

**EZcal RTD
User's Guide**

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Section 1

Introduction

Introduction

The EZcal RTD Calibration System is a complete calibration system that duplicates and automates the way an experienced technician calibrates RTD sensors, but without the time consuming manual data entry and calculations. EZcal RTD will reduce calibration time by 50%.

Some features provided by EZcal RTD are:

- Calibrates up to 11 sensors at a time
- Easy to use graphical interface
- Storage of information for up to 10 different reference sensors for easy retrieval
- Storage of information for up to 220 uncalibrated sensors for repeat calibrations
- Storage of up to 10 different calibration procedures for easy retrieval
- Provides a complete calibration report for each sensor including RTD coefficients and an R vs. T table
- Allows for electronic storage of calibration data

Requirements

The entire calibration system consists of:

- The 4312A System Thermometer
- A good quality working standard reference RTD sensor
- A stable temperature source (or sources)
- The EZcal RTD software
- A PC (running Windows 95 or higher) and printer

Installation

Although EZcal RTD creates a number of files when it is run, there is only one file needed for installation. To install the EZcal RTD software, create a folder on the C: drive named C:\EZcal RTD and copy the file named EZcal RTD.exe to that folder

To run EZcal RTD, click Run on the Windows Start Menu and select C:\EZcal RTD\EZcal RTD.exe, double click C:\EZcal RTD\EZcal RTD.exe from within Windows Explorer, or create and use a shortcut on the Windows desktop.

Running EZcal RTD for the First Time

The first time EZcal RTD is run, the communication parameters of the PC are defaulted to ComPort 1, 9600 baud, no parity, 8 data bits, and 1 stop bit (see Section 13: ComPort (4312A) Settings).

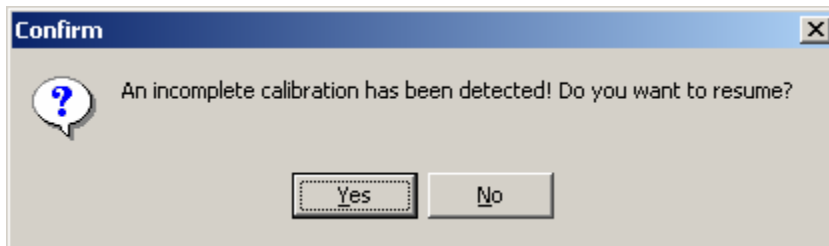
Be sure to match the 4312A RS-232C configuration (refer to the 4312A Operations Manual) to the ComPort (4312A) settings of EZcal RTD.

Any changes made to the EZcal RTD ComPort Settings will be saved to disk and retrieved the next time EZcal RTD is run.

