E500 Dual Channel Cryogenic Temperature Monitor

User's Manual

The Business of Science ™

OXFORD INSTRUMENTS

Contents

Revision History

Rev. 1.0.1	July 2008	Initial release.

E500 Dual Channel Cryogenic Temperature Monitor

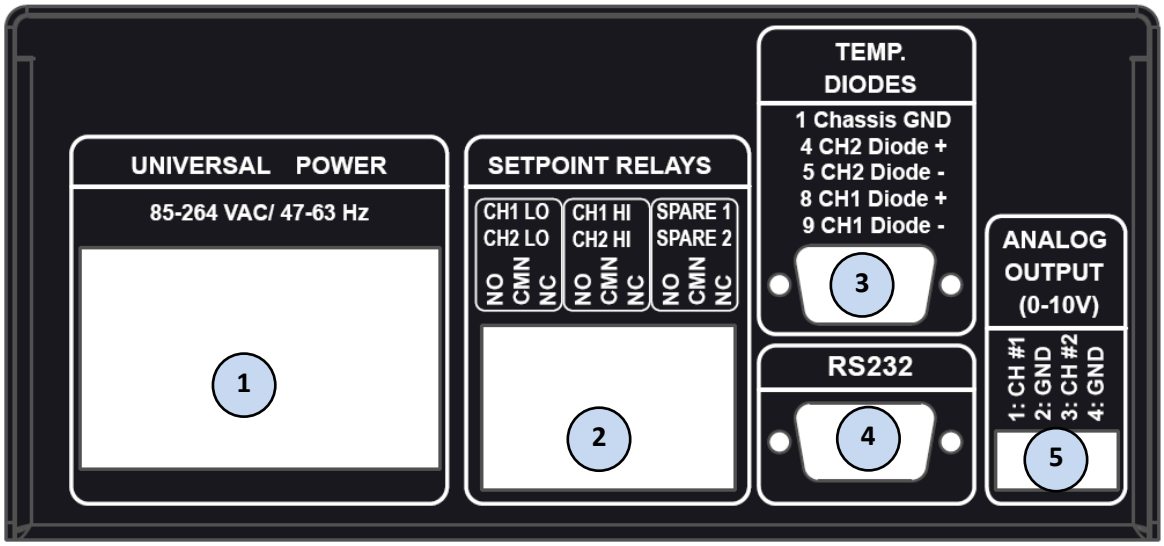
Overview

- Continuous visual update of two temperature sensors (channels) using backlit LCD display
- Drives two temperature diodes, intended for cryogenic temperature measurement
- Diode temperature curve selection from four pre-defined curves
- Supports one user-defined, programmable diode curve
- Six programmable setpoint relays (three per sensor/channel)
- Two 0 – 10 V analog outputs for temperature monitoring (one per sensor/channel)
- Provides an RS-232 serial port for a PLC or PC digital interface

Description

The E500 Cryogenic Temperature Monitor drives two diode temperature sensors, and provides a visual display of the temperature on a backlit LCD module. Typical applications include monitoring temperature of a two stage coldhead of a cryopump or cryocooler, using one diode (channel) for each stage. It can also be used to monitor two cryopumps or cryocoolers simultaneously, by using one diode (channel) for each coldhead. The high resolution measurement sensors provide noise rejection to deliver precise, accurate temperature readings. The diode curves are user selectable from four (4) pre-defined curves providing support for common diodes. In addition, a user-programmable curve is available for non-supported diodes. Temperature conversion is provided by a 10µA constant current source using a spline interpolation (piecewise polynomial).

E500 Installation



E500 Rear Panel

1 – IEC Power Entry. Universal Power input accepts 110 or 220 VAC at 50 or 60 Hz

2 – Setpoint Relays. Dry contacts are provided to trigger external equipment, or to provide status to control electronics, such as a PLC. Three relays are provided for each temperature channel. The top row connector is controlled by Channel #1 sensor, and the bottom is controlled by Channel #2. See the setpoint table for a detailed pin-out.

