TempCal

Field Calibration Software
for
DTS3250 Series Modules

V1.02

1/2011

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Table of Contents

INTRODUCTION.. 1

REQUIREMENTS. 2
Hardware. 2
Software. 2

SOFTWARE INSTALLATION. 3

GETTING STARTED.. 4
Start Up Page. 4
Main Menus. 5
File.. 5
Exit. 5
Setup. 6
Device. 6
Volt. 7
Directories. 8
Skip Initialization. 9
As Received Tests.. 9
Cal and Val Tests.. 9
All Tests.. 9
Utilities. 10
Save ListA Data to File. 10
Upload ListA Data from File. 10
Generate As Received Report 10
Generate Validation Report. 10
Debug. 11
Volt. 11
Help. 12
About. 12
Test Controls. 13
A/D Test. 13
Clear Offsets. 13
A/D Init. 14
Board 1 2 3 4. 14
As Received RTD. 14
Calibration RTD. 14
Validation RTD. 14
As Received T/C. 14
Calibration T/C.. 14
Validation T/C. 15
Report As Received. 15
Report Validation. 16
Replace Original Settings. 16
Save Cal to DTS. 17
Reset. 17

INSTALLING THE CALIBRATION HARNESS.. 18
16 Channel Unit. 18
32 Channel Unit. 22
64 Channel Unit. 27

MANUAL TEST OPERATION. 32
Defining a Test. 32
Device Setup. 32
Volt. 33
Directories. 34
Test Controls. 35
Running a Test. 36
A/D Test. 37
Connect RTD Cables. 38
As Received RTD. 39
Calibration RTD. 40
Validation RTD. 41
Connect T/C Cables. 42
As Received T/C. 43
Calibration T/C. 44
Validation T/C. 45
Report As Received. 46
Report Validation. 46
Replace Original Settings. 46
Save Calibration To DTS. 46
Validation. 48
Validation Reports. 48
Functional Validation. 51

AUTOMATIC TEST OPERATION. 52
Defining a Test. 52
Device Setup. 52
Volt. 53
Directories. 54
Test Controls. 55
Running a Test. 56
A/D Test. 57
Connect RTD Cables. 58
Connect T/C Cables. 59
Report Validation. 60
Replace Original Settings. 60
Save Calibration To DTS. 60
Validation. 62
Validation Reports. 62
Functional Validation. 65

Appendix A - Standard Voltage Response Limits. 66

Appendix B - Sample As Received Certificate of Calibration. 67

Appendix C - Sample Certificate of Calibration. 71

Appendix D - Software Change Log 75

Figures and Illustrations

Figure 1 - Main Window. 4
Figure 2 - File Menu. 5
Figure 3 - Setup Menu. 6
Figure 4 - Device Setup Window. 6
Figure 5 - Volt Setup Window. 7
Figure 6 - Directories Setup Window. 8
Figure 7 - Utilities Menu. 10
Figure 8 - Debug Menu. 11
Figure 9 - Help Menu. 12
Figure 10 - A/D Test Control. 13
Figure 11 - Clear Offsets Control. 13
Figure 12 - A/D Initialization Control. 14
Figure 13 - Board Validation and Calibration Controls. 15
Figure 14 - Report As Received Control. 15
Figure 15 - Report Validation Control. 16
Figure 16 - Replace Original Settings Control. 16
Figure 17 - Save Calibration to DTS Control. 17
Figure 18 - Reset. 17
Figure 19 - Validation cover page. 48
Figure 20 - Original Certificate of Calibration. 49
Figure 21 - New Certificate of Calibration. 50
Figure 22 - Validation cover page. 62
Figure 23 - Original Certificate of Calibration. 63
Figure 24 - New Certificate of Calibration. 64

Tables

Table 1 - RTD Voltage Response Limits. 66
Table 2 - Thermocouple Voltage Response Limits. 66
Table 3 - Sample As Received Summary Sheet. 67
Table 4 - Sample As Received Channel Error Report. 70
Table 5 - Sample Post Calibration Summary Sheet. 71
Table 6 - Sample Post Calibration Channel Error Report. 74

INTRODUCTION

This software is designed to re-calibrate the voltage A/D's of all DTS3250 series Thermocouple Scanners with software version 3.05 or 4.0 and newer. The software is designed to perform calibrations in either an automatic or manual mode. In the automatic mode the software will communicate with any Fluke Voltage Standard listed in the equipment requirements. In the manual mode, the user may use other secondary voltage standards. The software will prompt the user to input voltages at each point. Scanivalve recommends performing a voltage calibration (using TempCal) every six (6) months and that each of the module's RTD's be recalibrated every five (5) years. Please consult the factory for full RTD calibration procedures.

REQUIREMENTS

Hardware

Computer

Pentium IV Processor or better
2 Mb RAM
GPIB connection

Voltage Standard

Automatic Calibration

Fluke 5440B
Fluke 5700A

Manual Calibration

DC Voltage Standard

Range:	–10 mV to +131 mV.
Accuracy:	±1.5µV or better

Accessories

16 Channel DTS:

Scanivalve 21079-1 DTS Field Calibration Kit consisting of:
- 155870-1 DTS Calibration Board Set (1)
- 155868-1 DTS RTD Extension Cable (2)
- 155869-1 RTD Excitation Measurement Cable (1)
- 21089-1 Calibration Insulation (2)

32 Channel DTS:

Scanivalve 21079-2 DTS Field Calibration Kit consisting of:
- 155870-1 DTS Calibration Board Set (2)
- 155868-1 DTS RTD Extension Cable (4)
- 155869-1 RTD Measurement Cable (1)
- 21089-1 Calibration Insulation (4)

64 Channel DTS:

Scanivalve 21079-3 DTS Field Calibration Kit consisting of:
- 155870-1 DTS Calibration Board Set (4)
- 155868-1 DTS RTD Extension Cable (8)
- 155869-1 RTD Measurement Cable (1)
- 21089-1 Calibration Insulation (8)

Software

Windows XP Professional SP2 or higher or Windows 7.
Framework.net V2.0 or higher**
Microsoft Excel 2003 or Open Office version 3

**Framework.net is available as a free download from Microsoft.

SOFTWARE INSTALLATION

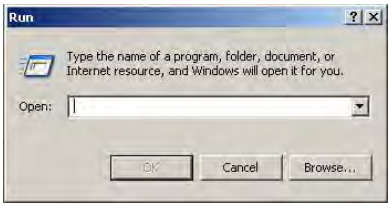
The TempCal Installation disk contains the following programs and files:

DTSCalsetup.msi
Setup.exe

To install the software,

1. Place the Install CD in a CD or DVD drive
2. Click **Start**, then **Run**

3. Select



4. Open the drive where the CD is installed, highlight **Setup.exe** and Click **Open**
5. Click **OK** in the Run Window to start the installation process.
6. Follow the on screen prompts to complete the installation process.

If TempCal has been downloaded from the Scanivalve website, unzip the file and double-click on the **Setup.exe** file. Follow the on screen prompts to complete the installation process.

GETTING STARTED

Start Up Page

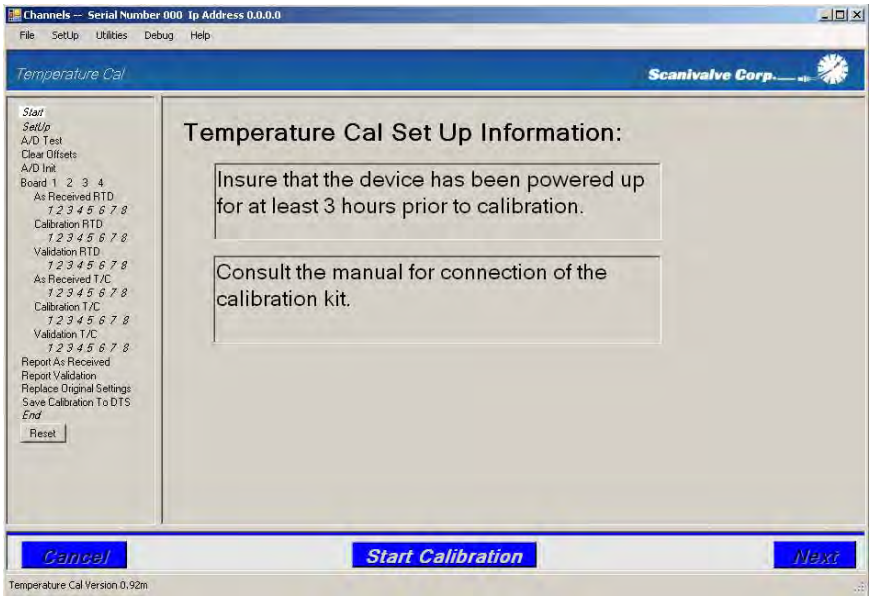


Figure 1 - Main Window

Main Menus

File

Exit

Clicking this option will close the TempCal program.

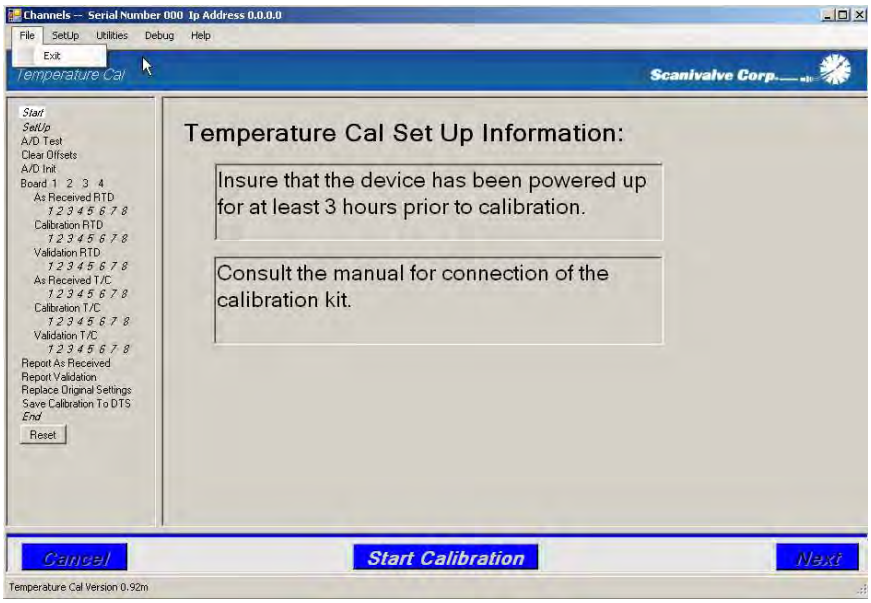


Figure 2 - File Menu

Setup

The options listed under setup are used to define the test. **The options are listed in the order in which they must be defined**.

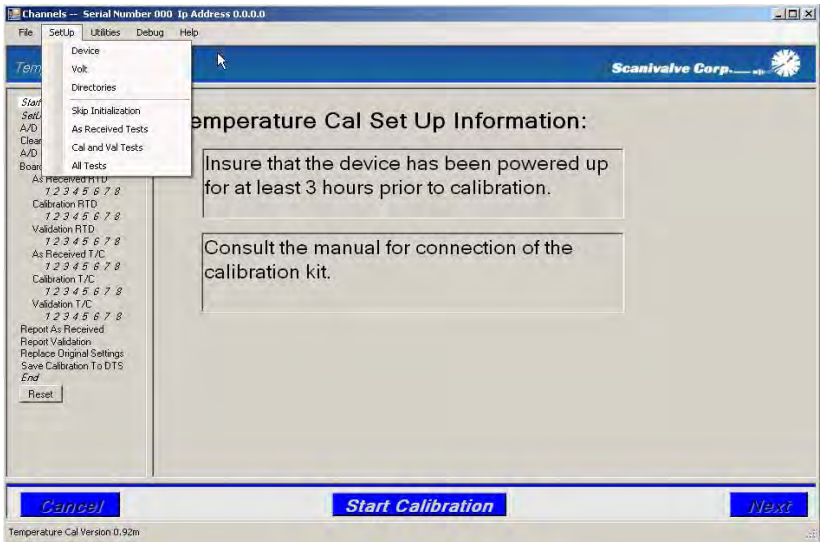


Figure 3 - Setup Menu

Device

This option is used to define the DTS3250 under test.

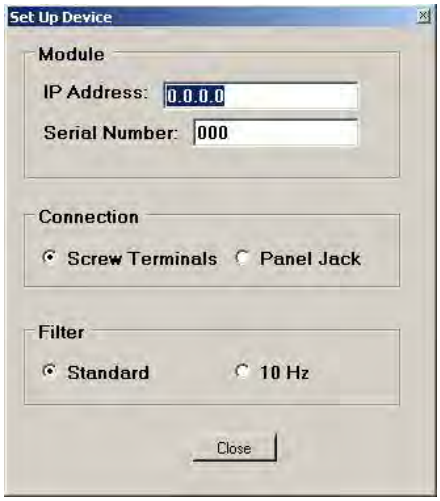


Figure 4 - Device Setup Window

IP Address
Input the IP Address of the DTS being calibrated.

Serial Number
Input the serial number of the DTS being calibrated.

Connection Type
Select the type of thermocouple connection.

Filter
Select the filter type.

Volt

This option is used to define the voltage standard to be used for the test.

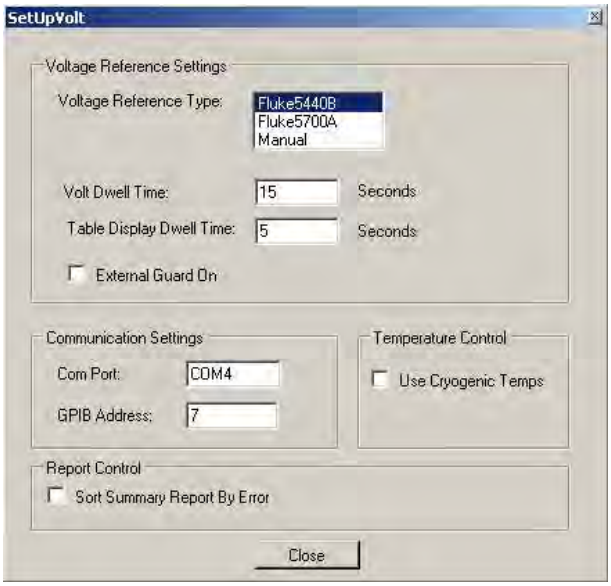


Figure 5 - Volt Setup Window

Voltage Reference Type
Select the voltage standard to be used. If the standard is not one of the listed voltage standards, the test must be run in the manual mode.

Volt Dwell Time
Set the dwell time between when the voltage is applied and the voltage is read. This will be grayed out when **Manual** reference type is selected.

Table Display Dwell Time
Set the dwell time controlling how long the tables will be displayed between each voltage measurement. This will be grayed out when **Manual** reference type is selected.

External Guard On
This function is not used. This will be grayed out when **Manual** reference type is selected.

Com Port
Set the Communications Port that the voltage standard will be using. This will be grayed out when **Manual** reference type is selected.

GPIB Address
Set the GPIB Address for communications with the voltage standard. This will be grayed out when **Manual** reference type is selected.

Use Cryogenic Temps
Select this option if calibrating the DTS for use in extremely cold temperature ranges. If this is selected and the DTS had not been previously calibrated for cryogenic temperatures, the first temperature point in the **As Received Validation** will not be correct. However, the unit will still calibrate correctly.

Sort Summary Report By Error
Selecting this option sorts the **Summary Reports** displaying the channels with the greatest error at the top. If this is not selected, the **Summary Reports** will be sorted numerically.

Directories

This option is used to define the directories where the calibration data and test reports will be stored.

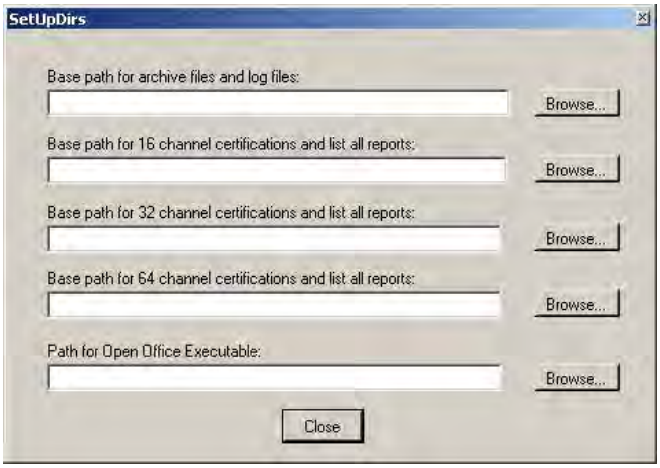


Figure 6 - Directories Setup Window

Base Path for Archive Files
This option is used to define the directory where files created in the test will be placed. The **Browse** button can be used to navigate to and select the directory, or the full path can be directly entered in the window.

Base Path for 16 Channel Certifications and List All Reports
The option is used to define the directory where all Validation Reports and ListA Reports generated for 16 channel units will be created. The **Browse** button can be used to navigate to and select the directory, or the full path can be directly entered in the window.

Base Path for 32 Channel Certifications and List All Reports
The option is used to define the directory where all Validation Reports and ListA Reports generated for 32 channel units will be created. The **Browse** button can be used to navigate to and select the directory, or the full path can be directly entered in the window.

Base Path for 64 Channel Certifications and List All Reports
The option is used to define the directory where all Validation Reports and ListA Reports generated for 64 channel units will be created. The **Browse** button can be used to navigate to and select the directory, or the full path can be directly entered in the window.

Path for Open Office Executable
This option is used if Microsoft Excel 2003 is not available and Open Office 'Calc' software is being used. In order for TempCal to reference Open Office instead of Excel 2003, the directory containing the file 'soffice.exe' must be entered here. The default installation location is: "C:\Program Files\OpenOffice.org 3\program". The **Browse** button can be used to navigate to and select the directory, or the full path can be directly entered in the window.

Skip Initialization
This option is used to configure the test controls to automatically remove the DTS initialization sequences from the test.

As Received Tests
This option is used to configure the test controls to generate **As Received Reports** only.

Cal and Val Tests
This option is used to configure the test controls to **Calibrate** the DTS and run a **Validation** of the test without performing an As Received test.

All Tests
The option is used to configure the test controls to perform a **complete** test.

Utilities

The options listed under utilities pertain to documenting the test.

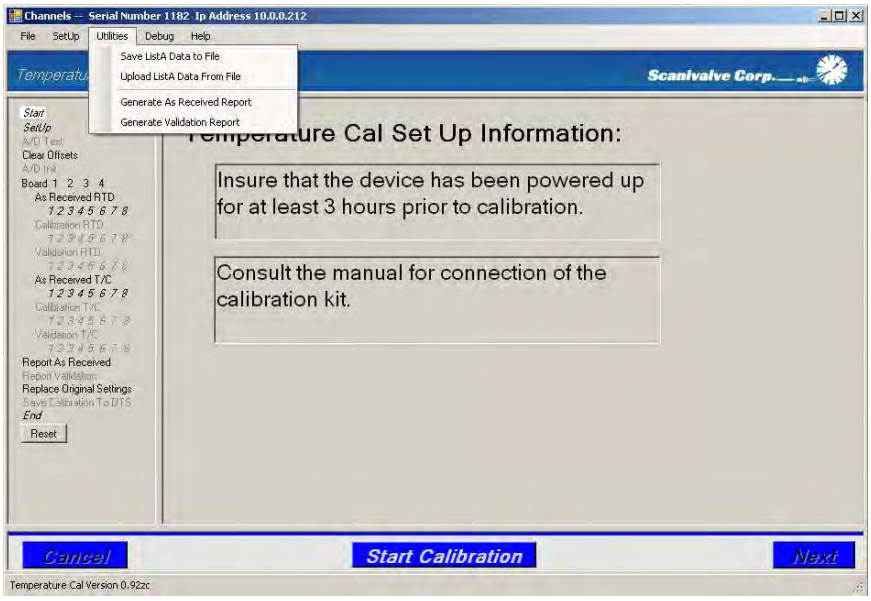


Figure 7 - Utilities Menu

Save ListA Data to File

This option is used to save all of the current DTS configuration and calibration data to a file. The file is created in the "Base Path for Archive Files and Log Files" defined in the '**Directories**' setup window.

Upload ListA Data from File

This option is used to load a saved DTS configuration and calibration setup from a file. The file uploaded must be located in the "Base Path for Archive Files and Log Files" defined in the '**Directories**' setup window.

Generate As Received Report

This option is used to generate a report on the "As Received" calibration accuracy of the module. The report will be generated in Microsoft Excel or Open Office, whichever applies.

Generate Validation Report

This option is used to generate a report on the calibration accuracy of the module after a calibration. The report will be generated in Microsoft Excel or Open Office, whichever applies.

Debug

The **Debug** feature allows the user to perform any error checking if problems are encountered with the operation of the test.

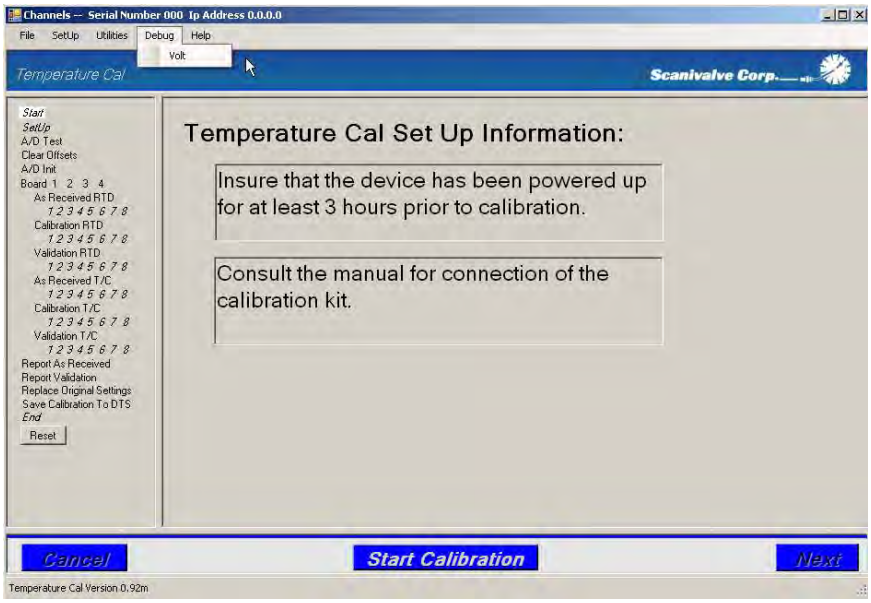


Figure 8 - Debug Menu

Volt

This option is used to test the communications with the Voltage Standard being used in the test.

Help

The **Help** feature provides information on the TempCal software.