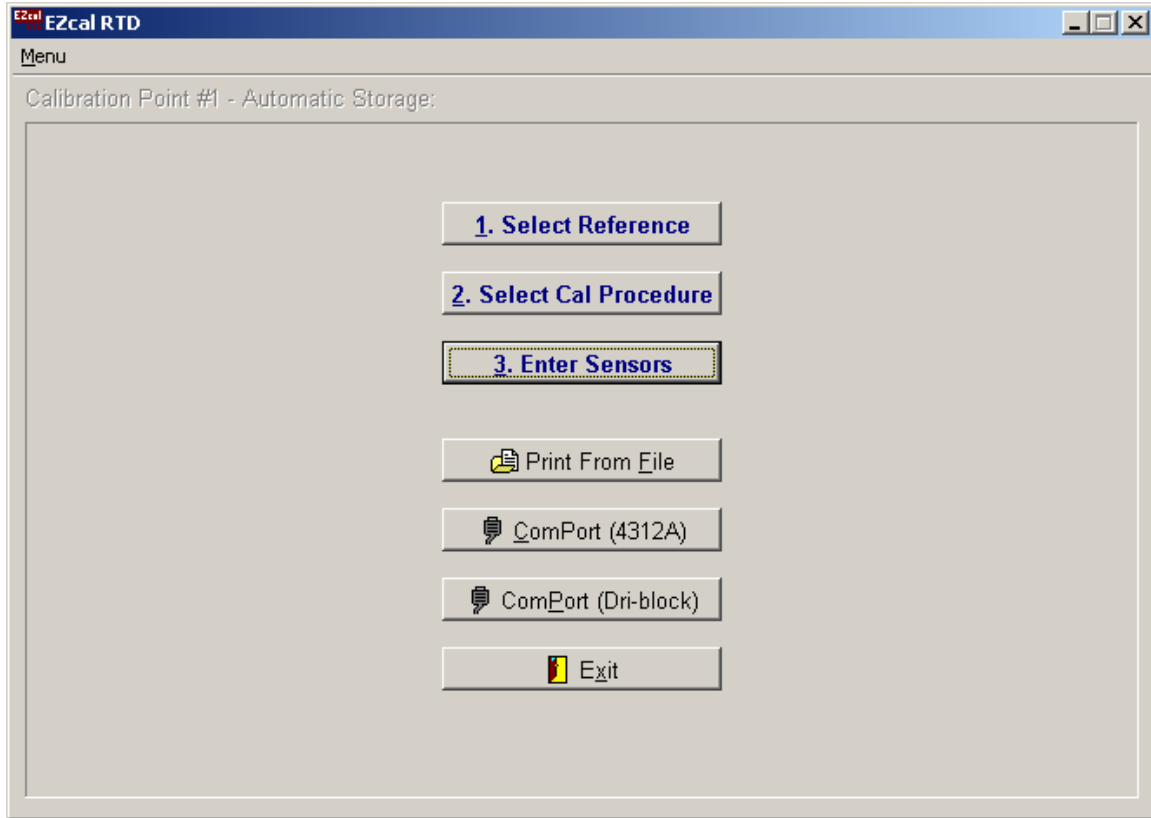
Interrupted Calibration

During the calibration process, EZcal RTD automatically stores its progress to disk as it advances. If for some reason, EZcal is interrupted in the middle of a calibration (e.g., power failure or interrupted communication with the 4312A), it is possible to resume calibration at the last point of progress.

EZcal checks for an interrupted calibration each time it is started. If one is detected, the user will be queried.



Click Yes to resume or No to discard the previous (incomplete) calibration.

Section 2**EZcal RTD Main Window**

To access the EZcal RTD Menu, click Menu in the upper left hand corner of the Main Window. Tool Buttons are located in the center of the Main Page and are provided for most of the Menu items.

- | | |
|-----------------------------|--|
| Select Reference | Click Select Reference to select a reference sensor against which the calibration will be performed (see Section 3: Select Reference). |
| Select Cal Procedure | Click Select Cal Procedure to select the procedure that will define the calibration (see Section 5: Select Calibration Procedure). |
| Enter Sensors | Click Enter Sensors to enter the information for the sensors to be calibrated (see Section 7: Enter Sensors). |
| Print From File | Click Print From File to print a calibration report from previously saved calibration data. |

- ComPort (4312A)** Click ComPort (4312A) to configure the ComPort for communication with the 4312A System Thermometer (see Section 13: ComPort (4312A) Settings).
- ComPort (Dri-block)** Click ComPort (Dri-block) to configure the ComPort for optional communication with a Techne Dri-block (see Section 14: ComPort (Dri-block) Settings).
- Exit** Click Exit to exit from EZcal RTD.
- About** Click About for information regarding the version of the EZcal RTD software.

Section 3

Select Reference

Select Reference Sensor					
	Date	Asset No.	Manufacturer	Model No.	Serial No.
<input checked="" type="radio"/> 0	10/20/2002	11235678	Rosemount	162N100	2027
<input type="radio"/> 1					
<input type="radio"/> 2					
<input type="radio"/> 3					
<input type="radio"/> 4					
<input type="radio"/> 5					
<input type="radio"/> 6					
<input type="radio"/> 7					
<input type="radio"/> 8					
<input type="radio"/> 9					

Calibration is performed against the reference sensor. The reference sensor must be connected to channel 0 of the 4312A.

EZcal RTD allows for storage of information for up to ten reference sensors.

