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TEC Controller 825A

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1 Introduction

The 825A TEC Controller/Thermocouple Thermometer was designed to control and measure the temperature of Aurora Scientific Inc. (ASI) physiology apparatus. The controller works with Peltier modules to control the temperature of a bath in the range 0 to 40°C within $\pm 0.1^\circ\text{C}$. The 825A TEC Controller includes an LED digital display that can be switched to show either Process or Setpoint temperature in $^\circ\text{C}$.

To achieve fast temperature step response times with very good long-term stability the control electronics uses a proportional/integral/derivative (PID) servo control loop. The inclusion of the integrator results in an exceptionally flat response.

A thermocouple thermometer is included in the 825A to allow accurate temperatures to be measured at a selected point of interest. A Physitemp microprobe T-type thermocouple is included with the 825A that can be used with the thermometer function. This probe is encapsulated in a Teflon jacket to prevent contamination of experimental fluids. The microprobe has a diameter of 0.025" (635 microns) with a response time of 0.1 seconds. The thermometer has a temperature measurement range of -50°C to $+50^\circ\text{C}$ with an accuracy of $\pm 1^\circ\text{C}$ over the range from 0°C to $+40^\circ\text{C}$. The thermometer includes an LED digital readout of the temperature displayed in $^\circ\text{C}$. A BNC signal output connector is also included that allows the temperature to be recorded with an A/D system, chart recorder or other voltage measuring device. The output voltage is $10\text{mV}/^\circ\text{C}$ with 0.000 volts corresponding to 0°C . Although the 825A is powered from mains power a 9VDC battery is also required to power the thermocouple thermometer circuitry. A low battery is indicated by the thermometer display flashing.

 *NOTE: The 825A is capable of producing up to 5 amperes of current to the TEC modules. This can cause the temperature of the TEC module to increase very rapidly. Never run the controller attached to a TEC module that doesn't have sufficient heat sinking. All ASI apparatus intended for use with an 825A includes a water-cooled heat sink on the TEC modules. Ensure water is flowing before switching on the 825A.*

2 Quick Start Guide

The following procedure will guide you through the basic operation of your 825A TEC Controller.

2.1 Demonstration Procedure

1. Attach the 6-pin mini DIN cable provided to the TO TEC connector on the front panel of the 825A. Attach the other end of the cable to the Aurora Scientific 800-series apparatus. Ensure that the cable is secure at both ends.
2. With the power switch, located on the front of the electronics box, in the OFF (down) position, plug the instrument into an appropriate AC source using the detachable line cord provided.
3. Turn the front panel SETPOINT control so that the turns counting dial reads 5.0 (the center of the range) which corresponds to 20°C.
4. Attach the water cooling lines to the 800-series apparatus and ensure water is flowing before switching on the 825A.



NOTE: The 825A TEC Controller can rapidly heat the TEC modules to temperatures high enough to damage the modules if sufficient heat sinking is not provided. Never connect the 825A to a bare TEC module.

5. Switch the DISPLAY switch to the Setpoint position (down). Turn the power switch ON. The POWER LED should illuminate.
6. The TEC Controller LED display should read close to 20.0°C. Now switch the DISPLAY switch to the Process position (up). The display should now show the process temperature (the temperature reported by the AD590 temperature sensor built into the 800-series apparatus).
7. Observe the Process temperature and ensure that it settles at the Setpoint temperature. If the Process temperature starts to change significantly then there is probably a problem with the TEC modules, the water supply or the temperature sensor. Shut off the 825A and go through the trouble shooting procedure provided in this manual.
8. Switch the DISPLAY back to the Setpoint position and using the SETPOINT knob adjust the temperature to a different temperature (e.g. 15°C). Switch the display back to Process and ensure that the Process temperature reaches the Setpoint temperature in about 3 minutes or less. Clockwise rotation of the SETPOINT knob will increase the Setpoint temperature.
9. Connect the T-type micro thermocouple probe to the T INPUT connector located on the front panel. Observe the temperature shown on the Thermocouple Temperature display.

3 General Operating Procedure

The 825A TEC Controller/Thermocouple Thermometer will control the temperature of Aurora Scientific 800-series apparatus and also provide a low noise readout of thermocouple temperature. Two displays are provided on the instrument. The right display shows Process or Setpoint temperature in °C depending on the DISPLAY switch setting. The left display shows thermocouple temperature in °C.



Figure 1: 825A TEC Controller Front Panel

3.1 Controlling Temperature

The SETPOINT knob controls the temperature such that a clockwise rotation of the knob increases temperature, and conversely, lower temperatures are set by counter-clockwise rotation. The knob adjusts the temperature in a range from 0 to 40°C. The knob is calibrated to provide a Setpoint of 0°C at a dial setting of 0. A dial setting of 10 corresponds to 40°C. Thus the control factor of the knob is 4°C/revolution.