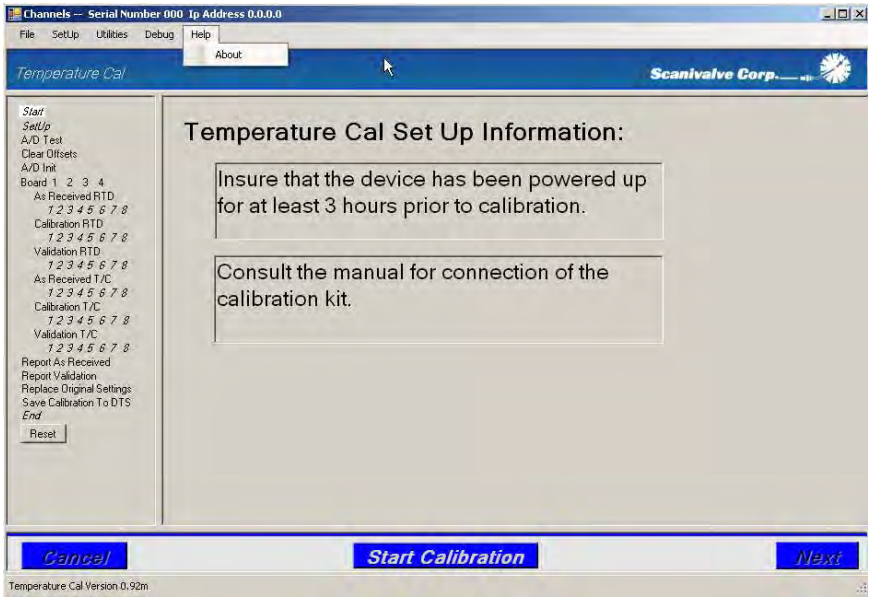


Figure 9 - Help Menu

About

This will display specific software information including the software version number.

Test Controls

A/D Test

The A/D Test control **allows the user to perform a functional test of the module's RTD and A/D circuits** before TempCal attempts to calibrate the unit. This ensures the A/D is functioning correctly and prevents the test from being run with a non-functioning A/D. This function is optional and not required for every test.

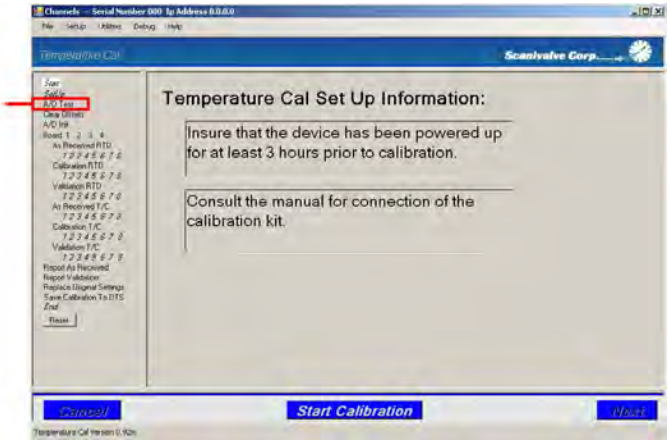


Figure 10 - A/D Test Control

Clear Offsets

The Clear Offsets control ensures that the unit is properly configured for the test. TempCal automatically removes any offsets manually put into the unit as well as resets the gain function to one and the ARPCON function to zero. **These configurations are important in order to properly calibrate the module.** After the calibration is complete, these settings will be maintained. Any unique offsets of these values will not be valid after a calibration. If the calibration is not saved, the original settings will be restored if the 'Restore Original Settings' option is selected. See page 16 for more information on the 'Restore Original Settings' function.

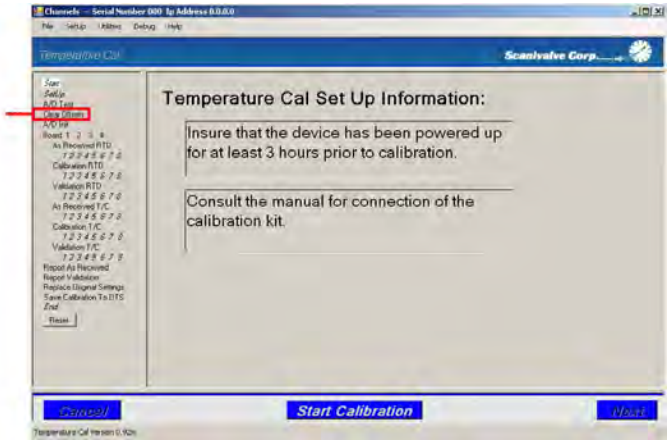


Figure 11 - Clear Offsets Control

A/D Init

The A/D Initialization function commands TempCal to perform and A/D Cal. This corrects for the internal temperature of the unit and ensures a successful calibration. It is important that this is done before the test and as such, **it is recommended that this option is enabled for every test**.

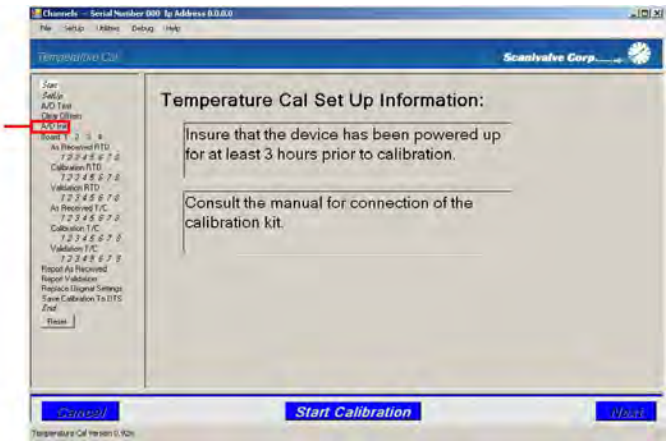


Figure 12 - A/D Initialization Control

Board 1 2 3 4

This portion of the test controls the actual calibration and validation of the unit. You can individually select each of the boards (1-2 with 32 channel units, 1-4 with 64 channel units) to perform the applicable validations and calibrations. This is useful when you only needed to validate or calibrate a select board.

As Received RTD
Selecting this option commands TempCal to perform a validation of the RTD(s) before altering any of the settings or existing calibration(s). **In order to get a complete As Received Report at the end of the test, this must be enabled.**

Calibration RTD
Selecting this option commands TempCal to perform a calibration of the RTD(s). **If this is not selected, a calibration of the RTD will be completed.**

Validation RTD
Selecting this option commands TempCal to perform a validation of the RTD(s) after calibration. **If this is not selected, a complete validation report cannot be generated at the conclusion of the calibration.**

As Received T/C
Selecting this option commands TempCal to perform a validation of the T/C's before altering any of the settings or existing calibration(s). **In order to get a complete As Received Report at the end of the test, this must be enabled.**

Calibration T/C
Selecting this option commands TempCal to perform a calibration of the T/C's. **If this is not selected, a calibration of the T/C's will be completed.**

Validation T/C
Selecting this option commands TempCal to perform a validation of the T/C's after any calibration is done. **If this is not selected, a complete validation report cannot be generated at the conclusion of the calibration.**

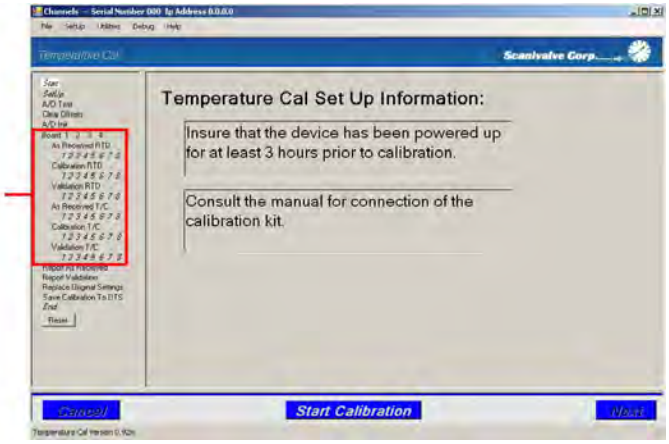


Figure 13 - Board Validation and Calibration Controls

Report As Received

This option determines whether or not a report will be generated showing the pre-calibration status of the unit. The As Received report is useful for determining the effects of the calibration. In order to get a complete As Received report, both 'As Received A/D' and 'As Received T/C' need to be selected (see above section 'Boards 1 2 3 4').

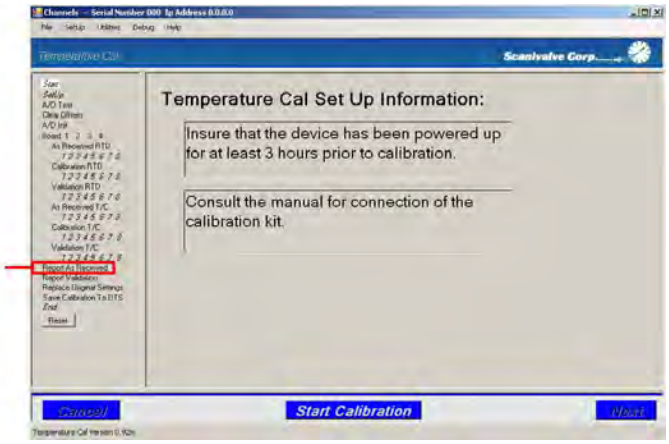


Figure 14 - Report As Received Control

Reference **Appendix B - Sample As Received Certificate of Calibration** to see an example of an As Received report.

Report Validation

This option determines whether or not TempCal will generate a report showing the post-test status of the unit. The Validation report is useful for determining the effect of the calibration and indicates whether or not the calibration is acceptable. In order for TempCal to generate a complete Validation report, Calibrate RTD, Validate RTD, Calibrate T/C and Validate T/C all need to be enabled (see above section 'Boards 1 2 3 4').

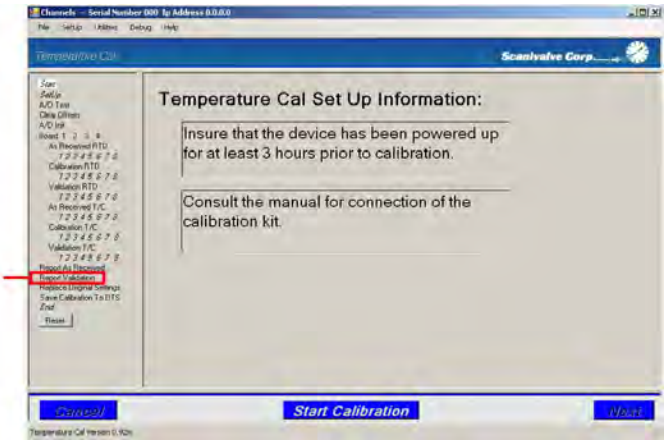


Figure 15 - Report Validation Control

Reference **Appendix C - Sample Certificate of Calibration** to see an example of a Validation Report.

Replace Original Settings

This option determines whether or not TempCal reconfigures the DTS back to the configuration before the calibration/validation. At the beginning of the test, TempCal configures many of the DTS parameters such as period and average. If is desired that the original settings be restored after the test is complete, enable this option. It should be noted, **if the configuration parameters are not reset, the DTS may not scan properly until several parameters are manually reconfigured.** It is recommended that this option is enabled.

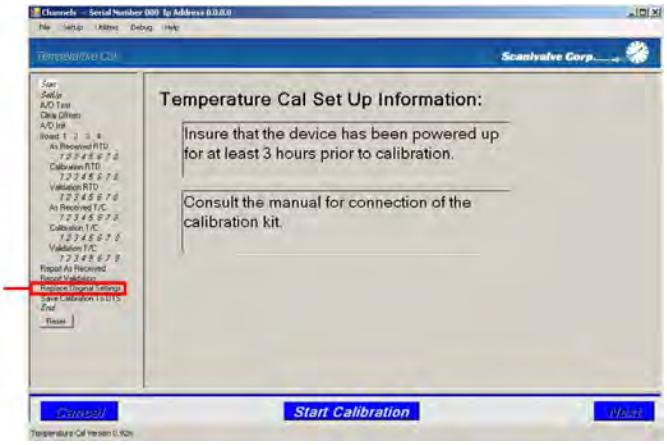


Figure 16 - Replace Original Settings Control

Save Cal to DTS

This option determines whether or not TempCal will give the user an option to save the calibration to the DTS. **If this is not selected, the calibration will not be saved.** If this option is enabled, TempCal will give the user the option to save the calibration to the DTS or not. Unless an acceptable calibration has been performed, select 'No' when asked to save the calibration. **If only an As Received test has been performed, do not save the calibration**.

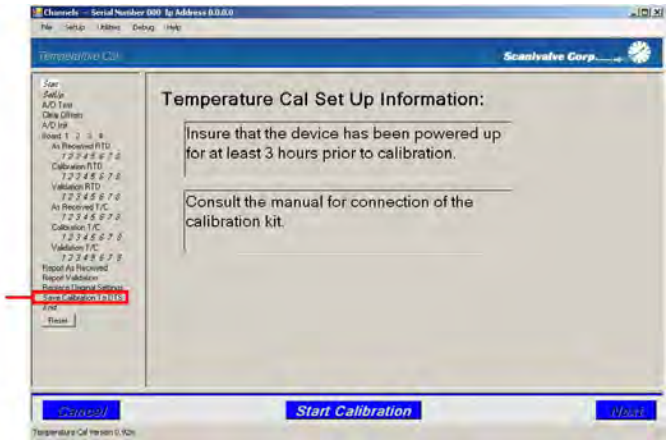


Figure 17 - Save Calibration to DTS Control

Reset

Clicking the **Reset** button enables all of the test controls. This configures the test controls to perform a **complete** test including initialization and configuration of the DTS, As Received, Calibration and Validation, and all associated reports.

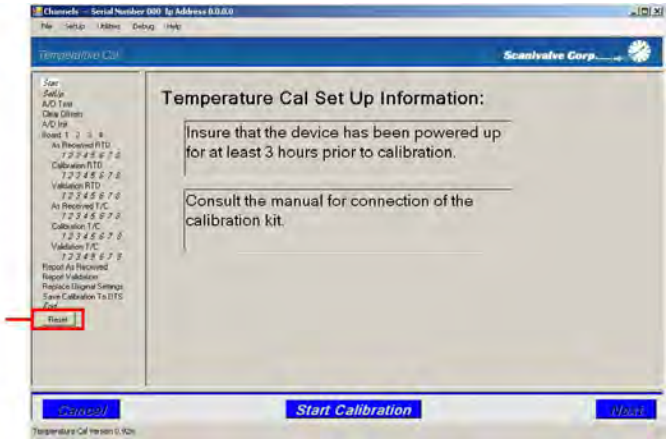
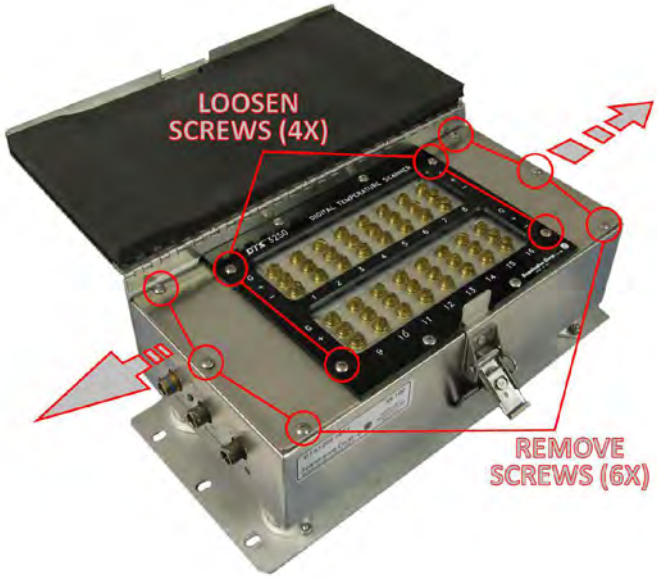


Figure 18 - Reset

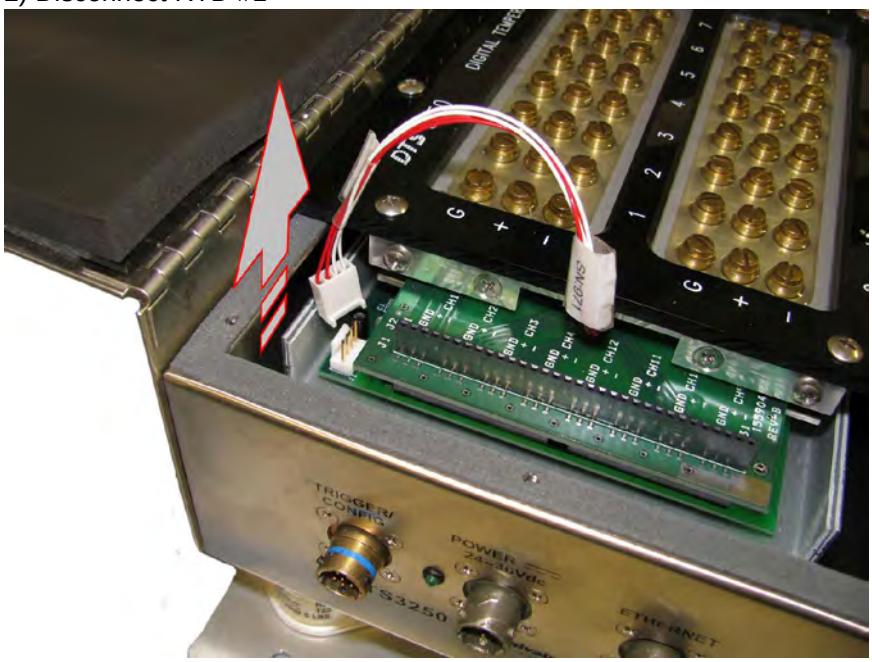
INSTALLING THE CALIBRATION HARNESS

16 Channel Unit

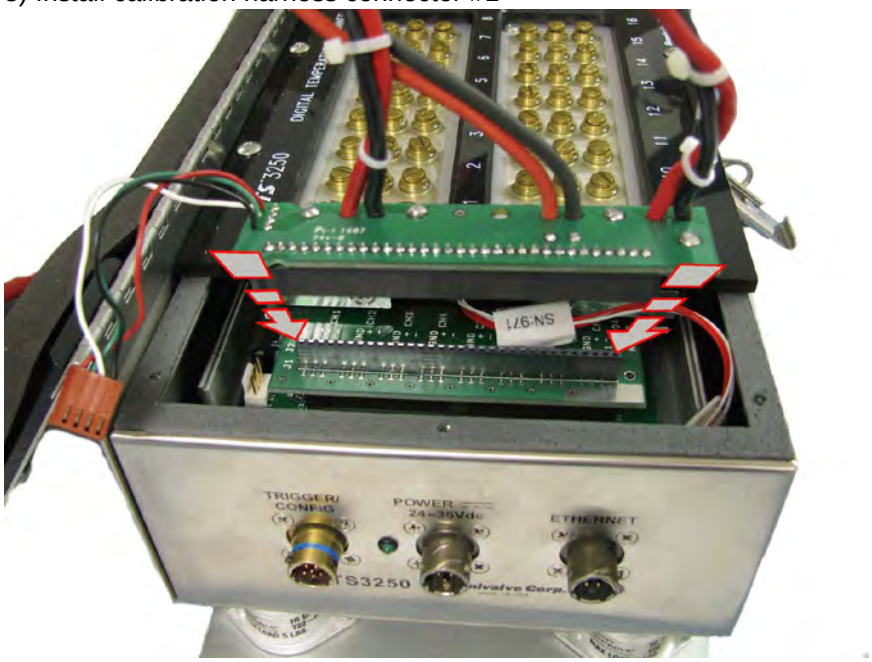
1) Remove side covers. **After the side covers are removed, re-tighten the 4 screws that were loosened.**



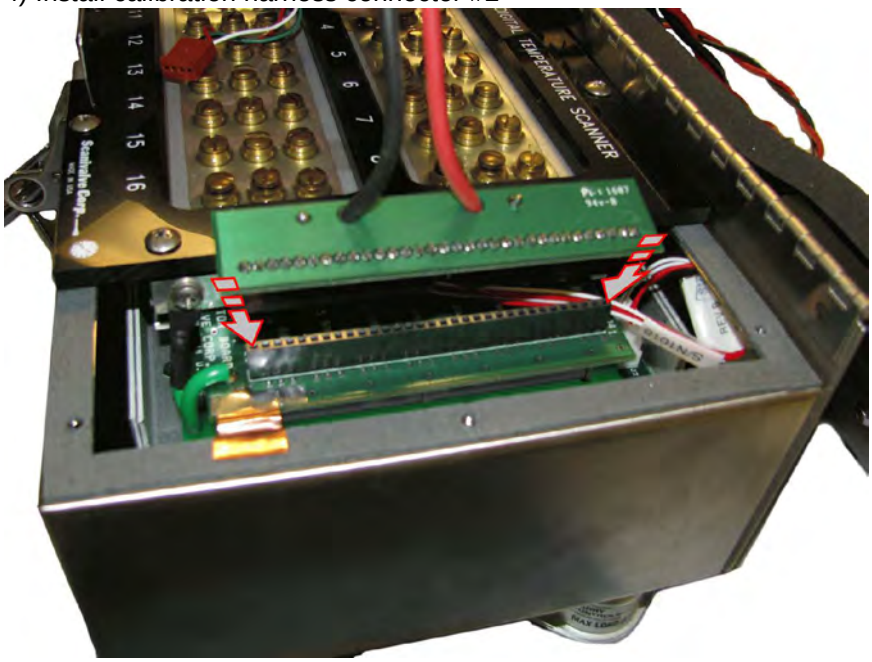
2) Disconnect RTD #1



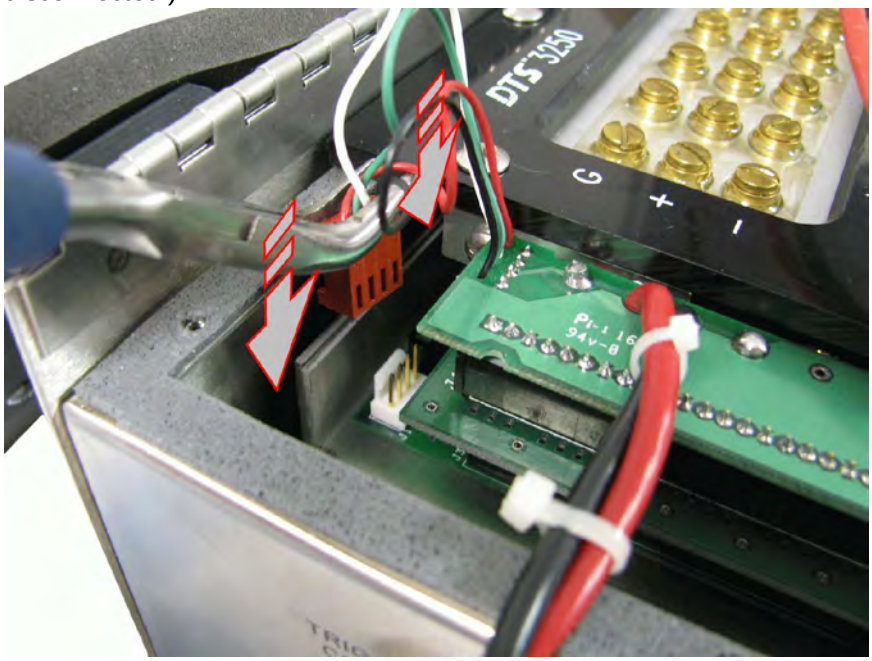
3) Install calibration harness connector #1



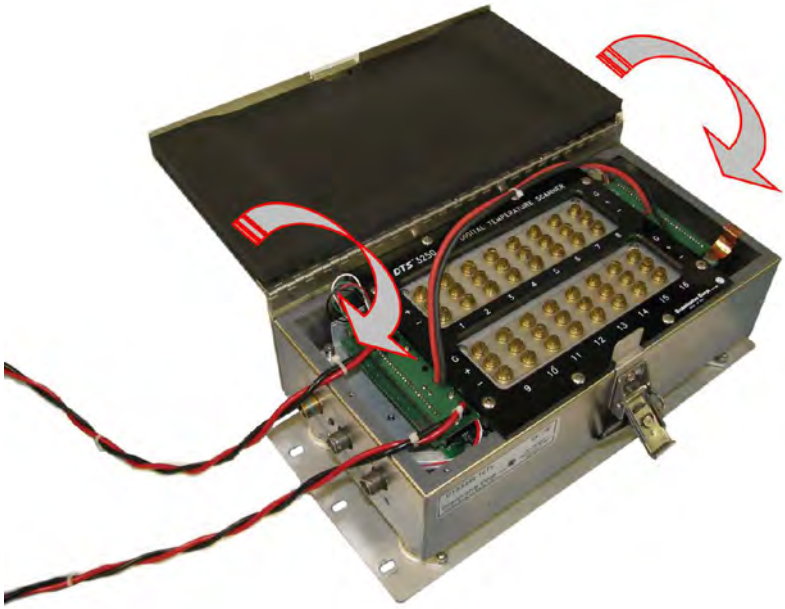
4) Install calibration harness connector #2



5) Install calibration harness connector #3 (Where the RTD was disconnected.)



