## INTRODUCTION

The DS1703K is a software evaluation kit designed for use with the Dallas Semiconductor family of 3-wire temperature sensing devices. Full device functionality is supported for the DS1620, DS1720, DS1626, DS1726, and DS1722. The SPI interface of the DS1722 is also supported. All user registers can be accessed through the software, allowing full read/write control of the devices. Both Fahrenheit and Celsius temperature readouts are provided for ease of use.

The software was designed for Windows^{TM} operating systems, and has been tested on Windows 98, Windows 2000, and Windows NT operating systems.

STARTING THE DS1703K EVALUATION KIT

The first step required to run the DS1703K evaluation software is to connect the DS9123 to an available serial port on the desired computer. The DS9123 is the serial interface brick that translates the serial data to the 3-Wire interface. With the DS9123 connected, the user can run the DS1703K.exe executable. The evaluation board does not need to be present to run the software. The first screen displayed is shown in Figure 1.

Figure 1. DS1703K Splash Screen
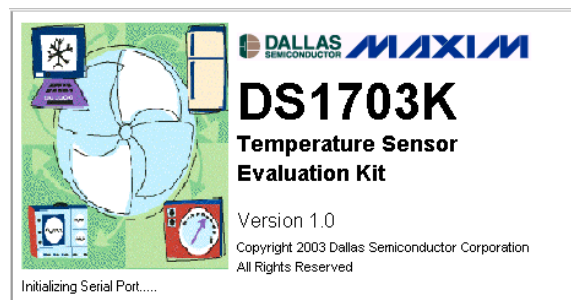
If the DS9123 module is not present, the software will not load completely and the message box shown in Figure 2 appears. If this message appears, there is a problem communicating with the DS9123, and the connection should be verified.

Figure 2. Unable to Initialize Screen
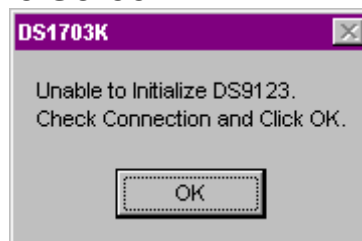

*Windows is a trademark of Microsoft Corp.*

Figure 3 shows the final screen that is shown if communication is not established with the DS9123. This screen allows the user to manually set the communications port (Comm Port) that the DS9123 is connected to, or have the program automatically look for the module. Pressing *Poll Serial Ports* enables the program to access all serial ports and look for the DS9123 module. If a DS9123 is found, the corresponding port number appears in the combo box.

Figure 3. Select Preferences Screen
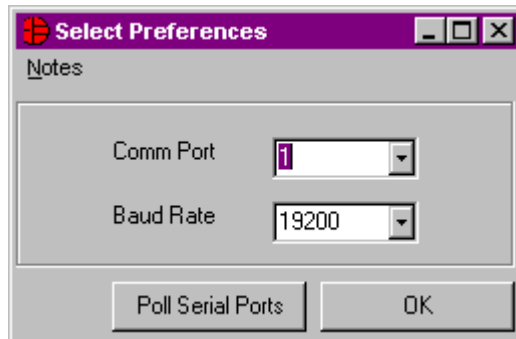
If communication is still not established, the software will be stuck in the initialization mode. To escape from this mode, the user must reboot or Ctrl-Alt-Del to End Task. If problems occur during the program start-up, check the DS9123 to make sure it is properly connected. Remove and reconnect if necessary. The Comm Port can be changed after the program has been fully loaded, by clicking on *Communication* under the *Preferences* menu. This loads the same screen shown in Figure 3.

Figure 4. Device Selection Screen
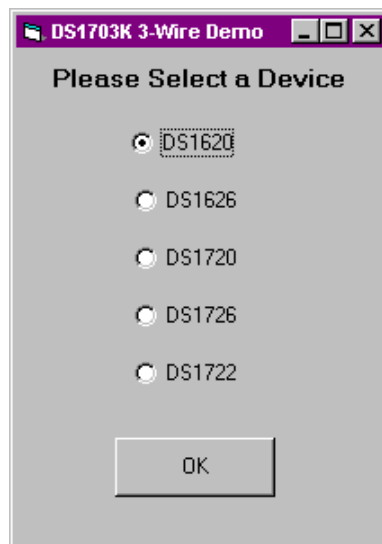
Once communication is established with the DS9123 module, the *Device Selection* screen is displayed as shown in Figure 4. This screen allows the user to choose which device parameters the software initially loads. After the correct device is selected, press *OK* to finish loading the program. The selected device can be changed at any time once the program has fully loaded by selecting the *Device* menu.

