Vue-TEC
Operators Manual Rev. 2.0

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1 Product Description

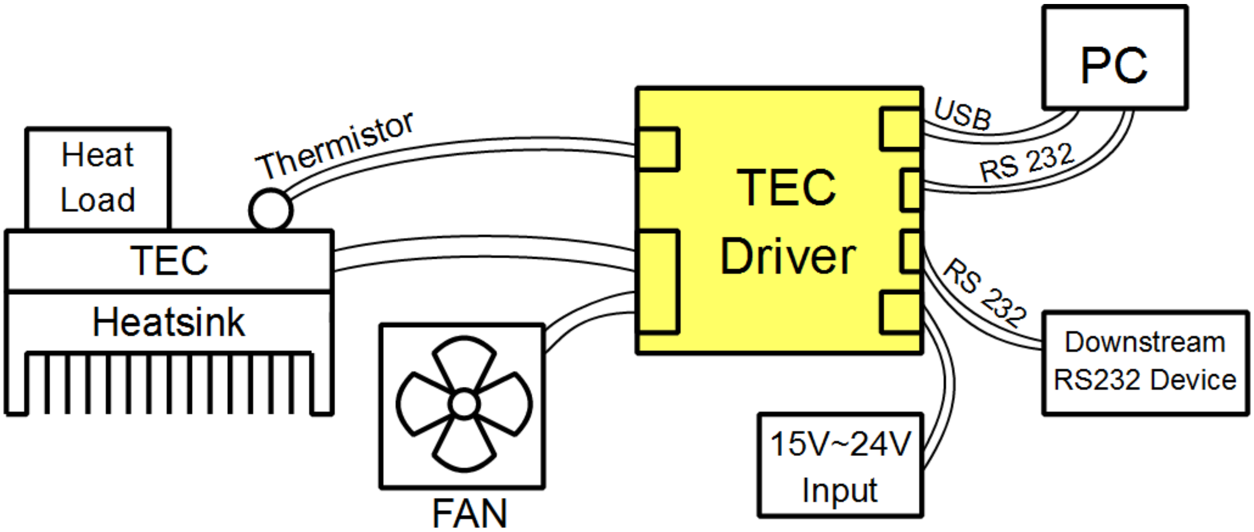
The Vue-TEC delivers up to 12A of low noise drive current for a Peltier device (thermoelectric cooler or TEC) at a voltage up to 22V. The driver is operated by a microprocessor that actively regulates the temperature of a thermal load and provides extensive start-up and diagnostic algorithms.

The Vue-TEC has a “passthrough” feature that allows specially formatted commands to be relayed to another device attached to its secondary RS-232 port. This allows you to control the TEC driver plus the second device from a single host serial port.

For convenient mouse-driven setup and adjustment, the Vue-TEC Developer's Kit includes a Windows application, WinVue. For customers who prefer to develop their own interface software, the VueMetrix web site http://www.vuemetrix.com/support contains a complete list of serial commands, USB drivers and associated documentation.

This manual describes firmware Version 6 or later and WinVue version 3.6 or later. All earlier controllers can be upgraded to this configuration. The latest version of WinVue can be found at http://www.vuemetrix.com/support. For firmware upgrades contact the factory.

2 Typical Application Diagram



3 User Safety

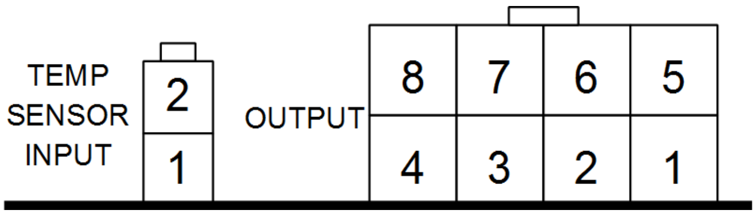
DO NOT OPEN AND ATTEMPT TO SERVICE THE UNIT. There are no user serviceable parts inside the Vue-TEC. Only qualified service personnel should remove the cover.

4 Specifications

Input and Output	
Input Voltage	15V ~ 24V DC
TEC Output Voltage Range	0V up to ±90% of input voltage at 12A output
TEC Output Current Range	0 ~ 12A
TEC Output Voltage Resolution (Typical)	33mV for 24V input 21mV for 15V input
TEC Output Voltage Ripple (Peak to Peak)	< 6% (when output current > 2A)
Fan Driver	
Fan output voltage	12V
Fan output maximum current	1.5A
Temperature Sensing	
Temperature Sensor	NTC 10 kOhm (not included)
Temperature Resolution	0.01ºC typical
Temperature Stability	125 ppm/ºC
Temperature Accuracy	user calibrated
General	
Power Supply Efficiency (Typical)	90% (for output > 30W)
Dimensions	7.5” x 2.7” x 1”
Connectors	
Thermistor Input	2 pin Molex Microfit PN: 43045-0200
Data/Control	3 pin RS-232 (Molex 70553-0002) or USB
TEC and Fan Output	8 pin Molex Mini-Fit Jr. (PN: 39-30-1080)

5 Electrical connections

5.1 Front



(The view is looking into the TEC driver. Pin numbers may also be on the mating connector housing.)

5.1.1 Temperature Sensor Connector

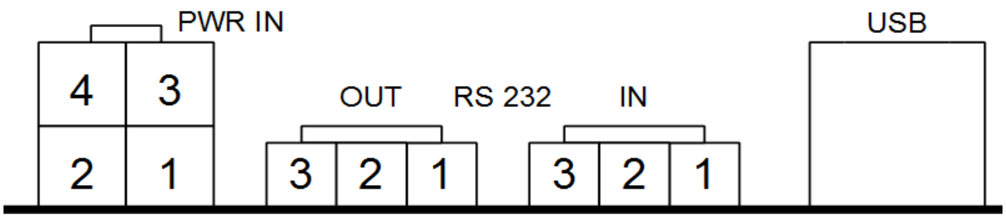
Pin 1	Thermistor Minus
Pin 2	Thermistor Plus
Connector Type	Molex Microfit PN: 43045-0200
Mating Connector Housing	Molex 43025-0200
Mating Terminal / Wire	Molex 43030-0009 (or compatible) / 24AWG wire

5.1.2 TEC Output Connector

Pin 1	Fan return
Pin 2	TEC Output Minus[1]
Pin 3	TEC Output Plus[1]
Pin 4	TEC Output Plus[1]
Pin 5	Fan positive (+12V)
Pin 6	TEC Output Plus[1]
Pin 7	TEC Output Minus[1]
Pin 8	TEC Output Minus[1]
Connector Type	Molex Mini-Fit Jr. 39-30-1080
Mating Connector Housing	Molex 39-01-2080
Mating Terminal / Wire	Molex 44476-1111 (or compatible) / 18 AWG wire

[1]The TEC connection polarity should be such that a positive voltage causes the temperature to rise.

5.2 Rear



(The view is looking into the TEC driver. Pin numbers may also be on the mating connector housing.)

5.2.1 Power Input Connector

Pin 1	Input Minus
Pin 2	Input Plus
Pin 3	Input Minus
Pin 4	Input Plus
Connector Type	Molex Mini-Fit Jr. 39-30-1040
Mating Connector Housing	Molex 39-01-2040
Mating Terminal / Wire	Molex 44476-1111[1] (or compatible) / 18 AWG wire

[1]The recommended mating terminals for the power input and output are Molex 44476-1111 and -1112. These are high current versions in the Molex terminal family. Lower current versions such as Molex 39-00-0039 can be used if the current per pin will always be < 3A.

5.2.2 RS232 Output Connector

Pin 1	Ground
Pin 2	RS232 Transmit (TEC Driver to another RS232 device)
Pin 3	RS232 Receive (another RS232 device to TEC Driver)
Connector Type	Molex C-Grid SL PN: 70553-0002
Mating Connector Housing	Molex 50-57-9403
Mating Terminal / Wire	Molex 16-02-0096 / 24 AWG wire

5.2.3 RS232 Input Connector

Pin 1	Ground
Pin 2	RS232 Receive (PC to TEC Driver)
Pin 3	RS232 Transmit (TEC Driver to PC)
Connector Type	Molex C-Grid SL PN: 70553-0002
Mating Connector Housing	Molex 50-57-9403
Mating Terminal / Wire	Molex 16-02-0096 / 24 AWG wire

Note: The Vuemetrix PN 1000-0229 is a cable that converts from the RS232 input / output connector to a standard 9 pin female RS232 connector.

5.2.4 USB Connector

Connector Type	Standard USB B connector

6 Installing and launching WinVue (Windows User Interface Software)

The WinVue program and this operators manual are located on the CD-ROM included with the TEC Driver. The correct program to use depends on whether you are using the passthrough feature. If not, the program is named tec.exe. If you are using the passthrough the chart gives the correct program name:

Configuration	***Program name***
TEC + MV	tec-mv
TEC + HCV	tec-hcv
TEC + LV15	tec-lv
TEC + LV30	tec-lv6

Do not use one of the passthrough versions without the correct type of controller connected.

6.1 Copy folders to PC

No installation procedure is necessary. Simply copy the contents of the CD-ROM to your computer's hard drive. Do not change the folder and subfolder structure and do not open the .zip file.

6.2 Launch the program

Locate the exe file and double click to launch the program.

If the TEC controller is turned on and plugged in to either USB or RS-232, WinVue will connect automatically.

If you start the program first and later make the connection to the controller, you must tell WinVue that a connection is now present. To do this open the dialog Communications->Communication Settings. Click on either the "Reset USB devices" or "Reset serial devices," depending on what type of connection you are using. WinVue will connect automatically.

6.3 Connecting to the controller

On startup, WinVue will scan the serial ports and USB ports of the PC to try to connect to any Vue-TEC that it finds.

If no connection can be found the message "No connection" will appear near the upper left of the main window.

If a connection is found the white activity banner in the upper left of the main window will display its status.

If more than one controller is found, all will be listed in the "Connection" menu. The "active" connection will be designated by a check mark in the menu, and will be named in the activity banner in the upper left of the main window. To switch connections select the one you want from the "Connection" menu. The content of all windows reflects the state of the active connection only.