6) Close and latch the lid

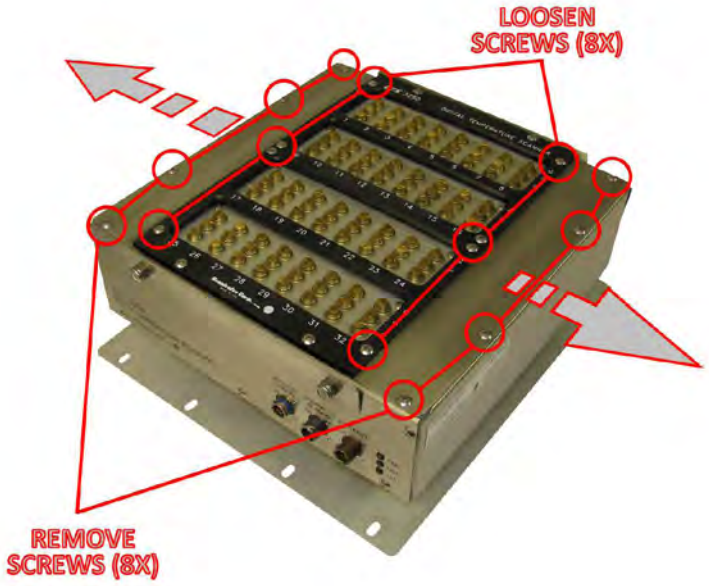


7) After powering the unit up, let the DTS thermally stabilize for a minimum of 3 hours before beginning the calibration.

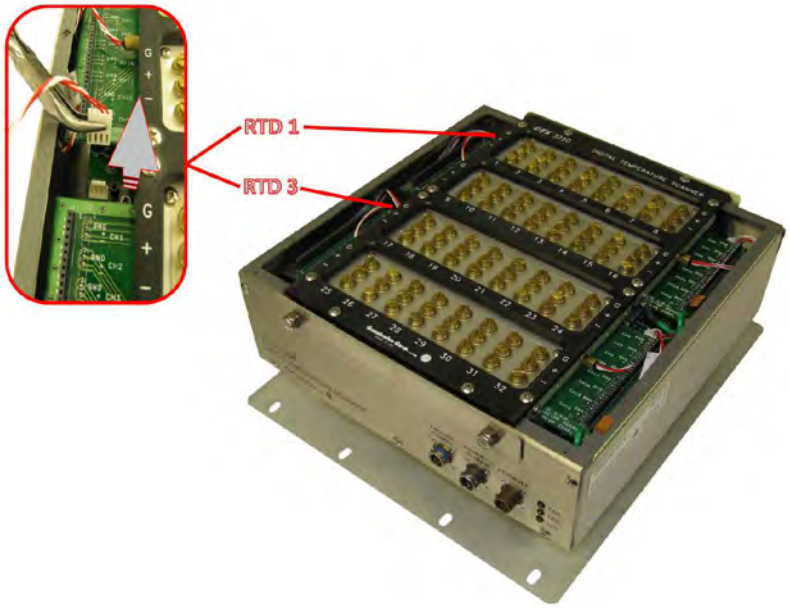
32 Channel Unit

1) Remove cover

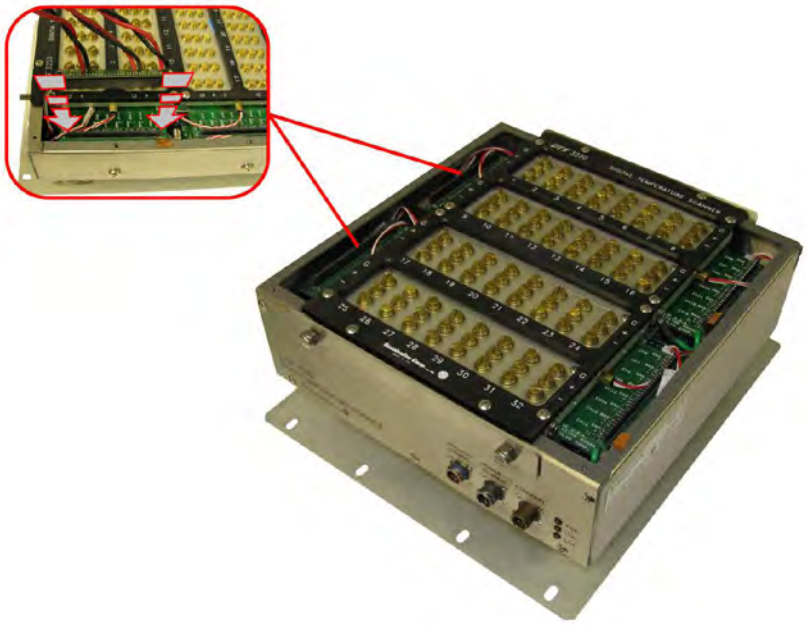
2) Remove side covers. **After the side covers have been removed, re-tighten the 8 screws that were loosened.**



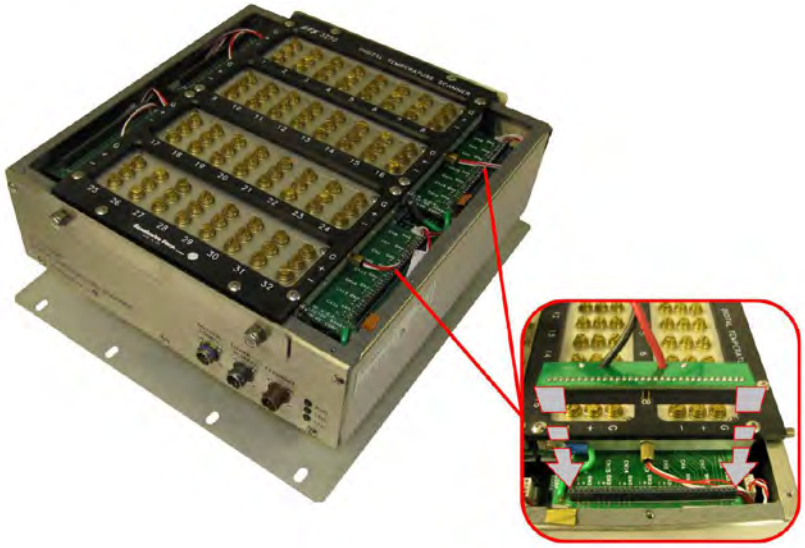
3) Disconnect RTD 1 and 3



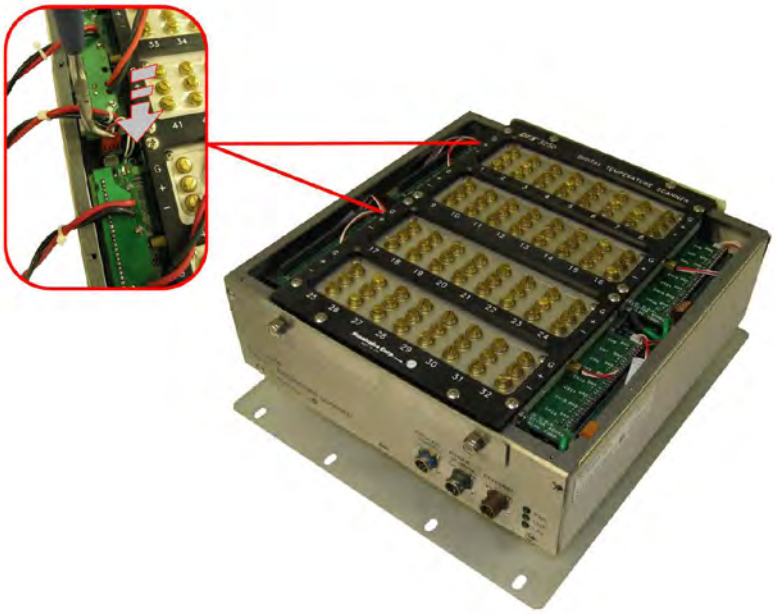
4) Install calibration harness connector #1 (2x)



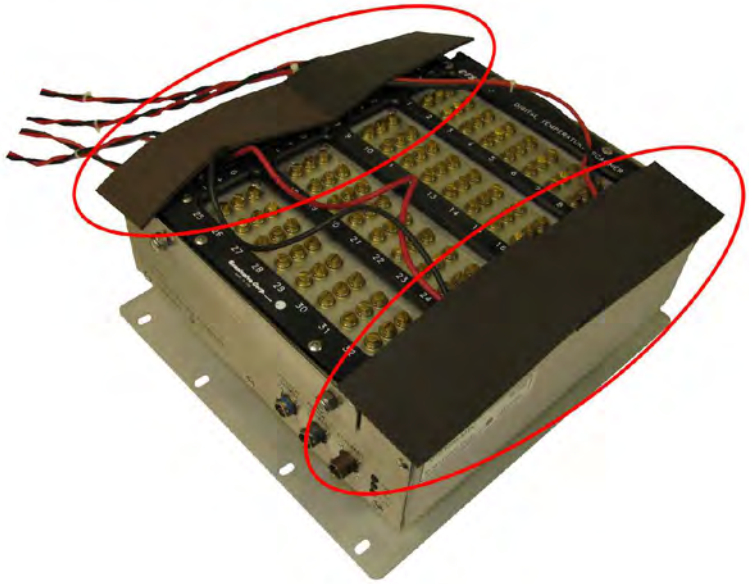
5) Install calibration harness connector #2 (2x)



6) Install calibration harness connector #3 (Where the RTD was disconnected. 2x)



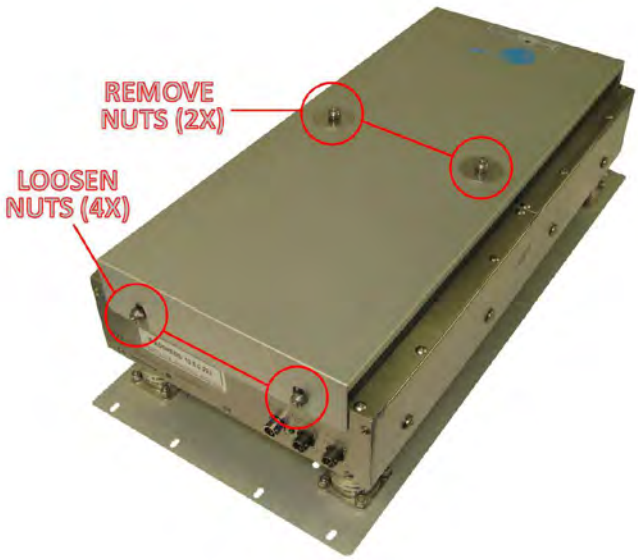
7) Place insulation over the exposed connectors



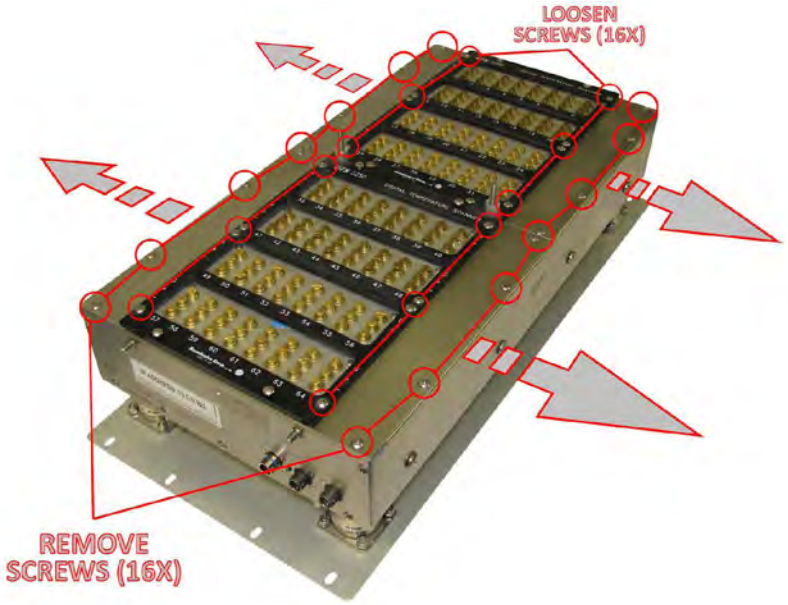
8) Install the cover. After powering the unit up, let the DTS thermally stabilize for a minimum of 3 hours before beginning the calibration.

64 Channel Unit

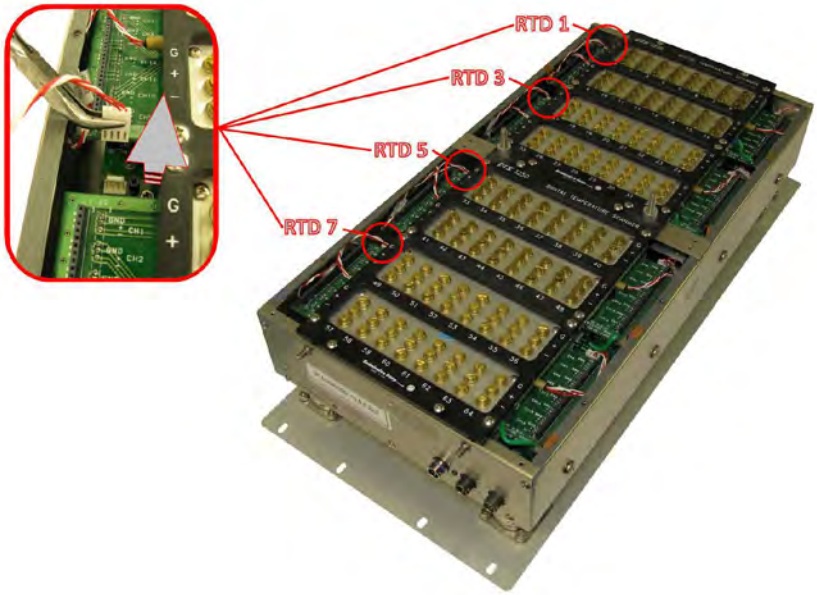
1) Remove cover



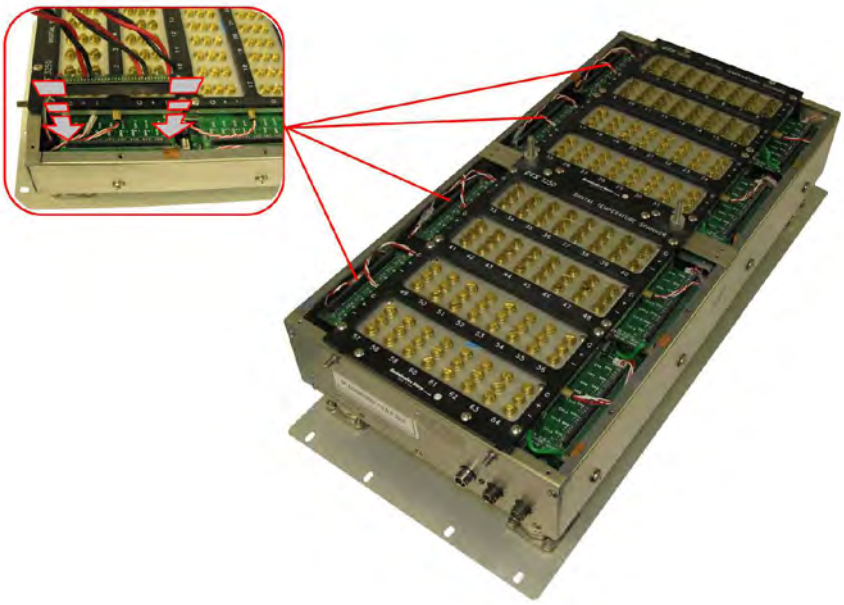
2) Remove side covers. **After the side covers have been removed, re-tighten the 16 screws that were loosened.**



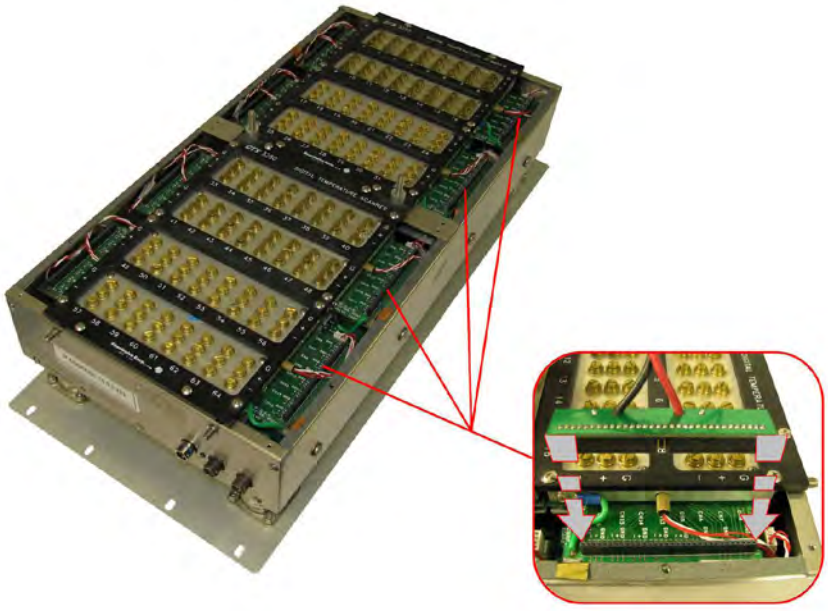
3) Disconnect RTD 1, 3, 5 and 7



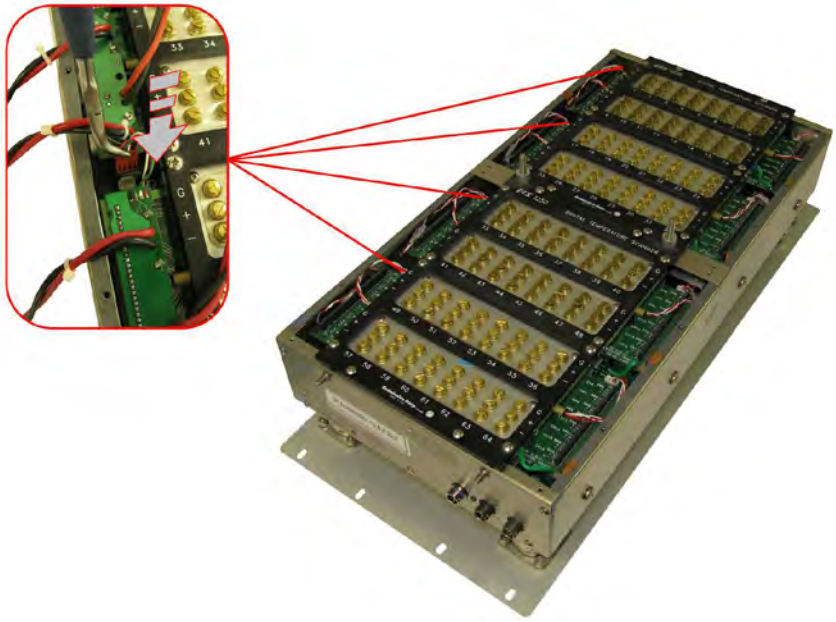
4) Install calibration harness connector #1 (4x)



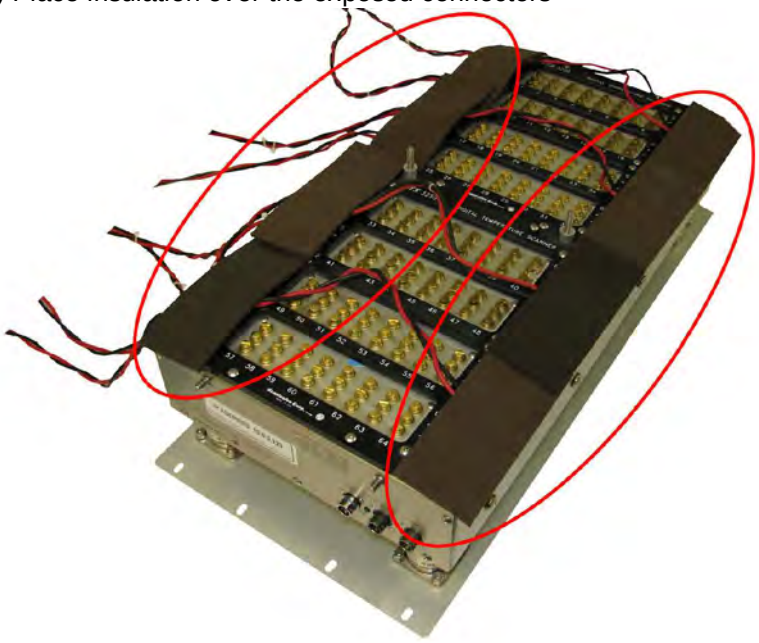
5) Install calibration harness connector #2 (4x)



6) Install calibration harness connector #3 (Where the RTD was disconnected. 4x)



7) Place insulation over the exposed connectors



8) Install the cover. After powering the unit up, let the DTS thermally stabilize for a minimum of 3 hours before beginning the calibration.

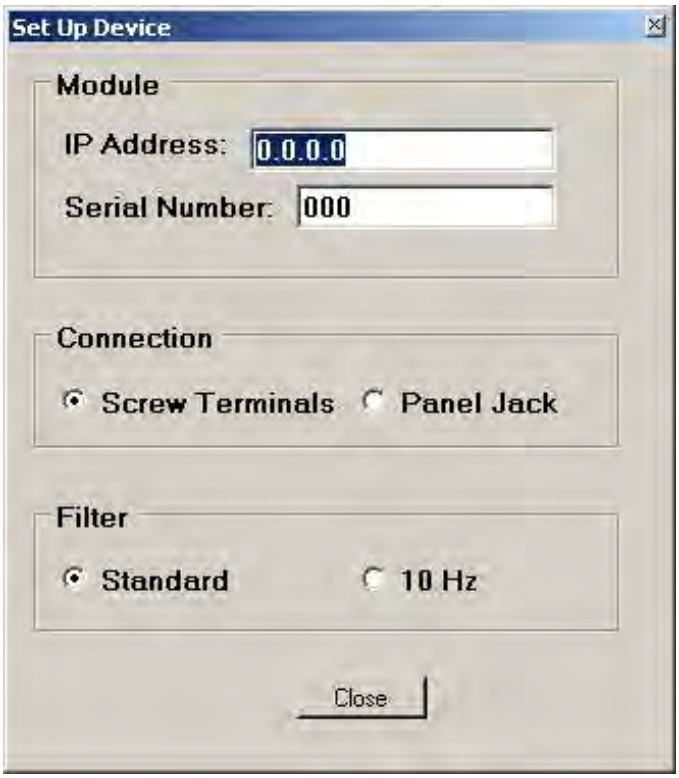
MANUAL TEST OPERATION

This section will cover the setup and operation of a manual test.

