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FEATURES:

- Full-Featured Evaluation Kit for the DS1702K includes testing software for the *DS1621, DS1721, DS1624, DS1629, DS75, and DS1775* devices. The DS1702K is comprised of five separate and unique software kits: the DS1721K.exe (works for both the DS1621 and DS1721), DS1624K.exe, DS1629K.exe, and the DS75K.exe. Each software package works through the same 2-wire DS1702K board (included in the DS1702K kit) with jumper selections. *The DS75K is completely software compatible with the DS1775 device requirements. However, the SOT23-5 (5-pin socket) is not provided.*

- Compatible with *Windows*™ 95, *Windows* 98, and *Windows* NT Operating Systems.

- Complete read/write access to all registers within the DS1621, DS1721, DS1624, DS1629, and DS75 devices.

- Measures temperatures from the full range of the devices -55°C to +125°C. Fahrenheit equivalent is -67°F to +257°F.

- Celsius and Fahrenheit temperature reading and charting is provided for the DS75, DS1621, and DS1721 devices.

KIT CONTENTS:

1. Separate Programming Software on the CDROM containing the DS1721K.exe, DS1624K.exe, DS1629K.exe and the DS75K.exe "Setup.exe" Installers.

2. 87-1702K-000, 2-Wire Demo board.

3. Demo Kit Documentation Provided on CDROM for each software program.

4. DS9123 *Universal Brick* serial port device and cable.

To use the kit, you will also need:

1. An available Serial Port to connect the DS9123 *Universal Brick* modular data cable.

2. Finally, you will need to provide a +2.7V to +5V regulated power supply with banana-jack leads.

Windows is a trademark of Microsoft.

HARDWARE:

The 2-wire board as shown in Figure 1.0 allows the user to test the functional capabilities of each device. The circuitry allows the user to read the temperature, and to read and write the appropriate registers of the socketed device.
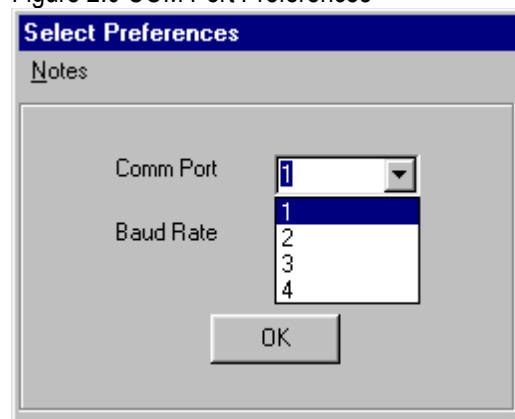
Figure 1.0   2-Wire Board Block Diagram
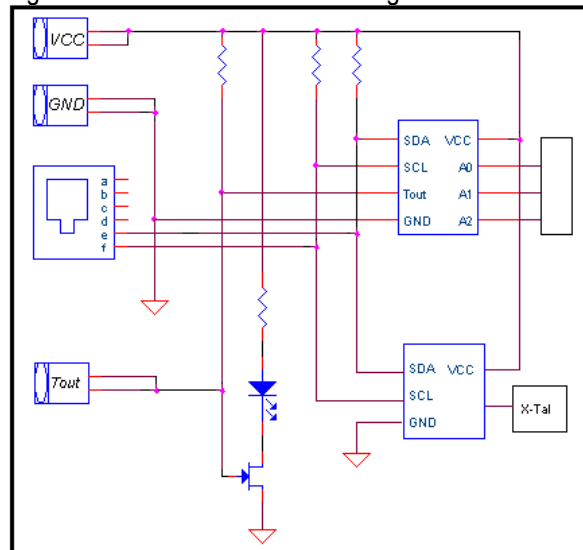
COM PORT SELECTIONS

The serial port selection can be changed by the user at any time by changing the "Comm Port" number on the "Select Preferences" form (see Figure 2.0). The "Select Preferences" form resides under the "Preferences" menu. The baud rate selection also resides on the "Select Preferences" form.

Figure 2.0 COM Port Preferences

USING THE DS1621/1721K EVALUATION KIT

Once the 2-wire cable is connected to the serial port, you may then turn on the +3V to +5V regulated power supply to power the board. Next, run the DS1721K.exe executable to view the screen shown in Figure 3.0.

Figure 3.0 DS1621/1721K Start-Up Splash Screen

The splash screen will appear if the DS9123 module is connected to the serial port. The evaluation board does not need to be present to run the software.

However, upon loading the software some registers are initialized; therefore, it is recommended that the evaluation board be present and powered upon software startup. Power for the DS9123 module is obtained via the serial port. *If the DS9123 module is not present, the software will not load.* The only way to escape this mode is to 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 TEMPERATURE SENSOR TAB

Upon successful loading of the software, the Temp. Sensor screen as shown in Figure 4.0 should appear. The Temperature Sensor screen is a tabbed user interface. All functions of the device may be accessed through this screen. The user may choose to populate the board with either the DS1621 device or the DS1721 device. The user may simply click the "On" button to begin immediately reading the device temperature in both Celsius and Fahrenheit.

As the evaluation board is designed to test no more than two devices at a time, the user must choose which device will be socketed. If testing the DS1621, the user may click on the "->1621" tree-view to obtain access to all of the DS1621 internal registers or by simply clicking on the "1621" radio button.

Figure 5.0 illustrates the tree-view when the user clicks on the "1621" radio button. All of the DS1621 device registers are displayed. By clicking on each of the commands in the tree-view, the user may execute a command such as "Start Conversions" or read and write to specific registers. The

software is designed to initialize the DS1721 device upon start up and to look for the device at address "000". The user may change the address by clicking the appropriate address at the top of the tab. Corresponding jumpers JP1, JP2, and JP3 or JP5, JP6, and JP7 should be in place. When the DS1721 150mil SO is used, the device will be placed in the OTS socket. Jumpers JP11 and JP12 will be removed when this socket is populated with any part other than the DS1629. JP9, JP10, and JP13 will be added for addresses other than "000".

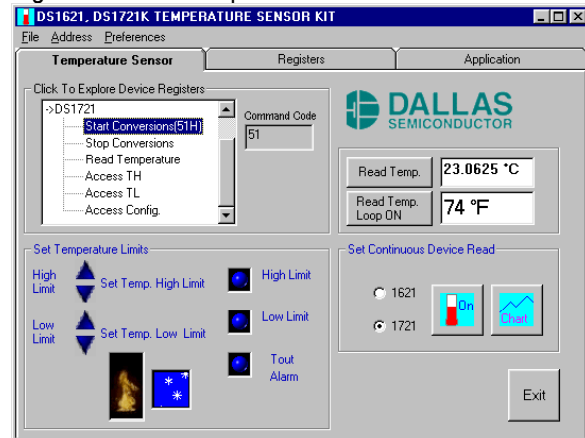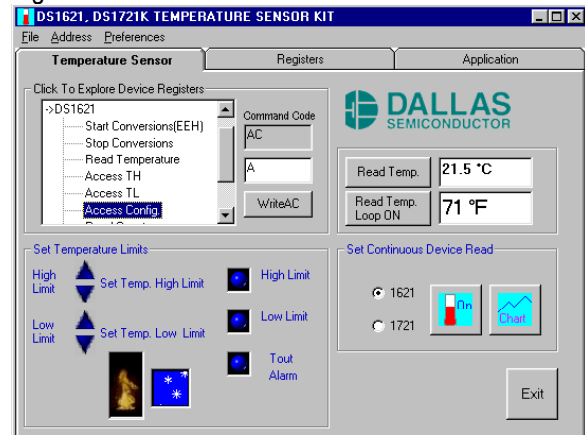Figure 4.0 The Temperature Sensor Screen


Figure 5.0   DS1621 Device Access

TEMPERATURE SENSOR ALARMS

The Temperature High and Temperature Low Flags are set and monitored in the Configuration Register. By writing to A1h and A2h the user may set the Temp. High and Temp. Low registers, respectively. When either alarm flag is set in the Configuration Register, the alarm is detected by software and the appropriate led(s) is (are) set from blue to red accordingly to indicate an alarm condition.

The user may click the blue Temp. High and Temp. Low arrows on the user interface to set the limits in the appropriate registers (see Figure 6.0). Any click on these arrows automatically writes to the corresponding register.

Note: The DS1621 alarm status flags (THF and TLF) are retained in nonvolatile memory in the Configuration Register. When these bits have been set by an alarm condition, they can only be cleared by writing 0 to these bits (i.e., by writing "A" to the Configuration Register).