DS1620/DS1720 OPERATION

DS1620/DS1720 Thermometer Tab

If the DS1620 or DS1720 is selected in the *Device Selection* form, the *Thermometer* tab shown in Figure 5 is loaded. With this screen displayed, the software continually reads the temperature and configuration registers from the part. The readings happen approximately 2.5s after the previous reading ends. The contents of the temperature register are shown on the form next to the thermometer in hexadecimal, Celsius, and Fahrenheit. The thermometer graphic also updates and tracks the Celsius temperature. The High Temperature Threshold (TH) and Low Temperature Threshold (TL) flags from the configuration register can be monitored in the bottom right of the form.

Figure 5. DS1620/DS1720 Thermometer Tab
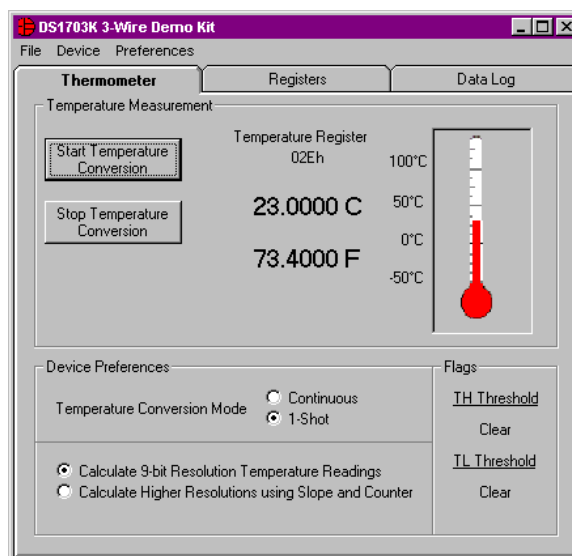
The upper left corner of the *Temperature Measurement* section has two buttons relating to temperature conversions. Pressing the *Start Temperature Conversion* button on this section sends the Start Convert T (EEh) command to the part. Pressing the *Stop Temperature Conversion* button sends the Stop Convert T (22h) command to the part.

In the *Device Preferences* section of the form there are two option buttons used to determine the conversion mode. These buttons allow the user to select either the 1-shot or continuous conversion mode. Selecting either option causes the software to issue a Read Config (ACh) command, modify the 1SHOT bit (bit 0), and then issue a Write Config (0Ch) command.

The final section of this form selects either 9-bit or higher resolution temperature calculations. If the 9-bit option is selected, only the contents of the temperature register are shown. However, selecting the higher resolution option causes the software to issue Read Counter (A0h) and Read Slope (A9h) commands during each temperature reading. The temperature is then calculated using Equation 1, where TEMP_READ is the value obtained by reading the temperature and then truncating the LSb.

$$TEMPERATURE = TEMP\_READ - 0.25 + \frac{(COUNT\_PER\_C - COUNT\_REMAIN)}{COUNT\_PER\_C} \qquad (1)$$

COUNT_PER_C is the value in the slope register, and COUNT_REMAIN is the value in the counter register. The *Thermometer* form also changes slightly when this mode is chosen, and looks like the screen shot in Figure 6. The changes allow the user to see the value of the slope and counter registers directly under the temperature data.

Figure 6. DS1620/DS1720 Higher Resolutions Screen
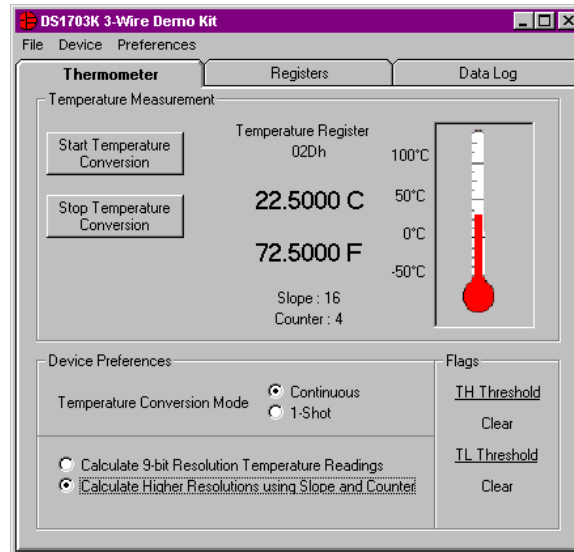
DS1620/DS1720 Registers Tab

The second tab of the DS1620/DS1720 evaluation software is the *Registers* tab. This tab is used to view and change all of the registers available to the user. When this tab is selected the configuration register will not be read every 2.5 seconds as indicated in the previous section. However, the temperature register is still read. Figure 7 shows the *Configuration Register* tab within the *Registers* tab.