Defining a Test

Device Setup

Click **Setup**, **Device** to open the Device Set Up Window.



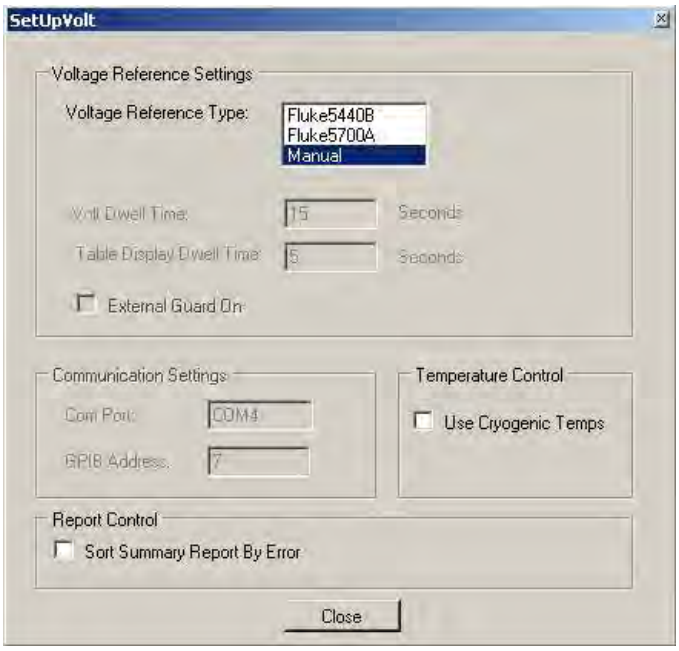
Enter the module configuration.

1. Enter the IP Address of the module.
2. Enter the serial number - this will be used in the reports.
3. Click on the thermocouple connection type.
4. Click the Standard Filter unless the module has the special 10 Hz filter option

Click when all of the information has been entered.

Volt

Click **Setup, Volt** to open the **Voltage Reference Settings Window**.



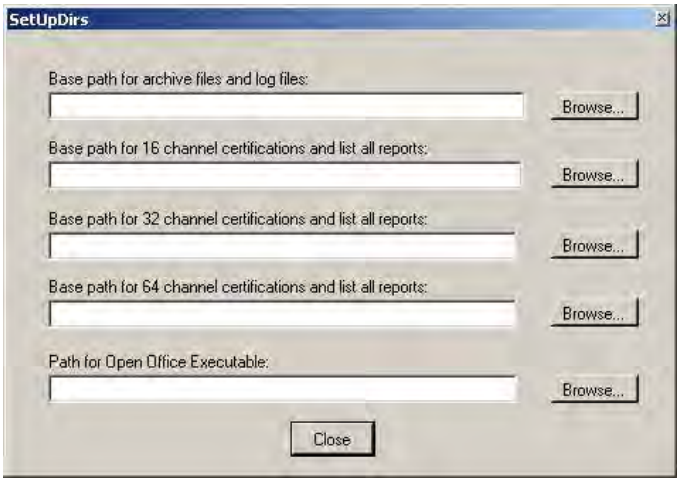
Enter the Voltmeter configuration.

1. Select the Voltmeter type. For manual tests, select **Manual**. If one of the voltage standards listed is available then the test can be run in the automatic mode by selecting the appropriate voltage standard. See the 'Automatic Test Setup' section for more details.
2. If the test is calibrating a DTS unit used for extreme cold temperatures, select the '**Use Cryogenic Temps**' option. Otherwise, leave it unselected.
3. Selecting '**Sort Summary Report By Error**' will float the channels with the greatest errors to the top of the report making it easier to review the Summary Report. If this is not selected, the channels will be arranged in numerical order.

Click when all of the information has been entered.

Directories

Click **Setup, Directories** to open the Directory definition window.



Base Path for Active Files
This option is used to define the directory where files created in the test will be placed. The **Browse** button can be used to navigate to and select the directory, or the full path can be directly entered in the window.

Base Path for 16 Channel Certifications and List All Reports
The option is used to define the directory where all Validation Reports and ListA Reports generated for 16 channel units will be created. The **Browse** button can be used to select the directory, or the full path can be directly entered in the window.

Base Path for 32 Channel Certifications and List All Reports
The option is used to define the directory where all Validation Reports and ListA Reports generated for 32 channel units will be created. The **Browse** button can be used to select the directory, or the full path can be directly entered in the window.

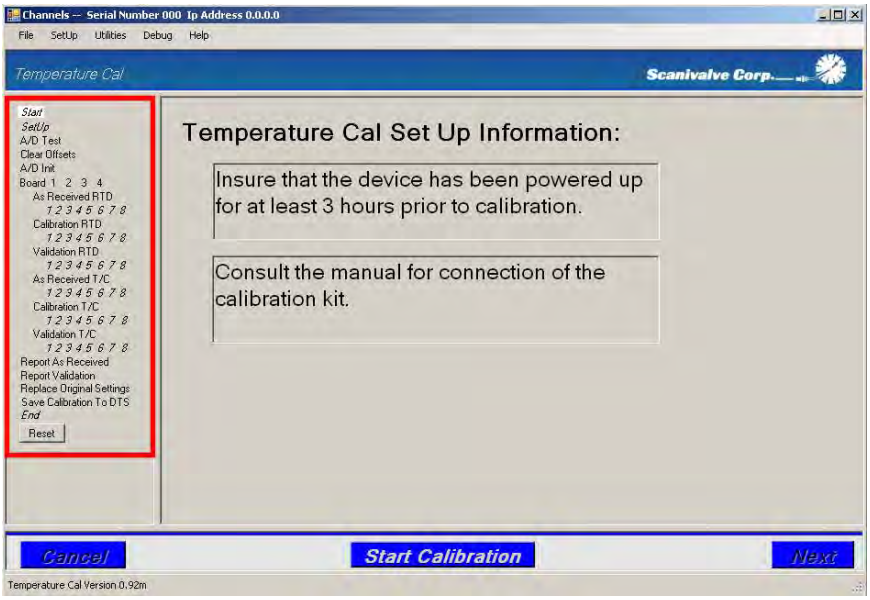
Base Path for 64 Channel Certifications and List All Reports
The option is used to define the directory where all Validation Reports and ListA Reports generated for 64 channel units will be created. The **Browse** button can be used to select the directory, or the full path can be directly entered in the window.

Path for Open Office Executable
This option is used if Microsoft Excel 2003 is not available and Open Office 'Calc' software is being used. In order for TempCal to reference Open Office instead of Excel 2003, the directory containing the file 'soffice.exe' must be entered here. The default installation location is: "C:\Program Files\OpenOffice.org 3\program". The **Browse** button can be used to navigate to and select the directory, or the full path can be directly entered in the window.

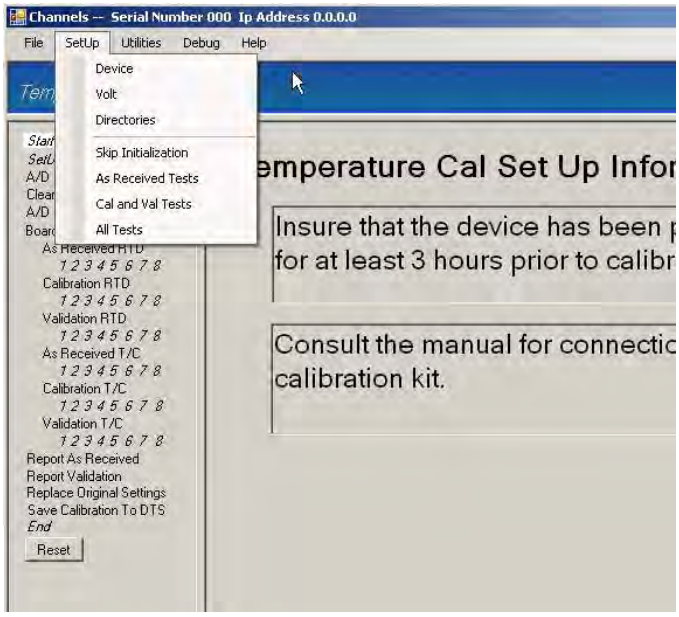
Click when all of the information has been entered.

Test Controls

The test controls can be configured by two means. The first method is by selecting and deselecting specific portions of the test in the **Test Controls** portion of the main screen.



Alternately, the test controls can be configured by selecting on of the pre-configured test setups found in the **Setup Menu**. See the section devoted to the **Setup Menu** in the **Getting Started** section of this manual.



Running a Test

Once the test has been defined and configured, the test can be commenced.

This is done by simply clicking

found at the bottom of the window.

To proceed through the test, click the

button at the bottom right corner of the window.

Additionally, the test can be advanced using the '**Enter**' key on the keyboard

At any point in the test, the test can be canceled by clicking

or by pressing the '**Escape**' key on the keyboard.

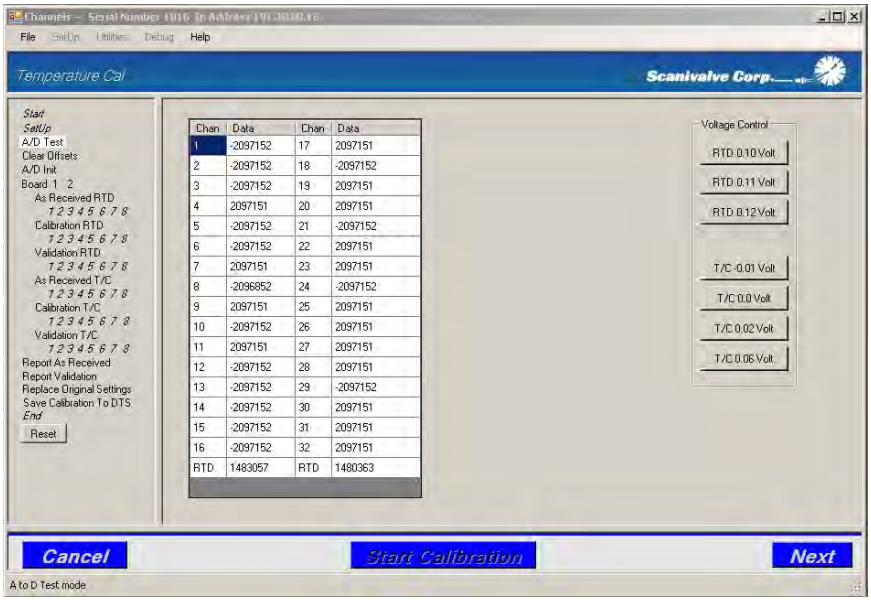
When a test is canceled, TempCal will automatically reset the DTS to the settings in place before the test was commenced.

When running the test in manual mode simply follow the on screen prompts.

A/D Test

The A/D Test page provides an interactive screen that enables the user to check the DTS' response to input voltages. Including this test in the calibration is only recommended if it is suspected that either an RTD or an individual T/C channel has failed. Otherwise, this test is generally not necessary.

Assuming a compatible voltage standard is not available to run the test automatically and the test is being run manually, the 'Voltage Control' buttons will not function. However, the user can manually apply the appropriate voltages and verify the DTS' response. In order for any voltages to be applied to the DTS, either the RTD connections of the Calibration Kit or the T/C connections of the Calibration Kit must be connected to the voltage standard for each respective test. **It is recommended that there is zero input voltage when making or breaking any connections.** See sections '**Connect RTD Cables**' and '**Connect T/C Cables**' for the relevant connection.

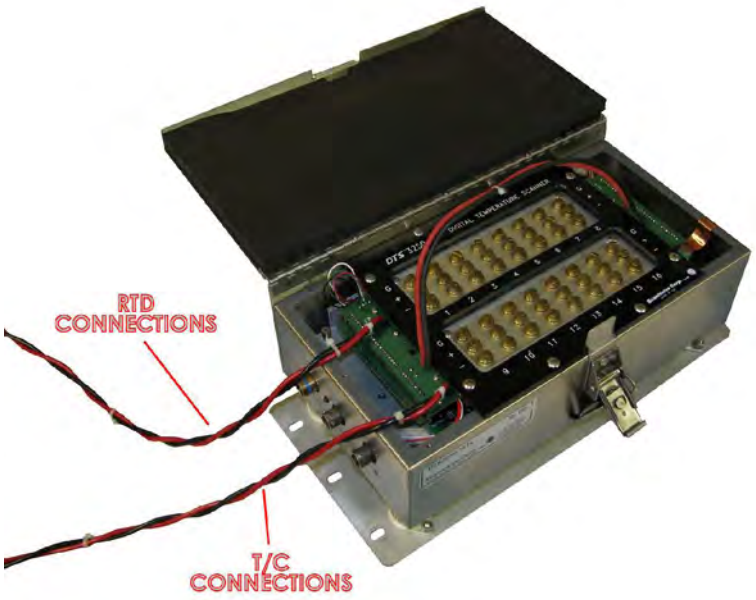


Note that the display updates at approximately 1 Hz.

Refer to **Appendix A - Standard Voltage Response Limits** to determine if the results of the test are within the recommended limits.

Connect RTD Cables

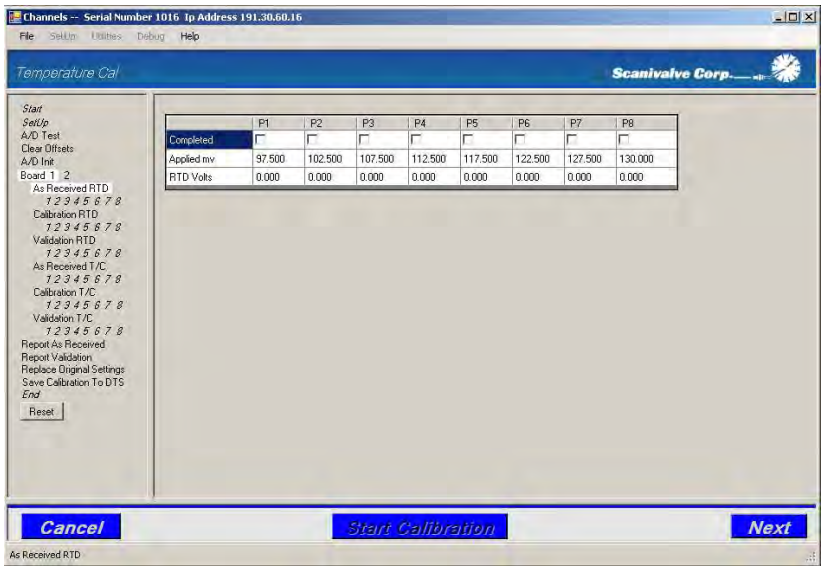
Before the As Received test, Calibration or Validation of the RTD(s) can be completed, the voltage standard must be connected to the RTD connections on the calibration harness.



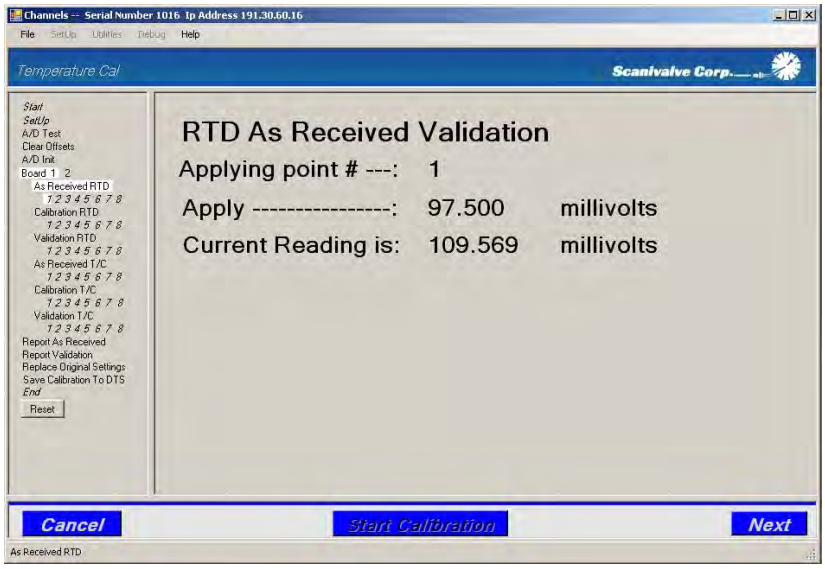
For each calibration harness, there is one RTD connection and one T/C connection. **The RTD connection for the voltage standard is labeled 'RTD.'** Connect the RTD connection to the voltage standard and click '**Next**.'

As Received RTD

Before TempCal begins to perform an As Received test of the DTS, a front screen will be displayed with a table representing each validation point for the RTD. Nothing needs to be done on this screen. To proceed and begin the test, click '**Next**.'



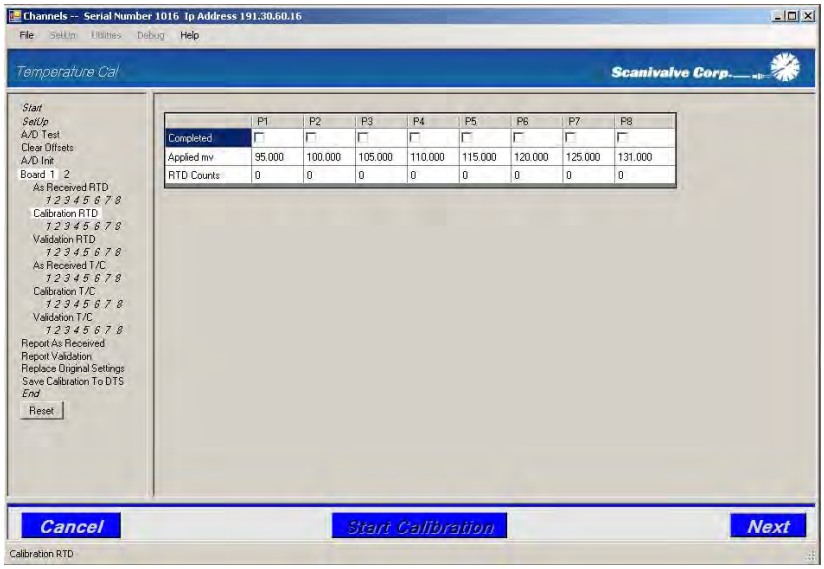
The next screen will prompt the user to input a known voltage using a voltage standard. This screen displays the voltage to be applied ('**Apply - - - -:**') as well as a reading of the currently applied voltage. Once the voltage has been applied and is stable, click '**Next**.'



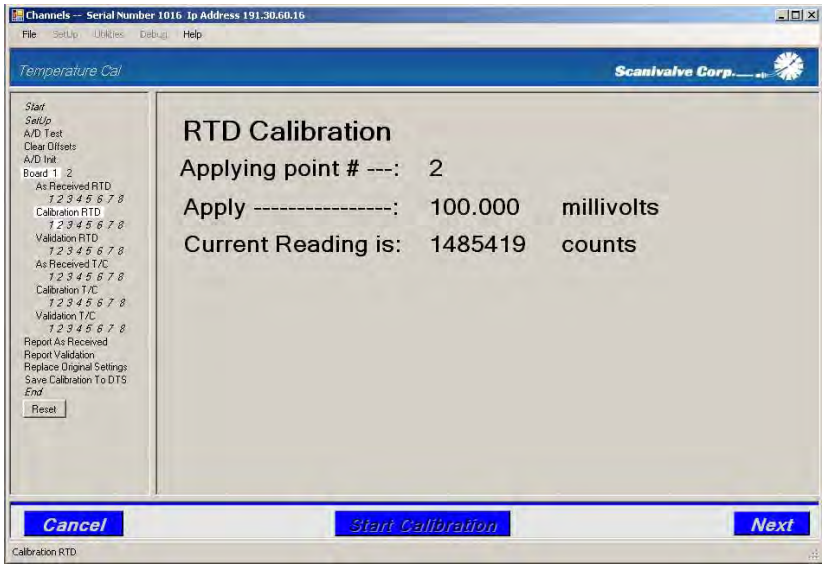
TempCal will return to the front screen and indicate that the point has been validated with a check mark in the box below the point. Continue through each point until all points have been validated.

Calibration RTD

Once the As Received validation has been completed (if applicable) TempCal will display a front screen for the Calibration of the RTD's. Nothing needs to be done on this screen. To proceed and begin the test, click '**Next**.'



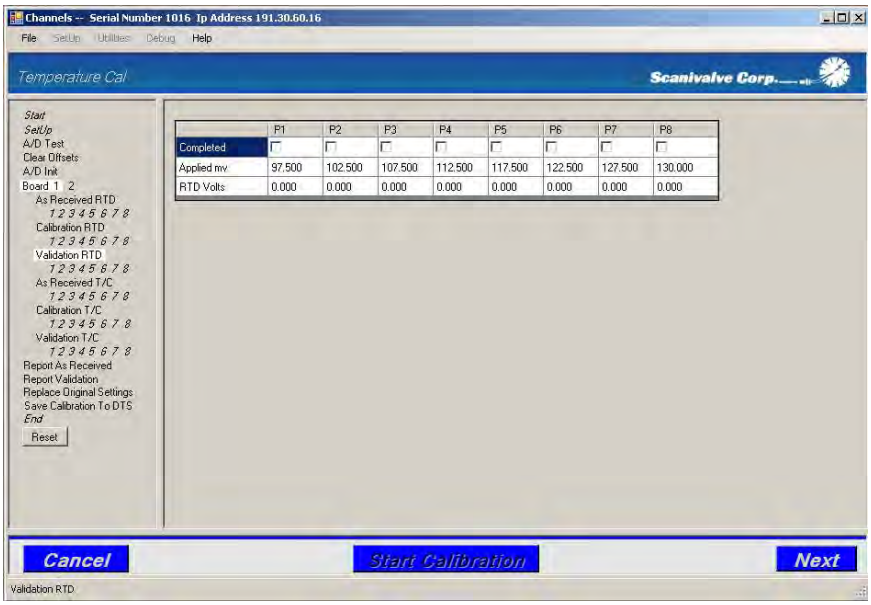
The next screen will prompt the user to input a known voltage using a voltage standard. This screen displays the voltage to be applied ('**Apply - - - -:**') as well as a reading of the currently applied voltage (displayed in raw counts). Once the voltage has been applied and is stable, click '**Next**.'



