

### Kit Instructions And Operating Procedures

#### Features:

- Full-Featured Evaluation Kit for the DS1701K with Temperature Sensor reading.
- Compatible with *Windows™ 95*, *Windows™ 98*, and *Windows™ NT* Operating Systems.
- Complete read/write access to all registers within the DS1701K devices and temperature reading for the DS1820, DS18B20, DS18S20, DS1821 and DS1822 devices.
- Measures temperatures from the full range of the devices  $-55^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ . Fahrenheit equivalent is  $-67^{\circ}\text{F}$  to  $+257^{\circ}\text{F}$ .
- Celsius and Fahrenheit temperature readings.

#### Kit Contents:

1. Programming Software CD ROM containing DS1701K.exe Installer.
2. 87-1701K-000 Demo board.
3. DS1701K Demo Kit documentation on CD ROM.
4. DS1820, DS18B20, DS18S20, DS1821 and the DS1822 Demo Devices.
5. DS9123 *Universal Brick™* serial port device and cable.

To use the kit, you will also need:

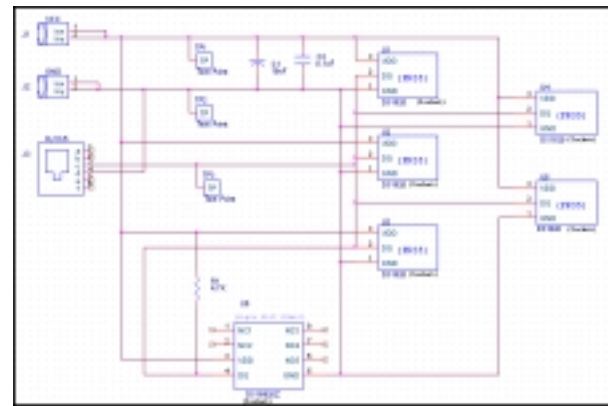
1. An available Serial Port to connect the DS9123 *Universal Brick™* modular data cable.
2. A +3 to +5 volt regulated power supply with banana jack leads.

#### Introduction:

The One-Wire board as shown in Figure 1.0 allows the user to test the functional capabilities of the Dallas Semiconductor thermal devices featuring the 1-wire interface.

The circuitry allows the user to read the temperature, and to read and write the appropriate registers of the socketed device.

**Figure 1.0 1-Wire Board Block Diagram**



#### Setup and Installation

The DS1701K program is a 32-bit application which is designed to run under *Windows™ 95*, *Windows™ 98* or *Windows™ NT*.

The DS1701K installer is designed to be loaded directly onto the user's PC. The Setup.exe file is a compressed executable which prompts the user for the location and drive for installation, then the "Setup" files are placed on the user's hard drive. You must run the "Setup" files to execute the DS1701K program files. Typically, the user will run Setup.exe from the *Windows™ 95* "Start" menu.

Typically, you can begin the installation process from the "Run" menu by opening

“D:\Setup\Setup.exe” located on the CDROM drive then follow the installation instructions. The program will prompt for the desired location on your hard disk. The program is set up for “C:\Program Files\Dallas Semiconductor\DS1701K”. However, you may change this directory by choosing the Browse function and the appropriate directory, then click on the Setup Icon. Run the DS1701K application and the screen shown in Figure 1.1 should appear.

### Using The DS1701K Evaluation Kit

Once the 1-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 DS1701K.exe executable to view the following screen.

Figure 1.1 DS1701K 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 2.0 should appear. The Temperature Sensor screen is a tabbed user interface. All functions of the device may be accessed through this screen.

### Evaluating the DS1821 (Single Drop)

The user must populate the board with the DS1821 Programmable Digital Thermostat device in the socket provided. The user may simply click the “On” button to begin immediately reading the device temperature in both Celsius and Fahrenheit.

*Note: To avoid data collisions with the single-drop device, no other device should be socketed while the DS1821 is under test.*

Figure 2.0 The Temperature Sensor Tab



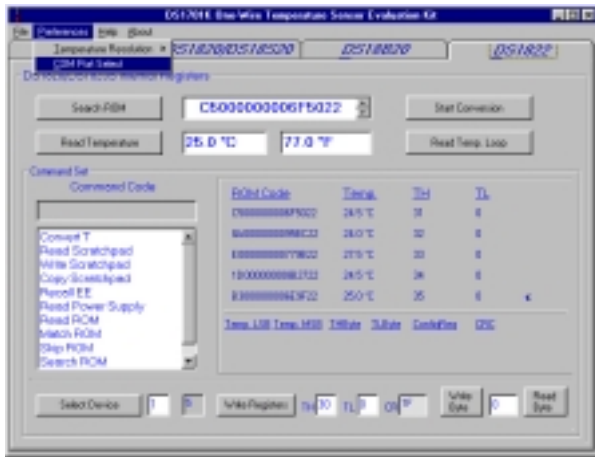
### Multi-Drop Device Access

*Note: The device count is performed during program start-up and at no other time. If you add or remove devices you should re-start the program.*

Upon activation of each tab, the program performs a device initialization routine that automatically reads the Search ROM of each multi-drop device on the bus and performs a temperature reading of all devices.