7 Installation and Setup

7.1 Required connections

The following connections are required. See sections 5.1 and 5.2 for connector types and pin assignments:

1. Input DC power
2. Thermistor
3. TEC
4. Either RS-232 or USB

7.2 Optional connections

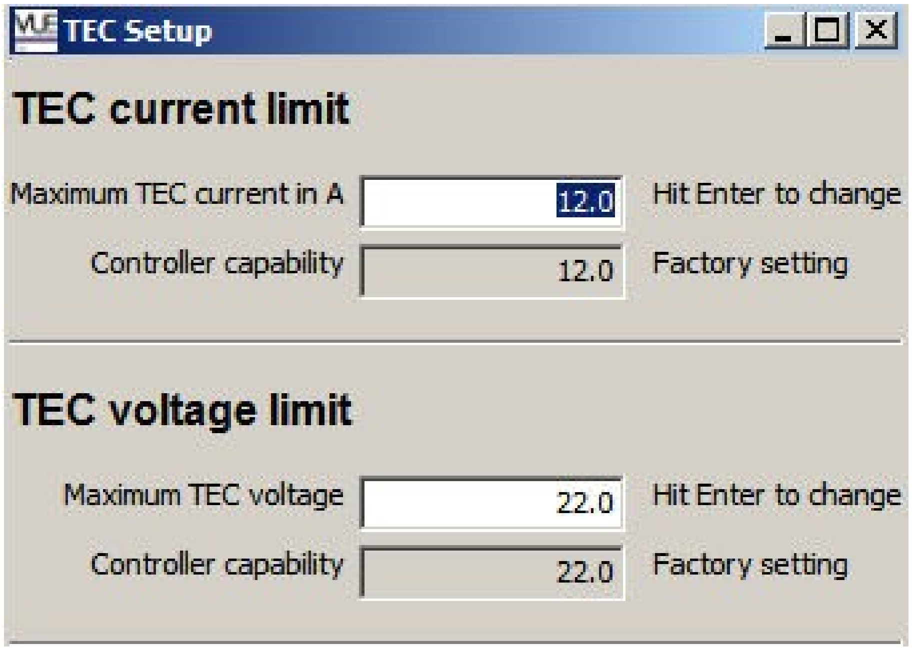
1. Cooling fan (always on as long as the TEC controller is powered)
2. RS-232 out if passthrough is to be used.

7.3 TEC setup

The controller is able to accommodate a variety of TEC models. It must be properly configured to account for the maximum current and voltage that your TEC can tolerate. This information is provided by the TEC manufacturer. Once the TEC's limits are entered into the controller's memory, it will avoid subjecting the TEC to over current or over voltage conditions.

> This section and those that follow assume you are using WinVue. The serial commands used in the controller setup are documented at http://www.vuemetrix.com/support/tech/tec_commands.html.

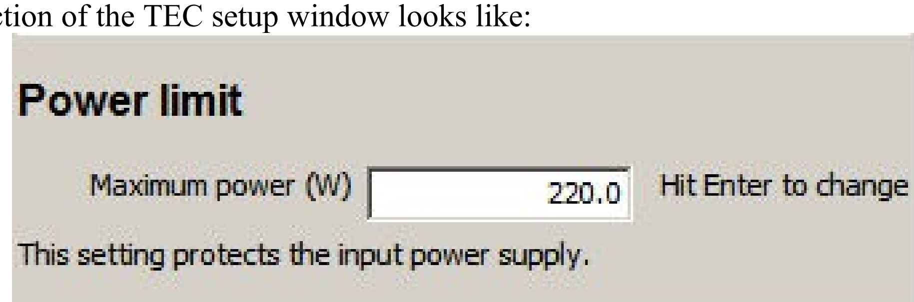
Open the TEC Setup window in WinVue. The top of the window looks something like this:



Enter the TEC maximum current in the first white box, and the TEC maximum voltage in the second. Below each is a gray field indicating the controller's maximum rating. If you attempt to enter a limit greater than this, the maximum rating will be used instead.

7.4 DC input power limit setup

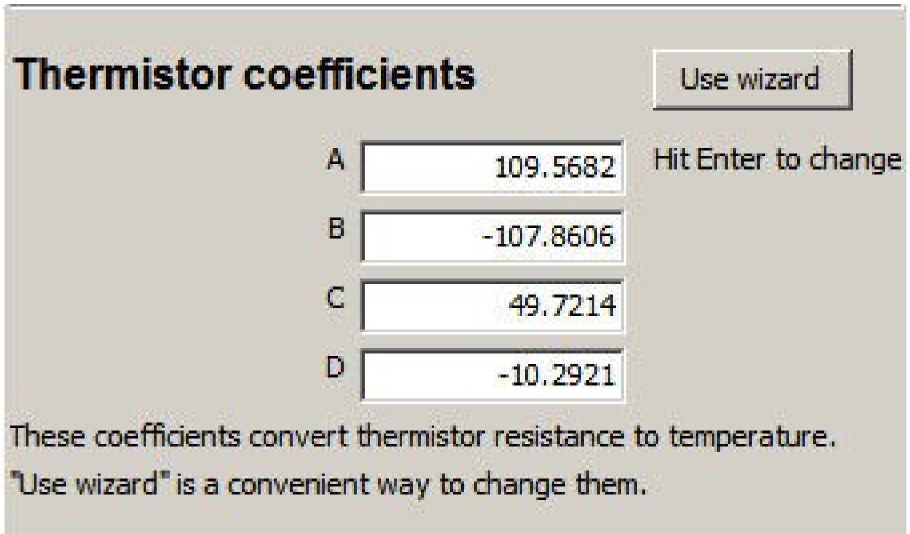
The controller can be configured to limit the power consumed from the input DC power supply. The next section of the TEC setup window looks like:



The controller will insure that the product of the TEC current and the TEC voltage is less than this value. There is no system limit for this.

7.5 Thermistor setup

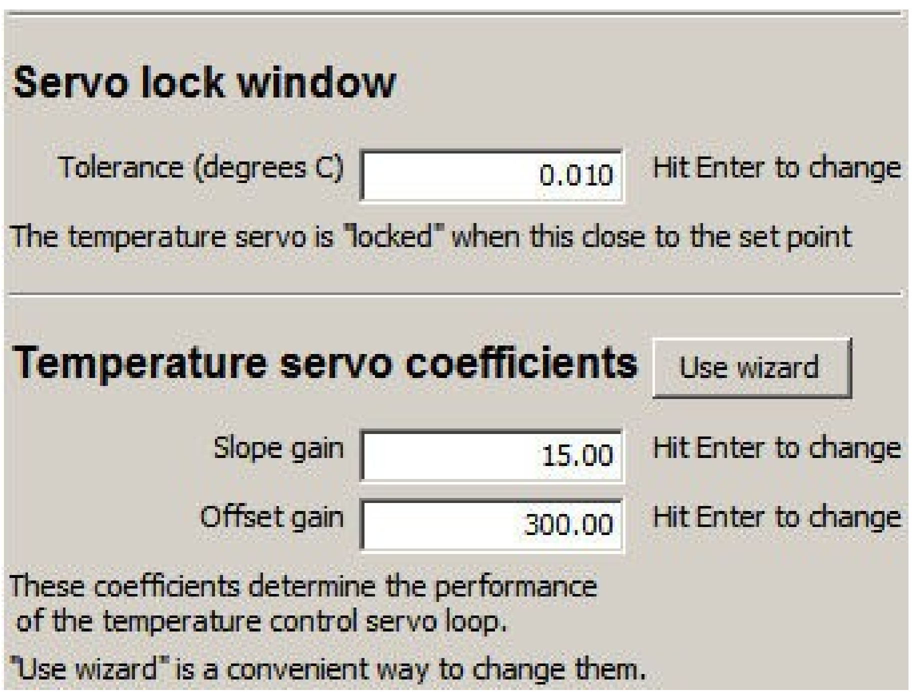
The controller calculates the temperature of its load by measuring the resistance of a thermistor. To convert resistance to temperature the controller uses a cubic equation, requiring four calibration constants. The controller has been preloaded with constants for a typical thermistor; details can be found on the web site at http://www.vuemetrix.com/support/tech/tempcontrolmeas.html#sensing.



To use a different thermistor the four constants can be entered here. The "Thermistor calibration" window is generally more convenient, and can be opened from the pull-down menu or from here by clicking the "Use wizard" button.

7.6 Servo setup

The TEC controller has a sophisticated temperature regulation (servo) algorithm. Its setup is critical to the successful use of the controller.



7.6.1 Servo lock window

Set the lock window to indicate how closely you want the controller to match the actual temperature to the set point. It can be visualized as a region of temperature around the set point within which the controller considers the temperature to be stabilized or "locked." If the temperature has been inside this window continuously for ten seconds, the controller will report its state as "locked."

This number should be selected with care as it has two important functions.

1. When the controller enters the locked state in Autostart mode, and the passthrough feature is in use, the controller sends the a command to the downstream controller to begin *its* Autostart procedure. This synchronizes the Autostart functions so that the laser controller does not start until the temperature is stabilized.
2. If the locked condition cannot be maintained at full drive, the controller will shut off with a "Servo fault: upper/lower rail". This is to prevent other equipment from being damaged by a thermal runaway condition or a faulty temperature sensor. If this is not desirable the size of the "lock window" can be increased to prevent possible nuisance shutoffs.

The servo will always try to maintain the set point as closely as possible, so the lock window does not affect the performance of the controller. The stability of the temperature is dependent on many factors, including the ambient environment. Most setups allow the controller to maintain the temperature to within 0.01C. In general the lock window should be set to the smallest tolerance that your system can achieve consistently.

7.6.2 Temperature servo coefficients

The temperature servo can adapt to a variety of loads and TECs. Two adjustable coefficients control the servo's response. It is critical to set these values correctly.