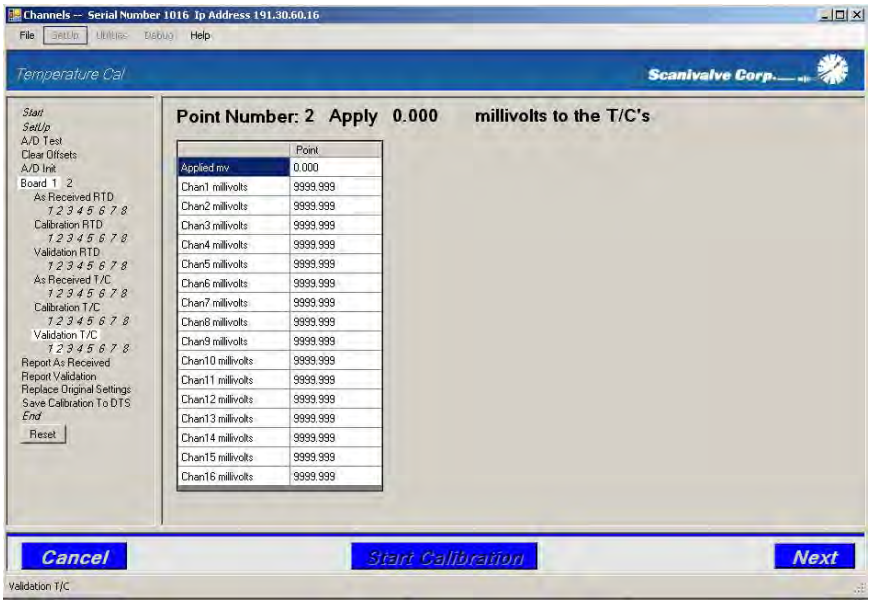
TempCal will return to the front screen and indicate that the point has been calibrated with a check mark in the box below the point. Continue through each point until all points have been calibrated.

Validation RTD

After performing the As Received test and the Calibration (if applicable) TempCal will display a front screen for the Validation of the RTD's. Nothing needs to be done on this screen. To proceed and begin with Validation, click '**Next**.'



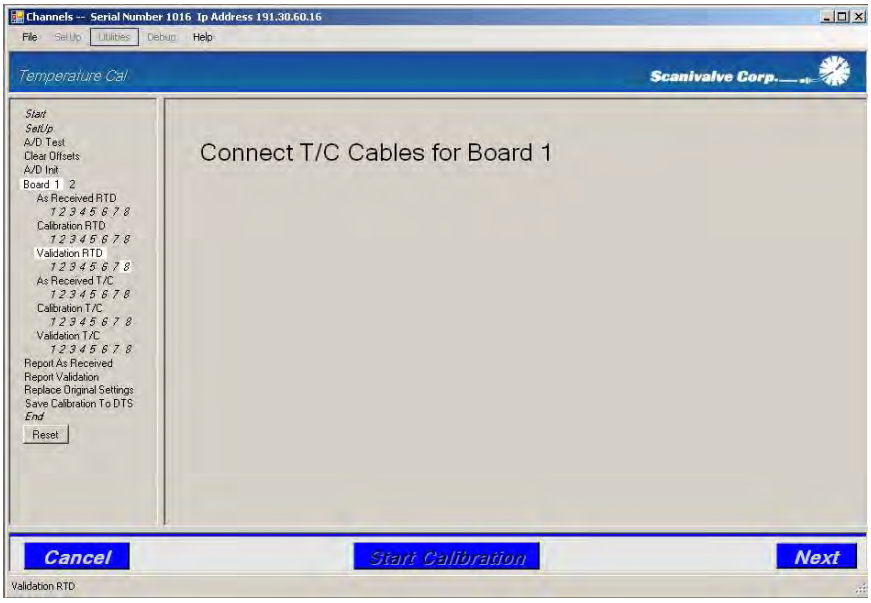
The next screen will prompt the user to input a known voltage using a voltage standard. This screen displays the voltage to be applied ('**Apply - - - -:**') as well as a reading of the currently applied voltage. Once the voltage has been applied and is stable, click '**Next**.'

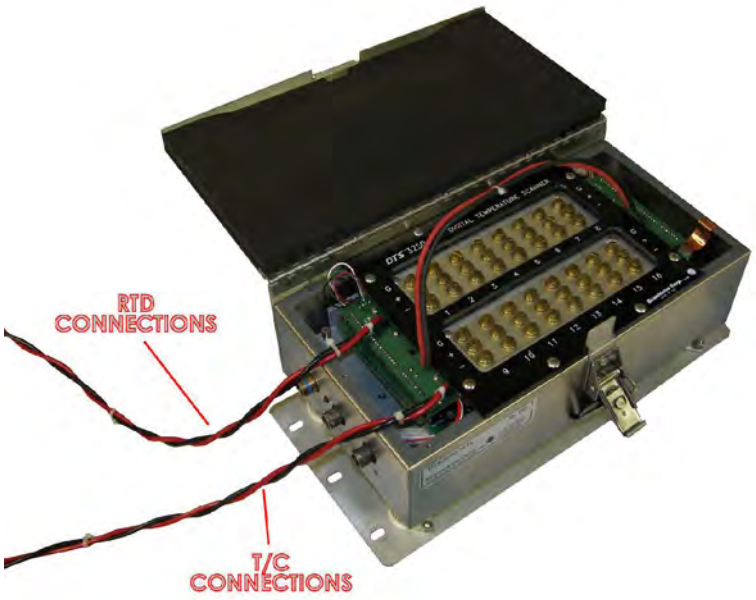


TempCal will return to the front screen and indicate that the point has been validated with a check mark in the box below the point. Continue through each point until all points have been validated.

Connect T/C Cables

Before the As Received test, Calibration or Validation of the T/C(s) can be completed, the voltage standard must be connected to the T/C connections on the calibration harness.

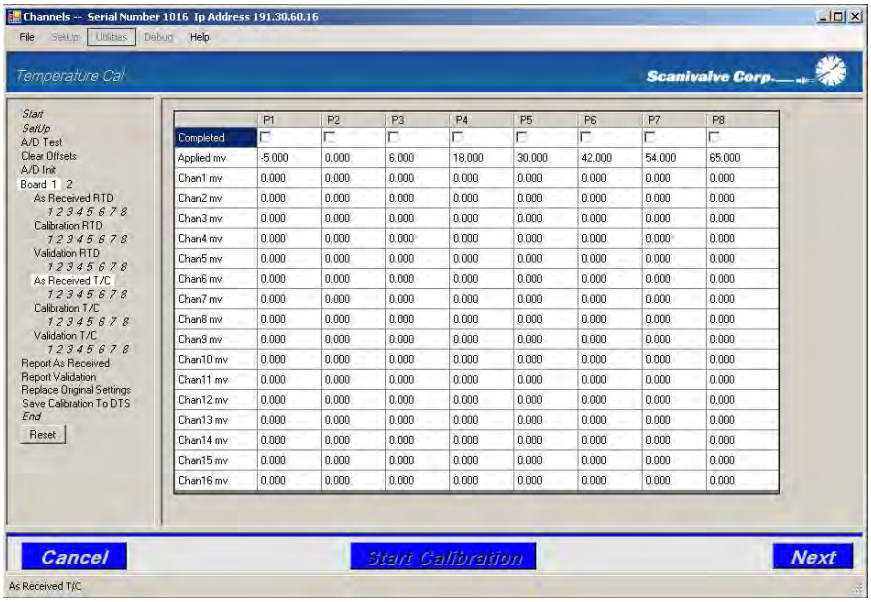




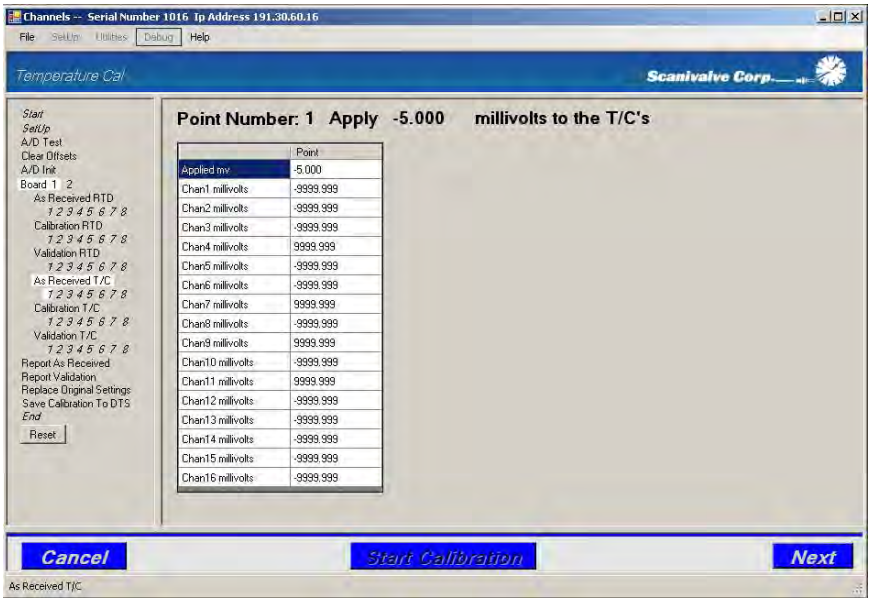
For each calibration harness, there is one RTD connection and one T/C connection. **The T/C connection for the voltage standard is labeled 'T/C.'** Connect the T/C connection to the voltage standard and click '**Next**.'

As Received T/C

Before TempCal begins to perform an As Received test of the DTS, a front screen will be displayed representing each validation point for the T/C's. Nothing needs to be done on this screen. To proceed and begin the test, click '**Next**.'



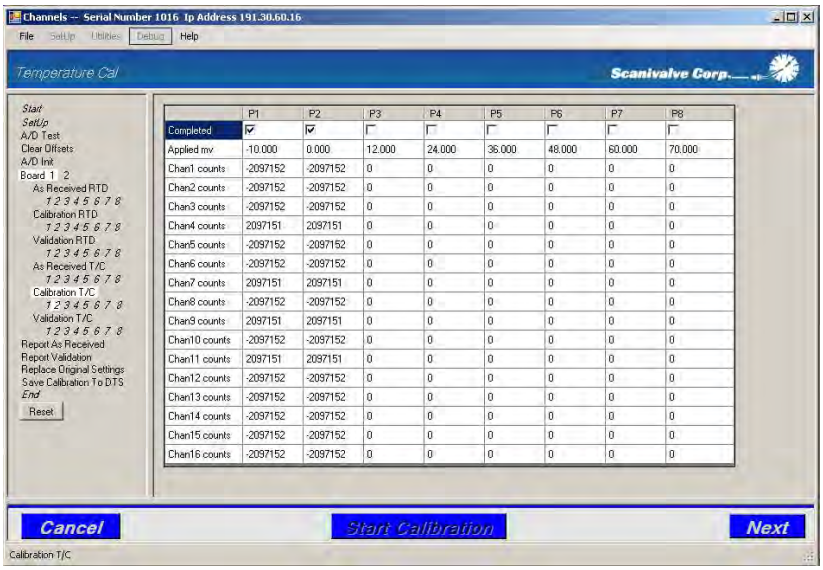
The next screen will prompt the user to input a known voltage using a voltage standard. This screen displays the point number and the voltage to be applied as well as a reading of the currently applied voltage. Once the voltage has been applied and is stable, click '**Next**.'



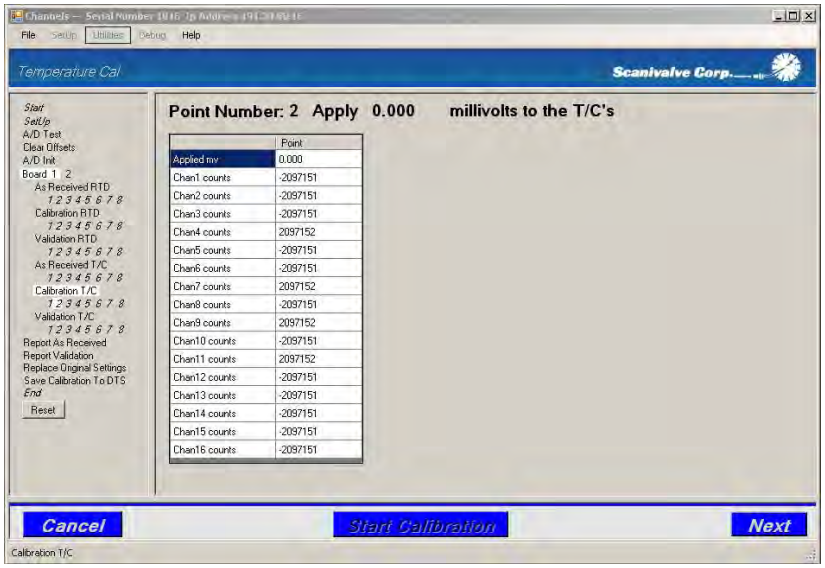
TempCal will return to the front screen and indicate that the point has been validated with a check mark in the box below the point. Continue through each point until all points have been validated.

Calibration T/C

Once the As Received validation has been completed (if applicable) TempCal will display a front screen for the Calibration of the T/C's. Nothing needs to be done on this screen. To proceed and begin the test, click '**Next**.'



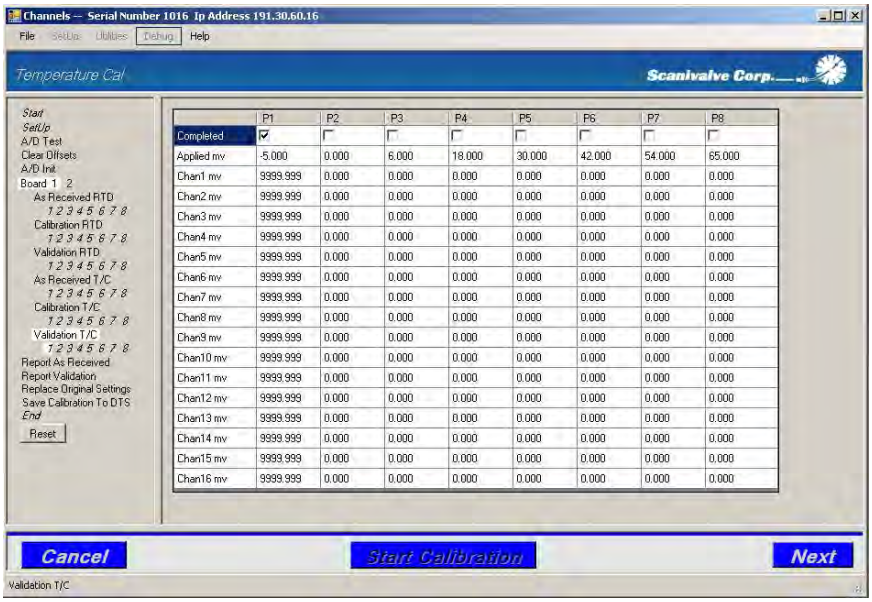
The next screen will prompt the user to input a known voltage using a voltage standard. This screen displays the point number and the voltage to be applied as well as a reading of the currently applied voltage (in raw counts). Once the voltage has been applied and is stable, click '**Next**.'



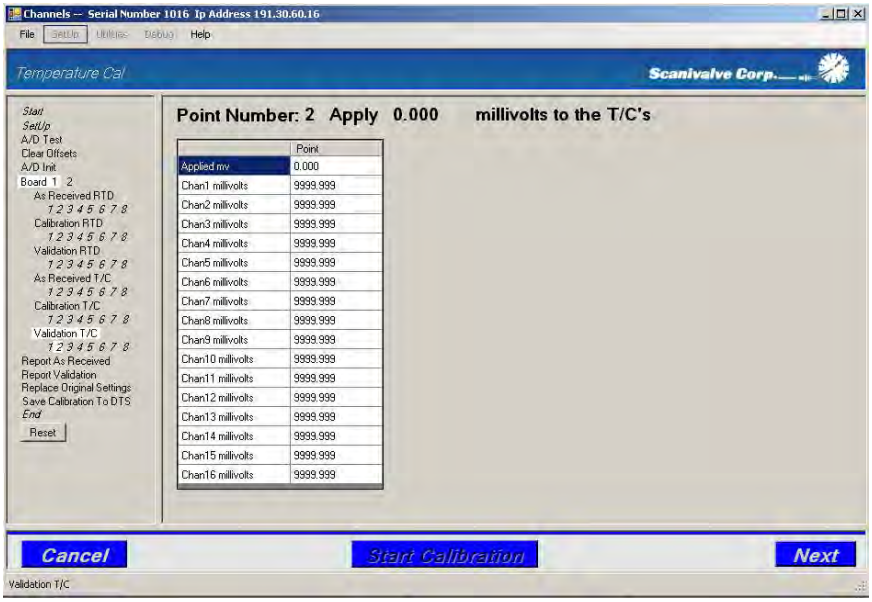
TempCal will return to the front screen and indicate that the point has been calibrated with a check mark in the box below the point. Continue through each point until all points have been calibrated.

Validation T/C

After performing the As Received test and the Calibration (if applicable) TempCal will display a front screen for the Validation of the T/C's. Nothing needs to be done on this screen. To proceed and begin with Validation, click '**Next**.'



The next screen will prompt the user to input a known voltage using a voltage standard. This screen displays the point number and the voltage to be applied as well as a reading of the currently applied voltage. Once the voltage has been applied and is stable, click '**Next**.'



TempCal will return to the front screen and indicate that the point has been validated with a check mark in the box below the point. Continue through each point until all points have been validated.

Report As Received

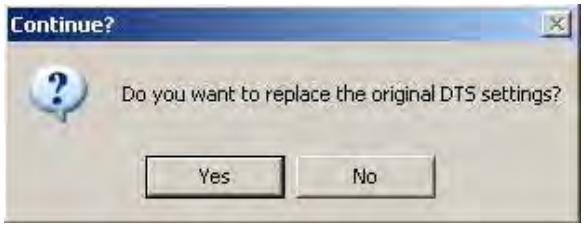
If the '**Report As Received**' function has been enabled for the test, TempCal will automatically generate an As Received report for the DTS. The files will be generated in the location specified in the '**Directories**' setup under '**Base path for XX channel certifications and list all reports**.' Reference **Appendix B - Sample As Received Certificate of Calibration** to see an example of an As Received report.

Report Validation

If the '**Report Validation**' function has been enabled for the test, TempCal will automatically generate a Validation report for the DTS' new calibration. The files will be generated in the location specified in the '**Directories**' setup under '**Base path for XX channel certifications and list all reports**.' Reference **Appendix C - Sample Certificate of Validation** to see an example of an As Received report.

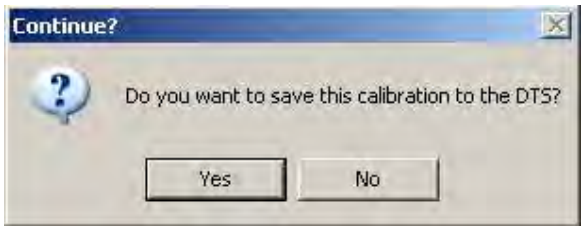
Replace Original Settings

If the '**Replace Original Settings**' function has been enabled for the test, TempCal will ask to replace the original DTS settings. Selecting '**Yes**' will command TempCal to reconfigure the DTS to the configuration before the test was conducted. **This is highly recommended.** Selecting '**No**' will not reconfigure the DTS and will leave the DTS configured for calibration. **In this state, the unit will not scan until several variables have been reconfigured.**



Save Calibration To DTS

If the '**Save Calibration To DTS**' function has been enabled for the test, TempCal will ask if the calibration should be saved to the DTS or not. It is recommended that the user first review the **As Received Report** and the **Validation Report** to determine if the calibration should be saved or not. Select '**Yes**' to save the calibration or '**No**' to ignore the most recent calibration and leave the DTS with the original pre-test calibration. **If only an As Received test has been run, do not save the calibration.**



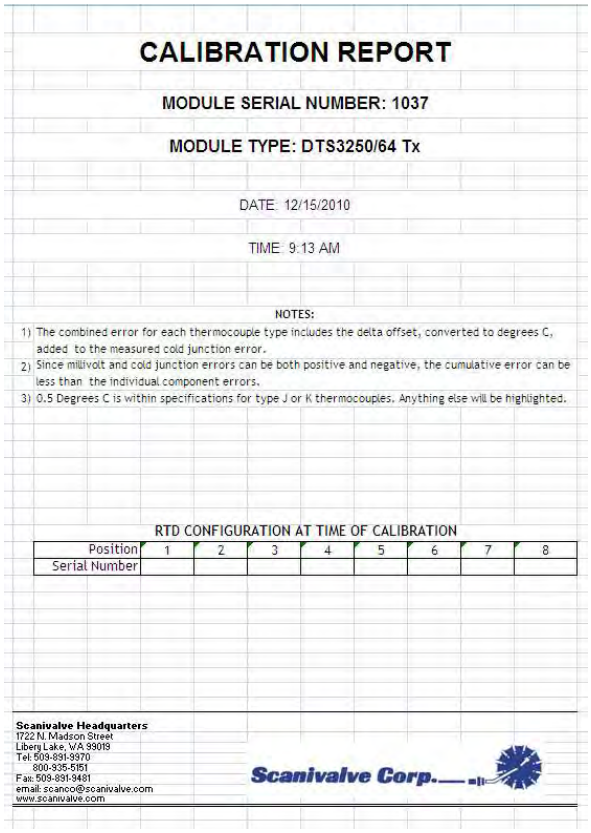
In order to restore the original calibration coefficients the DTS must be rebooted. After the '**No**' button is pushed deciding not to save the new calibration coefficients, TempCal automatically reboots the DTS. A message window appears noting this. Pressing the '**OK**' button is required to complete the test and restore the original calibration. As prompted in the message window, it may take several minutes for the DTS to reboot allowing a connection to be established again.

Validation

Validation Reports

If the '**Report As Received**' and '**Report Validation**' functions were enabled for the test, TempCal will have generated As Received and post-calibration Validation reports. These two reports can be used to evaluate the status of the unit before and after the calibration. In order for these reports to accurately represent the percentage of error of the unit, the error of the RTD's needs to be included in the report's calculations. The DTS was provided with a Certificate of Calibration new from the factory. This will be required as information included in this document is required to complete the form generated by TempCal.

The first page of the calibration report generated will include the module model and serial number, the date and time of the calibration or validation and configuration information of the module. The information that should be filled in manually on this sheet is the positioning of the internal RTD's. Scanivalve serializes and tracks all RTDs installed in DTS modules, and this information is important with regards to the validity of a calibration or validation. Depending of the model of module (16, 32 or 64 channel) several empty spaces will be left to record the serial number of the RTDs in each position within the module. This information can be found on the original certificate sheet of the module, but if it is not available contact Scanivalve. Figure 19 shows the first page of a Validation Report including the empty spaces to fill in RTD serial numbers.



CALIBRATION REPORT

MODULE SERIAL NUMBER: 1037

MODULE TYPE: DTS3250/64 Tx

DATE: 12/15/2010

TIME: 9:13 AM

NOTES:

1) The combined error for each thermocouple type includes the delta offset, converted to degrees C, added to the measured cold junction error.
2) Since millivolt and cold junction errors can be both positive and negative, the cumulative error can be less than the individual component errors.
3) 0.5 Degrees C is within specifications for type J or K thermocouples. Anything else will be highlighted.