3 – D-sub 9 Female: Temperature Sensors. Connect temperature sensor according to the following pin out:

Pin 1: Shield (GND)
Pin 2: No Connect (NC)
Pin 3: NC
Pin 4: Diode Sensor #1 Positive
Pin 5: Diode Sensor #1 Negative
Pin 6 – 7: NC
Pin 8: Diode Sensor #2 Positive
Pin 9: Diode Sensor #2 Negative

4 – D-sub 9 Male: RS-232 Serial Port. Provides serial interface to a remote serial device. The serial port is intended to be used with a standard "straight through" serial cable (not NULL Modem).

Pin 1: No Connect (NC)
Pin 2: RS-232 Transmit Out
Pin 3: RS-232 Receive In
Pin 4: NC
Pin 5: GND
Pin 6 – 9: NC

5 – Analog Outputs. Analog outputs are provided for recorder logging, or as status to a PLC. The outputs provide 0 – 10 V for each channel.

Pin 1: Channel #1 Voltage Output
Pin 2: GND
Pin 3: Channel #2 Voltage Output
Pin 4: GND

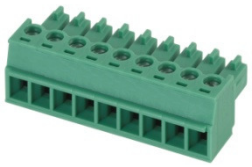
Setpoint Relay Pin-out

The table below describes the relay configuration. For each channel, 3 separate dry contacts are provided. Each dry contact has three connections: Normally Open, Normally Closed, and Common.

Pin-out (Left to Right)	Top Row	Bottom Row	Relay Position
Pin 1	Channel 1 Low Relay	Channel 2 Low Relay	Normally Open
Pin 2			Common
Pin 3			Normally Closed
Pin 4	Channel 1 High Relay	Channel 2 High Relay	Normally Open
Pin 5			Common
Pin 6			Normally Closed
Pin 7	Channel 1 Spare Relay	Channel 2 Spare Relay	Normally Open
Pin 8			Common
Pin 9			Normally Closed

Setpoint Relay Pin-out

The dual row connector provided on the E500 requires two male connectors for mating. The recommended mating connector is Phoenix Contact Part Number 1803646. Note that if only one channel is utilized, only one Phoenix Contact connector is needed.



Single Row Mating Connector (1803646)

Analog Outputs (0 – 10 V)

The E500 provides an analog output for each channel. A terminal block style plug is required to connect to the analog outputs. The recommended mating connector is Phoenix Contact Part Number 1803594. The outputs can provide a maximum output current of 60 mA each. To convert the output voltage to temperature, use the following formula:

Temperature (Kelvin) = 35 * Analog Output Voltage (in Volts)

This formula provides a maximum range of 0 – 350.0 K. The pinout (also shown on the back panel of the unit) is as follows:

Analog Output Pinout (Pin#1 left-most)	
1	Channel #1 Analog Output
2	Ground
3	Channel #2 Analog Output
4	Ground

E500 User Interface

The E500 provides a continuous display of the temperature measurements. The display interface also provides diode curve selection, and setpoint configuration.

Diode Curve Selection

The user can select the diode curve which corresponds to the temperature diode sensor connected to the E500. To select a diode curve:

1. Press the **MENU** button.
2. Scroll through the standard diode options by pressing the **UP** and **DOWN** buttons.
3. When the appropriate diode curve has been selected, press **MENU**.

E500 supports the following standard temperature sensor diodes:

