONITOR TEMP IN BNC on the **CL-100** and place the thermistor at a point of interest.

OPERATION

USING WITH A CHAMBER

1. Turn power to the **CL-100** on.
2. Set the **CL-100** MODE SELECTOR SWITCH into *auto*, the INTERNAL/EXTERNAL SELECTOR SWITCH to *internal* (see the **CL-100** user's manual), and the LOOP SPEED SELECTOR SWITCH to *medium*.
3. Start the solution flow to the **SC-20** INTEGRAL WATER JACKET.
4. Start solution flow through the **SC-20** into the chamber and to the **PHC Series** Imaging Chamber Heater/Cooler Jacket, if used.
5. Place the **TA-29** thermistor into the bath to measure the temperature at the point of interest.
6. Adjust the SET TEMP to the desired operating temperature. Allow the system to thermally stabilize. Monitor the temperature at the point of interest using the **TA-29** thermistor.
7. Make any temperature adjustments on the **CL-100** to compensate for heat loss from the **SC-20** to the bath.
8. Additional adjustment of the heater set point may be required if any of the following change substantially during an experiment:
 - Solution flow rate
 - Temperature of solution entering the heater
 - Ambient (room) temperature
 - Air currents around chamber

Efforts to minimize these factors will be rewarded.

OUTGASSING

A common problem with rapid heating of solutions is outgassing. The bubbles formed can often cause blockages or disruptions to the flow in the chamber bath. An effective solution to this problem is to pre-warm the perfusate at the reservoir. Warner Instruments carries a full line of Solution Reservoir Heaters designed to work in concert with our In-Line Solution Heaters.

APPENDIX

Maintenance

Salt solutions can be corrosive to metal components and can shorten the life of the heater/cooler if left in the unit during storage. The **SC-20** should be flushed with distilled water and blown dry after each use to eliminate the effects of salt and moisture.

NOTE: Proper maintenance is critical to the life and functionality of the device!

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
Perfusion lines:	Type 316 Stainless Steel 0.032" ID x 0.062" OD
Internal Dead Volume:	330 µl
Water Jacket Ports:	Type 316 Stainless Steel 0.12" ID x 0.147" OD
Controller:	Model CL-100 Bipolar Controller
Physical Dimensions:	21 x 165 mm (dia x length)
Cable Length:	1.9 m
Connector Type:	15 pin Male "D"
Weight:	109 g
Warranty:	1 year

Warranty and service

Warranty

The model **SC-20** is covered by our Warranty to be free from defects in materials and workmanship for a period of one year from the date of shipment. If a failure occurs within this period, we will either repair or replace the faulty component(s). This warranty does not cover instrument failure or damage caused by physical abuse, lack of maintenance, or electrical stress (inputs exceeding specified limits).

In the event that instrument repairs are necessary, shipping charges to the factory are the customer's responsibility. Return charges will be paid by Warner Instruments.

Normal business hours are 8:30 AM to 5:30 PM (EST), Monday through Thursday and 8:30 AM to 5:00 PM on Friday. Our offices are located at 1125 Dixwell Avenue, Hamden, CT 06514, and we can be reached by phone at (800) 599-4203 or (203) 776-0664. Our fax number is (203) 776-1278.

In addition, we can be reached by e-mail at support@warneronline.com or through the web at <http://www.warneronline.com>.

Service notes

Please refer all questions regarding service to our Engineering Department.

- A) Should service be required, please contact the factory. The problem may often be corrected by our shipping a replacement part. Factory service, if required will be expedited to minimize the customer inconvenience.
- B) Instruments are inspected immediately upon receipt and the customer is notified if the repair is not covered by the warranty. Repairs can often be completed in 1-2 days from our receipt of the instrument.
- C) If factory service is required, please observe the following instructions:
 - 1) Package the instrument with at least 3 inches of cushioning on all sides. Use the original shipping carton if it is available.
 - 2) Insure the shipment for its full value.
 - 3) Include with the shipment an explanation of the problem experienced.

IMPORTANT: CUSTOMERS OUTSIDE OF THE U.S.

Please be sure to contact us before return shipping any goods. We will provide instructions so that the shipment will not be delayed or subject to unnecessary expense in clearing U.S. Customs.