The DISPLAY switch controls whether the Setpoint or Process temperature is displayed on the right LED display. Setpoint is the desired temperature while Process is the temperature measured by an AD590 temperature sensor built into the Aurora Scientific 800-series apparatus. Note: the process temperature will never be exactly the same as the liquid temperature in the bath since the AD590 is attached to the bath plate some distance from the actual bath. This temperature offset should be measured by placing a probe in the bath. To obtain a specific liquid temperature in the bath the Setpoint may need to be

adjusted either higher or lower than the desired temperature to compensate for the position offset. All temperatures are set and measured in °C.

The 825A should settle to within 0.1°C of the Setpoint temperature within 3 minutes of changing the control. Smaller temperature changes will take less time. However the temperature of the liquid in a bath may take up to 8 minutes to reach a stable temperature after adjustment of the Setpoint. This is due to slower transfer of heat to the liquid than through the plate itself.

3.2 Measuring Thermocouple Temperature

The thermocouple thermometer can be used to measure the temperature of a T-type thermocouple within the temperature range from -50°C to +50°C. The stated accuracy of the thermometer is $\pm 1^\circ\text{C}$ in the temperature range from 0°C to +40°C. The thermometer can resolve 0.1°C and is powered by a 9VDC battery to ensure low-noise operation. The thermometer also includes a voltage output with a scale factor of 10mV/°C with 0.000 volts corresponding to 0.0°C.

A low battery condition is indicated by the left LED display flashing on and off. When this occurs replace the battery located in the drawer on the back panel of the instrument (see Figure 2).



Figure 2: 825A Back Panel with Battery Drawer Open

4 Calibration

Your 825A TEC Controller was calibrated at the factory to perform to the specifications found in this manual. If you believe that your 825A is not performing to these specifications, please contact Aurora Scientific for technical support.

5 Performance Guarantee, Technical Support, Warranty and Repair Information

Aurora Scientific is dedicated to providing you with products that allow you to meet your research goals. For this reason we offer a performance guarantee, technical support and a new product warranty. Our performance guarantee ensures you purchase the correct instrument for your research. Technical assistance is always free and will be available for the life of your product. If you do have a problem with a product then please know that all Aurora Scientific products are covered by a three-year warranty covering both parts and labour. If you need to return a product to us for repair then consult the final section of this chapter for returns information.

5.1 Performance Guarantee

Our performance guarantee states: if for any reason a new product does not meet your research needs then you can return it to Aurora Scientific for exchange or a full refund. The performance guarantee only applies to new products and must be exercised within 60 days of receipt of the instrument.

5.2 Technical Support

Technical assistance is always free and will be available for the life of your product. Please don't hesitate to contact us if you have any technical support issues. Contact us by telephone, email, fax, or regular mail.

5.3 Technical Support Contact Information and Return Shipping Addresses

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5.4 Warranty

Products manufactured by Aurora Scientific Inc. are guaranteed to the original purchaser for a period of three (3) years. Under this warranty, the liability of Aurora Scientific is limited to servicing, adjusting and replacing any defective parts that are of Aurora Scientific manufacture. Aurora Scientific is not liable to the customer for consequential or other damages, labour losses or expenses in connection with or by reason of the use or inability to use the products manufactured by Aurora Scientific.

Guarantee of parts and components not manufactured by Aurora Scientific shall be the same as the guarantee extended by the manufacturer of such components or parts. Where possible such parts returned to Aurora Scientific will be sent to the manufacturer for credit or replacement. Ultimate disposition of these items will depend upon the manufacturer's decision.

All shortages must be reported within ten (10) days after receipt of shipment.

Except where deviations are specified in literature describing particular products, the limited warranty above is applicable to all Aurora Scientific products, provided the products are returned to Aurora Scientific and are demonstrated to the satisfaction of Aurora Scientific to be defective.

Transportation costs of all products returned to Aurora Scientific must be borne by the customer and products must be returned to Aurora Scientific within three years after delivery to the original purchaser. Aurora Scientific cannot assume responsibility for repairs or changes not authorized by Aurora Scientific or damage resulting from abnormal or misuse or lack of proper maintenance.

Repair or service work not covered under the limited warranty will be billed at current service rates.

NO EXPRESS WARRANTIES AND NO IMPLIED WARRANTIES WHETHER FOR MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR USE, OR OTHERWISE OTHER THAN THOSE EXPRESSLY SET FORTH ABOVE WHICH ARE MADE EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, SHALL APPLY TO PRODUCTS SOLD BY AURORA

SCIENTIFIC INC, AND NO WAIVER, ALTERATION OR MODIFICATION OF THE FOREGOING CONDITIONS SHALL BE VALID UNLESS MADE IN WRITING AND SIGNED BY AN EXECUTIVE OFFICER OF AURORA SCIENTIFIC INC.