Reference No. Click the number of the reference sensor for which information is going to be selected, edited, or cleared.

OK Click OK once the information for the reference sensor to be used in the calibration has been entered and the appropriate number has been specified.

Note: Each time EZcal RTD is run, it will automatically retrieve the number of the reference sensor that was used for the last calibration.

Edit Click Edit to display the Edit Reference Sensor window (see Section 4: Edit Reference Sensor) for the specified reference sensor.

Clear Click Clear to delete the saved information for the specified reference sensor.

Section 4 Edit Reference Sensor

Edit Reference Sensor #0

10/27/2002

Asset No:

Manufacturer:

Model No:

Serial No:

Calibration Date: ▾

NIST Traceability No:

Coefficients:

R_{tp} =

a₊/a₈ =

b₊/b₈ =

a₋/a₄ =

b₋/b₄ =

Date The present date is displayed and saved.

Asset No. Enter the internal inventory control number of the sensor.

Manufacturer Enter the manufacturer of the sensor.

Model No. Enter the model number of the sensor.

Serial No. Enter the serial number of the sensor.

Calibration Date Enter the date the sensor was last calibrated.

- NIST Traceability No.** Enter the NIST Traceability number of the sensor.
- Rtp** Enter Rtp for the sensor.
- Coefficients** Enter the coefficients (a^+ , b^+ , a^- , and b^- , also known as a_8 , b_8 , a_4 , and b_4) for the sensor.
- OK** Click OK to save the information and return to the Select Reference Sensor window.
- Cancel** Click Cancel to exit without saving any changes that were made.

Section 5 Select Calibration Procedure

Select Calibration Procedure			
	Date	Range	Title
<input type="radio"/> 0	2/4/2003	Pos	Test 1
<input type="radio"/> 1	2/4/2003	Pos	Test 2
<input checked="" type="radio"/> 2	2/4/2003	Pos & Neg	Test 3
<input type="radio"/> 3			
<input type="radio"/> 4			
<input type="radio"/> 5			
<input type="radio"/> 6			
<input type="radio"/> 7			
<input type="radio"/> 8			
<input type="radio"/> 9			

EZcal RTD allows for storage up to ten calibration procedures.

Procedure No. Click the number of the calibration procedure for which information is going to be selected, edited, or cleared.

OK Click OK once the information for the calibration procedure has been entered and the appropriate number has been specified.

Note: Each time EZcal RTD is run, it will automatically retrieve the number of the calibration procedure that was used for the last calibration.

Edit Click Edit to display the Edit Calibration Procedure window (see Section 6: Edit Calibration Procedure) for the specified calibration procedure.

Clear Click Clear to delete the saved information for the specified calibration procedure.

Section 6 Edit Calibration Procedure

Edit Calibration Procedure #2

2/4/2003

Title:

Units:

Range:

Cal Point	Storage	Cal Temp (°C)	Dev (°C)	Period
1	<input type="text" value="Operator"/>	<input type="text" value="0.010"/>	<input type="text" value="0.100"/>	<input type="text" value="1"/>
2	<input type="text" value="Automatic"/>	<input type="text" value="100.000"/>	<input type="text" value="0.200"/>	<input type="text" value="2"/>
3	<input type="text" value="Automatic"/>	<input type="text" value="200.000"/>	<input type="text" value="0.200"/>	<input type="text" value="2"/>
4	<input type="text" value="Automatic"/>	<input type="text" value="-40.000"/>	<input type="text" value="0.200"/>	<input type="text" value="2"/>
5	<input type="text" value="Automatic"/>	<input type="text" value="-60.000"/>	<input type="text" value="0.200"/>	<input type="text" value="2"/>

- Date** The present date is displayed and saved.
- Title** Enter a title for the calibration procedure.
- Units** Select the units for the calibration: °C, °F, or K.
- Range** Select if the calibration is to be over a positive temperature range (3 points) only or if it is to be over both a positive and negative temperature range (5 points).
- Calibration Point** The number of the calibration points displayed depends on the range selected.
- For positive only calibration, there must be a calibration temperature near the triple point and two positive calibration temperatures. For positive and negative calibration, there must also be two negative calibration temperatures.

