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Addressable Thermistor String Reader

User's Manual

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Table of Contents:

1. Introduction 1

1.1 Features 2

1.2 Addressable Thermistor String Reader Application 3

1.3 Before using the “App” 4

2. Setup, Installation and Operation 5

2.1 Initial Quick Start Sequence 5

2.2 Installing Windows Mobile Device Center (WMDC) 9

2.3 Installing the USB to RS-485 Converter Driver 11

2.3.1 Making Windows Folder Visible 11

2.4 Installing the “App” 15

2.4.1 Launching the Installer 15

2.5 Starting the Application the First Time 19

3. User Interface 23

3.1 Overview 23

3.2 Live Readings Screen – Generic Readings 23

3.2.1 Temperature in 23

3.2.2 Display sensor 24

3.3 String Selection Screen 26

3.3.1 Project Explorer 27

3.4 Application Menu 32

3.4.1 Live Readings 33

3.4.2 About Therm. String Reader 38

3.5 File Menu 39

3.5.1 Delete Data Files 40

3.5.2 Export Data Files 41

3.5.3 View Data 44

3.5.4 Exit 45

4. Configuring Project Explorer Elements 46

4.1 Project Configuration 46

4.2 String Configuration 47

5. Files, Folders and Transferring Data 48

5.1 File Transfer 49

5.2 Backing up configurations 49

APPENDIX A. Data File Formats **..... 50**

A.1 Raw Data Text Report 50

A.2 Data Text Report with Column and Report Headers 51

APPENDIX B. Specifications 52

B.1 Hand-Held Device (HHD-NX7-B) Specifications 52

Table of Figures:

Figure 1 - Four-node Thermistor String 1

Figure 2 - USB to RS-485 Converter (Geokon part # 3810A-2) 2

Figure 3 - Hand-held PC running Addressable Thermistor String Reader 3

Figure 4 - Incorrect COM port Error Message 6

Figure 5 – Startup Window 7

Figure 6 - Live “Generic” Readings 8

Figure 7 - Windows Mobile Device Center 9

Figure 8 - Windows Explorer (Pocket_PC shown) 12

Figure 9 - Organize Drop-down Menu 12

Figure 10 - Folder Options, View tab shown 13

Figure 11 - Folder Options, Apply Button 14

Figure 12 - Windows Explorer window displaying HHD root folder 15

Figure 13 - Hand-held device root folder contents 16

Figure 14 - Installation Folder Contents 16

Figure 15 - Addressable Installer at root of HHD 17

Figure 16 – Thermistor String Reader Install Screen 18

Figure 17 – String Reader Icon in Start->Programs 18

Figure 18- Select Workspace Name 19

Figure 19 - Workspace Folder Selection 20

Figure 20 - Workspace Exist 20

Figure 21 – No string connection found 21

Figure 22 - Default initial screen 22

Figure 23 -" Temperature in" Selections 23

Figure 24 – Display sensor drop-down control 24

Figure 25 - Menu Options 25
Figure 26 - View Options 25
Figure 27 - String Selection Screen 26
Figure 28 - Project Explorer with expanded projects and strings 27
Figure 29 - Context Menu 28
Figure 30 - Workspace Selection Window 29
Figure 31 - List of Workspace Names 29
Figure 32 - Sort Elements Sub-Items 31
Figure 33 - Application Menu 32
Figure 34 - Live Readings Menu Selections 33
Figure 35 - Live Readings (single thermistor selected) 34
Figure 36 - Live Readings (All sensors selected) 35
Figure 37 - Menu Options 35
Figure 38 - Clear Data Warning 36
Figure 39 - View Options 37
Figure 40 – File Menu Options 39
Figure 41 - Delete Data Files Window 40
Figure 42 - Export Data Files Window 41
Figure 43 – Save File Window 42
Figure 44 - Extended Format Window 42
Figure 45 - View Data File Selection Window 44
Figure 46 - Sensor Reads Window 45
Figure 47 - Project Settings 46
Figure 48 - Addressable String Settings Window 47
Figure 49 - Enhanced Data Text Report 51

List of Tables:

Table 1 - USB to RS-485 Connector Pinout 7

Table 2 - Folder paths and File Names..... 48

1. Introduction

The Addressable Thermistor String Reader is made up of two components:

- The Readout Unit, consisting of a Windows Mobile handheld PC running the Addressable Thermistor String Reader Application (see Figure 3).
- The USB to RS-485 Converter which plugs into the mini USB OTG (Host & Client) connector on the hand-held device (see Figure 2). This converter connects to the addressable Thermistor “string” to be measured.

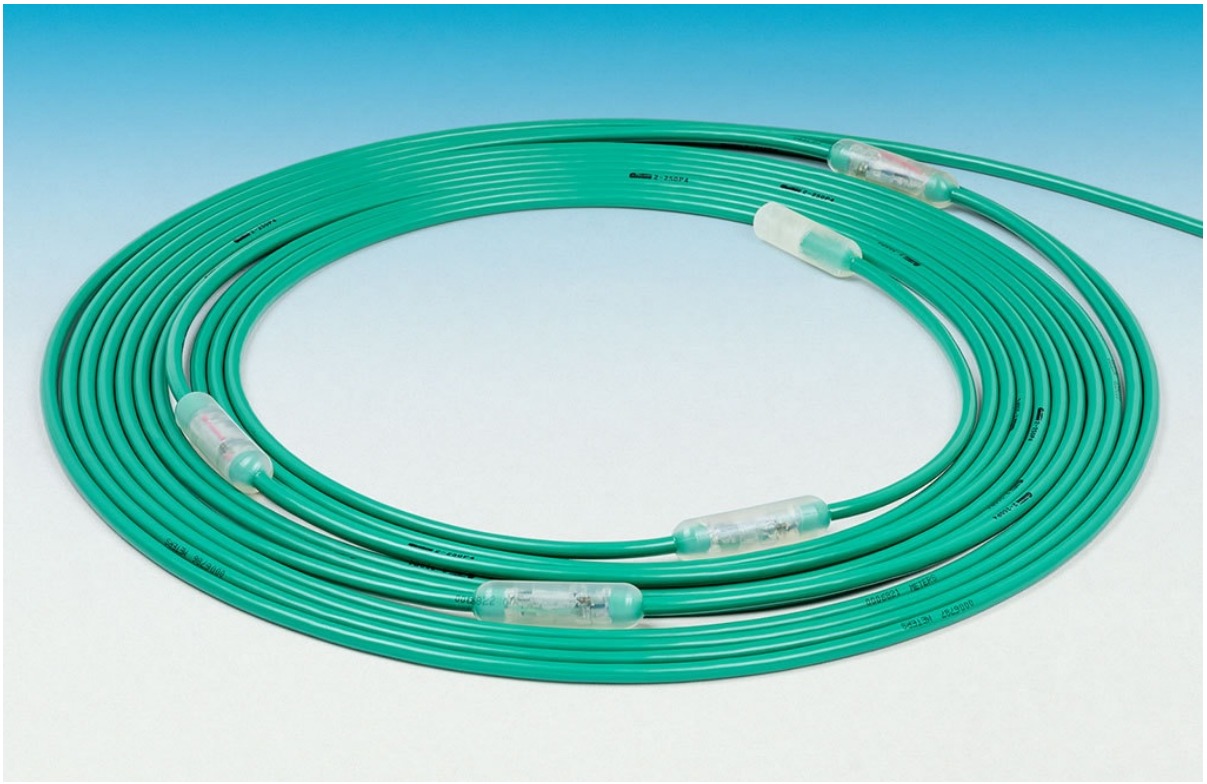

Figure 1 - Four-node Thermistor String

The two components combine to communicate with the addressable Thermistor string (see Figure 1) using RS-485, a reliable multi-drop electrical communications protocol. The automation protocol used to communicate with each Thermistor node is Modbus; each node acting as a Modbus slave while the hand-held device acts as the Modbus master.

Figure 2 - USB to RS-485 Converter (Geokon part # 3810A-2)

1.1 Features

Rugged, general purpose, reliable readout based on a Windows Mobile handheld PC:

- All the benefits of a Windows compatible device (Windows file system, USB connectivity)
- Long battery life
- Ease of use

Reliable and simple connection to an addressable thermistor string:

- Requires only a 4 wire connection to talk to 32+ thermistor sensors.
- Standard Modbus communication protocol.
- Inexpensive communication adapter.

1.2 Addressable Thermistor String Reader Application

The Addressable Thermistor Reader Application (the “App”) installs and runs on a ruggedized hand-held PC (see Figure 3) and is designed to communicate via a USB to RS-485 converter to an addressable string of thermistors.

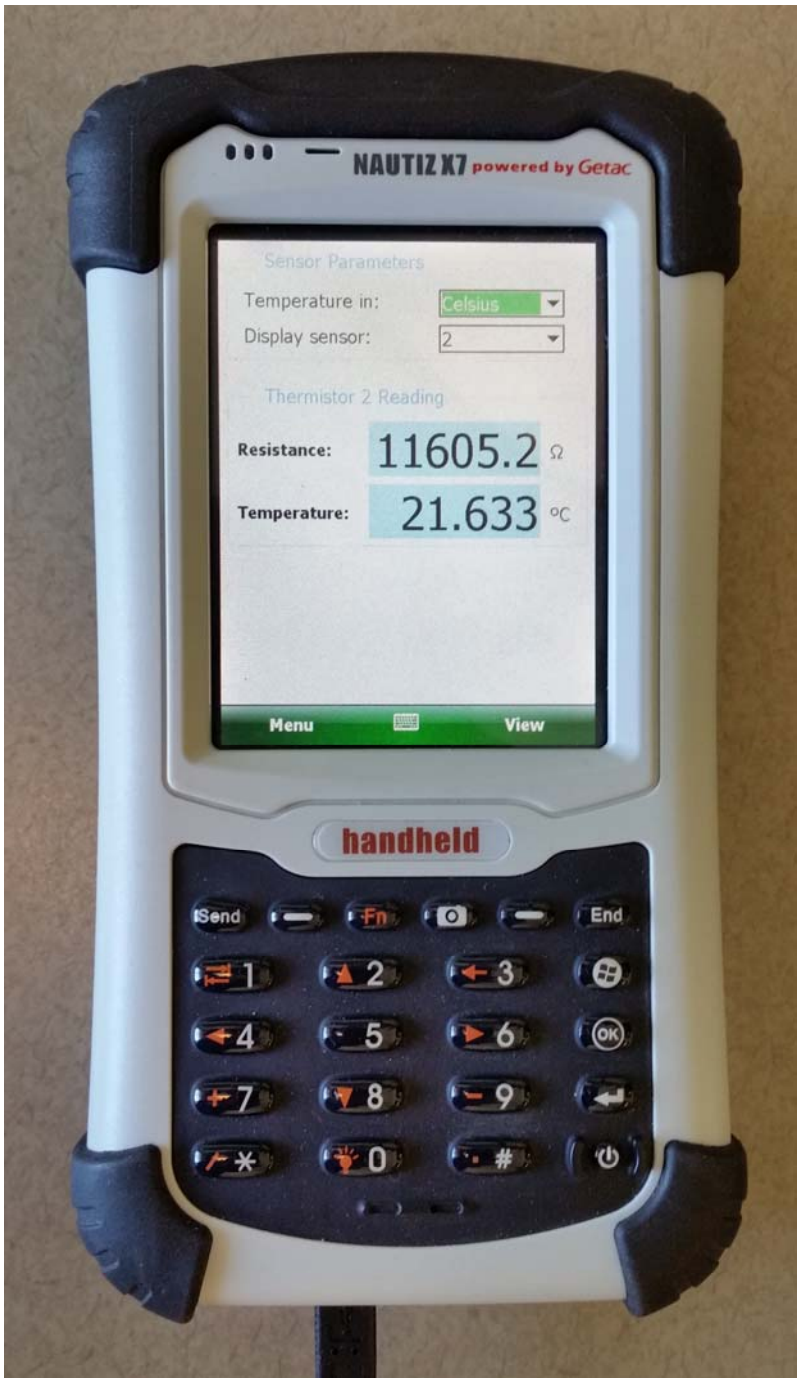

Figure 3 - Hand-held PC running Addressable Thermistor String Reader

1.3 Before using the “App”

The string reader software runs as an application under Windows Mobile 5 or 6 operating system installed on a hand-held PC.

- Please familiarize yourself with the hand-held PC and the Windows Mobile OS.
- It is assumed in the instructions below that you can launch applications from the Start button including File Explorer.
- It is assumed that you can tap the keyboard icon as needed and use the on-screen keyboard to enter text and numbers.

2. Setup, Installation and Operation

The steps described in section 2.1 are an attempt to guide the user through the process of connecting to the sensor, launching the “App” and taking a reading. If both the Addressable Thermistor String and the hand-held PC are purchased as a system, Geokon makes every effort to ensure that the system is completely set up and working before it leaves the factory. Other times, the user may already own the hand-held PC and are setting up their hardware and software for the very first time. The steps below attempt to cover all cases and refer the user to the appropriate section when more information is needed.

For those users that have purchased a complete Addressable system, a workspace with the name of “ATSR” will have been pre-defined and the driver for USB to RS-485 converter will already have been installed on the hand-held PC. Note that the workspace name can be changed at any time or new ones can be created (see section *3.3.1.1 Context Menu*). When purchasing a complete Addressable system, sections 2.2 through 2.5 can possibly be skipped but a quick review is recommended.

2.1 Initial Quick Start Sequence

The following steps are a guide to the typical operation of the Addressable and, if followed, should result in a successful sensor measurement:

A) If the driver for the USB to RS-485 converter (see Figure 2) has been previously installed then proceed to step B), otherwise please refer to section *2.2 Installing Windows Mobile Device Center (WMDC)* and section *2.3 Installing the USB to RS-485 Converter Driver*.

B) If the Addressable Thermistor String Reader Application has been previously installed on the hand-held PC then proceed to step C), otherwise please refer to section *2.2 Installing Windows Mobile Device Center (WMDC)* and section *2.4 Installing the “App”*.

C) If the Addressable Thermistor String has been connected to the USB to RS-485 Converter then proceed to step D), otherwise connect the 4 conductors of the Thermistor string to the converter using the pinout shown in Table 1.

D) Plug the USB to RS-485 Converter into the appropriate USB connector on the handheld PC. Some hand-held units use a USB OTG connector which will require an adapter cable such as Geokon's part number "HHD-NX7-1026". Other units have a full-size USB Host connector that the converter will plug directly into. Launch the "App" by tapping on "Start" from the hand-held PC's main window, then tap "Programs" then tap the Addressable Thermistor String Reader icon.

E) If this is the first time that the application has been started then see section *2.5 Starting the Application the First Time*
Otherwise proceed to step F.

F) After a few seconds, the startup screen, containing the Project Explorer, will be shown (see

G) Figure 5).

