



Description

The **HPRE2** Pre-heater is a 3-loop pre-heater (see figure) intended to heat solutions at flow rates up to 3ml/min. By heating solution over a longer "length" fluctuations in output temperature are smoothed due to lateral heat transfer between adjacent loops. The reduced fluctuations also allow stable control when the set point temperature is suddenly raised or lowered. The **HPRE2** Pre-heater has a thermistor embedded at the outflow end to sense the temperature of the pre-heater assembly. Typically the **HPRE2** is used with the Aux channel of the **TC2BIP** Bipolar Temperature Controller.

Performance of HPRE2

The performance of the **HPRE2** alone is illustrated in the figure. The power and voltage necessary to heat solution flowing through the pre-heater by 15°C is plotted for flow rates from 0.3ml/min to 4.5ml/min. To estimate the power or voltage necessary for larger or smaller increases in temperature just scale the power level appropriately. eg. for a 10°C increase multiply the power by $10/15 \approx 0.67$. or voltage by $\sqrt{10/15} \approx 0.82$. Typically if flow is in the **normal** direction the outflow temperature is **1-2C below** the temperature indicated by the embedded thermistor. For flow in the **reverse** direction the outflow temperature is typically **2-4C above** the temperature indicated by the embedded thermistor. Whenever possible you should monitor the temperature independently in the tissue chamber.

If you are **only** using higher flow rates (>2ml/min) you can get better performance (ie. higher outflow temps) by increasing G_{Aux} to 45% and reversing the flow direction so that the inflow is at the contact block end. Keep in mind that if you flow at say 0.5ml/min the outflow temperature could be 4C above the indicated temperature on the **TC2BIP** or **mTCII/mTC3**.

Precautions

Take care of the **HPRE2**, it cannot be disassembled for repair. Observe the following:-

1. **HPRE2** is made using fine glass capillaries. Don't bend or stress the capillaries. When you attach the 4pin connector make sure you **hold the pre-heater by the white plastic connector block** and **NOT** the capillaries. Use **soft flexible silicon** tubing (1/32" ID 3/32"OD Cole Parmer #06411-60; www.coleparmer.com ph 800-323-4340) for connections to the **HPRE2**.
2. Rinse the **HPRE2** after each use to prevent things growing inside and drain.
3. Do not subject the **HPRE2** to high pressures. If using a syringe only apply enough pressure to pass solution through the tubing.
4. Keep fluid off the outside of the **HPRE2**. The connectors will corrode if contacted with saline.
5. Do not overheat the **HPRE2**. Limit the input power to 0.6W ($V \approx 2.5$ Volts) with no flow and 1.5W ($V \approx 4$ Volts) at flow rates <2ml/min. If you use higher powers (voltages) you can overheat and damage the **HPRE2**.
6. You **MUST** use the embedded thermistor for feedback.

HPRE2 Specifications

DIMENSIONS: 4.5 x 1.4cm x 0.7cm (LxWxD)

DEAD VOLUME: approx. 50µl.

HEATER RESISTANCE: nominally 11Ω.

CONSTRUCTION: 3 loop pre-heater surrounded by resistance wire. Thermistor embedded in thermally conductive epoxy surrounding capillaries. 2-56 threaded mounting hole.

TEMPERATURE SENSOR: miniature 10kΩ (@ 25°C; Res. Ratio 4.4) NTC thermistor.