Note: Calibration temperatures can be listed in any order, but the calibration must be performed in the listed order.

Operator/Automatic Select whether the storage at the calibration point is to be operator entry or automatic (see Sections 8 and 9).

Calibration Temp Enter the calibration temperature for the calibration point.

Deviation For Automatic Storage, enter the deviation for the calibration point (see Section 9: Automatic Storage).

Period For Automatic Storage, enter the period for the calibration point (see Section 9: Automatic Storage).

OK Click OK to save the information and return to the Select Calibration Procedure window.

Cancel Click Cancel to exit without saving any changes that were made.

Section 7

Enter Sensors

Ch	Status	Asset No.	Manufacturer	Model No.	Serial No.
1	Scan	11778342	Instrulab	840	64123
2	Scan	11778343	Instrulab	840	65667
3	Scan	11777010	Instrulab	840	66556
4	Scan	11777006	Instrulab	840	65667
5	Scan	11777007	Instrulab	840	62222
6	Skip				
7	Skip				
8	Skip				
9	Skip				
10	Skip				
11	Skip				

EZcal RTD allows for calibration of up to eleven sensors. Sensors may be connected to any channel from 1 to 11 of the 4312A.

Channel No. The channel numbers correspond to those of the 4312A.

Scan/Skip Select whether a sensor to be calibrated is connected to the channel (Scan) or not (Skip).

Asset No. Enter the internal inventory control number of the sensor connected to the channel.

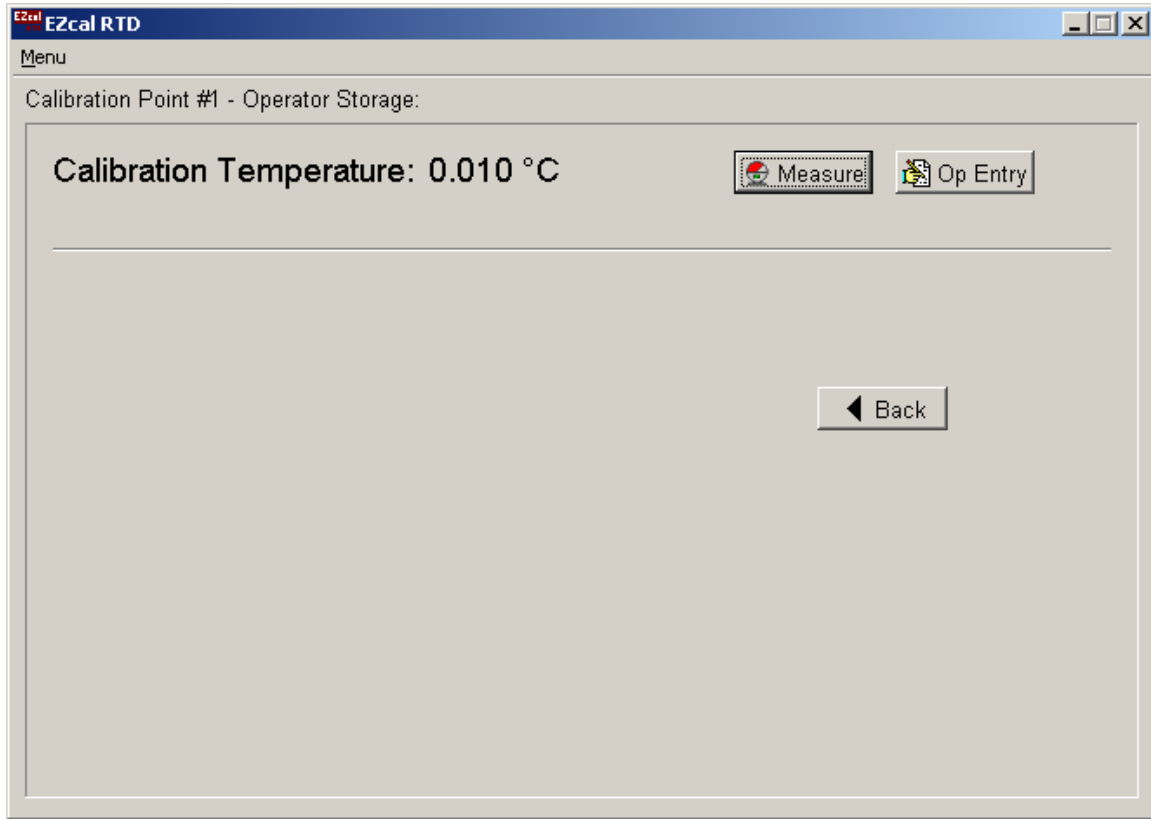
Note: If sensor information has previously been saved, an asset number can be selected from the pull-down list. When this is done, all sensor information will automatically be entered in the information boxes for the selected channel.