H) The USB to RS-485 converter typically appears as a COM port on a hand-held PC and different manufacturers may have different "default" settings, for instance, the Nautiz X7 uses "COM8" for the USB COM port while the Archer typically uses "COM2". From the Main Window, select the appropriate COM port for your unit.

If the COM port selected exists on the hand-held but is incorrect for the USB to RS-485 then the "App", after approximately 40 seconds, will change the status display from "Finding sensors…" to "Sensors found: 0".

If the COM port selected is disconnected on the hand-held then the error displayed in Figure 4 will be shown.

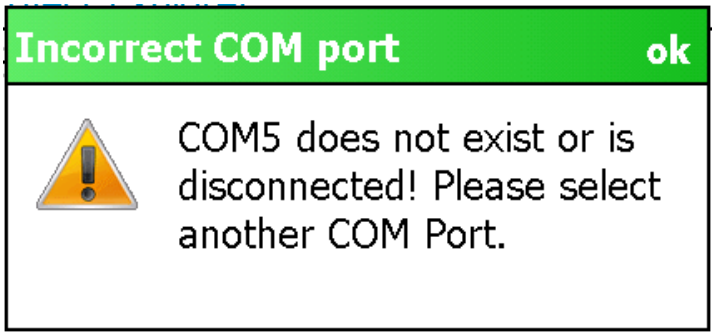

Figure 4 - Incorrect COM port Error Message

I) If the COM port selected is correct for the USB to RS-485 converter and the string is properly connected, after approximately 40 seconds the status display will change from "Finding sensors…" to "Sensors found: N", where N corresponds to the number of sensors in the string. After a few seconds more, the "Live Generic Readings" screen will be displayed (see Figure 6).

J) If storing thermistor string output is desired, tap on "View" then "String

Selection Screen" to select a pre-defined string configuration or to create a new string configuration. Please refer to section *3.3 String Selection Screen* as well as section *4.2 String Configuration*.

K) To close the "App "from the Live Readings Screen, tap "Menu" then "Close String Reader".

Thermistor String Cable Conductor Color	USB to RS-485 Connector Label	Description
Red	+5V	Thermistor String Power
Green	485-	Communication RS-485-
White	485+	Communication RS-485+
Black	GND	Ground

Table 1 - USB to RS-485 Connector Pinout

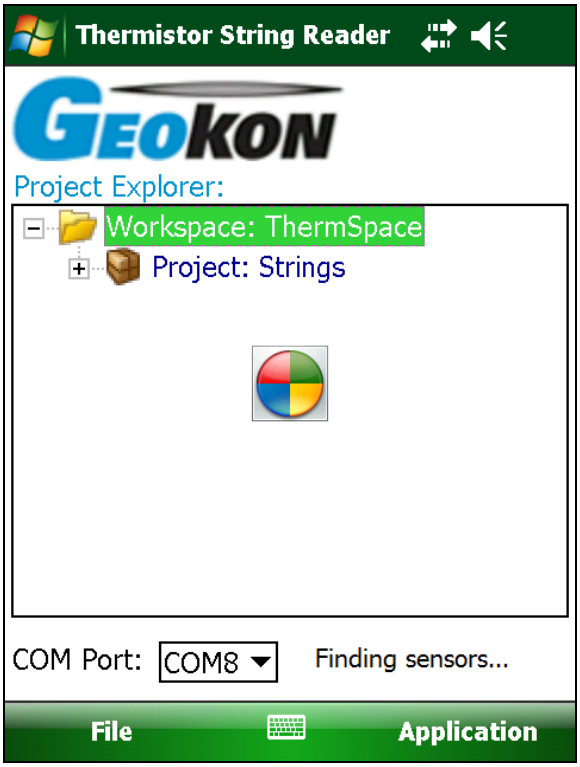

Figure 5 – Startup Window

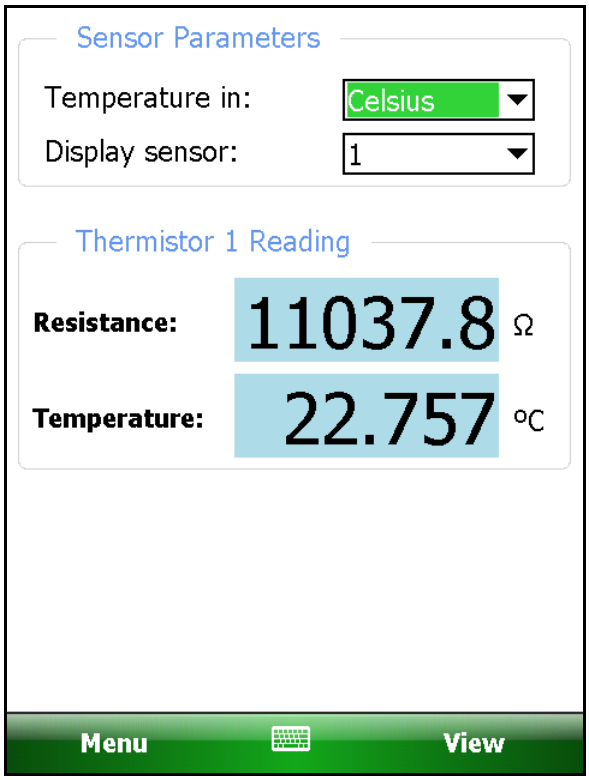

Figure 6 - Live "Generic" Readings

2.2 Installing Windows Mobile Device Center (WMDC)

The installation of the USB to RS-485 Converter drivers and the Addressable Thermistor String Reader Application requires the following:

- Hand-held device (HHD) running Windows Mobile Classic 5.X or higher (6.X recommended) with at least 50 Mbytes of free memory. HHD must have either a USB Host socket or a USB OTG socket. Windows .NET 3.5 Compact Framework (CF) and .NET framework English-language Messages package installed on HHD. Both "CAB" file installers are included in the Addressable Thermistor String Reader installer "Zip" file, available on Geokon's web-site (See section *2.4 Installing the "App"*).

- If the host PC's operating system is Vista, Windows 7 or Windows 8 then **Windows Mobile Device Center** should be installed on the host PC (see Figure 7). An active connection between the host PC and the HHD must be established either via a physical link or Bluetooth.

Figure 7 - Windows Mobile Device Center

Windows Mobile Device Center is available as either a 32-bit or 64-bit application from Microsoft and can be downloaded from the links below:

For 32-bit PCs:

http://www.microsoft.com/en-us/download/details.aspx?id=14

For 64-bit PCs:

http://www.microsoft.com/en-us/download/details.aspx?id=3182

Note: While the links above are believed to be accurate, Microsoft may change the location of its web pages from time to time, breaking the above links.

Download the appropriate WMDC installer then ensure that the HHD is connected to the host PC with the supplied USB cable. Launch the WMDC installer and follow the directions displayed. The installer will install the application on the Host PC as well as the Window Mobile program needed for communication.

After installing Windows Mobile Device Center, launch the application from the Windows Programs menu. If it doesn't automatically initiate a connection, click on the on-screen button named "Connect without setting up your device". When connecting with the USB cable, the WMDC application should automatically launch and connect each time the hand-held is connected to the PC.

2.3 Installing the USB to RS-485 Converter Driver

Nautiz X7 “FTDI” Driver Install Instructions:

1. Establish a connection between the Nautiz and the Host PC (see section *2.2 Installing Windows Mobile Device Center (WMDC)*).
2. From the “Thermistor String Reader” install folder on the PC navigate to the following sub-folder, “Archer Host USB\ARMv4VCPDriver\”, then copy the files; “ftdi_ser.dll” and “FTDIPORT.INF” to the Nautiz folder: “\Windows”. If the “\Windows” folder cannot be found on the Nautiz, see section *2.3.1 Making Windows Folder Visible.*
3. Turn off the Nautiz (hold power button until chime is heard) and disconnect the host USB cable.
4. Turn the Nautiz back on, wait for it to fully boot and connect the USB to RS-485 Converter (via the adapter cable, HHD-NX7-1026) to the USB port. The converter should already be connected to the Addressable Thermistor String.
5. At the prompt for a driver name, enter “ftdi_ser.dll” (do **not** enter quotes “”).
6. The prompt should disappear. As a default, the Nautiz uses “COM8” for the USB COM driver.

2.3.1 Making Windows Folder Visible

Installing drivers onto hand-held devices typically requires copying file to the “\Windows” folder on the device. Usually the folder will not be visible because it is a system folder and default folder options are set to hide system folders. With a connection established between the Nautiz and the Host PC (see section *2.2 Installing Windows Mobile Device Center (WMDC)*), follow the directions below to make the “\Windows” folder visible:

1. Open a Windows Explorer session and click on “Pocket_PC” from the “Computer” selection.
2. Click on the Organize button (see Figure 8).
3. From the resulting drop-down menu, click “Folder and search options” (see Figure 9) to display the Folder Options dialog.
4. Click on the “View” tab of the Folder Options dialog (see
5. Figure 10).
6. Under “Advanced Settings:”, click on “Show hidden files, folders, or drives” to enable the “Apply” button (see Figure 11).
7. Click on the “Apply” button to apply the new folder options to “Pocket_PC”.

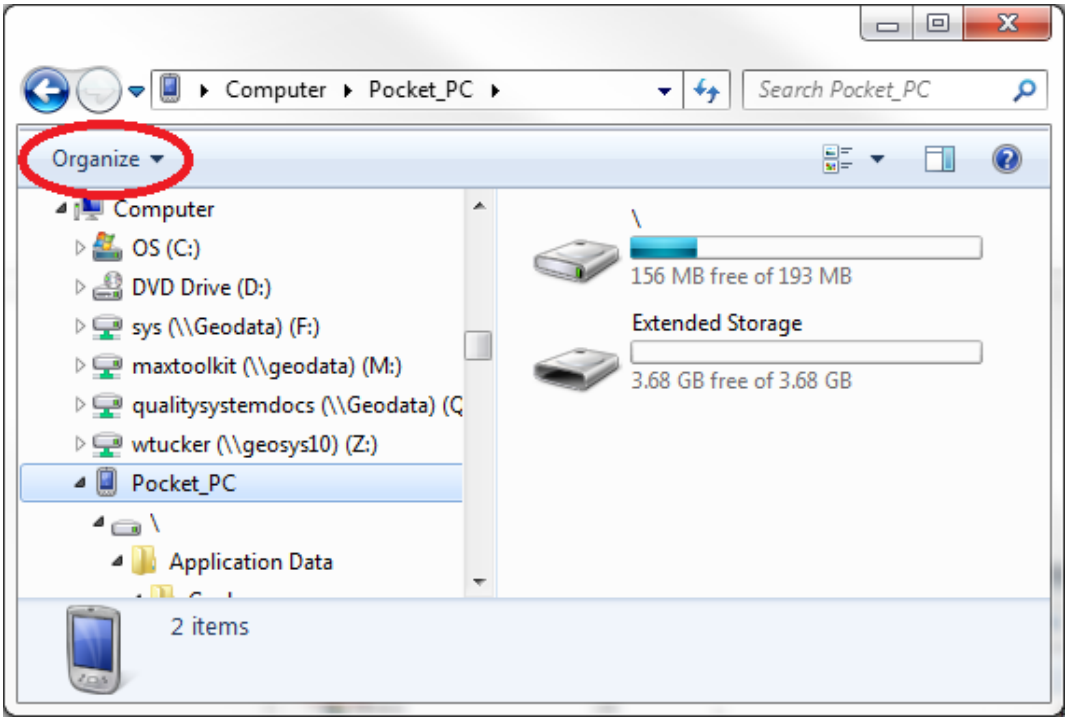

Figure 8 - Windows Explorer (Pocket_PC shown)