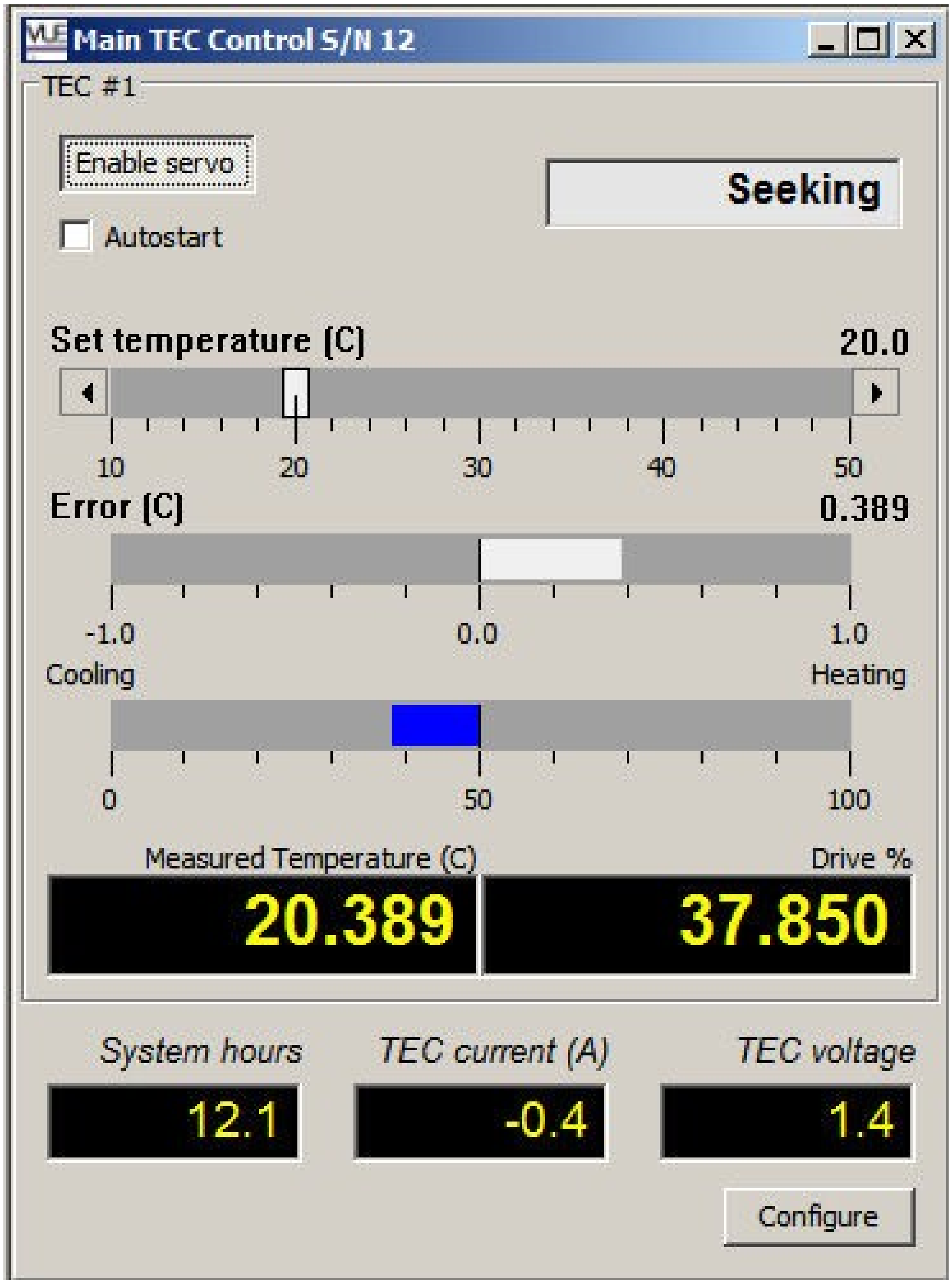
"Use wizard" will walk you through a procedure that characterizes your load and computes an appropriate set of coefficients. This is also available from the pull-down menu as "Temperature servo tuning."

The two servo coefficients can be directly entered here; however, tuning the servo by trial and error can be very time consuming.

For further information see http://www.vuemetrix.com/support/tech/tempcontrolmeas.html#tservo.

8 WinVue

8.1 Main TEC Control Window



This is the window you will most often use during daily operation.

8.1.1 Enable servo

By default the TEC controller powers up in the OFF state. The TEC is in its neutral position, neither heating nor cooling. Pressing the "Enable servo" button engages the temperature regulation servo, which will drive the TEC as necessary to achieve the set point. This is a toggle button, so pressing it again will disengage the servo. That returns the TEC to its neutral state.

8.1.2 Autostart

Selecting the "Autostart" button will engage the temperature regulation servo any time power is applied to the controller. This setting is remembered by the controller, so once "Autostart" is selected it is no longer necessary to connect a PC (or any other host computer). Simply turning on the controller causes it to drive to the desired temperature.

8.1.3 Status display

At any given moment the temperature regulation logic is in one of several "states," indicated by the text field to the right of the "Engage servo" button. The possible states and their meanings are:

- Off – The servo is not engaged and the TEC is neither heating nor cooling. The temperature will drift as the ambient environment changes.
- Seeking – The servo is engaged but has not yet reached the lock point, or has been within the *lock window* (see next) for less than ten seconds.
- Locked – The servo is stable and close to the set point. The region near the set point is called the *lock window*; its size can be changed by the TEC setup procedure (see section 7.6.1). In the Locked state the temperature must have been within the lock window for ten seconds or more.
- Manual – The servo is not engaged, and the TEC is either heating or cooling. This state can be entered by the Temperature Servo Tuning wizard.
- Fault – The controller has diagnosed an anomalous condition and has disengaged the servo. For more details see section 10.4.

8.1.4 Set temperature (C)

Use this slider to change the set point. This value is remembered by the controller in case of power off. The limits of this slider can be set by the Configure button (see 8.1.12).

8.1.5 Error (C)

A center-anchored bar graph display of the servo error, showing the signed difference between the measured temperature and the set point. The sensitivity of this display can be set by the Configure button (see 8.1.12).

8.1.6 Cooling...heating

A convenient visual display showing whether the controller is heating (red bar going to the right) or cooling (blue bar going to the left), and how much of its capacity is used.

8.1.7 Measured temperature

This is the actual temperature of the thermistor.

8.1.8 Drive %

This is reported on a scale where 0% = maximum cooling, 50% = neutral (no heating or cooling), 100% = maximum heating. Depending on the limits entered in the TEC setup procedure, you may never see the extremes of 0% or 100%.

8.1.9 System hours

This is simply the age of the unit, and increments as long as DC power is applied.

8.1.10 TEC current

The signed value of the current flowing through the TEC, where a negative value indicates cooling.

8.1.11 TEC voltage

The voltage drop across the TEC.

8.1.12 Configure

Allows you to change some of the limits in this window, see 8.1.4 and 8.1.5.

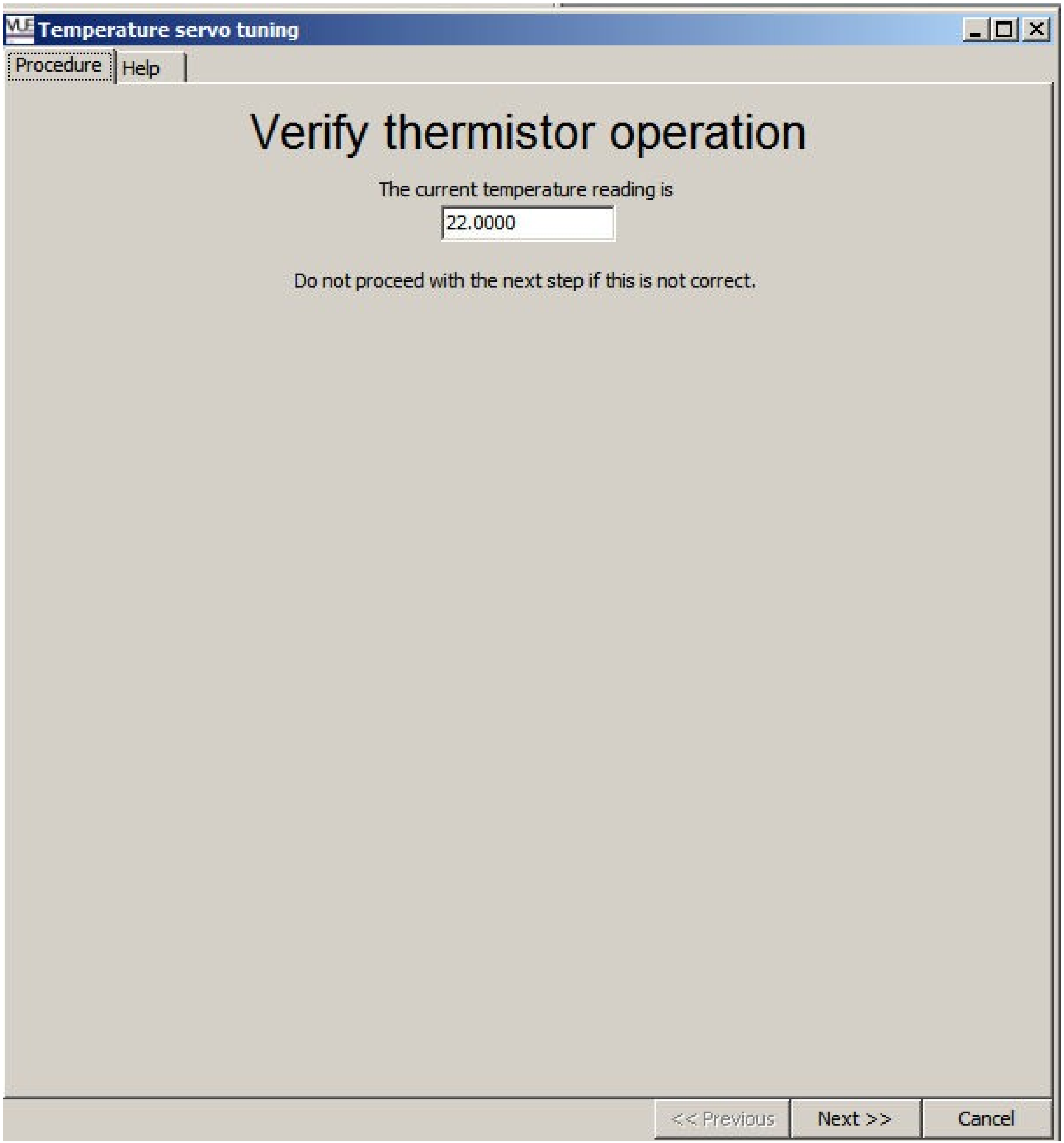
8.2 The TEC setup window

See sections 7.3 through 7.6.

8.3 The temperature servo tuning wizard

This window takes you through a sequence of logical steps that will result in a suitable set of servo control constants. We recommend you do this as part of the first-time setup of a new controller, or any time your thermal environment changes significantly. The procedure typically requires about ten minutes.

