TEMPERATURE CONTROLLED RESERVOIR NEST

As an accessory for our Quadra product line, Tomtec offers a temperature controlled reservoir nest. This reservoir nest can hold reservoirs or plates with the SBS microplate footprint. This nest can also service the cassette stackers, which provides a mechanism for putting microplates or reservoirs on and off of the nest, under program control.

The temperature controlled reservoir nest is connected by an umbilical cord to a stationary control unit along side the Quadra. The control unit is auto-voltage sensing (115/230 volts AC) and dual frequency (50/60Hz). It supplies 24-volt DC power to the nest via a temperature controller that provides Proportional, Integral and Differential (PID) control, from a temperature sensor in the nest.

There are two types of applications for this nest. The first, and simplest, application is to hold a reagent reservoir at a temperature, either above or below ambient. For this application, Tomtec can provide a Teflon coated aluminum reservoir. The maximum working volume is 200mL. To hold a specific temperature in the reservoir will require a modified setting on the PID controller. This is due to the heat transfer coefficient between the nest and the reservoir. The equilibrium temperature must be arrived at empirically.

Another solution for holding reagents at a non-ambient temperature is the use of Tomtec's recirculating reservoir, either the standard unit (Cat. #: 196-135A) or the Live Bottom system (Cat. #: 520-80). In this case the source container, feeding the recirculating reservoir, is held at the desired temperature. This could be either hot or cold.

The second application for the nest is to fill a microplate with reagents, then elevate the temperature of the microplate. This is envisioned as a repetitive step for successive microplates. It is typical of some Genomic assays. Since the microplate must stay on the nest to be heated, it is implied that it is only necessary to reach some pre-set temperature. If an elevated temperature is to be maintained for longer than 2–5 minutes, this should probably be accomplished off-line, if throughput is a factor.

Assuming, in the former application, it is desirable to bring the microplate to the desired temperature as fast as possible. This is accomplished by using a much higher temperature on the nest to create as wide a temperature differential as feasible. This now becomes a dynamic application requiring the microplate to be removed before an excessive temperature is obtained. The Quadra programming can easily be set for a repetitive timing sequence.

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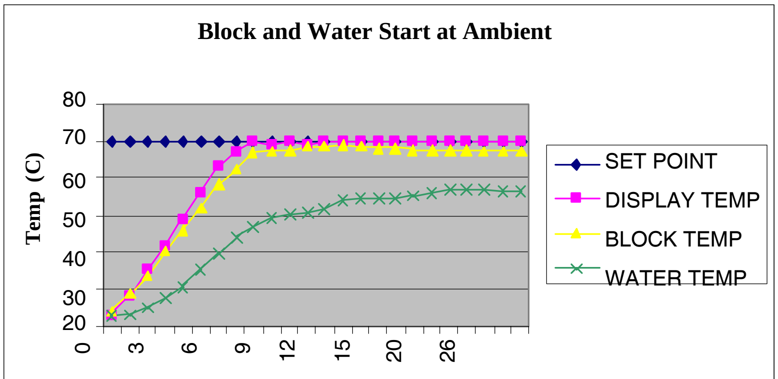
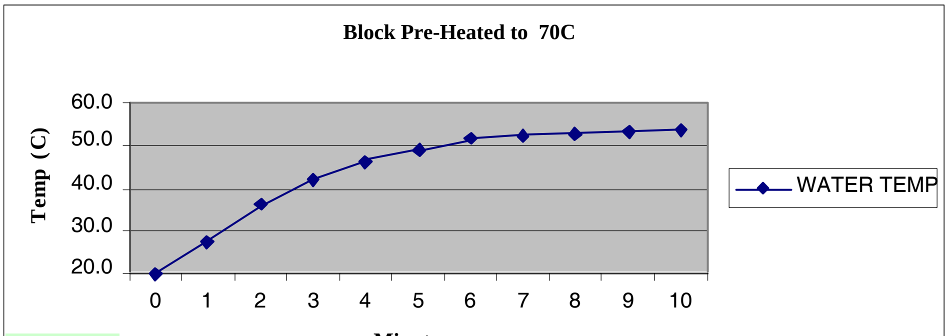
Depending on the protocol used, it may be possible to process the microplates in pairs. This would require the use of two nests. Plate # 1 is filled and placed on Nest # 1. The Quadra then fills Plate # 2 on Nest # 2, which absorbs the idle incubation time for # 1. Plate # 1 is then replaced with Plate # 3. The best temperature setting on the nest would be derived empirically based on the cycle time plate to plate. There is a caveat. Should an error occur and the cycle stops, the timing of the plates on the heated nest is affected, and its temperature will continue to rise.