Manufacturer Enter the manufacturer of the sensor connected to the channel.

Model No. Enter the model number of the sensor connected to the channel.

- Serial No.** Enter the serial number of the sensor connected to the channel.
- Save** In some applications, the same sensors will be calibrated repeatedly. EZcal RTD provides a shortcut for entering sensor information. Information for up to 220 sensors can be saved and accessed by asset number.
- Click Save to save the information for all sensors listed on the Enter Sensors window.
- Delete** Click Delete to display the Delete Saved Sensor Info window. Once the window is displayed, highlight the asset numbers of the sensors to delete and click Delete.
- Clear** Click Clear to clear all information from the form.
- Ok** Click Ok to begin the calibration procedure.
- Note:** At this time, the programmed information for the reference sensor will automatically be sent to the 4312A for channel 0. Also, the command for the selected channels to scan and display in ohms will automatically be sent.
- Cancel** Click Cancel to return to the Main Window without beginning the calibration procedure.

Section 8 Operator Storage



Operator storage at a calibration point serves two purposes. First, it allows for manual entry of a known source temperature. Second, in cases where there is space for only one sensor in the temperature source, it allows the reference sensor and each sensor to be calibrated to be measured one at a time.

Cal Point Heading The number of the calibration point and the storage type is displayed.

Calibration Temp The specified calibration temperature at the calibration point is displayed.

Note: The calibration temperature is displayed for reference purposes only. EZcal RTD does not control the temperature source when the storage type is Operator.

Measure Click Measure to measure the temperature source.

Insert the reference sensor into the temperature source and click Start to begin measuring.

Click Record to record the measurement.

Back Click Back to go back to the previous calibration point.

Next Click Next to continue the calibration.

Repeat Click Repeat to repeat the measurement.

Op Entry Click Op Entry to manually enter the known source temperature.

Once the reference temperature has been recorded, measurements for each sensor to be calibrated can be performed.

Channel Number The channel number of the sensor to be measured is displayed.