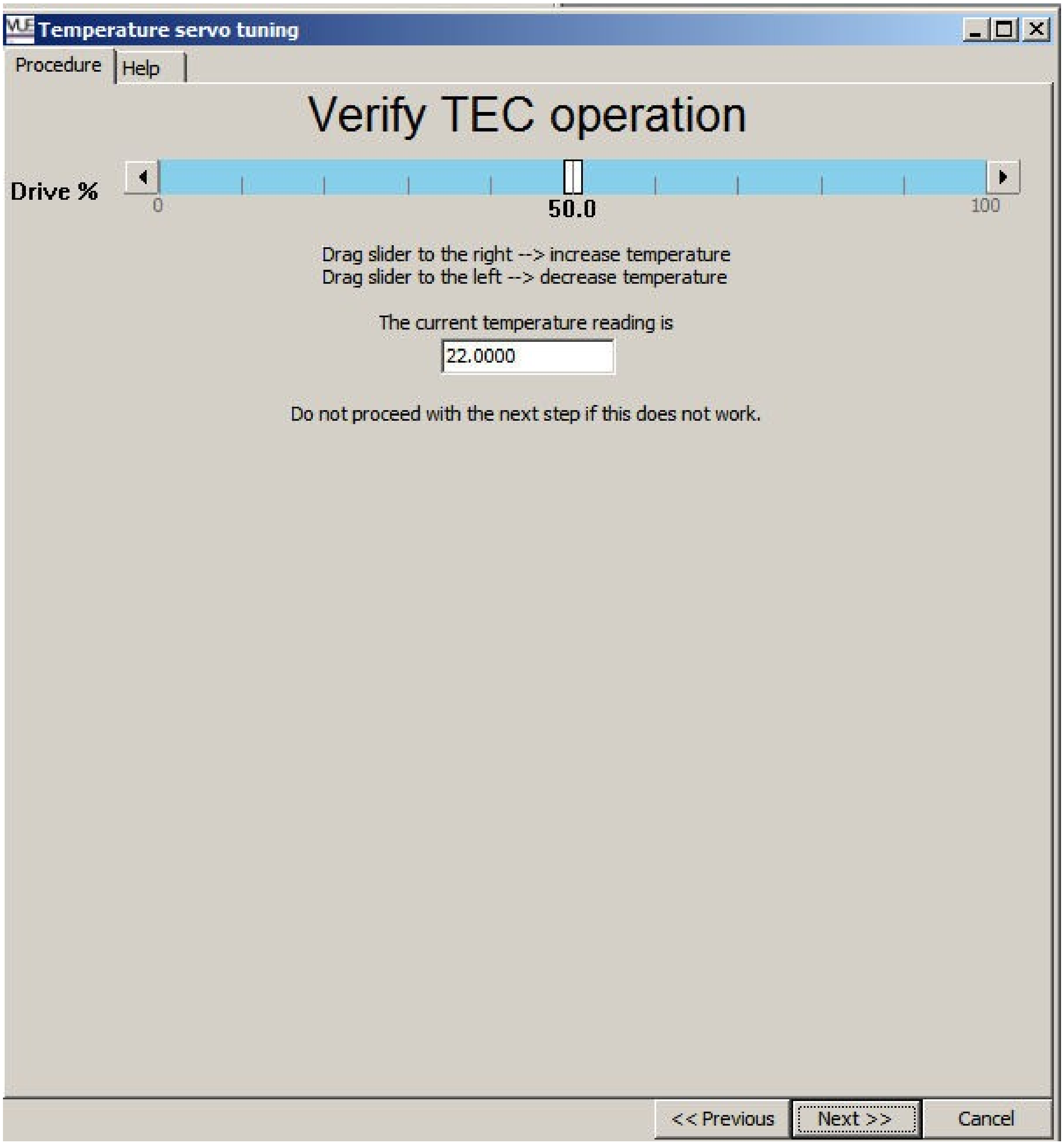
8.3.1 Verify thermistor operation



The first panel of the wizard confirms that the thermistor is properly connected and calibrated. The readout shows the controller's current value for the temperature. If your system is sitting at room temperature you should be able to tell if the value is reasonable. If an accurate calibration is needed see section 9, Thermistor coefficients.

Click Next to advance to the next panel.

8.3.2 Verify TEC operation

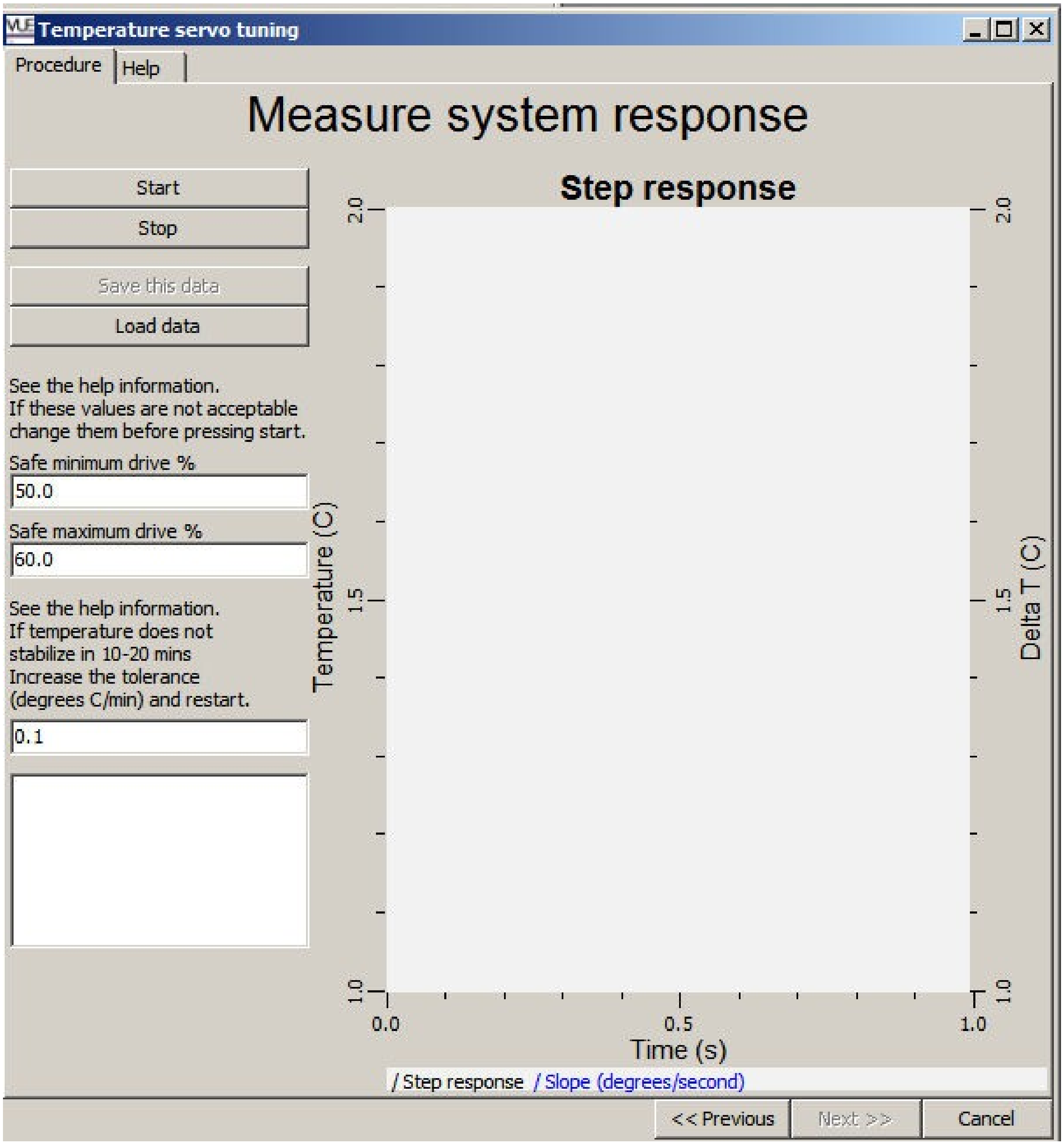


This panel can be used to confirm that the TEC is connected correctly. If you drag the slider to the right, the TEC will act as a heat source and the temperature should increase. Drag the slider to the left to make the TEC decrease the temperature.

If you already know that the TEC connections are correct, simply click Next to advance immediately to the next panel.

8.3.3 Measure system response

In this panel WinVue will use the TEC to apply a steady heating signal to your load. It will track the response of the load versus time, and in a later steps this will be converted to a set of parameters that describe the physical properties of the load. This is the most time-consuming step in the setup process.



Initially the window looks like this. In most cases you will not need to change any of the default settings. Simply press Start and the procedure is automatic.

8.3.3.1 Save this data

It is often a good idea to save the data once it has been collected. It can be loaded again at any time. It is stored in a binary format.

8.3.3.2 Load data

This can be used to load a previously saved set of data, so you can continue with the subsequent steps without the time-consuming process of re-acquiring it.

8.3.3.3 Safe minimum/maximum drive

Use of the default settings will typically cause the temperature of your system to rise by about 5-10 degrees during this procedure. If this is a problem you can change the amount of TEC drive by editing the text fields.

> 50% drive represents no heating or cooling, 0% represents the full cooling capability of the TEC and 100% represents its full heating capability.

During the procedure the "Safe minimum drive" will be applied first. WinVue will wait until the temperature becomes stable under these conditions, and then the "Safe maximum drive" will be applied.

8.3.3.4 Tolerance (degrees C per minute)

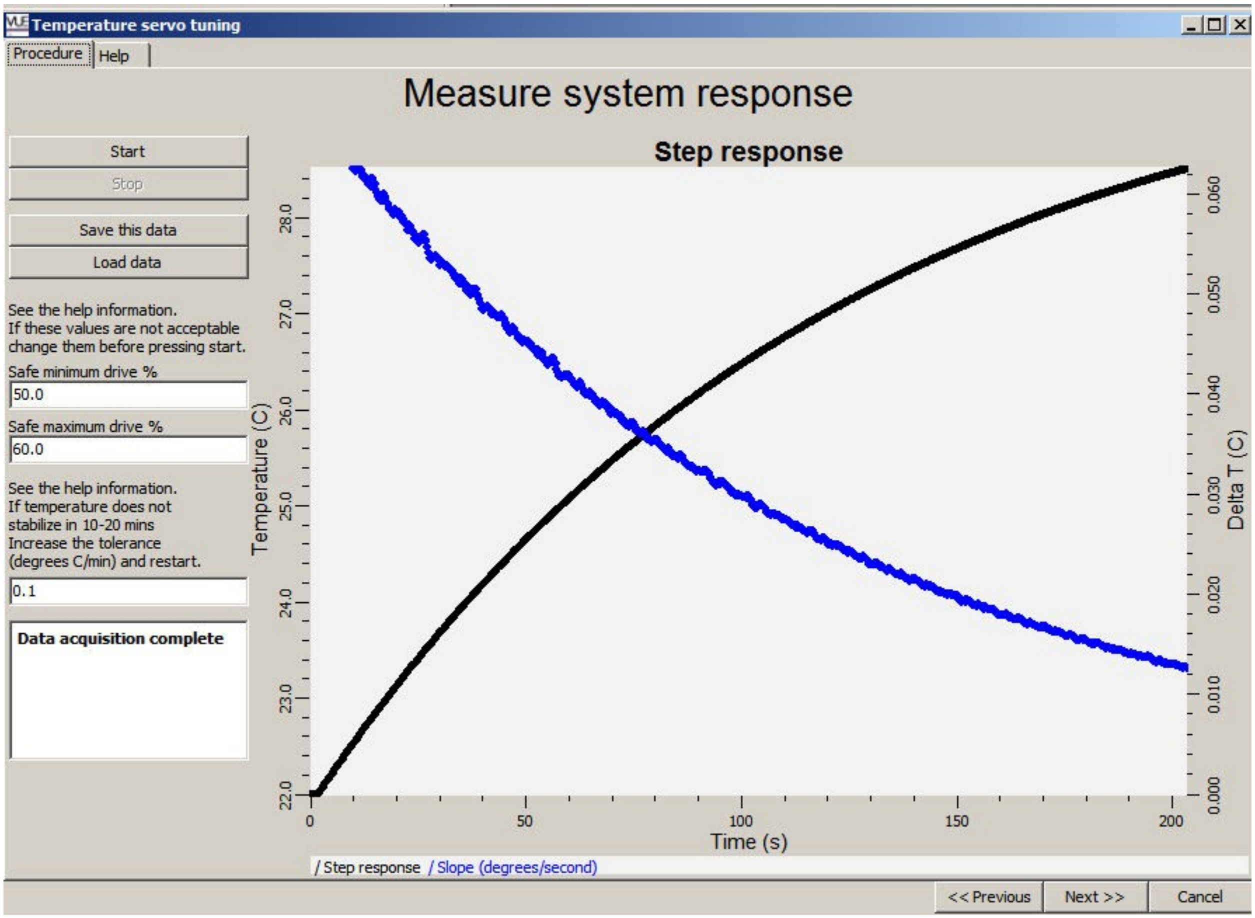
In order for the procedure to work correctly the thermal environment must be stable before the "Safe maximum drive" is turned on. WinVue considers the environment to be stable enough when the change in temperature versus time is less than 0.1 degrees per minute. In some environments this may be difficult to achieve, and you can ease this requirement by entering a larger number before clicking start. In most cases, however, this is not advisable.