5.5 Returning Products to Aurora Scientific for Repair

There are a few simple steps that must be completed before returning your product to Aurora Scientific.

1. Obtain a Return Material Authorization number (RMA#).

Contact our technical support department to obtain a RMA #. We require the serial number of the product along with your contact information, i.e. your name, institution, phone number and email address.

2. Package your instrument.

Use the original packaging materials if available. If you do not have original packaging then ensure that the product is wrapped in bubble pack and placed in a sturdy corrugated cardboard box. If you are returning a force transducer please place the transducer head in the plastic protective box and then wrap the plastic box in bubble pack and place it in a small cardboard box which can then be placed in the larger box along with the electronics. For force transducer repairs we require both the transducer head and the control electronics. Please don't send the power cord. When returning a muscle lever system wrap the motor in bubble pack and place it along with the lever arm in a small cardboard box and then place that box in the larger shipping container along with the controller. For muscle lever repairs we require the motor, lever arm, motor cable and control electronics. Please don't send the power cord.

3. Prepare Customs documents.

Canadian Clients: no customs documents are required, skip to step 4.

European Clients: no customs documents are required, skip to step 4 and ship to Aurora Scientific Europe.

Asia, Australia and New Zealand Clients: no customs documents are required, skip to step 4 and ship to Aurora Scientific Asia.

USA and Rest of the World Clients: You must include a Commercial Invoice (CI) with the shipment. Please click this link to download a blank CI.

You can also prepare the commercial invoice yourself instead of using the downloadable form. Print the document on your company's letterhead and include the following information: Date, Shipper's Name, Address and Phone Number (your company information), Consignee's Name, Address and Phone Number (Aurora Scientific Inc. is the Consignee), Country of Origin of Goods (this will be Canada if you purchased the instrument from Aurora Scientific or USA if your product was purchased from Cambridge Technology), Conditions of Sale (include the following statement: GOODS RETURNING TO FACTORY FOR REPAIR, TEMPORARY IMPORT), Number of Packages (normally 1), Description of Goods (e.g. Model 300B Muscle Lever System, Serial Number 1111), Quantity of Each Item (normally 1) and Value for Customs Purposes (the original purchase price of the instrument).

Place three (3) copies of your CI in an envelope and mark the outside CUSTOMS PAPERS ENCLOSED. Attach the envelope to the outside of the box.

4. Choose a shipper and prepare the waybill.

European Clients: ship your instrument to Aurora Scientific Europe in Dublin, Ireland.

Asia, Australia and New Zealand Clients: ship your instrument to Aurora Scientific Asia in Hong Kong.

Canadian, USA and all other Clients: ship your instrument to Aurora Scientific in Ontario, Canada.

You may ship your instrument back to us via the courier of your choice or via parcel post. If possible we prefer that you ship via FedEx. You are responsible for both the shipping and brokerage charges so please mark the waybill accordingly. Please don't ship freight collect. Shipments sent freight collect will be received but you will be invoiced for the shipping charges when your instrument is returned.

5. Prepare and send a purchase order.

After we receive the instrument we will evaluate it and contact you with the estimated repair cost. We require a purchase order before we can repair and return your instrument. Please fax or email us the purchase order at your earliest convenience.

6 Specifications

825A Controller

Output Voltage:	12VDC
Output Current (max):	±3.5A
Feedback Sensor:	AD590
Control Range:	0-40°C
Temperature Stability:	< ±0.1°C
Setpoint Control:	Front panel, 10-turn
Control Loop:	PID
Warm-up:	1 hour to rated accuracy
Digital Display:	Setpoint temperature/feedback temperature – switch selectable, °C
Output Connector:	6-pin mini DIN
Dimensions:	3.5" (9 cm) high, 8.4" (21 cm) wide (1/2 rack), 10" (25 cm) deep
Weight:	7 lbs. (3.1 kg)

Thermocouple Thermometer

Thermocouple Type:	T
Temperature Range:	-50°C to +50°C
Temperature Accuracy:	±1°C, 0°C to +40°C
Output Voltage:	10 mV/°C (0 V = 0°C)
Calibration:	Ice Point
Input Connector:	Miniature T-type
Output Connector:	BNC
Digital Display:	Thermocouple Temperature, °C
Power Requirements:	9 VDC battery, 3mA maximum

Thermoelectric Module

Number of TECs:	2
Power:	33 W
Voltage:	15 V

Electrical

Power Requirements: 120VAC ±10%, 50/60Hz, 2 amps max. (100VAC, 220VAC, and 240VAC available)

CAUTION Replace Fuse with same Type and Rating

Fuse Type:	250V Time Delay, IEC 127-III: 5x20mm
Fuse Rating:	110/125VAC – T 2.0A 220/240VAC – T 2.0A