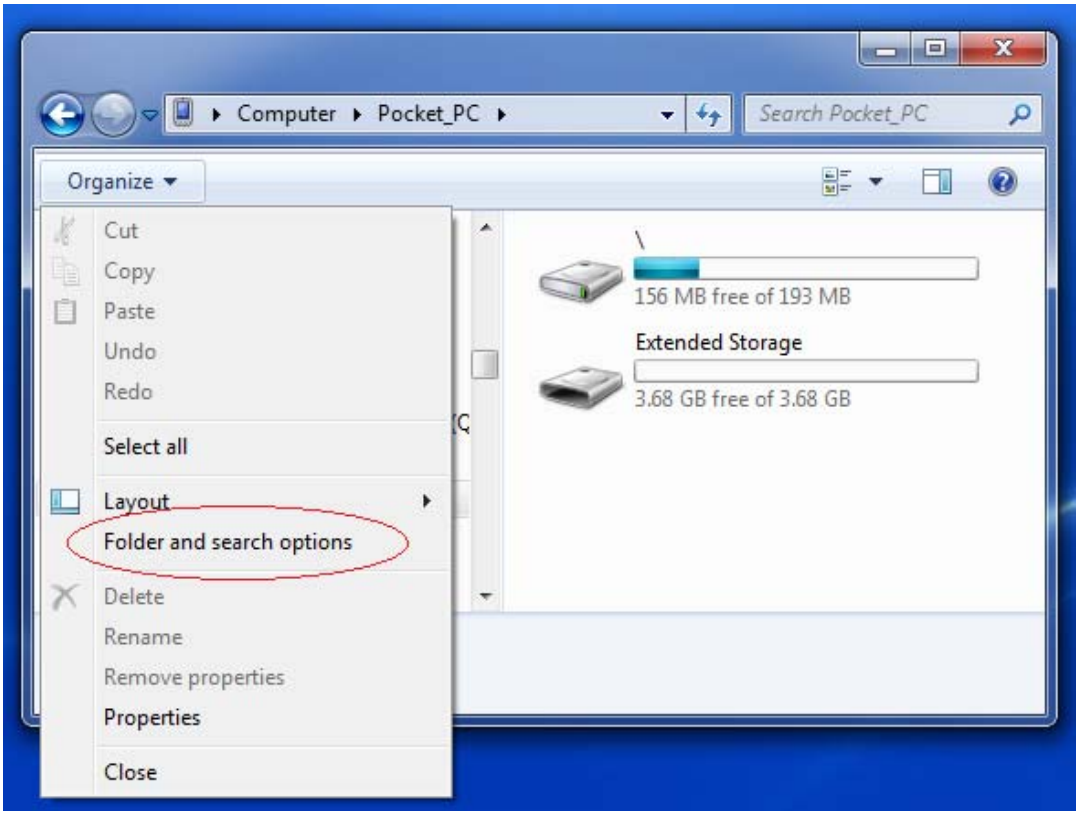

Figure 9 - Organize Drop-down Menu

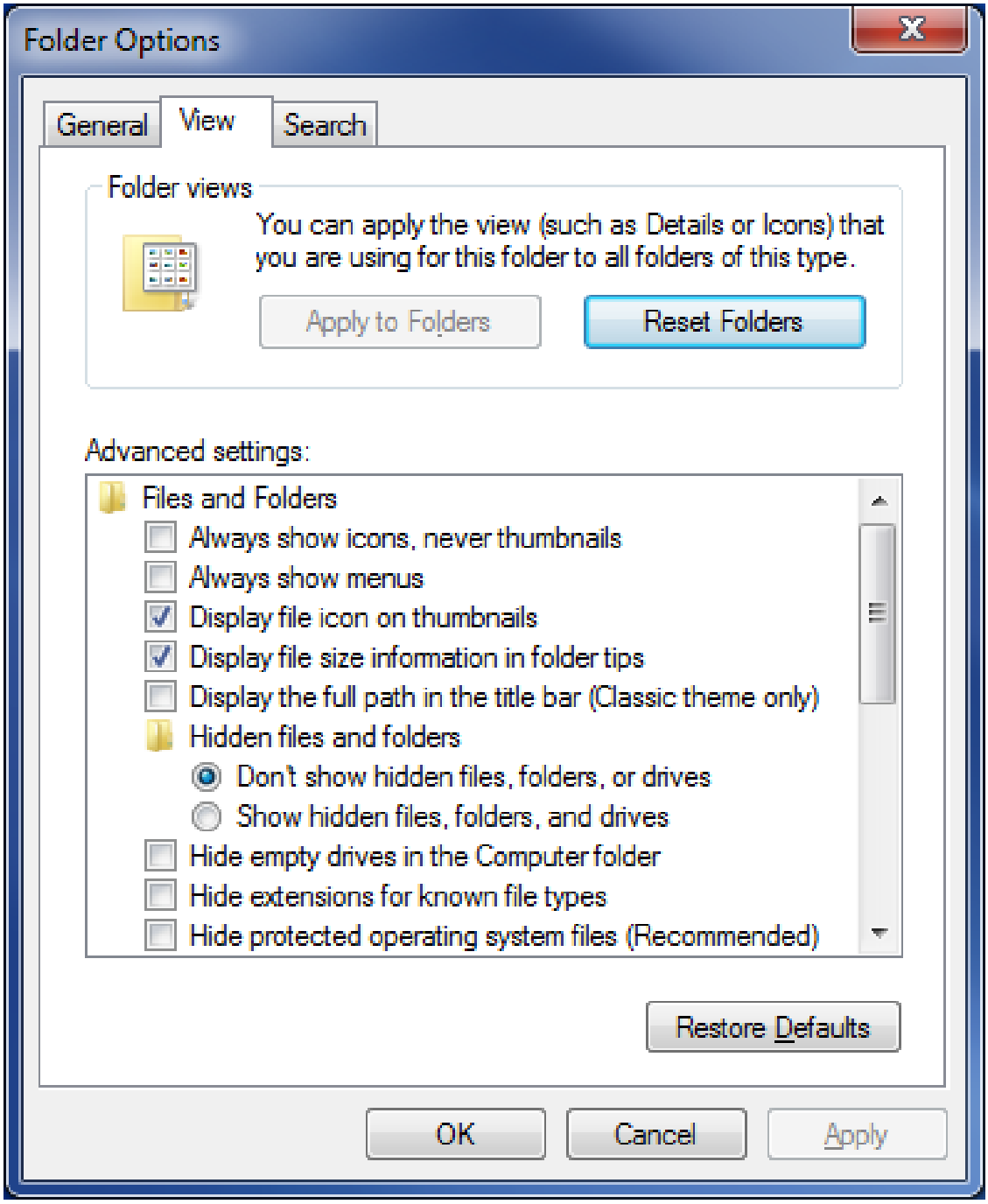

Figure 10 - Folder Options, View tab shown

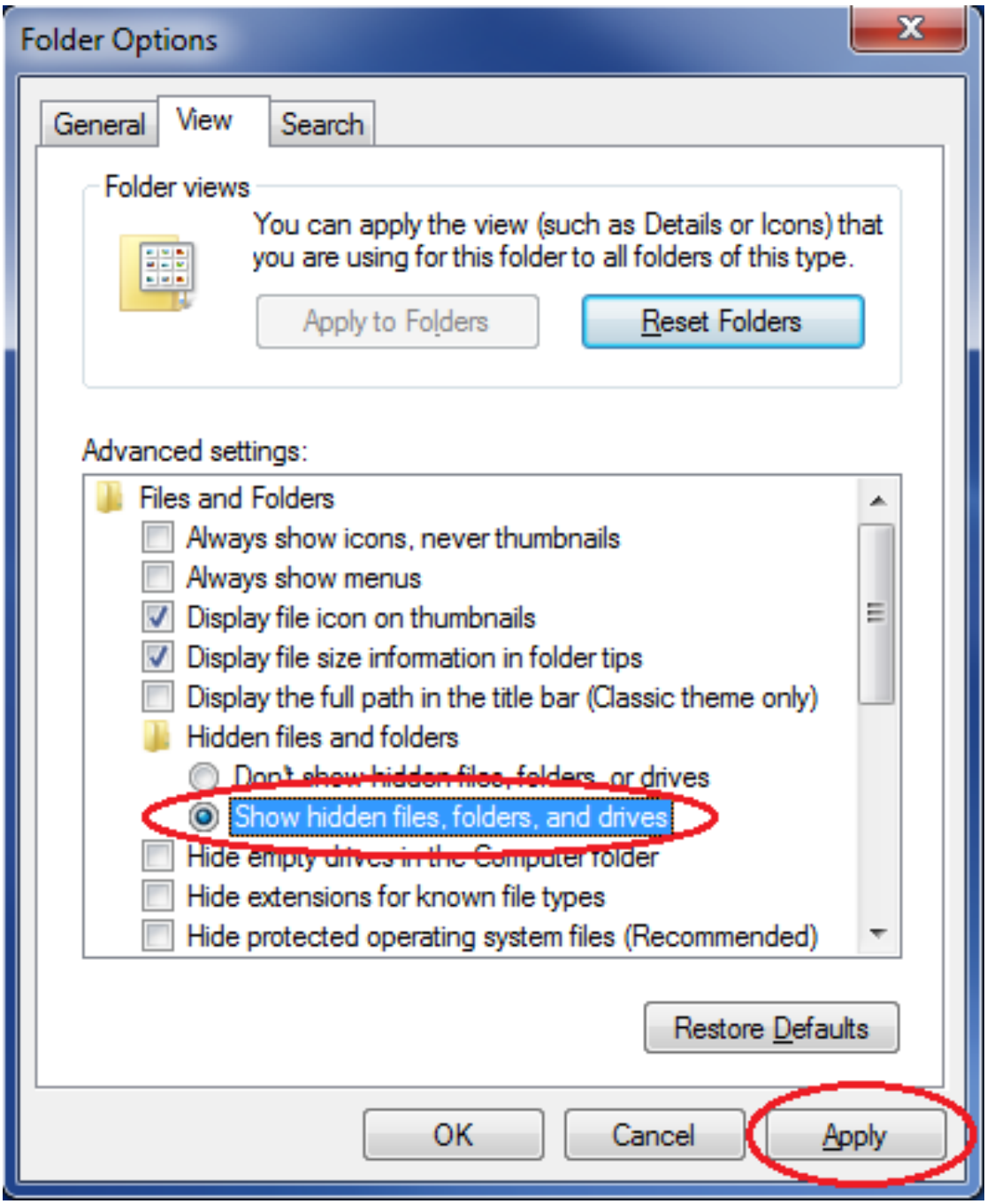

Figure 11 - Folder Options, Apply Button

2.4 Installing the "App"

The installation of the Addressable Thermistor Reader Application requires the following:

- Hand-held device (HHD) running Windows Mobile Classic 5.X (6.X recommended) or higher with at least 50 Mbytes of free memory. HHD must have USB capability, either with a full-size host port or an USB OTG port. Windows .NET 3.5 Compact Framework (CF) and .NET framework English-language Messages package installed on HHD. Both "CAB" file installers are included in the Addressable Thermistor installer "Zip" file, available on Geokon's web-site.

- If host PC's operating system is Vista, Windows 7 or Windows 8 then **Windows Mobile Device Center** should be installed on the host PC (see section *2.2 Installing Windows Mobile Device Center (WMDC)*). Before installation can begin an active connection between the host PC and the HHD must be established either via a physical link (USB) or Bluetooth.

2.4.1 Launching the Installer

On the host PC, open a Windows Explorer session and click on "Pocket_PC" from the "Computer" selection (see Figure 12).

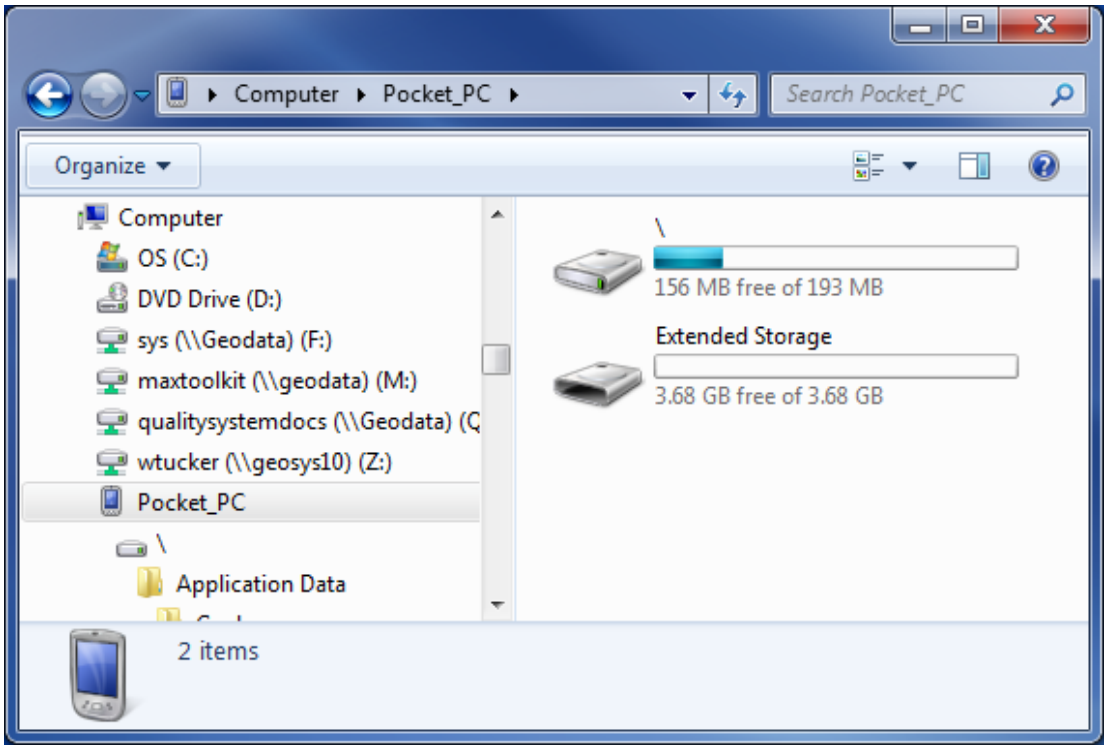

Figure 12 - Windows Explorer window displaying HHD root folder

As shown in Figure 12, double-click the icon labeled "\" to navigate to the hand-held PC's system root shown in Figure 13.

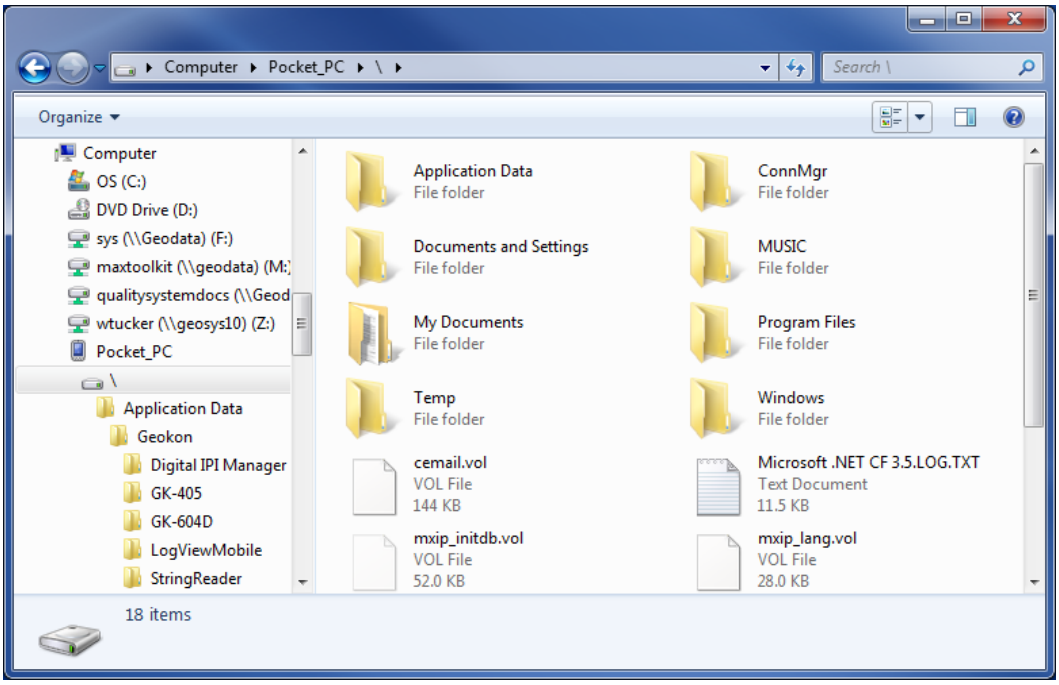

Figure 13 - Hand-held device root folder contents

Next, unzip the installer (downloaded from Geokon's web-site), then open a new Windows Explorer window and navigate to the root folder of the installation folder (see Figure 14).

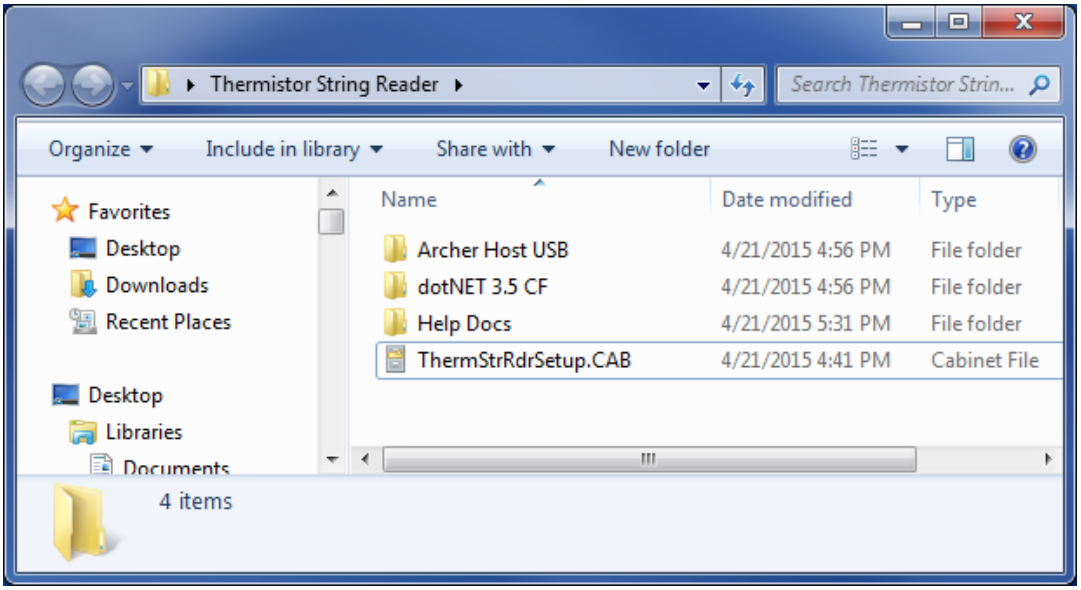

Figure 14 - Installation Folder Contents

Copy the file, “ThermStrRdrSetup.CAB” from the installation folder on the PC to the HHD system root folder. From the HHD, navigate to the system root folder using File Explorer (see Figure 15) and tap the file, “ThermStrRdrSetup” to execute the installer.

