

Delta T Controller Instructions Series 5

Delta T5 Controller package contains:

- A. Power Supply with 4 multiple voltage plugs
- B. Controller
- C. TTL Cable
- D. Calibration plug
- E. 3 Pin Mini DIN Connector
- F. 1/8" phone jack
- G. Screw Driver

Setup:

1. Retract the retaining clip that holds the protective cap over the AC plug socket and replace with the appropriate plug to mate with your AC outlet.
2. Plug the power supply cable into the back of the controller. Socket Labeled Power 12VDC.
3. Plug the power supply into your AC source.
4. Plug the stage adapter cord 6 pin MiniDIN into the socket on the front of the controller. (*Figure 6*)
5. Plug the reference thermistor into the two-pin socket on the pigtail hanging out of the 6 pin mini Din plug.
6. Apply a smear of immersion oil to the gold temperature sensor (*Figure 3*) located at 12:00 o'clock in the opening of the stage adapter. Place a dish into the stage adapter by aligning the tabs on the dish with the opening in the stage adapter, lowering the dish into the receptacle, then rotating the dish 15 degrees clockwise until it stops. Then, turn the two knurled screws located adjacent to the tabs until they are snug. This will secure the dish in the stage adapter so that it will not move during translation.



Figure 1



Figure 2

Description of Interface (See Figure 4):

Power Button turns the unit on and off.

Select Key will cycle through the display modes.

(While the following LEDs are illuminated the display indicates):

Red Top Left = Setpoint the temperature that the controller is maintaining at the dish thermistor

Yellow = Dish temperature of the Dish thermistor (gold sensor touching the bottom of the dish)

Green = Reference temperature of the reference thermistor

Orange = Heated Lid voltage that is continuously sent to the Heated Lid.

Blue = Imaging voltage sent to the dish when in imaging mode

Red Lower Left = Heat Shock voltage that is sent to the dish when the heat shock mode is activated.

Red Alarm (top right) an error has occurred. When flashing, an alarm will sound and power to the dish is reduced.

Reset Button (top right) silences the alarm, restores the output to the value set in the imaging mode.

Up Arrow Key – Increments setting values

Down Arrow Key – decrements setting values

Imaging Button - momentary changes the output from dynamic to imaging mode

Heat Shock + Enable buttons – must be pressed together to activate heat shock mode