Figure 6.0 Temperature Sensor Alarms
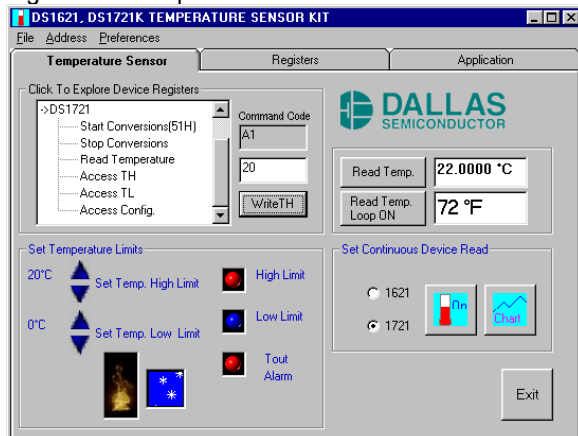
TEMPERATURE CHARTING

By clicking the "Chart" button next to the "On" button, the software will begin plotting the device temperature (see Figure 7.0). The user must click the "On" button to view continuous real-time temperature data. Otherwise, the last temperature reading will be plotted indefinitely. Since this plot is performed via a dynamic reading of the device temperature register, any changes in device temperature will be immediately detected and plotted.

There are three scales for plotting the device temperature. The software is set to display the "Room Temperature" scale as the initial setting.

The "Room Temperature" scale is from +15.75°C to +26.25°C or about +60.35°F to +79.25°F. The "Mid Scale" and "Full Scale" settings are also available to view variations and wider temperature extremes.

Note: If the current temperature is above +26.25°C, the user must click the "Mid Scale" or "Full Scale" radio buttons to see the plot. The program does not set the scale changes automatically.

The "Chart Temp." button can be used to clear an existing temperature chart and to plot new temperature data.

When the user clicks "OK" the temperature plot is hidden, but still active. Following the initial "Chart" command, the user will should click "Chart Temp." to continue to view the dynamic temperature data plot.

Figure 7.0 DS1621/1721K Temperature Charting
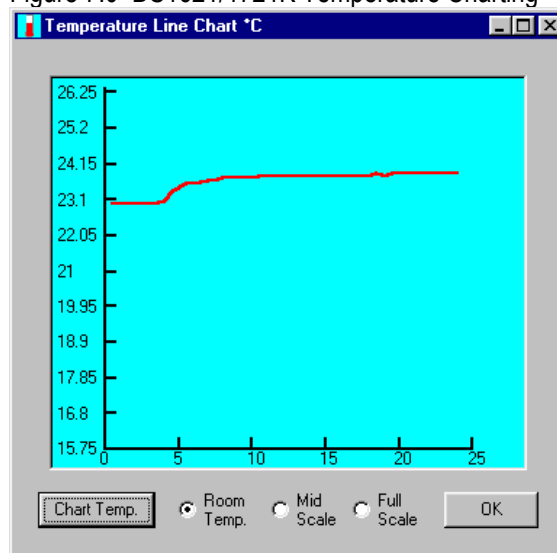
THE REGISTER ACCESS TAB

To view the Register Tab (see Figure 8.0) simply click on the word "REGISTERS" at the top of the tab form. The Register Tab provides user access to both the DS1621 and the DS1721 device internal registers.

The following list of commands are available via the Register Tab:

1621 Start(EEh): When clicked, this command button sends an "EEh" to the device to start temperature conversions for the 1621 device. This must be done prior to reading the temperature, otherwise the device will not update temperature readings.

Stop Conversions(22h): This command is used to halt the continuous conversion mode.

1721 Start(51h): This is the start temperature conversion command button for the DS1721.
Write Config. Reg.(ACh): This command writes the command code in the adjacent edit box to the configuration register.

Read Config. Reg.(ACh): The user may read the configuration register to determine the status of the Temp. High and Temp. Low flags or to set the polarity of Tout as well as monitor conversion completion. See the "Operation And Control" section for the DS1621 and DS1721 data sheets.

Read Temp. Loop On/Off: When clicked, the command performs a continuous read of the temperature register, as shown in Figure 3.0.

Write TH (A1h): This command writes the contents of the adjacent edit boxes (two bytes) to the Temp. High register.

The value written will set the temperature high threshold for operation of the Tout output.

Read TH (A1h): This command allows the user to read the contents of the Temp. High register. See "Command Set" in the data sheets.

Write TL (A2h): This command writes the contents of the adjacent edit boxes (two bytes) to the Temp. Low register. The value written will set the temperature Low threshold for operation of shutting off the Tout output.

Read TL (A2h): This command allows the user to read the contents of the Temp. Low register. See "Command Set" in the data sheets.

Note: For the DS1721 the Alarm LEDs are self-clearing when the power is cycled. For the DS1621 the user must clear the Temp. High and Temp. Low Flags in the Config. Register to clear the Alarm LEDs.

1621 Read Counter (A8h): This command reads the value of the counter byte from the DS1621. The DS1721 does not have a corresponding register.

1621 Read Slope (A9h): This command reads the value of the slope byte counter from the DS1621. The DS1721 does not have a corresponding register

1721 Set 9 to 12-Bit Resolution: This set of commands is controlled by writing to the R1,R0 bits in the configuration. The DS1621 does not have corresponding bits as all conversions have 9-bit resolution.

Figure 8.0   Register Access Tab
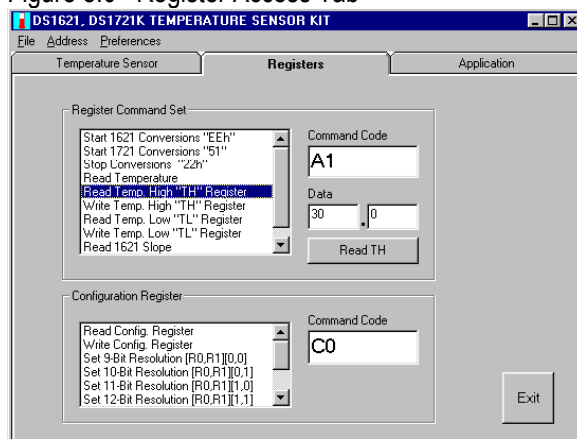
One-Shot Bit: This command is controlled by writing to the Configuration Register. If 1Shot is "1", the DS1621 or the DS1721 will perform and store one temperature conversion upon reception of the Start Convert T protocol. If 1 Shot is "0", either device will perform continuous conversions.

Set/Clear Polarity Bit: This command is controlled by writing to the Configuration Register. If POL is "1", the active state of the Tcom output of either the DS1621 or the

DS1621 will be high. A "0" stored in this location sets the thermostat output to an active low state. The power-up default state is "1" (active high).

THE DEVICE APPLICATION TAB

The Device Application Tab may be accessed by clicking "APPLICATION" at the top of the tab form.

The Device Application Tab provides a color block diagram of the DS1721 which, at a block level, is the functional equivalent of the DS1621. Differences between the two devices exist in the resolution of the temperature reading, the "Start Conversion" command, and the DS1621 provides a slope byte counter as well as an "NVB" bit in the Configuration Register.

As shown in Figure 9.0, the Tout output can be used to turn on an external fan (provided by the user) once the pre-set temperature limit has been exceeded. This output may also be used for any number of other signaling functions to the processor or simply be used with an LED as an On/Off indicator, as demonstrated on the 2-wire evaluation board.
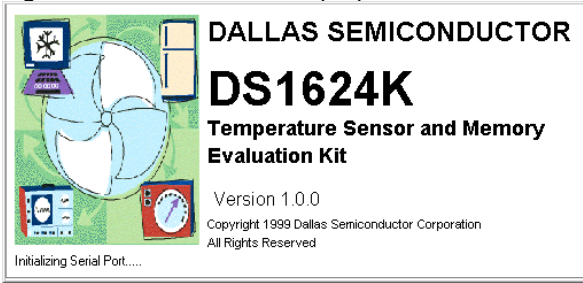
Figure 9.0 Device Application Tab
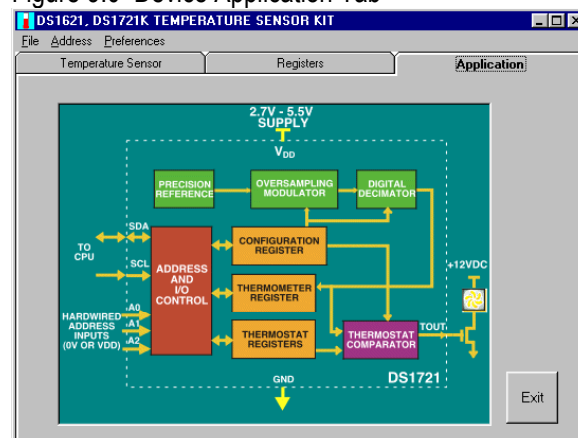
USING THE DS1624K EVALUATION KIT

Once the 2-wire cable is connected to the serial port, you may then turn on the +3V to +5V regulated power supply to power the board. Next, run the DS1624K.exe executable to view the screen shown in Figure 10.0. The splash screen will appear if the DS9123 module is connected to the serial port. The evaluation board does not need to be present to run the software. However, upon loading the software some registers are initialized, therefore it is recommended that the evaluation board be present and powered upon software startup. Power for the DS9123 module is obtained via the serial port. *If the DS9123 module is not present, the software will not load.* The only way to escape this mode is to 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.