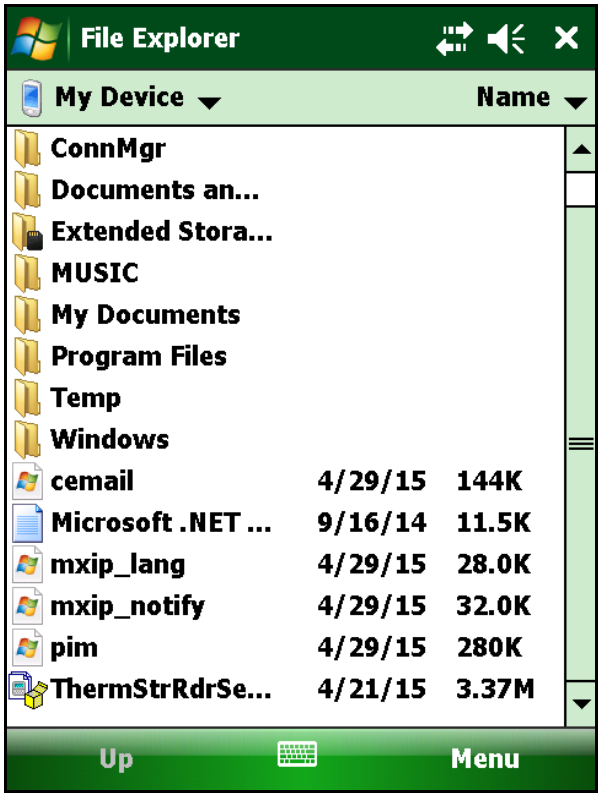

Figure 15 - Addressable Installer at root of HHD

If there is a storage card installed in the HHD then the user will be prompted to choose the location for the installation (see Figure 16). It is recommended that “Device” be selected then tap “Install” with the stylus to initiate the install process.

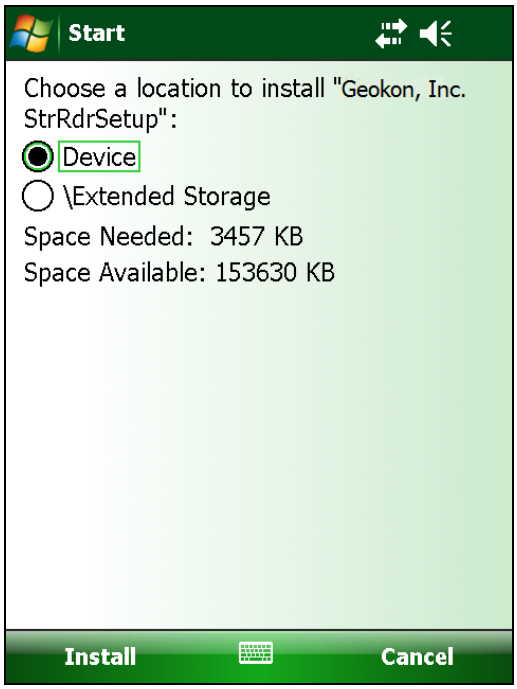

Figure 16 – Thermistor String Reader Install Screen

The file, ThermStrRdrSetup.CAB can be now deleted from the system root folder to free up memory. The Addressable Thermistor Reader application is now installed and its icon should appear in "Start->Programs" (see Figure 17).

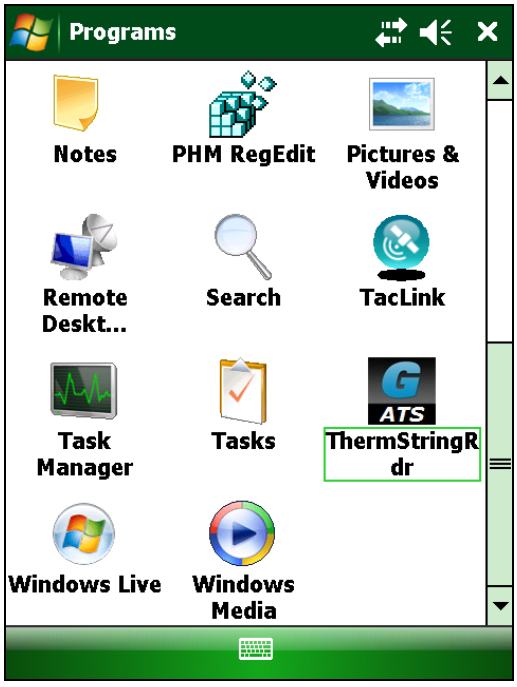

Figure 17 – String Reader Icon in Start->Programs

2.5 Starting the Application the First Time

The readout software is launched by tapping the Start button and selecting the icon (to the right) from the drop down list or clicking on Programs and then clicking the icon (to the right).

When starting the Addressable Thermistor Readout Application for the first time, you will be prompted to create a workspace name. The workspace name can be any combination of letters and numbers and should be descriptive in nature. After creation, this name will be displayed in the Project Explorer window.

Figure 18- Select Workspace Name

Once you've selected the name for your workspace, you will be prompted to choose or create a folder on your hand-held device where all the workspace elements will be stored. As can be seen in Figure 19, the default workspace location is in a folder name the same as the workspace name under a special shared folder reserved for workspaces. For Windows Mobile devices this folder is located at:

```
\Application Data\Geokon\ThermStringRdr\Workspaces.
```

The App appends the name of the new workspace to this shared folder (see section *5. Files, Folders and Transferring Data*) and uses it as the default location for the new workspace. The user is free to select their own location, either by entering it directly, or the **Browse [...]** button may be used to navigate to a different folder location or to create a new folder (see Figure 19). This workspace location will be stored in the App's configuration for subsequent application access. After workspaces are created, all future user access to workspaces is always by name.

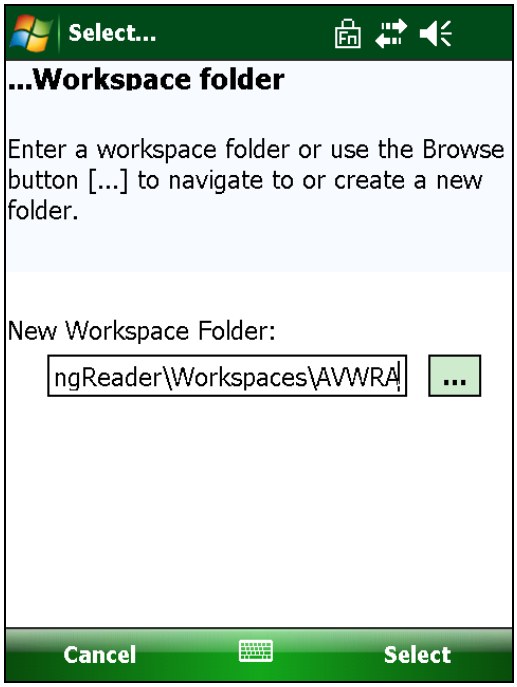

Figure 19 - Workspace Folder Selection

Note: If the newly selected workspace folder contains an existing workspace, the string reader will display a dialog asking the user if they want to import the workspace as is or to rename it with the previously specified new workspace

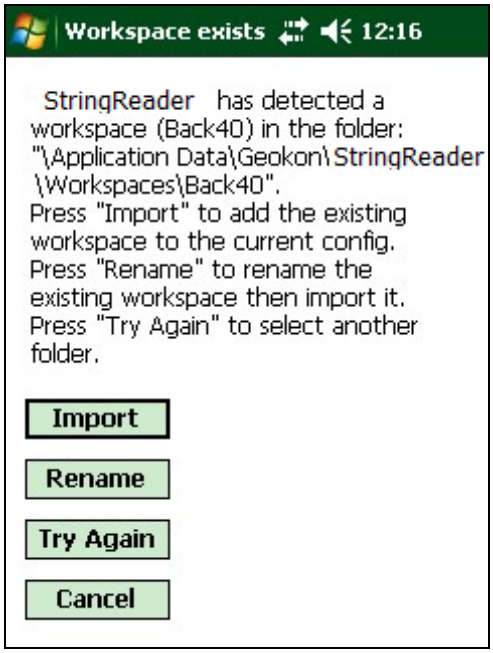

Figure 20 - Workspace Exist

After the initial workspace is created the App will attempt to find any sensors on a connected string. If no remote module can be found then the error message seen in Figure 21 will be displayed. By default the application looks for an addressable thermistor string on COM5 but will remember the COM number of the last successful connection.

If the connection attempt is unsuccessful, the newly created workspace will be opened by default and you will be able to create new project and string configurations for your workspace (See Figure 22).

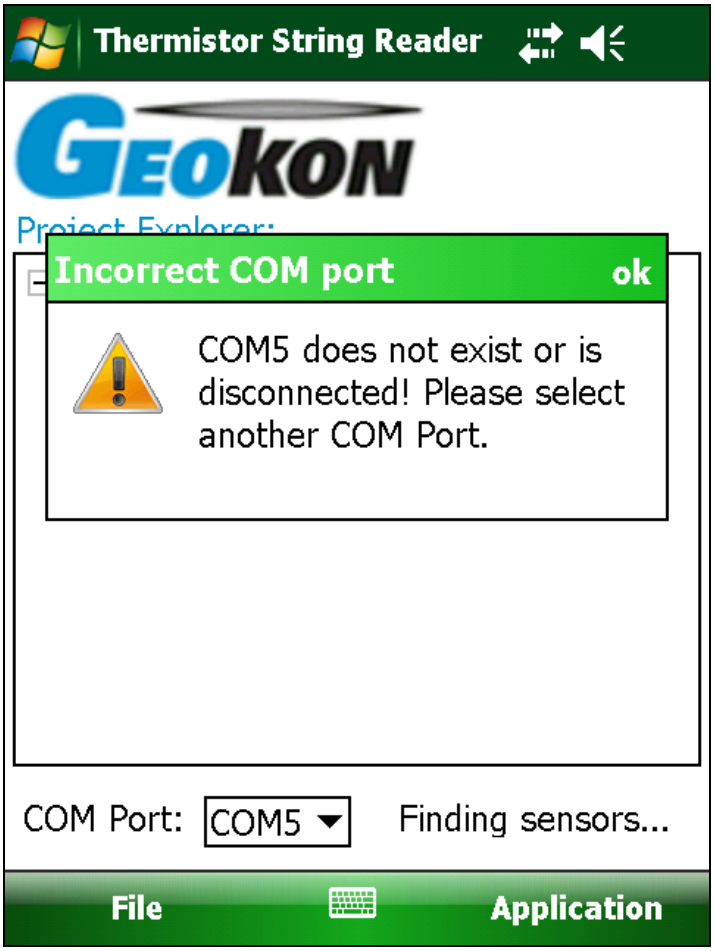

Figure 21 – No string connection found

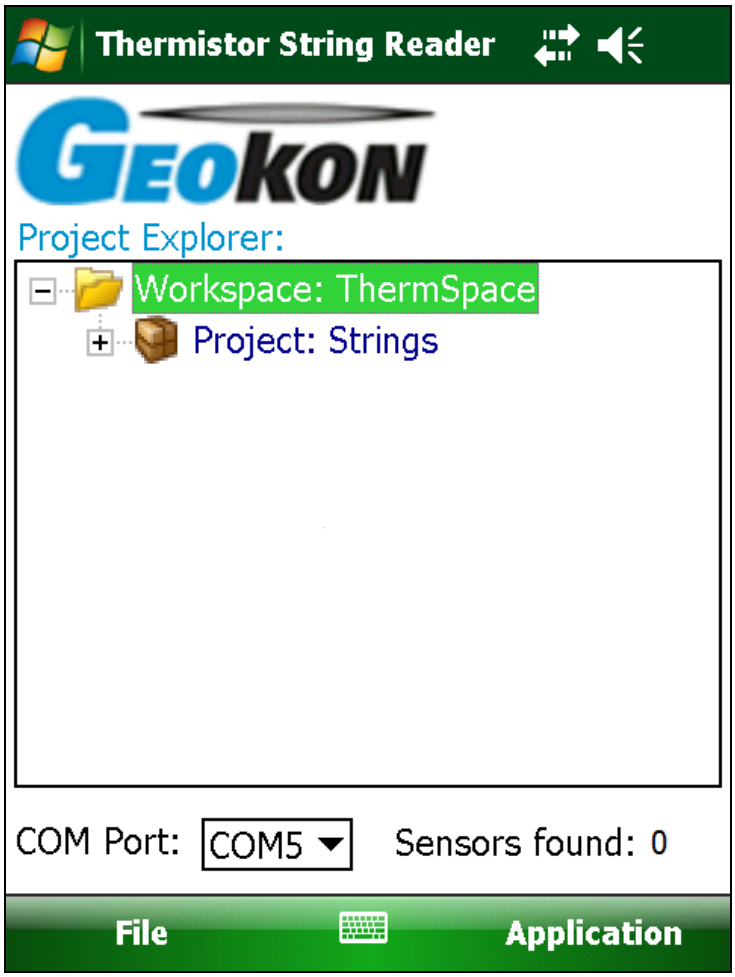

Figure 22 - Default initial screen

Note: With all subsequent attempts to connect to the thermistor string, please ensure that the string is wired to the USB to RS-485 adapter and that the adapter is plugged into the USB port before launching the Thermistor String Reader.

3. User Interface

3.1 Overview

After the applications is launched, following a successful connection, the Thermistor String Reader will display the screen shown in Figure 6. This is the Live Readings screen and it is shown in “Generic Readings” mode, meaning that thermistor string is not associated with any pre-defined string configuration. The following sections describe the Thermistor String Reader user interface in greater detail.

3.2 Live Readings Screen – Generic Readings

Figures 6 shows a typical thermistor output in degrees Celsius as well as in ohms. In “Generic Readings” mode, the two on-screen controls that control sensor measurement are “Temperature in:” and “Display sensor”. These controls are described below:

3.2.1 Temperature in

The “Temperature in” control allows the user to select between temperature displayed in degrees Celsius or Fahrenheit (see Figure 23).

