SOFTWARE USERS MANUAL

FOR

MODEL 6530

DIGITAL TERAOHM BRIDGE-METER

NOTICE

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1. MODEL 6530 TERAOHM BRIDGE-METER CONTROL AND DATA ACQUISITION SOFTWARE

The TeraCal Data Acquisition Software is the accompanying control software for your Guildline model 6530 Teraohm Bridge-Meter. Using your Teraohm Bridge-Meter with the computer will increase its functionality and simplicity. Before using your model 6530 with the computer, you should ensure that the operation of this software package is well understood. This software was designed with an interface that blends the most common features of a traditional front panel coupled with the familiarity of the Windows^{TM} interface. The control of the model 6530 Teraohm Bridge-Meter through this software will enable you to automate your measurement process, acquire your data, and analyze the results. TeraCal also will operate the older 6520 Digital Teraohmmeter

Section 1 in this manual has been written in a fashion that breaks down each window and it's associated controls/indicators on an as needed basis. This means that this manual describes each window in terms of their processes that you, as a user, would be able to execute. All the controls/indicators are explained as they are called upon in the processes in which they are used. This section describes only the software and its functionality. It is best for any inquiry about a certain point of the software to at least read the entire of sub-section in regards to the window that has the point in question. The utilities provided with TeraCal are described in detail in section 2.

Section 2, like section 1, in this manual has been written in a fashion that breaks down each window and its associated controls/indicators of the utilities provided with TeraCal on an as needed basis. These utilities are predefined test analysis. These utilities are set up in a manner that simplifies the preparation of a given measurement data set in comparison to conventional means of entering the data. Furthermore, these utilities will present some processing options not available through the standard TeraCal data analysis. This section of the manual describes each window in terms of their functions that you, as a user, would be able to execute. All the controls/indicators are explained as they are called upon in the processes in which they are used. This section describes only the software and its functionality. It is best for any inquiry about a certain point of the software to at least read the entire sub-section in regards to the window that has the point in question.

Section 3 is the User Notes to the TeraCal software. This section includes a measurement operation guide (section 3.1) which has been written in the approach that the basic functionality of the software is not addressed. It is understood to be a complete set of example setups in which to base your own measurements upon, focusing on both the hardware and the software. These examples are written in a step by step procedure. When using this section, you may wish to refer to the recommended setup tables in the Appendix (section 4.1) for a specific setup to obtain optimum values. This section also contains information that is not required for the use of

TeraCal, but is suggested information to help you improve the functionality and reliability. Included in the section are notes on the method for data storage/backup (section 3.2) with the supplied configuration, as well as information on how to troubleshoot/prevent problems with your software and the computer in which it is installed (section 3.3). There is also a subsection on key navigation through TeraCal (section 3.4) to help you move within the program more efficiently or in the event a pointing device is not available.

Section 4 is the appendix for quick reference to specific tables and other data.

For the best benefit out of this document, one should read it in the order it is presented, as the latter sections will, in many cases, assume that you have read and understood the information presented in the earlier sections.

Other literature and resources that exist are the Model 6530 Technical Manual, which addresses the front panel usage and hardware aspects of your 6530 Teraohm Bridge-Meter, as well as the training seminar and demo version of TeraCal software to help in educating the user about the use of the 6530 Teraohm Bridge-Meter.

1.1.   INSTALLATION AND SYSTEM CONFIGURATION

System Requirements

In order to run TeraCal, the software must be installed on a system that meets the system requirements stated below:

Software

- Microsoft^{TM} Windows^{TM} XP Sevice Pack 3 or newer Operating System.
- National Instruments^{TM} driver software for Windows^{TM} (supplied on TeraCal CD).
- Microsoft^{TM} Excel^{TM} XP or newer (recommended).
- Microsoft^{TM} Internet Explorer^{TM} 7.0 or newer (recommended).
- Seagate^{TM} Crystal Reports^{TM} 8.5 or newer (recommended).

Hardware (supplied with system)

- Minimum 50 Megabytes of free harddrive space for the program files.
- A SVGA graphics card and monitor.
- Mouse supported by Windows^{TM}.
- National Instruments^{TM} GPIB interface.
- Printer supported by Windows^{TM} (recommended).
- CD-ROM for installation purposes only (recommended).

Installation

TeraCal is supplied on a CD-ROM. For your convenience, the CD-ROM will automatically start up the TeraCal setup program after it has been placed in your CD-ROM drive. For those who do not have Windows^{TM} autoplay extender enabled, simply run the setup executable from the CD-ROM through "Windows Explorer". The setup program will ask you if you wish to install and verify the install directory. Click on "Finish" and the setup will decompress all the files as well as create the appropriate directory structure.   This setup will also update itself to the "Add/Remove Programs" list in your "Control Panel" for easy uninstallation. To run TeraCal, there will be a shortcut created in your "Start Menu". This is found by clicking on "Start", then pointing to the sequence of sub-menus "Programs...TeraCal".

NOTE: You will in many cases need to run the installation as an Administrator to successfully complete the install.

Also note that it may be desirable to install the Training Demo software on a computer that does not actually control the hardware. The demo version will at no time attempt to communicate over a GPIB bus and therefore it is also not a system requirement. The demo version only simulates the hardware operation as if there was a system present, but maintains all other

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functionality. The TeraCal Demo can be beneficial on other computers for training purposes and offline data processing/viewing.

All of the files for the TeraCal program, as well as the help file and digital copies of the manuals, are installed together in the TeraCal directory structure which is located at "C:\Program Files\TeraCal" for the program and help file. These items all contain links in the "Start Menu" located in "Start...Programs... TeraCal...".

All of the files for the TeraCal Demo program as well as the training seminar are installed together in the TeraDemo directory structure which is located at "C:\Program Files\TeraDemo" for the program and training seminar file. These items also all contain links in the "Start Menu" located in "Start...Programs... TeraCal Demo...".

Upgrading From TeraCal v2.x

You should uninstall TeraCal v2.x before installing TeraCal 3 as TeraCal 3 will install over your older TeraCal 2.x installation. All data files from the 2.x versions of TeraCal will work in TeraCal 3 with the exception that in some cases there is less data available in the TeraCal 2.x files, some report fields will remain blank in these cases. Also all TeraCal 2.x configuration files will also work in TeraCal 3 with the exception that the test and maximum voltages may be different on the measurement sequence (*.SEQ) files.

GPIB Driver Setup

When installing the National Instruments^{TM} driver software for Windows^{TM} you may encounter a prompt that instructs you to close the autorun program to complete the installation. This prompt will only appear if you already have a version of the driver database installed. If your version of the driver database is older than the supplied drivers on the TeraCal CD then it is recommended that you do close the autorun and continue the installation of the drivers. If your drivers are a more recent or the same version you should cancel the driver installation process at this point. Note that installation of the drivers will usually require a reboot of the system.

Once the GPIB drivers are installed you will need to configure the GPIB settings. This is done through National Instruments Measurement and Automation Explorer (NI MAX). The NI MAX should be run with administrator privileges to configure the GPIB settings. The settings that are most important are the Bus Timing MUST be set to 2usec, and the AutoPolling should be disabled. (see next page). Failing to use these setting can result in erratic behavior of the system, primarily the 6564. These settings are retained by the system and should only need to be set once.

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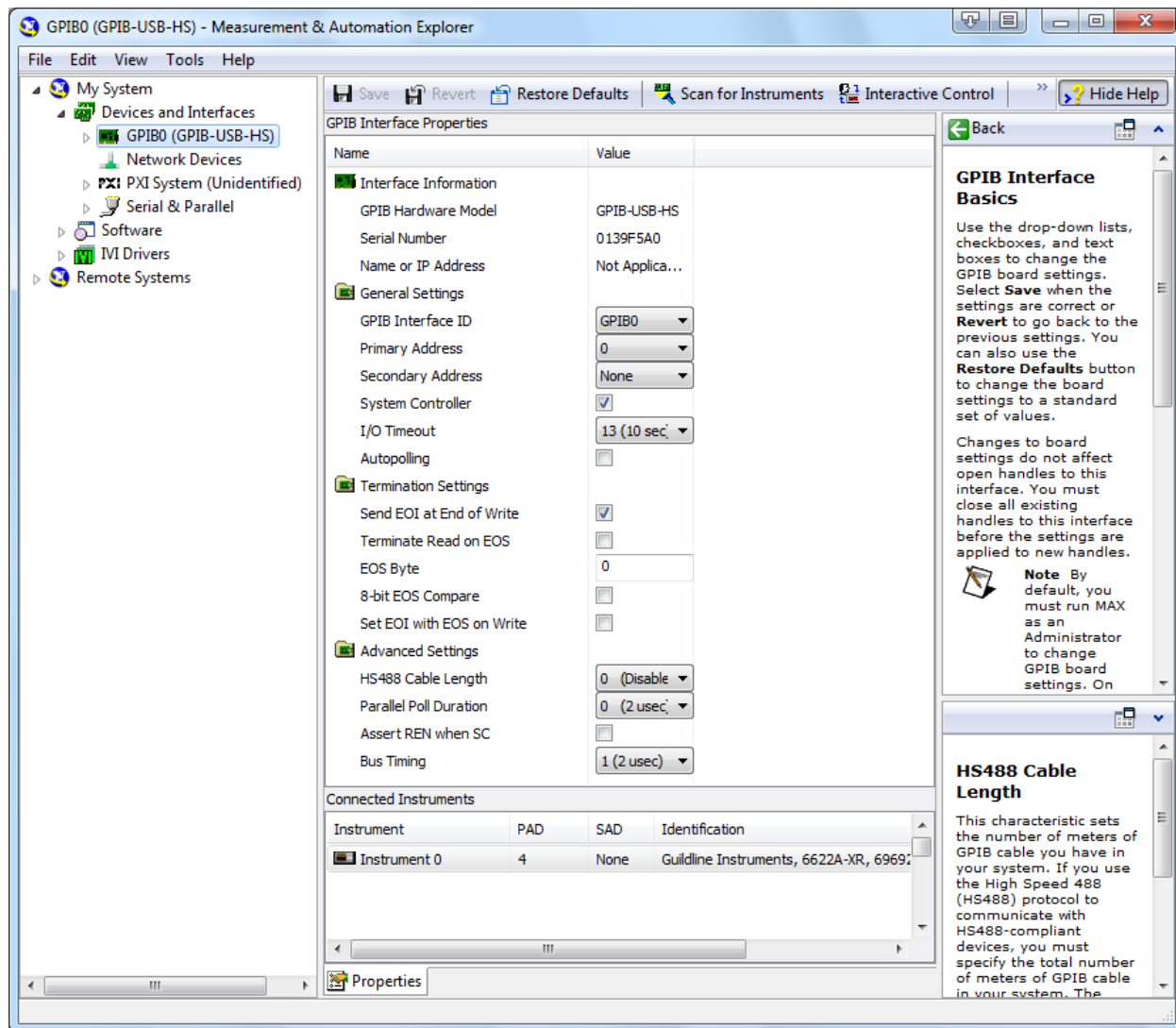
1.2.   GENERAL

Throughout the various windows in TeraCal, you will see different indicators and controls. These are used to display and retrieve information for you, as well as to control some of the features in TeraCal. In some windows throughout TeraCal, you will also find menu bars that offer pertinent commands for that area of the program.

Warning: It is strongly advised that you do not attempt to change any parameters manually while under software control. If manual intervention is viewed as necessary, it should only occur while the software is either closed or displaying an error message. During software control, the front panel controls, particularly those of the model 6530, may appear to be inactive, due to the frequency of communication by the software. For manual control of the model 6530, refer to the Model 6530 Technical Manual.

1.2.1. Indicators

Indicators are how TeraCal displays information to you. The more common indicators are message indicators (text), numeric displays and graphs. Indicator data cannot be changed directly by you. TeraCal updates them, as new information is available.

1.2.2. Controls

Controls are how you can input your information and choices into TeraCal. The most common controls are buttons, switches and numeric entry fields. These controls are, in most cases, set to default values and can be changed, as well as loaded with saved values to be edited or just viewed. Controls are activated by clicking on them. You will see a visual representation of the action of that control or the edit cursor field will be activated. The displayed text for each control represents the applicable state that will be achieved when it is activated by the user. Data can be entered in numeric entry fields by either directly entering data in the field or by clicking on the associated index arrows. The index arrow pointing up will increase the value displayed in the field, while the index arrow pointing down will decrease the value displayed in the field.

1.2.3. Fields

Fields are actually a type of control that requires a value or text entry through the keyboard. Being a type of control, they will also in many cases be set to preset values and can be loaded with saved values, as well as edited directly. This type of control is the most predominant type in all of the configuration windows. To edit the contents of a field, click with your mouse pointer inside the field and an editing cursor will appear. Enter in the desired information and then click outside the field to keep the contents in the field.

1.2.4. Menu Bar

The other main way you have to navigate through TeraCal is the menu bar. The menu bar has a series of commands within it that are relevant to that window. These commands usually consist of file management functions and program options rather than control of an actual measurement. Some of the more common menu items also can be accessed by controls in the window or through quick key combinations known as hotkeys. All menu items can also be accessed by pressing the Alt key and using the arrow keys to navigate through, or by using the mouse.

1.3. MAIN WINDOW
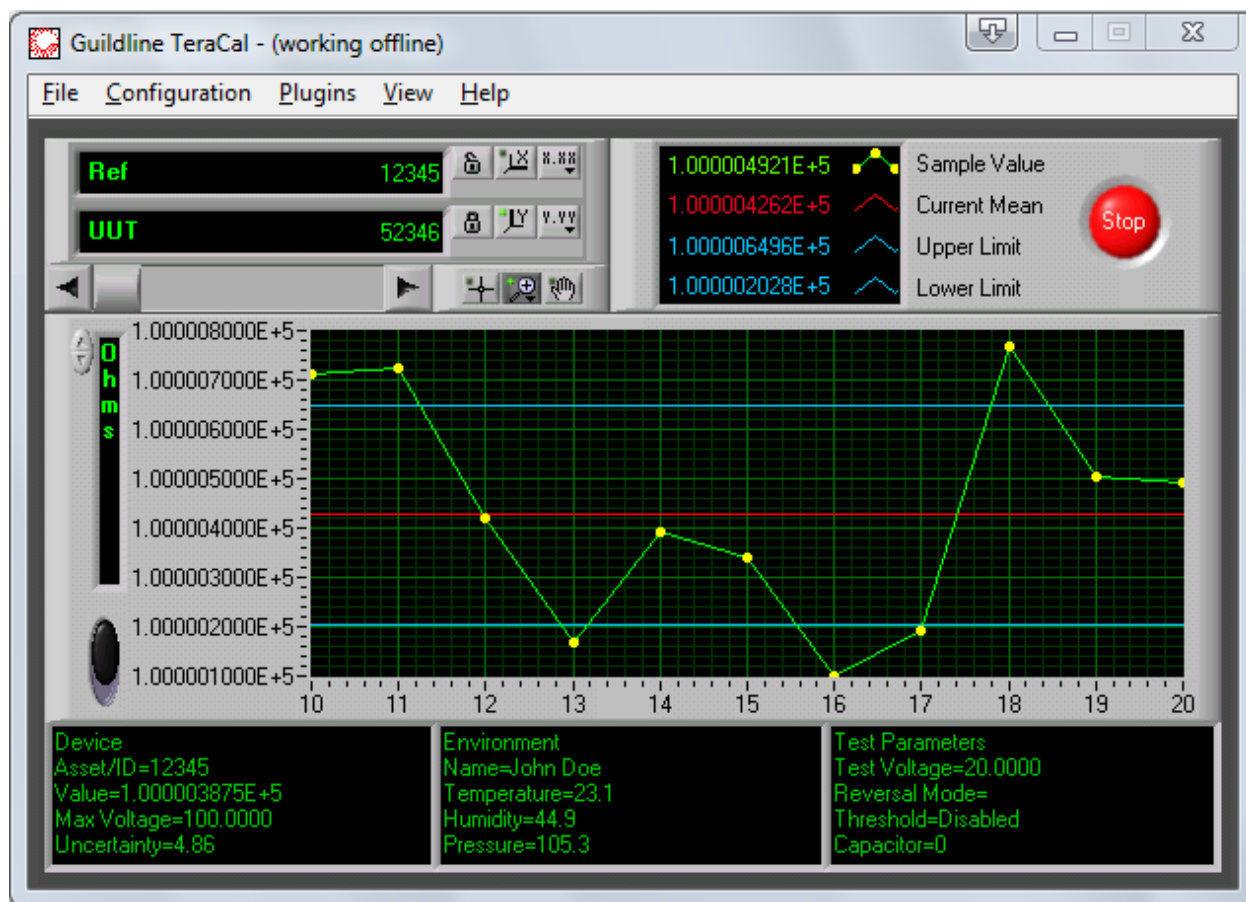
In the main window, there is a series of indicators and controls to setup and observe the measurement process. There is also a menu bar to access most of the functions and features of TeraCal.

1.3.1. Stop Button

The "Stop" button located to the upper right is used to end a measurement in progress. When you start a measurement, you will notice that the "Stop" button will turn red. It will remain red until the test has stopped. If you need to end a measurement early, you can click on this control and the test will stop. The button will return to black when the test has successfully stopped.

1.3.2. Units Control

The "Units" control sets the units in which you wish to view the incoming data. Changing the units will not affect the data being stored. All data is stored as either resistance ratio/current regardless of the settings on the "Units" control.

NOTE: The resistance ratio is with respect to the reference. In the case where the measurement is direct from the Teraohm Bridge-Meter this reference value is 1 arbitrarily so that ratio=resistance. However, where the Teraohm Bridge-Meter is used as a transfer standard the actual reference value is stored so that both resistance and ratio can still be viewed.

1.3.3. Device Indicators

At the top left of the main window, there are two indicators displaying which two devices that are being used for the test.

1.3.4. Numerical Indicators

Above the graph there are four indicators displaying numerical values. These numbers are "Sample Value" (current 6530 test sample point reading), "Current Mean" (calculated mean of all test sample points in the logged test up to that point, after the logging delay), as well as the "Upper Limit" and "Lower Limit" (the current calculated mean +/- one current calculated standard deviation). Directly beside the current numbers there is a legend that shows the plot line colour/style which corresponds to the displayed value. Clicking on these plot lines will bring up a drop menu allowing you to modify the plot's appearance.

1.3.5. Using The Graph

The graph on the main panel has many features available for you to view your incoming data if you so choose. The incoming data that is displayed are the four numerical indicators described in section 1.3.4 for all test sample points from the start of the logged test, including the logging delay, to the current sample. The main functions being that you can scroll back to view older samples at any time during the test using the scrollbar located above the graph, and you can modify the x and y scales by the control buttons above the scrollbar. The x.xx and y.yy is a control for you to change the format and precision of each respective axis. The two buttons with bi-directional arrows will enable/disable the auto-scaling feature of the graph for each axis. Auto scaling is a function that optimizes the scale of graph to display all the points, but maximizing the fixed amount of viewing space. This feature is enabled on the y-axis by default, therefore displaying the changes at the smallest possible scale that will still show all the information on the graph. There is also the zoom button, which will change your mouse pointer to a magnifying glass to show that the feature is active. You can either click on a central point for the zoom or highlight an area to zoom into. Lastly, by clicking on the hand, you can arbitrarily drag the graph to the position you want. While in this mode, your mouse pointer is in the shape of a hand. To return to normal from any of these states, just click on the crosshair button, for the default view mode. Clicking on the extremes of the x and y axis numbers will highlight the selected number to allow you to change the scale.

1.3.6. Details Button

Clicking the "Details" button located at the bottom left of the graph will toggle the front panel to the split screen mode. In the split screen mode, the graph will become smaller to display more text fields which contain environmental and test configuration information.

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1.3.7. File Menu

The menu functions located in the File menu are some of the program's basic functions such as file management, printing and some program setup utilities.

File...Save Data As (hotkey Ctrl+S)

This command will open a standard windows file dialog prompting you for a name in which to save the current test data. Once given a filename, you can then click on OK to complete that task.

File...Config File Update

This command will open a standard windows file dialog prompting you for a name in which to save the updated value for the U.U.T. device configuration file based on the mean of the current measurement displayed in the main window. Once given a filename, you can then click on OK to complete that task. This function is disabled when the Administrative Options "File Protect" feature is enabled.

File...Print Window (hotkey Ctrl+P)

This menu item will print the contents of the main window through your windows default printer.

File...Printer Setup

This will call up your Windows printer configuration editor so that you can prepare your printer for any documents you will need to print out of TeraCal.

File...Administrative Options

The Administrative Options allows you to set the passcode and block out the ability to overwrite configuration files. You are required to know the existing password to access the Administrative Options window.

File...Scanner Setup

The Scanner Setup window allows the setting of the GPIB address for up to four 6564 High Resistance Scanners.

File...Rescan For Device

This function, when selected, will open a GPIB scanning utility that will query all 32 possible addresses for a model 6530.

File...Quit (hotkey Ctrl+Q)

This item, when selected, will quit the TeraCal program.

1.3.8. Configuration Menu

The Configuration menu contains links to all the configuration windows used in creating device files and the test setup.

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Configuration...Resistor Configuration

This menu item opens the Resistor Configuration window for you to create and edit "*.RES" or resistor files. These files are to store and recall information about resistance devices used by the 6530.

Configuration...Test Configuration

This menu item opens the Test Configuration window for you to create and edit "*.MEA" or test setup files. From this window, you also initiate the actual test. You start the test by clicking on "OK". If you do not wish to start the test, then remember to click on "Cancel".

Configuration...Surface/Volume Resistivity

The Surface/Volume Resistivity is a utility that is designed to generate a report for either surface or volume resistance. The tests taken for this utility require an external surface/volume resistivity device. You are required to choose the test data file or manually enter the measurement results as well as enter the parameters of the surface and volume resistivity device. With all of the data present you can generate a report of the test.

