

***qpod 2e* Temperature Specifications**

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Temperature Range: -15 °C to + 105 °C

The integrated temperature controller can set temperatures between -40 °C and 105 °C. Under normal conditions, circulating room temperature (~22 °C) water through the Peltier heat exchanger, the *qpod 2e* will achieve temperatures in the range of -15 °C to 105 °C. Somewhat lower temperatures (-25 °C) can be obtained by the use of ice water. Additional insulation and even colder coolant (circulating chiller) will be needed to achieve the lowest temperatures.

Note that a dry purge gas must be used for work below the dew point temperature to prevent condensation on the cuvette.

Temperature Precision: better than ± 0.01 °C

Temperature precision is a measure of how well the temperature controller keeps the cuvette holder at constant temperature. For the *qpod 2e* the average deviation for 50 temperatures reported by the controller is reported in Table 1 for set temperatures between -20 °C and +105 °C.

The deviations observed are semi-random (not small oscillations). We have no adequate means of measuring the actual sample temperature in the cuvette to this precision; however, the response time for the sample temperature is much slower than that of the holder temperature and, if the cuvette is adequately covered and sufficient time is given to equilibration, one would expect the sample temperature precision to be even better than that of the holder.

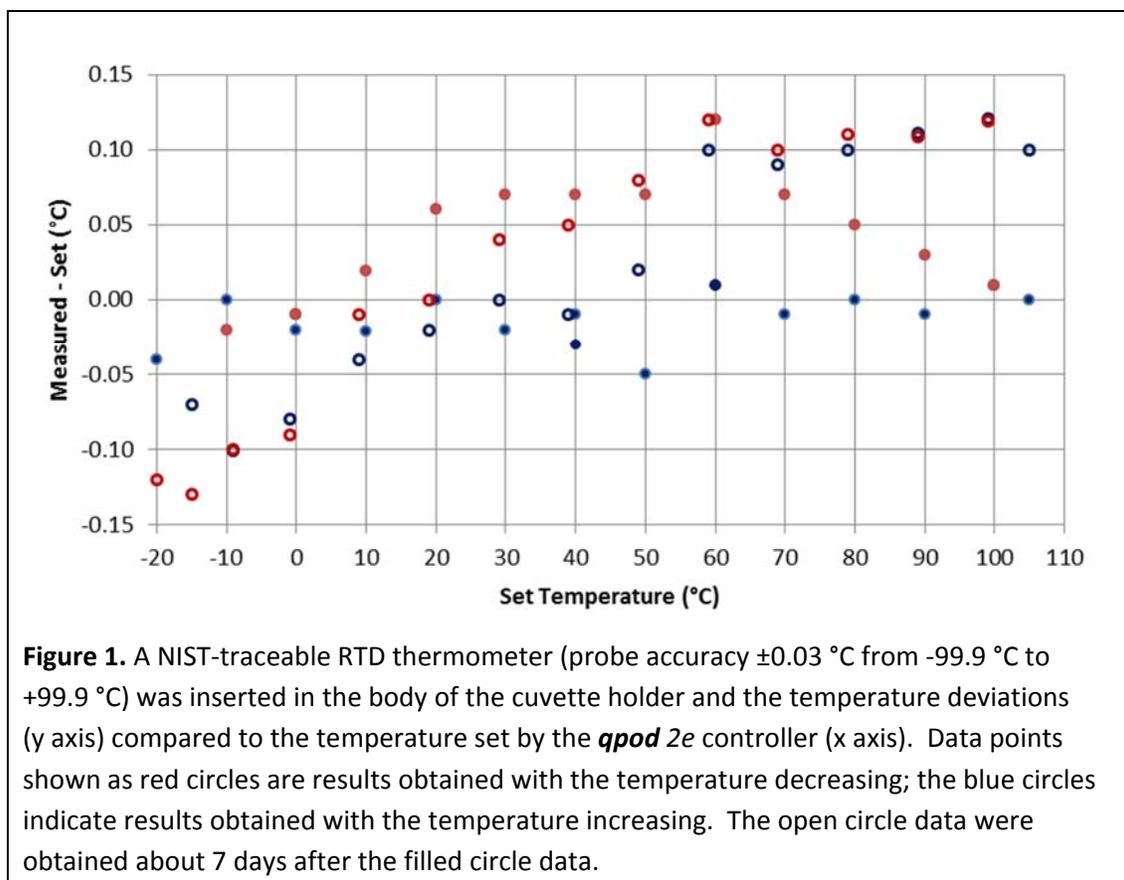
Table 1. Average deviation (for 50 points) of the reported temperature from the set temperature for several set temperatures.