8.3.3.5 General considerations

For best results the thermal environment should be kept as stable as possible during this test. In actual operation this is less important since the temperature servo will make the necessary adjustments, but for the purpose of accurately characterizing the system it is a good idea to gather this data under optimum conditions.

Before the data acquisition begins, WinVue will wait for the temperature to stabilize. This will take at least 10 seconds, but if the thermal environment is changing it may take several minutes. After 20 minutes an error message will appear; if necessary the tolerance can be increased as described above.

The data acquisition is automatic. When it stops the window will look approximately like this:



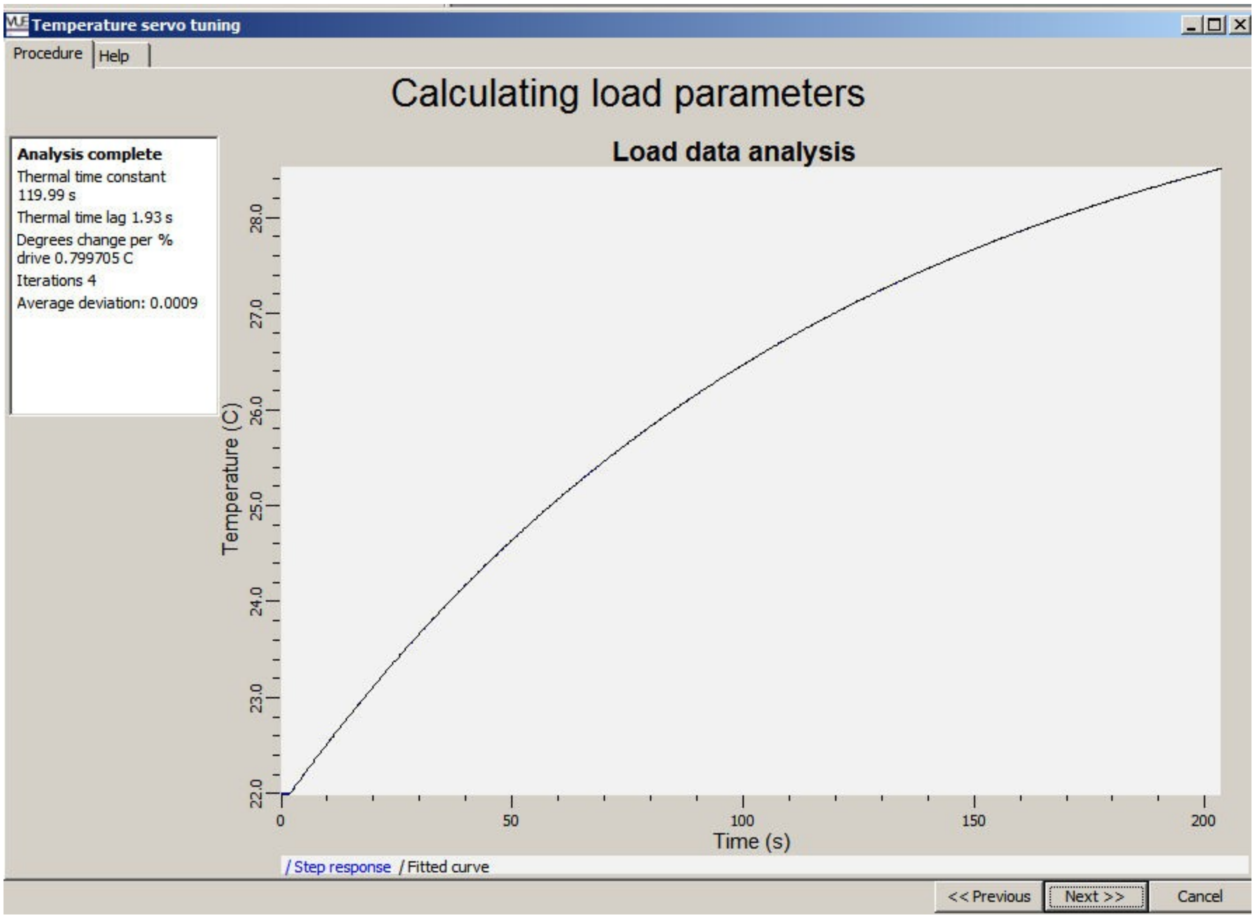
The blue curve is the derivative of the black curve.

If you loaded a previously saved data set the blue curve is not shown.

When the data acquisition stops the "Next" button is enabled.

8.3.4. Calculating load parameters

In this panel the data from the previous panel is parametrized. This procedure is automatic and typically requires less than a few seconds. It is numerical fitting procedure, and results in two curves: one for the raw data, and one for the parametrized curve. They may be almost indistinguishable from each other, as in this example.



8.3.4.1 Theory

Mathematically the black curve is described by the following function:

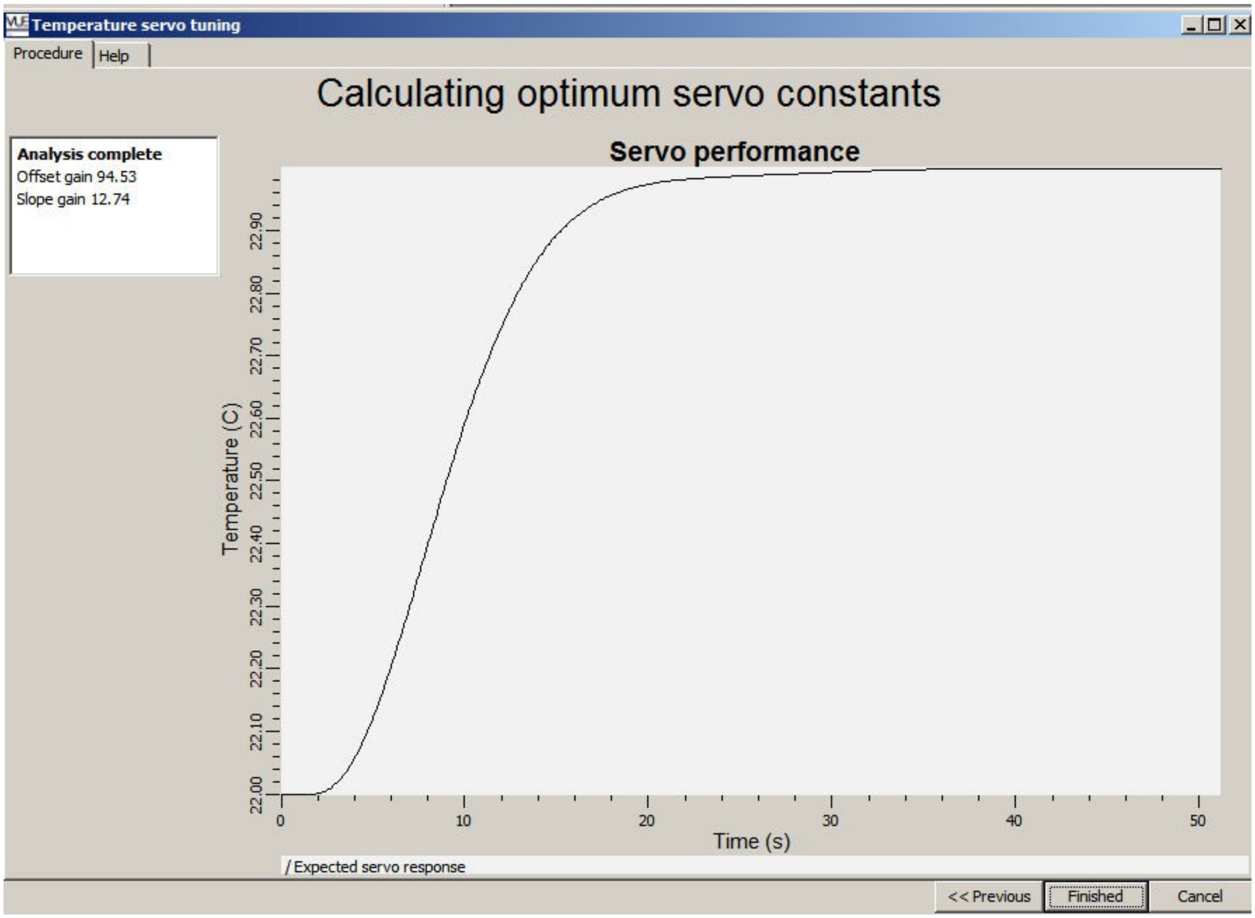
$T(t) = T0 + (T1 – T0) (1 – e^{-(t-t')/\tau})$

where

- T0 is the stable temperature of the system at the “Safe minimum drive”
- T1 is the stable temperature of the system at the “Safe maximum drive,” asymptotically approached during the measurement. T1 and T0 together indicates the magnitude of the system response to a given amount of drive, the “Degrees change per percent drive.”
- t is time
- T is the temperature of the system versus time
- t' is the delay in the response of the sensor, the “Thermal time lag.”
- τ is the thermal time constant of the system