Configuration...Transfer Cal Utility

The Transfer Cal utility is designed to decrease the uncertainty of measurements taken by the 6530. This decrease of uncertainty is based on using the 6530 as a transfer standard between a known and an unknown resistor. You are required to choose a data file or manually enter both the calibration (cal) measurement and the test measurement results, as well as enter the parameters of the standard resistor used. With all of the data present you can generate a report of the test.

Configuration...Voltage Coefficient Utility

The Voltage Coefficient utility is designed to compute the voltage coefficient of the resistance device while being measured by the 6530. You are required to choose data files of tests taken on a given resistor at different voltages or manually enter the measurement results. With all of the data present you can generate a report of the voltage coefficient.

Configuration...Environment Variables

Clicking on this option brings up a window where you can log the test variables external to the direct system. These items include ambient air pressure, temperature and humidity in separate fields. As an option the pressure, humidity, and temperature can be monitored and entered automatically by the 6530. You also have a place to log your name as the test operator and the company/lab name. The information entered here will be logged with all data files.

Configuration...Coefficients

The Coefficients utility is a utility for you to view, store, and retrieve the calibration coefficients of your 6530.

1.3.1. Plugins Menu

The Plugins menu contains links to the installed plugins. These plugins are modular expansions to the TeraCal software and offer automation of higher level processes as well as dedicated test routines. These plugins can be added to and therefore the items listed in the menu can vary.

1.3.2. View Menu

The View menu has all the features in it that are used to display test information. Most of these items are used with sample data.

View...Test Overview

The Test Overview window will appear when you select this item. Inside the Test Overview is where you will be able to view your test, along with the post test analysis completed by TeraCal.

View...History Chart

Selecting this function will bring up a window quite similar to the Test Overview window. This window is called the History Chart. In here, you will be able to group data from multiple tests for your analysis.

View...File Manager

The File Manager is an organizational tool allowing you to view, with more detail data files in a chosen directory. This is done by selecting the "Directory" button in the File Manager window and then the "Select Cur Dir" button in the following windows file dialog at the chosen directory. The details shown within the file are filename, Rs control number (reference), Rx control number (U.U.T.) and date stamp. From this window you can open the file in the associated viewer. You can also print out the listing that is being displayed.

View...Resolution...(.001ppm, .01ppm, .1ppm, 1ppm, 10ppm)

This will open a sub-menu that has resolution selection options of , .001, .01, .1, 1, and 10 ppm. Selecting one of these options will change the displayed data's resolution to the chosen option and place a menu marker beside the menu item to point out the current selection. The default resolution is 1ppm.

1.3.3. Help Menu

In the Help menu you will find three selections that will assist you. They include information such as the operation of TeraCal, and contact information for Guildline Instruments Limited Support. This function will open a small window that will display a quick description of the control or indicator your mouse pointer is hovering over. This window will update itself as you hover over other controls and indicators throughout all of the windows in TeraCal. This window will remain on top of all others until you click on the close button.

Help...Help

This menu selection will open up the windows help file, which is your on-line reference guide. The help file can be navigated through hyperlinks and the search engine.

Help...About

Selecting this item will open a window that displays the program version number and how to contact Guildline Instruments Limited. If you have an active connection to the internet, you can click on the web address shown in the window to automatically open Internet Explorer and load our home page. Here you can access even more information about Guildline Instruments Limited and our products.

1.4.   RESCAN FOR DEVICE WINDOW
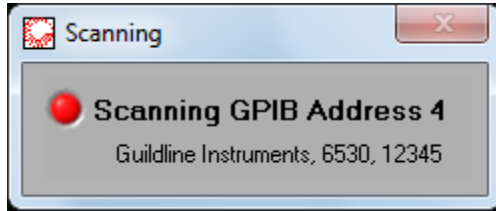
This function, when selected, will open a GPIB scanning utility that will query all 32 possible addresses for a model 6530 Teraohm Bridge-Meter. The address of the model 6530 that is found will be saved in the Tera.ini file, so that TeraCal will check that address first at startup. Run this function:

1) If TeraCal indicates upon startup that the model 6530 has not been found.
2) If the GPIB cables of the model 6530 have been disconnected at any time, particularly as the result of the model 6530 having been replaced.
3) If the model 6530 has been turned on after TeraCal was opened.
4) If a communication error has been reported.

1.5. ADMINISTRATIVE OPTIONS WINDOWS

1.5.1. Enter Passcode Window
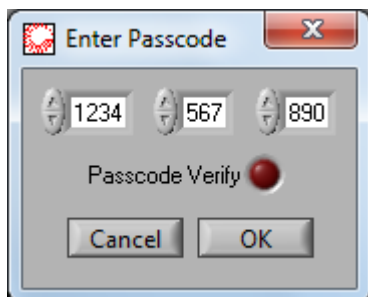
The Enter Passcode window allows you to enter the present passcode to access the Administrative Options window. Be certain to remember your passcode, as you cannot enter the Administrative Options window without a passcode once it has been set for the first time. Until you select a password for the first time, the Enter Passcode window will be automatically bypassed when you click on the "Administrative Options" File menu item, so that the Administrative Options window appears immediately.

1.5.1.1. Passcode Fields

The "Passcode" fields are where you can type in the present supervisor passcode for accessing the Administrative Options. The passcode consists of one four-digit field and two succeeding three-digit fields. The number in the four-digit field can be any one to four digit number between 1 and 9999. The numbers in the three-digit fields can be any one to three digit number between 1 and 999. Unless you change it, TeraCal will automatically display the original default password containing "1" in each field, which is not necessarily the actual current password.

Note: The entered numbers for the passcode DO NOT need to fill the 3 or 4 digit fields in which they are typed or be filled with zero's.

1.5.1.2. Pass Code Verify

The Pass Code Verify indicator shows if the passcode entered is correct.

1.5.1.3. OK Button

Clicking the "OK" button will exit the Enter Passcode window. If the passcode has been correctly entered, then the Administrative Options window will be displayed. If the passcode has not been correctly entered, then you will be returned to the main window.

1.5.1.4. Cancel Button

Clicking the "Cancel" button will exit the Enter Passcode window and return you to the main window.

1.5.2. Administrative Options Window
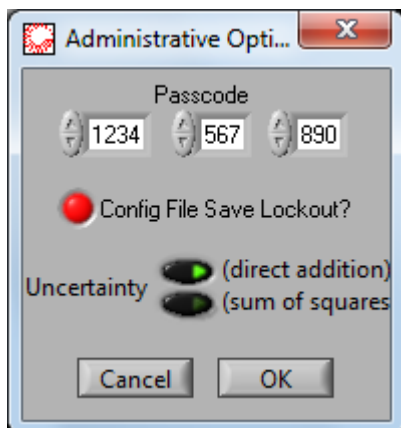
The Administrative Options window allows you to set the passcode and block out the ability to overwrite configuration files. This provides the ability for supervisory control over your measurement process and devices. Be certain to remember your passcode, as you cannot enter this window without a passcode once it has been set for the first time.

1.5.2.1.Passcode Fields

The "Passcode" fields are where you can type in the new supervisor passcode for accessing the Administrative Options. The passcode consists of one four-digit field and two succeeding three-digit fields. The number in the four-digit field can be any one to four digit number between 1 and 9999. The numbers in the three-digit fields can be any one to three digit number between 1 and 999. Unless you change it, the present password is displayed. When TeraCal is first installed, there is no password, although the default proposed password of 1, 1, 1 will be displayed.

1.5.2.2.Config File Save Lockout Control

The "Config File Save Lockout" control enables/disables the ability for the user to overwrite configuration files in TeraCal. This includes all resistor and test setup files. Having the control "lit up" enables the feature. When TeraCal is first installed, the control is not lit up, indicating that the feature is not enabled.

1.5.2.3.Uncertainty Control

The "Uncertainty" control is a switch that selects the uncertainty calculation method in TeraCal. You can select "direct addition" or "sum of squares" method. When TeraCal is first installed, the uncertainty is calculated by the sum of squares method.

1.5.2.4.OK Button

Clicking the "OK" button will exit the Administrative Options window and update the information. Until the "OK" button has been clicked for the first time since TeraCal was installed, there is no password required to enter this menu. After the first time that the "OK"

button is clicked, the passcode will be the default containing 1 in each field, unless you have entered a new passcode in the "Passcode" fields. It is recommended that a password that is not the default be chosen.

1.5.2.5.Cancel Button

Clicking the "Cancel" button will exit the Administrative Options window without updating the information.

1.6.   SCANNER SETUP WINDOW
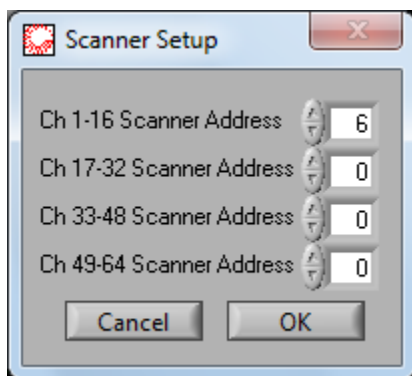
The Scanner Setup window allows you to set the GPIB address for TeraCal to communicate to the 6564 scanner assigned to the corresponding bank of channels.

1.6.1.   Ch 1-16 Scanner Address
The "Ch 1-16 Scanner Address" field is where you can type in the GPIB address configured for the 6564 scanner defined as channels 1 to 16.

1.6.2.   Ch 17-32 Scanner Address
The "Ch 17-32 Scanner Address" field is where you can type in the GPIB address configured for the 6564 scanner defined as channels 17 to 32.

1.6.3.   Ch 33-48 Scanner Address
The "Ch 33-48 Scanner Address" field is where you can type in the GPIB address configured for the 6564 scanner defined as channels 33 to 48.

1.6.4.   Ch 49-64 Scanner Address
The "Ch 49-64 Scanner Address" field is where you can type in the GPIB address configured for the 6564 scanner defined as channels 49 to 64.

1.6.5.   OK Button
Clicking the "OK" button will exit the window and update the information.

1.6.6.   Cancel Button
Clicking the "Cancel" button will exit the window without updating the information.

1.7.   RESISTOR CONFIGURATION WINDOW
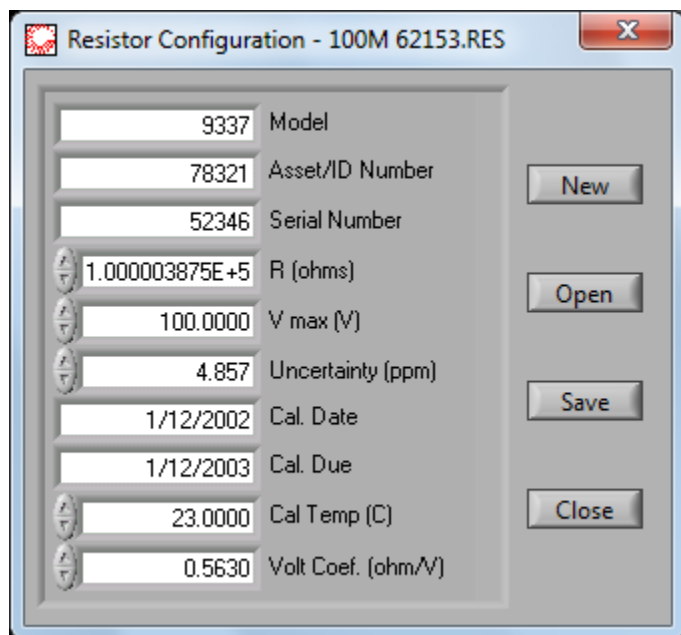
The Resistor Configuration window is where you can create and edit "*.RES" or resistor files that are used by TeraCal. These files profile of your resistors for usage within TeraCal. These profiles contain the resistance value, the excitation values, the control numbers, and calibration information.

1.7.1.   Model Field
The "Model" field is where you can type in the model type for the resistor you are describing.

1.7.2.   Asset/ID Field
The "Asset/ID" field is where you can type in the asset or identification number for the resistor you are describing.

1.7.3.   Serial Number
The "Serial Number" field is where you can type in the serial number for the type of resistor you are describing.

1.7.4.   R (ohms) Field
The "R (ohms)" field is where you can type in the actual value for the resistor you are describing. When you first enter a value in this field the usual and maximum excitation values are automatically suggested.

1.7.5.   Vmax (V) Field

The "Vmax (V)" field is where you can type in the maximum voltage for the resistor you are describing. This field is where the maximum value to run a test is stored for when this resistor is used. If the system detects that the resistor will be excited beyond this value, then the test is automatically stopped.

1.7.6.   Uncertainty (ppm) Field

The "Uncertainty (ppm)" field is where you can type in the known uncertainty for the resistor you are describing. This uncertainty will be used for transfer measurements where this resistor is the reference.

1.7.7.   Cal Date Field

The "Cal Date" field is where you can log the date that the resistor was calibrated.

1.7.8.   Cal Due Field

The "Cal Due" field is where you can log the date that the resistor is due to be calibrated.

1.7.9.   Cal Temp (C) Field

The "Cal Temp (C)" field is where you can log the temperature that the resistor was calibrated at.

1.7.10. Volt Coef (ohms/C) Field

The "Volt Coef (ohm/V)" field is where you can log the voltage coefficient for that resistor.

1.7.11. New Button

The "New" button will clear all fields to allow the creation of a new resistor profile.

1.7.12. Open Button

The "Open" button allows you to open an existing resistor configuration file to be edited. Clicking on this button will open a file dialog box prompting for a resistor configuration file "*.RES" to open for editing.

1.7.13. Save Button

The "Save" button allows you to save the edited or created resistor configuration to a file. Clicking on this button will open a file dialog box prompting for a resistor configuration file "*.RES" name to save the data under. This function will not allow overwriting an existing file when the Administrative Options "File Protect" feature is enabled.

1.7.14. Close Button

Clicking the "Close" button will exit the Resistor Configuration window.

1.7.15. Creating a Resistor File

Upon opening the Resistor Configuration window or after pressing the "New" button, there are several fields to be filled in. The "Asset/ID Number" field will help you keep track of specific

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resistors, while the "Serial Number", "Model Number", "Cal. Date", and "Cal. Due" provide supplementary information. "Cal. Temp. (C)" and "Volt Coef. (Ohm/V)" can also be filled in for your future reference. The "R(ohms)" field is where you enter the known or approximate value of the resistor. The "V max (V)" field is the maximum voltage you wish to apply to the resistor. Always use caution when setting these values, as using wrong values will result in bad data or even failed tests. Lastly, there is the "Uncertainty (ppm)" field, where you can state any known inaccuracy of the resistor's value. Once you have all the information in place, you must save the resistor file so that it can be used during the test.

1.7.16. Saving a Resistor File

To save the resistor configuration that is currently being displayed, you click on the "Save" button. This will call up a Windows file dialog prompting you for a file name for your resistor configuration. Type out the name you wish to call the configuration and click on "Save". The file extension ".RES" will automatically be added to your saved Resistor Configuration.

1.7.17. Loading a Resistor File

To load a resistor configuration that has previously been saved, click on the "Open" button in the Resistor Configuration window. A standard Windows file dialog will prompt you to select a file with ".RES" extension. You then find and select the file of choice, highlight it and then click on "Open".

1.7.18. Editing a Resistor File

To edit an existing resistor file, you need to open the file into the Resistor Configuration window. While the configuration is in the window, you can change the fields to reflect the desired resistor configuration. When this is complete, you merely save the new resistor configuration using the same name to overwrite the old file or a new name to keep both resistor configurations. You can then click on "Close" to close the Resistor Configuration window.
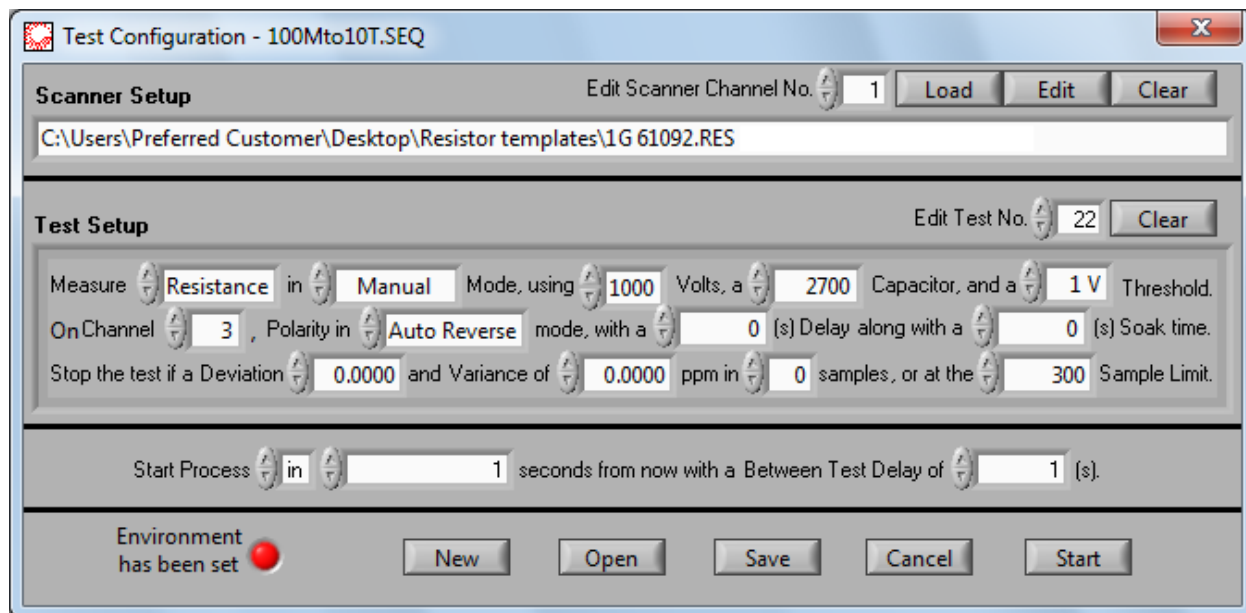
1.7.19. Resistor File Format

The resistor file consists of these eleven lines. The first acting as a header and the other ten are read in as a configuration file. This file is stored as standard ASCII text and can be opened by any text editor. DO NOT edit these files outside the TeraCal as in doing so they may no longer work in the program.

```
[Resistor]
R=1.0000000E+8
Serial=56375
Manufacturer=Guildline
Asset=38733
ppm=4.2340000E+0
Date=1999/06/23
Due=2000/06/23
Vmax=1.0000000E+2
```

caltemp=2.3000000E+1
coef=3.1600000E-4

1.8. TEST CONFIGURATION WINDOW

In the Test Configuration window, you will be able to select which resistor file you will use for your test. You can also control, from this panel, the amount of samples within a test. The controls for the Auto Reversal feature can also be accessed on this panel. When working in this window, use caution, as clicking on the "Start" will execute the test configuration as displayed. Be sure to click on "Cancel", if you do not wish to execute the test and wish to close this window instead.

1.8.1. Edit Scanner Channel No. Field
The "Edit Scanner Channel No." field allows you to select the desired scanner channel you wish to load or edit the resistor profile for.

1.8.2. Resistor Profile Load Button
Clicking on the "Load" button will bring up the Select Resistor File window to allow you to search for the resistor configuration file that will be loaded for the selected scanner channel. Once a resistor file is loaded, it used for the maximum voltage protection values as well as the traceability information.

1.8.3. Resistor Profile Edit Button
The "Edit" button will call up the "Resistor Configuration" window with the selected resistor's information for the selected scanner channel. This will be a blank template, if no resistor file has been previously selected. This will allow you to edit an existing file or create a new one without having to exit from the Test Configuration window. When you have completed your editing,

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closing the window will update any file already loaded into your test configuration. The "Resistor Configuration" window can also be accessed through the "Configuration" menu.

1.8.4.   Resistor Profile Clear Button
Clicking on the "Clear" button will clear the displayed resistor configuration.

1.8.5.   Test Setup Controls
The Test Setup is where you get to choose all the test's parameters for each test in your sequence. You simply enter into all the fields within the "Test Setup" control the parameters that you desire for your test. You can index through each test using the "Edit Test No." control.

1.8.6.   Test Setup Clear Button
Clicking on the "Clear" button will clear the displayed test configuration.

1.8.7.   Test Mode Control
The "Test Mode" control allows you to set TeraCal up for current measurements, as well as the different types of resistance measurements.   Refer to section 4.1 for the summary of recommended test setups.

1.8.8.   Ranging Mode Button
The "Ranging Mode" button will enable you to access the manual configuration variables of the measurement. These include Threshold, Cap, and V test (V). Leaving the control in Auto Range will let the 6530 auto range itself.

1.8.9.   Volts Field
The "Volts" control is where you can establish the test voltage used by the 6530 while in a manually configured resistance test. Refer to section 4.1 for the summary of recommended test setups.

1.8.10. Capacitor Field
The "Capacitor" control is where you can establish the capacitor used by the 6530 while in a manually configured test. Refer to section 4.1 for the summary of recommended test setups.

1.8.11. Threshold Field
The "Threshold" control is where you can establish the threshold used by the 6530 while in a manually configured test. Refer to section 4.1 for the summary of recommended test setups.

1.8.12. Reversal Mode Control
To set the Reversal mode, you toggle the control labeled "Reversal" in the Test Configuration window. Reversal mode is a feature in TeraCal that allows the choice of either the computer or the 6530 to control the reversal.

1.8.13. Delay Control

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The "Delay" control allows you to select how long you wish to delay the start of the test after each polarity reversal.

1.8.14. Soak Time Control

The "Soak Time" control allows you to select how long you wish to apply voltage to the test resistor before taking any reading after each polarity reversal.

1.8.15. Target Standard Deviation Field

The "Target Standard Deviation" control is where you define an acceptable amount of deviation to satisfy your criteria and carry on to the next test. If this field is left at zero, then TeraCal does not enable deviation as an end of test criteria. If the desired test criteria are not met, then the test will exit when the sample limit has been reached as defined in the "No. Of Samples" control.