Figure 3

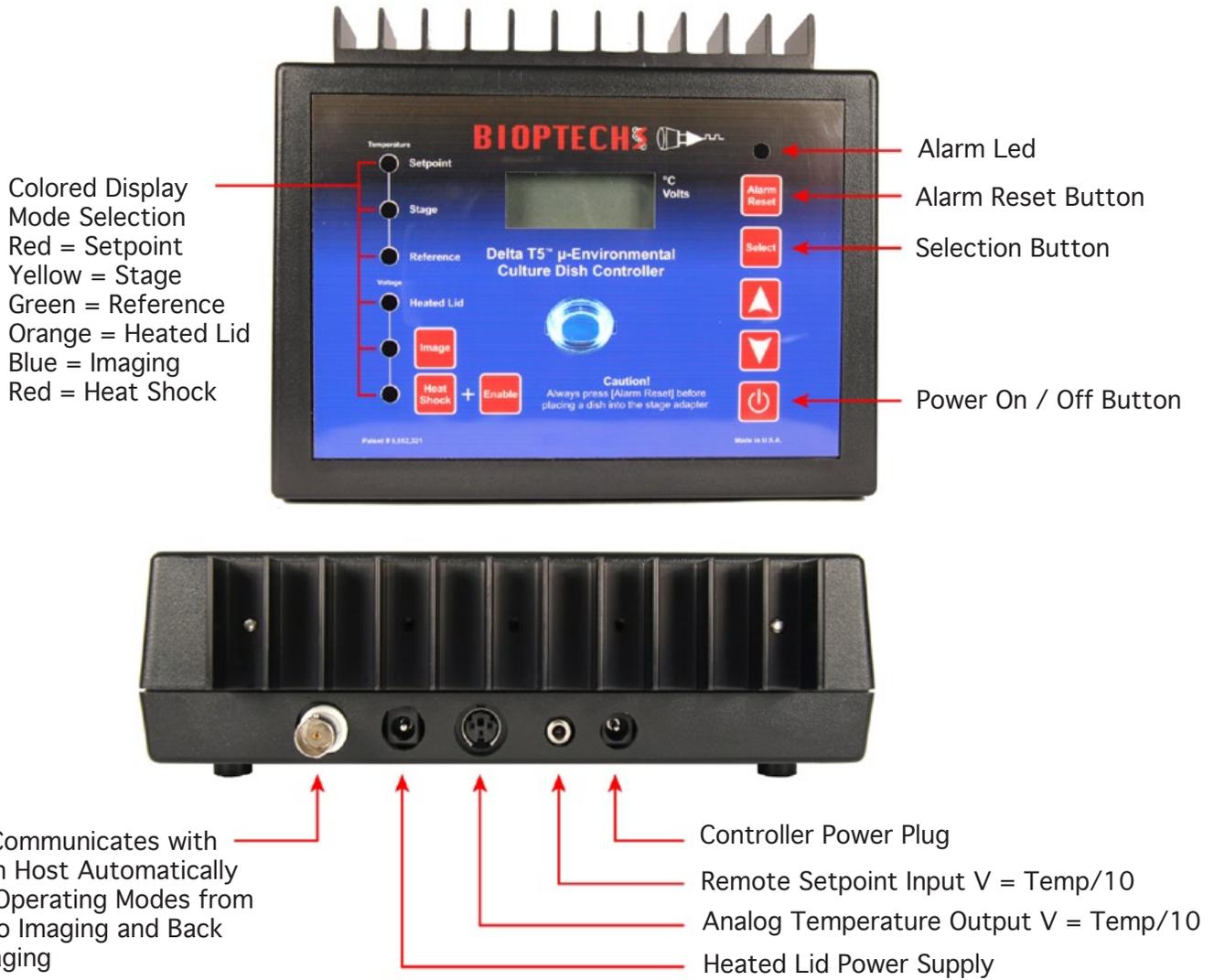


Figure 4

Operation:

The Delta T is unlike any other specimen-warming device. It transfers heat directly to the cells by means of an electrically conductive optically transparent coating on the underside of the glass surface on which the cells rest. Please familiarize yourself with its operation and characteristics before conducting an experiment. The temperature transfer capability of the Delta T is extremely fast. Therefore, any time a new dish is placed into the stage adapter you must first press the "Reset" button to tell the controller that it is regulating a new dish. If the controller has been left on without a dish in the stage adapter or the stage adapter has not been plugged in while the controller is on, the controller will go out of range attempting to regulate something that is not there! Pressing the "Reset" button brings the controller back to its proper starting point.

Adjusting the Setpoint

Make sure there is a dish in the stage adapter with 1.5 to 2.0 ml of media or water. Also make sure the stage adapter six pin mini-din plug is plugged into the front of the controller (Figure 6). Set the Setpoint temperature two degrees below the desired cell temperature. The setpoint can be adjusted by pressing either the up or down arrow keys while the Setpoint LED is lit. Allow the system to equilibrate for 5 minutes. Then place the reference sensor into the center of a covered dish. You may want to cut a slit or hole into one of the plastic lids for this measurement to allow the thermistor to be placed in the center of the dish. The temperature of the reference sensor can be displayed by

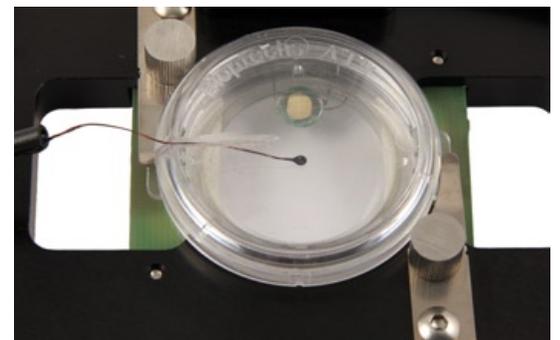
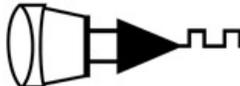


Figure 5



pressing the select key to illuminate the Reference LED. Take notice of the deviation of the setpoint and resulting temperature and add or subtract the appropriate value to the setpoint. Example: If you want the dish to be at 37°C, the initial setpoint should be 35°C. After equilibration, you find that the dish temperature is 36.5. Therefore, you need to add 0.5 degrees to the setpoint temperature to obtain the desired result. Once you have established the setpoint for your system you can begin working with cells.

Calibration

The calibration of the unit can be checked and adjusted using the following procedure: If the stage adapter is plugged in, unplug the stage adapter, then plug the enclosed calibration plug into the front of the controller (6 pin mini din) and press Select until the Dish led is lit.

The display should read 25.0 degrees. If it needs adjustment, turn the potentiometer with the enclosed miniature screwdriver by inserting it into the hole on the front of the controller farthest from the plug (Figure 6). Press Select again to display the Reference temperature.

The display should read 25.0 degrees. The potentiometer in the access hole nearest to the plug on the front of the controller (Figure 6) will adjust the Reference circuit. When calibration is complete you can remove the calibration plug and re-insert the stage adapter plug.