Figure 7. DS1620/DS1720 Configuration Register Tab
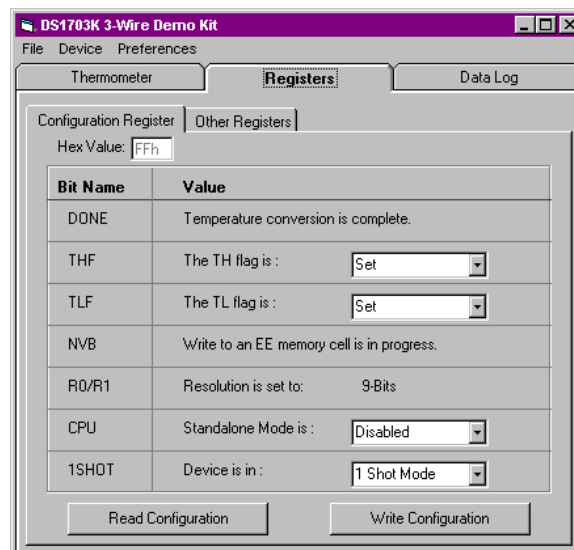
The hexadecimal (hex) value of the Configuration register is shown in the text box in the upper left corner of the tab. Below that, each bit name is listed and a combo box shows the current status of the bits. To change the value of the bits, select the combo box and change it to the desired setting. Changing the combo boxes do not change the hex value shown, as this value is only updated on configuration register reads. The bits listed without combo boxes are read only bits.

Clicking the *Read Configuration* button sends the Read Config (ACh) command to the part and updates the form with the value read. Clicking *Write Configuration* sends the Write Config (0Ch) command to the part followed by a data byte represented by the combo box choices. After the write, a read is also done, and the form is updated. This ensures the write process was successful.

Figure 8. DS1620/DS1720 Other Registers Tab
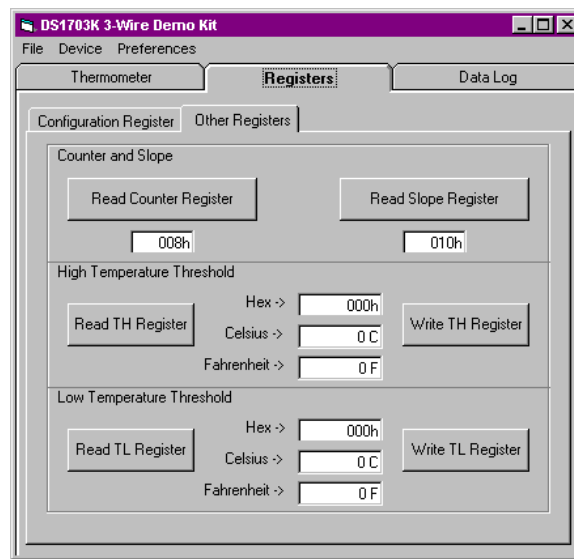
The second tab within the *Registers* tab is the *Other Registers* tab, and is shown in Figure 8. This register is used to access the Counter, Slope, High Temperature Threshold (TH), and Low Temperature Threshold (TL) registers.

Pressing *Read Counter Register* sends the Read Counter (A0h) command to the part, and then the software displays the hex contents under the button. Pressing the *Read Slope Register* button has similar functionality. The Read Slope (A9h) command is sent, and the contents are displayed under the button. These two registers are read only.

The TH register is read by pressing the *Read TH Register* button. The software sends the Read TH (A1h) command, and displays the contents to the right of the button. For user convenience, the TH value is shown in hex, Celsius, and Fahrenheit format. To write the TH register, press the *Write TH Register* button. This sends the Write TH (01h) command followed by two data bytes. Any of the text boxes (hex, °C, °F,) can be used to write to the TH register. The software automatically detects which text box was last modified, and sends the data from that box. For example, if 55 C is entered in the Celsius box, the software will convert that to 06Eh and send the data to the part.

The TL register interface functions exactly as the TH register except the commands Write TL (02h) and Read TL (A2h) are used.