1.8.16. Sample Window Field

"Sample Window" is a control that lets you vary the sample size of the standard deviation calculation. This allows you to specify how many readings that you require for a given standard deviation. If this field or the deviation field is left at zero, then TeraCal does not enable deviation as an end of test criteria. When deviation is used as an end of test criteria, the test will continue until the standard deviation of the last "Sample Window" sample size falls within the deviation limit or until the "No. of Samples" has been reached.

1.8.17. Sample Limit Field

The "No. of Samples" control allows you to select how many samples you wish to log for the test(s) you execute. TeraCal will use this number to know when to stop the current test and carry out the next test, if there is more than one test in the sequence.

1.8.18. Start of Process Delay Field

The start of process delay can be specified in two manners; the specific time and date, or length of time from now (in seconds). To choose the method of entering in your startup delay, use the "in/at" control and then enter the corresponding information.

1.8.19. Between Tests Delay Field

The "Between Test Delay" control is for you to specify how much time, in seconds, you wish to pause between tests in your sequence.

1.8.20. Setting the Environment Button/Indicator

The "Test Environment" window settings allow you to log the conditions under which the test is being executed. Here you enter in the values for test area Temperature, Humidity and Pressure, as well as the "Location" of the company/lab name and the name of the test conductor, in the respective fields. To set the environment, click on the indicator for the environment on the Test Configuration window. This will be "Click to set Environment" if you have not yet set the environment, or "Environment Set" if you have. This action will bring up the window with the fields to edit these settings. Click on "OK" to accept the changes, and the window will close and

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update the new information. Click on Cancel to not accept the changes. The indicator will also display that the environment log has been set by displaying "Environment Set". The "Test Environment" window can also be accessed through the "configuration" menu.

1.8.21. Open Button

The "Open" button allows you to open an existing test sequence file to be edited or executed. Clicking on this button will open a file dialog box prompting for a test sequence file "*.SEQ" to open for editing.

1.8.22. Save Button

The "Save" button allows you to save the edited or created test sequence to a file. Clicking on this button will open a file dialog box prompting for a test sequence file "*.SEQ" name to save the data under. This function will not allow overwriting an existing file when the Administrative Options "File Protect" feature is enabled.

1.8.23. Cancel Button

Clicking the "Cancel" button will exit the Test Sequence window without executing the test(s).

1.8.24. Start Button

Clicking the "Start" button will prompt you to select the directory that the test results will be saved in. Pressing "Cancel" will return you to the Test Configuration window. Pressing "OK" will open another window allowing you to create a new directory for the file storage. Pressing "Cancel" in this window will return you to the Test Configuration window. Pressing "Save" in this window will exit the Test Sequence window and execute the test(s).

1.8.25. Saving a Test Configuration

To save the test configuration that is currently being displayed, you click on the "Save" button. This will call up a Windows file dialog prompting you for a file name for your test configuration. Type out the name you wish to call the configuration and click on save. The file extension ".SEQ" will automatically be added your saved Test Configuration.

1.8.26. Loading a Test Configuration

To load a test configuration that has previously been saved, click on the "Open" button in the Test Configuration window. A standard Windows file dialog will prompt you to select a file with ".SEQ" extension. You then find and select the file of choice, highlight it and then click on "Open".

1.8.27. Editing a Test Configuration

To edit an existing test configuration, you need to open the file in the Test Configuration window. While the configuration is in the window, you can change the fields to reflect the desired test configuration. When this is complete, you merely save the new test configuration using the same name to overwrite the old file or a new name to keep both test configurations.

1.8.28. Exiting the Test Configuration

You must take special care as to how you exit the "Test Configuration" window. Before leaving this window, you must be certain whether you wish to initiate the test on exit or not. You can then click on "Start" to close the window, create a directory to save the test data in and execute the test, or click on "Cancel" to close the window and not start the test.

1.8.29. Test Configuration File Format

The test configuration file consists of these four lines. The first acts as a header and the other three are read in as a configuration file. This file is stored as standard ASCII text and can be opened by any text editor. It is possible, but not recommended, for you to edit these files outside the TeraCal program.

[Sequence]
Between=1
Scanner=\09C:\\Program Files\\TeraCal\\66533-
10T.RES\09\09\09\09\09\09\09\09\09\09\09\09\09\09\09\09\09\09\09\09\09\09\09\09\09\09\09\09\09
\09\09\09\09\09\09\09\09\09\09\09\09\09\09\09\09\09\09\09\09\09\09\09\09\09\09\09\09\09\0
9\09\09\09\09\0D\0A
Tests=0.000000\090.000000\099.000000\092.000000\092.000000\090.000000\090.000000\090.0
00000\090.000000\090.000000\090.000000\09300.000000\0D\0A

1.9. TEST ENVIRONMENT
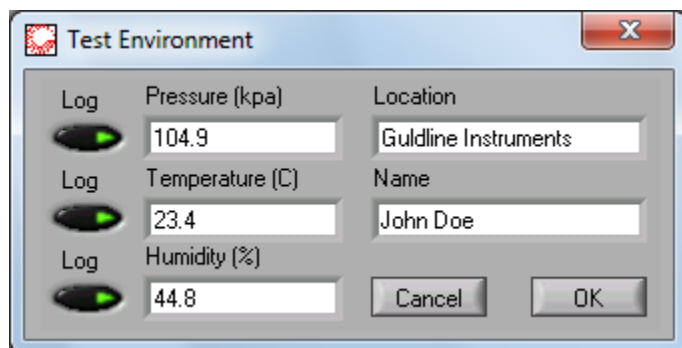
The Test Environment window is where you can log the test variables external to the direct system. These items include ambient air pressure, temperature and humidity in separate fields. These can be entered manually or logged with the 6530's internal data logger option. You also have a place to log your name as the test operator and the company/lab name. These items will get logged into each test and shown in all reports. All of these items will remain in active memory as long as the program is running, with the exception of the company name that is also saved in the Tera.ini file, so that it can be reloaded as a default value to this field the next time the program is started. Click on "OK" to accept the changes, and the window will close and update the new information. Click on "Cancel" to not accept the changes.

1.9.1. Location Field

In the "Location" field, the program operator should enter his or her company or lab name to have this displayed on the measurements logged using TeraCal. The entry of this field is stored in the initialization file of TeraCal as the default.

1.9.2. Name Field

In the "Name" field, the program operator should enter his or her name to have this displayed on the measurements logged using TeraCal.

1.9.3. Pressure (kpa) Field

In the "Pressure (kpa)" field, the program operator should either enable the logging function or enter the ambient air pressure of the test environment to have this displayed on the measurements logged using TeraCal.

1.9.4. Log Button

The Log button located beside the "Pressure (kpa)" field enables TeraCal to use the pressure readings from the internal data logger inside the 6530.

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1.9.5.   Temperature (C) Field

In the "Temperature (C)" field, the program operator should either enable the logging function or enter the ambient air temperature of the test environment to have this displayed on the measurements logged using TeraCal.

1.9.6.   Log Button

The Log button located beside the "Temperature (C)" field enables TeraCal to use the temperature readings from the internal data logger inside the 6530.

1.9.7.   Humidity (%) Field

In the "Humidity (%)" field, the program operator should either enable the logging function or enter the ambient relative humidity of the test environment to have this displayed on the measurements logged using TeraCal.

1.9.8.   Log Button

The Log button located beside the "Humidity (%)" field enables TeraCal to use the humidity readings from the internal data logger inside the 6530.

1.9.9.   OK Button

Clicking the "OK" button will exit the Test Environment window and update the information.

1.9.10. Cancel Button

Clicking the "Cancel" button will exit the Test Environment window without updating the information.

1.10. DATA LOGGING

As with any data acquisition software, the primary purpose is to retrieve and store data. The configuration is designed for single measurements meaning you will need to save your test before starting the next one. TeraCal will save to a user selected filename at the end of or even during a test in process. Saving a test in process saves the information currently available without interrupting the test.

1.10.1. Saving a Data File

To save the data file that is currently being displayed on the main window, you can go to the menu bar and select "File...Save Data As" or use hotkey "Ctrl+S". You will then see a Windows file dialog prompting you to save the information in a *.TES file. This file can then be recalled by the Test Overview window for review. If you have chosen to save a file that has the same name and path as another file, you will get a warning message. In this message, you are given the choice to cancel the saving operation or replace the other file with the one you are trying to save.

1.11. TEST OVERVIEW WINDOW
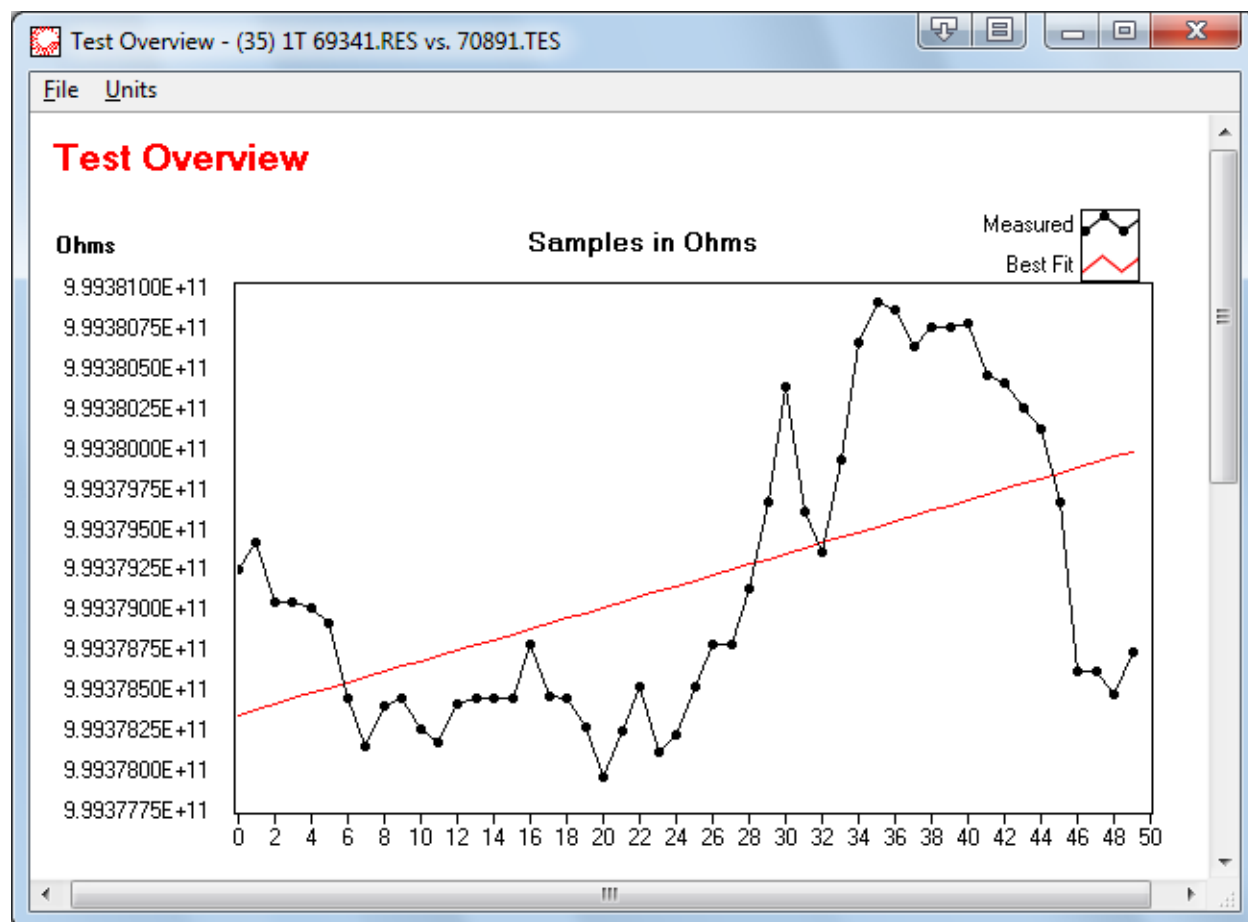
The Test Overview window is where you can open and edit saved test data. This window will complete a data analysis of the opened test file and display a graph with the best-fit curve; as well as mean, standard deviation and uncertainty calculations. These are all displayed in a clean, organized report format, which can be printed out.

1.11.1. Graph

The graph displays all the points used for calculations within a given test. The graph displays sample values on the vertical axis with respect to an incrementing sample number on the horizontal axis. The incrementing sample number always starts with 0. The sample value axis can adjust its resolution (from .001ppm - 10ppm) and units (resistance or ohms). The scale ranges of this graph are auto selected to display all the points used at the best resolution. The dimension of the sample values is determined by the units menu. Refer to section 1.10.18. Along with all the points being displayed there is a best fit line plot to help graphically represent any measurement drift. The points displayed here can be adjusted with the "Data Manager" tool.

1.11.2. Test Filename Indicator

The "Test Filename" indicator displays the filename of the test that is being displayed.

1.11.3. Test Date/Time Indicator

The "Test Date/Time" indicator displays the time that the displayed test was executed.

1.11.4. Standard Asset/ID Indicator

The "Standard" indicator displays the control number of the standard resistor used for the displayed test.

1.11.5. U.U.T. Asset/ID Indicator

The "U.U.T." (Unit Under Test) indicator displays the control number of the resistance device tested in the displayed test.

1.11.6. Test Voltage Indicator

The "Test Voltage (V)" indicator displays the test voltage used for the resistor under test in the displayed test in volts.

1.11.7. Power For Test Indicator

The "Power For Test (mW)" indicator displays the power dissipated in the resistor under test for the displayed test in mW.

1.11.8. Sample Delay Indicator

The "Sample Delay (s)" indicator displays the sample delay used in the displayed test in seconds (s).

1.11.9. Temperature During Test Indicator

The "Temperature During Test(C)" indicator displays the temperature of the test environment logged in the Environment Options during the time the test being displayed was taken in °C.

1.11.10. Humidity During Test Indicator

The "Humidity During Test (%)" indicator displays the relative humidity of the test environment logged in the Environment Options during the time the test being displayed was taken as a percentage (%).

1.11.11. Pressure During Test Indicator

The "Pressure During Test (kpa)" indicator displays the air pressure of the test environment logged in the Environment Options during the time the test being displayed was taken in kpa.

1.11.12. Standard Deviation Indicator

The "Standard Deviation (ppm)" indicator displays one standard deviation of the samples for the test being displayed in ppm. See Section 4.2.1 for more standard deviation calculation formula.

1.11.13.Expanded Uncertainty Indicator

The "Expanded Uncertainty (ppm)" indicator displays the calculated uncertainty of the samples for the test being displayed in ppm. See Section 4.2.2 for more uncertainty calculation formula. Data is displayed in this indicator only if "ohms" units has been selected. Refer to section 1.10.18.

1.11.14.Done By Indicator

The "Done By" indicator displays the name of the system operator logged in the Environment Options during the time the test being displayed was taken.

1.11.15.Test Mean Indicator

The "Test Mean" indicator displays the calculated average of the of the samples for test being displayed. The dimension of the test mean is determined by the units menu. Refer to section 1.10.18.

1.11.16.Notes Field

The "Notes" field displays and allows you to edit the notes you would like to store with the displayed test. In this field the typed text will auto wrap to the next line as you reach the end of a line. This means that you do not have to hit enter to go to the next line. The "Enter" and the Tab" functions are not valid in this window.

1.11.17.File Menu

The menu functions located in the File menu are the Test Overview's functions such as data file management, editing, and printing options.

File...Open (hotkey Ctrl+O)

This command will open a standard windows file dialog prompting you for a name of the data file you wish to open. Once given a filename, you can then click on OK to complete that task.

File...Save (hotkey Ctrl+S)

This command will open a standard windows file dialog prompting you for a name in which to save the current test data. Once given a filename, you can then click on OK to complete that task.

File...Data Manager

This command will open the Data Manager window that allows you to select the range of data in the displayed test that you would like to focus on. Refer to section 1.11.

File...Min Max

This command will crop out the minimum and the maximum sample from the displayed sample set.

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File...Filter

This command will open the Filter Tool window that allows you to employ various filtering options to optimize your measurement data.

File...Restore

This command will restore modified test data being displayed to that in the originally saved file.

File...Open In Excel

This command will open the file you are currently viewing in Microsoft^{TM} Excel so that you can apply your own mathematical processes to the stored data.

File...Export to Crystal

This command will open the file you are currently viewing in Seagate^{TM} Crystal Reports so that you can format your own report.

File…*Publish To Web*

This command will create an html report of the current Test Overview window.

File...Print Window (hotkey Ctrl+P)

This menu item will print the contents of the Test Overview window through your Windows default printer.

File...Printer Setup

This will call up your Windows printer configuration editor so that you can prepare your printer for any documents you will need to print out of TeraCal.

File...Close (hotkey Ctrl+W)

This command will close the Test Overview window.

1.11.18.Units Menu

The menu functions located in the Units menu are the Test Overview's data display options; such as units and resolution. These items are also marked within the menu to show which option is currently in use.

Units...Ratio

This will configure the Test Overview Window to display all data in ratio. This is particularly useful for tests created through the transfer cal utility. Ohms is the default unit.

Units...Ohms

This will configure the Test Overview Window to display all data in ohms. Ohms is the default unit.

Units...Invert

This will show the calculated interchange of the displayed test. The default is the non-inverted or U.U.T with respect to Reference Standard being displayed.

Units...Resolution...(.001 ppm, .01 ppm, .1 ppm, 1 ppm, 10 ppm)

This will open a sub-menu that has resolution selection options of .001, .01, .1, 1, and 10 ppm. Selecting one of these options will change the displayed data's resolution to the chosen option and place a menu marker beside the menu item to point out the current selection. The default resolution is 1 ppm.

1.11.19.Viewing a Test

To open a previously made test file to be viewed, select "File...Open" from the menu bar or use hotkey "Ctrl+O". This will bring up a standard Windows file dialog that is looking for "*.TES" files. Highlight the file of choice and click on "Open".

1.11.20.Editing a Test Overview

When test files are initially created, there is no opportunity to add your own notes, or to modify the sample set. For this reason, you can edit and then resave a currently loaded test file from the viewer. While in the viewer, you can alter the "Notes" field to place any additional information that is not represented in the given information by the viewer. You can also save the data after it has been cropped to have only the desired data remaining in the file. This is especially key when establishing what data you wish to have entered into a history file. It is recommended that when you edit a test data file, that you save to another filename. This practice will prevent overwriting your original data so that you can always return to the source information, as needed.

1.11.21.Saving a Test Overview

In the Test Overview you can save the file by selecting "File...Save" or by using hotkey "Ctrl+S". In the file dialog that comes from selecting the save function, you can choose a new name for the file or use the same name to overwrite the updated file. If you choose to overwrite or your new name already exists, you will get a warning message asking if you wish to replace the older file or cancel the operation. Click on "Replace", if you are sure that you do not need the older copy.

1.11.22.Test File Format

The test file consists of a minimum of sixteen lines. The first fourteen are read in as a configuration file, and all other lines are the stored data and reversal rate information. This file is stored as standard ASCII text and can be opened by any text editor. DO NOT edit these files outside the TeraCal as in doing so they may no longer work in the program.

Rs=1.000000000E+0
Rx=1.500000000E+8
uncertainty=3.050000000
STDserial=60538A
TSTserial=
Time=1999/03/03,14:26:19
Vtest=100.000
Power=0.0250
Humidity=45.43
Pressure=103.74
Temp=23.36
Name= Mark Evans
Place= GCS
Notes=
9.993714300 9.993742115 9.993745344 9.993757513 ...   9.993815626
30.000000000 30.000000000 30.000000000 30.000000000 ...   30.000000000

1.12. DATA MANAGER TOOL
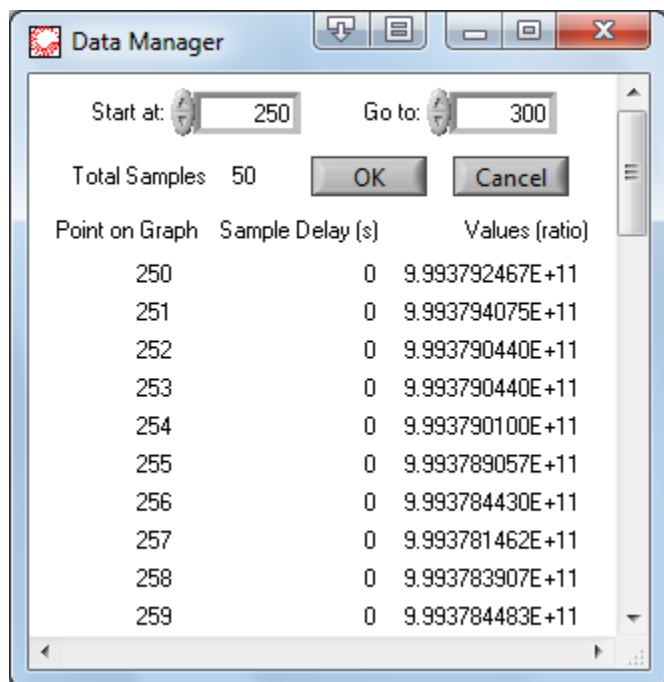
The Data Manager tool is a utility called up through the Test Overview window's file menu to allow you to remove unwanted extra data from the test data file that you are viewing. When you select the Data Manager tool, a window will open with a "Start at" and a "Go to" field to select the range of points you wish to keep. The Data Manager will also scroll down to display the total number of samples and each sample's reversal rate and value. Click on the "OK" button and your data will be updated. The Data Manager tool does not permanently affect your saved data. To keep the changes made by the Data Manager tool, you must resave your data.

Note: In TeraCal, data is not stored based on a timeline. Instead, samples are based on an incrementing sample number. This is because using the automatic reversal rate removes the measurement time as a constant variable. For those instances where the timeframe is necessary information, the sample delay for each measurement is logged.