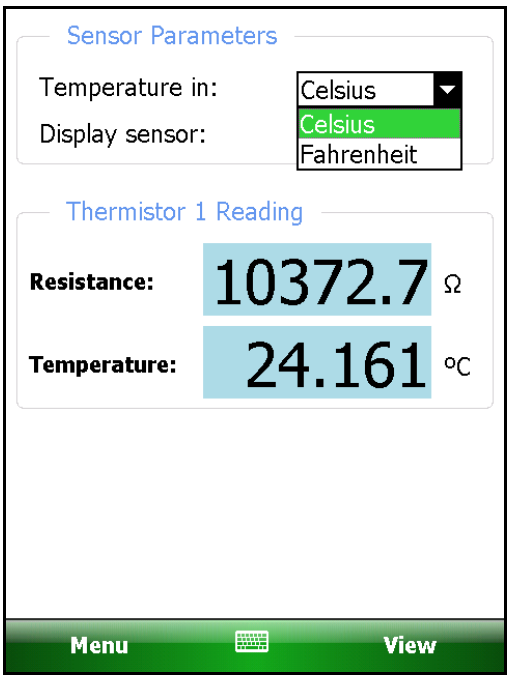

Figure 23 -" Temperature in" Selections

3.2.2 Display sensor

Because most Geokon Addressable Thermistor strings are comprised of more than one sensor, this control allows the user to select any or all of the sensors for display (see Figure 24).

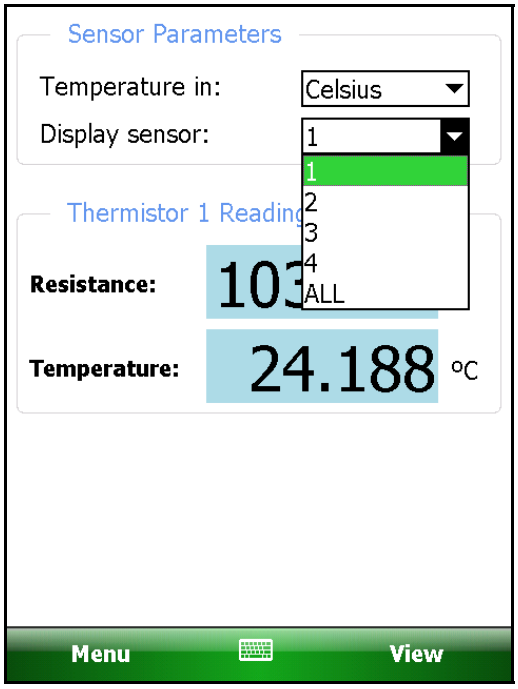

Figure 24 – Display sensor drop-down control

In addition to the controls described in sections 3.2.1 through 3.2.2, Menu Options (see Figure 25) and View Options (see Figure 26) allow functionality such as storing, saving and clearing data. In "Generic Readings" mode, the only Menu Option available is "Close String Reader" while the only valid View Option choice is "String Selection Screen", described further in the next section (see section *3.3 String Selection Screen*).

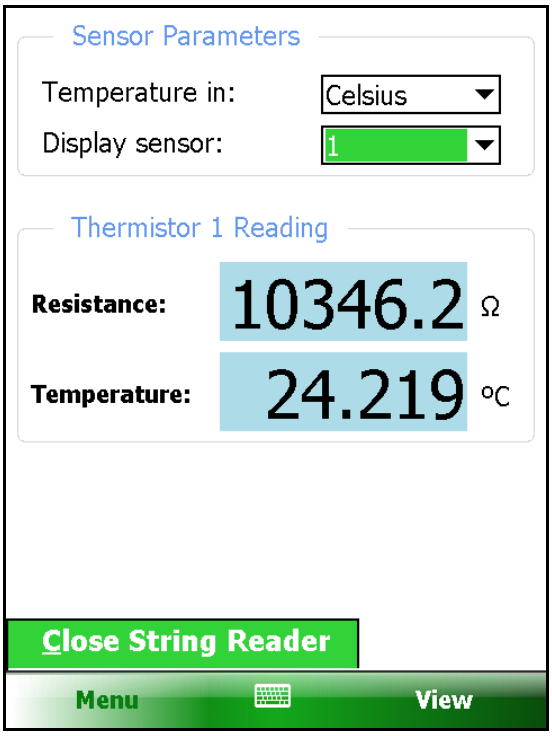

Figure 25 - Menu Options

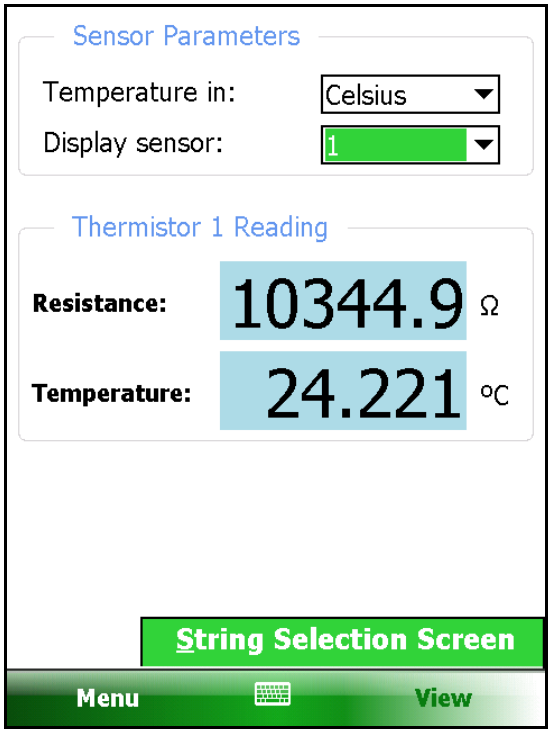

Figure 26 - View Options

3.3 String Selection Screen

The String Selection Screen (see Figure 27) contains a number of navigation controls designed to make the job of selecting application elements and functions easier. These navigation controls present an organizational view of the active workspace, inform the user about the state of the application, and provide the user with tools to configure and control Geokon devices.

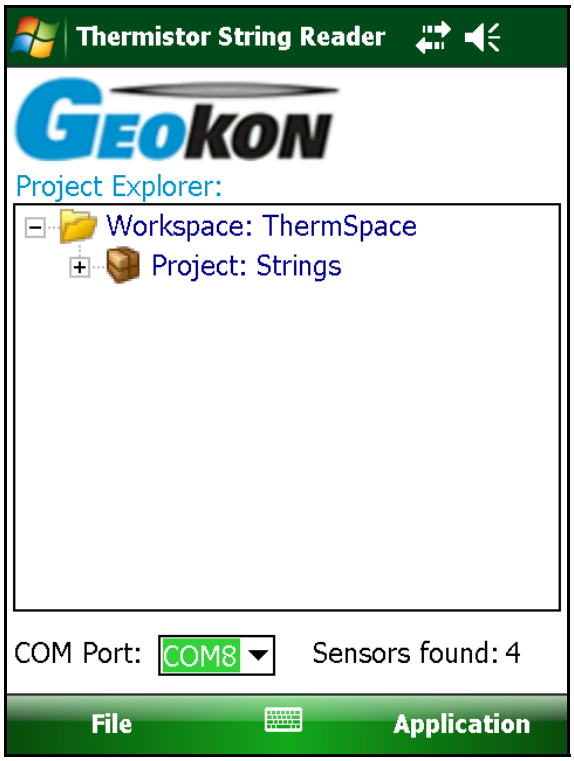

Figure 27 - String Selection Screen

The String Selection Screen is comprised of several core components:

Project Explorer	Element selection tool. Context (drop-down) menu.
Application Menu	Allows display changes and provides information about the string reader application.
File Menu	Data file exporting, viewing and deleting options.
Status Area	Displays the active COM Port number and string connection status.

3.3.1 Project Explorer

The Project Explorer is the primary navigation mechanism for moving around the Thermistor String Reader workspace. The Project Explorer presents a view of the workspace which includes projects and strings. These views reflect the hierarchical relationship between these elements.

The highest element within the workspace hierarchy tree is a project. Projects allow a String Reader user to group strings into organizational units based on the user's preference. A project can reflect a specific site where thermistor strings have been installed such as a construction site, dam, tunnel, etc. This organizational feature makes it easy to find string configurations along with related data files. The list of strings defined under a project can be viewed by selecting a specific project and expanding its branch in the explorer view (click on + sign preceding the project name) (see Figure 28).

In the hierarchy of the project explorer, strings are child elements of a project. string. String settings can be edited by selecting the desired string in the explorer tree. Once selected, string settings can be displayed using “Edit Settings” from the context menu (see Figure 29).

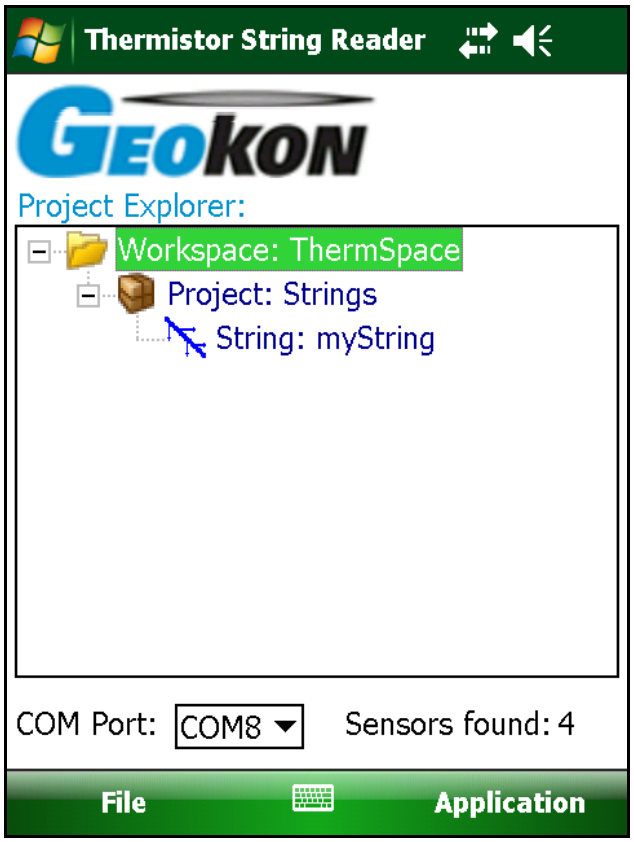

Figure 28 - Project Explorer with expanded projects and strings

3.3.1.1 Context Menu

Using the Project Explorer, new workspace elements can be added by with the context menu. Access the drop-down menu by tapping and holding the explorer element that is to be operated on. A menu is then displayed that is context sensitive in that, based on the current selection, the appropriate elements will be enabled and others will be disabled. The screen-shot shown in Figure 29 depicts the drop-down menu with the menu item, "Add String", disabled (grayed out) since a "string" element is selected in the Project Explorer and one string element cannot be added to another. Additional information for each context menu item follows:

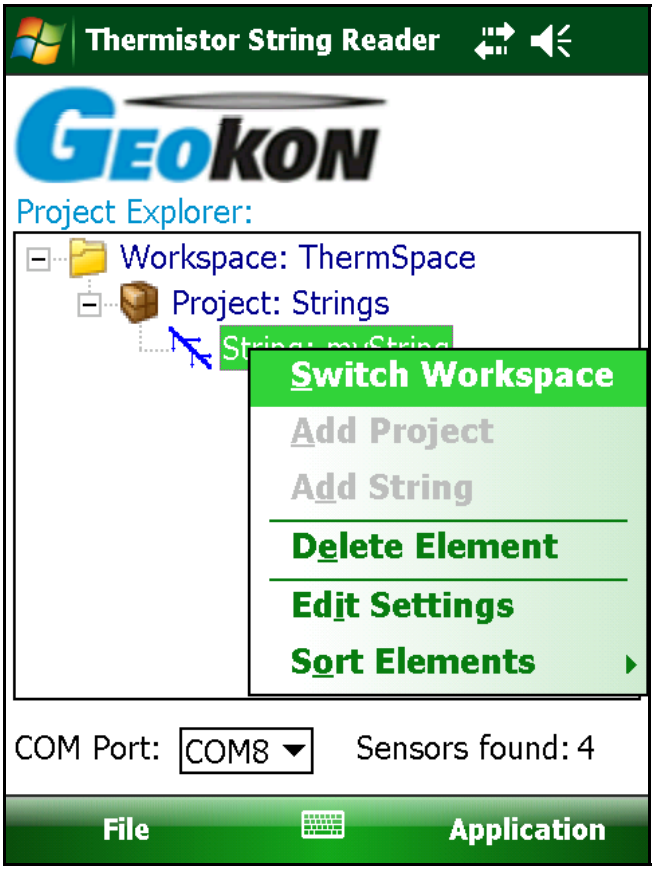

Figure 29 - Context Menu

Switch Workspace:

Use this context menu item to open any previously opened workspace, select a workspace from the file system or create a completely new workspace. Click this menu item to display the Workspace Selection window (see Figure 30).

Figure 30 - Workspace Selection Window

Figure 31 - List of Workspace Names

Click on the drop-down control to display the available workspaces (see Figure 31).

Alternatively, a new name can be entered in the workspace name selection box. If the Thermistor String Reader recognizes the name as a workspace it has opened before, it will simply re-open the

existing workspace.

If the workspace name is new to the string reader then a workspace folder selection window is displayed (see Figure 19). Select the appropriate folder (or use the default) and a new workspace is created with the name entered above.

Add Project:

This menu item allows new projects to be created and added to a workspace. After tapping on this Context Menu item, the Project Settings Dialog will be displayed and can be edited. See section *4.1 Project Configuration* for more information regarding project configuration. This menu item will only be enabled when the workspace is selected.

Add String:

This menu item allows new string configurations to be created and added to a project. After tapping on this Context Menu item, the Addressable String Settings Dialog will be displayed and can be edited. See section *4.2 String Configuration* for more information regarding string configuration. This menu item will only be enabled when a project is selected.

Delete Element:

Project Explorer Elements can be deleted using this Context Menu item. A confirmation dialog will be displayed before the element is deleted.

Edit Settings:

This menu item allows configuration editing of the selected Project Explorer Element. See section *4.1 Project Configuration* and *4.2 String Configuration* for more information regarding configuration editing.

Sort Elements:

Project, String and Sensor explorer elements can be sorted by newest or oldest first by selecting the appropriate “Sort Elements”

sub-item (see Figure 32).