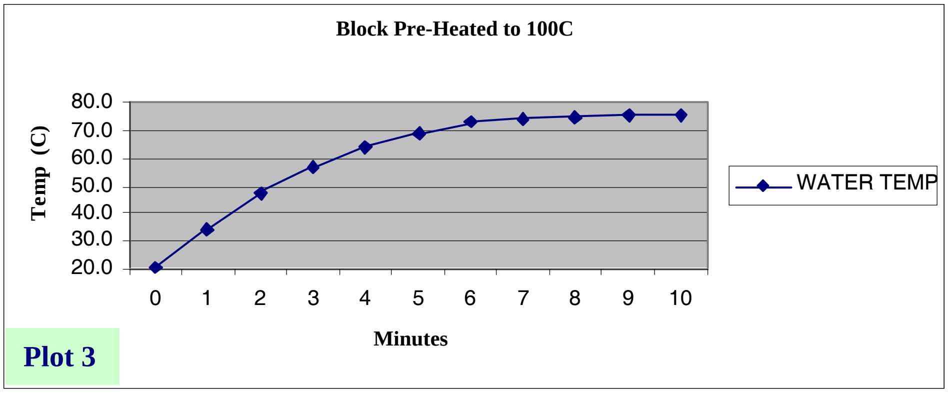
Following is a plot of the various temperatures over time. The temperature control reservoir nest is designed for the Greiner "U" bottom plates with "*hanging*" wells (Greiner Cat. #: 650101). The set point is the temperature of the nest at the sensor location. ***Note: the block temperature is different, depending on where it is measure and the heat transfer coefficient***. This is more pronounced by the difference between the set point and the water temperature in the well. The first plot shows everything starting at ambient. The second plot shows water temperature in the microplate when placed on a 70°C nest at time zero. The third plot shows a higher driving temperature of 100°C.

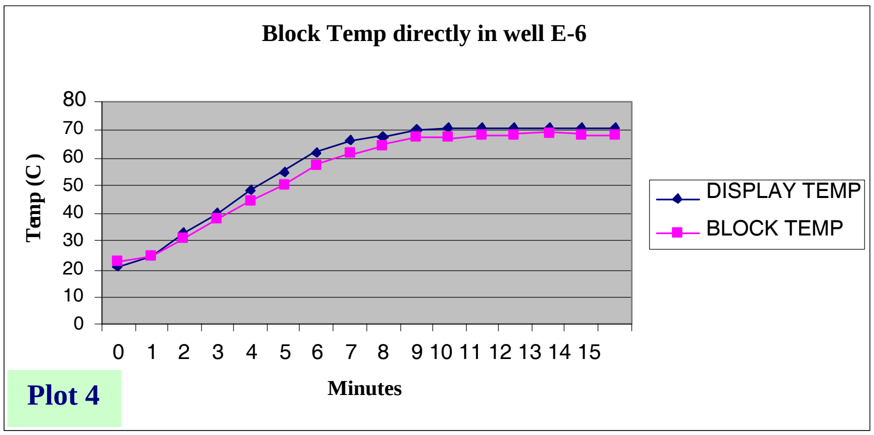


Plot 1



Plot 2


Block Pre-Heated to 100C
Temp (C)
80.0
70.0
60.0
50.0
40.0
30.0
20.0
0 1 2 3 4 5 6 7 8 9 10
Minutes
WATER TEMP
Plot 3


Block Temp directly in well E-6
Temp (C)
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Minutes
DISPLAY TEMP
BLOCK TEMP
Plot 4