Figure 10.0 DS1624K Start-up Splash Screen

DALLAS SEMICONDUCTOR

DS1624K

Temperature Sensor and Memory Evaluation Kit

Version 1.0.0

Copyright 1999 Dallas Semiconductor Corporation
All Rights Reserved

Initializing Serial Port.....

THE TEMPERATURE SENSOR TAB

Upon successful loading of the software, the Temp. Sensor screen shown in Figure 11.0 should appear. The Temperature Sensor screen is a tabbed user interface. All functions of the device may be accessed through this screen. The user must populate the board with the DS1624 device in the DIP socket provided.

The user may simply click the "On" button to begin immediately reading the device temperature in both Celsius and Fahrenheit.

Figure 11.0 The Temperature Sensor Tab
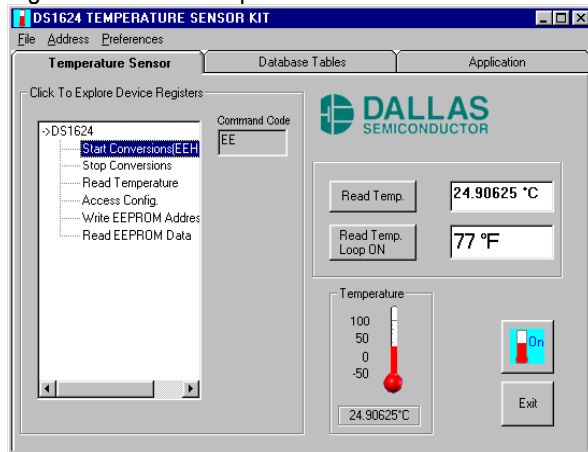
The user may click on the "->DS1624" tree-view (see Figure 15.0) to obtain access to all of the DS1624 internal registers.

The software is designed to initialize the DS1624 device upon start up and to look for the device at address "000". The user may change the address by clicking the appropriate address located under the "Address" tab. Corresponding jumpers JP1, JP2, and JP3 should be in place.

Table 1.0 illustrates the Command Set for the four internal device registers plus the command code for the beginning

address of the 256 bytes of EEPROM memory. These commands are described in detail in the following paragraphs.

Table 1.0 Command Set

DS1624 COMMAND SET

INSTRUCTION	DESCRIPTION	PROTOCOL
	TEMPERATURE CONVERSION COMMANDS	
Read Temperature	Read last converted temperature value from temperature register.	AAh
Start Convert T	Initiates temperature conversion.	EEh
Stop Convert T	Halts temperature conversion.	22h
	MEMORY COMMANDS	
Access Memory	Reads or writes to 256–byte EEPROM memory.	17h
Access Config	Reads or writes configuration data to configuration register.	ACh

THE DS1624 COMMAND SET

Read Temperature [AAh]: This command reads the last temperature conversion result from the Thermometer Register in the format described in the "OPERATION-Measuring Temperature" section of the data sheet. If one's application can accept thermometer resolution of only 1.0°C, the master only must read the first data byte and follow with a NACK and STOP. For higher resolution, both bytes must be read.

Start Convert T [EEh]: This command begins a temperature conversion. No further data is required. In one-shot mode, the temperature conversion will be performed and then the DS1624 will remain idle. In continuous mode, this command will initiate continuous conversions.

Stop Convert T [22h]: This command stops temperature conversion. No further data is required. This command may be used to halt a DS1624 in continuous conversion mode. After issuing this command, the current temperature measurement will be completed, and then the DS1624 will remain idle until a Start Convert T is issued to resume conversions.

Access Memory [17h]: This command instructs the DS1624 to access the user-EEPROM array, starting with the specified byte address. Read/write depends upon the state of the R/W* in the 2-wire control byte.

Access Config [ACh]: If R/W* is 0, this command causes the next data byte value to be written into the configuration register (see Table 2.0). If R/W* is 1, the next data byte read is the value stored in the configuration register.

Table 2.0 DS1624 Configuration Register

CONFIGURATION/STATUS REGISTER							
DONE	1	0	0	0	0	1	1SHOT

DONE = Conversion Done bit. "1"=Conversion complete, "0"= conversion in progress.

1SHOT = Temperature Conversion Mode. If 1SHOT is "1", the DS1624 will perform one temperature conversion upon reception of the Start Convert T protocol. If 1SHOT is "0", the DS1624 will continuously perform temperature conversions and store the last completed result in the Thermometer Register. The user has read/write access to the nonvolatile bit, and the factory default state is "0" (continuous mode).

THE DATABASE TABLES TAB

The DS1624K Evaluation Kit has been designed to provide data logging and printing of both temperature and EEProm data. There are two separate data tables provided within the Microsoft Access database. All 256 bytes of EEProm data are stored in the Access database table while only 60 temperature readings are captured and stored.

Figure 12.0, illustrates the listview access to both the Configuration Register and the Command Set device registers available through the Database Tables Tab. The user may set or clear the *1Shot mode* as well as *Start* and *Stop Conversions*. The user may also access the *1Shot* and *Done* bits by simply clicking the "Read Config. Register" command in the listview.

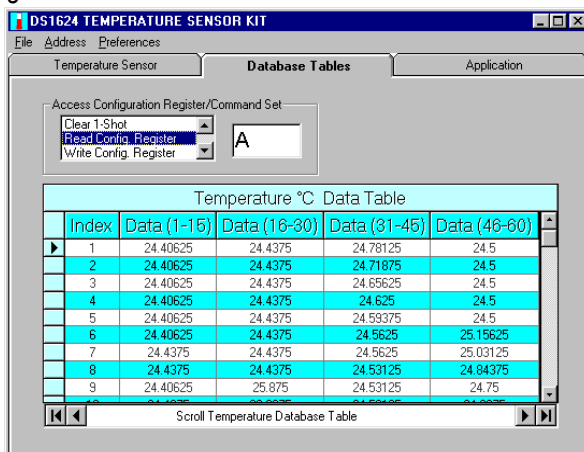Figure 12.0   Database Tables Tab

Figure 13.0 illustrates the "Load Temp. Data" function of the program. Through the File menu selection, the user may activate the "Load Temp. Data" command function that will automatically and immediately read real-time temperature data directly into the database table. Temperature data can also be directed the user's network

or local printer, or saved to the "TempData.txt" text file that will be created to reside within the program folder.

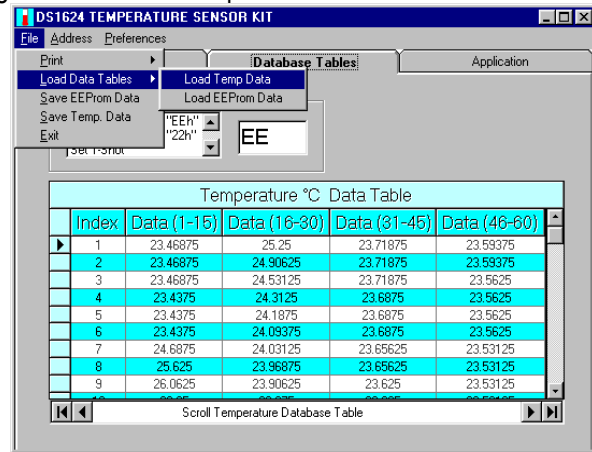Figure 13.0   Load Temperature Data

Figure 14.0 illustrates the "Load EEProm Data" function of the program. Through the File menu selection, the user may activate the "Load EEProm Data" command function which will automatically and immediately read real time 256 bytes (addresses 00 to FF) of EEPROM data directly into the database table. EEPROM data can also be directed the user's network or local printer, or saved to the 1624EE.txt text file which will be created to reside within the program folder.

It should be noted that the database tables are not write-enabled; therefore, they cannot be changed from the executeable program. To change EEPROM data, the user should make use of the "Write EEPROM Address & Data" command in the listview.