1.12.1. Start At Control

The "Start at" field allows you to select where you would like the range of points you wish to view to begin. This means that all data before the entered sample number will be removed from the display, as well as the calculations. The new sample range will be automatically renumbered to start at 0.

1.12.2. Go To Control

The "Go to" field allows you to select where you would like the range of points you wish to view to end. This means that all data after the entered sample number will be removed from the display, as well as the calculations. If the selected sample number is greater than the present maximum sample number, the new maximum sample number will be the same as the present maximum sample number.

1.12.3. Total Samples Indicator

The "Total Samples" indicator displays the total number of samples within the displayed data.

1.12.4. Point On Graph Indicator

The "Point On Graph" indicator displays the sample number of each point within the displayed data, always beginning at 0.

1.12.5. Sample Delay Indicator

The "Sample Delay" indicator displays the reversal rate used at each point within the displayed data in seconds.

1.12.6. Values Indicator

The "Total Samples" indicator displays the sample value of each point within the displayed data as the U.U.T.:Standard ratio.

1.12.7. OK Button

Clicking the "OK" button will exit the Data Manager window and crop the data as selected.

1.12.8. Cancel Button

Clicking the "Cancel" button will exit the Data Manager window without cropping the data.

1.13. FILTER TOOL
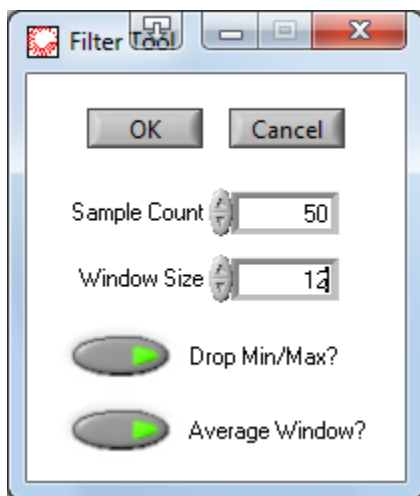
The Filter Tool is a more advanced utility called up through the Test Overview window's file menu to allow you to remove unwanted data segments and fiter the remaining test data file that you are viewing. When you select the Filter Tool, a window will open with a "Sample Count" and a "Window Size" field to select the segments of data points you wish to keep. The Filter Tool will also give you the option to drop the min and max from the window of kept data points and average them. Click on the "OK" button and your data will be updated. The Filter Tool does not permanently affect your saved data. To keep the changes made by the Filter Tool, you must resave your data.

Note: In TeraCal, data is not stored based on a timeline. Instead, samples are based on an incrementing sample number. This is because using the automatic reversal rate removes the measurement time as a constant variable. For those instances where the timeframe is necessary information, the sample delay for each measurement is logged.

1.13.1. Sample Count
The "Sample Count" field allows you to select where you would like the range of points you wish to apply this filter to. This means that all the data will be broken into segments of the entered sample count number and the remaining options within the filter will be applied to each data segment . The "Sample Count" range will default to the reversal rate of the measurement.

1.13.2. Window Size
The "Window Size" field allows you to select the number of samples from the end of each data segment defined bt the "Sample Count" that you wish to keep. This will remove all data points before the window. The kept data will be then processed as per the "Drop Min/Max?" and "Average Window?" options.

1.13.3. Drop Min/Max? Button

The "Drop Min/Max?" option will remove the minimum and maximum values from the data remaining in the "Window".

1.13.4. Average Window?

The "Average Window?" option will average the values from the data remaining in the "Window".

1.13.5. OK Button

Clicking the "OK" button will exit the Data Manager window and crop the data as selected.

1.13.6. Cancel Button

Clicking the "Cancel" button will exit the Data Manager window without cropping the data.

1.14. HISTORY CHART WINDOW
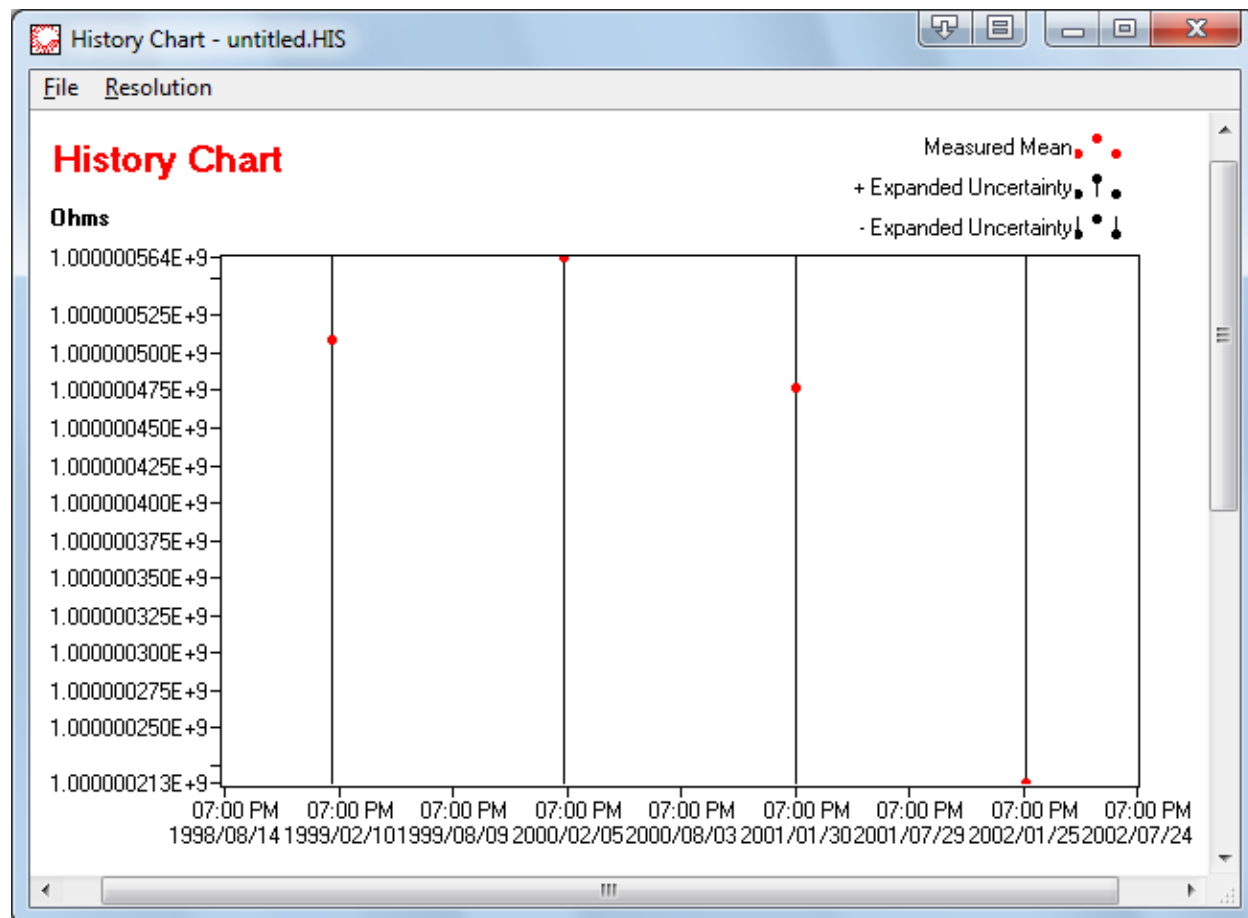
The History Chart window is similar to the Test Overview window, except that the viewer is made to open and create "*.HIS" history files. History files are cumulated test "*.TES" file data grouped into one file for the purpose of analyzing many measurements on the same resistor.

1.14.1. Graph
The graph displays all the points used for calculations within a given trend analysis. The graph displays sample values with respect to time. The sample value axis can adjust its resolution (from .001 ppm to 10 ppm) and units (resistance or ohms). The scale ranges of this graph are auto selected to display all the points used at the best resolution. Along with all the points being displayed, there is a secondary set of points showing the uncertainty of each point as the points represented here are calibration or measurement average points.

1.14.2. History Filename Indicator
The "History Filename" indicator displays the filename of the trend analysis that is being displayed.

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1.14.3. Last Entry Indicator

The "Last Entry" indicator displays the time that the trend analysis was last updated.

1.14.4. Done By Indicator

The "Done By" indicator displays the name of the system operator logged in the History File Editor.

1.14.5. Company Indicator

The "Company" indicator displays the name of the company logged in the History File Editor.

1.14.6. Resistor Asset/ID Indicator

The "Resistor Asset/ID" indicator displays the control number of the resistor used for the trend analysis.

1.14.7. Standard Deviation Indicator

The "Standard Deviation" indicator displays one standard deviation of the samples for the trend analysis being displayed. See Section 4.2.1 for more standard deviation calculation formula.

1.14.8. Expanded Uncertainty Indicator

The "Expanded Uncertainty" indicator displays the calculated uncertainty of the samples for trend analysis being displayed. See Section 4.2.2 for more uncertainty calculation formula.

1.14.9. Overall Mean Indicator

The "Overall Mean" indicator displays the calculated average of the samples for the trend analysis being displayed.

1.14.10. Notes Indicator

The "Notes" indicator displays the notes stored with the displayed trend analysis. The contents of this indicator can be edited in the History File Editor.

1.14.11. File Menu

The menu functions located in the File menu are the History Chart's functions such as data file management, editing, and printing options.

File...Edit (hotkey Ctrl+E)

This command will open the History Chart Editor window to allow you to edit or create history files for trend analysis.

File...Display (hotkey Ctrl+D)

This command will open a standard windows file dialog prompting you for a name of the history file you wish to display. Once given a filename, you can then click on OK to complete that task.

File...Config File Update

This command will open a standard windows file dialog prompting you for the name of the resistor file you wish to update with the value displayed in "Expected Value Now" field.

File...Open In Excel

This command will open the file you are currently viewing in Microsoft^{TM} Excel so that you can apply your own mathematical processes to the stored data.

File...Export to Crystal

This command will open the file you are currently viewing in Seagate^{TM} Crystal Reports so that you can format your own report.

File…*Publish To Web*

This command will create an html report of the current History Chart window.

File...Print Window (hotkey Ctrl+P)

This menu item will print the contents of the main window through your windows default printer.

File...Printer Setup

This will call up your Windows printer configuration editor so that you can prepare your printer for any documents you will need to print out of TeraCal.

File...Close (hotkey Ctrl+W)

This command will close the History Chart Window.

1.14.12. Resolution Menu

The menu functions located in the Units menu are the History Chart's data display options; such as units and resolution. These items are also marked within the menu to show which option is currently in use.

Resolution...(.001 ppm, .01 ppm, .1 ppm, 1 ppm, 10 ppm)

This will open a sub-menu that has resolution selection options of .001, .01, .1, 1, and 10 ppm. Selecting one of these options will change the displayed data's resolution to the chosen option and place a menu marker beside the menu item to point out the current selection. The default resolution is 1 ppm.

1.14.13. Updating Resistor Files

Through the History Window, you can update you resistor's configuration file to use the "Expected Value Now" as the nominal value for that device. To do this, you go to the file menu

and select "Config File Update". You will then be prompted to select the .RES file in which you wish to modify. This function can be enabled or disabled through the Administrative Options.

1.14.14. Displaying a History File

To open a previously made history file to be viewed, select "File...Display" from the menu bar or use hotkey "Ctrl+D". This will bring up a standard Windows file dialog that is looking for "*.HIS" files. Highlight the file of choice and click on "Open".

1.14.15. Editing a History File

History files are created from concatenated data of more than one test. This meaning that it can be a more complex process to edit a history file. To edit or create a History Chart file you select "File...Editor" from the menu bar or use hotkey "Ctrl+E". A file editing window will appear where you can add/remove any stored point in the history of the resistor using test files to generate values or manually entering in the values. Through this window you can also enter your name, as the file's creator, the company name, and extra notes. It is recommended that when you edit a history file that you use great caution as the data is intended for estimating your resistor's value between calibrations by plotting their long term drift.

1.14.16. Printing a History File

To print the information currently being displayed to you, go to "File...Print Window" or use hotkey "Ctrl+P". This function will print out a one-page document that will have the same layout as the contents of the display window.

1.14.17.History File Format

The history file consists of eight lines. The first five are read in as a configuration file and all other lines are the stored data. The sixth line is a time-zone-independent number of seconds that have elapsed since 12:00 a.m., Friday, January 1, 1904, Universal Time. The seventh line is the mean value in ohms. The eighth line is the uncertainty in ppm. This file is stored as standard ASCII text and can be opened by any text editor. DO NOT edit these files outside the TeraCal as in doing so they may no longer work in the program.

```
TSTserial=54865
Time=3/9/99,9:21 AM
Name= John Doe
Place= Guildline Calibration Services
Notes=
3003329503    3003322681    ...        3003340606
999.837404403          999.849730807          ...        999.852198273
0.002581        0.056895        ...        0.013972
```
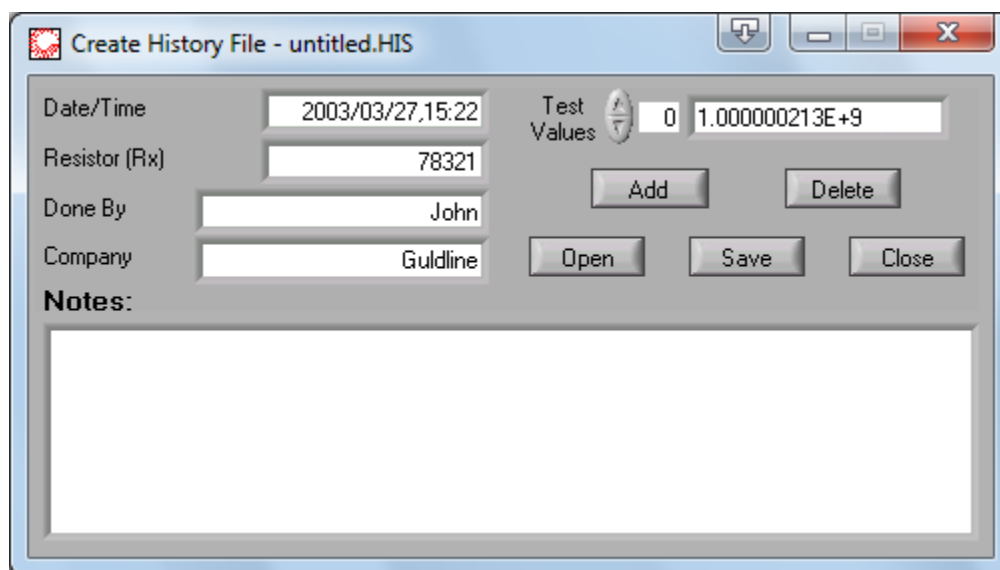
1.15.   HISTORY FILE EDITOR

The History File Editor is an interface to allow you to change the values which are used in your trend analysis. To open the History File Editor, go to the History Chart menu bar, and select "File...Editor" or hotkey "Ctrl+E". In the History File Editor, you can enter your name, as the file's creator, the company name, as well as your own notes. From this window, you add or delete history data either from a test data file or through direct entry. The date and resistor control number fields are updated by the editor to date stamp the last time the file was modified and to track the control number of the resistor's history. There is also a full list of all data points in the history file available for review.

1.15.1. Date/Time Indicator
The "Date/Time" indicator is where the current date and time are shown. This date and time are stamped into any saved history file to state when it was last modified.

1.15.2. Resistor (Rx) Field
The "Resistor (Rx)" field is where the control number of the resistor that is being traced in the history file can be entered. It is usually loaded from the data files used to create the history file.

1.15.3. Done By Field
In the "Done By" field, you are to enter the name of the history file's creator or modifier to be logged with the stored data.

1.15.4. Company Field
In the "Company" field, you are to enter the company name to be logged with the history file.

1.15.5. Notes Field

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The "Notes" field is where you may enter any other notes you wish to have stored with the history data.

1.15.6. Test Values Indicator

The "Test Values" indicator displays all the points that will be used in the history file displayed in the editor.

1.15.7. Add Button

The "Add" button allows you to add new points to a history file. Selecting this button will bring up a prompt to choose between entering a point directly or sourcing the point from a test file. The manually entered selection provides you with a Date, Value, and an Uncertainty field to enter all the information necessary to a historical data point. Choosing the file option will open a file dialog box prompting for a data file "*.TES" to extract this information from.

1.15.8. Delete Button

The "Delete" button allows you to delete the displayed point in the "Test Values" indicator.

1.15.9. Open Button

The "Open" button allows you to open an existing history file to be edited in this editor. Clicking on this button will open a file dialog box prompting for a history file "*.HIS" to open for editing.

1.15.10. Save Button

The "Save" button allows you to save the edited or created history to a file. Clicking on this button will open a file dialog box prompting for a history file "*.HIS" name to save the data under.

1.15.11. Close Button

Clicking the "Close" button will exit the History File Editor.

1.15.12. Viewing a History File

To open a previously made history file to be edited, click on the "Open" button. This will bring up a standard Windows file dialog that is looking for "*.HIS" files. Highlight the file of choice and click on "Open".

1.15.13. Saving a History File

In the History File Editor you can save the file by clicking on the "Save" button. In the file dialog that comes from selecting the save function, you can choose a new name for the file or use the same name to overwrite the updated file. If you choose to overwrite or your new name already exists, you will get a warning message asking if you wish to replace the older file or cancel the operation. Click on replace if you are sure that you do not need the older copy.

1.15.14. Editing a History File

You edit or create a history file by adding or removing historical points in the history trend as well as change or add notes to the "Notes" field. If you wish to add points, you click on the "Add" button and choose the method in which to enter the data. You can add historical points either by a test data file or directly entering the data. Adding the first point will also fill in the Resistor (Rx) field. All subsequent points will have the control number compared to the current number, and you will be warned if you attempt to enter data for a resistor of a different control number. If you need to delete a point, then you can use the "Delete" button to remove the displayed point in the "Test Values" indicator. When all editing is complete you will need to save the changes, by selecting the "Save" button.

1.16.   FILE MANAGER WINDOW
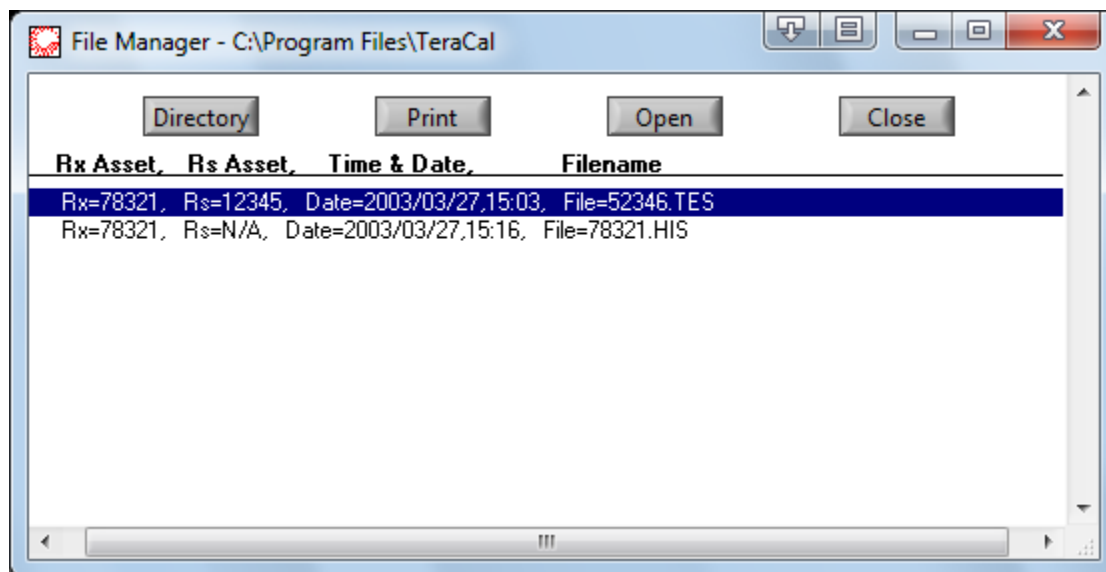
The File Manager is an organizational tool allowing you to view, in more detail, data files in a chosen directory. The details shown within the file are the Rx Asset control number, Rs Asset control number, Time & Date stamp and filename. From this window, you can open the file in the associated viewer. You can also print out the listing that is being displayed.

1.16.1. Directory Button
Clicking the "Directory" button brings up a windows file dialog box prompting you to select a directory that you wish to preview. When you have found the desired directory, click on the "Select Cur Dir" button.