DS1620/DS1720 Data Log Tab

The *Data Log* tab is the final tab available in the DS1620/DS1720 software interface. Figure 9 shows the *Data Log* tab with the *Temperature* tab selected within it.

## Figure 9. Temperature Tab
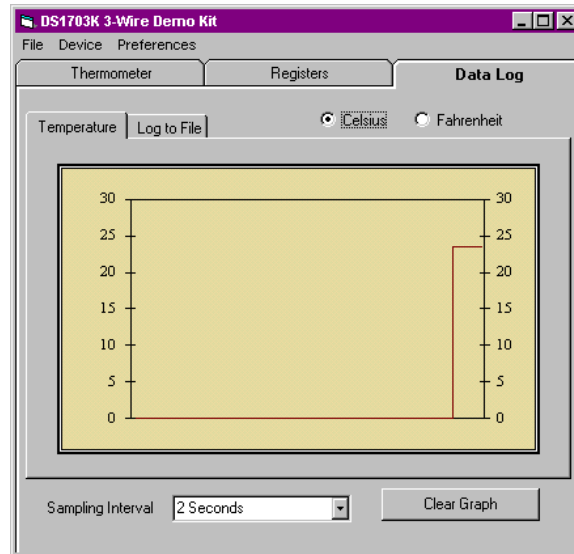
The *Temperature* tab is used to graphically display the temperature obtained from the part. The option button to the right of the temperature determines if Celsius or Fahrenheit data is plotted. Switching the temperature mode causes the chart to clear all data points, and then resume plotting. Below the chart is a combo box used to set the time interval between temperature plots. The final button on this tab is labeled *Clear Graph*. Pressing this button clears the temperature plot shown.

DS1620/DS1720 Log to File Tab

The data from the device can also be saved to a text file by selecting the *Log to File* tab within the *Data Log* tab. This tab is shown in Figure 10.

Figure 10. Log to File Tab
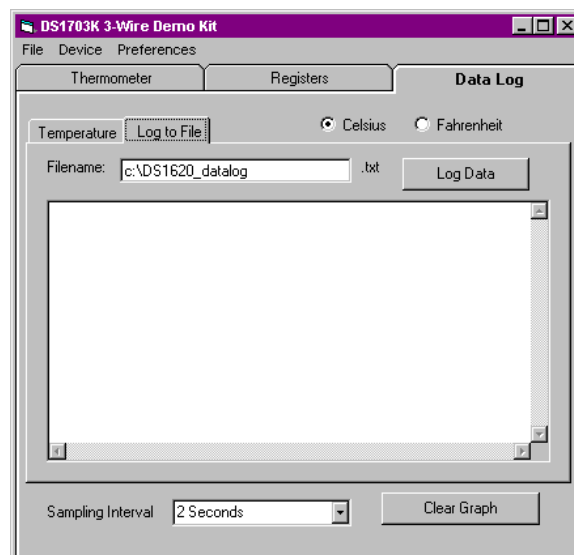
When first loaded, the software does not start logging the data to a file. However, when a data log file is necessary, pressing the *Log Data* button starts the process. After the button is pressed, data begins to appear in the large text box shown on the form. New data is inserted in the text box at a rate equal to the sampling interval specified in the combo box.

Figure 11. Logging Data Screen
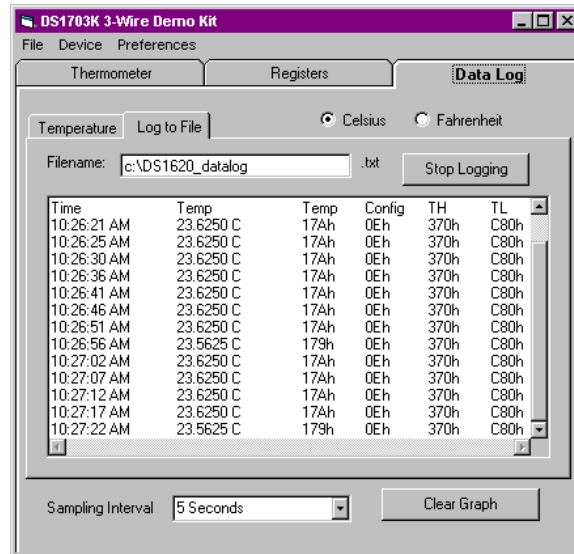
A screen shot of the software logging data can be seen in Figure 11. The user should note that the sampling interval is the same for both the data file and the temperature chart. Also note that the Celsius or Fahrenheit option button applies to both the data file and chart as well. It is not possible to plot one temperature mode and log data in another.