RTD CONFIGURATION AT TIME OF CALIBRATION

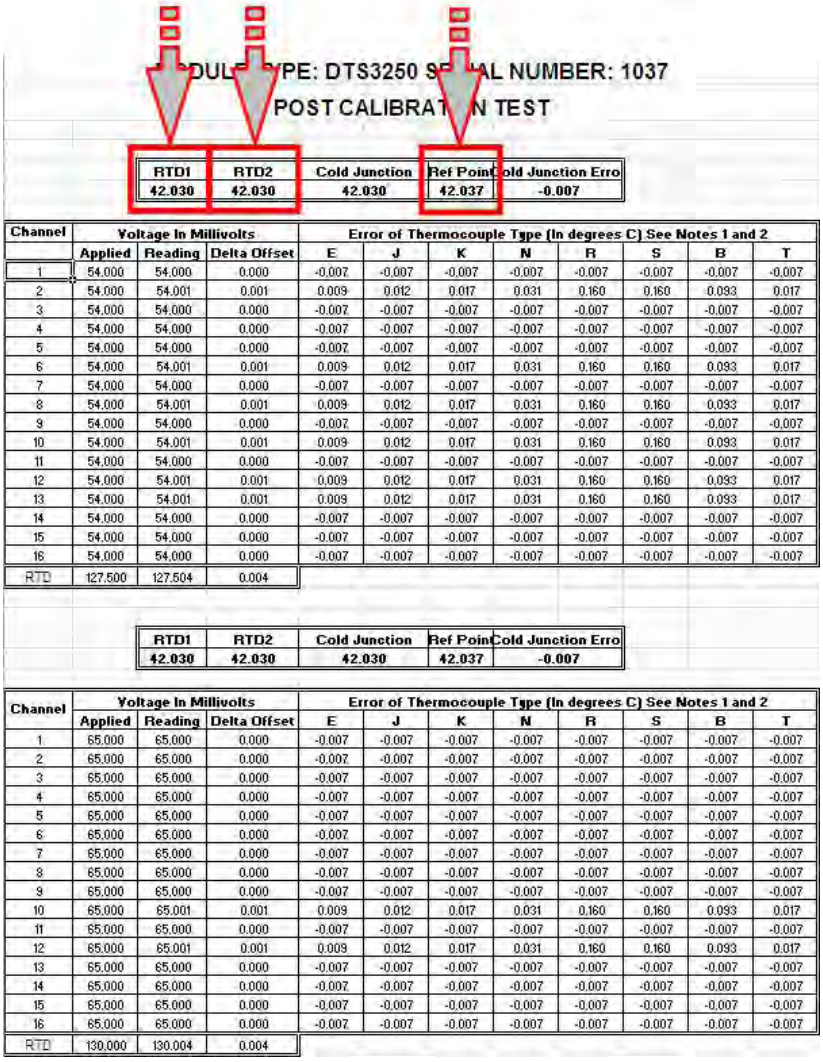
Position	1	2	3	4	5	6	7	8
Serial Number								

Scanivalve Headquarters
1722 N. Madson Street
Liberty Lake, WA 99019
Tel: 509-891-9970
800-935-5151
Fax: 509-891-9481
email: scanco@scanivalve.com
www.scanivalve.com

Scanivalve Corp.

Figure 19 - Validation cover page

The second page of the Certificate of Calibration should look like Figure 20 below. Along the top of the table the RTD readings are listed. Each set of RTD readings are unique to each DTS and each calibration of the RTD's. **Ensure that you reference the Certificate of Calibration from the same unit and the most recent calibration.**



DULE TYPE: DTS3250 SERIAL NUMBER: 1037

POST CALIBRATION TEST

RTD1	RTD2	Cold Junction	Ref Point	Cold Junction Erro
42.030	42.030	42.030	42.037	-0.007

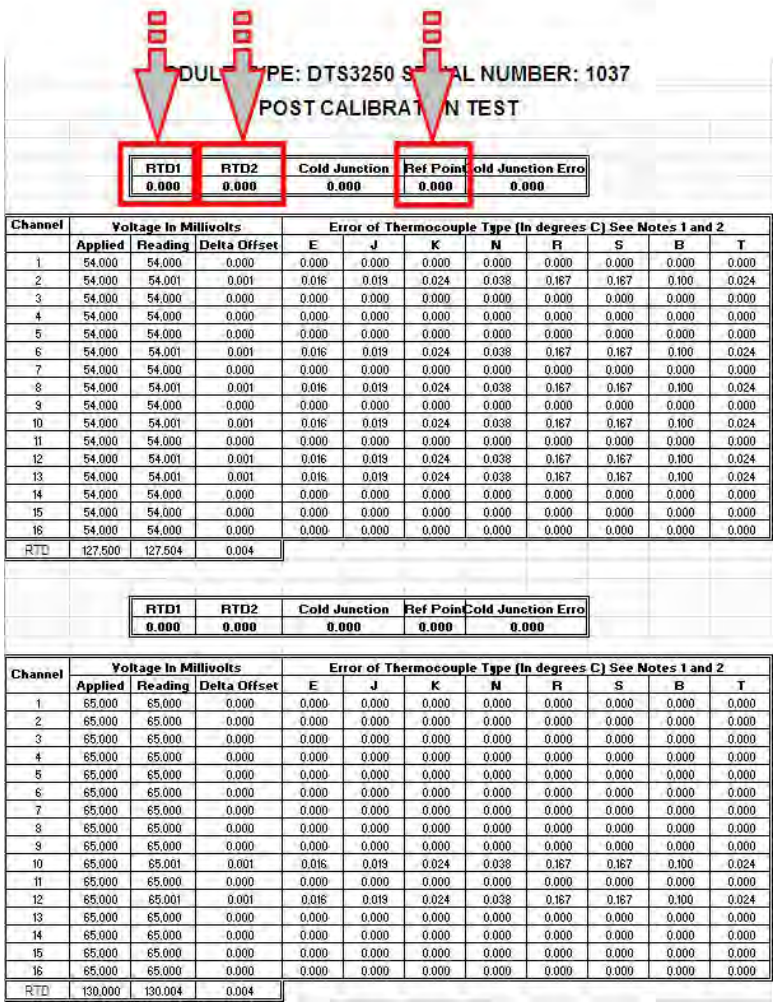
Channel	Voltage In Millivolts			Error of Thermocouple Type (In degrees C) See Notes 1 and 2							
	Applied	Reading	Delta Offset	E	J	K	N	R	S	B	T
1	54.000	54.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
2	54.000	54.001	0.001	0.009	0.012	0.017	0.031	0.160	0.160	0.093	0.017
3	54.000	54.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
4	54.000	54.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
5	54.000	54.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
6	54.000	54.001	0.001	0.009	0.012	0.017	0.031	0.160	0.160	0.093	0.017
7	54.000	54.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
8	54.000	54.001	0.001	0.009	0.012	0.017	0.031	0.160	0.160	0.093	0.017
9	54.000	54.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
10	54.000	54.001	0.001	0.009	0.012	0.017	0.031	0.160	0.160	0.093	0.017
11	54.000	54.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
12	54.000	54.001	0.001	0.009	0.012	0.017	0.031	0.160	0.160	0.093	0.017
13	54.000	54.001	0.001	0.009	0.012	0.017	0.031	0.160	0.160	0.093	0.017
14	54.000	54.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
15	54.000	54.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
16	54.000	54.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
RTD	127.500	127.504	0.004								

RTD1	RTD2	Cold Junction	Ref Point	Cold Junction Erro
42.030	42.030	42.030	42.037	-0.007

Channel	Voltage In Millivolts			Error of Thermocouple Type (In degrees C) See Notes 1 and 2							
	Applied	Reading	Delta Offset	E	J	K	N	R	S	B	T
1	65.000	65.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
2	65.000	65.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
3	65.000	65.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
4	65.000	65.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
5	65.000	65.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
6	65.000	65.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
7	65.000	65.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
8	65.000	65.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
9	65.000	65.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
10	65.000	65.001	0.001	0.009	0.012	0.017	0.031	0.160	0.160	0.093	0.017
11	65.000	65.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
12	65.000	65.001	0.001	0.009	0.012	0.017	0.031	0.160	0.160	0.093	0.017
13	65.000	65.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
14	65.000	65.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
15	65.000	65.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
16	65.000	65.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
RTD	130.000	130.004	0.004								

Figure 20 - Original Certificate of Calibration

The new Certificate of Calibration TempCal generates will be formatted exactly the same as the Certificate of Calibration provided with the DTS. To include the RTD errors from the original calibration in the new Certificate of Calibration simply input the values from **RTD 1**, **RTD 2** and **Ref Point** into the respective inputs. These values only need to be entered into the first positions on the first page (titled SN_###_Pts 1 & 2). Reference Figure 21 below.



DUL PE: DTS3250 S AL NUMBER: 1037

POST CALIBRA N TEST

RTD1	RTD2	Cold Junction	Ref Point	Cold Junction Erro
0.000	0.000	0.000	0.000	0.000

Channel	Voltage In Millivolts			Error of Thermocouple Type (In degrees C) See Notes 1 and 2							
	Applied	Reading	Delta Offset	E	J	K	N	R	S	B	T
1	54.000	54.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	54.000	54.001	0.001	0.016	0.019	0.024	0.038	0.167	0.167	0.100	0.024
3	54.000	54.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4	54.000	54.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	54.000	54.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	54.000	54.001	0.001	0.016	0.019	0.024	0.038	0.167	0.167	0.100	0.024
7	54.000	54.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8	54.000	54.001	0.001	0.016	0.019	0.024	0.038	0.167	0.167	0.100	0.024
9	54.000	54.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	54.000	54.001	0.001	0.016	0.019	0.024	0.038	0.167	0.167	0.100	0.024
11	54.000	54.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
12	54.000	54.001	0.001	0.016	0.019	0.024	0.038	0.167	0.167	0.100	0.024
13	54.000	54.001	0.001	0.016	0.019	0.024	0.038	0.167	0.167	0.100	0.024
14	54.000	54.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
15	54.000	54.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
16	54.000	54.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
RTD	127.500	127.504	0.004								

RTD1	RTD2	Cold Junction	Ref Point	Cold Junction Erro
0.000	0.000	0.000	0.000	0.000

Channel	Voltage In Millivolts			Error of Thermocouple Type (In degrees C) See Notes 1 and 2							
	Applied	Reading	Delta Offset	E	J	K	N	R	S	B	T
1	65.000	65.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	65.000	65.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	65.000	65.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4	65.000	65.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	65.000	65.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	65.000	65.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7	65.000	65.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8	65.000	65.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9	65.000	65.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	65.000	65.001	0.001	0.016	0.019	0.024	0.038	0.167	0.167	0.100	0.024
11	65.000	65.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
12	65.000	65.001	0.001	0.016	0.019	0.024	0.038	0.167	0.167	0.100	0.024
13	65.000	65.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
14	65.000	65.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
15	65.000	65.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
16	65.000	65.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
RTD	130.000	130.004	0.004								

Figure 21 - New Certificate of Calibration

Once the values are entered into the Certificate of Calibration any RTD errors can be accounted for and included in the calibration reports. Scanivalve recommends that the RTD's be recalibrated every 5 years. This procedure is only applicable when the RTD's are within the 5 year calibration period.

Functional Validation

As an option, a functional validation can be performed on the DTS after a new calibration using a Thermocouple Simulator or an Ice Point Calibrator. This ensures an acceptable calibration.

To perform a functional validation, connect to the DTS with a Telnet client, such as HyperTerminal or Telnet. Configure the DTS as follows:

SET PERIOD 7812
SET AVG 4
SET FPS 0
SET XCSCANTRIG 0
SET FORMAT 0
SET EU 1

Type '**Scan**' to begin scanning.

Using a Thermocouple Simulator or an Ice Point Calibrator, introduce a known voltage to each channel of the DTS individually.

Thermocouple leads or panel jack connectors may introduce errors into the readings. If it is suspected that this is the case, contact Scanivalve for support.

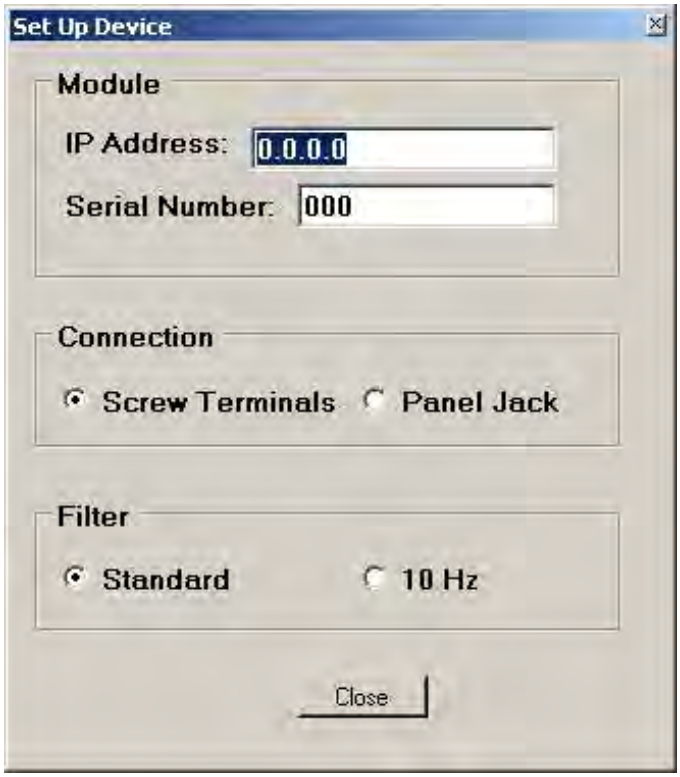
AUTOMATIC TEST OPERATION

This section will cover the setup and operation of an automatic test

Defining a Test

Device Setup

Click **Setup**, **Device** to open the Device Set Up Window.



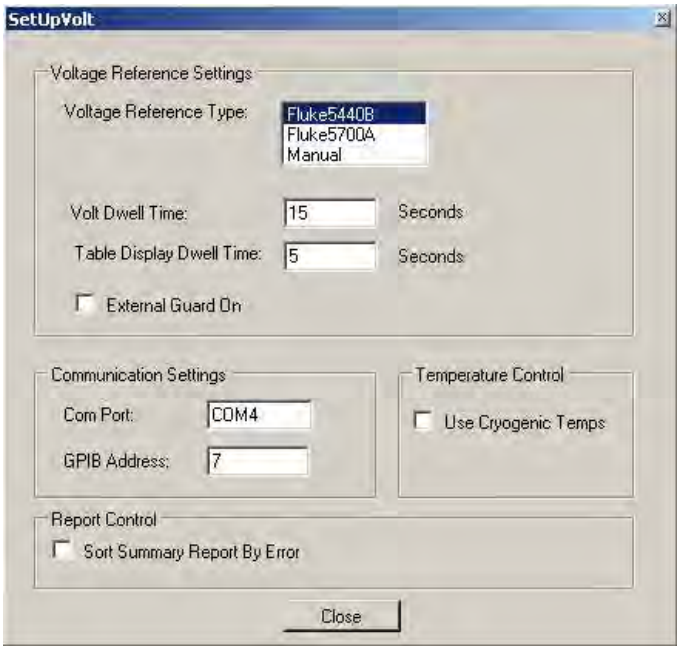
Enter the module configuration.

1. Enter the IP Address of the module.
2. Enter the serial number - this will be used in the reports.
3. Click on the thermocouple connection type.
4. Click the Standard Filter unless the module has the special 10 Hz filter option

Click when all of the information has been entered.

Volt

Click **Setup, Volt** to open the **Voltage Standard Set Up Window**.



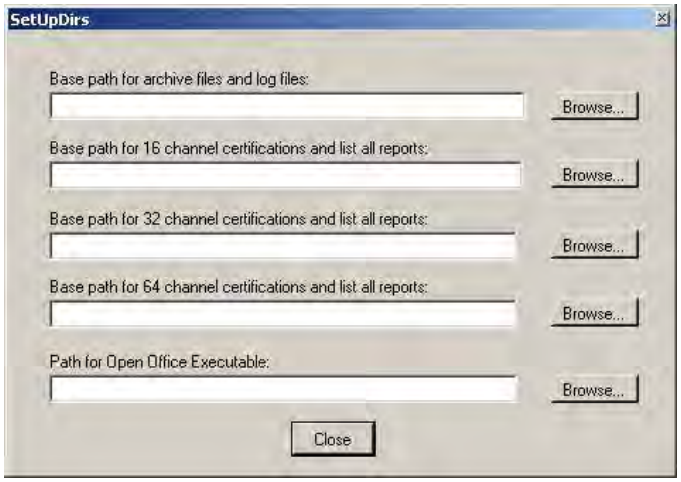
Enter the Voltmeter configuration.

1. Select the Voltmeter type. For automatic tests, select one of the Fluke voltage standards listed.
2. Set the **Volt Dwell Time**. 15 seconds is suggested.
3. Set the **Table Display Dwell Time**. This is personal preference.
4. The **External Guard On** box should be left unchecked.
5. Set the **Com Port** that the voltage standard will be using.
6. Set the **GPIB Address** that the voltage standard will be using.
   The Fluke Voltmeters operate over a GPIB interface when in the automatic calibration mode. Scanivalve Corp recommends an ICS Electronics 4895 Serial to GPIB interface be used.
7. If the test is calibrating a DTS unit used for extreme cold temperatures, select the '**Use Cryogenic Temps**' option. Otherwise, leave it unselected. Reference the Voltage Setup section for more information.
8. Selecting '**Sort Summary Report By Error**' will float the worst channels to the top of the report making it easier to review the Summary Report. If this is not selected, the channels will be arranged in numerical order.

Click Close when all of the information has been entered.

Directories

Click **Setup, Directories** to open the Directory definition window.



Base Path for Active Files
This option is used to define the directory where files created in the test will be placed. The **Browse** button can be used to navigate to and select the directory, or the full path can be directly entered in the window.

Base Path for 16 Channel Certifications and List All Reports
The option is used to define the directory where all Validation Reports and ListA Reports generated for 16 channel units will be created. The **Browse** button can be used to select the directory, or the full path can be directly entered in the window.

Base Path for 32 Channel Certifications and List All Reports
The option is used to define the directory where all Validation Reports and ListA Reports generated for 32 channel units will be created. The **Browse** button can be used to select the directory, or the full path can be directly entered in the window.

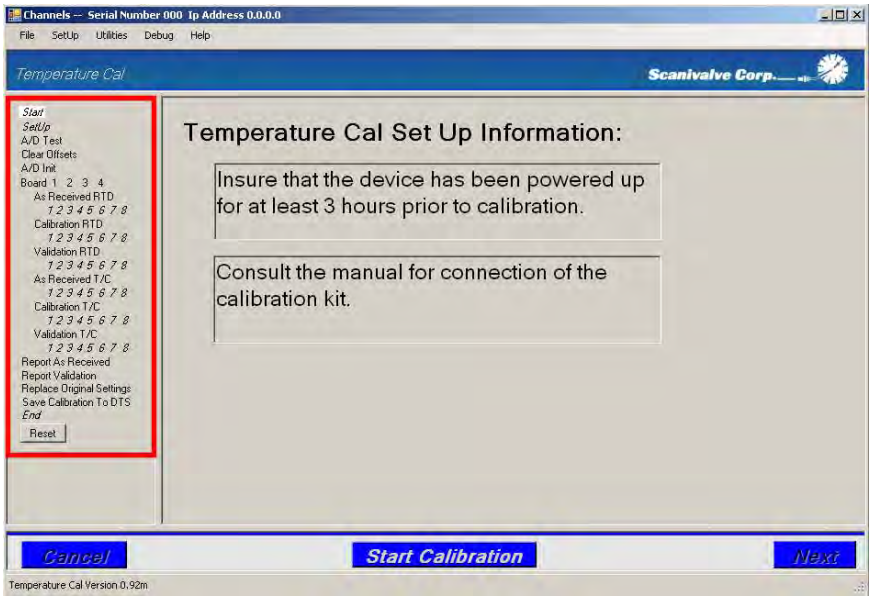
Base Path for 64 Channel Certifications and List All Reports
The option is used to define the directory where all Validation Reports and ListA Reports generated for 64 channel units will be created. The **Browse** button can be used to select the directory, or the full path can be directly entered in the window.

Path for Open Office Executable
This option is used if Microsoft Excel 2003 is not available and Open Office 'Calc' software is being used. In order for TempCal to reference Open Office instead of Excel 2003, the directory containing the file 'soffice.exe' must be entered here. The default installation location is: "C:\Program Files\OpenOffice.org 3\program". The **Browse** button can be used to navigate to and select the directory, or the full path can be directly entered in the window.

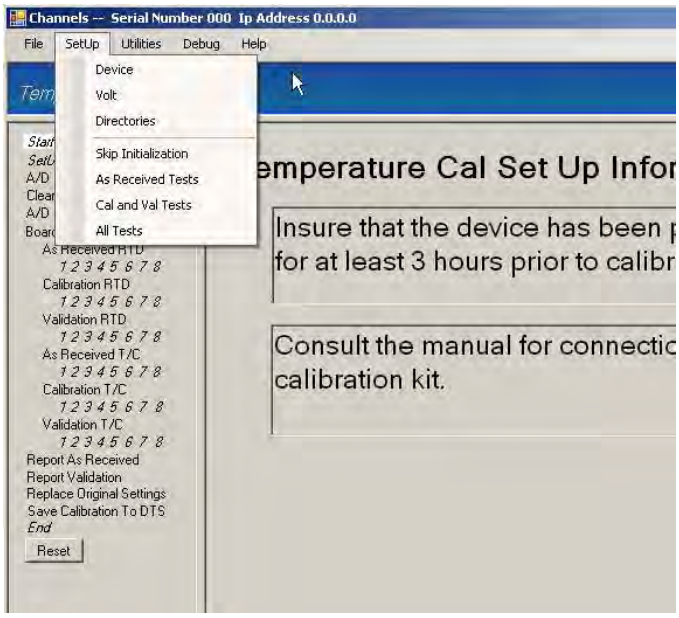
Click when all of the information has been entered.

Test Controls

The test controls can be configured by two means. The first method is by selecting and deselecting specific portions of the test in the **Test Controls** portion of the main screen.



Alternately, the test controls can be configured by selecting on of the pre-configured test setups found in the **Setup Menu**. See the section devoted to the **Setup Menu** in the **Getting Started** section of this manual.



Running a Test

Once the test has been defined and configured, the test can be commenced.

This is done by simply clicking

found at the bottom of the window.

To proceed through the test, click the

button at the bottom right corner of the window.

Additionally, the test can be advanced using the '**Enter**' key on the keyboard

At any point in the test, the test can be canceled by clicking the

or by pressing the '**Escape**' key on the keyboard.

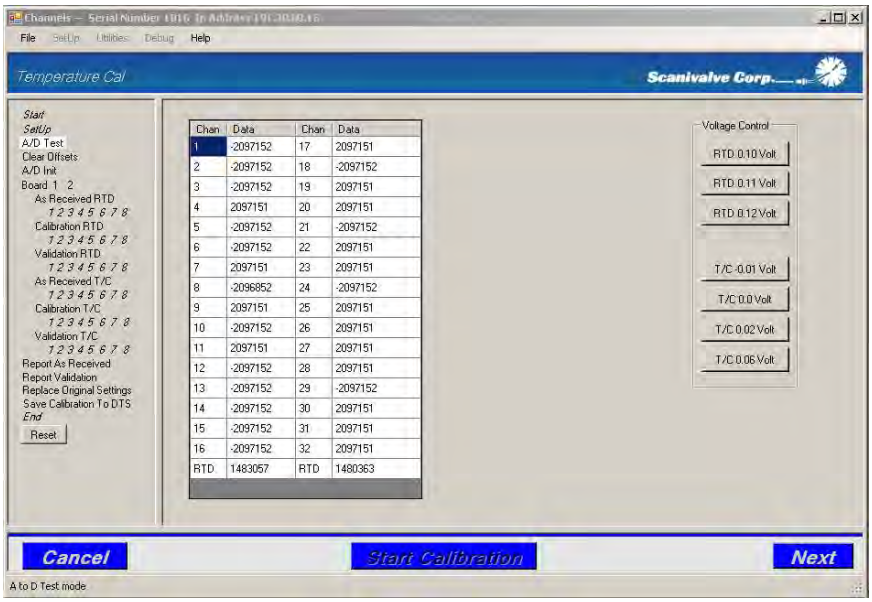
When a test is canceled, TempCal will automatically reset the DTS to the settings in place before the test was commenced.