Figure 14.0   Load EEPROM Data
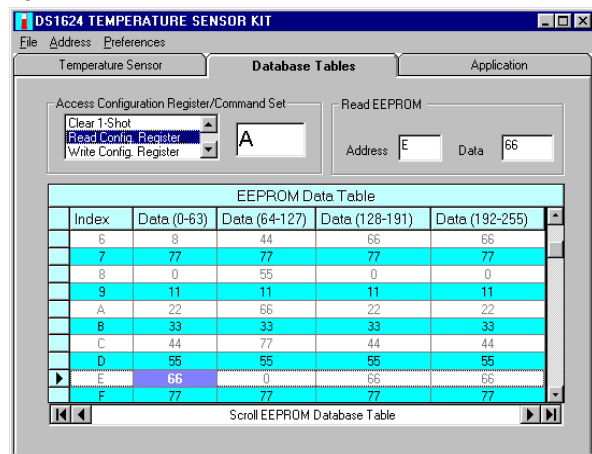
The user can also read EEPROM data from the "Save EEProm Data" menu selection (see Figure 15.0).   This selection is available under the file menu. When the user clicks the "Save EEprom Data" button, the program begins an immediate read of all 256 bytes of EEPROM data,

which is sequentially read into the text window. As long as the form is activated, the user may scroll and view the data. However, when the form is deactivated the EEPROM data is no longer available to view from the program. The data is however, available in the newly created (or updated) file called "1624EE.txt" text file, which is created to reside alongside the program executable within the program folder.

Figure 15.0   Save EEProm Data
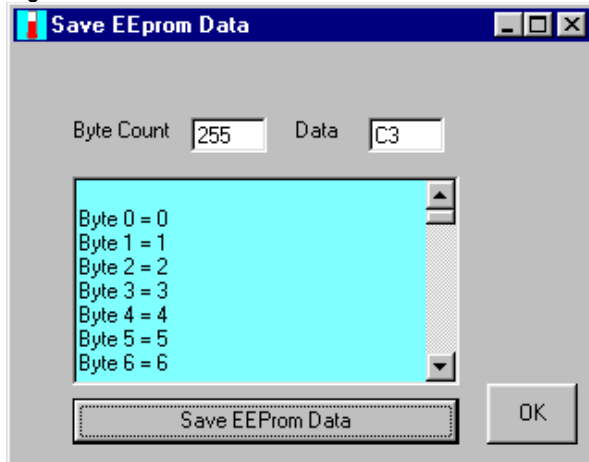
THE APPLICATION TAB GRAPHIC

Figure 16.0 provides a block diagram that illustrates the internal functions of the DS1624. There are four major functional areas of the device. In a typical application, the 2-wire circuitry will interface to a CPU. The "Address and I/O Control" block provides read/write access to the internal registers and the "Temperature Sensor" interfaces to the "Status Register and Control Logic."

The 256 bytes of user EEPROM is also illustrated in the block diagram as "EEPROM Memory (256 bytes)." As shown, the EEPROM is accessed independently of the temperature registers.

Figure 16.0   Application Tab
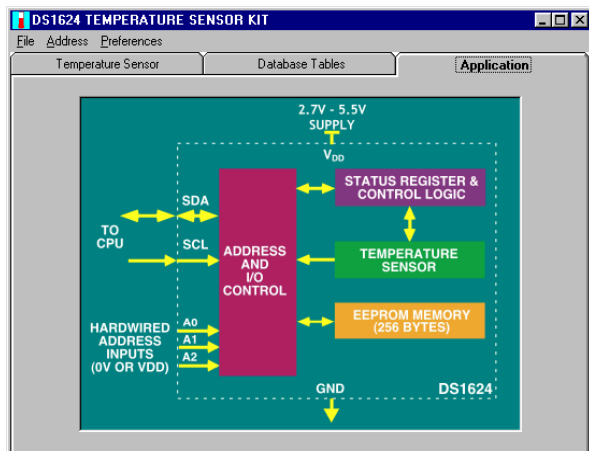
USING THE DS1629K EVALUATION KIT

Once the 2-wire cable is connected to the serial port, you may then turn on the +3V to +5V regulated power supply to power the board. Next, run the DS1629K.exe executable to view the screen shown in Figure 17.0.

Figure 17.0 DS1629K Start-up Splash Screen

The splash screen will appear if the DS9123 module is connected to the serial port. The evaluation board does not need to be present to run the software.

However, upon loading the software some registers are initialized, therefore it is recommended that the evaluation board be present and powered upon software startup. Power for the DS9123 module is obtained via the serial port. *If the DS9123 module is not present, the software will not load.* The only way to escape this mode is to reboot or Ctrl-Alt-Del to End Task. If problems occur during the program start-up, check the DS9123 unit to make sure it is properly connected. Remove and reconnect if necessary.

The software is designed to initialize the DS1629 device upon start up and to look for the device at address "111". The device is internally hardwired to this address. Thus only one DS1629 device can reside on a 2-wire bus to avoid bus contention.

Add Jumpers JP11 and JP12 for the XTAL. Jumpers JP11 and JP12 will be removed when this socket is populated with any part other than the DS1629. *Jumpers JP5, JP6, JP7, JP9, and JP10 must be removed for the DS1629.*

Jumper JP13 should be added to view the open collector output of the OSC signal at TP5. JP8 should be added and JP4 should be removed to view the alarm output Tout at the red banana jack J3 and TP4.

THE OPERATION TAB

Upon successful loading of the software, the "Operation" screen as shown in Figure 18.0 should appear. The Operation screen is a tabbed user interface.

The user may simply click the "Read Temp" button to begin immediately reading the device temperature in both Celsius and Fahrenheit.

Figure 18.0 The Operation Tab
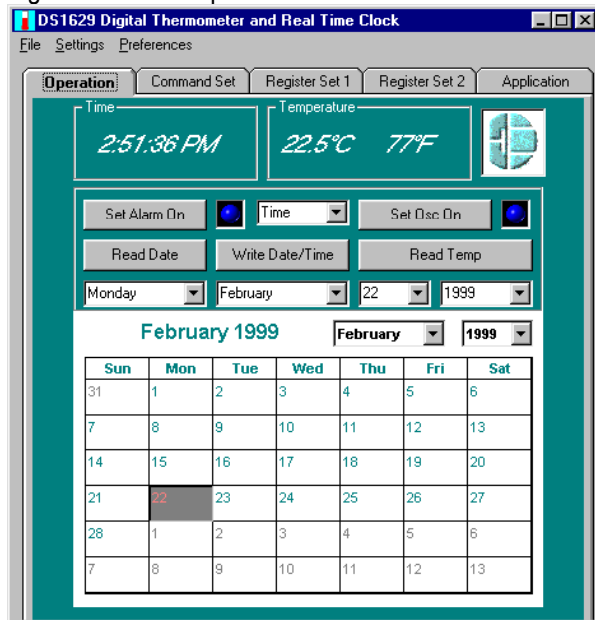
Set Alarm On-   When clicked, this command button automatically reads the adjacent combo box to determine if the user has selected "Time", "Thermal", or "Either." The data will be "ORed" with the user OSC frequency selection. The program then writes the appropriate selection to the Configuration Register. If the "Time" or "Either" selection is made, the program will automatically read the current system time before setting a one minute alarm delay.

When the led turns from blue to green, the alarm is set and is waiting for alarm flags to be set in the Configuration Register. There will be a one minute delay before the alarm is activated. When activated, the alarm LED will turn red and the appropriate .wav sound will also be activated.

When the "Thermal" or "Either" selection is made, the data is "ORed" with the OSC user selection before being written to the Configuration Register. Prior to making this selection the user should set the "Temp. High" and "Temp. Low" limits. However, upon device initialization, the program automatically writes "30" and "0" to the "Temp. High" and "Temp. Low" registers, respectively. The user may test the temperature alarm by clicking the "Set Alarm On" button, then on the "Command "Set" tab the user may click "Access TH". The user may then set the "Temp. High" limit below the current temperature to activate the alarm flags in the Configuration Register that will in turn activate the program alarm, thus turning the alarm LED red and appropriate alarm sound. See Table 1.0 for Configuration Register flags.

Set OSC On- Located under the "Settings" menu is the form for the Oscillator Output. The program is designed to initially disable the OSC output where OSC1=OSC0=0, then set the device such that OSC1=OSC0=1. This ensures a known state at start-up which is in agreement with the data sheet. See Figure 5.0 Access Oscillator output control.

Read Date- When the user clicks this button, the program automatically reads the contents of the DS1629 clock internal clock registers and loads this data into the day, month, date, and year combo boxes so that the user may view the device clock settings with the single click of a button. The user may click the "Register Set 1" tab to view the full date and time. Upon initial power-up the device should read "Sunday:January:1:2000" This reading is a clear indication that the clock has not previously been set with the current date and time.

Write Date/Time- By clicking this button, the user can load the current system date and time into the DS1629 internal registers. The program will automatically select the combo box settings and load them directly into the device internal clock registers.

Read Temp- When this button is clicked, the program will begin a continuous read of the device temperature data. The command button reads as "Read Temp. On" during a continuos read and "Read Temp. Off" when the temperature function has been shut off.

CONFIGURATION REGISTER FUNCTIONS

The DS1629 internal device Configuration Register is designed according to a two-byte structure (see Table 3). *The user may write control bits to only the MSB portion of the register.* If data is written to the LSB portion of the register, problems occur in device interpretation of the data. Both the MSB and LSB portions of the register contain status information and thus can be read simultaneously.