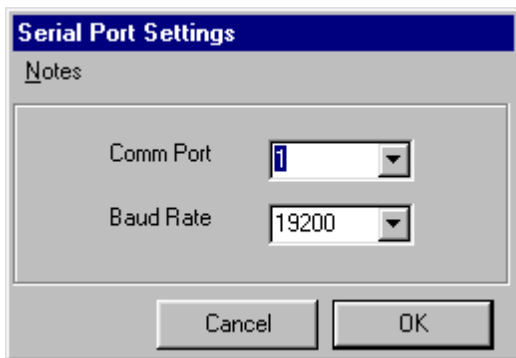
The temperature resolution for the DS18B20 and the DS1822 can be set via the "Preferences" menu, along with the COM port settings. Because the program "learns" the ports settings, you should not change the COM port once a connection is made. If you experience difficulty getting the program to initialize, it may require that you change COM ports to see if this is the problem.

**Figure 3.0 COM Port and Resolution Menu**



Once the COM port is selected (Figure 3.0), the DS9123 should remain connected to that port. The COM port selected by the program must always match the COM port location of the DS9123 serial adapter (Figure 4.0).

**Figure 4.0 COM Port Selection**

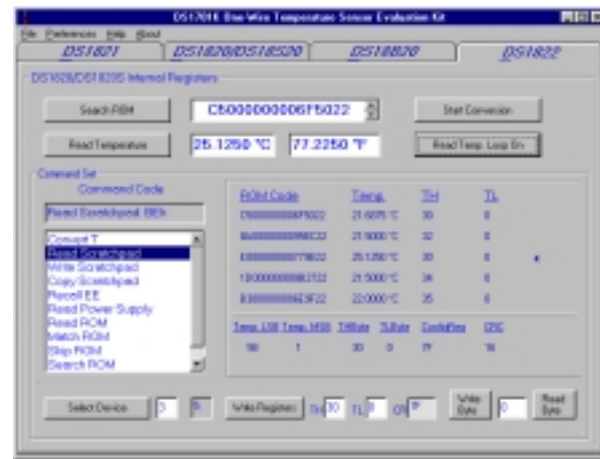


The DS18B20 and DS1822 resolution settings can be made through the menu selection. Because both the DS1820 and DS18S20 have a predetermined 9-bit resolution, the menu selection has no effect on these temperature readings.

The user is required to write the appropriate setting to the device before the device returns the appropriate temperature resolution. The menu command does not write the resolution setting to the device. The menu setting changes the format of the data so that up to 12-bit resolution can be read from the device. The selection menu also places the appropriate data in the config. text box.

The user must then select the device and issue the 'write registers' command so that the device will begin reporting the appropriate data resolution (Figure 5.0).

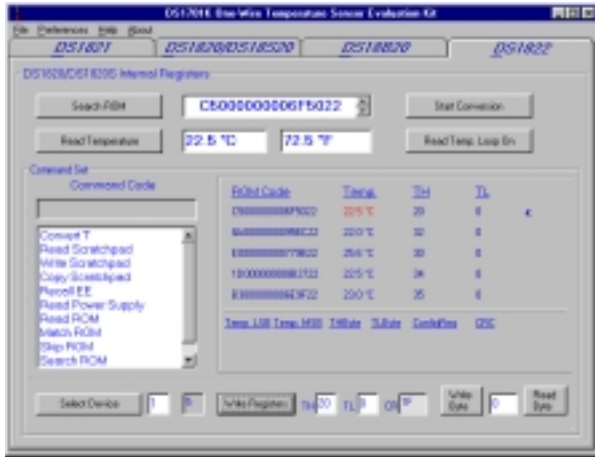
**Figure 5.0 Resolution Selection**



## The DS1701K Alarm Reporting

The user should take note here that the alarm command (ECh) is not used to perform the alarm search because only devices in alarm respond to this command. This evaluation kit uses the DS9123 which requires a response for each command. Instead of using this command we read the TH and TL values of the device and determine through software if these settings exceed the device limits. Using the 'write registers' command the user can set limits, then apply temperature changes to the devices to monitor which limits have been exceeded (Figure 6.0).