After the text box contains 50 lines of data, the software saves the data to a text file. The name and location of this text file is determined by the small text box labeled *Filename:*. If only a small amount of data is needed, press the *Stop Logging* button to force the software to save the current data to a text file. If the text file gets longer than 1 million lines, a new file is made with an integer value appended to the end of the name. For example, if DS1620_datalog.txt is greater than 1 million lines, a new file will be started titled DS1620_datalog1.txt.

DS1626/DS1726 OPERATION

DS1626/DS1726 Thermometer Tab

If the DS1626 or DS1726 is selected in the *Device Selection* form, the *Thermometer* screen shown in Figure 12 is loaded. With this screen displayed, the software continually reads the temperature and configuration registers from the part. The readings happen approximately 2.5s after the previous reading ends. The contents of the temperature register are shown on the form next to the thermometer in hexadecimal, Celsius, and Fahrenheit. The thermometer graphic also updates and tracks the Celsius temperature. The High Temperature Threshold (TH) and Low Temperature Threshold (TL) flags from the configuration register can be monitored in the bottom right of the form.

Pressing the *Start Temperature Conversion* button on this screen sends the Start Convert T (51h) command to the part. Pressing the *Stop Temperature Conversion* button sends the Stop Convert T

(22h) command to the part. The last button, *Soft POR*, sends the Software POR (54h) command to the part, and the part initiates a power-on reset.

Figure 12. DS1626/1726 Thermometer Tab
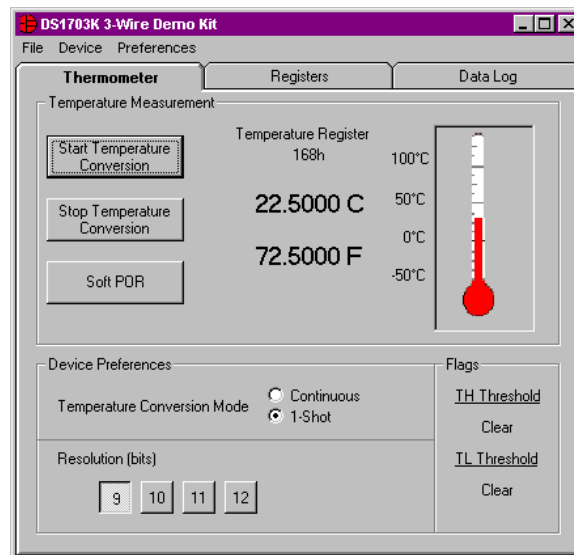
In the *Device Preferences* section of the form there are two option buttons used to determine the conversion mode. These buttons allow the user to select either the 1-shot or continuous conversion mode. Selecting either option causes the software to issue a Read Config (ACh) command, modify the 1SHOT bit (bit 0), and then issue a Write Config (0Ch) command.

The bottom section of the form allows the user to select the resolution the device is to use to report temperature. Pressing any of these buttons changes the contents of the configuration register to the desired resolution state. The software reads the configuration register by sending Read Config (ACh), then modifies the R0/R1 bits, and finally writes the data after sending the Write Config (0Ch) command.

DS1626/DS1726 Registers Tab
The first tab available within the *Registers* tab is the *Configuration Register* and is shown in Figure 13. This page gives access to the bits in the configuration register. The details of using this page are described in the *DS1620/DS1720 Register Tab* section.

# Figure 13. DS1626/1726 Configuration Register
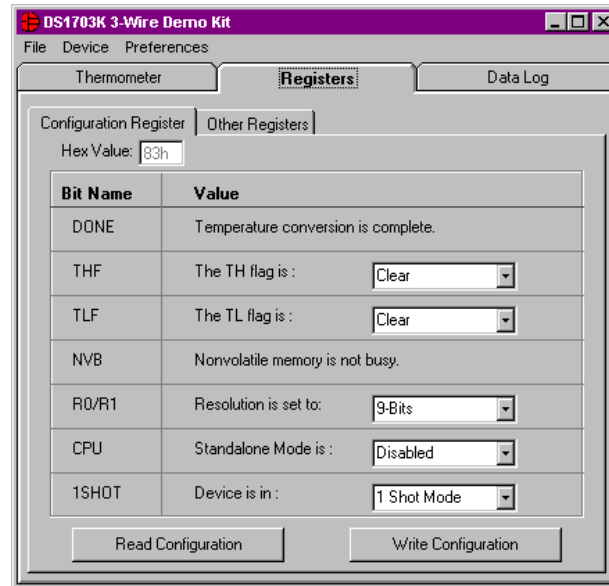
The second tab available to access registers is the *Other Registers* tab. This tab displays information regarding the Counter, Slope, TH, and TL registers and is exactly like the *DS1620/DS1720* tab. Please refer to that section for a complete description. The final tab available to the user is the *Data Log* tab. This tab is exactly like the *DS1620/DS1720 Data Log* tab, and that section should be read for detailed information.