1.16.2. Print Button
Clicking the "Print" button will print the displayed information in the File Manager Window.

1.16.3. Open Button
Clicking the "Open" button will load the selected file into associated TeraCal viewer so that you can see more details or edit the stored data.
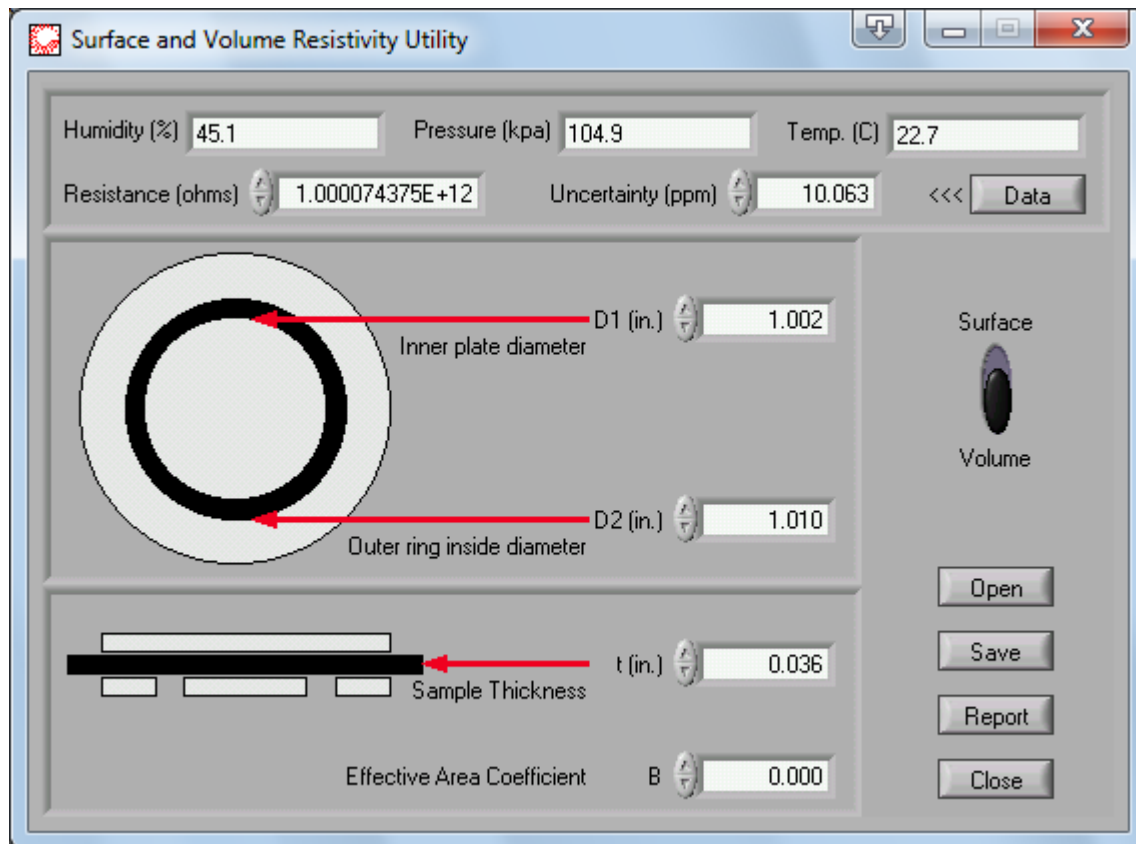
1.16.4. Close Button
Clicking the "Close" button will exit the File Manager.

2. UTILITIES

Within TeraCal there are some data utilities to generate reports for common test practices used with the 6530. These utilities are set up to simplify the organization and preparation of the test data and measurement parameters.

2.1. SURFACE/VOLUME RESISTIVITY UTILITY

The Surface/Volume Resistivity utility window is a post process utility that will calculate the surface/volume resistivity from acquired test data. The utility can be accessed by selecting the "Surface/Volume Resistivity" item of the Configuration menu. The tests for this utility require an external surface/volume resistivity device. The test data is entered either manually, or through a TeraCal test data file, as well as the parameters for the surface/volume resistivity device. The values are then calculated on either a surface or volume resistivity report based on the selection made.

2.1.1. Humidity (%) Field
The "Humidity" field enters and displays the ambient relative humidity logged at the time of the test.

2.1.2. Pressure (kpa) Field
The "Pressure" field enters and displays the ambient air pressure logged at the time of the test.

2.1.3. Temperature (C) Field
The "Temperature" field enters and displays the ambient air temperature logged at the time of the test.

2.1.4. Resistance (ohms) Field
The "Measured Resistance" field enters and displays the average resistance of the test.

2.1.5. Uncertainty (ppm) Field
The "Uncertainty" field enters and displays the calculated uncertainty of the test.

2.1.6. D1 (in.) Field
The "D1" field enters and displays the inner plate diameter of the surface/volume resistivity device used for the test.

2.1.7. D2 (in.) Field
The "D2" field enters and displays the outer ring diameter of the surface/volume resistivity device used for the test.

2.1.8. t (in.) Field
The "t" field enters and displays the sample thickness of the sample measured in the test.

2.1.9. B Field
The "B" field enters and displays the effective area coefficient of the sample measured in the test.

2.1.10. Data Button
The "Data" button loads the test information from a "*.TES" data file.

2.1.11. Surface/Volume Switch
Clicking the "Surface/Volume" switch will select which type of report you are generating.

2.1.12. Open Button
To load a physical properties profile of a surface or a volume resistivity test from a saved file click on the "Open" button.

2.1.13. Save Button

To save a physical properties profile of a surface or a volume resistivity test to a file click on the "Save" button.

2.1.14. Report Button

Clicking the "Report" button will generate a report based on the current data in the utility.

2.1.15. Close Button

Clicking the "Close" button will close the Surface/Volume Resistivity utility.

2.2. SURFACE RESISTIVITY REPORT
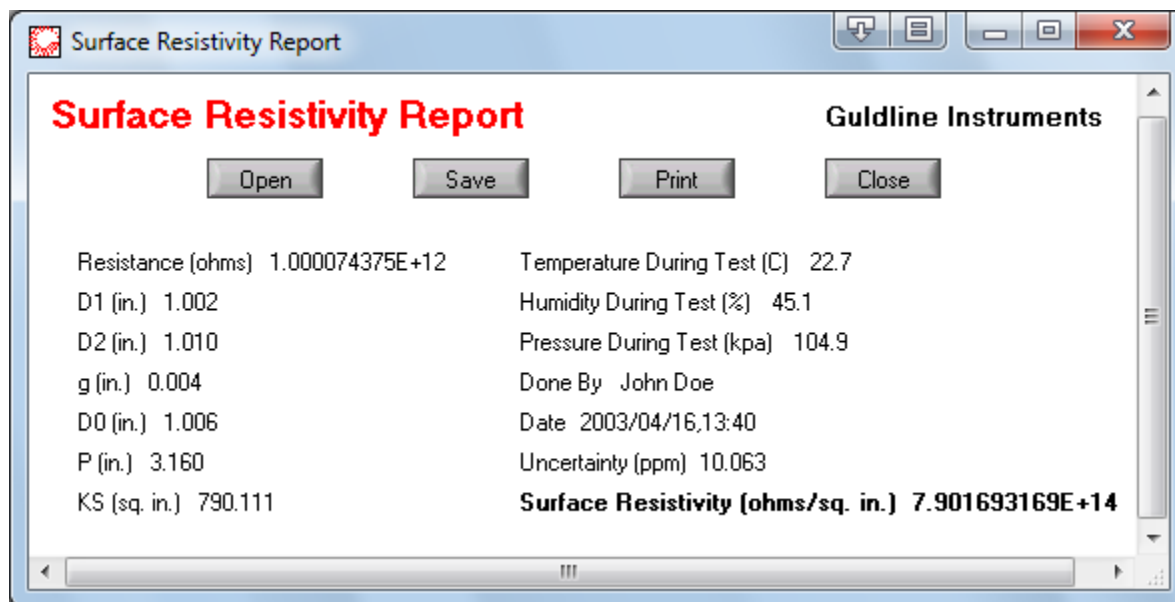
The Surface Resistivity report window is a summary of a surface resistivity test. This report contains the environmental conditions, test conductor and calculations for the test. From this report you can view the current test, open and save report files, as well as print out a hard copy.

2.2.1. Humidity (%) Field
The "Humidity" indicator displays the ambient relative humidity logged at the time of the test.

2.2.2. Pressure (kpa) Indicator
The "Pressure" indicator displays the ambient air pressure logged at the time of the test.

2.2.3. Temperature (C) Indicator
The "Temperature" indicator displays the ambient air temperature logged at the time of the test.

2.2.4. Resistance (ohms) Indicator
The "Resistance" indicator displays the average measured resistance of the test.

2.2.5. Date Indicator
The "Date" indicator displays the date and time the test was taken.

2.2.6. Done By Indicator
The "Done By" indicator displays the name of the system operator.

2.2.7. Uncertainty Indicator
The "Uncertainty" indicator displays the calculated uncertainty of the test.

2.2.8. D1 (in.) Indicator

The "D1" indicator displays the inner plate diameter of the surface resistivity device used for the test.

2.2.9. D2 (in.) Indicator

The "D2" indicator displays the outer ring diameter of the surface resistivity device used for the test.

2.2.10. g (in.) Indicator

The "g" indicator displays the gap distance of the surface resistivity device used in the test.

2.2.11. D0 (in.) Indicator

The "D0" indicator displays the midpoint diameter of the surface resistivity device used for the test.

2.2.12. P (in.) Indicator

The "P" indicator displays the effective perimeter coefficient of the sample measured in the test.

2.2.13. KS (sq. in.) Indicator

The "KS" indicator displays the surface coefficient of the sample measured in the test.

2.2.14. Surface Resistivity (ohms/sq. in.) Indicator

The "Surface Resistivity" indicator displays the calculated surface resistivity of the test.

2.2.15. Open Button

Clicking the "Open" button will open a previously saved report.

2.2.16. Save Button

Clicking the "Save" button, will save the current report.

2.2.17. Print Button

Clicking the "Print" button will print the report.

2.2.18. Close Button

Clicking the "Close" button will close the report window.

2.3. VOLUME RESISTIVITY REPORT
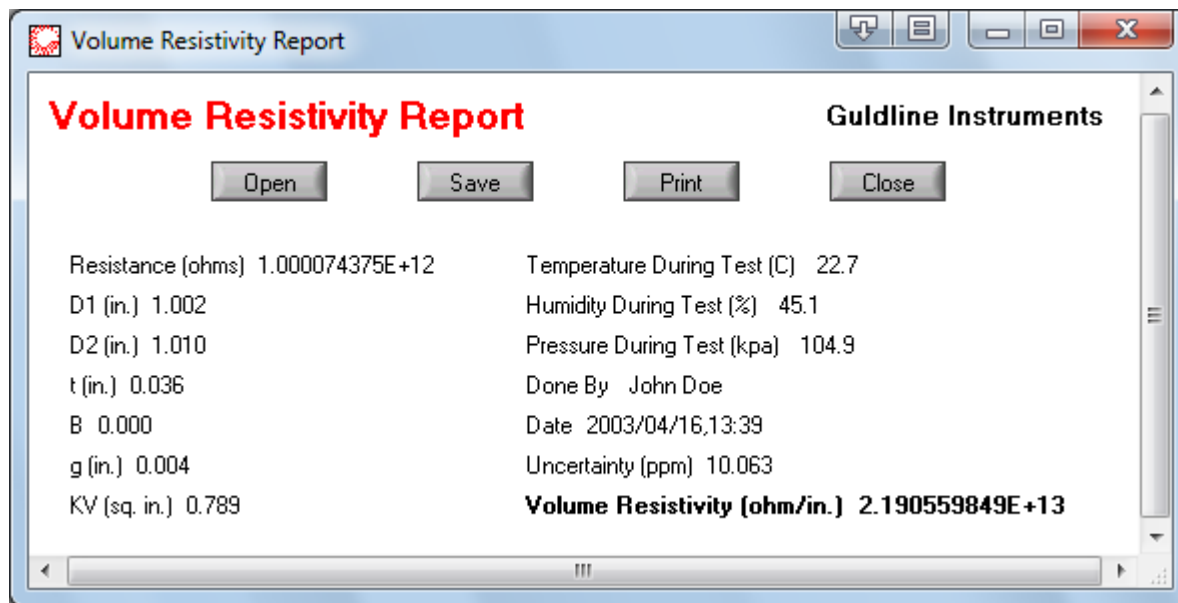
The Volume Resistivity report window is a summary of a volume resistivity test. This report contains the environmental conditions, test conductor and calculations for the test. From this report you can view the current test, open and save report files, as well as print out a hard copy.

2.3.1. Humidity (%) Field
The "Humidity" indicator displays the ambient relative humidity logged at the time of the test.

2.3.2. Pressure (kpa) Indicator
The "Pressure" indicator displays the ambient air pressure logged at the time of the test.

2.3.3. Temperature (C) Indicator
The "Temperature" indicator displays the ambient air temperature logged at the time of the test.

2.3.4. Resistance (ohms) Indicator
The "Resistance" indicator displays the average measured resistance of the test.

2.3.5. Date Indicator
The "Date" indicator displays the date and time the test was taken.

2.3.6. Done By Indicator
The "Done By" indicator displays the name of the system operator.

2.3.7. Uncertainty (ppm) Indicator

The "Uncertainty" indicator displays the calculated uncertainty of the test.

2.3.8.   D1 (in.) Indicator

The "D1" indicator displays the inner plate diameter of the surface/volume resistivity device used for the test.

2.3.9.   D2 (in.) Indicator

The "D2" indicator displays the outer ring diameter of the surface/volume resistivity device used for the test.

2.3.10. t (in.) Indicator

The "t" indicator displays the sample thickness of the sample measured in the test.

2.3.11. B Indicator

The "B" indicator displays the effective area coefficient of the sample measured in the test.

2.3.12. g (in.) Indicator

The "g" indicator displays the gap distance of the volume resistivity device used in the test.

2.3.13. KV (sq. in.)Indicator

The "KV" indicator displays the volume coefficient of the sample measured in the test.

2.3.14. Volume Resistivity (ohms/in.) Indicator

The "Volume Resistivity" indicator displays the calculated volume resistivity of the test.

2.3.15. Open Button

Clicking the "Open" button will open a previously saved report.

2.3.16. Save Button

Clicking the "Save" button, will save the current report.
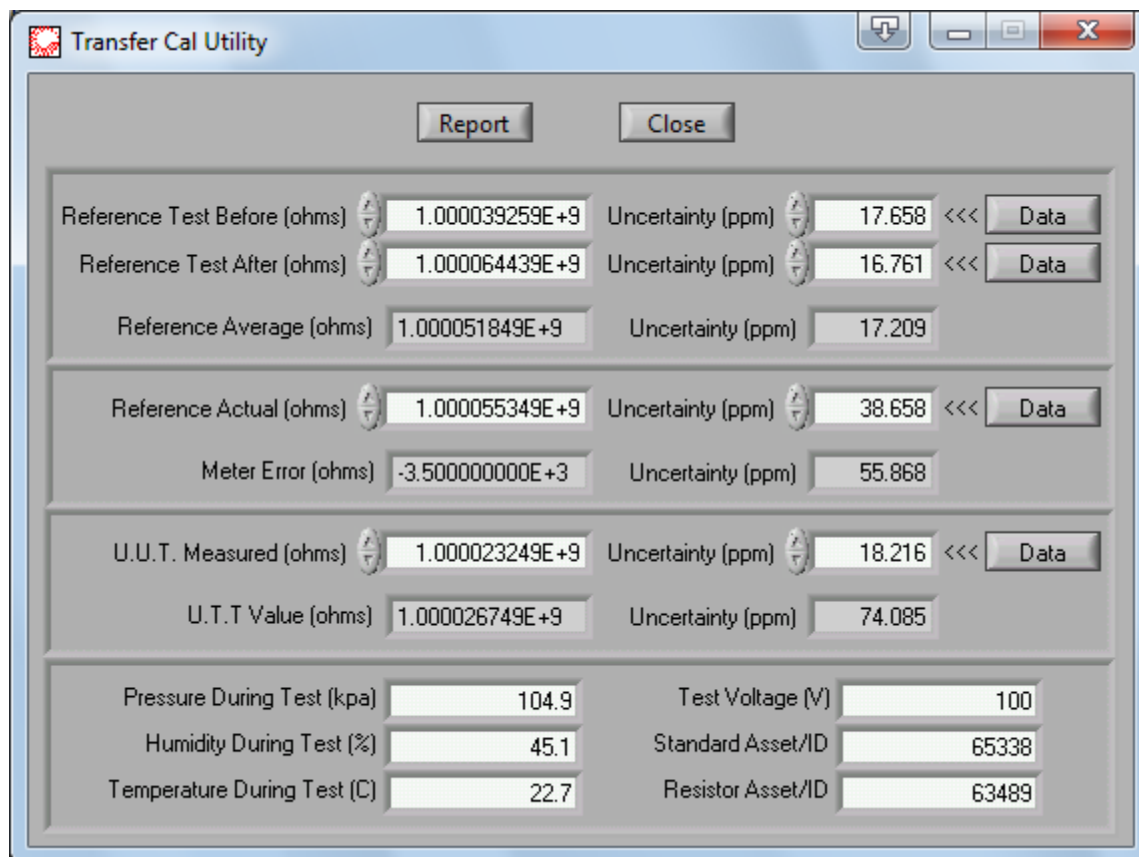
2.3.17. Print Button

Clicking the "Print" button will print the report.

2.3.18. Close Button

Clicking the "Close" button will close the report window.

2.4.   TRANSFER CAL UTILITY

The Transfer Cal utility window is a post process utility that can be used to reduce the uncertainty of a measurement. The utility can be accessed by selecting the "Transfer Cal Utility" item of the Configuration menu. The tests for this utility do not require any external devices to complete. The test data is entered manually, or through a TeraCal test data file, as well as a resistor profile. The Transfer Cal utility bases its reduction of uncertainty on using the 6530 as a transfer standard, rather than a direct measurement device. This can improve your base uncertainty greatly by using the uncertainty of your reference resistor and the short term stability of the 6530 rather than the direct long term uncertainty of the Teraohm Bridge-Meter. The tests for this utility used should all occur with 4 hours of each other to use the 6530 as a transfer standard.

2.4.1. Humidity (%) Field
The "Humidity" field enters and displays the ambient relative humidity logged at the time of the test.

2.4.2. Pressure (kpa) Field
The "Pressure" field enters and displays the ambient air pressure logged at the time of the test.

2.4.3. Temperature (C) Field

The "Temperature" field enters and displays the ambient air temperature logged at the time of the test.

2.4.4. Standard Asset/ID Field

The "Standard Asset/ID" field enters and displays the serial number of standard resistor used for the tests in this process.

2.4.5. Resistor Asset/ID Field

The "Resistor Asset/ID" field enters and displays the serial number of the resistor under test in this process.

2.4.6. Test Voltage (V) Field

The "Test Voltage (V)" field enters and displays the voltage used for the tests in this process.

2.4.7. Reference Test Before (ohms) Field

The "Reference Measured Before" field enters and displays the resistance of the first test taken on the reference resistor.

2.4.8. Reference Test After (ohms) Field

The "Reference Measured After" field enters and displays the resistance of the second test taken on the reference resistor.

2.4.9. Reference Average (ohms) Indicator

The "Reference Average" indicator displays the average resistance of the first and the second test taken on the reference resistor.

2.4.10. Reference Actual (ohms) Field

The "Reference Average" field enters and displays the actual known resistance of the reference resistor.

2.4.11. Meter Error (ohms) Indicator

The "Meter Error" indicator displays the calculated 6530 error.

2.4.12. U.U.T. Measured (ohms) Field

The "U.U.T. Measured" field enters and displays the measured resistance of the U.U.T. resistor.

2.4.13. U.U.T. Value (ohms) Indicator

The "U.U.T. Value" field enters and displays the corrected resistance of the U.U.T. resistor.

2.4.14. Uncertainty (ppm) Fields/Indicators

The "Uncertainty" fields/indicators enter and display the calculated uncertainty of the test.

2.4.15. Data Buttons

The "Data" buttons load the test information from a "*.TES" data file and device information from a "*.RES" configuration file.

2.4.16. Report Button

Clicking the "Report" button will generate a report based on the current data in the utility.

2.4.17. Close Button

Clicking the "Close" button will close the Transfer Cal utility.

2.5.   TRANSFER CAL REPORT

The Transfer Cal Report is a Test Overview ("*.TES") report. The report is derived from the U.U.T. measurement with the 6530 meter error correction applied to the results. Refer to Section 1.10 for the details about the Test Overview window.

2.6. VOLTAGE COEFFICIENT UTILITY

The Voltage Coefficient utility window is a post process utility that will calculate the voltage coefficient from a series of acquired test data. The utility can be accessed by selecting the "Voltage Coefficient Utility" item of the Configuration menu. The tests for this utility do not require any external devices to complete. The test data is entered either manually, or through a TeraCal test data files. The purpose of this utility is to allow you to take multiple tests on a given resistor at different voltages and find the voltage coefficient. You can enter up to 10 different voltage level tests to be used. You should at least use two points, for this type of report generation.

2.6.1. Humidity (%) Field
The "Humidity" field enters and displays the ambient relative humidity logged at the time of the test.

2.6.2. Pressure (kpa) Field
The "Pressure" field enters and displays the ambient air pressure logged at the time of the test.

2.6.3. Temperature (C) Field

The "Temperature" field enters and displays the ambient air temperature logged at the time of the test.

2.6.4. Standard Asset/ID Field
The "Standard Asset/ID" field enters and displays the serial number of standard resistor used for the tests in this process.

2.6.5. Resistor Asset/ID Field
The "Resistor Asset/ID" field enters and displays the serial number of the resistor under test in this process.

2.6.6. Resistance (ohms) @ 1V - Resistance (ohms) @ 1000V Fields
The "Resistance @ 1V" field enters and displays the average resistance of the test taken at 1V. The remaining fields up to the "Resistance @ 1000V" are used for the same purpose as the "Resistance @ 1V", for their respective voltage.

2.6.7. Uncertainty (ppm) Fields
The "Uncertainty (ppm)" field enters and displays the calculated uncertainty of the test taken at the given voltage. The uncertainty is associated with the test value to the left of the field.

