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CHAPTER 1

INTRODUCTION

The TREQ-L mobile data terminal is a rugged yet economical graphic terminal for use in a wide range of commercial mobile applications. It has been designed with a robust set of industrial-grade features and options.

- Windows® CE 5.0 operating system
- Marvell PXA270 processor (ARMV5TE) with Intel XScale technology running at 416 MHz
- 2 Gbytes non-volatile storage
- 128 MB RAM
- Bright 178 mm (7") TFT color WVGA (800 x 480) display
- Analog-resistive touch screen
- Seven backlit programmable elastomeric function keys
- Backlit programmable elastomeric navigation key
- Built-in speaker and built-in jack for external speaker connection
- Permanent integral cable with strain relief (customizable)
- Tough automotive grade polycarbonate housing
- Custom logo and/or custom keypad text/symbols (optional)
- Sealed housing to protect against dust and light liquid spills
- Stud pattern on the back of the case for industry-standard mounts
- Front and back powered USB host ports
- Support for standard USB keyboards, mice, and memory devices
- One standard serial port, configurable as EIA-232 or EIA-422
- Powered from a 12- or 24-volt supply
- Built-in protection from power transients and spikes (SAE J1455 compliant)
• Power backup circuit providing at least two seconds of up-time in the event of a power failure and notification to application code

• Support for application development with industry standard tools, such as Microsoft Visual Studio 2008, Microsoft Visual Studio 2005, and Embedded Visual C++ 4.0

• Optional TREQ-L developer’s kit that includes: TREQ-L, demo cable, USB memory drive, USB WiFi adapter, USB-to-serial converter, RAM mount, user guide, software development kit, and sample application source code
CHAPTER 2

PRODUCT DESCRIPTION AND ARCHITECTURE

2.1 Hardware

2.1.1 User Interface

Display
The TREQ-L features a TFT color WVGA (800 x 480 pixels) LCD display, 178 mm (7 in.)
diagonal size. The display’s high brightness offers excellent daylight readability.

Touch Screen
A clear analog-resistive touch screen covers the entire display area and can be used for most
input.

Keypad
Along the bottom of the unit are seven backlit, tactile elastomeric keys and a backlit navigation
key. The left-most key is backlit with a red LED; the others are backlit with amber LEDs. The
keys can be independently programmed to perform separate tasks as desired.

Text and/or symbols on the elastomeric keypad may be customized during manufacturing.

External Peripherals
Two USB ports are available on the TREQ-L, with one on the front of the unit for easy access.
These ports can be used to add many other devices, such as a keyboard, mouse, or 802.11
wireless Ethernet device.

2.1.2 Processor

The processor for the TREQ-L is the Marvell PXA270 (ARMV5TE), incorporating Intel
XScale technology. The PXA270 runs at 416MHz.

2.1.3 System and Application Memory

DRAM
The memory system uses 128 Mbytes of SDRAM volatile memory with a maximum band-
width of 400 Mbytes per second.

Flash
The TREQ-L uses an internal 2 Gbyte flash to hold the main Windows CE image and provide
non-volatile storage for user applications and data.
2.1.4 Serial Communications

The TREQ-L has one serial port, designated COM1, that can communicate up to 921,600 baud. Refer to Chapter 9, “Mechanical” for serial port pinout data.

The COM1 serial port can be configured in software to your choice of EIA-232 with hardware flow control (supporting RX, TX, RTS, and CTS) or EIA-422. Refer to section 6.3.5, “Serial Ports” for more information on configuring this port.

The TREQ-L also has two powered (500 mA per port) full speed USB host ports that are OHCI version 1.1 compliant. The first USB port is integrated into the TREQ-L front panel for easy access. The second USB port is on the back of the unit next to the integral cable.

2.1.5 Speaker

The TREQ-L includes an internally mounted 40 mm speaker, providing the ability to play a variety of audio, including audible feedback, warnings, messages, and media clips. A speaker jack on the back of the unit provides the option of an external speaker. The internal speaker is disabled when an external speaker is attached. The speaker jack output is amplified (it is not a line-out signal).

2.1.6 Power Supply

The TREQ-L has an 8- to 32-volt input range and can be powered directly from a 12- or 24-volt power supply. The terminal includes circuitry to protect against normal variations such as transients and spikes (SAEJ1455 compliant).