Austin Scientific (ASC) Temperature Diode

CTI Temperature Diode

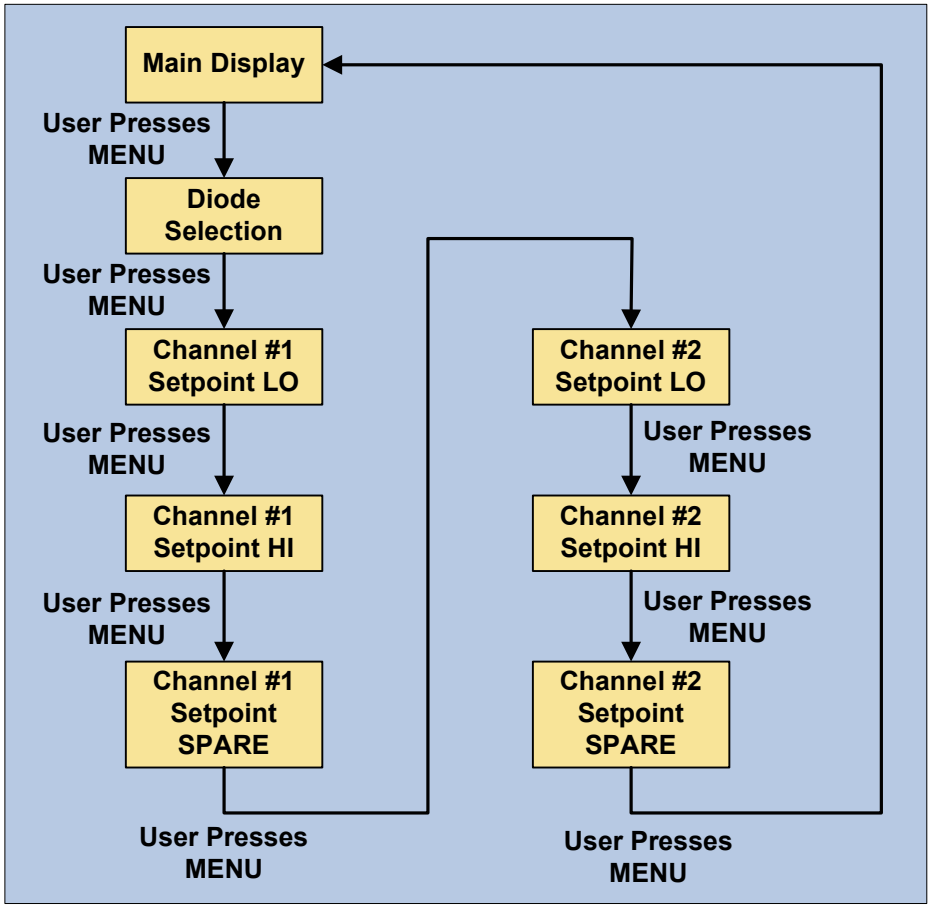
DT-470 Silicon Diode

DT-670 Silicon Diode

Setpoint Configuration

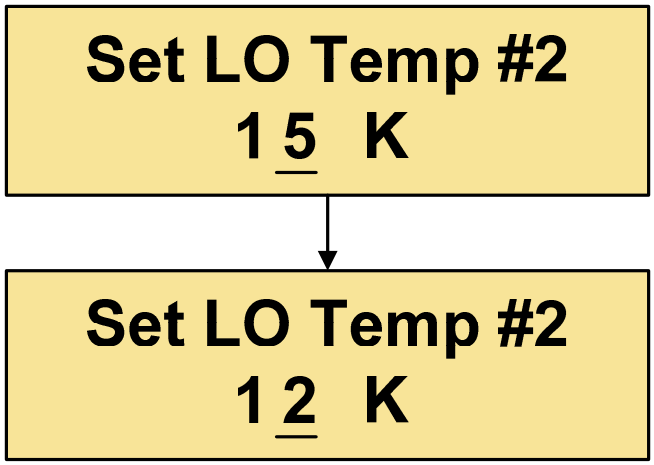
The user can individually configure each setpoint relay to a unique temperature. Each channel has 3 setpoints associated with its temperature measurement – LOW, HIGH, and SPARE. A flow chart is shown to aid in navigating the menus. In addition, an example is shown at the end of the section. If no buttons are pressed for roughly 10 seconds, the display times out and returns to the main menu. NOTE: the changes *are stored* and take effect if the menu times out. To configure a setpoint:

1. Press the **MENU** button twice. The first relay is "**Channel #1 LO**". When the temperature is *below* this value, the relay is in the "Active" position. The temperature value is modified by pressing **UP** or **DOWN** for each digit. Once the digit has been set, press **ENTER** to move to the next digit.
2. Press the **MENU** button to configure "**Channel #1 HI**". When the temperature is *above* this value, the relay is in the "Active" position.
3. Press the **MENU** button to configure "**Channel #1 SPARE**". When the temperature is *above* this value, the relay is in the "Active" position.
4. Continue to press the **MENU** button to cycle through the Channel #2 setpoints.



Example

The example shown below will configure Channel #2 Low Setpoint Relay to 12 K. Begin by pressing **MENU** to navigate to the "Select Diode" display shown below.