2.6.8. Data Buttons
The "Data" buttons will load the test information from "*.TES" data files.

2.6.9. Report Button
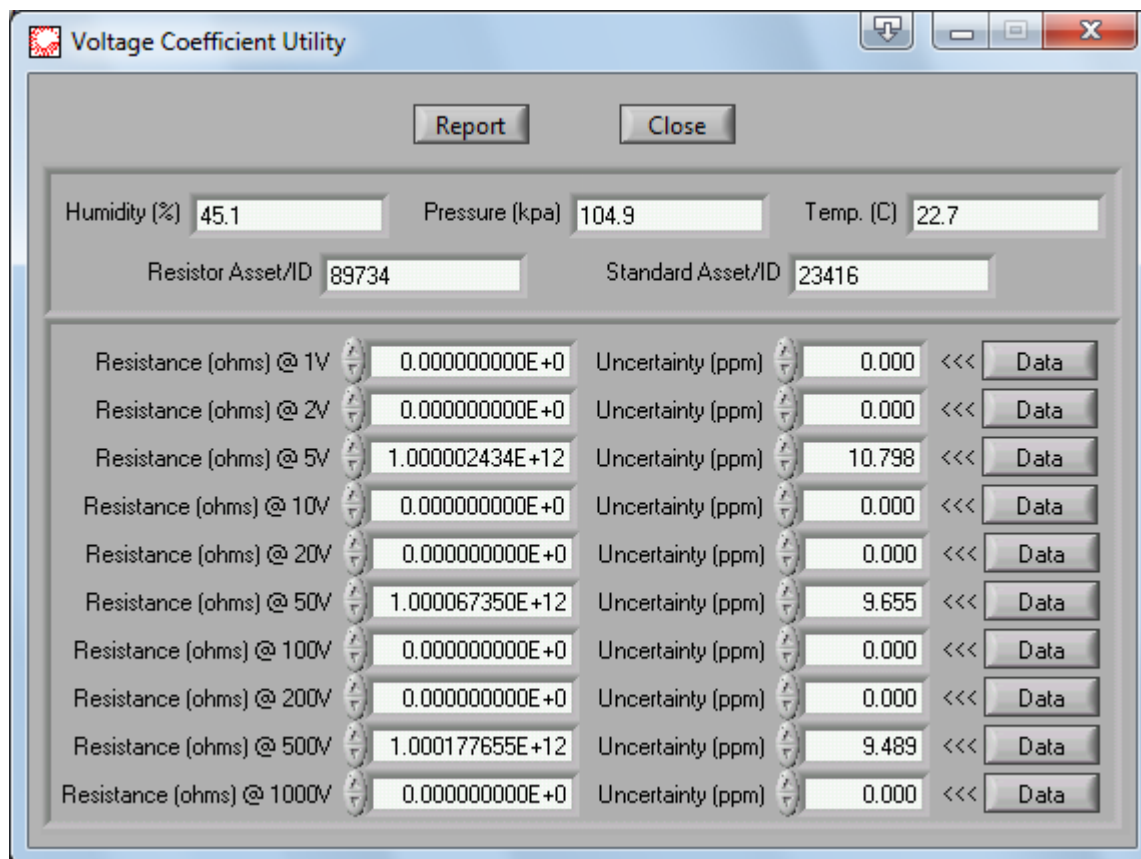Clicking the "Report" button will generate a report based on the current data in the utility.

2.6.10. Close Button
Clicking the "Close" button will close the Voltage Coefficient utility.

2.7.   VOLTAGE COEFFICIENT REPORT
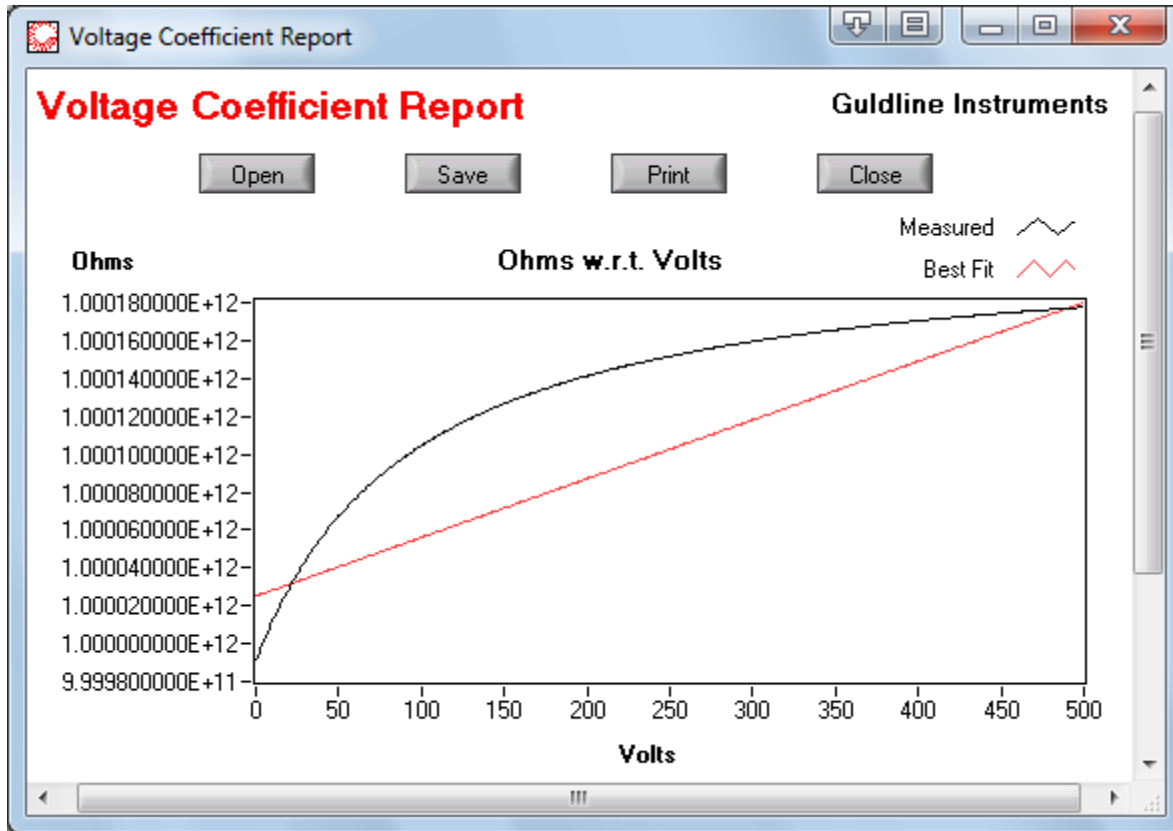
The Voltage Coefficient report window is a summary of many tests taken at different voltages. The average values of each test are plotted on a graph to show the voltage curve. From this curve, the best fit line is used to calculate the voltage coefficient. This report also contains the environmental conditions, test conductor and calculations for the test. From this report you can view the current test, open and save report files, as well as print out a hard copy.

2.7.1. Graph
The graph displays all the points entered. The graph displays sample values on the vertical axis with respect to voltage on the horizontal axis. The voltage always starts with 0 and ends with 1000. Along with all the points being displayed there is a best fit line plot to help graphically represent the linear voltage coefficient.

2.7.2. Humidity (%) Field
The "Humidity" indicator displays the ambient relative humidity logged at the time of the test.

2.7.3. Pressure (kpa) Indicator
The "Pressure" indicator displays the ambient air pressure logged at the time of the test.

2.7.4. Temperature (C) Indicator

The "Temperature" indicator displays the ambient air temperature logged at the time of the test.

2.7.5. Standard Asset/ID Indicator

The "Standard Asset/ID" indicator displays the serial number of standard resistor used for the tests in this process.

2.7.6. Resistor Asset/ID Indicator

The "Resistor Asset/ID" indicator displays the serial number of the resistor under test in this process.

2.7.7. 0 Volt Resistance (ohms) Indicator

The "0 Volt Resistance (ohms)" indicator displays the extrapolated resistance at 0 volts.

2.7.8. Voltage Coefficient (ohms/V) Indicator

The "Voltage Coefficient (ohms/V)" indicator displays the calculated voltage coefficient based on the best fit curve.

2.7.9. Date Indicator

The "Date" indicator displays the date and time the test was taken.

2.7.10. Done By Indicator

The "Done By" indicator displays the name of the system operator.

2.7.11. Expanded Uncertainty (ppm) Indicator

The "Expanded Uncertainty (ppm)" indicator displays the calculated uncertainty of the test.

2.7.12. Open Button

Clicking the "Open" button will open a previously saved report.

2.7.13. Save Button

Clicking the "Save" button will save the current report.

2.7.14. Print Button

Clicking the "Print" button will print the report.

2.7.15. Close Button

Clicking the "Close" button will close the report window.

2.8.   COEFFICIENT REPORT (6530 ALL MODELS)

Range	Voltage	+ Coef	- Coef
90k to 200k	1V	65	65
200k to 2M	1V	39	39
2M to 20M	1V	24	24
20M to 200M	1V	7	7
20M to 200M	3V	6	6
20M to 200M	10V	13	13
200M to 2G	1V	22	22
200M to 2G	3V	26	26
200M to 2G	10V	23	23
200M to 2G	30V	25	25
200M to 2G	100V	27	27
2G to 20G	1V	36	36
2G to 20G	3V	33	33
2G to 20G	10V	35	35
2G to 20G	30V	29	29
2G to 20G	100V	30	30
2G to 20G	300V	32	32
2G to 20G	1000V	35	35
20G to 200G	10V	26	26
20G to 200G	30V	23	23
20G to 200G	100V	25	25

Voltage	Coefficient	Limits +/- ppm
-1 V	-1	+/-1000
-3 V	-3	+/-1000
-10 V	-10	+/-1000
-30 V	-30	+/-1000
-100 V	-100	+/-1000
-300 V	-300	+/-1000
-1000 V	-1000	+/-1000
1 V	1	+/-1000
3 V	3	+/-1000
10 V	10	+/-1000
30 V	30	+/-1000
100 V	100	+/-1000
300 V	300	+/-1000
1000 V	1000	+/-1000

Cap.	Coefficient	Limits +/- ppm
27 pF	61156	+/-200000
270 pF	37987	+/-80000
2700 pF	25654	+/-20000

The Coefficient report window is a summary of all the coefficients of your 6530. These coefficients have been generated as a result of your 6530 calibration. This is an example of the report window for 6530 users with firmware version J or newer.

NOTE: Changing the values in this window will affect the calibration of your 6530. Proper care should be maintained when using this window.

From this report you can view the coefficients, open and save a coefficient report file to recover from the event of a non-volatile memory failure, as well as print out a hard copy.

2.8.1.   Range Coefficient Table
The Range Coefficient Table located to the upper left of the report allows you to display, as well as set, the range coefficients for the 6530. It is itemized by source voltage and resistance

measurement range having an error correction coefficient on a per resistance/voltage basis. This table is unique to 6530's with firmware revision J and newer.

2.8.2. Voltage Coefficient Table

The Voltage Coefficient Table located to the upper right of the report allows you to display, as well as set, the voltage coefficients for the 6530's built in voltage source. It is itemized by voltage having an error correction coefficient on a per voltage and polarity basis.

2.8.3. Capacitor Coefficient Table

The Capacitor Coefficient Table located to the bottom right of the report allows you to display, as well as set, the integration capacitor coefficients for the 6530's integration capacitors. It is itemized by nominal capacitance having an error correction coefficient on a per capacitor basis.

2.8.4. Threshold Coefficient Table

The Threshold Coefficient Table located to the bottom right of the report allows you to display, as well as set, the integration threshold voltage coefficients for the 6530's integration threshold voltages. It is itemized by threshold voltage having an error correction coefficient on a per threshold voltage basis.

2.8.5. Zero Coefficient

The Zero Coefficient allows you to display, as well as set, the coefficient for the 6530's input protection resistor.

2.8.6. Shunt Offset Coefficient

The Shunt Offset Coefficient allows you to display, as well as set, the coefficient for the 6530's input shunt resistor which enables higher current range measurements.

2.8.7. Shunt Gain Coefficient

The Shunt Gain Coefficient allows you to display, as well as set, the coefficient for the 6530's input shunt resistor which enables higher current range measurements.

2.8.8. Cal Date Field

The Cal Date Field allows you to display, as well as set, the calibration date for the 6530.

2.8.9. Model/Serial Field

The Model/Serial Field allows you to display the 6530's model number, serial number, and firmware revision.

2.8.10. Load Button

Clicking the "Load" button will open a previously saved report.

2.8.11. Save Button
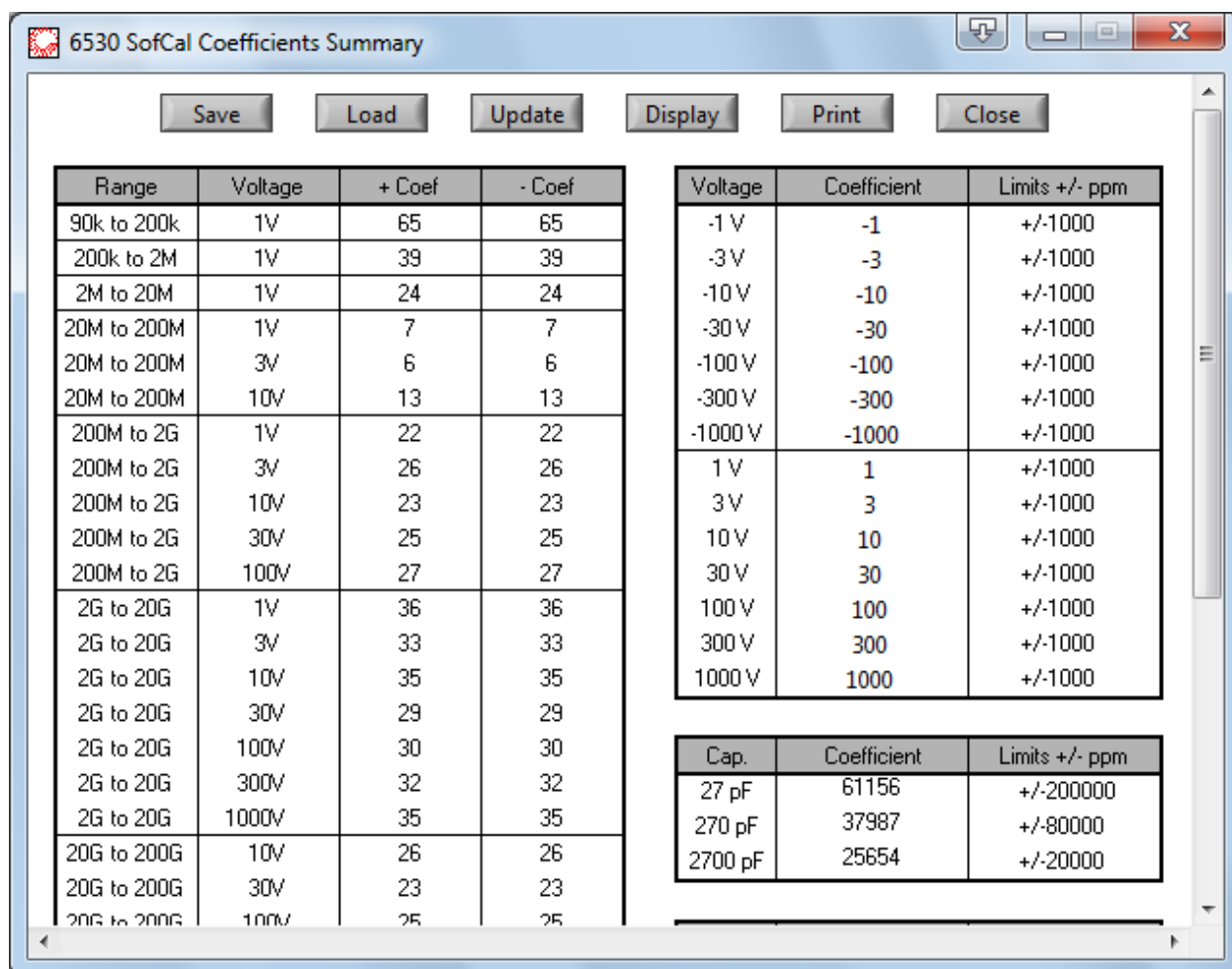
Clicking the "Save" button will save the currently displayed coefficient report to a file.

2.8.12. Update Button

Clicking the "Update" button will download the currently displayed coefficient report into your 6530's non-volatile memory.

CAUTION: Improper use of this button can invalidate the calibration of your 6530.

2.8.13. Display Button

Clicking the "Display" button will read the currently stored coefficients of your 6530's non-volatile memory and display them in the report window.
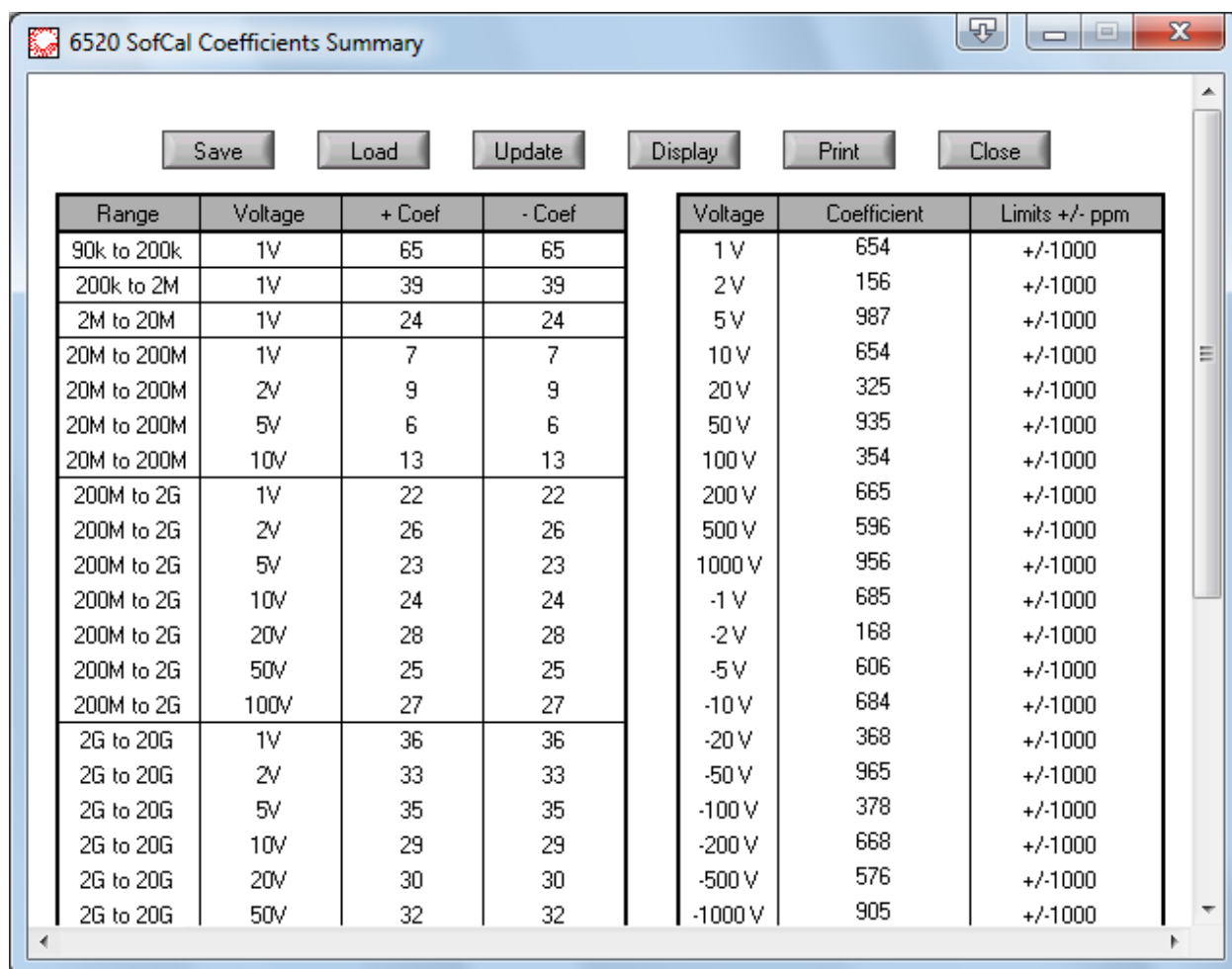
2.8.14. Print Button

Clicking the "Print" button will print the coefficient report.

2.8.15. Close Button

Clicking the "Close" button will close the coefficient report window.

2.9. COEFFICIENT REPORT (6520 REV J AND NEWER)

6520 SofCal Coefficients Summary

Range	Voltage	+ Coef	- Coef	Voltage	Coefficient	Limits +/- ppm
90k to 200k	1V	65	65	1 V	654	+/-1000
200k to 2M	1V	39	39	2 V	156	+/-1000
2M to 20M	1V	24	24	5 V	987	+/-1000
20M to 200M	1V	7	7	10 V	654	+/-1000
20M to 200M	2V	9	9	20 V	325	+/-1000
20M to 200M	5V	6	6	50 V	935	+/-1000
20M to 200M	10V	13	13	100 V	354	+/-1000
200M to 2G	1V	22	22	200 V	665	+/-1000
200M to 2G	2V	26	26	500 V	596	+/-1000
200M to 2G	5V	23	23	1000 V	956	+/-1000
200M to 2G	10V	24	24	-1 V	685	+/-1000
200M to 2G	20V	28	28	-2 V	168	+/-1000
200M to 2G	50V	25	25	-5 V	606	+/-1000
200M to 2G	100V	27	27	-10 V	684	+/-1000
2G to 20G	1V	36	36	-20 V	368	+/-1000
2G to 20G	2V	33	33	-50 V	965	+/-1000
2G to 20G	5V	35	35	-100 V	378	+/-1000
2G to 20G	10V	29	29	-200 V	668	+/-1000
2G to 20G	20V	30	30	-500 V	576	+/-1000
2G to 20G	50V	32	32	-1000 V	905	+/-1000

The Coefficient report window is a summary of all the coefficients of your 6520. These coefficients have been generated as a result of your 6520 calibration. This is an example of the report window for 6520 users with firmware version J or newer.

NOTE: Changing the values in this window will affect the calibration of your 6520. Proper care should be maintained when using this window.

From this report you can view the coefficients, open and save a coefficient report file to recover from the event of a non-volatile memory failure, as well as print out a hard copy.

2.9.1. Range Coefficient Table

The Range Coefficient Table located to the upper left of the report allows you to display, as well as set, the range coefficients for the 6520. It is itemized by source voltage and resistance

measurement range having an error correction coefficient on a per resistance/voltage basis. This table is unique to 6520's with firmware revision J and newer.

2.9.2. Voltage Coefficient Table
The Voltage Coefficient Table located to the upper right of the report allows you to display, as well as set, the voltage coefficients for the 6520's built in voltage source. It is itemized by voltage having an error correction coefficient on a per voltage and polarity basis.