The TREQ-L includes a power backup circuit that provides at least two seconds of guaranteed up-time in the event of a power failure and notifies application code of the power failure event. Low or failing input power events cause the TREQ-L to enter a power-saving operating mode while allowing user applications to save data and shut down. In most cases, the power-save mode will extend the up-time beyond two seconds.

2.1.7 Housing

The TREQ-L housing is made of a tough, automotive grade polycarbonate that is designed to withstand everyday use in commercial mobile environments.

A four-bolt stud pattern on the back of the case allows installation of the TREQ-L using industry-standard mounts such as RAM Mount products.

A custom logo may be added to the front of the case during manufacturing.
2.1.8 Integral Cable

The TREQ-L integral cable includes power, ground, and signals for the COM1 serial port. The cable is two meters and terminates with a Molex Mini-Fit-type eight-pin connector. Refer to section 9.2, “Connector Pinouts” for pinout and connection information.

NOTE ☞ Your cable configuration may be customized with a different length and connector type. Contact Beijer Electronics technical support at http://www.beijerelectronicsinc.com/support/contact/?type=tech with cable connector issues.

2.1.9 Developer’s Kit

The TREQ-L developer’s kit includes all of the hardware and software tools necessary for developing applications on the TREQ-L mobile data terminal. These include:

- Demo cable
  Refer to section 9.3, “Demo Cable” for pinout and connection information. This cable is used to power the TREQ-L device and provide a serial communications connection between the TREQ-L and a PC.

NOTE ☞ The TREQ-L’s serial port must be configured for EIA-232 to use the demo cable for serial communications. Contact Beijer Electronics technical support for assistance in setting up communications with other serial port configurations.

- USB to serial converter
  This device can be used to set up an ActiveSync connection between the TREQ-L and a PC. Refer to Chapter 5, “Connect to a PC Via ActiveSync” for additional information. An ActiveSync connection can be used to download and debug applications written for the TREQ-L. Refer to Chapter 6, “Application Development” for more information on this topic.

- USB memory drive
  This device may be inserted into one of the TREQ-L’s USB ports and used as an external hard disk. The drive contains the TREQ-L user guide, software development kit (SDK), and a demo application source code.

  The SDK provides support for developing applications for the TREQ-L in the form of libraries and header files. Refer to section 6.2.2, “SDK Installation” for more information about the software development kit.

  Source code and a Microsoft Visual Studio solution are provided for the TREQ Demo application that is preinstalled on TREQ-L terminals that come with the developer’s kit. The demo is an MFC-based application that is written in C++ and provides several examples of how to interface with the TREQ-L hardware.

- USB WiFi adapter
  This device provides network connectivity that can be used to download and debug applications, browse the Internet, transfer files, and so on. It provides a connection faster than the serial ActiveSync connection.
Refer to Chapter 6, “Application Development” for more information on setting up the TREQ-L to debug and develop applications over an Ethernet connection. Refer to section 7.2, “Wireless Ethernet” for more information on using the USB WiFi adapter.

- RAM mount
  Refer to the “Getting Started” insert included with the TREQ-L developer’s kit for a drawing and quick start instructions.

2.2 Software

2.2.1 Bootloader

The TREQ-L has a bootloader application that executes on boot-up, loads the Windows CE kernel into memory, and boots the kernel. There is no indication that the bootloader is executing—the screen is black and the speaker is silent while the Windows CE kernel is loaded. The TREQ-L has a typical 10- to 20-second boot time. Refer to section 10.1.2, “Bootloader” for information on upgrading the bootloader.

2.2.2 Windows CE

The TREQ-L runs the Windows CE 5.0 operating system. Windows CE is a resource-constrained and scalable version of Microsoft® Windows for embedded hardware that offers broad support for third-party application development, software, and hardware. The TREQ-L utilizes the Professional version of Windows CE that includes common end user applications like Windows Media Player and Internet Explorer. A software shell is included with Windows CE that contains program management and control panel routines. Following are some of the Windows CE components that are included with the TREQ-L. For a complete list, refer to the document available for download from the following Web site:


- Active Template Library
- Microsoft Foundation Classes
- .NET Compact Framework
- ActiveSync®
- WordPad
- Online Help
- Local Area Networking
- Wide Area Networking
- Peer-to-Peer Networking
- Power Management
- Hive-based (persistent) Registry
- Direct Draw video graphics engine
- Windows Media Player and associated audio and video codecs
- Internet Explorer 6.0
- Command Shell
- Graphical Shell
- Soft Keyboard

Windows CE on the TREQ-L uses about 30 MB of disk space in the form of an image file named NK.BIN in the \HardDisk directory. This file contains all of the above components and the code required to set up and operate TREQ-L hardware (device drivers). The operating system may need to be upgraded for future releases. See Chapter 10, “Technical Support” for details on how to upgrade the TREQ-L operating system.