*Once the cursor is on the ONES digit, use the **UP / DOWN** keys to increment the value under the desired value of 12K is reached.*

*After the value has been set, either press **MENU** until the Main Display is reached, or let the display timeout after 10 seconds.*

Serial Port Interface

The E500 provides a DB9 Male connector for serial port communications. A "straight through" serial cable, as shown in the diagram below, is necessary for interfacing to the serial port. Only pins 2, 3, and 5 are required.

Pin Assignment		
DB9 Female (to E500)		DB9 (to Controller)
1	----------	1
2	----------	2
3	----------	3
4	----------	4
5	----------	5
6	----------	6
7	----------	7
8	----------	8
9	----------	9

Serial Port Cable

All commands start with '$', and end with \r\n. The serial port should be configured as shown in the following table.

Serial Port Settings	
Baud Rate	19,200
Data Bits	8
Parity	NONE
Stop Bits	1
Flow Control	None

Serial Port Commands

The following serial port commands are provided:

GetRev
Returns: Revision x.x

	Example
SEND	$GetRev\r\n
RECEIVE	$Revision 1.0\r\n

GetTemp(channel) - Returns the current temperature in K for the selected channel.
Channel: 1 or 2
Returns: xxx.x or "OOR" if out of range.

Example (Get Channel 2 Temp)	
SEND	$GetTemp 2\r\n
RECEIVE	$21.6\r\n

GetSetp(channel,relay)
Channel: 0 or 1 (0-> Channel 1, 1-> Channel 2)
Relay: 0, 1, or 2. 0->LO, 1->HI, 2->SPARE
Returns: xxx (integer)

Example (Get Channel 2 SPARE setpoint)	
SEND	$GetSetp 1,2\r\n
RECEIVE	$280\r\n

SetSetp(channel,relay,temp)
Channel: 0 or 1 (0-> Channel 1, 1-> Channel 2)
Relay: 0, 1, or 2. 0->LO, 1->HI, 2->SPARE
Temp: xxx (integer, no decimal point)
Returns: $xxx\r\n (returns the new value stored)

Example (Set Channel 1 LOW setpoint to 12K)	
SEND	$SetSetp 0,0,12\r\n
RECEIVE	$12\r\n

GetVolt(channel) - Returns the voltage in Volts for the selected channel.

Channel: 1 or 2

Returns: x.xxxx

Example (Get Channel 2 Voltage)	
SEND	$GetVolt 2\r\n
RECEIVE	$1.2345\r\n

E500 Curve Programmer

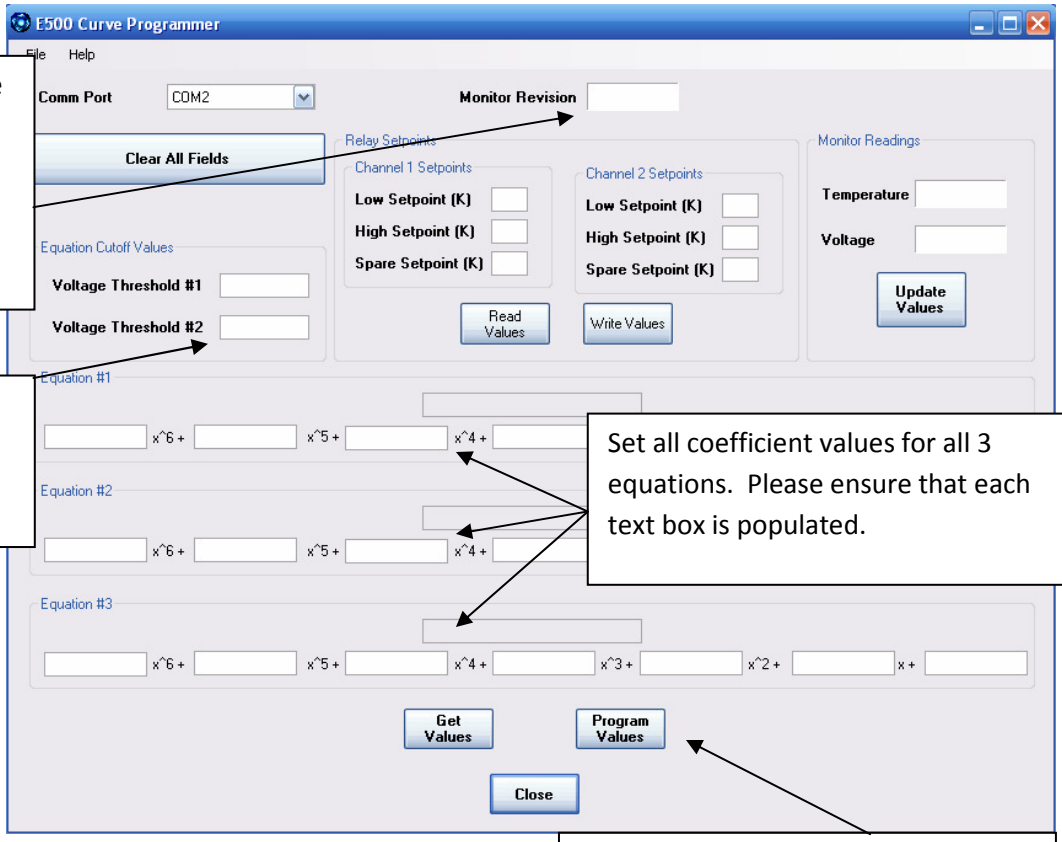
To enter data for a user defined diode curve, the **E500 Curve Programmer** can be used. This utility allows the user to enter the polynomial coefficients that control the voltage to temperature conversion.