Table 3.0 Configuration/Status Register

Configuration/Status Register

OS1	OS0	A1	A0	0	CNV	POL	1SH	MSB
MSb							LSb	
CAF	TAF	CAL	TAL	0	0	0	0	LSB

1SH = Temperature Conversion Mode. If 1SHOT is "1", the DS1629 will perform one temperature conversion upon reception of the Start Convert T protocol. If 1SHOT is "0", the DS1629 will continuously perform temperature conversions and store the last completed result in the Thermometer Register. The user has read/write access to

the nonvolatile bit, and the factory default state is "0" (continuous mode).

POL = ALRM Polarity Bit. If POL = "1", the active state of the ALRM output will be high. A "0" stored in this location sets the thermostat output to an active low state. The user has read/write access to the nonvolatile POL bit, and the factory default state is "0" (active low).

CNV = Power-up conversion state. If CNV=0 (factory default), the DS1629 will automatically initiate a temperature conversion upon power-up and supply stability. Setting CNV=1 will cause the DS1629 to power up in a standby state. Table 4.0 illustrates how the user can set 1SH and CNV, depending on the power consumption sensitivity of the application.

Table 4.0 Thermometer Power-up Modes

CNV	1SH	MODE
0	0	Powers up converting continuously (factory default)
0	1	Automatically performs one conversion upon power-up. Subsequent conversions require a Start Convert command.
1	0	Powers up in standby; upon Start Convert command, conversions will be performed continuously.
1	1	Powers up in standby; upon Start Convert command, a single conversion will be performed and stored.

A1, A0 = Alarm Mode. Table 5.0 defines the DS1629 alarm mode, based on the settings of the A1 and A0 bits. These bits define what event will activate the ALRM output. The alarm flags, CAF, TAF, CAL, TAL, are functional regardless of the state of these bits. Both locations are read/write and nonvolatile, and the factory default state disables the ALRM output (A1=A0=0).

Table 5.0 Alarm Mode Configuration

A1	A0	ALARM MODE
0	0	Neither Thermal or Time (Disabled)
0	1	Thermal only
1	0	Time only
1	1	Either Thermal or Time

OS1, OS0 = Oscillator Output Setting. Table 6.0 defines the frequency of the OSC output, as defined by the settings of these bits. Both locations are read/write and nonvolatile, and the factory default state sets the OSC frequency equal to the crystal frequency (OS1=OS0=1). The output should be disabled if the user does not intend to use it to reduce power consumption.

Table 6.0 OSC Frequency Configuration

OS1	OS0	OSC FREQUENCY
0	0	Disabled
0	1	$1/8f_0$
1	0	$1/4f_0$
1	1	f_0

CAF = Clock Alarm Flag. This volatile status bit will be set to "1" when the clock comparator is in an active state. Once set, it will remain "1" until reset by writing to or reading form either the clock register or clock alarm register. A "0" in this location indicates the clock is not in an alarm condition. This is a read- only bit.

TAF = Thermal Alarm Flag. This volatile status bit will be set to "1" when the thermal comparator is in an active state. Once set, it will remain "1" until measured temperature falls below the programmed TL setting. A "0" in this location indicates the thermometer is not in an alarm condition. This is a read-only bit.

CAL = Clock Alarm Latch. This volatile status bit will be set to "1" when the clock comparator becomes active. Once set, it will remain latched until DS1629 power is cycled. A "0" in this location indicates the clock has never been in an alarm condition since the DS1629 was powered-up. This is a read-only bit.

TAL = Thermal Alarm Latch. This volatile status bit will be set to "1" when the thermal comparator becomes active. Once set, it will remain latched until DS1629 power is cycled. A "0" in this location indicates the DS1629 temperature has never exceeded T_H since power-up. This is a read-only bit.

It should be noted that the LSB of the Configuration Register is read-only. Writing to the LSB will cause problems with device command interpretation.

COMMAND REGISTER FUNCTIONS

The device Command Set consists of eleven basic commands, which be discussed in detail in the following pages. The "Command Set" tab (see Figure 19.0) provides access to all devices registers and commands. By clicking on the tree-view, each command is activated.
The command set for the DS1629 is as follows:

Access Config [ACh]: If R/W* is 0, this command writes to the configuration register. After issuing this command, the next data byte value is to be written into the configuration register. If R/W* is 1, the next data byte read is the value stored in the configuration register. Because the MSB of the configuration register is read/write and the LSB is read-

only, the user only needs to write one byte to the register. One or two bytes can be read.

Figure 19.0   Command Set Tab
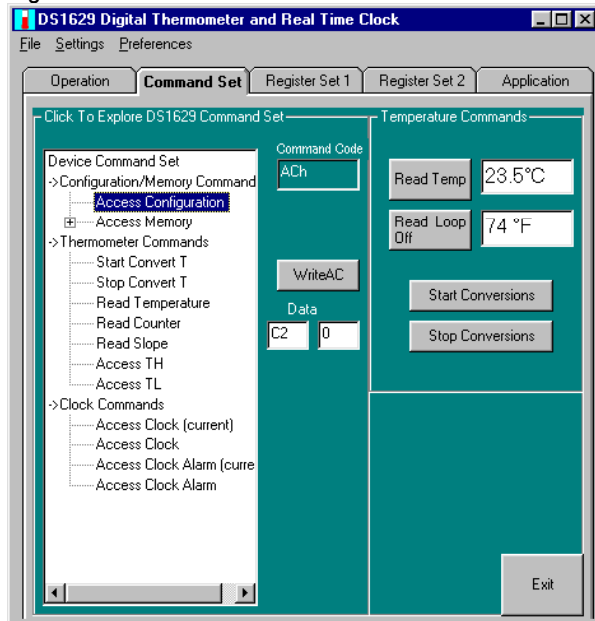
Start Convert T [EEh]: This command begins a temperature conversion. No further data is required. In one-shot mode, the temperature conversion will be performed and then the DS1629 will remain idle. In continuous mode, this command will initiate continuous conversions. Issuance of this protocol may not required upon DS1629 power-up, depending upon the state of the CNV bit in the configuration register.

Stop Convert T [22h]: This command stops temperature conversion. No further data is required. This command may be used to halt a DS1629 in continuous conversion mode. After issuing this command, the current temperature measurement will be completed, and then the DS1629 will remain idle until a Start Convert T is issued to resume conversions.

Read Temperature [AAh]: This command reads the last temperature conversion result from the Thermometer Register in the format described in the "OPERATION-Measuring Temperature" section of the data sheet. If one's application can accept thermometer resolution of only 1.0°C, the master only must read the first data byte and follow with a NACK and STOP. For higher resolution, both bytes must be read.

Read Counter [A8h]: This command returns the 8-bit COUNT_REMAIN value, used for high resolution thermometer calculations.

Read Slope [A9h]: This command returns the 8-bit COUNT_PER_C value, used for high resolution thermometer calculations.

Access Clock [C0h]: Accesses the DS1629 clock/calendar register. If R/W* is 0 the master will write to the clock register (set the clock). If R/W* is 1, the clock register is read. The Clock register is addressed, so the user must provide a beginning byte address, whether a read or write is performed. A write to or read from this register or the Clock Alarm register is required to clear the clock alarm flag (CAF).

Access Clock Alarm [C7h]: Accesses the DS1629 clock alarm register. If R/W* is 0 the master will write to the clock alarm register (set/change the alarm). If R/W* is 1, the clock alarm register is read. The Clock Alarm register is addressed, so the user must provide a beginning byte address, whether a read or write is performed. A write to or read from this register or the Clock register is required to clear the clock alarm flag (CAF).

Access TH [A1h]: If R/W* is 0, this command writes to the TH register. After issuing this command, the next two bytes written to the DS1629, in the format described for thermostat set-points, will set the high temperature threshold for operation of the ALRM output and TAF/TAL flags. If R/W* is 1, the value stored in this register is read back.

Access TL [A2h]: If R/W* is 0, this command writes to the TL register. After issuing this command, the next two bytes written to the DS1629, in the format described for thermostat set-points, will set the high temperature threshold for operation of the ALRM output and TAF flag. If R/W* is 1, the value stored in this register is read back.

Access Memory [17h]: This command instructs the DS1629 to access the user-SRAM array, starting with the specified byte address. Read/write depends upon the state of the R/W* in the 2-wire control byte.

TEMPERATURE SENSOR ALARMS

The temperature high and low flags are set and monitored in the internal device registers. By writing to address "A1h" and address "A2h" the user may set the Temp. High (Access TH) and Temp. Low (Access TL) registers, respectively.