2.9.3. Capacitor Coefficient Table
The Capacitor Coefficient Table located to the bottom right of the report allows you to display, as well as set, the integration capacitor coefficients for the 6520's integration capacitors. It is itemized by nominal capacitance having an error correction coefficient on a per capacitor basis.

2.9.4. Threshold Coefficient Table
The Threshold Coefficient Table located to the bottom right of the report allows you to display, as well as set, the integration threshold voltage coefficients for the 6520's integration threshold voltages. It is itemized by threshold voltage having an error correction coefficient on a per threshold voltage basis.

2.9.5. Zero Coefficient
The Zero Coefficient allows you to display, as well as set, the coefficient for the 6520's input protection resistor.

2.9.6. Shunt Offset Coefficient
The Shunt Offset Coefficient allows you to display, as well as set, the coefficient for the 6520's input shunt resistor which enables higher current range measurements.

2.9.7. Shunt Gain Coefficient
The Shunt Gain Coefficient allows you to display, as well as set, the coefficient for the 6520's input shunt resistor which enables higher current range measurements.

2.9.8. Cal Date Field
The Cal Date Field allows you to display, as well as set, the calibration date for the 6520.

2.9.9. Model/Serial Field
The Model/Serial Field allows you to display the 6520's model number, serial number, and firmware revision.

2.9.10. Load Button
Clicking the "Load" button will open a previously saved report.

2.9.11. Save Button
Clicking the "Save" button will save the currently displayed coefficient report to a file.

2.9.12. Update Button

Clicking the "Update" button will download the currently displayed coefficient report into your 6520's non-volatile memory.

CAUTION: Improper use of this button can invalidate the calibration of your 6520.

2.9.13. Display Button

Clicking the "Display" button will read the currently stored coefficients of your 6520's non-volatile memory and display them in the report window.
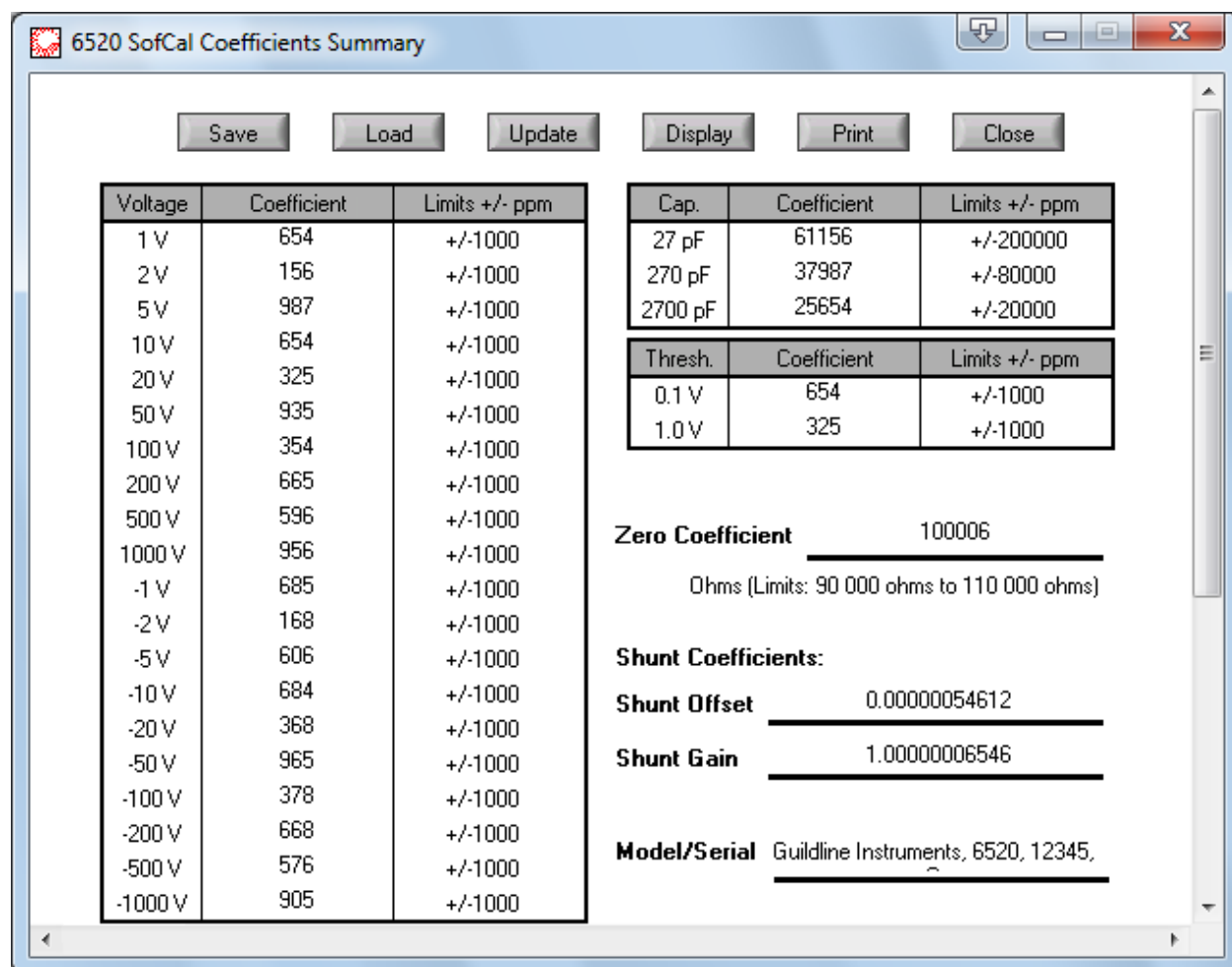
2.9.14. Print Button

Clicking the "Print" button will print the coefficient report.

2.9.15. Close Button

Clicking the "Close" button will close the coefficient report window.

2.10. COEFFICIENT REPORT (6520 REV G AND PREVIOUS)

6520 SofCal Coefficients Summary

Voltage	Coefficient	Limits +/- ppm
1 V	654	+/-1000
2 V	156	+/-1000
5 V	987	+/-1000
10 V	654	+/-1000
20 V	325	+/-1000
50 V	935	+/-1000
100 V	354	+/-1000
200 V	665	+/-1000
500 V	596	+/-1000
1000 V	956	+/-1000
-1 V	685	+/-1000
-2 V	168	+/-1000
-5 V	606	+/-1000
-10 V	684	+/-1000
-20 V	368	+/-1000
-50 V	965	+/-1000
-100 V	378	+/-1000
-200 V	668	+/-1000
-500 V	576	+/-1000
-1000 V	905	+/-1000

Cap.	Coefficient	Limits +/- ppm
27 pF	61156	+/-200000
270 pF	37987	+/-80000
2700 pF	25654	+/-20000

Thresh.	Coefficient	Limits +/- ppm
0.1 V	654	+/-1000
1.0 V	325	+/-1000

Zero Coefficient   100006

Ohms (Limits: 90 000 ohms to 110 000 ohms)

Shunt Coefficients:

Shunt Offset   0.00000054612

Shunt Gain   1.00000006546

Model/Serial Guildline Instruments, 6520, 12345,

The Coefficient report window is a summary of all the coefficients of your 6520. These coefficients have been generated as a result of your 6520 calibration. This is an example of the report window for 6520 users with firmware version G or previous.

NOTE: Changing the values in this window will affect the calibration of your 6520. Proper care should be maintained when using this window.

From this report you can view the coefficients, open and save a coefficient report file to recover from the event of a non-volatile memory failure, as well as print out a hard copy.

2.10.1. Linearity Coefficient Table
The Linearity Coefficient Table located to the bottom of the report allows you to display, as well as set, the resistance linearity coefficients for the 6520. It is itemized by decade resistance value

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having an error correction coefficient on a per resistance basis. This table is unique to 6520's with firmware revision G and previous.

2.10.2. Voltage Coefficient Table

The Voltage Coefficient Table located to the upper left of the report allows you to display, as well as set, the voltage coefficients for the 6520's built in voltage source. It is itemized by voltage having an error correction coefficient on a per voltage and polarity basis.

2.10.3. Capacitor Coefficient Table

The Capacitor Coefficient Table located to the upper right of the report allows you to display, as well as set, the integration capacitor coefficients for the 6520's integration capacitors. It is itemized by nominal capacitance having an error correction coefficient on a per capacitor basis.

2.10.4. Threshold Coefficient Table

The Threshold Coefficient Table located to the upper right of the report allows you to display, as well as set, the integration threshold voltage coefficients for the 6520's integration threshold voltages. It is itemized by threshold voltage having an error correction coefficient on a per threshold voltage basis.

2.10.5. Zero Coefficient

The Zero Coefficient allows you to display, as well as set, the coefficient for the 6520's input protection resistor.

2.10.6. Shunt Offset Coefficient

The Shunt Offset Coefficient allows you to display, as well as set, the coefficient for the 6520's input shunt resistor which enables higher current range measurements.

2.10.7. Shunt Gain Coefficient

The Shunt Gain Coefficient allows you to display, as well as set, the coefficient for the 6520's input shunt resistor which enables higher current range measurements.

2.10.8. Cal Date Field

The Cal Date Field allows you to display, as well as set, the calibration date for the 6520.

2.10.9. Model/Serial Field

The Model/Serial Field allows you to display the 6520's model number, serial number, and firmware revision.

2.10.10.Load Button

Clicking the "Load" button will open a previously saved report.

2.10.11.Save Button

Clicking the "Save" button will save the currently displayed coefficient report to a file.

2.10.12.Update Button

Clicking the "Update" button will download the currently displayed coefficient report into your 6520's non-volatile memory.

CAUTION: Improper use of this button can invalidate the calibration of your 6520.

2.10.13.Display Button

Clicking the "Display" button will read the currently stored coefficients of your 6520's non-volatile memory and display them in the report window.

2.10.14.Print Button

Clicking the "Print" button will print the coefficient report.

2.10.15.Close Button

Clicking the "Close" button will close the coefficient report window.

3.   USER NOTES

3.1.   MEASUREMENT OPERATION GUIDE

This section contains information regarding the measurement of resistors with the model 6530. This guide is provided for control of the Teraohm Bridge-Meter through a computer running the TeraCal software package. An operating guide for manual control of the Teraohm Bridge-Meter is provided in the Model 6530 Technical Manual.

3.1.1.   Resistance Measurement

The model 6530 is capable of resistance measurement for values 100 kΩ to 100 PΩ. This can be a fully automated process or can a user defined process.

CAUTION:
Voltages up to 1000 V DC can appear at the resistor connections during resistance measurements.

NOTE:
In this, as in all measurements, optimum results will be obtained if the environment is controlled. The recommendations in the Instrument Society of America (ISA) publication ISA RE52.1, especially in regards to relative humidity, should be observed.

The following steps outline the general procedure for making a resistance measurement.

Connect the IEEE-488.2 interface connector of the model 6530 to an IBM-PC compatible computer running Windows 9x/NT^{TM} (or newer) and run the TeraCal software.

Step 1)	Connect the resistance device to the "Input" and "Output" terminals of the 6530 Teraohm Bridge-Meter.
Step 2)	You can change the scale being displayed by clicking on the "Units" control on the TeraCal main window. The default unit for resistance is "Ohms". The units available are:

Ratio	The ratio of U.U.T. with respect to the Ref. (for transfer purposes)
Ohms	Resistance value of U.U.T.
Delta (ppm)	The difference between Ratio and the nominal ratio expressed in ppm of nominal (the nominal ratio is resistance entered in the Test Configuration window)

NOTE:
The displayed units do not affect the stored data. Test data is always stored in ratio.

Step 3)   Click on the "Configuration" menu and select "Test Configuration" from the TeraCal main window.

Step 4)   Load the "Resistor Configuration" information into the "Test Configuration" window.

    i)   If you already have a saved resistor profile, click on the "Load Resistor Profile" button to upper left.

    ii)   Otherwise, enter all the pertinent information for the resistor to be used, if this information is known. The following parameters can be entered:

Manufacturer/Model	used to identify resistor in test file, test overview, and history file
Asset/ID Number	used to identify resistor in test file, test overview, and history file
Serial Number	used to identify resistor in test file, test overview, and history file
R (ohms)	Value in ohms of the resistor – 100k ohm to 100P ohm.
V test (V)	Test voltage that will be applied to the resistor during measurement – must be a value between 1 and 1000 inclusive.
V max (V)	Maximum voltage that will be allowed for the resistor during measurement – must be a value between 1 and 1000 inclusive.
Uncertainty (ppm)	Uncertainty of the resistance value in ppm of the nominal value – used to calculate the measurement uncertainty
Cal. Date	For reference purposes
Cal. Due	For reference purposes
Cal Temp (C)	For reference purposes
Volt Coef. (ohm/V)	For reference purposes

Step 5)   Set the measurement mode to "Resistance Mode" and determine if you "Manual Range" or "Auto Range" by setting the "Ranging Mode" switch.

    i)   If you select Auto Range mode you do not need to enter these parameters, skip to step 6.

    ii)   Otherwise, enter all the pertinent information for the resistor to be used, if this information is known. The following parameters can be entered:

Threshold	The threshold voltage used by the 6530. – can be 10V, 1V, or 0.1V.
Cap	The capacitor used by the 6530 – can be 27pF, 270pF, or 2700pF.

| | V test (V) | Test voltage that will be applied to the resistor during measurement – must be a value between 1 and 1000 inclusive. |

Step 6) Set the "Polarity" of the measurement. This can be Positive, Negative, or Auto Reverse.

Step 7) Set the sample "Delay" to control the minimum rate that you read in samples.

Step 8) Set the "Soak" time of your measurement that determines the time that the voltage is applied before reading the resistor.

Step 9) Set the "Window" of readings for which the retrieved value is processed over.

Step 10) Set the "Rev. Rate", in samples, to control when the polarity reverses in Auto Reverse mode.

Step 11) Set the number of "Samples" to be taken.

Step 12) Save this test configuration by clicking on the "Save" button, entering an appropriate name for the configuration file and clicking on the "Save" button in the Save Sequence File dialog box.

Step 13) Click on the "Start" button. The measurement will now begin.

Step 14) You may terminate the measurement at any time by clicking on the "Stop" button.

Step 15) You may save the displayed data file by selecting "File" on the menu bar, selecting "Save Data As", entering an appropriate name for the configuration file and clicking on the "Save" button in the Save Data File dialog box.

Step 16) To process the results, open the "Test Overview" window from the "View" menu of the main window.

Step 17) Then within the "Test Overview" window, select "Open" from file menu and select the data file you wish to view.

Step 18) From here you can make data adjustments and print out the report with the options in the menu bar (see section 1.10 for more details). Once completed, you then close the "Test Overview" and return to the main window.

3.1.2. Current Measurement

The model 6530 is capable of resistance measurement for values 100 mA to 1 pA. This can be a fully automated process or can a user defined process.

NOTE:
In this, as in all measurements, optimum results will be obtained if the environment is controlled. The recommendations in the Instrument Society of America (ISA) publication ISA RE52.1, especially in regards to relative humidity, should be observed.

The following steps outline the general procedure for making a current measurement.

Connect the IEEE-488.2 interface connector of the model 6530 to an IBM-PC compatible computer running Windows 9x/NT^{TM} (or newer) and run the TeraCal software.

Step 1) Connect the current source to the "Input" terminal of the 6530 Teraohm Bridge-Meter.

Step 2) You cannot change the scale being displayed by clicking on the "Units" control on the TeraCal main window. The only unit for current is "Amps". The units available are:

Step 3) Click on the "Configuration" menu and select "Test Configuration" from the TeraCal main window.

Step 4) Set the measurement mode to "Current Mode" and determine if you "Manual Range" or "Auto Range" by setting the "Ranging Mode" switch.

    iii)   If you select Auto Range mode you do not need to enter these parameters, skip to step 5.

    iv)   Otherwise, enter all the pertinent information for the resistor to be used, if this information is known. The following parameters can be entered:

        Threshold   The threshold voltage used by the 6530. − can be 10V, 1V, or 0.1V.

        Cap   The capacitor used by the 6530 − can be 27pF, 270pF, or 2700pF.

Step 5) Set the "Polarity" of the measurement. This can be Positive, Negative, or Auto Reverse.

Step 6) Set the sample "Delay" to control the minimum rate that you read in samples.

Step 7) Set the "Window" of readings for which the retrieved value is processed over.

Step 8) Set the "Rev. Rate", in samples, to control when the polarity reverses in Auto Reverse mode.

Step 9) Set the number of "Samples" to be taken.

Step 10) Save this test configuration by clicking on the "Save" button, entering an appropriate name for the configuration file and clicking on the "Save" button in the Save Sequence File dialog box.

Step 11) Click on the "Start" button. The measurement will now begin.

Step 12) You may terminate the measurement at any time by clicking on the "Stop" button.

Step 13)   You may save the displayed data file by selecting "File" on the menu bar, selecting "Save Data As", entering an appropriate name for the configuration file and clicking on the "Save" button in the Save Data File dialog box.

Step 14)   To process the results, open the "Test Overview" window from the "View" menu of the main window.

Step 15)   Then within the "Test Overview" window, select "Open" from file menu and select the data file you wish to view.

Step 16)   From here you can make data adjustments and print out the report with the options in the menu bar (see section 1.10 for more details). Once completed, you then close the "Test Overview" and return to the main window.

3.2.   DATA STORAGE

In TeraCal, as in any other software, a good practice is to have a backup method. A good backup method will incorporate the storage of all important data used in the program and by the program on a reliable non-volatile media that can be removed from the system in which it is used. Supplied with your model 6530 is the installed CD that can restore all of your program files and necessary drivers for TeraCal to operate. The model 6530 software, being based on a personal computer, allows for many options in backup media. Provided with most computers is the 31/2" floppy drive. The floppy disk for this drive can hold up to 1.44 Megabytes of information. This is much larger than any data file produced or used by TeraCal. In most cases, you will be able to place up to 100 files per floppy disk, depending on the size of the files you are saving to the disk. To store a file on disk, you can load the file in its associated viewer and then resave it to the floppy disk drive as well as on your hard drive. You can also copy the chosen files through Windows Explorer or the command prompt.

When you have placed all the files to the disk and you are satisfied with your backup, you should write-protect the disk, and store the disk in a safe area as described by the disk manufacturer's instructions. Usually this is to be a cool, dry area with no magnetic sources nearby.

3.3. TROUBLESHOOTING TERACAL

In the event that your computer system is not working properly, it is also quite likely that the TeraCal software will not operate properly either. You must first fix the problems in the computer and then retry using the software. The most common problems that occur in a computer system are improper configuration and viruses. If you have recently changed your computer system settings, you should review those changes to ensure that the changes are not the cause of your problem. If this has been ruled out, then be certain that someone has not tampered with the computer. In either case, using the device manager in Windows 9x/NT^{TM} will help you find any conflicts in your system setup. You should also check for viruses, especially if you have shared files on your computer with other computers. If you are sharing files, you should make every attempt to control those files transferred to your computer and use a current virus scan and repair utility on your system. In the event that there was never a problem with the computer or the problem was repaired, and TeraCal still is not operating properly then you should try reinstalling it as directed in section 1.1 of this manual. If this still fails, then contact Guildline Instruments Limited for technical support.

3.3.1. Error Messages
If, while using TeraCal, a hardware problem occurs, error messages will pop up to guide you towards a solution. This error message must be cleared by the user. Below is a list of the error messages placed into TeraCal and their associated number as referred to by the model 6530.

If you stop the operation of TeraCal in the event of an error, the error may still remain in the queue in the model 6530. This error will be displayed by TeraCal on the startup of the next test. For this reason, it is advised to allow TeraCal to clear the error before taking any action. Most errors are reported by TeraCal within a second of occurring. However, the error may not be directly reported to TeraCal in the event of a series of subsequent errors or if the Teraohm Bridge-Meter completely stops responding. In these cases, the result will be either the current error in queue or a timeout error.

This error will appear in events such as communication has been lost, a failsafe is triggered, or if hardware has not responded when initiating any test or test process. If any of these error appear, correct any setup/configuration problems and/or re-verify communication through the "Rescan for Device" function as indicated.

Surface/Volume configuration error:
"Surface/Volume configuration error. Your surface/volume resistivity device is configured for volume mode and this is a surface mode test. Please correct the problem and try again."

Surface/Volume configuration error:
"Surface/Volume configuration error. Your surface/volume resistivity device is configured for surface mode and this is a volume mode test. Please correct the problem and try again."

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Timeout error:
"Timeout error. Please verify your test setup parameters and try again."

Interlock error:
"Interlock error. Please verify your interlock device is connected and in the proper state."

Communication failure:
"There has been a communication failure. Please verify that all cables are connected and rescan for the tera-ohmmeter."

Communication failure:
The serial number of the tera-ohmmeter does not match the previously scanned number please verify that you have the correct unit connected and rescan.

Communication failure:
The model number of the tera-ohmmeter is not correct please verify that you have the correct unit connected and rescan.

P.O.S.T. Errors:
This error message lists all Power On Self Test errors at the time when the model 6530 is first detected on the GPIB bus. If this happens, try restarting your hardware. If there continues to be errors listed, then contact your local Guildline representative.

Self Test Failed
-NVROM Checksum fail
-ROM Checksum fail
-Analog +5V fail
-Analog -5V fail
-Analog +15V fail
-Analog -15V fail
-Analog Precharge fail
-Analog HV Monitor fail
-Analog 10V ref fail
-Analog Ramp fail
-Digital +5V fail
-Digital -5V fail
-Digital +15V fail
-Digital -15V fail

3.3.2. Warnings

There are several warning messages you will encounter while you are using TeraCal. These warnings are placed in the software as a preventative measure against unintentional data loss or to notify you about a hardware configuration detail that needs to be addressed. This warning message must be cleared by the user.

"Replace <path and filename>?"

This warning will appear whenever you attempt to save data information to a name that already exists in that directory. This message is a precautionary step that helps prevent accidental overwrites, but allows for intentional overwrites.