**Figure 6.0 Temperature Alarm Settings**

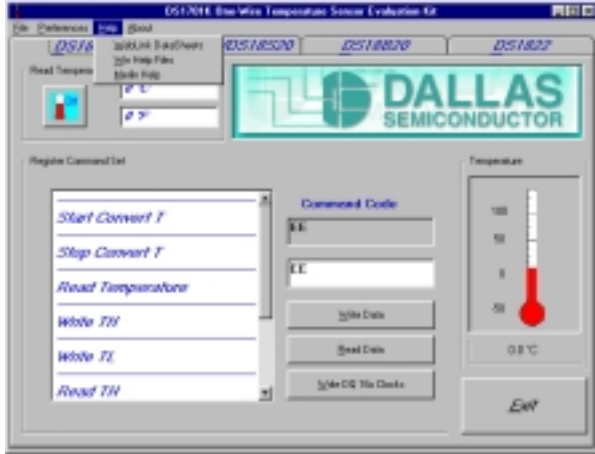


### Parasite Power Usage

Click "Read Power Supply" list item to turn on the strong pullup for parasite power.

### The DS1701K Help Files and DataSheets

**Figure 7.0 Help Menu Selections**



There are three methods of help available to the user:

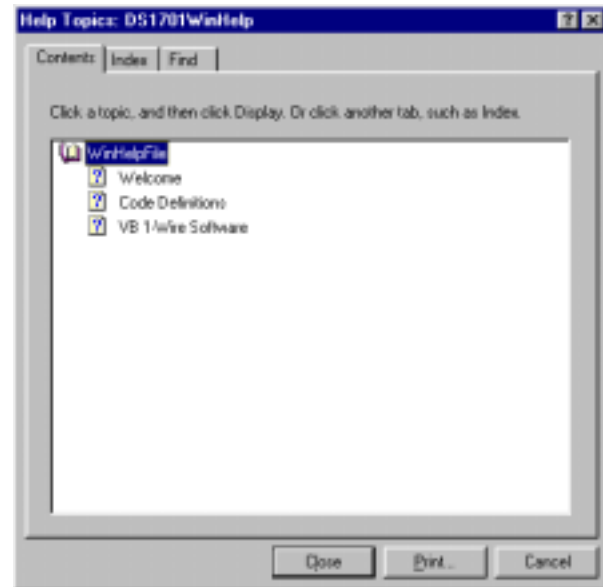
1. Device datasheets can be obtained by linking to the Dallas Semiconductor web pages (Figure 8.0).
2. Win Help provides help with definitions, command codes and provides sample software (Figure 9.0).
3. Merlin Help provides command codes and glossary term definitions (Figure 10.0).

There are also documentation and software folders available on the CDROM. The CDROM information can be obtained via the File->Browse function using Windows™95 or File->Explore through Windows™98.

**Figure 8.0 Datasheet Selection**



**Figure 9.0 WinHelp Help Files**



**Figure 10.0 Merlin Help Files**



**Figure 11.0 About Selection**



User system information may be obtained through the About menu, as well as Company contact info.

## Device Command Codes

The following is a list of command codes for the DS1821 single-drop device, as well as the DS1820, DS18S20, DS18B20 and DS1822 multi-drop devices.

### Start Convert T "EEh"

Start Convert T command = EE hexadecimal. This command initiates a temperature conversion. In One-Shot Mode, the temperature conversion will be performed then the DS1821 will remain idle. In Continuous Mode this command will initiate continuous conversions.

### Stop Convert T "22h"

Stop Convert T command = 22 hexadecimal. This command stops a temperature conversion. This command may be used to halt a DS1821 continuous conversion after the current conversion is completed. The DS1821 will remain idle until a Start Convert T command is issued to resume continuous operation.

### Read Temperature "AAh"

Read Temperature command = AA hexadecimal. This command reads the contents of the register that contains the last conversion result.

### Write TH "01h"

Write TH command = 01 hexadecimal. After issuing this command, the user writes 8 bits of data to the TH (high temp) Register.

### Write TL "02h"

Write TL command = 02 hexadecimal. After issuing this command, the user writes 8 bits of data to the TL (low temp) Register.

### Read TH "A1h"

Read TH command = A1 hexadecimal. After issuing this command, the user reads 8 bits of data present in the TH (high temp) Register.

### Read TL "A2h"

Read TL command = A2 hexadecimal. After issuing this command, the user reads 8 bits of data present in the TL (low temp) Register.

### Write Status "0Ch"

Write Status command = 0C hexadecimal. This would be used for clearing the values of the THF and TLF flags as well as setting polarity and mode bits in the Configuration Register. After issuing this command, the user writes 8 bits of data to the Configuration Register.

### Read Status "ACh"

Read Status command = AC hexadecimal. After issuing this command, the user reads 8 bits of data present the Status and Configuration Register.