When the temperature exceeds the Access TH limit, the "ALRM" output at pin 3 will be activated. The polarity of the ALRM output is determined by setting "POL" bit in the Configuration Register. IF POL = "1", the active state of the ALRM output will be high and the inactive or normal state will be low. A "0" stored in the POL bit location sets the thermostat ALRM output to an active low state and a normal or inactive high state. The ALRM device output can be monitored at the Tout red banana jack or at TP4 on the 2-Wire board (87-1702K-000).

The "TAF" status bit flag is monitored by the program to determine when the temperature high limit has been exceeded. The program then sets the alarm LED on the "Operation" tab and will also activate the appropriate temperature alarm sound. The temperature low limit must then be exceeded to remove the "TAF" flag in the configuration status register and resume normal operation. The user may simulate these conditions by first setting the "Access TH" temperature below the current room temperature. This will cause the "TAF" status flag to be set thus initiating an alarm condition. Then, the user must set the "Access TH" above the current room temperature before setting the "Access TL" limit above the current room temperature. Once this sequence of actions is complete, the "TAF" flag will be cleared by the device and the user should then set the "Access TL" limit below the current room temperature to resume normal operation. Upon power-up, the program automatically sets Access TH = "30" and Access TL = "0".

CLOCK REGISTER COMMAND SET

The user may gain access to the Clock Command Set by clicking "Access Clock" on the tree-view. When clicked, the program will immediately read all seven internal device clock registers. The user may read the system time by clicking "Access Clock(current)". This command collects the user's PC time and segments the data into a format usable by the DS1629. The user can then simply click the "Write Clock" button to write the current system time directly into all seven device registers. See Figure 20.0 Access Clock Commands.

Please note that the clock registers are partitioned according to the data sheet section "Operation-Real Time Clock/Calendar", with clock register "00" containing seconds data and clock register "06" containing the year. It is also important to note that register "03" contains the day information and that Sunday is defined as day one.

READ TEMPERATURE COMMANDS

There are several ways to read the device temperature. As stated previously, the user may click the "Read Temp" button on the "Operation" tab to activate a timer loop which continuously reads register "AAh" to acquire the current temperature.

The user may also click "Read Temperature" on the tree-view to perform a single read of the temperature register without setting a loop timer. A single temperature read can also be performed by clicking the "Read Temp" button on the "Command Set" tab.

A read timer loop is set when the user clicks the "Read Loop Off" button. The program activates the timer loop and displays the caption "Read Loop On" as long as the timer loop is activated. However, as there are several other functions, including the alarm functions which use timers, it is not recommended to leave the read temperature loop on while performing other functions because of the reduced response time of the program.

Figure 20.0 Access Clock Commands
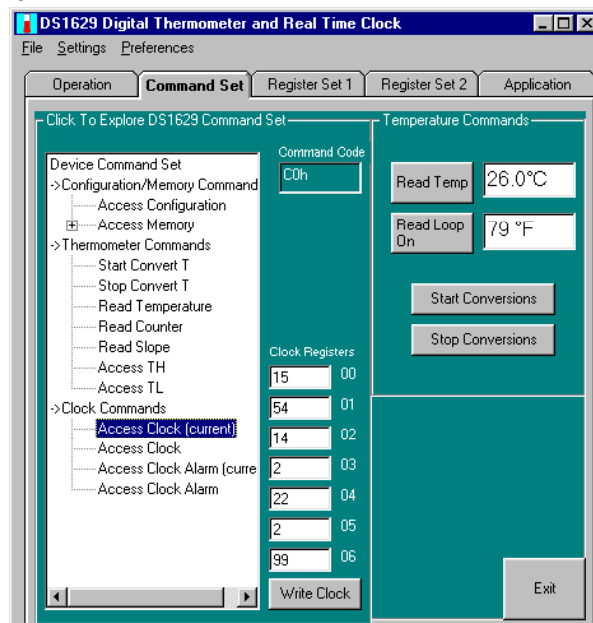
CLOCK/TEMPERATURE ALARM SOUNDS

Audible alarm sounds are provided for user convenience. The user may click the "Settings" menu for access to the alarm sounds form (see Figure 21.0). The program selects the bell as the default alarm sound. However, the user may choose the voice sounds if he so chooses. The user may also select the "Test" button to make certain that the *.wav files are present and in the correct folder for program access. The *.wav files must be in the same directory as the program executeable to work properly. Once the alarm sounds form is active, the user may click F5 on the keyboard to test all available sounds.

Figure 21.0 Access Alarms Sounds

Figure 22.0 Oscillator Output Control

Figure 23.0 Saving 1629 SRAM

OSCILLATOR OUTPUT FREQUENCY CONTROL

The Oscillator Output control form (see Figure 22.0) resides under the "Settings" menu. Upon program start-up, the oscillator output is set to OSC f0, where the MSB of the configuration register are set as OSC1=OSC0=1. However, during program initialization these bits are first set to zero to disable the oscillator output before setting the default state of these bits to one.

The user may click "Set OSC On" on the "Operation" tab to activate the oscillator output frequency. However, since the default state is on, the program will first disable the output to allow the user to choose the desired frequency from the "Settings" menu oscillator output form. If the user does not select a frequency of OSC 1/8f0 or OSC 1/4f0 or OSC f0, the default setting of OSC f0 will be activated. By clicking the "Enable Oscillator" button on the "Register Set 2" tab, the program will automatically set OSC f0.

SAVING DEVICE SRAM DATA

The 1629 device has 32 bytes of SRAM storage, which is saved to the text file "1629SRAM.txt" when the user clicks the "Save SRAM Data" command button on the Save DS1629 SRAM Data form (see Figure 23.0). This form is located under the "File" menu.

When clicked, the program first reads the SRAM contents before writing the data to a text file. The "1629SRAM.txt" file typically resides in the program executeable directory. As text data, the file can be read by any text editor program.
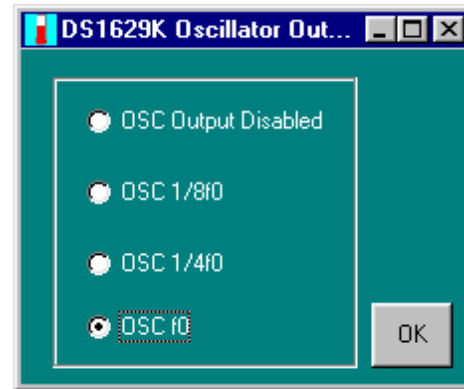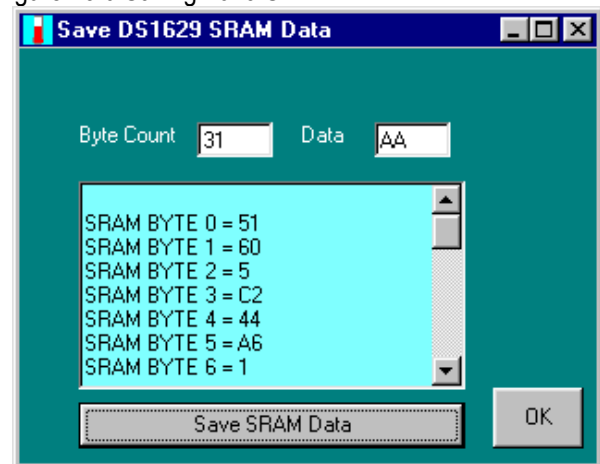
REGISTER SET 1 TAB-CLOCK REGISTER

By clicking on the "Register Set 1" tab (see Figure 24.0), the user interface will become active. The "Register Set 1" tab allows the user to both read and write to the DS1629 real time clock.

At program start-up the real time clock registers are read to determine the clock settings. The user may click "Read Loop Off" to start a read loop time, which will perform continuous reads of the device clock registers. By clicking "Read Clock Register", a single read of all seven clock registers is performed.

Once the user has entered the desired data into each of the seven time keeping registers, he may click the "Write Clock Register" command button to write the data directly into all seven registers simultaneously. The user should also be reminded that the current time is written into the device if "Write Time/Date" is clicked on the "Operation" tab.

Figure 24.0 Register Set 1 Tab
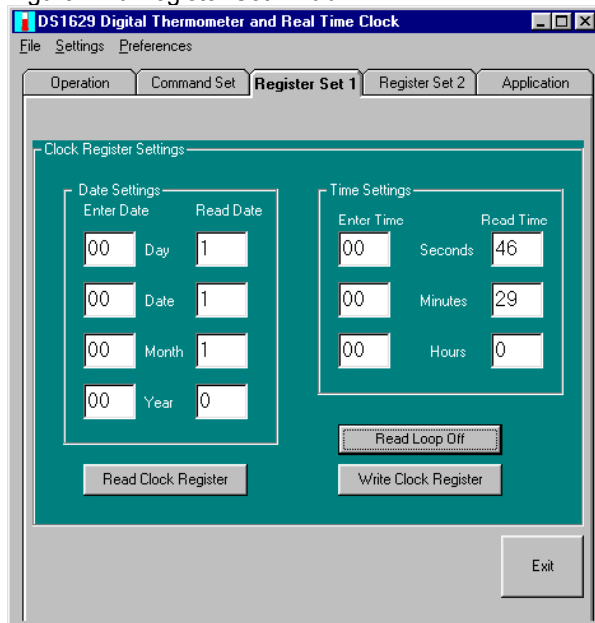
REGISTER SET 2 TAB FUNCTIONS

The "Register Set 2" tab (see Figure 25.0) allows the user access to the Configuration Register functions as well as the Slope and Counter registers. This screen also allows for automatic enabling and disabling of the oscillator output, as well as providing access to the Clock Alarm and SRAM registers.