When running the test in an automatic mode you will only be prompted to hook the RTD portion of the calibration kit to the voltage source at the beginning of the test and then disconnect the RTD connections and hook up the T/C portion of the calibration kit midway through the test.

A/D Test

The A/D Test page provides an interactive screen that enables the user to check the DTS response to input voltages. Including this test in the calibration is only recommended if it is suspected that either an RTD or an individual T/C channel has failed. Otherwise, this test is generally not necessary.

When running an automatic test with a compatible voltage source, the user can simply click the '**Voltage Control**' buttons to verify the DTS' response. In order for any voltages to be applied to the DTS, either the RTD connections of the Calibration Kit or the T/C connections of the Calibration Kit must be connected to the voltage standard for each respective test. **It is recommended that the user click the 'T/C 0.0 Volt' button before making or breaking any connection with the calibration harness.** See sections '**Connect RTD Cables**' and '**Connect T/C Cables**' for the relevant connection.

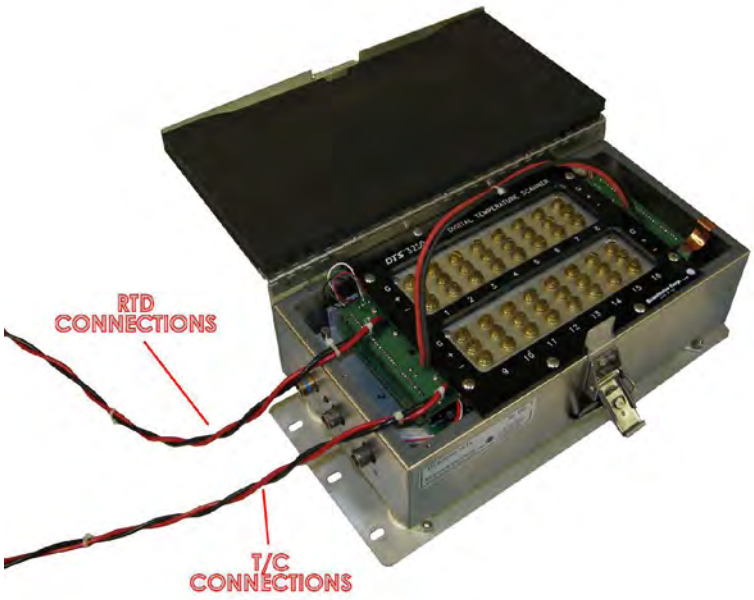


Note that the display updates at approximately 1 Hz.

Refer to **Appendix A - Standard Voltage Response Limits** to determine if the results of the test are within the recommended limits.

Connect RTD Cables

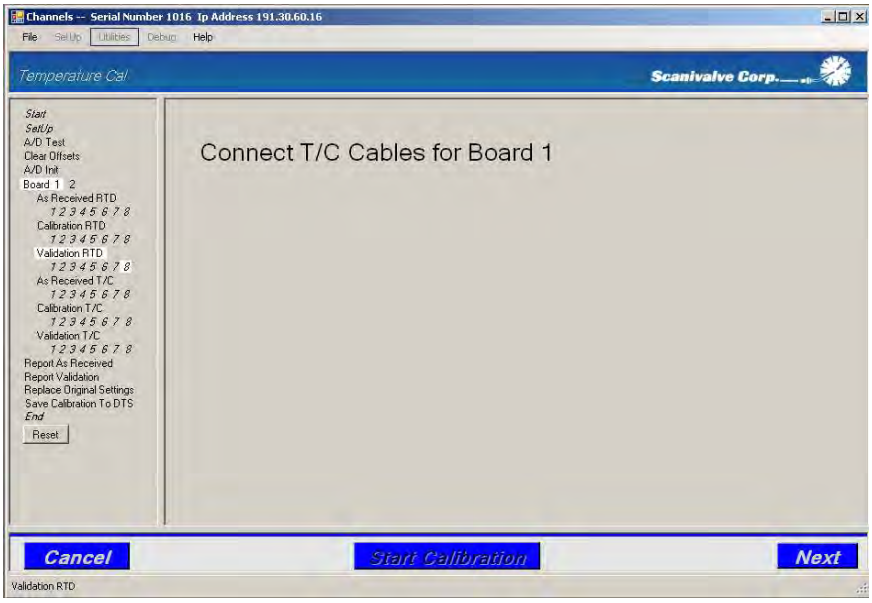
Before the As Received test, Calibration or Validation of the RTD(s) can be completed, the voltage standard must be connected to the RTD connections on the calibration harness.

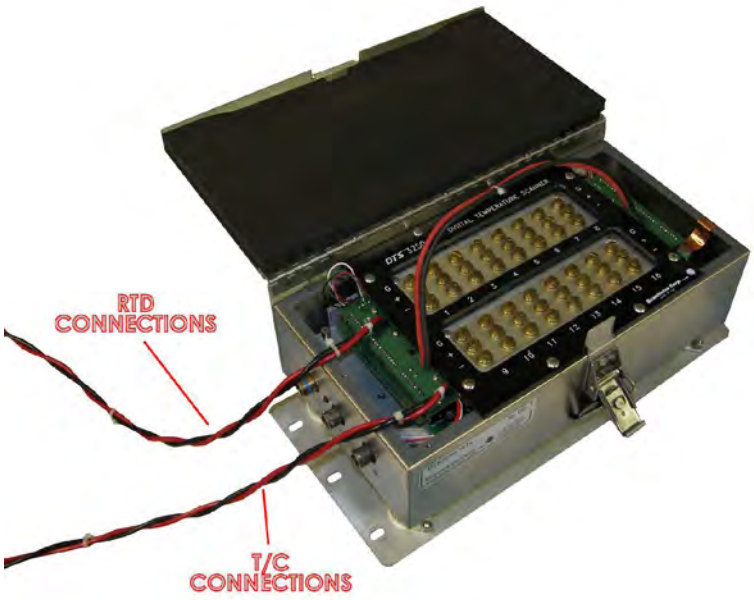


For each calibration harness, there is one RTD connection and one T/C connection. **The RTD connection for the voltage standard is labeled 'RTD.'** Connect the RTD connection, and click '**Next**.'

Connect T/C Cables

Before the As Received test, Calibration or Validation of the T/C(s) can be completed, the voltage standard must be connected to the T/C connections on the calibration harness.





For each calibration harness, there is one RTD connection and one T/C connection. **The T/C connection for the voltage standard is labeled 'T/C.'** Connect the T/C connection, and click '**Next**.'

Report As Received

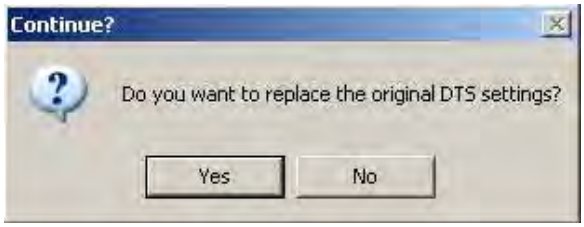
If the '**Report As Received**' function has been enabled for the test, TempCal will automatically generate an As Received report for the DTS. The files will be generated in the location specified in the '**Directories**' setup under '**Base path for XX channel certifications and list all reports**.' Reference **Appendix B - Sample As Received Certificate of Calibration** to see an example of an As Received report.

Report Validation

If the '**Report Validation**' function has been enabled for the test, TempCal will automatically generate a Validation report for the DTS' new calibration. The files will be generated in the location specified in the '**Directories**' setup under '**Base path for XX channel certifications and list all reports**.' Reference **Appendix C - Sample Certificate of Validation** to see an example of an As Received report.

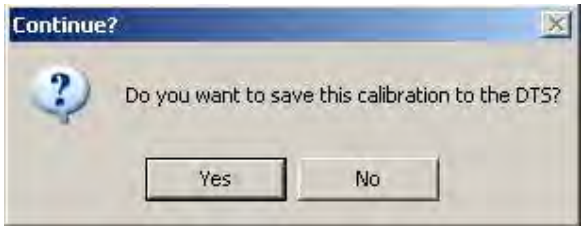
Replace Original Settings

If the '**Replace Original Settings**' function has been enabled for the test, TempCal will ask to replace the original DTS settings. Selecting '**Yes**' will command TempCal to reconfigure the DTS to the configuration before the test was conducted. **This is highly recommended.** Selecting '**No**' will not reconfigure the DTS and will leave the DTS configured for calibration. **In this state, the unit will not scan until several variables have been reconfigured.**



Save Calibration To DTS

If the '**Save Calibration To DTS**' function has been enabled for the test, TempCal will ask if the calibration should be saved to the DTS or not. It is recommended that the user first review the **As Received Report** and the **Validation Report** to determine if the calibration should be saved or not. Select '**Yes**' to save the calibration or '**No**' to ignore the most recent calibration and leave the DTS with the original pre-test calibration. **If only an As Received test has been run, do not save the calibration.**



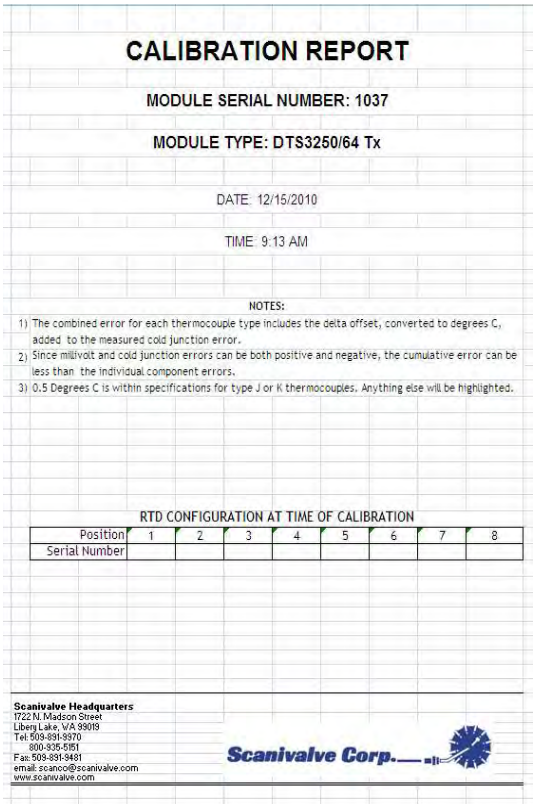
In order to restore the original calibration coefficients the DTS must be rebooted. After the '**No**' button is pushed deciding not to save the new calibration coefficients, TempCal automatically reboots the DTS. A message window appears noting this. Pressing the '**OK**' button is required to complete the test and restore the original calibration. As prompted in the message window, it may take several minutes for the DTS to reboot allowing a connection to be established again.

Validation

Validation Reports

If the '**Report As Received**' and '**Report Validation**' functions were enabled for the test, TempCal will have generated As Received and post-calibration Validation reports. These two reports can be used to evaluate the status of the unit before and after the calibration. In order for these reports to accurately represent the percentage of error of the unit, the error of the RTD's needs to be included in the report's calculations. The DTS was provided with a Certificate of Calibration new from the factory. This will be required as information included in this document is required to complete the form generated by TempCal.

The first page of the calibration report generated will include the module model and serial number, the date and time of the calibration or validation and configuration information of the module. The information that should be filled in manually on this sheet is the positioning of the internal RTD's. Scanivalve serializes and tracks all RTDs installed in DTS modules, and this information is important with regards to the validity of a calibration or validation. Depending of the model of module (16, 32 or 64 channel) several empty spaces will be left to record the serial number of the RTDs in each position within the module. This information can be found on the original certificate sheet of the module, but if it is not available contact Scanivalve. Figure 22 shows the first page of a Validation Report including the empty spaces to fill in RTD serial numbers.



CALIBRATION REPORT

MODULE SERIAL NUMBER: 1037

MODULE TYPE: DTS3250/64 Tx

DATE: 12/15/2010

TIME: 9:13 AM

NOTES:

1) The combined error for each thermocouple type includes the delta offset, converted to degrees C, added to the measured cold junction error.
2) Since millivolt and cold junction errors can be both positive and negative, the cumulative error can be less than the individual component errors.
3) 0.5 Degrees C is within specifications for type J or K thermocouples. Anything else will be highlighted.

RTD CONFIGURATION AT TIME OF CALIBRATION

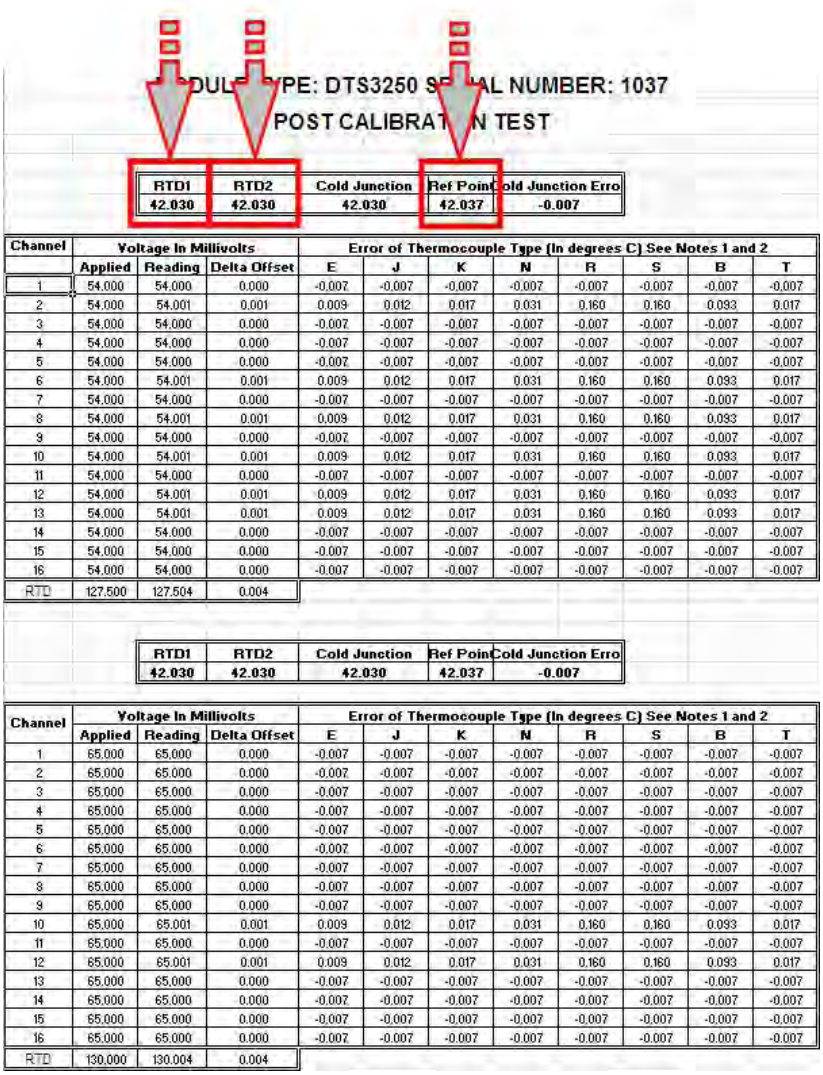
Position	1	2	3	4	5	6	7	8
Serial Number								

Scanivalve Headquarters
1722 N. Madson Street
Liberty Lake, WA 99019
Tel: 509-891-9970
800-935-5151
Fax: 509-891-9481
email: scanco@scanivalve.com
www.scanivalve.com

Scanivalve Corp.

Figure 22 - Validation cover page

The second page of the Certificate of Calibration should look like Figure 23 below. Along the top of the table the RTD readings are listed. Each set of RTD readings are unique to each DTS and each calibration of the RTD's. **Ensure that you reference the Certificate of Calibration from the same unit and the most recent calibration.**



PE: DTS3250 S AL NUMBER: 1037

POST CALIBRAT N TEST

RTD1	RTD2	Cold Junction	Ref Point	Cold Junction Erro
42.030	42.030	42.030	42.037	-0.007

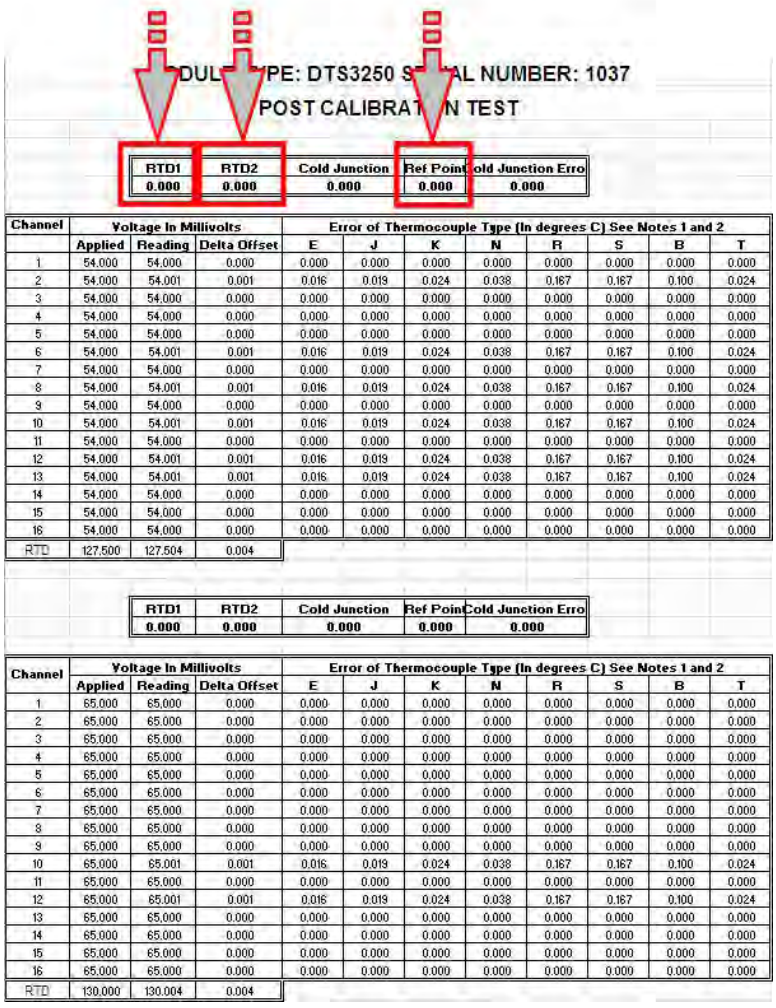
Channel	Voltage In Millivolts			Error of Thermocouple Type (In degrees C) See Notes 1 and 2							
	Applied	Reading	Delta Offset	E	J	K	N	R	S	B	T
1	54.000	54.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
2	54.000	54.001	0.001	0.009	0.012	0.017	0.031	0.160	0.160	0.093	0.017
3	54.000	54.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
4	54.000	54.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
5	54.000	54.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
6	54.000	54.001	0.001	0.009	0.012	0.017	0.031	0.160	0.160	0.093	0.017
7	54.000	54.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
8	54.000	54.001	0.001	0.009	0.012	0.017	0.031	0.160	0.160	0.093	0.017
9	54.000	54.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
10	54.000	54.001	0.001	0.009	0.012	0.017	0.031	0.160	0.160	0.093	0.017
11	54.000	54.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
12	54.000	54.001	0.001	0.009	0.012	0.017	0.031	0.160	0.160	0.093	0.017
13	54.000	54.001	0.001	0.009	0.012	0.017	0.031	0.160	0.160	0.093	0.017
14	54.000	54.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
15	54.000	54.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
16	54.000	54.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
RTD	127.500	127.504	0.004								

RTD1	RTD2	Cold Junction	Ref Point	Cold Junction Erro
42.030	42.030	42.030	42.037	-0.007

Channel	Voltage In Millivolts			Error of Thermocouple Type (In degrees C) See Notes 1 and 2							
	Applied	Reading	Delta Offset	E	J	K	N	R	S	B	T
1	65.000	65.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
2	65.000	65.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
3	65.000	65.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
4	65.000	65.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
5	65.000	65.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
6	65.000	65.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
7	65.000	65.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
8	65.000	65.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
9	65.000	65.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
10	65.000	65.001	0.001	0.009	0.012	0.017	0.031	0.160	0.160	0.093	0.017
11	65.000	65.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
12	65.000	65.001	0.001	0.009	0.012	0.017	0.031	0.160	0.160	0.093	0.017
13	65.000	65.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
14	65.000	65.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
15	65.000	65.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
16	65.000	65.000	0.000	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
RTD	130.000	130.004	0.004								

Figure 23 - Original Certificate of Calibration

The new Certificate of Calibration TempCal generates will be formatted exactly the same as the Certificate of Calibration provided with the DTS. To include the RTD errors from the original calibration in the new Certificate of Calibration simply input the values from **RTD 1**, **RTD 2** and **Ref Point** into the respective inputs. These values only need to be entered into the first positions on the first page (titled SN_###_Pts 1 & 2). Reference Figure 24 below.



DUL PE: DTS3250 S AL NUMBER: 1037

POST CALIBRA N TEST

RTD1	RTD2	Cold Junction	Ref Point	Cold Junction Erro
0.000	0.000	0.000	0.000	0.000

Channel	Voltage In Millivolts			Error of Thermocouple Type (In degrees C) See Notes 1 and 2							
	Applied	Reading	Delta Offset	E	J	K	N	R	S	B	T
1	54.000	54.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	54.000	54.001	0.001	0.016	0.019	0.024	0.038	0.167	0.167	0.100	0.024
3	54.000	54.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4	54.000	54.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	54.000	54.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	54.000	54.001	0.001	0.016	0.019	0.024	0.038	0.167	0.167	0.100	0.024
7	54.000	54.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8	54.000	54.001	0.001	0.016	0.019	0.024	0.038	0.167	0.167	0.100	0.024
9	54.000	54.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	54.000	54.001	0.001	0.016	0.019	0.024	0.038	0.167	0.167	0.100	0.024
11	54.000	54.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
12	54.000	54.001	0.001	0.016	0.019	0.024	0.038	0.167	0.167	0.100	0.024
13	54.000	54.001	0.001	0.016	0.019	0.024	0.038	0.167	0.167	0.100	0.024
14	54.000	54.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
15	54.000	54.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
16	54.000	54.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
RTD	127.500	127.504	0.004								

RTD1	RTD2	Cold Junction	Ref Point	Cold Junction Erro
0.000	0.000	0.000	0.000	0.000

Channel	Voltage In Millivolts			Error of Thermocouple Type (In degrees C) See Notes 1 and 2							
	Applied	Reading	Delta Offset	E	J	K	N	R	S	B	T
1	65.000	65.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	65.000	65.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	65.000	65.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4	65.000	65.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	65.000	65.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	65.000	65.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7	65.000	65.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8	65.000	65.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9	65.000	65.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	65.000	65.001	0.001	0.016	0.019	0.024	0.038	0.167	0.167	0.100	0.024
11	65.000	65.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
12	65.000	65.001	0.001	0.016	0.019	0.024	0.038	0.167	0.167	0.100	0.024
13	65.000	65.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
14	65.000	65.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
15	65.000	65.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
16	65.000	65.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
RTD	130.000	130.004	0.004								

Figure 24 - New Certificate of Calibration

Once the values are entered into the Certificate of Calibration any RTD errors can be accounted for and included in the calibration reports. Scanivalve recommends that the RTD's be recalibrated every 5 years. This procedure is only applicable when the RTD's are within the 5 year calibration period.