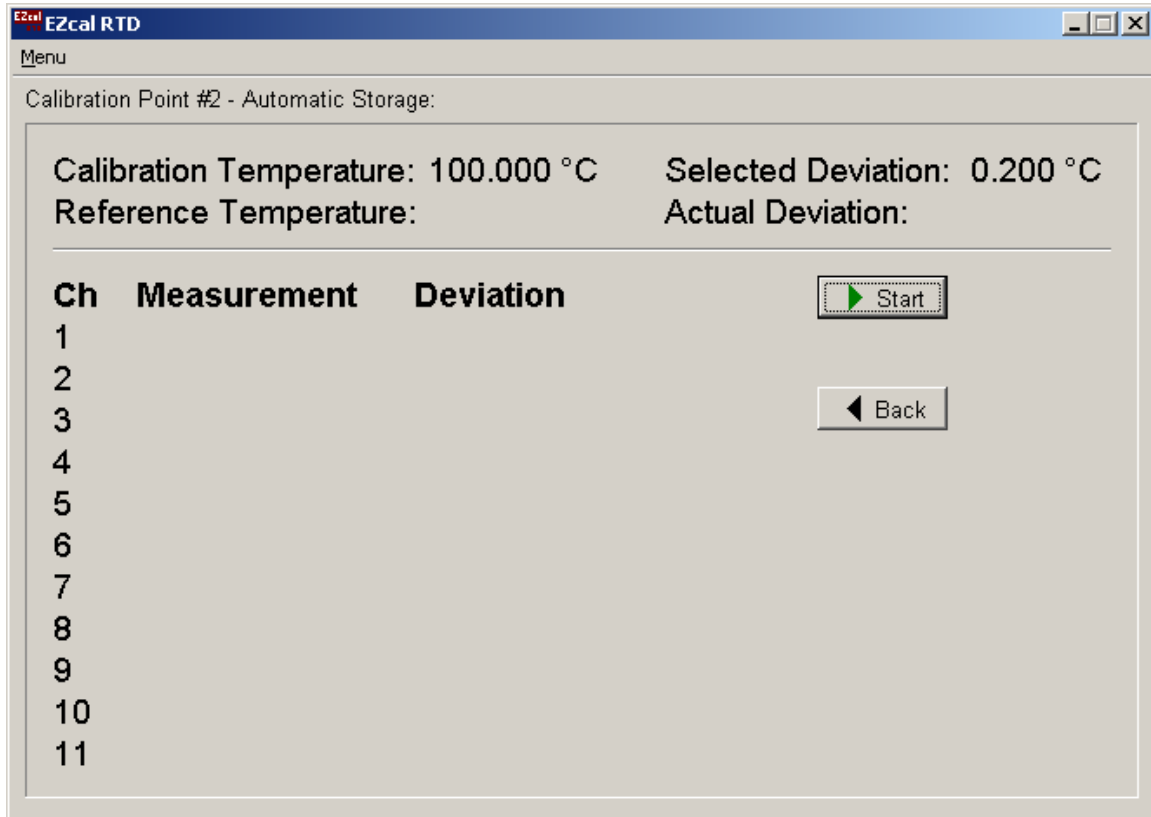
Measurement Insert the sensor into the temperature source and click Start to begin measuring.

Back Click Back to discard all measurements for the calibration point and start over.

Next Click Next to continue the calibration.

Repeat Click Repeat to repeat the measurement.

Section 9 Automatic Storage



In most cases, automatic storage will be the storage type selected. At each calibration point, automatic storage will perform all of the functions of the technician.

Cal Point Heading The number of the calibration point and the storage type is displayed.

Calibration Temp The specified calibration temperature at the calibration point is displayed.

Note: If dri-block communication is enabled (see Section 14: ComPort (Dri-block) Settings), EZcal RTD will automatically adjust the set point of a Techne Dri-block for positive calibration points.

Insert the reference sensor and the appropriate sensors to be calibrated into the temperature source and click Start to begin the calibration.

Reaching Temp EZcal RTD begins measuring the reference sensor. "Reaching Temperature" is flashed within the window until the source temperature is within $\pm 0.5^\circ$ of the calibration temperature.

Note: If the source temperature settles to a stable value but is outside of the $\pm 0.5^\circ$ temperature band, click Override to manually override and begin calibration.

Settling

Once the reference temperature is within the $\pm 0.5^\circ$ temperature band, it must stay there for one minute.

“Settling” and a countdown timer are displayed during this period.

Note: If the source temperature drifts outside of the $\pm 0.5^\circ$ band, the timer will reset.

Calibrating

At the conclusion of the Settling period, EZcal RTD records the reference temperature and begins the actual calibration for the point.

EZcal RTD begins storing measurements for the reference sensor and the sensors to be calibrated. EZcal continues to do so for the duration of the user defined period (see Section 6: Edit Calibration Procedure).

“Calibrating” and a countdown timer are displayed during this period.

Note: If the source temperature should deviate from the temperature recorded at the conclusion of the Settling period by more than the user defined deviation (see Section 6: Edit Calibration Period), a new temperature will be recorded, the timer will be reset, and EZcal RTD will begin storing measurements over again.

Click Override to manually override the user defined period.

At the conclusion of the Calibrating period, EZcal RTD will sound an alarm to alert the user.

The displayed measurements are the last measurements taken for the reference sensor and each sensor being calibrated. However, each sensor’s average measurement over the user defined period is used in the calculation of the coefficients.