DS1722 OPERATION

DS1722 Thermometer Tab

Selecting the DS1722 from the *Device Selection* form loads the screen shown in Figure 14. This is the *Thermometer* tab for the DS1722.

With this screen displayed, the software continually reads the temperature and configuration registers from the part. The readings happen approximately 2.5s after the previous reading ends. The contents of the temperature register are shown on the form next to the thermometer in hexadecimal, Celsius, and Fahrenheit. The thermometer graphic also updates and tracks the Celsius temperature.

Figure 14. DS1722 Thermometer Tab
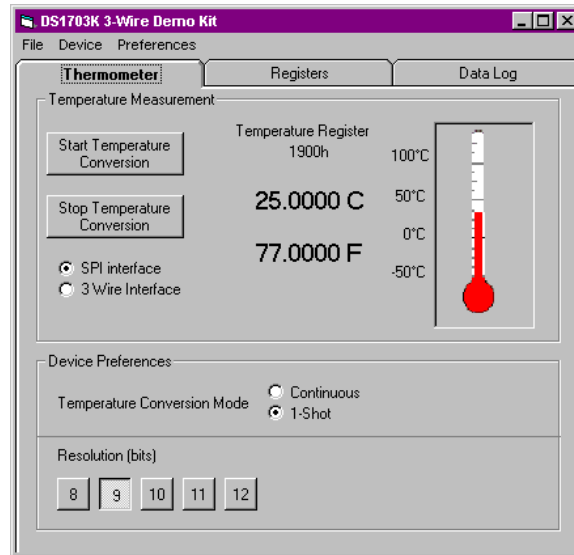
The first item of importance on this form is the SPI or 3-wire Interface option button. When using the DS1722, this should be the first option selected to ensure the part communicates properly. Although these buttons do not change anything internal to the part, the software transmits and receives data much differently based on the option chosen. If the SPI interface is chosen please note that the communication process is quite slow. The DS9123 serial interface module is not designed for SPI data transfer, and thus the process is tedious. All commands are functional, but the software may be slow to respond to button presses and changes.

The two large buttons toward the top left of the form are used to start and stop temperature conversions. The functionality of these buttons is directly tied to the status of the option buttons located in the *Device Preferences* section. If the 1-Shot mode is selected, clicking *Start Temperature Conversion* reads the configuration register from address 00h, sets the 1SHOT bit (bit 4), then writes the data to address 80h. If the DS1722 is in Continuous conversion mode, pressing the button does nothing. Pressing the *Stop Temperature Conversion* button will put the device in 1-Shot mode. The configuration register is read from address 00h, the SD bit (bit 0) is set, and then the data is written to address 80h.

The bottom section of the form allows the user to select the resolution the device is to use to report temperature. Pressing any of these buttons changes the contents of the configuration register to the desired resolution state. This is done by reading address 00h, modifying the R0-R2 bits, and then writing the data to address 80h.

DS1722 Registers Tab
The second tab for the DS1722 is the *Registers* tab. This tab displays the status of the configuration register. When this tab is selected the configuration register is not read every 2.5s as indicated in the previous section. However, the temperature register is still read. The three combo boxes on the right side of the form allow the user to view the current settings of the register, and change them to a different setting. The hex value of the configuration register is shown in the small text box at the top. This text box is read only.

Figure 15. DS1722 Registers Tab

Pressing the *Read Configuration* button sends the address 00h to the DS1722, reads the data byte, and updates the form. Pressing the *Write Configuration* button sends the address 80h, and then writes the data byte corresponding to the combo boxes. Once the information is written, the register is read and the form is updated to show the current status.

DS1722 Data Log Tab

The final tab available to the user is the *Data Log* tab. When using the SPI interface, the quickest sampling time available is 8s. The software will revert to this value if anything less is selected. Detailed instructions for using this tab can be found in this document under *DS1620/DS1720 Data Log Tab* section.