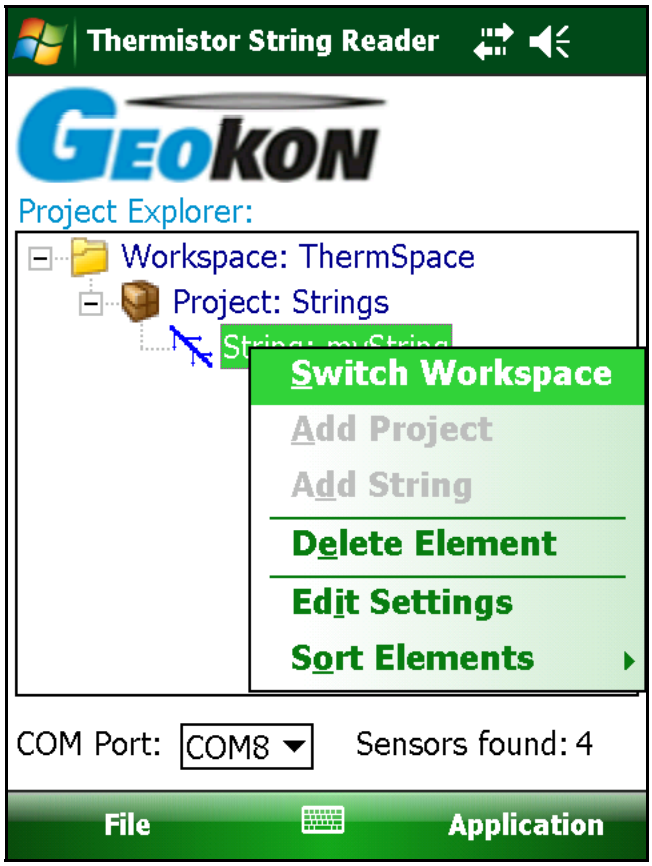

Figure 32 - Sort Elements Sub-Items

3.4 Application Menu

The Thermistor String Reader Application Menu provides access to additional application functionality. It is located in the lower, right corner of the main window frame (see Figure 33).

Figure 33 - Application Menu

3.4.1 Live Readings

This menu item will only be enabled if a successful connection has been established with an addressable thermistor string. A successful connection is indicated by a status “Sensors found: N” at the bottom-right of the main screen, where N is some number from 1 to 255 (see Figure 28).

Tapping on the “Live Readings” menu item displays the sub-menu shown in Figure 34.

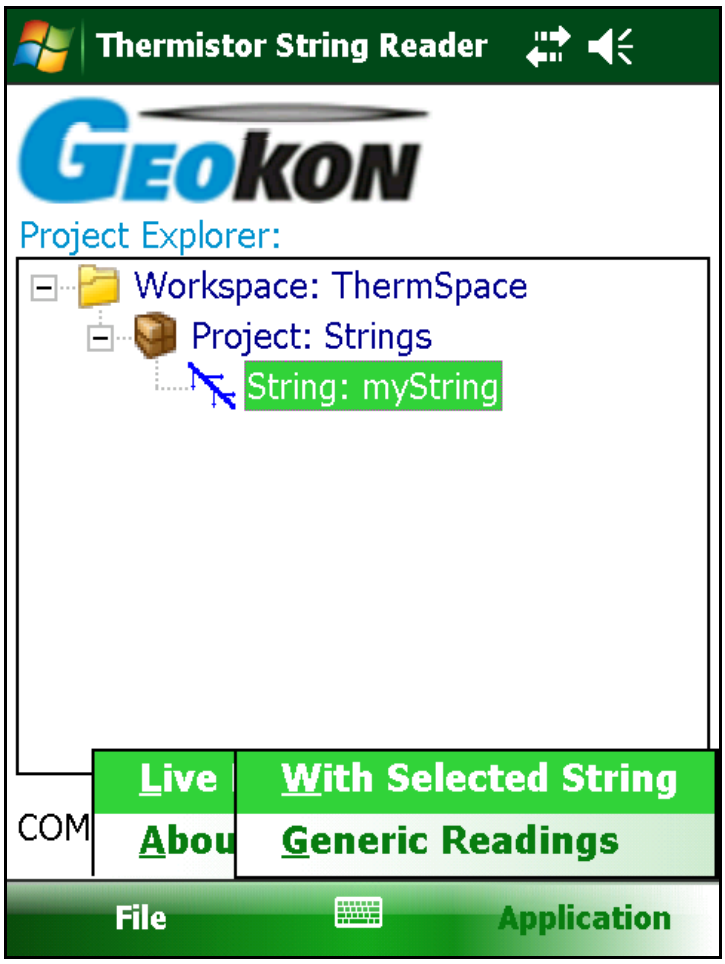

Figure 34 - Live Readings Menu Selections

3.4.1.1 Live Readings - With Selected String

Tapping this menu item will cause the Live Readings screen to be displayed with its parameters initialized for the specific string selected (see Figure 35).

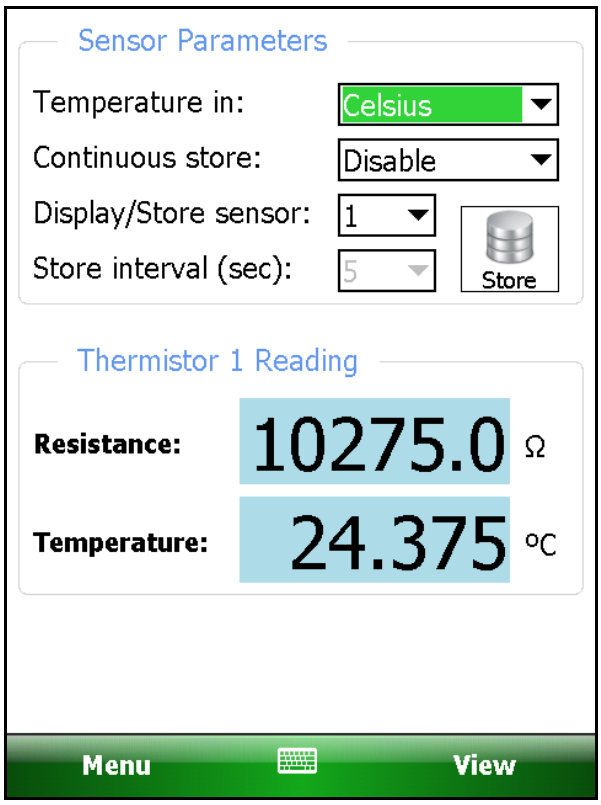

Figure 35 - Live Readings (single thermistor selected)

Note that when a string is selected, Live Readings contains a "Store" button that allows multiple readings to be stored for a particular sensor. With each tap on this button a new reading is stored for the selected sensor. Each time a reading is stored, a "beep" will be heard from the hand-held unit.

A different sensor can be selected for measurement by accessing the drop-down box to the right of the "Display/Store sensor:" label. The new sensor can be chosen from the list of all sensors in the string.

When "ALL" is selected for "Display/Store sensor:" the display changes the thermistor readings panel to a scrolling list (see Figure 36). With strings containing more than 2 sensors, a scroll bar will be displayed to the right of the sensor output to allowing the entire string to be viewed. A long string may require slightly longer for all sensors to be updated.

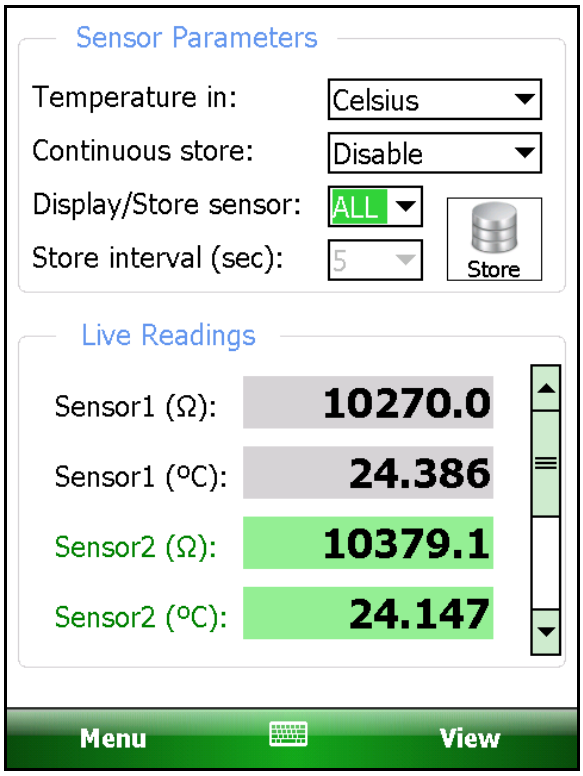

Figure 36 - Live Readings (All sensors selected)

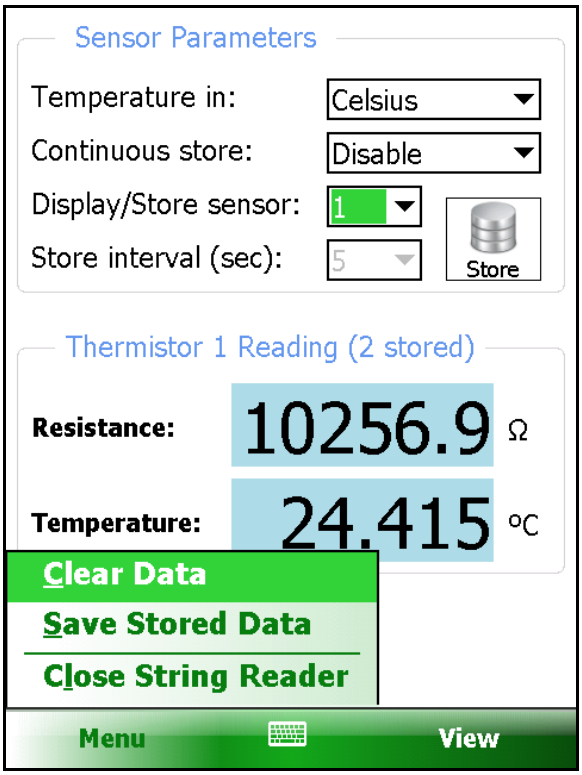

Figure 37 - Menu Options

3.4.1.1.1 Live Readings (With Sensor) Menu Options

The available Menu options (see Figure 37) are outlined below:

Clear Data – Allows clearing of all readings stored (in the current session) for the selected thermistor. Tapping this menu option displays the warning shown in Figure 38. Tapping "Yes" will clear all data (from the current session) and will reset the readings stored counter to "0". This feature has no effect on previously saved data.

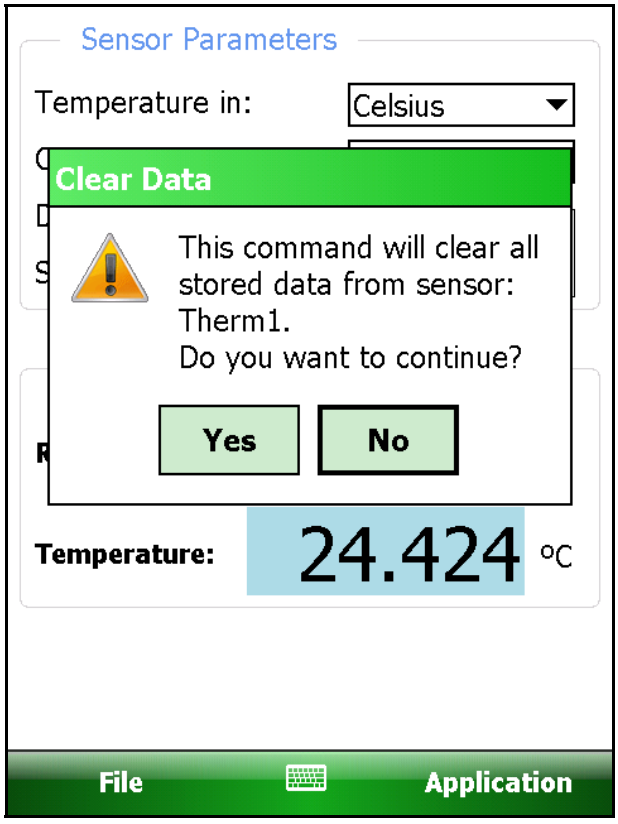

Figure 38 - Clear Data Warning

Save Stored Data – Saves all stored data (from the current session) for the selected thermistor. A message is displayed informing the user how many readings were stored. The readings stored counter will also be reset to "0". The readings are saved to a file contained in a special data folder under the string configuration folder structure. The readings are either saved to a new data file or appended to an existing data file. Please refer to the "String Configuration", section *4.2 String Configuration* for more information. Data files can be exported with special formatting at a later time.

Close String Reader – Shuts down the application and breaks the connection to the string. The user will be given the opportunity to save any stored data (from the current session).

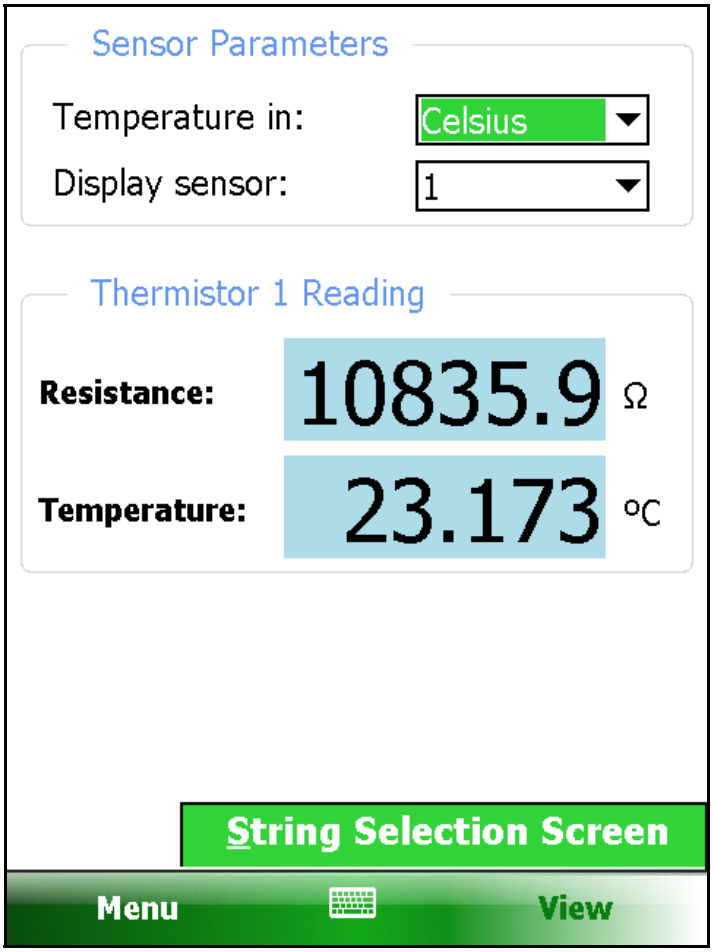

Figure 39 - View Options

3.4.1.1.2 View Options

The available View options (see Figure 39) are outlined below:

String Selection Screen – This option returns operation to the "String Selection Screen" where other sensors may be selected, edited or created. See section *3.3 String Selection Screen* for more information.

3.4.1.2 Live Readings – Generic Readings

See section *3.2 Live Readings Screen – Generic Readings* of this manual.

3.4.2 About Therm. String Reader

Tapping this menu item displays a window containing copyright and version information about the Addressable Thermistor String Reader.

3.5 File Menu

The file menu is used to delete and export data files along with viewing of data (see Figure 40).