Read Config.- By clicking the button a timer is activated which immediately sets the command button caption to "Read Loop On" and performs a continuous read of the MSB and LSB of Configuration Register.

Write Config.- Each click this button will cause a one-time write to the MSB of the Configuration Register. Write commands to the LSB portion of the Configuration Register are not allowed because the LSB provides only status information and writing data to the LSB can and will cause problems in device command interpretation.

Read Slope- The Slope register returns the COUNT_PER_C value when this button is clicked.

Read Counter- The Counter register returns the COUNT_REMAIN value when this button is clicked.

Enable Oscillator- The OSC1 and OSC0 bits in the Configuration Register are both set high when this button is clicked.

Disable Oscillator- The OSC1 and OSC0 bits in the Configuration Register are both set low when this button is clicked.

Read Alarm- By clicking this button, all four DS1629 clock alarms registers are read into the text boxes located directly below the "Read Alarm" command button.

Write Alarm- When the user has entered the desired alarm data into each of the four clock alarm registers located directly below the command button, the "Write Alarm" button may be clicked to write the alarm setting into the device. The settings are automatically read back under the "Read Alarm" column.

Figure 25.0 Register Set 2 Tab
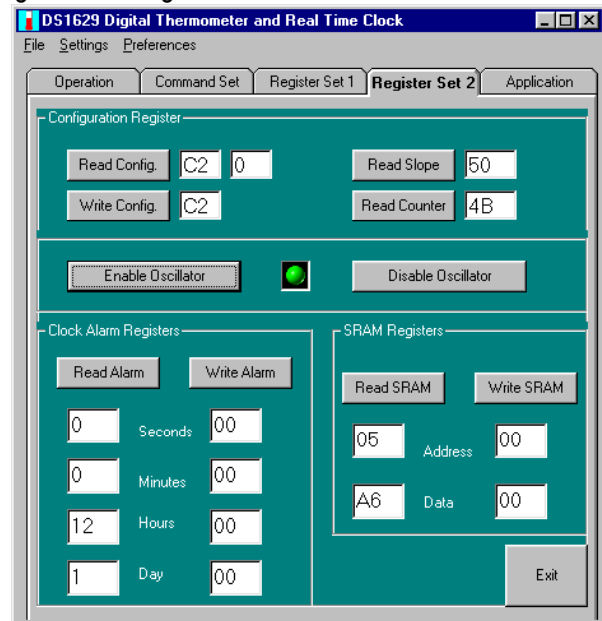
Read SRAM- Upon program start-up, the SRAM address pointer is set to location "00". The user may enter into the address text box "00" to "1F". Since there are only 32 bytes of SRAM space, if the user reads from an address higher than "1F" the SRAM address pointer will automatically wrap around back into the 32 byte address space available.

Write SRAM- The user may enter any hex address in the specified 32 byte range along with any byte wide hex data in the appropriate text box. When the user clicks the "Write SRAM" button, the data is written to the specified address.

THE APPLICATION TAB GRAPHIC

Figure 26.0 provides a block diagram that illustrates the internal functions of the DS1629. There are eleven major functional areas in addition to the crystal and oscillator divider circuits. In a typical application, the 2-wire circuitry will interface to a CPU. The "Address and I/O Control" block provides read/write access to the internal registers. The "Temperature Sensor" interfaces to the "Thermal Register" and the "Thermal Alarm" register. The thermal registers interface to the "Thermal Alarm Comparator" and the "Alarm Select" circuitry.

Figure 26.0 Application Tab
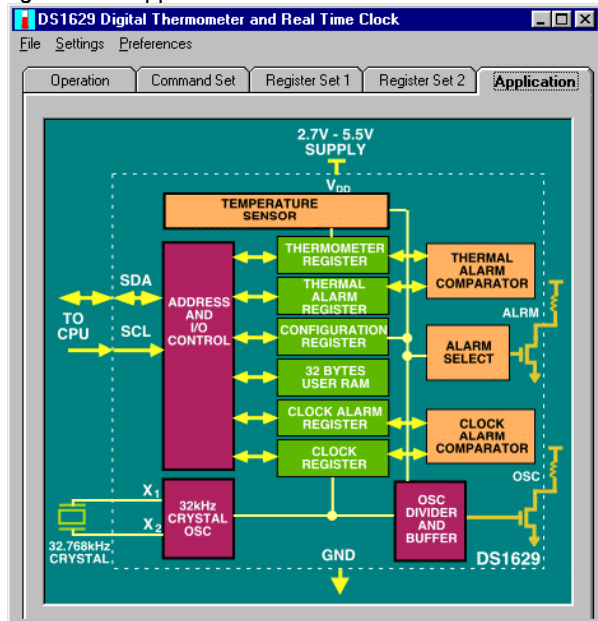
The "Clock Alarm Register" interfaces with the "Clock Register" circuitry which in turn interfaces with the "Clock Alarm Comparator" circuitry. The "Alarm Select" circuitry will determine whether a temperature or clock alarm mode has been selected. This selection will be set by the user through the "Configuration "Register."

The user may set the alarm mode and the oscillator frequency through the "Configuration "Register", which also provides alarm status. The DS1629 also provides both alarm and variable frequency oscillator outputs.

The 32-bytes of user SRAM is also illustrated in the previous block diagram. As shown, the SRAM is accessed independently of the other device registers and is not connected with the alarms or clock and temperature registers.

USING THE DS75K EVALUATION KIT

Once the 2-wire cable is connected to the serial port, you may then turn on the +3v to +5v regulated power supply to power the board. Next, run the DS75K.exe executable to view the screen shown in Figure 27.0.

The splash screen will appear if the DS9123 module is connected to the serial port. The evaluation board does not need to be present to run the software. However, upon loading the software some registers are initialized, therefore it is recommended that the evaluation board be present and powered upon software startup. Power for the DS9123 module is obtained via the serial port. *If the DS9123 module is not present, the software will not load.* The only way to escape this mode is to 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.
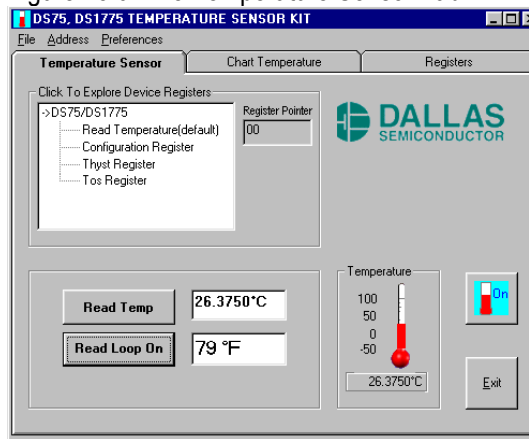
Figure 27.0 DS75K Start-up Splash Screen
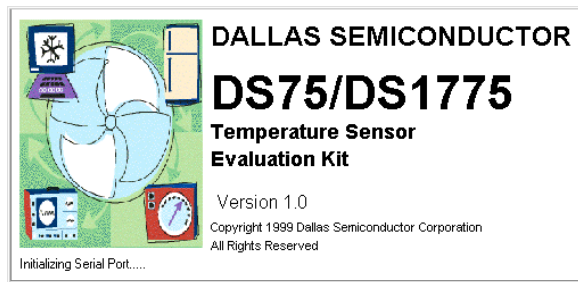
THE TEMPERATURE SENSOR TAB

Upon successful loading of the software, the Temp. Sensor screen as shown in Figure 28.0 should appear.

Figure 28.0 The Temperature Sensor Tab

The Temperature Sensor screen is a tabbed user interface. All functions of the device may be accessed through this screen. The user must populate the board with the DS75 device in the OTS socket provided. *The DS1775 is the functional equivalent of the DS75 but has a fixed address of location "000". The DS1775 is not included in this kit because of its package type.* The package type of the DS1775 is an SOT23-5 (5-pin package) while the DS75 is an 8-pin SO (150mil) and will fit into the OTS socket provided on the 87-1702K-000 2-Wire Board.

Click the "On" button to begin immediately reading the device temperature in both Celsius and Fahrenheit.