## Multi-Drop Device Command Codes

The following is a list of command codes for the DS1820, DS18S20, DS18B20 and DS1822 multi-drop devices.

### Convert T “44h”

Convert T = 44 hexadecimal. This command begins a temperature conversion. The temperature conversion will be performed and " the multi-drop device" will remain idle. If the bus master issues read time slots following this command, the device will output 0 as long as it is busy making a temperature conversion. It will return a 1 when the temperature conversion is complete. If parasite powered, the bus master has to enable a strong pull-up for a period greater than  $t_{CONV}$  immediately after issuing this command.

### Read Scratchpad “BEh”

Read Scratchpad = BE hexadecimal. This command reads the contents of the scratchpad. The reading will commence at byte 0, and will continue until the 9th byte is read. If not all locations are to be read, the master may issue a reset to terminate reading at any time.

### Write Scratchpad “4Eh”

Write Scratchpad = 4E hexadecimal. This command writes into the scratchpad, starting at the TH register. The next three bytes written will be saved in scratchpad memory at address locations 2 through 4. All three bytes must be written before the reset is issued. Address 4 of the DS1820 and the DS18S20 are reserved. Address 4 of the DS18B20 and the DS1822 are the Configuration registers.

### Copy Scratchpad “48h”

Copy Scratchpad = 48 hexadecimal. This command copies the scratchpad into memory. Three bytes, address locations 2 through 4 are stored into memory. Relative to the speed of 1-Wire timing protocol, this operation can be considered immediate. Address 4 of the DS1820 and the DS18S20 are reserved and are not stored. Address 4 of the DS18B20 and the DS1822 are the Configuration registers and are stored along with the TH and TL registers. If parasite powered, the bus master has to enable a strong pull-up for a

period greater than 10 ms immediately after issuing this command.

### Recall EE “B8h”

Recall EE = B8 hexadecimal. This command recalls the temperature triggers TH, TL and the configuration values stored in memory. This recall happens automatically upon power-up so valid data is available in the scratchpad as soon as the device has power applied. With every read data time slot issued after this command has been sent, the device will output its temperature converter busy flag ; 0=busy, 1=ready.

### Read Power Supply “B4h”

Read Power Supply = B4 hexadecimal. With every data time slot issued after this command has been sent, the device will signal its power mode. Parasite Power = 0, External Power Supplied = 1". During a typical read cycle the user will read either 0 or FF.

### Read ROM “33h”

Read ROM = 33 hexadecimal. This command allows the bus master to read the 8-bit family code, unique 48-bit serial number and 8-bit CRC. This command can be used only if there is a single device on the bus. If more than one slave is present on the bus, a data collision will occur when all slaves try to transmit at the same time, producing a wired AND result. This command is not implemented in this evaluation kit.

### Match ROM “55h”

Match ROM = 55 hexadecimal. The Match ROM command, followed by the 64-bit ROM code, allows the bus master to address a specific device on the multi-drop bus. Only the slave device that exactly matches the 64-bit ROM code will respond. All slave devices that do not match the code will wait for a reset pulse. This command is not implemented in this evaluation kit.

### **Skip ROM “CCh”**

Skip ROM = CC hexadecimal. This command can save time in a single-drop bus system by allowing the bus master to access the device functions without providing the ROM code. If more than one slave is present on the bus, a data collision will occur when all slaves try to transmit at the same time, producing a wired AND result.

### **Search ROM “F0h”**

Search ROM = F0 hexadecimal. The Search ROM command allows the bus master to use a process of elimination to identify the 64-bit ROM codes of all slave devices on the bus. The Search ROM process is the repetition of a simple 3-step routine. Read a bit, read the complement of the bit, write the desired value of that bit. The bus master performs this simple 3-step routine on each bit of the ROM. After one complete pass, the bus master has learned one ROM code for a single slave device. The remaining number of devices and their ROM codes may be identified by additional passes. Each device drops off the bus following identification of its ROM code. A reset command during the Search ROM puts all devices back on the bus. Therefore, a reset command is not recommended until all ROM codes are found.

### **Alarm Search “ECh”**

Alarm Search = EC hexadecimal. The flow chart of this command is identical to that of the Search ROM algorithm. The slave device will only respond if an alarm condition has been encountered at the temperature measurement. An alarm condition is defined as a temperature higher than TH or lower than TL. The alarm condition remains set as long as the device is powered or until another temperature measurement reveals a non-alarming value. Following a change in the TH or TL settings, a temperature conversion should be done to validate the alarm condition.

The Alarm Search function is not implemented in this evaluation kit because this function requires that at least one multi-drop device be in alarm. Otherwise, no communication between the device and the software can occur. Since we require a response each and every time we communicate through the DS9123 (which will not be in alarm), this function is omitted.