8.3.5 Calculating optimum servo constants

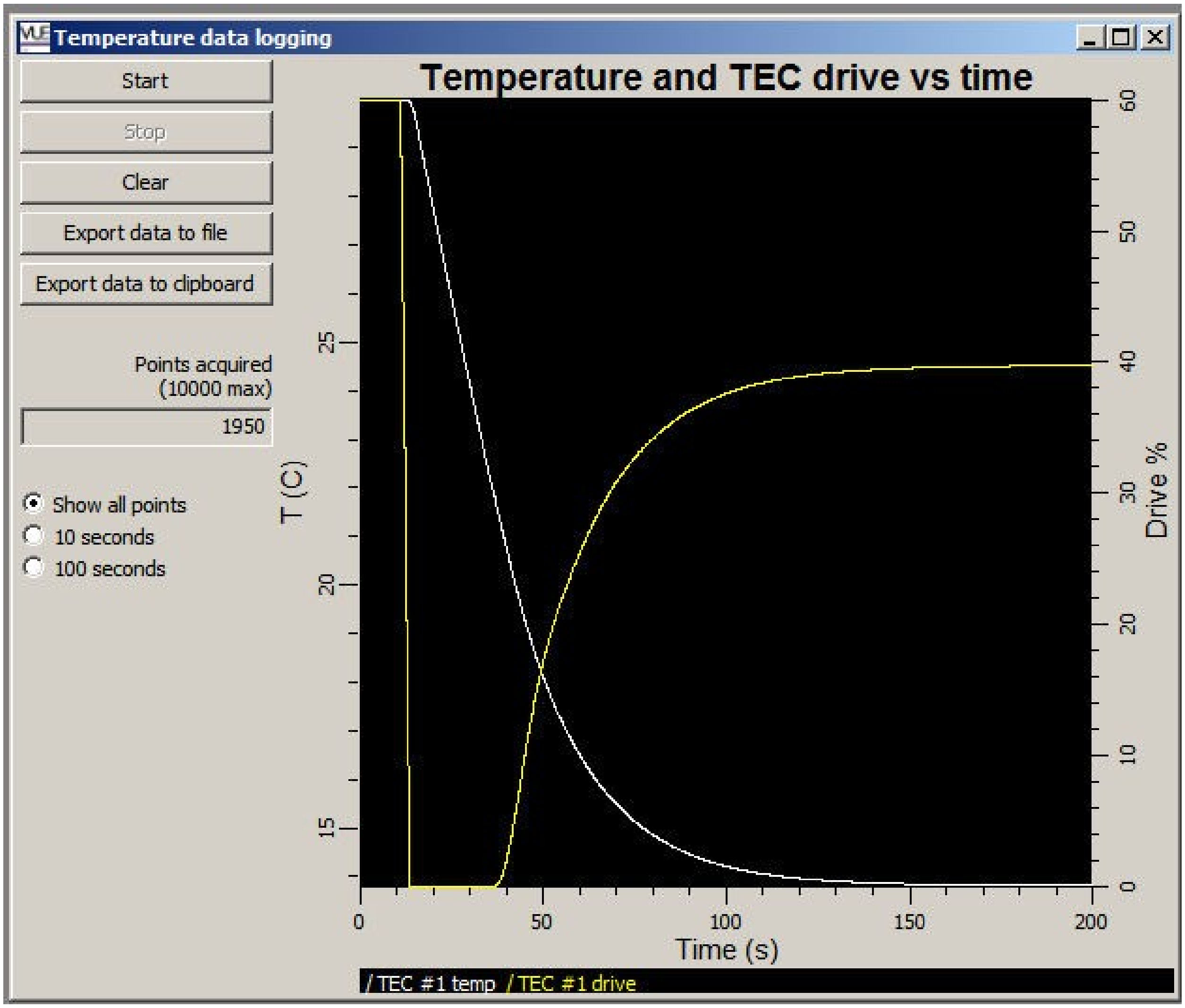
The last panel takes the result from the previous step and uses it another numerical calculation, this one to compute the operating constants for the temperature servo. This procedure is slower than the previous one and will often require more than ten seconds to finish. When the analysis is complete the "Finished" button will become enabled. Click to upload the constants and close the wizard.



The temperature controller is now ready for use. The wizard does not have to be run again unless the thermal environment changes significantly.

8.4 Temperature data logging

At times it may be informative to log temperature versus time, along with the drive settings that were used by the servo.



Here the white curve is temperature and is scaled by the left-hand axis. The yellow curve is drive, scaled by the right-hand axis. On this scale 50% is the neutral point (no voltage across the TEC) and 0% is maximum cooling. The figure shows the action of the driver when changing the temperature from 30ºC to 13.8ºC.

8.4.1 Start

Starts data acquisition.

8.4.2. Stop

Stops data acquisition. This button is enabled when data acquisition is in progress.

8.4.3. Clear

Discards the accumulated data and sets the time to zero.

8.4.4. Export data to file

The data will be stored in a .csv (comma separated value) file. A dialog box will allow you to choose a file name.

8.4.5. Export data to clipboard

The data will be placed on the system clipboard in tab-delimited format, suitable for pasting into text editors or spreadsheets.

8.4.6 Points acquired

After 10000 data points have been collected the data acquisition will stop, otherwise the graphics becomes slow.

8.4.7 Show all points/10 seconds/100 seconds

Controls what portion of the data is shown on the graph. Data points are not discarded.

8.5 Thermistor coefficients

See section 9.

8.6 Measure thermal load

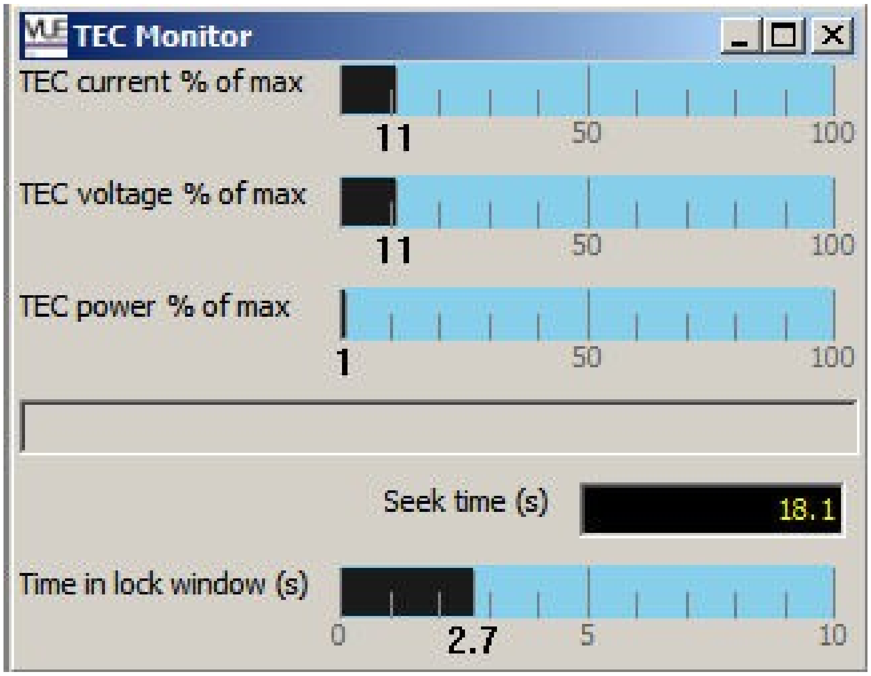
The functions of this window have been replaced by the Temperature Servo Tuning Wizard. It is retained for backward compatibility.

8.7 Temperature servo simulation

The functions of this window have been replaced by the Temperature Servo Tuning Wizard. It is retained for backward compatibility.

8.8 TEC monitor

This window has no control function; it is for diagnostic purposes only. It indicates how close the drive is to one of its maximum settings, either current, voltage or power.

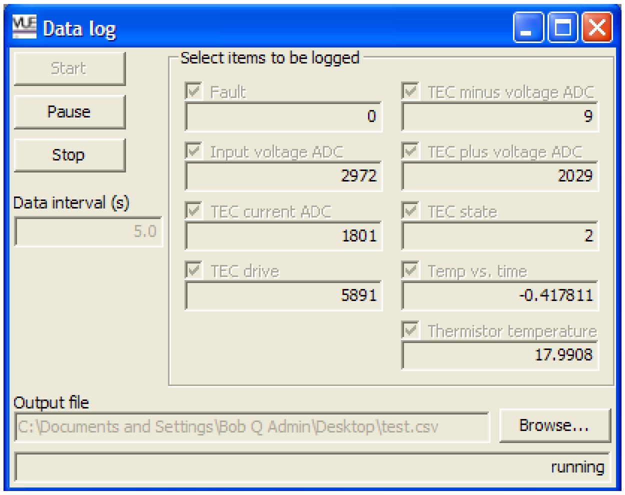


The three bar graphs at the top indicate the percentage of allowed current, voltage, and power that is being produced by the driver. The gray field underneath displays an message when one of the percentages is at the maximum. If this occurs and the temperature is no longer approaching the set point, it constitutes a dangerous condition. The background of the text field turns red and in ten seconds the driver will shut down to protect the system.

The display of "seek time" indicates how long the driver has been trying to acquire the set point. It stops incrementing when the driver is in its "locked" state.

The "Time in lock window" display shows how long the temperature has been within the lock window. After ten seconds the state of the servo changes from "seeking" to "locked."

8.9 Data Log Window



This window records various system data into a comma delimited file.

Start – Starts the data recording process

Pause – Pause the data recording process

Stop – Stops the data recording process

Data Interval – The length of time to pause in between data recordings.

8.10 Service Window

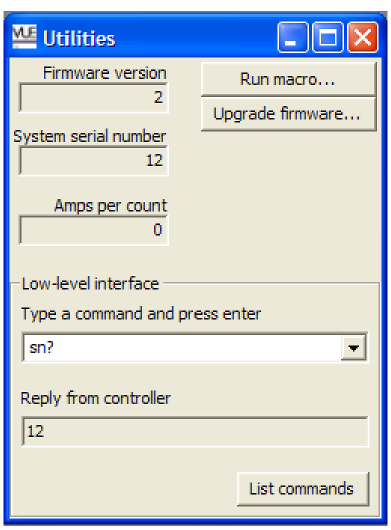
This window displays a number of parameters that are intended for debugging uses only. It may be referred to during tech support sessions.

8.11 Communications Log Window

This window has a single "Enable Logging" button that shows the communications between WinVue and the TEC Driver. It is intended for use during tech support sessions only.

8.12 Utility Window

This window is intended for firmware upgrade and for programmers who will be writing specialized software to command the TEC driver.



Firmware version – This shows the version number of the firmware currently installed.

System serial number – Serial number of the TEC driver

"Type a command" and "Reply from controller" – For example, the "sn?" command returns the current serial number, which is 12.

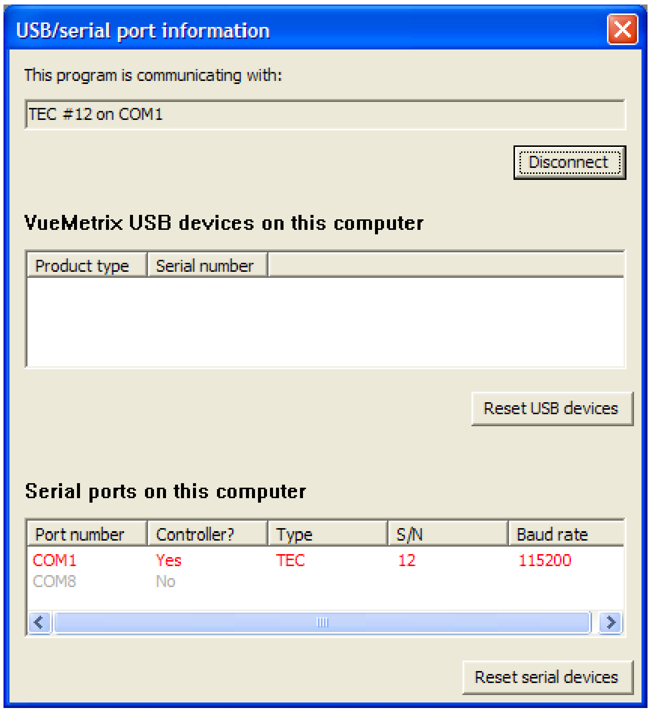
List commands – lists all of the commands implemented on the TEC driver. For a fuller explanation of each command, see the web site. The list in WinVue is always the most up-to-date.