In order to determine appropriate values, several "Voltage vs. Temperature" data points should be viewed in graph form. The graph can be broken up piece-wise into a maximum of 3 equations. For each of the equations, a trend line should be developed using a program such as Microsoft Excel or Matlab. Up to a 6th order polynomial can be used for each equation to provide maximum flexibility.

Once the values have been chosen, the fields shown below should be populated.

Begin by pressing "Get Values" at the bottom of the screen. This will ensure that communications are established. If successful, the "Monitor Revision" will be available.

Set the 2 voltages values that determine the boundaries of the 3 equations.



Set all coefficient values for all 3 equations. Please ensure that each text box is populated.

An advanced feature is also provided to allow the user to write the coefficients and setpoints to a file from the E500 Temperature Monitor. Select "File -> Write Values to File…" and browse to a file location. This will create a user editable text file with the coefficients and setpoints. Updates can be made to the file to change values, and then downloaded back to the E500 Monitor by selecting "File -> Program Values From File…".

Once all fields are populated, press "Program Values" to permanently program the new coefficients to the CUSTOM curve.

Technical Specifications

The technical specifications for the E500 Dual Channel Cryogenic Temperature Monitor are listed in the table below.

E500 Specifications

Features	**Display 2 Temperatures**	
	Four Selectable Diode Curves	
Power	**110/220 VAC Input @ 50/60 Hz (Universal Input)**	
Connectors	**IEC Power Input**	
	DB9F (Diode Driver)	
Dry Contact Rating	**Carry AC Current**	**10 A @ 250 VAC**
	Carry DC Current	**5 A @30 VDC**
	Max Switching Voltage	**400 VAC 300 VDC**
	Max Switching Current	**NO: 10 A NC: 8 A**
	Max Switching Power	**NO: 2,500 VA NC: 2,000 VA 150 W**
Analog Output	**0 – 10 V 60mA max**	
Dimensions	**4.37” (W) x 6.20” (L) x 2.56” (H)**	

Order Information

The contact information is listed below:

- Sales & Marketing 1-800-611-8871
- Technical Support 1-800-404-1055 or 1-512-441-6893
- Web Information www.oxinst.com/austin

Use the following Table to determine the P/N and optional accessories when placing order with Austin Scientific.

E500 Dual Channel Cryogenic Temperature Monitor	93-00040-000	E500, includes connections for dry contacts, analog output and power cable. Order diode cable(s) separately per desired configuration (see below).			
	99-00072-000	19" Rack Mount Kit (Fits up to 2 E500's)			
	10-00001-000	E500 Curve Programmer (to program custom diode curve)			
Configuration	**Cables**	**10 Ft**	**15 Ft**	**20Ft**	**50 FT**
Single Cryopump or coldhead	Standard Single Diode Cable	10133-10	10133-15	10133-20	10133-50
Dual Diode Cryopump or coldhead	Dual Diode Cable	81-00016-010	81-00016-015	81-00016-020	81-00016-050
Two Cryopumps or coldheads	Dual Cryopump Diode Cable	81-00038-010	81-00038-015	81-00038-020	81-00038-050