2.2.3 Device Drivers

The TREQ-L contains hardware peripherals that require additional support beyond that provided by Windows CE to set up and operate. Beijer Electronics provides software device drivers for these peripherals as part of the standard operating system installation. Following is a list of some peripherals requiring Beijer Electronics-provided support.

- LCD display
- Display and keypad backlight
- Audio codec/controller
- Touch screen
- Integrated keypad
- Serial port
- Power backup circuit

Device drivers are included in the operating system as dynamically linked libraries. They are loaded and initialized at boot-up and provide run-time interfaces for application programming.

A standard driver application interface allows you to dynamically configure the hardware without detailed knowledge about the components. For example, you can set the display and keypad backlight intensities and re-map the keypad key functions. See Chapter 6, “Application Development” for details on the device driver program interfaces and how they can be used in user applications.

2.2.4 System Settings

Control panel applets provide a graphical user interface for controlling some of the TREQ-L hardware peripherals. These applets utilize the device driver interfaces described in the previ-
ous section. Display the control panel in Windows CE by tapping the Start menu and then Set-
tings, Control Panel (see Figure 1).

The TREQ Panel applet and desktop shortcut provide a convenient central location to access
most of the commonly used hardware controls. Refer to Chapter 4, “System Settings” for
detailed information about the TREQ Panel and other control panel applets that control the
TREQ-L hardware.

2.2.5 Applications

Windows CE comes with several user applications (see section 2.2.2, “Windows CE”). In
addition, there are a variety of utility applications available with Windows CE. These applica-
tions are located either in the \Windows directory or on the flash drive. Beijer Electronics pro-
vides applications to supplement the Windows CE applications, including RegEditCE.exe for
editing the registry. These applications are located on the flash drive. In addition, you can write
your own applications for the TREQ-L. These applications must be compiled for Windows CE
running on an ARM platform. See Chapter 6, “Application Development” for application
development setup instructions and code samples.

The TREQ-L developer’s kit includes a special application called “TREQ Demo” (see Figure
2). You can access the demo from a desktop shortcut. (TREQ Demo can be downloaded from
http://www.beijerelectronicsinc.com and installed on any TREQ-L.) TREQ Demo is an
MFC-based C++ Smart Device application compiled with Microsoft Embedded Visual Studio 2005.

Figure 2
TREQ Demo Application
Notes
CHAPTER 3
GETTING STARTED

3.1 Power On/Off/Reset

3.1.1 Turn On the TREQ-L

To turn on the TREQ-L, attach the integral cable connector to a power source. The TREQ-L
boots and loads the operating system, and the desktop with the Windows CE logo is displayed,
as shown below.

![Windows CE Desktop]

*Figure 3*
*Windows CE Desktop*

Icons for software your company has installed may be displayed next to those shown above.

To use the TREQ-L, press the keys on the TREQ-L frame, or tap the touch keys on the touch
screen.

Refer to section 3.2, “Touch Screen” for information on using the touch screen.

Refer to section 3.3, “Keys” for information on using the keys around the frame.
### 3.1.2 Turn Off the TREQ-L

To turn off the TREQ-L, detach the integral cable from the power source.

When the TREQ-L is powered off, information in the Windows CE registry and any data stored on the internal flash hard-disk (\HardDisk) is retained. However, the Windows CE file system root folder is RAM-based and will be lost. Consequently, any information that must be retained must be stored under the \HardDisk and \USBHardDisk folders. To avoid losing data, make sure you close any open applications and back up data to a persistent storage location before powering off the TREQ-L. **Corruption will occur if data is being written to files located on \HardDisk or \USBHardDisk during a loss of power.**

Provided the TREQ-L has been powered on for at least several minutes, the power backup circuit will maintain power to the device for at least two seconds after power is removed. This time is provided for applications to perform an orderly shutdown and save any data. Due to the power-saving features of the TREQ-L’s software drivers, the unit may remain powered for up to 30 seconds. **Beijer Electronics recommends waiting at least 30 to 40 seconds before attempting to re-power the unit.** As an alternative, press and hold the reset button with a paper clip, apply power (attach the integral cable), then release the reset button. Refer to section 3.1.3, “Reset the TREQ-L” below for more information about the reset button.