Run macro – You can store a list of commands, like "sn?", in a text file, and run them using the "Run macro…" button.

Upgrade firmware – Use this to load a different version of the driver firmware.

8.13 Connection Settings Window

The "Connection Settings" window is accessed via the "Connection" menu.



Disconnect – Close the port currently being used by WinVue. This allows another program to use the serial port.

Reset USB devices – Rescan the USB bus looking for a TEC driver. This button is used when a TEC driver is attached after WinVue has started.

Reset serial devices – Rescan the COM ports looking for a TEC driver.

9. Thermistor

When the controller ships from the factory it is setup for a particular thermistor, the **RL0503-5820-97-MS** from **Thermometrics**. VueMetrix has selected this as its standard.

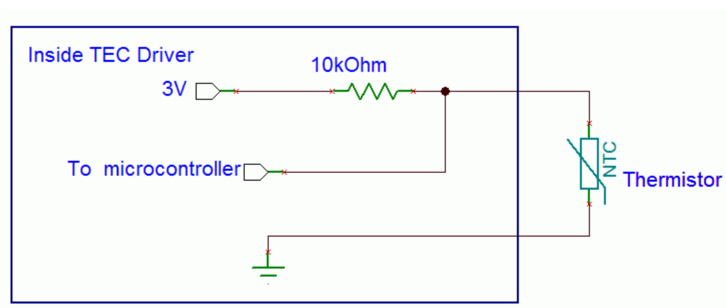
It is a 10kΩ NTC thermistor, so called because:

- its resistance is 10kΩ at 25ºC
- its resistance decreases with temperature, i.e., it has a negative temperature coefficient (NTC).

The circuitry inside the controller is optimized for this general type of thermistor. Others may work but will result in a loss of precision.

Not all 10kΩ NTC thermistors are the same, and the dependence of their resistance on temperature will vary significantly from one device to another. The temperature reported by the controller will be inaccurate unless the procedure in this section is performed.

9.1 Theory



In the controller the thermistor forms a simple voltage divider with a fixed 10kΩ resistor and a 3V source. The divided voltage is read by the microcontroller to compute the current temperature as follows:

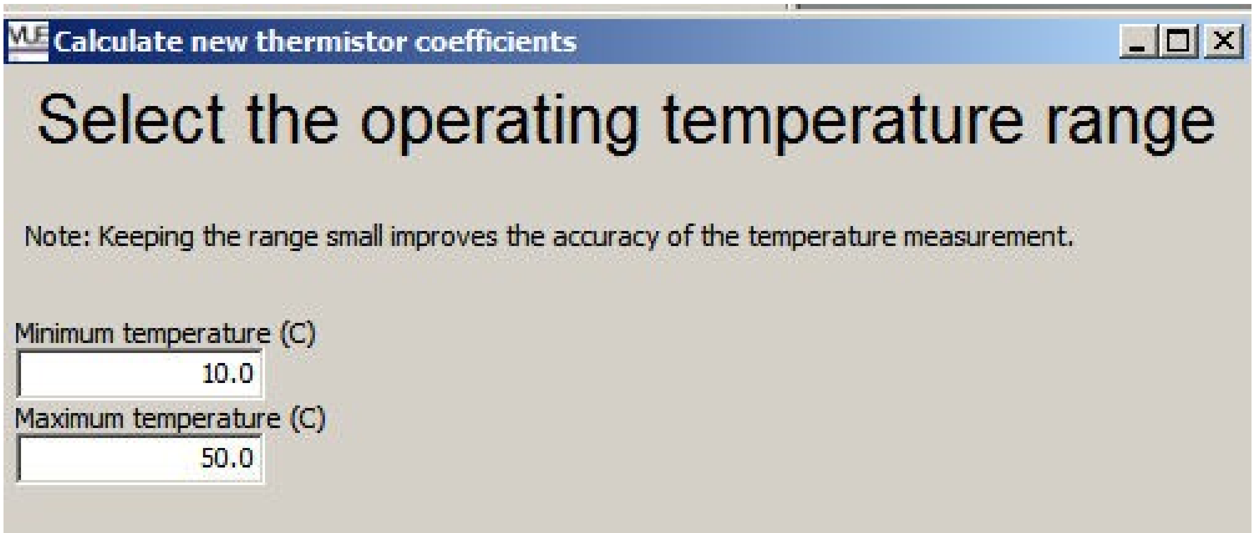
Let V = the voltage across the thermistor
Temperature = $A + BV + CV^2 + DV^3$

The thermistor coefficients (A, B, C, and D) are stored in the TEC driver. Once set they do not have to be changed again unless the thermistor is changed.

9.2 WinVue support

WinVue can calculate new coefficients using the “Thermistor coefficients” window. This window has several pages.

9.2.1 Select the operating temperature range



The numbers you enter here are not critical. The reported temperature will be most accurate within this range.

9.2.2 Select method for providing resistance vs. temperature data

In order to calculate the proper coefficients, WinVue needs to know the resistance of the thermistor as a function of temperature. Unfortunately, thermistor manufacturers use several different methods for characterizing their devices. Sometimes they give a few parameters plus a simple formula; in three of these typical cases WinVue will perform the calculation for you.

In the general case manufacturers provide a table of resistance versus temperature; then WinVue needs a comma-separated value file that contains this data. The file should be formatted as a series of lines *temperature, resistance.* You can use a spreadsheet program or a text editor to create this file.

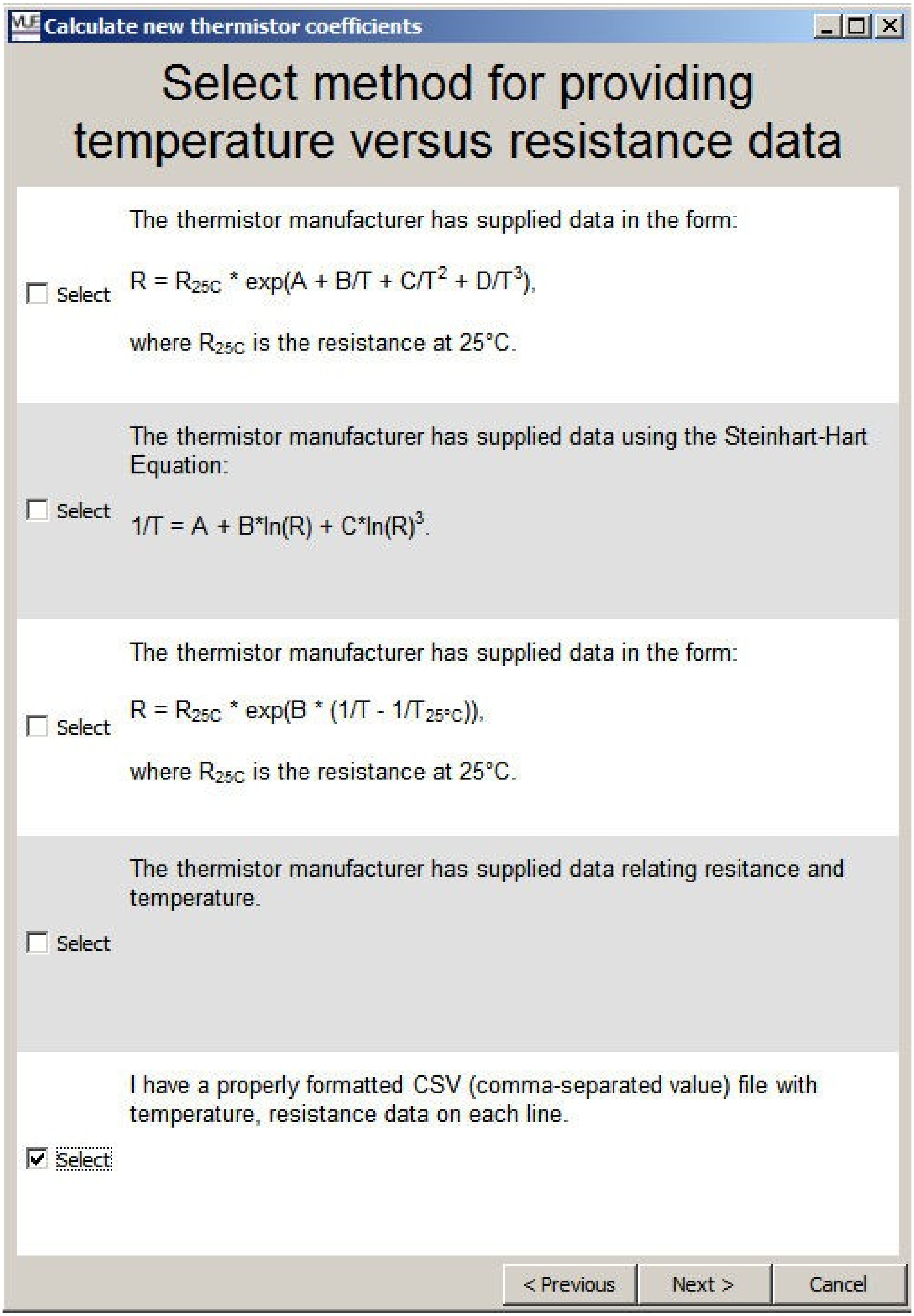
Example:

15.0,15000.0

25.0,10000.0

etc...

In this window select the method you will use and click the appropriate check box. The Next button will become enabled when you do.


Calculate new thermistor coefficients
Select method for providing temperature versus resistance data
The thermistor manufacturer has supplied data in the form:
Select
R = R25C * exp(A + B/T + C/T2 + D/T3),
where R25C is the resistance at 25°C.
The thermistor manufacturer has supplied data using the Steinhart-Hart Equation:
Select
1/T = A + B*ln(R) + C*ln(R)3.
The thermistor manufacturer has supplied data in the form:
Select
R = R25C * exp(B * (1/T - 1/T25°C)),
where R25C is the resistance at 25°C.
The thermistor manufacturer has supplied data relating resitance and temperature.
Select
I have a properly formatted CSV (comma-separated value) file with temperature, resistance data on each line.
Select
< Previous
Next >
Cancel

9.2.3 Check controller parameters

The calculation also requires the value of the fixed (ballast) resistor and the reference voltage. On standard TEC controllers these values are 10000 and 3.0, respectively, and WinVue will enter them automatically. All you need to do is hit Next.