Functional Validation

As an option, a functional validation can be performed on the DTS after a new calibration using a Thermocouple Simulator or an Ice Point Calibrator. This ensures an acceptable calibration.

To perform a functional validation, connect to the DTS with a Telnet client, such as HyperTerminal or Telnet. Configure the DTS as follows:

SET PERIOD 7812
SET AVG 4
SET FPS 0
SET XCSCANTRIG 0
SET FORMAT 0
SET EU 1

Type 'Scan' to begin scanning.

Using a Thermocouple Simulator or an Ice Point Calibrator, introduce a known voltage to each channel of the DTS individually.

Thermocouple leads or panel jack connectors may introduce errors into the readings. If it is suspected that this is the case, contact Scanivalve for support.

Appendix A - Standard Voltage Response Limits

Table 1 - RTD Voltage Response Limits

APPLIED VOLTAGE	IDEAL COUNTS	LOW LIMIT	HIGH LIMIT
100 mV	1354760	1339760	1369760
110 mV	1490236	1475236	1505236
120 mV	1625712	1610712	1640712

Table 2 - Thermocouple Voltage Response Limits

APPLIED VOLTAGE	IDEAL COUNTS	LOW LIMIT	HIGH LIMIT
-10 mV	-275985	-290985	-260985
0 mV	0	-15000	15000
20 mV	551970	536970	566970
60 mV	1655911	1640911	1670911

Appendix B - Sample As Received Certificate of Calibration

Table 3 - Sample As Received Summary Sheet

MODULE TYPE: DTS3250 SERIAL NUMBER: 1037
AS RECEIVED

T/C Points				
Channel	Applied	Reading	Delta Offset	Abs Offset
8	65.000	64.953	-0.047	0.047
8	54.000	53.961	-0.039	0.039
10	65.000	64.965	-0.035	0.035
2	65.000	64.967	-0.033	0.033
8	42.000	41.968	-0.032	0.032
11	65.000	64.968	-0.032	0.032
13	65.000	64.970	-0.030	0.030
10	54.000	53.971	-0.029	0.029
14	65.000	64.971	-0.029	0.029
2	54.000	53.973	-0.027	0.027
3	65.000	64.973	-0.027	0.027
12	65.000	64.973	-0.027	0.027
11	54.000	53.974	-0.026	0.026
13	54.000	53.975	-0.025	0.025
8	30.000	29.976	-0.024	0.024
14	54.000	53.976	-0.024	0.024
6	65.000	64.976	-0.024	0.024
15	65.000	64.976	-0.024	0.024
10	42.000	41.977	-0.023	0.023
1	65.000	64.978	-0.022	0.022
7	65.000	64.978	-0.022	0.022
3	54.000	53.978	-0.022	0.022
2	42.000	41.979	-0.021	0.021
12	54.000	53.979	-0.021	0.021
5	65.000	64.979	-0.021	0.021
11	42.000	41.980	-0.020	0.020
13	42.000	41.980	-0.020	0.020
6	54.000	53.980	-0.020	0.020
15	54.000	53.981	-0.019	0.019
14	42.000	41.982	-0.018	0.018
1	54.000	53.982	-0.018	0.018
3	42.000	41.983	-0.017	0.017
12	42.000	41.983	-0.017	0.017
5	54.000	53.983	-0.017	0.017
7	54.000	53.983	-0.017	0.017
10	30.000	29.983	-0.017	0.017
9	65.000	64.983	-0.017	0.017

RTD Points				
Channel	Applied	Reading	Delta Offset	Abs Offset
1	0.000	0.000	0.000	0.000
1	0.000	0.000	0.000	0.000
1	0.000	0.000	0.000	0.000
1	0.000	0.000	0.000	0.000
1	0.000	0.000	0.000	0.000
1	0.000	0.000	0.000	0.000
1	0.000	0.000	0.000	0.000
1	0.000	0.000	0.000	0.000

16	65.000	64.983	-0.017	0.017
4	65.000	64.984	-0.016	0.016
8	18.000	17.984	-0.016	0.016
6	42.000	41.984	-0.016	0.016
2	30.000	29.985	-0.015	0.015
15	42.000	41.985	-0.015	0.015
1	42.000	41.986	-0.014	0.014
7	42.000	41.986	-0.014	0.014
16	54.000	53.986	-0.014	0.014
11	30.000	29.986	-0.014	0.014
13	30.000	29.986	-0.014	0.014
14	30.000	29.987	-0.013	0.013
5	42.000	41.987	-0.013	0.013
4	54.000	53.987	-0.013	0.013
9	54.000	53.987	-0.013	0.013
3	30.000	29.988	-0.012	0.012
6	30.000	29.988	-0.012	0.012
12	30.000	29.988	-0.012	0.012
15	30.000	29.989	-0.011	0.011
10	18.000	17.990	-0.010	0.010
1	30.000	29.990	-0.010	0.010
7	30.000	29.990	-0.010	0.010
4	42.000	41.990	-0.010	0.010
9	42.000	41.990	-0.010	0.010
16	42.000	41.990	-0.010	0.010
5	30.000	29.991	-0.009	0.009
2	18.000	17.992	-0.008	0.008
11	18.000	17.992	-0.008	0.008
13	18.000	17.992	-0.008	0.008
6	18.000	17.993	-0.007	0.007
12	18.000	17.993	-0.007	0.007
14	18.000	17.993	-0.007	0.007
4	30.000	29.993	-0.007	0.007
9	30.000	29.993	-0.007	0.007
16	30.000	29.993	-0.007	0.007
8	6.000	5.993	-0.007	0.007
3	18.000	17.994	-0.006	0.006
7	18.000	17.994	-0.006	0.006
15	18.000	17.994	-0.006	0.006
2	-5.000	-4.995	0.005	0.005
3	-5.000	-4.995	0.005	0.005
1	18.000	17.995	-0.005	0.005
5	18.000	17.995	-0.005	0.005
4	18.000	17.996	-0.004	0.004
16	18.000	17.996	-0.004	0.004
8	0.000	-0.004	-0.004	0.004
9	-5.000	-4.996	0.004	0.004
11	-5.000	-4.996	0.004	0.004

14	-5.000	-4.996	0.004	0.004
1	-5.000	-4.997	0.003	0.003
5	-5.000	-4.997	0.003	0.003
7	-5.000	-4.997	0.003	0.003
10	-5.000	-4.997	0.003	0.003
12	-5.000	-4.997	0.003	0.003
13	-5.000	-4.997	0.003	0.003
15	-5.000	-4.997	0.003	0.003
16	-5.000	-4.997	0.003	0.003
6	6.000	5.997	-0.003	0.003
10	6.000	5.997	-0.003	0.003
9	18.000	17.997	-0.003	0.003
1	0.000	0.003	0.003	0.003
3	0.000	0.002	0.002	0.002
4	0.000	0.002	0.002	0.002
4	-5.000	-4.998	0.002	0.002
11	6.000	5.998	-0.002	0.002
13	6.000	5.998	-0.002	0.002
6	-5.000	-4.999	0.001	0.001
2	6.000	5.999	-0.001	0.001
7	6.000	5.999	-0.001	0.001
9	6.000	6.001	0.001	0.001
12	6.000	5.999	-0.001	0.001
14	6.000	5.999	-0.001	0.001
15	6.000	5.999	-0.001	0.001
6	0.000	-0.001	-0.001	0.001
7	0.000	0.001	0.001	0.001
9	0.000	0.001	0.001	0.001
10	0.000	-0.001	-0.001	0.001
15	0.000	0.001	0.001	0.001
16	0.000	0.001	0.001	0.001
8	-5.000	-5.000	0.000	0.000
2	0.000	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000
13	0.000	0.000	0.000	0.000
14	0.000	0.000	0.000	0.000
1	6.000	6.000	0.000	0.000
3	6.000	6.000	0.000	0.000
4	6.000	6.000	0.000	0.000
5	6.000	6.000	0.000	0.000
16	6.000	6.000	0.000	0.000

Table 4 - Sample As Received Channel Error Report

MODULE TYPE: DTS3250 SERIAL NUMBER: 1037
AS RECEIVED

RTD1	RTD2	Cold Junction	Ref Point	Cold Junction Error
40.130	40.190	40.160	40.109	0.051

Channel	Voltage In Millivolts			Error of Thermocouple Type (In degrees C) See Notes 1 and 2							
	Applied	Reading	Delta Offset	E	J	K	N	R	S	B	T
1	-5.000	-4.997	0.003	0.099	0.109	0.124	0.166	0.551	0.551	0.351	0.124
2	-5.000	-4.995	0.005	0.132	0.147	0.173	0.243	0.884	0.884	0.551	0.173
3	-5.000	-4.995	0.005	0.132	0.147	0.173	0.243	0.884	0.884	0.551	0.173
4	-5.000	-4.998	0.002	0.083	0.089	0.100	0.128	0.384	0.384	0.251	0.100
5	-5.000	-4.997	0.003	0.099	0.109	0.124	0.166	0.551	0.551	0.351	0.124
6	-5.000	-4.999	0.001	0.067	0.070	0.075	0.089	0.218	0.218	0.151	0.075
7	-5.000	-4.997	0.003	0.099	0.109	0.124	0.166	0.551	0.551	0.351	0.124
8	-5.000	-5.000	0.000	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051
9	-5.000	-4.996	0.004	0.116	0.128	0.149	0.205	0.718	0.718	0.451	0.149
10	-5.000	-4.997	0.003	0.099	0.109	0.124	0.166	0.551	0.551	0.351	0.124
11	-5.000	-4.996	0.004	0.116	0.128	0.149	0.205	0.718	0.718	0.451	0.149
12	-5.000	-4.997	0.003	0.099	0.109	0.124	0.166	0.551	0.551	0.351	0.124
13	-5.000	-4.997	0.003	0.099	0.109	0.124	0.166	0.551	0.551	0.351	0.124
14	-5.000	-4.996	0.004	0.116	0.128	0.149	0.205	0.718	0.718	0.451	0.149
15	-5.000	-4.997	0.003	0.099	0.109	0.124	0.166	0.551	0.551	0.351	0.124
16	-5.000	-4.997	0.003	0.099	0.109	0.124	0.166	0.551	0.551	0.351	0.124
RTD	0.000	0.000	0.000								

RTD1	RTD2	Cold Junction	Ref Point	Cold Junction Error
40.130	40.190	40.160	40.109	0.051

Channel	Voltage In Millivolts			Error of Thermocouple Type (In degrees C) See Notes 1 and 2							
	Applied	Reading	Delta Offset	E	J	K	N	R	S	B	T
1	0.000	0.003	0.003	0.099	0.109	0.124	0.166	0.551	0.551	0.351	0.124
2	0.000	0.000	0.000	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051
3	0.000	0.002	0.002	0.083	0.089	0.100	0.128	0.384	0.384	0.251	0.100
4	0.000	0.002	0.002	0.083	0.089	0.100	0.128	0.384	0.384	0.251	0.100
5	0.000	0.000	0.000	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051
6	0.000	-0.001	-0.001	0.035	0.032	0.027	0.013	-0.116	-0.116	-0.049	0.027
7	0.000	0.001	0.001	0.067	0.070	0.075	0.089	0.218	0.218	0.151	0.075
8	0.000	-0.004	-0.004	-0.014	-0.026	-0.047	-0.103	-0.616	-0.616	-0.349	-0.047
9	0.000	0.001	0.001	0.067	0.070	0.075	0.089	0.218	0.218	0.151	0.075
10	0.000	-0.001	-0.001	0.035	0.032	0.027	0.013	-0.116	-0.116	-0.049	0.027
11	0.000	0.000	0.000	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051
12	0.000	0.000	0.000	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051
13	0.000	0.000	0.000	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051
14	0.000	0.000	0.000	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051
15	0.000	0.001	0.001	0.067	0.070	0.075	0.089	0.218	0.218	0.151	0.075
16	0.000	0.001	0.001	0.067	0.070	0.075	0.089	0.218	0.218	0.151	0.075
RTD	0.000	0.000	0.000								

Appendix C - Sample Certificate of Calibration

Table 5 - Sample Post Calibration Summary Sheet

MODULE TYPE: DTS3250 SERIAL NUMBER: 1037
POST CALIBRATION TEST

T/C Points				
Channel	Applied	Reading	Delta Offset	Abs Offset
8	65.000	64.953	-0.047	0.047
8	54.000	53.961	-0.039	0.039
10	65.000	64.965	-0.035	0.035
2	65.000	64.967	-0.033	0.033
8	42.000	41.968	-0.032	0.032
11	65.000	64.968	-0.032	0.032
13	65.000	64.970	-0.030	0.030
10	54.000	53.971	-0.029	0.029
14	65.000	64.971	-0.029	0.029
2	54.000	53.973	-0.027	0.027
3	65.000	64.973	-0.027	0.027
12	65.000	64.973	-0.027	0.027
11	54.000	53.974	-0.026	0.026
13	54.000	53.975	-0.025	0.025
8	30.000	29.976	-0.024	0.024
14	54.000	53.976	-0.024	0.024
6	65.000	64.976	-0.024	0.024
15	65.000	64.976	-0.024	0.024
10	42.000	41.977	-0.023	0.023
1	65.000	64.978	-0.022	0.022
7	65.000	64.978	-0.022	0.022
3	54.000	53.978	-0.022	0.022
2	42.000	41.979	-0.021	0.021
12	54.000	53.979	-0.021	0.021
5	65.000	64.979	-0.021	0.021
11	42.000	41.980	-0.020	0.020
13	42.000	41.980	-0.020	0.020
6	54.000	53.980	-0.020	0.020
15	54.000	53.981	-0.019	0.019
14	42.000	41.982	-0.018	0.018
1	54.000	53.982	-0.018	0.018
3	42.000	41.983	-0.017	0.017
12	42.000	41.983	-0.017	0.017
5	54.000	53.983	-0.017	0.017
7	54.000	53.983	-0.017	0.017
10	30.000	29.983	-0.017	0.017

RTD Points				
Channel	Applied	Reading	Delta Offset	Abs Offset
1	0.000	0.000	0.000	0.000
1	0.000	0.000	0.000	0.000
1	0.000	0.000	0.000	0.000
1	0.000	0.000	0.000	0.000
1	0.000	0.000	0.000	0.000
1	0.000	0.000	0.000	0.000
1	0.000	0.000	0.000	0.000
1	0.000	0.000	0.000	0.000

9	65.000	64.983	-0.017	0.017
16	65.000	64.983	-0.017	0.017
4	65.000	64.984	-0.016	0.016
8	18.000	17.984	-0.016	0.016
6	42.000	41.984	-0.016	0.016
2	30.000	29.985	-0.015	0.015
15	42.000	41.985	-0.015	0.015
1	42.000	41.986	-0.014	0.014
7	42.000	41.986	-0.014	0.014
16	54.000	53.986	-0.014	0.014
11	30.000	29.986	-0.014	0.014
13	30.000	29.986	-0.014	0.014
14	30.000	29.987	-0.013	0.013
5	42.000	41.987	-0.013	0.013
4	54.000	53.987	-0.013	0.013
9	54.000	53.987	-0.013	0.013
3	30.000	29.988	-0.012	0.012
6	30.000	29.988	-0.012	0.012
12	30.000	29.988	-0.012	0.012
15	30.000	29.989	-0.011	0.011
10	18.000	17.990	-0.010	0.010
1	30.000	29.990	-0.010	0.010
7	30.000	29.990	-0.010	0.010
4	42.000	41.990	-0.010	0.010
9	42.000	41.990	-0.010	0.010
16	42.000	41.990	-0.010	0.010
5	30.000	29.991	-0.009	0.009
2	18.000	17.992	-0.008	0.008
11	18.000	17.992	-0.008	0.008
13	18.000	17.992	-0.008	0.008
6	18.000	17.993	-0.007	0.007
12	18.000	17.993	-0.007	0.007
14	18.000	17.993	-0.007	0.007
4	30.000	29.993	-0.007	0.007
9	30.000	29.993	-0.007	0.007
16	30.000	29.993	-0.007	0.007
8	6.000	5.993	-0.007	0.007
3	18.000	17.994	-0.006	0.006
7	18.000	17.994	-0.006	0.006
15	18.000	17.994	-0.006	0.006
2	-5.000	-4.995	0.005	0.005
3	-5.000	-4.995	0.005	0.005
1	18.000	17.995	-0.005	0.005
5	18.000	17.995	-0.005	0.005
4	18.000	17.996	-0.004	0.004
16	18.000	17.996	-0.004	0.004
8	0.000	-0.004	-0.004	0.004
9	-5.000	-4.996	0.004	0.004

11	-5.000	-4.996	0.004	0.004
14	-5.000	-4.996	0.004	0.004
1	-5.000	-4.997	0.003	0.003
5	-5.000	-4.997	0.003	0.003
7	-5.000	-4.997	0.003	0.003
10	-5.000	-4.997	0.003	0.003
12	-5.000	-4.997	0.003	0.003
13	-5.000	-4.997	0.003	0.003
15	-5.000	-4.997	0.003	0.003
16	-5.000	-4.997	0.003	0.003
6	6.000	5.997	-0.003	0.003
10	6.000	5.997	-0.003	0.003
9	18.000	17.997	-0.003	0.003
1	0.000	0.003	0.003	0.003
3	0.000	0.002	0.002	0.002
4	0.000	0.002	0.002	0.002
4	-5.000	-4.998	0.002	0.002
11	6.000	5.998	-0.002	0.002
13	6.000	5.998	-0.002	0.002
6	-5.000	-4.999	0.001	0.001
2	6.000	5.999	-0.001	0.001
7	6.000	5.999	-0.001	0.001
9	6.000	6.001	0.001	0.001
12	6.000	5.999	-0.001	0.001
14	6.000	5.999	-0.001	0.001
15	6.000	5.999	-0.001	0.001
6	0.000	-0.001	-0.001	0.001
7	0.000	0.001	0.001	0.001
9	0.000	0.001	0.001	0.001
10	0.000	-0.001	-0.001	0.001
15	0.000	0.001	0.001	0.001
16	0.000	0.001	0.001	0.001
8	-5.000	-5.000	0.000	0.000
2	0.000	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000
13	0.000	0.000	0.000	0.000
14	0.000	0.000	0.000	0.000
1	6.000	6.000	0.000	0.000
3	6.000	6.000	0.000	0.000
4	6.000	6.000	0.000	0.000
5	6.000	6.000	0.000	0.000
16	6.000	6.000	0.000	0.000

Table 6 - Sample Post Calibration Channel Error Report

MODULE TYPE: DTS3250 SERIAL NUMBER: 1037
POST CALIBRATION TEST

RTD1	RTD2	Cold Junction	Ref Point	Cold Junction Error
40.130	40.190	40.160	40.109	0.051

Channel	Voltage In Millivolts			Error of Thermocouple Type (In degrees C) See Notes 1 and 2							
	Applied	Reading	Delta Offset	E	J	K	N	R	S	B	T
1	-5.000	-4.997	0.003	0.099	0.109	0.124	0.166	0.551	0.551	0.351	0.124
2	-5.000	-4.995	0.005	0.132	0.147	0.173	0.243	0.884	0.884	0.551	0.173
3	-5.000	-4.995	0.005	0.132	0.147	0.173	0.243	0.884	0.884	0.551	0.173
4	-5.000	-4.998	0.002	0.083	0.089	0.100	0.128	0.384	0.384	0.251	0.100
5	-5.000	-4.997	0.003	0.099	0.109	0.124	0.166	0.551	0.551	0.351	0.124
6	-5.000	-4.999	0.001	0.067	0.070	0.075	0.089	0.218	0.218	0.151	0.075
7	-5.000	-4.997	0.003	0.099	0.109	0.124	0.166	0.551	0.551	0.351	0.124
8	-5.000	-5.000	0.000	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051
9	-5.000	-4.996	0.004	0.116	0.128	0.149	0.205	0.718	0.718	0.451	0.149
10	-5.000	-4.997	0.003	0.099	0.109	0.124	0.166	0.551	0.551	0.351	0.124
11	-5.000	-4.996	0.004	0.116	0.128	0.149	0.205	0.718	0.718	0.451	0.149
12	-5.000	-4.997	0.003	0.099	0.109	0.124	0.166	0.551	0.551	0.351	0.124
13	-5.000	-4.997	0.003	0.099	0.109	0.124	0.166	0.551	0.551	0.351	0.124
14	-5.000	-4.996	0.004	0.116	0.128	0.149	0.205	0.718	0.718	0.451	0.149
15	-5.000	-4.997	0.003	0.099	0.109	0.124	0.166	0.551	0.551	0.351	0.124
16	-5.000	-4.997	0.003	0.099	0.109	0.124	0.166	0.551	0.551	0.351	0.124
RTD	0.000	0.000	0.000								

RTD1	RTD2	Cold Junction	Ref Point	Cold Junction Error
40.130	40.190	40.160	40.109	0.051

Channel	Voltage In Millivolts			Error of Thermocouple Type (In degrees C) See Notes 1 and 2							
	Applied	Reading	Delta Offset	E	J	K	N	R	S	B	T
1	0.000	0.003	0.003	0.099	0.109	0.124	0.166	0.551	0.551	0.351	0.124
2	0.000	0.000	0.000	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051
3	0.000	0.002	0.002	0.083	0.089	0.100	0.128	0.384	0.384	0.251	0.100
4	0.000	0.002	0.002	0.083	0.089	0.100	0.128	0.384	0.384	0.251	0.100
5	0.000	0.000	0.000	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051
6	0.000	-0.001	-0.001	0.035	0.032	0.027	0.013	-0.116	-0.116	-0.049	0.027
7	0.000	0.001	0.001	0.067	0.070	0.075	0.089	0.218	0.218	0.151	0.075
8	0.000	-0.004	-0.004	-0.014	-0.026	-0.047	-0.103	-0.616	-0.616	-0.349	-0.047
9	0.000	0.001	0.001	0.067	0.070	0.075	0.089	0.218	0.218	0.151	0.075
10	0.000	-0.001	-0.001	0.035	0.032	0.027	0.013	-0.116	-0.116	-0.049	0.027
11	0.000	0.000	0.000	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051
12	0.000	0.000	0.000	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051
13	0.000	0.000	0.000	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051
14	0.000	0.000	0.000	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051
15	0.000	0.001	0.001	0.067	0.070	0.075	0.089	0.218	0.218	0.151	0.075
16	0.000	0.001	0.001	0.067	0.070	0.075	0.089	0.218	0.218	0.151	0.075
RTD	0.000	0.000	0.000								

Appendix D - Software Change Log

Version 1.00 - 08/2010. First release.

Version 1.01 - 12/2010. Updated As Received and Validation report formatting. Included support for 64 channel panel jack modules.

Version 1.02 - 1-2011. Updated As Received and Validation report formatting to reflect correct specified accuracy tolerances. Corrected the way TempCal creates the '.dts' file to ensure that a file is created for every test.