**NOTE**

To test whether the unit is still powered by the backup circuit, you can tap the touch screen and listen for a tap sound. Screen tap sounds must be enabled; refer to section 4.1.6, “Volume and Sounds” for information on enabling/disabling screen tap sounds (tap sounds are enabled by default).

### 3.1.3 Reset the TREQ-L

If the operating system on your TREQ-L stops operating, press and release the reset button. This button is located in the lower right area of the integrated keypad, below and between the sixth and seventh keys (counting from the left). Use a paper clip or other similar object and gently insert it into the hole to perform a hard reset.

If the TREQ-L does not restart, verify that the TREQ-L’s power connector is fully seated and that the cable has power.

**NOTE**

You can also remove power and then restore it to reset the TREQ-L. Refer to section 3.1.2, “Turn Off the TREQ-L” for caveats regarding this procedure.

**Corruption will occur if data is being written to files located on \HardDisk or \USBHardDisk when the TREQ-L is reset.**
3.2 Touch Screen

3.2.1 Touch Screen Care

Use only your fingertip or a stylus to tap the touch screen. Other objects (such as either end of a pencil) will damage the transparent film or plastic backing. Use a light touch, just hard enough for the screen to respond.

To clean the touch screen, moisten a soft cloth with water or a window cleaner such as Windex®. Then gently wipe the screen clean with the cloth. Do not spray liquid directly on the touch screen.

3.2.2 Touch Screen Use

When you tap or press on the TREQ-L touch screen, it responds with a clicking sound. Tap on an icon (e.g., “Internet Explorer”) to highlight and select the item. Tap twice (double-tap) on an icon to open the item or start the program.

Tap [Start] to display the Windows Start menu, which gives you access to all system functions and programs. Any of the menu options with right-pointing arrows will open a sub-menu. Tap one of the options to display its sub-menu. For example, tap Programs, and a sub-menu of all user programs loaded on your TREQ-L is displayed.

Tap the screen background to close the Start menu, or tap [Start] again.

**NOTE** If you are having problems selecting functions on the touch screen, you may need to recalibrate the touch screen. Refer to section 4.1.1.2, “Recalibrate” on page 18 for information.

3.3 Keys

The TREQ-L has seven function keys and a circular control pad with four arrow keys and a center key (see Figure 4). All keys may be configured to perform any action, including launching applications, executing key codes, or executing sequences that execute key codes or launch applications. Refer to section 6.3.1, “Keypad” for details and examples of how to map the keys.

![Figure 4](image-url)
3.3.1 Function Keys

The left-most function key is mapped by default to launch the Windows Explorer application (\Windows\explorer.exe). Autorepeat is disabled by default for this key. The next six function keys are mapped by default to the keyboard function keys F1 through F6 (left to right). Autorepeat is disabled by default for these keys.

The function keys may be configured for a normal and a shifted state. The shifted state provides a mechanism to quickly switch between two sets of mappings. The keypad state can be changed programmatically (refer to section 6.3.1, “Keypad” for details on the keypad driver API). The \HardDisk\bin\KeyShiftCE.exe utility is a sample application that switches the keypad state. The function keys are mapped by default in the shifted state to the keyboard keys “a” through “g.”

3.3.2 Arrow Keys

The circular pad on the right-hand side is, by default, a keyboard direction control pad with up, down, left, and right arrow keys. The arrow keys move an on-screen selection or typing cursor similar to the arrow keys on a PC keyboard. Autorepeat is enabled by default.

The center of the pad responds as a fifth key, which by default functions to select or actuate the highlighted option (like a keyboard enter key). Autorepeat is disabled by default for this key. Press the center key to select or actuate a function that is currently selected/highlighted. For example, tap a desktop icon using the touch screen to select it, navigate to the “My Device” icon with the arrow keys, then press the center of the pad to actuate/execute the icon. The result is a new Windows Explorer session.