Calculate new thermistor coefficients
Check controller parameters
Two parameters are needed to proceed further. In most cases WinVue knows the correct values and displays them below, and you can simply hit Next and proceed. If your controller has been customized or if this program is not configured for your controller, you can modify these parameters by entering new values here.
Fixed ballast resistor
10000
Reference voltage
3.0
< Previous
Next >
Cancel

9.2.4. Compute new coefficients

The last panel computes new coefficients and displays a graph indicating the dependence of temperature on the measured voltage. It also displays the "residuals," the temperature error at each voltage that results from the use of the cubic equation described in 9.1.

Hit "Finished" to upload these new values into the controller.

Calculate new thermistor coefficients

Compute new coefficients

The Y-values are the voltage that will be sensed by controller as a function of thermistor temperature. The microprocessor converts this voltage to a temperature reading using a simple formula. The second curve is the 'residuals' - the difference between the computed and actual temperature. This shows the accuracy of the parameterization process.

When you press Finish these parameters will be uploaded to the controller.

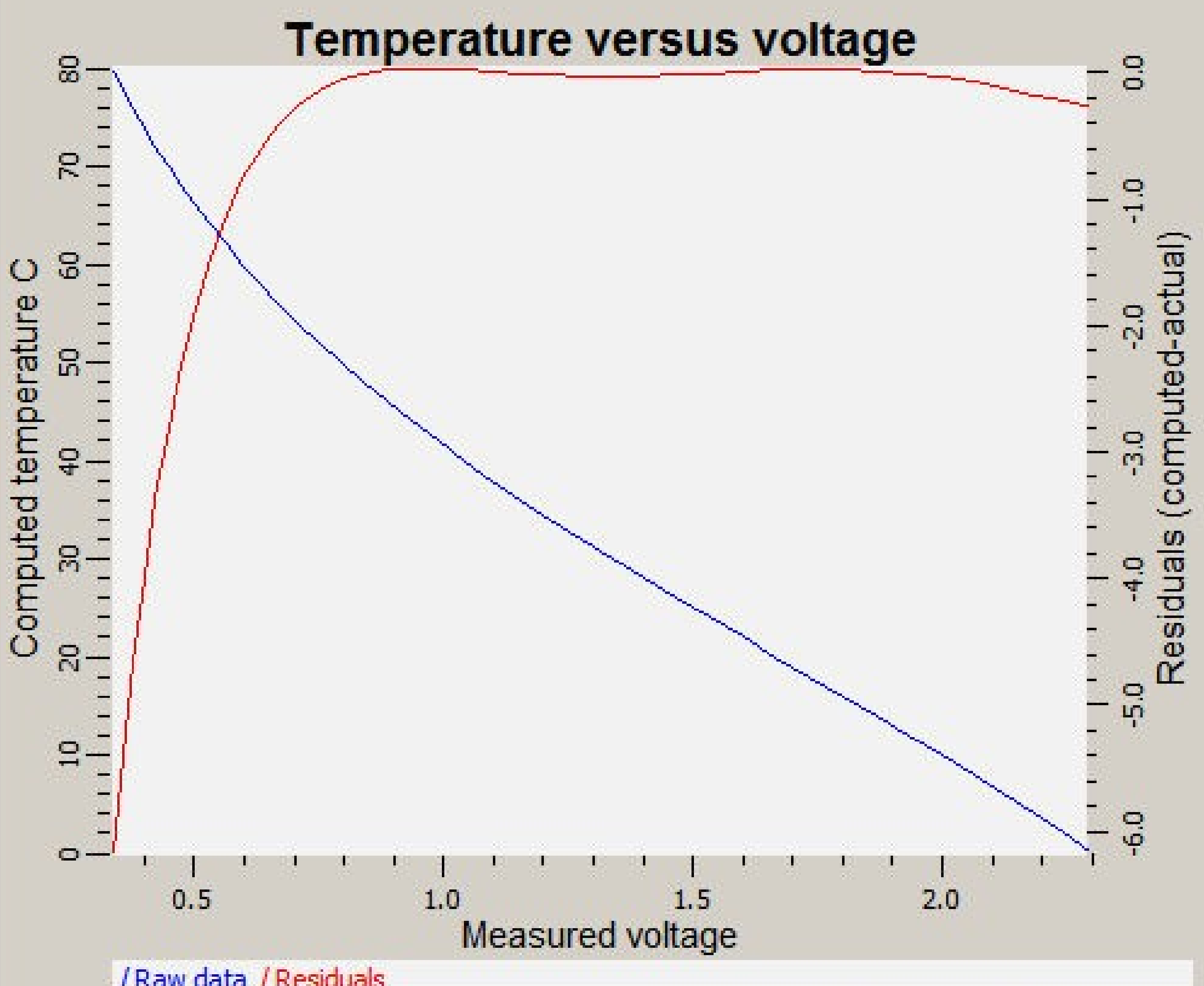
Fitted parameters

A = 97.538039

B = -80.187480

C = 30.307096

D = -6.062185



< Previous | Finished | Cancel

10 Programming and Customization Information

10.1 Communicating with the VueMetrix TEC Driver

10.1.1 RS232 Communication

The RS232 connector uses just three lines: ground, transmit, and receive. There is no flow control or hardware handshake. To open a COM port to the TEC driver, use the following RS232 settings:

Baud rate = 115200
Parity = None
Data bits = 8
Stop bit = 1

All communications are in ASCII text. Each command to the controller should be terminated by either a “>” character, a carriage return or a new line (hex character values 0D and 0A).

All responses are in ASCII text as well. So if the computer asks for the serial number “sn?>”, and if the serial number is “12”, the response will be a character “1” and a character “2”. The response will not be a single byte that represents the numeric 12.

10.1.2 USB Communication

A DLL file is available to simplify the task of communicating with Vue-TEC via the USB. Details are in the support website at http://www.vuemetrix.com/support/ .

10.2 Command List

The full list of commands supported by the TEC driver, go the Utility Window and click on the “List Commands” button. These commands can be tried out in the utility window’s “Type a command…” textbox.

10.3 Further Information

For a detail description of the commands and communicating to Vumetrix products, visit the support website at http://www.vuemetrix.com/support/ , scroll down to the section that says “Programmer’s documentation”.

10.4 Fault Codes

The command “**f?**” returns the operating fault. Here are the fault codes:

0	No Fault
1	Flash memory fault
2	Temperature servo fault
3	Input voltage fault
4	Output voltage fault
5	Over current fault

More details can be obtained with the "**fdesc?**" command. Suppose that "f?" results in fault code 3, the input voltage fault. The "fdesc?" then will result in something like: "Input voltage low (13.03)".

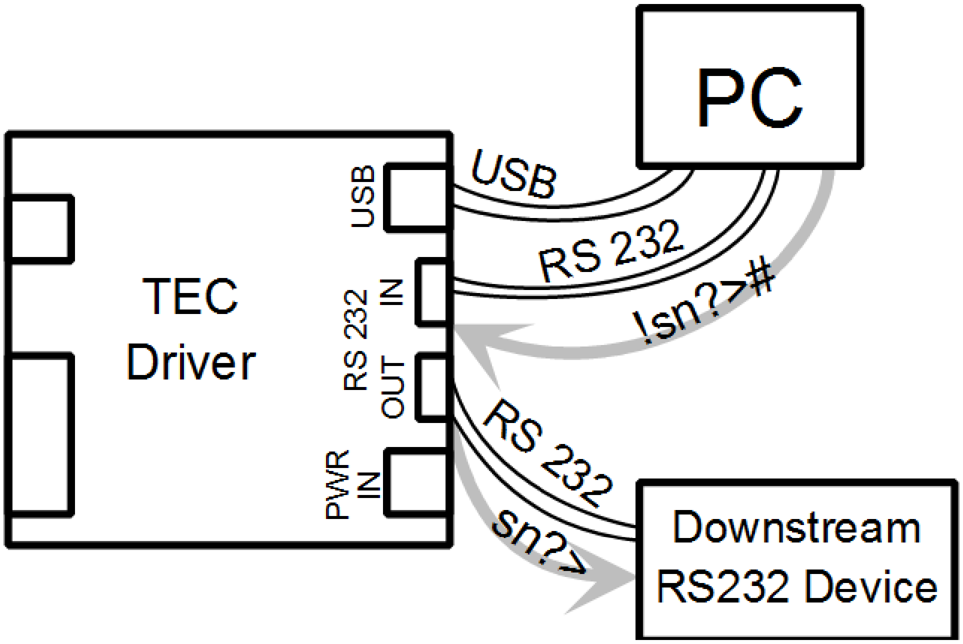
If "f?" returns a 2, meaning temperature servo fault, more information can be obtained using the "**t0s?**" (get servo state) command. The servo state codes are:

0	Off
1	Seeking
2	Locked
3	Manual
101	Drive at upper rail too long – The TEC drive has been at the upper rail (100%) for too long, and the temperature is not increasing.
102	Drive at lower rail too long – The TEC drive has been at the lower rail (0%) for too long, and the temperature is not decreasing.
103	Lost lock – The servo was previously locked but has lost the set point and is unable to reacquire it.
104	No convergence to set point – The servo was unable to acquire lock.
105	Temperature measurement out of bounds – The microprocessor detects a thermistor voltage that is too high, indicating a bad connection to the thermistor.
106	TEC drive hardware fault – The circuit that drives the TEC reported a hardware fault.

For more information, visit the Fault code page at:
http://www.vuemetrix.com/support/tech/faults.html

10.5 Passthrough Feature

The passthrough feature allows the TEC Driver to pass messages to another downstream RS232 device. The connection diagram is shown below:



The command being passed to the TEC Driver is wrapped inside an "!" character and a "#" character. For example, if "!sn?>#" is sent to the TEC driver, the command will be passed to the downstream device as "sn?>".

The passthrough works with USB – You can pass the "!sn?>#" command using either the RS232 IN port or the USB port.

The passthrough expects a reply – The downstream device is expected to send some sort of reply immediately. If there is a reply, it will be relayed to the host PC. If there is no reply within a certain amount of time, a "passthrough timed out" error message will be send to the host PC.

Normal RS232 extension cable is to be used between TEC Driver and the RS232 downstream device – The "RS232 OUT" port transmit and receive signals are already reversed compared to the "RS232 IN" port. This is shown in the "Rear Panel Connectors" section at the start of this manual. This means that the cable connecting the "RS232 OUT" port and the downstream device should be a normal extension cable. The "null modem" cables, where the transmit and receive lines cross over, are not to be used.

Do not type the "#" character in the WinVue Utility Window – The pass through feature can be tested in the WinVue Utility window, but do not type the "#". Instead, simply type "!sn?>". When the WinVue Utility window sees a command starting with the "!" character, it will attach the "#" character at the end automatically.

Appendix: Revision History

1.1.1 Changed connector pin diagrams on page 5 and 6. Re-indexed document. Date 1/19/2010.

2.0 Extensive re-write to reflect WinVue and controller firmware changes. Date 4/3/2010