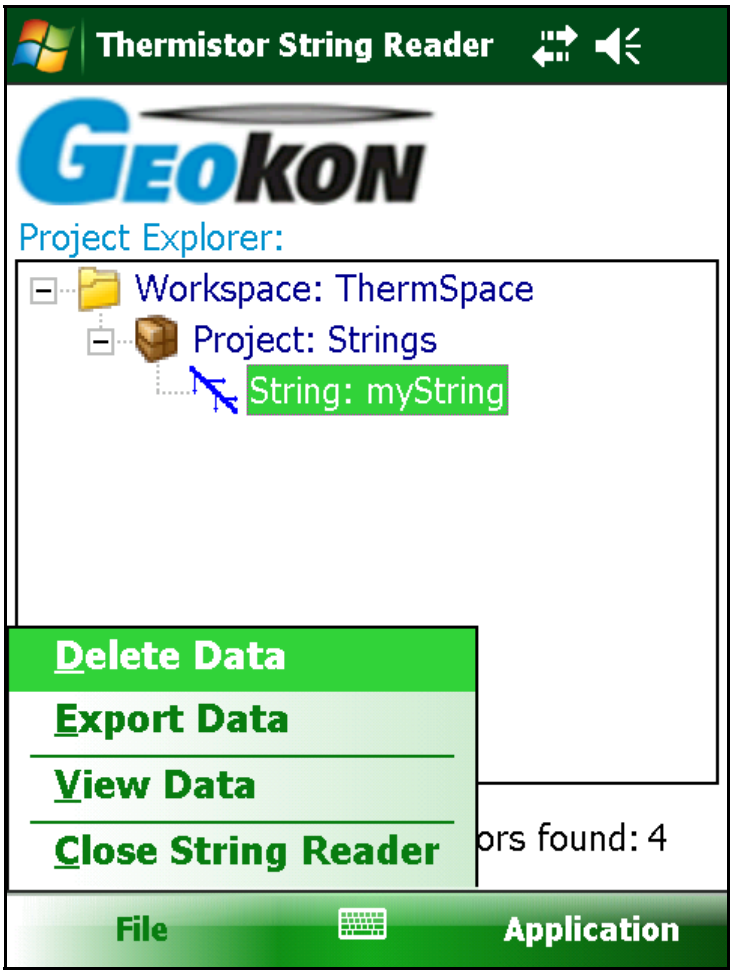

Figure 40 – File Menu Options

3.5.1 Delete Data Files

If a selected string contains data files then tapping on the “Delete Data” File Menu option displays the window shown in Figure 41.

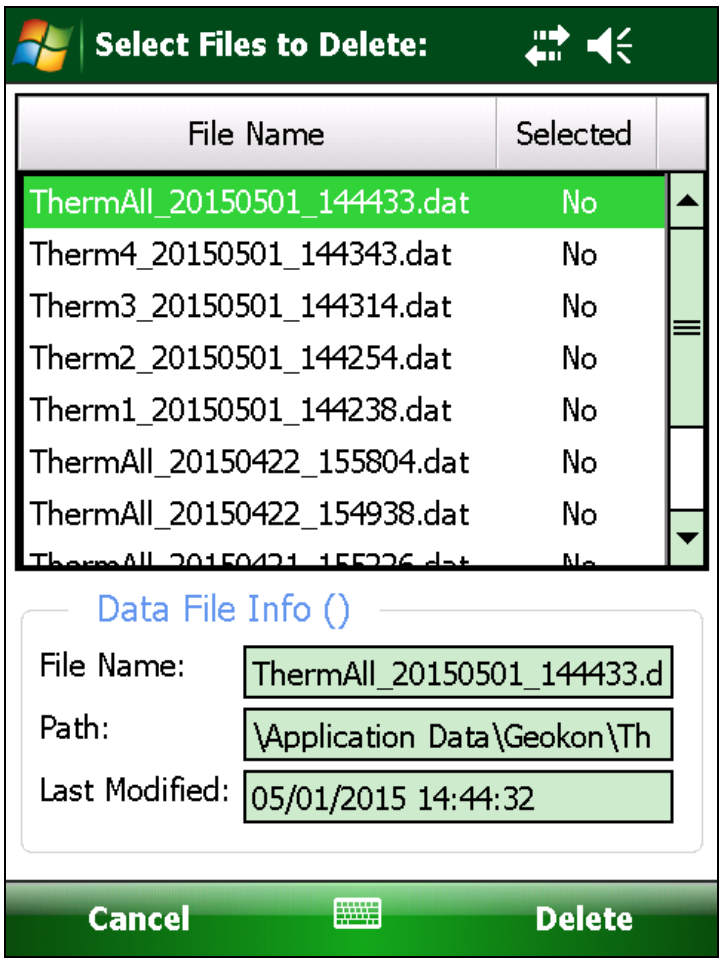

Figure 41 - Delete Data Files Window

The Delete Data File Menu option allows the deleting of data files from the current sensor, selected via the Project Explorer. Figure 41 shows the files available for sensor, “Channel1”. A file may be selected (or deselected) by tapping in the “Select” column. Multiple files may be selected for deleting. If a selected file name is too long to fit in the “File Name:” text box, tap inside the text box and use the arrow keys on the hand-held PC’s external keypad to scroll left or right.

Once all the desired files are selected, tapping on “Delete” will cause the string reader application to prompt the user to confirm that they really want to delete the selected files. Tap on “Yes” to finish the deletion.

3.5.2 Export Data Files

The Export menu is used to export sensor data to a folder of the user's choosing (see Figure 42).

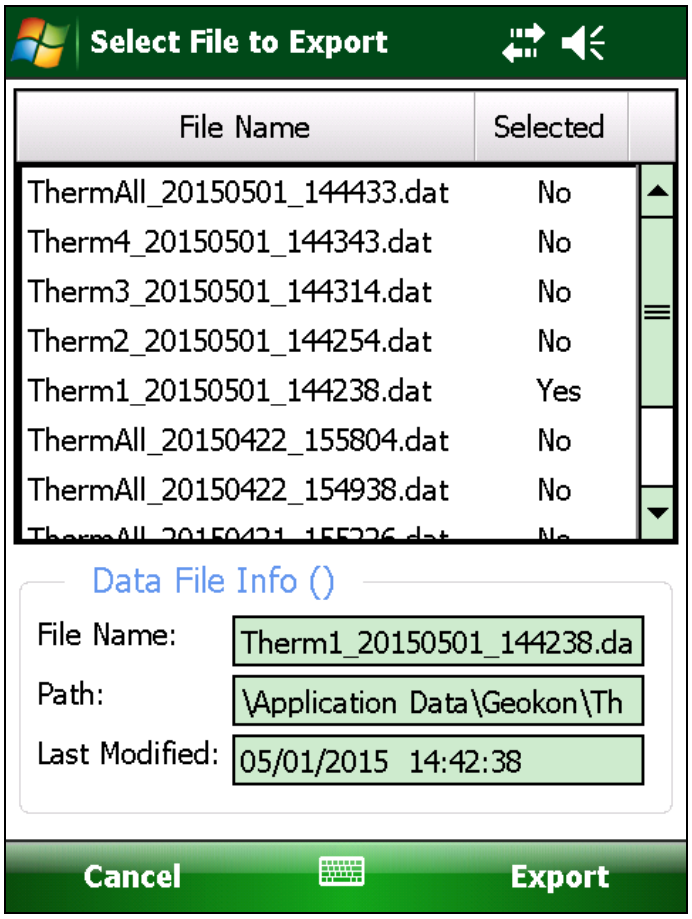

Figure 42 - Export Data Files Window

The Export Data Menu Option allows exporting of data files from the current sensor, selected via the Project Explorer. Figure 42 shows the files available for sensor, "Channel1". A file may be selected (or deselected) by tapping in the "Select" column. Multiple files may be selected for exporting. If a selected file name is too long to fit in the "File Name:" text box, tap inside the text box and use the arrow keys on the hand-held PC's external keypad to scroll left or right.

Once all the desired files are selected, tap "Export" to display the "Save File" window (Figure 43) where a new name and folder may be specified for each file. If more than one file was selected then a checkbox is displayed allowing the same folder to be used for each file, if desired.

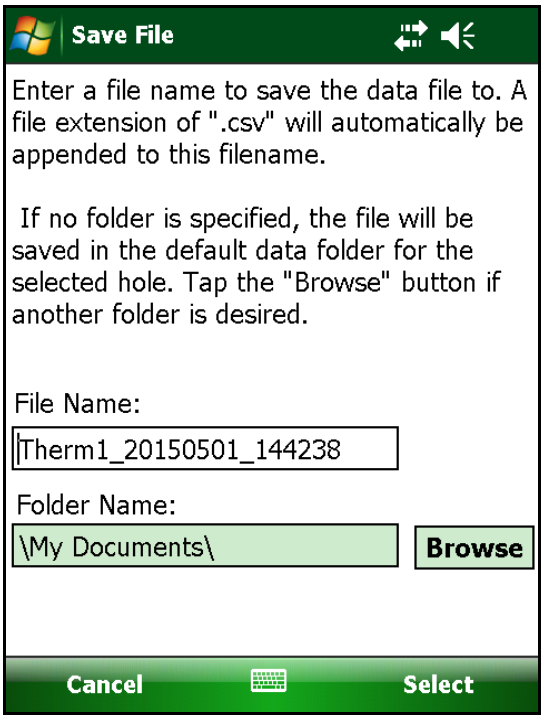

Figure 43 – Save File Window

After all the paths for each file have been specified, the Extended Format window will be displayed (see Figure 44).

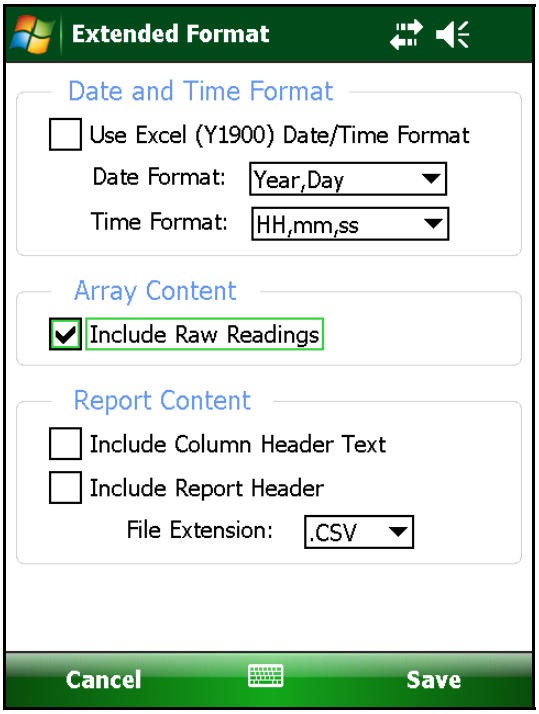

Figure 44 - Extended Format Window

The Extended Format Window allows additional formatting options to be applied to the data before exporting. These options are described below:

Date and Time Format:

If the “Use Excel (Y1900) Date/Time Format” checkbox is checked, the Date and Time format drop-down controls below it will be disabled. The date and time is saved in a numeric format that can be readily formatted in MS Excel and is equal to the number of seconds since 1/1/1900 (the fractional part amounts to the elapsed time, the day the measurement took place).

If the “Use Excel (Y1900) Date/Time Format” checkbox is **not** checked, the Date and Time formats can be individually set via their respective drop-down controls.

Array Content:

The array content can be changed to include or exclude the raw reading (before conversion by the gage factor) of the sensor.

Report Content

The data “report” can be changed to include or exclude column header text as well as report header text. Please refer to Appendix C for an example of column header and report header text.

The file extension for the generated file can also be changed from “.csv” to “.txt”. If “.txt” is selected as the data file extension, then all the column data will be separated by tabs instead of commas.

3.5.3 View Data

When the View Data File Menu option is clicked and a sensor has been previously selected, the “Select File” window is displayed (see Figure 45). Tap in the “Selected” column to select a data file for viewing. Tap “View” when done to display the “Sensor Reads” window (see Figure 46).

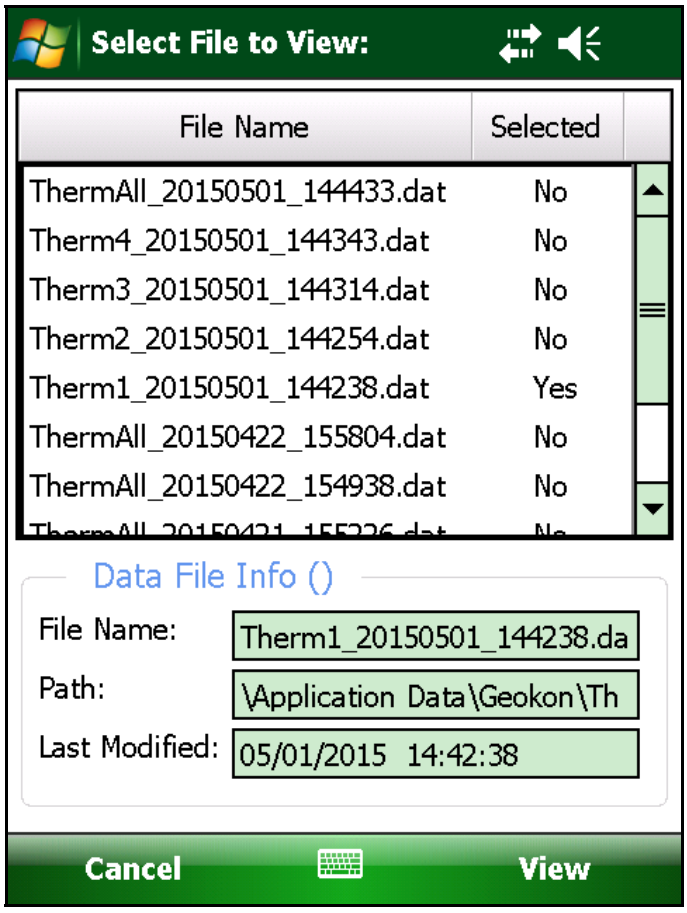

Figure 45 - View Data File Selection Window

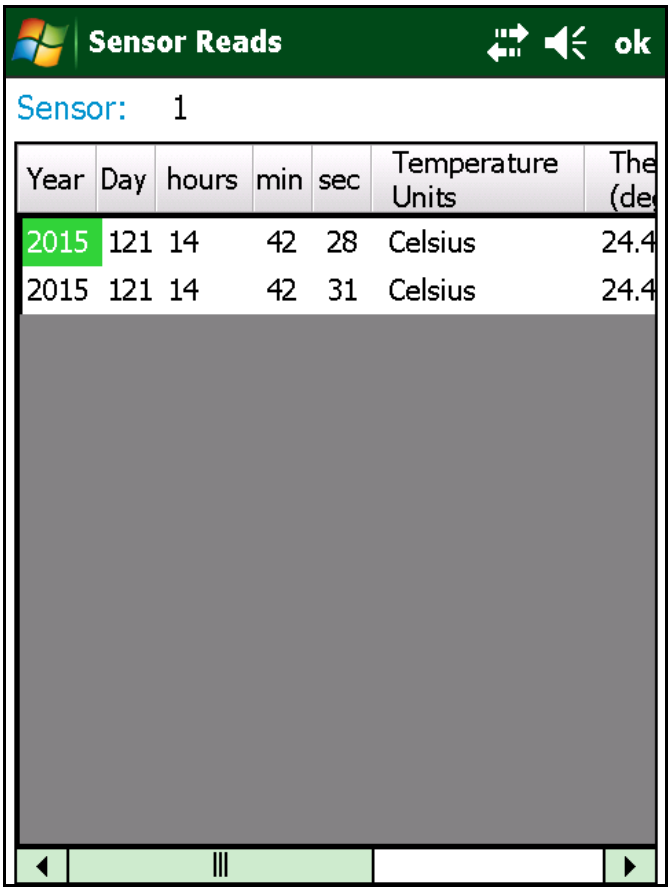

Figure 46 - Sensor Reads Window

The scrollbar at the bottom of the screen can be used to display columns that are off the current “page”.