Selected Deviation The user defined deviation for the calibration point is displayed.

Actual Deviation The actual deviation over the user defined calibration period is displayed for the reference sensor.

Sensor Deviation The deviation over the calibration period is displayed for each sensor being calibrated.




Note: The deviations are displayed to indicate the validity of the sensor measurements. They are not used during the calibration procedure.

- Back** Click Back to go back to the previous calibration point.
- Next** Click Next to advance to the next calibration point.
- Repeat** Click Repeat to repeat the measurements.

Section 10

Select Output

Select Output

Channel: 1   

Manufacturer: Instrulab
 Model No: 840
 Serial No: 65667
 Asset No: 1177006

Calibration Data

Temperature	Resistance
0.010°C	99.086 0
100.000°C	138.392 0
200.000°C	175.326 0

Coefficients

Rtp = 99.0860
 a+/a8 = 2.62130E-02
 b+/b8 = -4.12141E-02

Channel

Select the channel number of the sensor for which the calibration data is to be saved or printed.

Summary Info

For the specified sensor, the user entered sensor information along with the calibration data and calculated coefficients are displayed for review.

Print

Click the Print button to advance to the Print window and print the calibration report for the specified sensor.

Save To Disk

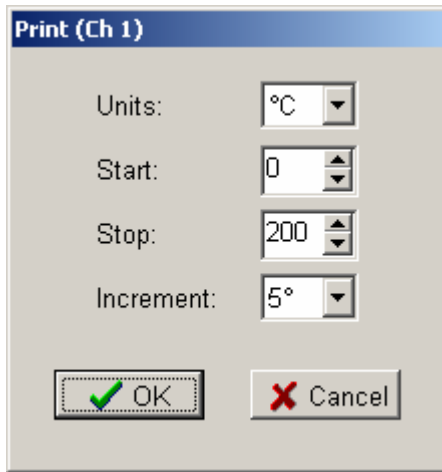
Click the Save To Disk button to save the calibration data for the specified sensor.

Done

Click Done to return to the Main window when finished printing and saving data for all calibrated sensors.

Section 11

Print

**Units**

Select the units for the calibration report.

Note: The units selected for the calibration report need not be the same units used during calibration.

Start

Enter the starting temperature of the R vs. T table (see Section 12: Calibration Report).

Note: The start temperature cannot fall outside of the 4312A's measuring range (i.e. -190 °C to 500 °C).

It is advised not to print below 0 °C for a positive only calibration, since the data will not be valid.

Stop

Enter the ending temperature of the R vs. T table.

Note: The stop temperature cannot fall outside of the 4312A's measuring range (i.e. -190 °C to 500 °C).

Increment

Select the increment for the R vs. T table: 0.1°, 1°, 5°, or 10°.

OK

Click OK to print the calibration report.

Cancel

Click Cancel to return to the Select Output window without printing.

Section 12 Calibration Report

Each calibration report contains the date the report was printed, the reference sensor information, the calibrated sensor information, the calibration data, the calculated coefficients for the calibrated sensor, and an R vs. T table.

Instrulab Inc.

EZcal RTD Version 1.0

10/29/2002

Calibration Performed by _____

Reference Sensor

Manufacturer	: Rosemount	Model No.:	162N100
Serial No.	: 2027	Asset No.:	II235678
NIST Trace No.:		Cal. Date:	7/26/2002

Calibrated Sensor

Manufacturer	: Instrulab	Model No.:	840
Serial No.	: 65667	Asset No.:	II777006

Calibration Data

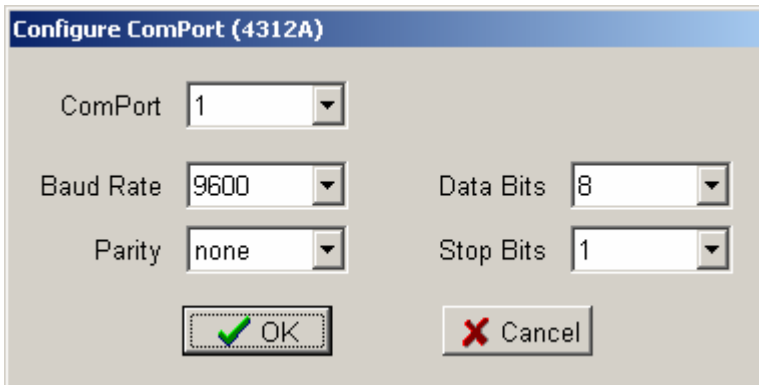
Temperature	Resistance
0.010°C	99.086 Ω
100.000°C	138.392 Ω
200.000°C	175.326 Ω