"You may not select an existing file."

This warning will only show up in the File Manager when you highlight a file and click on the "Open" button. What is meant by this error is that you are not to select a particular file with this file dialog box. Instead, you are to find the directory that contains the desired files and click on "Select Cur Dir".

"The ability to overwrite has been locked out. You can enable config file overwrites in Administrative Options."

This warning will show up in the main window the Test Sequence, and the History Chart window.
It is a notice that device configuration files are currently protected by the Administrative Options.

"Your reference resistor serial numbers do not match."

This warning will only show up in the Transfer Cal utility when you select a secondary reference test file with a resistor serial number that does not match the first selection.

"Your measurements have taken place over a greater period of time than 4 hours."

This warning will only show up in the Transfer Cal utility when you select a resistor test file that breaks the short term stability time guideline for resistance transfer.

"Your test resistor serial numbers do not match."

This warning will only show up in the Voltage Coefficient utility when you select a resistor test file with a serial number that does not match the first selection.

3.3.3. Password Removal

If in the event that you have forgotten or lost the TeraCal "Administrative Options" password. You can return to the installation default of no password and no file protect by opening up a Command Prompt window and typing:

del c:\tera.sys

This file is created by TeraCal after using the "Administrative Options" and by deleting it you will return to the TeraCal installation default.

3.4.   KEY NAVIGATION

Throughout the TeraCal software, you can use "hotkeys" to navigate through the various options. These keys allow for use without a mouse, and as a quick shortcut to window and menu items. The most important keys are the "Alt" key to highlight the menu which can then be navigated using the arrow keys, or by selecting the underlined letter of the available options. As well, you can use the "Tab" key to cycle through the windows various controls and fields. Holding the "Shift" key while "Tabbing" through the controls/fields will let you cycle in the opposite direction. To use the selected control you can press the space bar for activating buttons or switches, and arrow keys for cycling though multi-selection dials. Fields can be typed into with the desired information, and tabbed out of when done. In the windows that contain an "OK" or "Cancel" button, the "Enter" key can be used to activate the "OK" button and the "Esc" key can be used to activate the "Cancel" button at any time.

Some of the more common menu functions have a direct hotkey linked to them, allowing you to access them without having to access the menu first. These keys are always the "Ctrl" key held in conjunction with a letter key. Below is a list of the various direct hotkey links and the windows in which they are used.

Ctrl + S (Save data as...)   This hotkey is used only in the main window. This will save the current test to a chosen test file.

Ctrl + S (Save)   This hotkey is used only in the test overview window. This will save the displayed/modified test file to a chosen name.

Ctrl + P (Print)   This hotkey is used in the main, test overview, and history chart window. This will print the active window from which it is launched.

Ctrl + Q (Quit)   This hotkey is used only in the main window. This quit the program.

Ctrl + H (Help)   This hotkey is used only in the main window and will load up TeraCal help file.

Ctrl + O (Open)   This hotkey is used in the test overview window and will open the test file of your choice to be viewed.

Ctrl + W (Close Window)   This hotkey is used in the test overview and the history chart window and will close that window.

Ctrl + E (Editor)   This hotkey is used in the history chart window and will open the file editor so you can create or edit a history file.

Ctrl + D (Display)   This hotkey is used in the history chart window and will open the history file of your choice to be displayed.

3.5.   USING TERACAL DEMO PROGRAM

3.5.1.   On Other Computers

With the TeraCal Demo program, you can set up other computers for "off-line" training, keeping the actual system reserved for official measurement use. Installing the demo on other computers also creates separate workstations for data processing, including printing. These workstations can be made part of a network with the actual system computer to make the access to the stored data even simpler, as TeraCal, along with the demo, supports network file functions within Windows.

3.5.2.   On the System Computer

The demo version also can be run simultaneously to the full version in the system computer to allow you to manage or process files while you wait for measurements to complete. This makes the system computer equivalent to the earlier mentioned data workstations. Being a completely separate program and process allows access to all data management windows, regardless if the system running the full version TeraCal is in a state that does not.

3.6. EXPORTING TO EXCEL

Data that is exported to Microsoft^{TM} Excel can be used to apply your own custom mathematics and analysis. You can export test or history data to Excel in various ways. Knowing the format by which the data is exported will make it easier to navigate the contents of the exported file.

The example given below is a test (*.TES) file for a test generated through the main window. The basic layout is that all stored test control and reference information is stored in the first section (upper left). The second section (lower right) is the raw data and reversal rate information. The precision of the data is 9 digits, as in TeraCal. However by default, Excel displays 2 digits. This can be modified by the cell(s) formatting to display the whole number.

Note:
The Rs title is always applied to the reference in the saved data. In cases where the transfer standard method is used the RS is the resistance value. Where a direct reading from the 6530 is stored the value is equal to 1.

The next example given below is a history (*.HIS) file for history data generated through the History File Editor window. The basic layout is that all stored history control and reference information is stored in the first section (upper left). The second section (lower right) is the history data. The precision of the data is 9 digits, as in TeraCal. However by default, Excel displays 2 digits. This can be modified by the cell(s) formatting to display the whole number.

Note:
The date in the first column is recorded as a time-zone-independent number of seconds that have elapsed since 12:00 a.m., January 1, 1904, Universal Time. This differs from Microsoft^{TM} Excel's reference date of 12:00 a.m., January 1, 1900, Universal Time.

3.7. EXPORTING TO CRYSTAL REPORTS

Data that is exported to Seagate^{TM} Crystal Reports can be used to apply your own custom mathematics and report layout. You can export test or history data to Crystal Reports in various ways. Knowing the format by which the data is exported will make it easier to navigate the contents of the exported file.
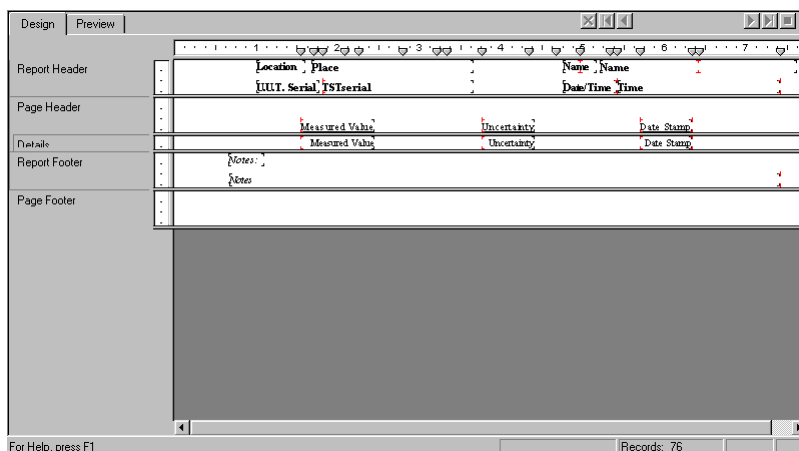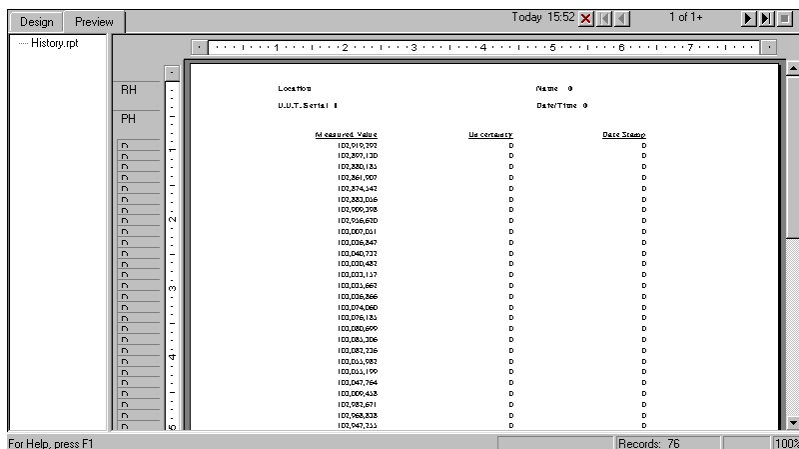
The example given below is a test (*.TES) file for a test generated through the main window. The basic layout is that all stored test control and reference information is stored in the report header section. The page header and details sections contain the raw data and sample rate information. The precision of the data is 9 digits, as in TeraCal. The notes are then stored in the report footer section.

Note:
The Rs title is always applied to the reference in the saved data. In cases where the transfer standard method is used the RS is the resistance value. Where a direct reading from the 6530 is stored the value is equal to 1.

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The next example given below is a history (*.HIS) file for history data generated through the History File Editor window. The basic layout is that all stored test control and reference information is stored in the report header section. The page header and details sections contain the raw data and sample rate information. The precision of the data is 9 digits, as in TeraCal. The notes are then stored in the report footer section.
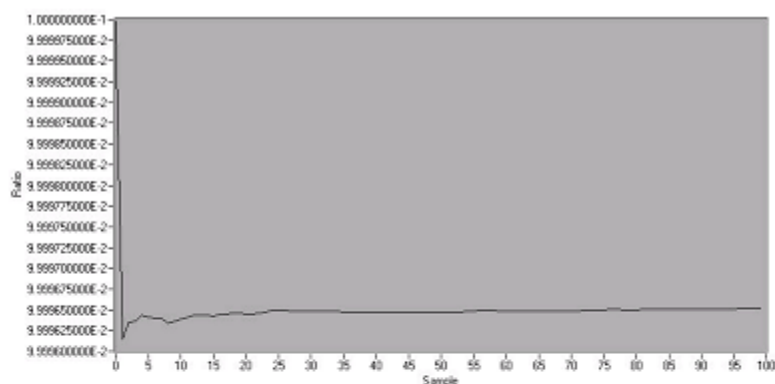

Note:
The date in the last column is recorded as a time-zone-independent number of seconds that have elapsed since 12:00 a.m., January 1, 1904, Universal Time.

3.8.   EXPORTING TO WEBPAGE

Both reports can be exported to a webpage to be published online or used as a generic data exchange format. These reports contain all data, graphs and variables stored in the history or test file. You will be prompted to make a name for the webpage created. All necessary graphics and data webpage source will be placed into a directory with the name you have chosen. Both Test Overview (top) and History Chart (bottom) webpage examples are shown below.

The example given below is a test (*.TES) file for a test generated through the main window. The basic layout is that the graph is stored in the first section. The second section is the notes. The third section contains all stored history control and reference information. The last section is the history data. The precision of the data is 9 digits, as in TeraCal.
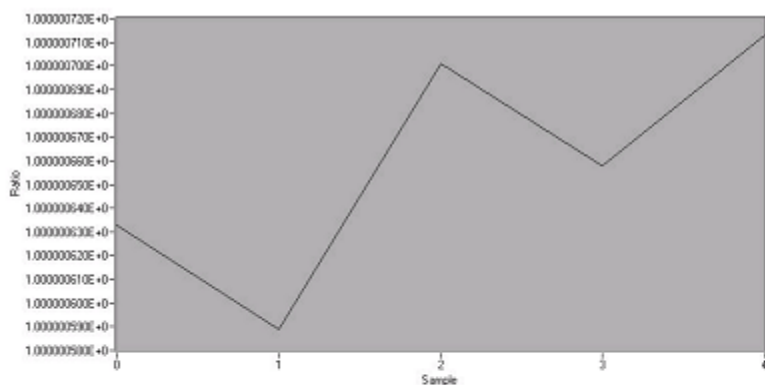

Notes
This is the space for user notes.

Rs	1.000000000E+0	Power	1.9600
Rx	1.000000000E-1	Humidity	
uncertainty	0.120	Pressure	
STDAsset	6634ts-1ohm	Temp	
TSTAsset	6634-tenthohm	Name	
Time	2002/02/09,19:46	Place	
Itest	140.0000		

	Measured Ratio	Reversal Rate
0	0.099999973	60.000000000
1	0.099996150	60.000000000
2	0.099996351	60.000000000
3	0.099996364	60.000000000
4	0.099996431	60.000000000

Note:
The Rs title is always applied to the reference in the saved data. In cases where the transfer standard method is used the RS is the resistance value. Where a direct reading from the 6530 is stored the value is equal to 1.

The next example given below is a history (*.HIS) file for history data generated through the History File Editor window. The basic layout is that the graph is stored in the first section. The second section is the notes. The third section contains all stored history control and reference information. The last section is the history data. The precision of the data is 9 digits, as in TeraCal.

Notes
This is the space for user notes.

| TSTAsset | 548623 | | Name | Mark Evans |
| Time | 2002/05/27,09:28 | | Place | GCS |

	Measured Ratio	Uncertainty	Date Stamp
0	1.000000633	0.087000000	3095366400.000000000
1	1.000000589	0.092000000	3098044800.000000000
2	1.000000701	0.085000000	3100723200.000000000
3	1.000000658	0.090000000	3108585600.000000000
4	1.000000713	0.082000000	3111264000.000000000

Note:
The date in the last column is recorded as a time-zone-independent number of seconds that have elapsed since 12:00 a.m., January 1, 1904, Universal Time.

4. APPENDIX

4.1. SUMMARY OF RECOMMENDED TEST SETUPS

4.1.1. Recommended Resistance Mode Test Setup

U.U.T. (Ω)	Vtest (V)	Cap (pF)	Thresh (V)	Reversal (mode)
100 k	1	2700	10	Auto Reverse
1 M	1	2700	10	Auto Reverse
10 M	1	2700	10	Auto Reverse
100 M	1	2700	10	Auto Reverse
1 G	10	2700	10	Auto Reverse
10 G	100	2700	10	Auto Reverse
100 G	1000	2700	10	Auto Reverse
1 T	1000	2700	1	Auto Reverse
10 T	1000	2700	0.1	Auto Reverse
**100 T	*1000*	*2700*	*0.1*	*Auto Reverse*
100 T	1000	270	0.1	Auto Reverse
1 P	1000	27	0.1	Auto Reverse
10 P	1000	27	0.1	Auto Reverse

** Base and XP 6530 models only have 2700pF cap range

Table 4-1 : Recommended Resistance Mode Test Setup

4.1.2. Recommended Current Mode Test Setup

U.U.T. (A)	Vtest (V)	Cap (pF)	Thresh (V)	Reversal (mode)
10 u	N/A	2700	10	Manual Reverse
1 u	N/A	2700	10	Manual Reverse
100 n	N/A	2700	10	Manual Reverse
10 n	N/A	2700	1	Manual Reverse
1 n	N/A	2700	0.1	Manual Reverse
100 p	N/A	2700	0.1	Manual Reverse
10 p	N/A	270	0.1	Manual Reverse
1 p	N/A	27	0.1	Manual Reverse
100 f	N/A	27	0.1	Manual Reverse
10 f	N/A	27	0.1	Manual Reverse

** Base and XP 6530 models only have 2700pF cap range

Table 4-2 : Recommended Current Mode Test Setup

4.2. FORMULAS

Contained here is a reference of all the formulas as well as to where they are utilized throughout BridgeWorks.

4.2.1. Mean
The mean being the direct addition of a set of values, then divided by the number of values within the given set.

$$\mu = \tfrac{1}{n}\sum_{i=0}^{n-1} x_i$$

4.2.2. Standard Deviation
The standard deviation of a sample set is used in the main window, Update Config File option, History Chart file editor, Test Overview, and all utilities.

$$\sigma_x = \sqrt{\tfrac{1}{n}\sum_{i=0}^{n-1}\left(x_i - \mu\right)^2}$$

where $\mu = \tfrac{1}{n}\sum_{i=0}^{n-1} x_i$, and n is the number of elements in X.

4.2.3. Uncertainty
The uncertainty of a sample set being the direct addition of all known uncertainties, and two times the standard deviation of the sample set. The uncertainty of a sample set is used in the Update Config File option, History Chart file editor, Test Overview, and all utilities.

$$U = 2\sigma_x + \sum_{i=0}^{n-1} x_i$$

where X_i are known uncertainties.

4.2.4. Ratio to Ohms Conversion

The value in ohms is always calculated by multiplying the measured ratio times the reference resistor. This function is used in the main window, Update Config File option, History Chart file editor, Test Overview.

$$R_{value} = R_{ref} \times Ratio$$

4.2.5. Delta from Nominal

The delta from nominal is displayed only in the main window as ppm from the nominal ohms value entered. Therefore, it is calculated as the difference between the initial value and the most recent value times one million.

$$\Delta_{ppm} = \left(R_{ref} \times Ratio - R_x \right) \times 1000000$$

4.2.6. Expected Value Now

The "Expected Value Now" function is only found in the History Chart and is a simple slope extrapolation of the best fit line based on stored values in the resistor's history to the current date and time.

$$R = \Delta_{time} \times time$$

4.2.7. 0 Volt Resistance

The "0 Volt Resistance" function is only found in the Voltage Coefficient report and is a simple slope extrapolation of the best fit line based on entered values in the resistor's voltage to value curve extrapolated to the value at 0 volts.

$$R = \Delta_{volts} \times volts$$

4.2.8. Surface Resistivity

The "Surface Resistivity" is found on the Surface Resistivity report and is calculated by.

$$\rho_s = K_s \times R$$

where $K_s = \dfrac{\pi \times D_0}{D_2 - D_1}$.

where $D_0 = D_1 + \dfrac{D_2 - D_1}{2}$.

where D_1 = inner electrode diameter.

where D_2 = outer guard ring diameter.

where R = measured resistance.

4.2.9. Volume Resistivity

The "Volume Resistivity" is found on the Volume Resistivity report and is calculated by.

$$\rho_v = \dfrac{K_v}{\tau} \times R$$

where $K_v = \pi \left(\dfrac{D_1}{2} + B \dfrac{D_2 - D_1}{2} \right)^2$.

where $D_0 = D_1 + \dfrac{D_2 - D_1}{2}$.

where D_1 = inner electrode diameter.

where D_2 = outer guard ring diameter.

where R = measured resistance.

where τ = average sample thickness.

where B = effective area coefficient.

5. GLOSSARY

ASCII - *"American Standard Code for Information Interchange" is a pre-determined standard for text. This is the format in which all of the information stored and used by TeraCal.*

Auto-Scaling - *This is a feature of some graphs in a LabVIEW^{TM} based program. When enabled, that graph will set the scale of the axis(s) of your choice to adjust itself to give the most magnification but still maintain that all the points are showing.*

Best Fit Curve - *The best fit curve is defined as the curve on a graph that best represents the points plotted. This line does not usually go through all the points. The purpose of the best fit curve is to see the trend of the plot without the random peaks. In TeraCal, a linear best fit for all best fit curve analysis is used.*

Calibration - *This is the act of taking a comparison of a given device to a known reference point with the intent to make the unknown device known, traceable to the reference.*

Checksum - *This a numeric value that is reached when a mathematical algorithm is applied to the memory. This value is stored and used to verify the integrity of the information in the memory chips.*

Closure - *Closure is what is meant by verifying your calibration through taking another measurement to trace back to a second Standard Resistor or via an interchange.*

Control - *There are many types of controls, with different appearances and functions. The one thing that is common, and is their defining factor, is that they are how the user of any program inputs their commands.*

Crop - *To crop is to select a section of data that you wish to keep and then remove the rest.*

EEPROM - *Electronically Erasable Programmable Read Only Memory is a non-volatile memory that is used to store data inside the model 6530. This memory can be erased or changed within the system but will retain its contents when the power is off.*

EPROM - *Erasable Programmable Read Only Memory is a non-volatile memory that is used to store the programming inside the model 6530. This memory cannot be erased or changed within the system and retains its contents when the power is off.*

Field - *This is a type of control in which you are to enter a text or numeric value directly.*

Highlight - *This is the action of selecting in Windows 9x/NT^{TM}. When you have selected a control or a section of text, Windows will outline the selection. This outline "highlights" your current selection to show that Windows will direct your commands/entry to that specific part of the active window.*

Hotkey - *This is a keystroke or key combination that, when pressed, has a predetermined function. Some of these will vary in different programs and windows, while others are universal throughout Windows 9x/NT^{TM}. A complete listing of valid hotkeys is listed in the Key Navigation section of User Notes (3.5).*

IEEE 488.2 - *This is a standardized interface for communication over a GPIB bus. This is both a hardware and command level standard that your model 6530 adheres to. See the Model 6530 Technical Manual for more information.*

Indicator - *There are many types of indicators, with different appearances and functions. The one thing that is common, and is their defining factor, is that they are how the any program displays information to the user and cannot be modified.*

Interchange - *A resistance verification measurement where you measure two resistors, then reverse their configuration and measure them again to see if you get the original ratio's reciprocal.*

Load - *This is the action of selecting and opening a file into active memory for use within a program.*

Menubar - *The menubar contains an organized list of pertinent commands and is located at the top of the window. This can be accessed with the "Alt" key or your pointing device.*

P.O.S.T - *Power On Self Test*

Ref. - (*Reference) Resistor. This is an abbreviation that means the resistance standard that you are referencing your resistor under test to.*

Reversal Rate - *This is the rate in which the model 6530 reverses the current while in the measurement cycle. See the Model 6530 Technical Manual for more information.*

Save - *This is the action of copying a file out of active memory to a non-volatile storage media for later recall within a program.*

Standard Deviation - *The Standard Deviation is a calculated value that expresses how much the points within a set deviate from the mean of that set. The formula in which this is calculated can be found in section 4.2.*

Uncertainty - *Uncertainty is a calculated value that expresses how confident the mean value from a set of recorded values is the actual value. This takes into consideration the known uncertainties of the system and the standard deviation of the sample set. The formula in which this is calculated can be found in section 4.2.*

U.U.T. - *(Unit Under Test). This is an abbreviation that means the resistance that you are testing.*

Vmax - *This is the maximum voltage you wish to allow through a given resistor. This is set as a safety precaution for your resistor connected to the model 6530.*

Vtest - *This is test voltage used for the measurement, and should be selected so that it is less than Vmax.*

6. INDEX

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