Set temperature	-20	0	20	40	60	80	100	105
Average deviation	0.001	0.006	0.004	0.002	0.003	0.005	0.003	0.003

Temperature Accuracy: within ± 0.15 °C

Temperature Accuracy is a measure of how well the temperature of the sample holder compares to the temperature set by the TC 1 Temperature Controller.

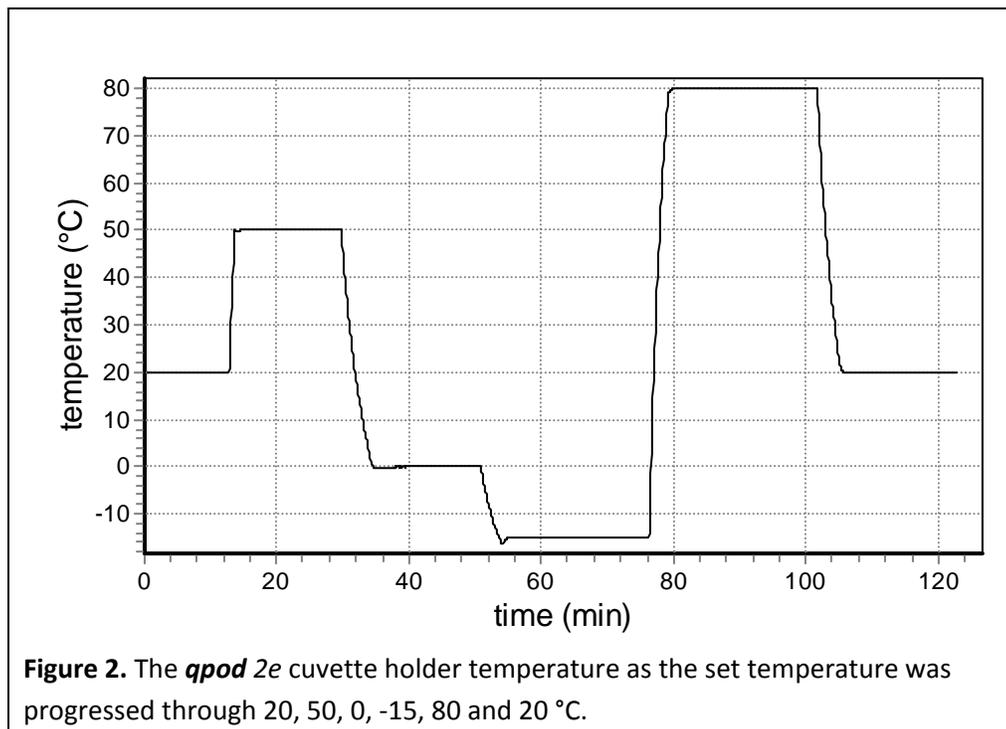
Figure 1 shows deviations for 55 measured temperatures for set temperatures between -20 °C and +105 °C. All of the points are within ± 0.15 °C of the set temperatures.



Temperature Reproducibility: better than ± 0.07 °C

Temperature reproducibility is a measure of the ability of the temperature to return to an original value for any given set temperature (See Figure 1.). It accounts for differences depending on the direction of temperature change and variations from day to day. In Figure 1, the set temperature with the worst reproducibility is 50 °C with a total range of -0.05 to 0.08 °C. The temperature reproducibility reported is half of this range.

Example of Temperature Performance



Typical Temperature Equilibration Data

A *qpod 2e* was equilibrated at one temperature and then the set temperature was changed to a higher or lower value (Table 2). For increasing temperatures, circulating water at a little above room temperature was used; for decreasing temperature, ice water was used.

Table 2. Time required for cuvette holder temperature changes. Three time are shown: The time required to first get within 1 °C of the set temperature; The time after which the temperature remains within ± 1 °C from the set temperature; The time the controller begins to indicate by an LED that the holder temperature has remained stable (within ± 0.025 °C of the set temperature) for 1 minute.				
Temperature change (°C)	0 to 80	80 to 105	105 to 20	20 to -20
Circulating water T (°C)	29	29	Iced	iced
Time to get within 1 °C (min)	2.4	1.7	4.5	7.1
Time to lock on temperature (min)	2.4	1.7	4.5	9.9
Time to lock on indicator light (min)	6.3	3.8	11.8	12.3

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