Coefficients

Rtp	=	99.0860
a+/a8	=	2.62130E-02
b+/b8	=	-4.12141E-02

T (C)	R (Ω)	T (C)	R (Ω)
0	99.082	150	157.141
5	101.108	155	158.984
10	103.127	160	160.822
15	105.140	165	162.654
20	107.146	170	164.481
25	109.146	175	166.302
30	111.140	180	168.118
35	113.127	185	169.928
40	115.107	190	171.733
45	117.082	195	173.532
50	119.050	200	175.326
55	121.012		
60	122.967		
65	124.917		
70	126.860		
75	128.797		
80	130.728		
85	132.653		
90	134.572		
95	136.485		
100	138.392		
105	140.293		
110	142.188		
115	144.078		
120	145.961		
125	147.839		
130	149.711		
135	151.577		
140	153.437		
145	155.292		

Section 13 ComPort (4312A) Settings



Click ComPort (4312A) on the Main window to display the Configure ComPort (4312A) window.

The displayed settings are for the PC's ComPort. These settings must match those of the 4312A System Thermometer in order for the 4312A to properly communicate with EZcal RTD.

ComPort settings are saved to disk and retrieved each time EZcal RTD is run.

ComPort	Specifies the ComPort of the PC to which the 4312A is connected.
Baud Rate	Specifies the baud rate of the serial communication between the PC and the 4312A (1200, 2400, 4800, or 9600).
Parity	Specifies the parity for the serial communication between the PC and the 4312A (none, odd, or even).
Data Bits	Specifies the number of data bits for the serial communication between the PC and the 4312A (7 or 8).
Stop Bits	Specifies the number of stop bits for the serial communication between the PC and the 4312A (1 or 2).

To accept any changes made to the ComPort settings, click OK.

To exit without changing the ComPort settings, click Cancel.

Section 14 ComPort (Dri-block) Settings

Configure ComPort (Dri-block)

Enable Dri-block Communication

Address 1

ComPort 3

Baud Rate 9600 Data Bits 8

Parity even Stop Bits 1

EZcal provides for communication with a Techne Dri-block Calibrator. When **Enable Dri-block Communication** is checked, EZcal RTD will automatically adjust the set point of the dri-block for each of the positive calibration points for which the Storage type is set to Automatic.

Click ComPort (Dri-block) on the Main window to display the Configure ComPort (Dri-block) window.

The displayed settings must match those of the dri-block in order for the dri-block to properly communicate with EZcal RTD. All settings are saved to disk and retrieved each time EZcal RTD is run.

Address Specifies the programmed address of the dri-block.

Check Click Check to test the communication settings by attempting to change the set point of the dri-block to 50.0°.

Note: EZcal RTD sends set point values per the specified units for the Calibration Procedure. In order for the set point to be set properly, the dri-block must be configured for the same units. Also, EZcal expects the dri-block to be configured for one digit of resolution.

ComPort Specifies the ComPort of the PC to which the dri-block is connected.

Baud Rate Specifies the baud rate of the serial communication between the PC and the dri-block (1200, 2400, 4800, or 9600).

Parity Specifies the parity for the serial communication between the PC and the dri-block (none, odd, or even).

Data Bits Specifies the number of data bits for the serial communication between the PC and the dri-block (7 or 8).

Stop Bits Specifies the number of stop bits for the serial communication between the PC and the dri-block (1 or 2).

To accept any changes made to the ComPort settings, click OK.

To exit without changing the ComPort settings, click Cancel.