Click on the "->DS75/DS1775" tree-view to obtain access to all of the DS75 internal registers.

The DS75 internal registers are organized as device pointers. Table 7.0 illustrates the settings for the four internal pointer registers of the DS75. Please note that the DS75 and the DS1775 are functionally equivalent. The

only functional difference is that the DS1775 operates at a fixed address of "A2=0, A1=0, A0=0" while the DS75 may reside from address "000" to address "111".

Table 7.0 Pointer Registers

Pointer Register Structure

POINTER	ACTIVE REGISTER
00h	Temperature (default)
01h	Configuration
02h	T_{HYST}
03h	T_{OS}

The software is designed to initialize the DS75 device upon start up and to look for the device at address "000". The user may change the address by clicking the appropriate address located under the "Address" tab. Corresponding jumpers JP5, JP6 and JP7 should be in place. When the DS75 150mil SO is used, place the device in the OTS. JP9, JP10 and JP13 will be added for addresses other than "000".

TEMPERATURE SENSOR ALARMS

The temperature high and temperature low flags are set and monitored in the internal device registers. By writing to 03h and 02h the user may set the Temp. High (Tos) and Temp. Low (Thyst) registers, respectively.

When the high temperature exceeds Tos the output O.S. will be active. The polarity of the O.S. output is determined by setting the "POL" bit. If POL = "1", the active state of the O.S. output will be high and the normal, or standby state will be low. A "0" stored in this location sets the thermostat output to an active low state with a high O.S. output inactive state.

For user convenience, the blue Tos LED on the "Chart Temperature" tab turns red when the Tos high limit has been exceeded. It will turn blue again when the device temperature falls below the Thyst setting.

CONFIGURATION REGISTER

The DS75 Configuration Register is shown in Table 8.0

Table 8.0 DS75 Configuration Register

CONFIGURATION/STATUS REGISTER

0	R1	R0	F1	F0	POL	TM	SD

If SD is set to "1", the DS75 will go into a shut down mode and will revert to a low-power standby mode. The power-up default state is "0" (continuous conversion mode).

If TM is set to "1" the device will revert from its normal comparator mode to an interrupt mode. The power-up default state is "0" (comparator mode).

F1 and F0 are O.S. Fault Tolerance bits. The fault tolerance defines the number of consecutive conversions returning a temperature beyond limits required to set the O.S. output in an active state. The DS75 will power-up at "00", such that a single occurrence will trigger a fault. For higher fault tolerances, F0 and F1 can be changed a shown in Table 9.0.

Table 9.0 Fault Tolerance

Fault Tolerance Configuration Table 4

F1	F0	Consecutive conversions beyond limits to generate fault
0	0	1
0	1	2
1	0	4
1	1	6

R1 and R0 are the Thermometer Resolution bits. Table 10.0 defines the resolution of the digital thermometer, based on the settings of these two bits. There is a direct trade-off between resolution and conversion time. The device default state is "00" (9-bit conversions).

Table 10.0 Thermometer Resolution

Thermometer Resolution Configuration

| R1	R0	Thermometer Resolution	Max Conversion Time
0	0	9–bit	0.15s
0	1	10–bit	0.3s
1	0	11–bit	0.6s
1	1	12–bit	1.2s

TEMPERATURE CHARTING

By clicking the "Chart" icon button, the software will begin plotting the device temperature (see Figure 29.0). Since this plot is performed via a dynamic reading of the device temperature register, any changes in device temperature will be immediately detected and plotted. The user may also click "Halt" to halt the temperature plot and click "Chart" to restart the plot.

There are three scales for plotting the device temperature. The software is set to display the "Room Temperature" scale as the initial setting. The "Room Temperature" scale is from +15.75°C to +26.25°C or about +60.35°F to +79.25°F. The "Mid Scale" and "Full Scale" settings are also available to view variations and wider temperature extremes.

The "Chart Temp." icon button can be used to clear an existing temperature chart and to plot new temperature data.

Figure 29.0 DS75K Temperature Charting
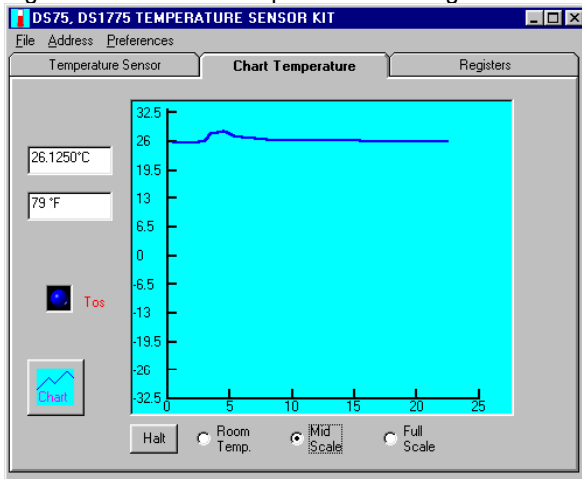
Note: If the current temperature is above +26.25°C, the user must click the "Mid Scale" or "Full Scale" radio buttons to see the plot. The program does not set the scale changes automatically.

THE REGISTER ACCESS TAB

To view the Register Tab, as shown in Figure 30.0, simply click on the word "Registers" at the top of the tab form. The Register Tab provides user access to the device internal registers.

The following list of commands is available via the Register tab:

Read Temp. Loop On/Off (Pointer Register 00): When clicked, the command performs a continuous read of the temperature register, as shown in Figure 30.0.

Configuration Reg. (Pointer Register 01): The user may read the Configuration Register to set the polarity of O.S. output as well as to set the output interrupt mode or to put the device in standby mode. The user may also set the fault tolerance and the thermometer resolution. See the "Operation-Programming" section for the DS75 data sheet.

Write Tos (Pointer Register 03): This command writes the contents of the edit boxes to the Temp. High register. The value written will set the temperature high threshold for operation of the Tos (O.S) output.

Read Tos (Register Pointer 03): This command allows the user to read the contents of the Temp. High register. See "Thermostat Setpoints Programming" in the data sheet.

Write Thyst (Register Pointer 02): This command writes the contents of the edit boxes to the Temp. Low register. The value written will set the temperature Low threshold for operation of shutting off the Tos O.S. output, provided the output is already active.

Read Thyst (Register Pointer 02): This command allows the user to read the contents of the Temp. Low register.

Figure 30.0   Register Access Tab
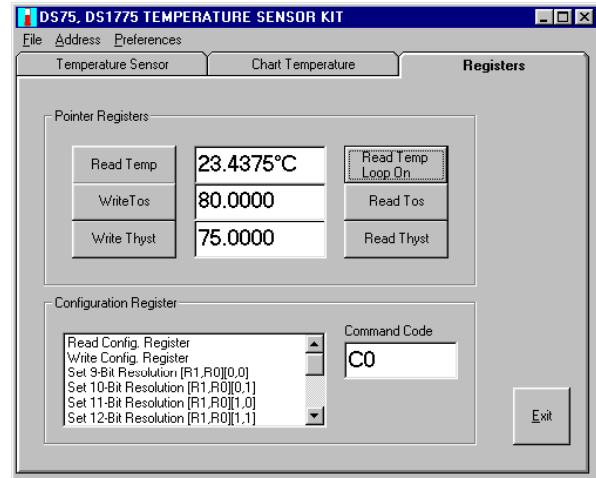
Set 9 to 12-Bit Resolution: This set of commands is controlled by writing to the R1,R0 bits in the Configuration Register.

Set/Clear Polarity Bit: This command is controlled by writing to the Configuration Register. If POL is "1", the active state of the Tos output of the DS75 will be high. A "0" stored in this location sets the thermostat output to an active low state. The power-up default state is "0" (active low output).

Set Fault Tolerance[F1,F0]: This command is controlled by writing to the Configuration Register. By clicking on the ListView on the "Register" tab the user may change the previous conversion setting. For example, by clicking on the "Fault Tolerance[F1,F0][1,1] the user will send "7Ch" to the Configuration Register. This command provides 12-bit Resolution and sets the polarity bit to an active high state along with a Fault Tolerance level of "6".

Set Thermostat Mode TM: This command is also controlled by writing to the Configuration Register. By clicking on the ListView on the "Register" tab the user may set the "TM" bit to "1". Thus, changing the device output from comparator mode "0" to interrupt output mode. See "O.S. Output Transfer Function Figure 2", in the DS75 data sheet.

Shut Down Mode SD: Clicking this command in the ListView of the "Register" tab will set the "SD" bit in the Configuration Register to "1" and put the device in standby mode. The device will stop continuous conversions and the O.S. output will be remain unchanged in comparator mode. The user should expect to see "65" sent to the device Configuration Register. Thus, with this software command, the polarity bit is set to "1" along with a 12-bit temperature resolution.