Figure 6

Adjusting the Heated Lid Value

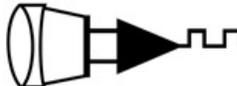
The Heated Lid power supply socket is located on the back panel of the controller and is labeled Heated Lid on the bottom of the controller. Press select until the Heated Lid led is lit, the power is adjusted by pressing the up or down arrow keys. Proper heated lid voltage is obtained by experimentation. Start by setting the heated lid to 2.5 volts and let it warm up for about 5 minutes. Then place it on a Delta T dish that has been regulating at the desired temperature for 5 minutes. Place a temperature dot, shiny side up onto the top glass of the headed lid to check the temperature of the Heated Lid. The temperature dot will turn green at 37 degrees. If a temperature other than 37 degrees is desired in the dish, lower the voltage 0.2V to the heated lid every five minutes until condensation appears. Then reset the voltage up 0.2V to the previous setting. If a temperature over 37 degrees is desired in the dish then increase the voltage 0.2V to the heated lid every five minutes until condensation disappears. Once you have a value setting for your system it should not need further adjustment. Remove the temperature dot from the heated lid once adjustments are complete.

Adjusting the “Imaging Mode” Voltage:

What is imaging mode? The Delta T5 operates in one of two modes, Dynamic temperature control or Imaging. In dynamic mode, the default mode, the controller will dynamically control temperature in order to maintain the setpoint temperature. That means the energy sent to the dish is changing in response to anything that influences the temperature of the dish. These influences are surface evaporation, perfusion, ambient temperature, and entropy. While an image is being acquired you do not want to have these dynamic energy changes occurring. Therefore, Biotech's has implemented an imaging mode that enables you to send a fixed value to the dish during the time an image is being acquired. This mode is not possible with peripheral heating devices but given the fast thermal response of the Delta T it is easy. Place a dish in the stage adapter and adjust the setpoint to achieve the desired cell temperature. Let the system equilibrate for 20 minutes. Press and hold the “Select” button until the “Dish” LED flashes. During this time the display will indicate the voltage at the dish. The voltage may change over time, that is normal. Record the voltage that is displayed most consistently. Press the “Select” button to cycle through until the “Imaging” LED lights. Then adjust the imaging voltage using the arrow keys to your recorded value.

Setting the Heat shock Value

Temperature achieved is a product of wattage and time. You can set the wattage by adjusting the voltage sent to the dish. This voltage is adjusted by pressing the arrow keys while the Heat shock Led is selected. Wattage is calculated as V^2 / R . The dish resistance is 10Ω. Example; A 5v Heat Shock voltage will transfer 2.5 watts of energy to the dish when activated. The heatshock voltage can only be activated manually by pressing both the Heatshock and Enable keys. Heatshock is maintained only as long as you hold the Heat shock keys.



Setup options:

The controller has a protection alarm feature that lights a flashing LED on the front of the controller, sounds an audible alarm and reduces the power going to the dish to a value below the Imaging setting to prevent possible damage to the cells. This alarm will activate if the temperature of the dish deviates more than 0.9 degrees from the setpoint. In some cases it might be desirable to disable the audible alarm or the power interrupt. To access these options press and hold the reset button for at least 5 seconds. The “Reset” LED will light and remain lit indicating you are in the alarm-programming mode. Pressing the up arrow will toggle the disable of the audible alarm. When the audible alarm is disabled a [~] will appear on the numeric display (*Figure 7*). Pressing the down arrow will toggle the disable of the power interrupt. When the power interrupt is disabled a [^] will appear on the numeric display (*Figure 7*) but the control current will continue. Note: The Reset LED will flash if the controller goes into alarm. This feature cannot be disabled.



Figure 7

Remote Setpoint

The Delta T5 can be remotely programmed by applying a DC voltage equal to setpoint temperature $\div 10$ to the Remote setpoint plug on the backside of the controller (*Figure 4*). Example: If you want to operate at 37.0 degrees then ramp to 42.0 degrees, send the controller 3.7 Volts then 4.2 volts. There is a 1/8” phone plug provided to make the connection. It is most convenient to use a digital to analog conversion device from a computer but any common grounded DC voltage source will work.

Temperature Monitor

The Delta T5 temperature can be monitored in analog form by reading the voltage available from the 3-pin Mini-DIN plug on the backside of the controller (*Figure 4*). The temperature is equal to temperature degrees C $\div 10$. Example: 37°C = 3.7 volts. A mating 3 pin mini DIN plug is included for your convenience.

TTL interface

The Imaging mode can be activated by either manually pressing the imaging button on the front of the controller or applying a TTL high and hold voltage to the BNC connector located on the back of the controller (*Figure 4*). This will enable your acquisition host to automatically activate the imaging mode. The default is TTL low. When the controller receives a TTL high it will change to the imaging mode only during the time the TTL is held high.

Cleaning

The controller can be wiped down with mild soap and water. Do not use petroleum-based solvents. Do not immerse.