3.5.4 Exit

Tapping on this menu item will cause the program to cease execution.

4. Configuring Project Explorer Elements

Each Project Explorer Element has settings that can be configured. For some, like Workspace and Project, the settings consist only of a name and description. String elements require another parameter that determines how data files are written to.

Each element's settings can be adjusted using the Edit Settings option from the Context Menu.

4.1 Project Configuration

Figure 47 depicts the Projects Settings window:

- **Project ID**
  Read-only value, generated when the project was created. Used internally by the Addressable Thermistor String Reader.
- **Project Name**
  Use the on-screen keyboard to enter a unique and descriptive name for the project.
- **Description**
  Using the on-screen keyboard, enter a brief description pertaining to the project.
- **Date created**
  Read-only date and time value, generated when the project was created.

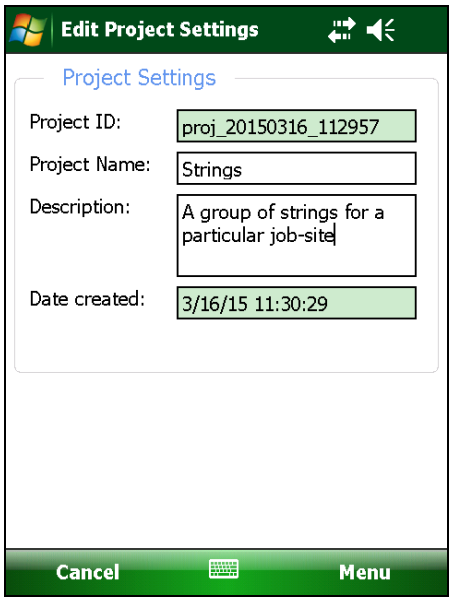

Figure 47 - Project Settings

When done editing, project settings can be saved via the "Menu->Save Settings" option. Workspace configuration is similar to project configuration in that only the name and description are editable.

4.2 String Configuration

The string settings window manages string configuration much the same as the Project Settings window (see Figure 48)

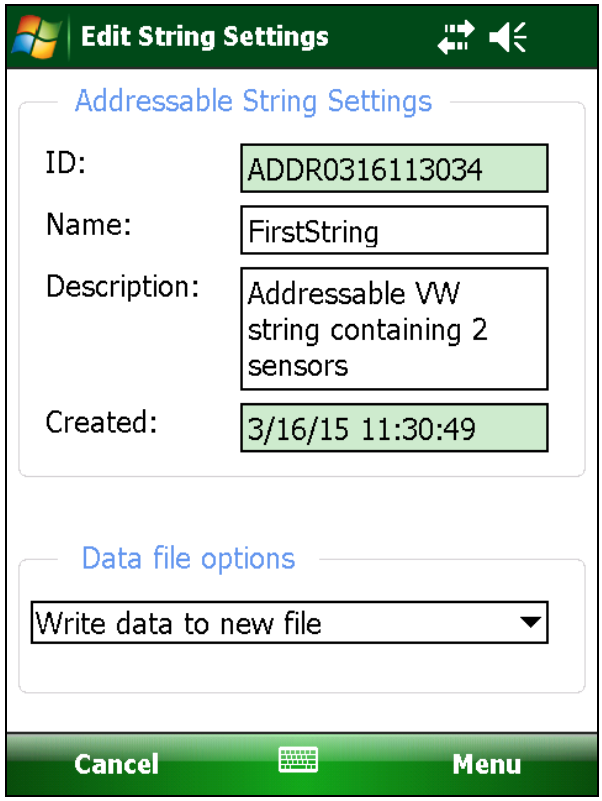

Figure 48 - Addressable String Settings Window

In addition to Name and Description, String Settings include an additional setting, "Data file options", that defines how the data is stored on the file system each time data is saved from "Live Readings – With Selected String" (see section *3.4.1.1.1 Live Readings (With Sensor) Menu Options*):

Append data to existing file	Writes data to last data file written to, appending it sequentially after the last data record.
Write data to new file	Creates new file each time data is stored.
Create new file then append	Creates a new file when data is initially stored then appends data to this file on each subsequent collection.

5. Files, Folders and Transferring Data

The Addressable Thermistor String Reader application uses several types of files and dedicated folder locations to keep track of Workspaces and Project Explorer element configuration files, such as sensor configuration files and data files. The default locations and names for some of these appear in Table 2:

Purpose	***Default Folder***	***Filename***
Addressable Thermistor String Reader preferences and configuration	\Application Data\Geokon\ThermStringRdr\	Config.xml
Addressable Thermistor String Reader conversions	\Application Data\Geokon\ThermStringRdr\	Conversions.xml
Workspace repository	\Application Data\Geokon\ThermStringRdr\Workspaces\	N/A
Project repository (Workspace)	\Application Data\Geokon\ThermStringRdr\ Workspaces\<WRK_SPC_FLDR>\ (1)	.wkspc
String repository (Project)	\Application Data\Geokon\ThermStringRdr\ Workspaces\<WRK_SPC_FLDR>\<PROJECT_ID>\ (2)	.proj
Sensor repository (String)	\Application Data\Geokon\ThermStringRdr\ Workspaces\<WRK_SPC_FLDR>\<PROJECT_ID>\ <STRING_ID>\ (3)	.string

Table 2 - Folder paths and File Names

1. <WRK_SPC_FLDR> is usually the same as the workspace name but is not required to be.
2. <PROJECT_ID> can be found in each Project's settings.
3. <STRING_ID> can be found in each String's settings.

Note: Manual editing any of the configuration files and/or renaming folders above is **strongly** discouraged and may cause all configuration data to be lost!

5.1 File Transfer

In general, the only files generated by the Thermistor String Reader that will have to be transferred are the sensor data files, although periodically archiving others on a "master" PC is recommended. Connecting the Field PC to a desktop or laptop PC using the supplied USB cable (Type A to mini B) is straight forward and allows the user to view the Field PC's storage as a flash drive on the desktop/laptop; you can then simply drag the files around to any folder on the desktop/laptop.

- If you are using Windows XP you will need to download and install the program, "ActiveSync". This application is available for free from the Microsoft site (www.microsoft.com and search for "Active Sync download"). Once installed (generally requires a reboot), simply connect the USB cable from the Field PC and then open "My Computer" on the XP machine and see a "PDA" entry under drives. Just double click on it to see the folders in the Field PC.

- If you are using Windows Vista or Windows 7, Microsoft includes software called Windows Mobile Device Center and you should be able to immediately connect to the Field PC and see it in the "Computer" window.

It is not necessary to set up any 'syncing' options although it can easily be accomplished. Another Bluetooth partnership can also be set up from your desktop/laptop (assuming they have Bluetooth modules) to the Field PC and transfer files that way.

All of these options (and more) are described in the Field PC's Reference Guide.

5.2 Backing up configurations

To guard against accidental data loss and as a matter of good computer technique, critical data and configuration files should be periodically backed up.

- Entire Workspaces can be backed up using file/folder copy techniques in Windows Explorer.

- Although backing up a Workspace automatically includes any data files stored as part of the project element "String" structure, data files can be individually backed up per Sensor using the Data Export function from the File menu. After exporting, the resulting ".csv" file should be transferred to a desktop PC using the techniques described in section *5.1 File Transfer*.

APPENDIX A. Data File Formats

A.1 Raw Data Text Report

When exporting, “raw” text data is the default for the Extended Format options of the “Export Data Menu” (see section *3.5.2 Export Data Files* and Figure 47).

2015,111,16,46,31,Celsius,23.996,10448.38,1

2015,111,16,46,37,Celsius,23.997,10447.74,2

2015,111,16,46,41,Celsius,23.997,10447.74,3

2015,112,11,18,18,Celsius,23.632,10617.57,4

2015,112,11,18,22,Celsius,23.632,10617.57,5

2015,112,11,18,27,Celsius,23.632,10617.57,6

2015,112,11,18,32,Celsius,23.634,10616.92,7

2015,112,11,18,37,Celsius,23.634,10616.92,8

2015,112,11,18,42,Celsius,23.635,10616.27,9

2015,112,11,18,47,Celsius,23.635,10616.27,10

2015,112,11,18,52,Celsius,23.636,10615.62,11

2015,112,11,18,57,Celsius,23.636,10615.62,12

Column: 1 2 3 4 5 6 7 8 9

Where:

Column 1 represents the year when the array was stored
Column 2 represents the Julian day when the array was stored
Column 3 represents the hour when the array was stored
Column 4 represents the minute when the array was stored
Column 5 represents the second when the array was stored
Column 6 represents the Thermistor reading units, either “Celsius” or “Fahrenheit”
Column 7 represents the sensor temperature in the unit specified in column 6
Column 8 represents the raw Thermistor reading in Ohms
Column 9 represents the array number

Note: The number (and definition) of columns may change as “Export Data→ Extended Format” options are changed (see Figure 44)

A.2 Data Text Report with Column and Report Headers

The report below (see Figure 49, shown in Excel format for clarity) illustrates additional report formatting capability by adding column and report headers. Note that this report contains data for only one thermistor node and the date and time appear as one field by using the Y1900 Date/Time option. This was file was created by storing data while channel "4" was displayed in Live Readings. Export was chosen when the string was selected.

Thermistor Data					

Project Name: Strings					
String Name: myString					
Thermistor: 4					
File Name: Therm4_20150421_164643.CSV					

Date and Time	Temperature	Thermistor	Thermistor	Array#	
	Units	(degrees)	(ohms)		
4/21/2015 16:46:31	Celsius	23.996	10448.38	1	
4/21/2015 16:46:37	Celsius	23.997	10447.74	2	
4/21/2015 16:46:41	Celsius	23.997	10447.74	3	
4/22/2015 11:18:18	Celsius	23.632	10617.57	4	
4/22/2015 11:18:22	Celsius	23.632	10617.57	5	
4/22/2015 11:18:27	Celsius	23.632	10617.57	6	
4/22/2015 11:18:32	Celsius	23.634	10616.92	7	
4/22/2015 11:18:37	Celsius	23.634	10616.92	8	
4/22/2015 11:18:42	Celsius	23.635	10616.27	9	
4/22/2015 11:18:47	Celsius	23.635	10616.27	10	
4/22/2015 11:18:52	Celsius	23.636	10615.62	11	
4/22/2015 11:18:57	Celsius	23.636	10615.62	12	

Figure 49 - Enhanced Data Text Report

APPENDIX B. Specifications

B.1 Hand-Held Device (HHD-NX7-B) Specifications

Processor	806 MHz PXA310
Operating System	Windows Mobile® 6.1 Classic
Included Software	Microsoft® Office Mobile; multiple languages
Memory	128 MB RAM
Data Storage	4 GB internal data storage; compact Flash slot (Type I or II); SD/SDHC slot; SDIO supported; user accessible CF and SD slots
Color Display	480x640 pixel, Anti-glare 3.5” VGA resolution, sunlight readable, 262K color (18 bit), TMR Technology with LED backlight.
Keyboard	Dedicated backlit numeric keypad; Four-way directional buttons using function key (Fn); discrete keys for Start, Menu Left, Menu Right, Camera, “ok”, Return and Power/Suspend;
Ports	RS-232C 9-pin “D” connector; 1 x USB host and client (Mini AB USB OTG, 1.2 host, 2.0 client); 12 VDC @ 4.1 Amps Max power in
Case	IP67 waterproof
Environmental	Tested to MIL-STD810F for water, humidity, sand, dust vibration, altitude, shock and temperature
Power	Intelligent 5600 mAh Li-Ion battery; can be easily changed in the field without tools
Wireless Connectivity	Internal Bluetooth® wireless technology option, 2.0 +EDR, Class 1, range 20 m; WLAN: Integrated 802.11b/g supports AES TKIP, WEP, WPA and WPA2
Certification & Standards	FCC Class B; CE Mark; EN60950; RoHS compliant; FM approved Class I, Div 2
Operating Temperature	-30°C to 60°C
Storage Temperature	-40°C to 70°C
Shock Survival	Multiple drops from 1.22 m onto concrete
Dimensions (L x W x H)	179 mm (7") x 97 mm (3.8") x 37 mm (1.5")
Weight	490 g, with battery

B.2 Hand-Held Device (HHD-NX8-BW) Specifications

Processor	Texas Instruments 4470 dual-core @ 1.5 GHz
Operating System	Microsoft® Windows® Embedded Handheld 6.5.3
Included Software	Microsoft® Office Mobile 2010; multiple languages
Memory / Disk	1GB RAM / 4GB iNAND Flash
Storage Expansion	User accessible MicroSD/MicroSDHC slot
Display	FWVGA (854x480); IPS; 600 nits, capacitive multi-touch Asahi Dragontrail, chemically strengthened glass
Keyboard	Numeric backlit keypad with 3 programmable function keys. On-screen QWERTY keyboard.
Connections	USB A Host, USB micro (PC sync and charging), DB9 RS-232 serial, 3.5 mm headset (stereo and mic)
Case	IP67 waterproof
Camera	8-megapixel, rear-facing with autofocus and LED illumination.
Environmental	Tested to MIL-STD810G for water, humidity, sand, dust vibration, altitude, shock and temperature
Power / Battery Life / Charge Time	5200 mAh, 3.7 V, Li-Ion warm-swappable battery / approx. 8.5 hours / approx. 5 hours (4000 mAh)
Wireless Connectivity	Internal Bluetooth® Class 2; WLAN: Integrated 802.11b/g/n supports AES TKIP, WEP, WPA and WPA2
Operating Temperature	-30°C to 60°C
Storage Temperature	-40°C to 70°C
Shock Survival	Multiple drops from 1.22 m onto concrete
Dimensions (L x W x H)	191 mm (7.5") x 80 mm (3.2") x 35 mm (1.4")
Weight	490 g, with battery