3.3.3 Reset Button

The reset button is recessed and located under a small opening between and below the sixth and seventh function keys. Gently press the reset button with a paper clip or similar object to perform a hard reset of the TREQ-L unit. Refer to section section 3.1.3, “Reset the TREQ-L” for more details on resetting the terminal.
3.4 System Settings

To access the system settings (calibration, double-click (double-tap), backlight, keyboard, TREQ panel, date/time, volume and sounds, and more) through the Windows CE control panel, select **Start, Settings, and Control Panel** as shown below.

![Windows CE Start Menu](image)

Refer to Chapter 4, “System Settings” for information on the control panel settings.

3.5 Install Third-Party or Custom Software

You can install any software application on the TREQ-L that is compatible with Windows CE, has been compiled for the ARM platform, and does not exceed the system requirements of your TREQ-L. You can download it from a network or the Internet (depending on your interface setup), or you can use ActiveSync (refer to Chapter 5, “Connect to a PC Via ActiveSync” on page 33 for information).

Third-party software applications are typically packaged in a Microsoft CAB file format, which are then packaged in a PC-side installer executable or Microsoft MSI file. The bare CAB files can be copied to the TREQ-L and installed manually, or the MSI file can be executed on a PC and the included CAB file downloaded and installed via ActiveSync.
For applications installed via ActiveSync, execute the downloaded installation file from Windows Explorer on a PC. The application installer should automatically launch ActiveSync, download a CAB file to the TREQ-L, and initiate installation of the CAB file on the TREQ-L.

A CAB file can be downloaded directly to the TREQ-L without ActiveSync. For this type of installation, double-tap the CAB file from a Windows Explorer session on the TREQ-L to initiate the installation process.

**NOTE**

It is recommended that the destination of the CAB file installation files be in the HardDisk directory because that storage location is on the internal persistent storage, otherwise the installation will be lost after a power cycle. See section 3.1.2, “Turn Off the TREQ-L” for more details.

**NOTE**

See section 10.1.1, “Operating System” on page 79 for information about UpgradeCE.exe, a Beijer Electronics package manager program that can be used similarly to the Windows CE CAB installer. UpgradeCE.exe software application packages and settings are retained even after system firmware upgrades.

### 3.6 Run Third-Party Software

Third-party or custom software installed on the TREQ-L may be listed in the Start menu under “Programs.” Tap a program name in the menu to run the program.

A program may also have an icon on the desktop. If so, double-tap the icon to start the program.

### 3.7 Build Your Own Software

You can write your own applications and program your own key functions (for the keys around the TREQ-L frame) using Microsoft programming tools. Refer to Chapter 6, “Application Development” for more information.
CHAPTER 4
SYSTEM SETTINGs

4.1 Control Panel

Many of the system settings can be adjusted through the Windows CE control panel. To access the control panel, select Start, Settings, and Control Panel.

![Windows CE Control Panel]

Figure 6
Windows CE Control Panel

Applets on the control panel that are used to configure TREQ-L settings include the following (see Figure 6):

- Stylus
- PC Connection
- Backlight
- Keyboard
- TREQ Panel
- Date/Time
- Volume and Sounds
- Network and Dial-up Connections
- Bluetooth Device Manager
4.1  Stylus

Use the Stylus applet to set the double-tap speed and spacing or to recalibrate the touch screen. You should recalibrate any time it becomes difficult to make selections or to double-tap items on the screen. Double-tap the Stylus icon on the control panel, and the Stylus Properties dialog box is displayed.

4.1.1  Double-Tap

To set the speed and distance between double-taps, tap the Double-Tap tab, as shown below.

![Figure 7](image)

*Figure 7*
Stylus Properties, Double-Tap

On the checkered grid at the top, tap the grid twice (double-tap) using a tap speed that is comfortable for you. The tap speed should be quick, but not so quick that it becomes difficult to do.

Below the checkered grid is an image of a “director’s” sign. Double-tap on the image to test your new setting. The top of the sign should lift up or drop down with each double-tap. If it does not, reset the double-tap action on the checkered grid.

You can keep resetting the double-tap until it is right for you. Tap [OK] to save any changes and exit. Tap [X] to exit the dialog box without saving.

4.1.1.2  Recalibrate

To recalibrate the touch screen, tap the Calibration tab, as shown below.

![Figure 8](image)

*Figure 8*
Stylus Properties, Calibration
Tap **[Recalibrate]**, and a large “+” symbol is displayed on the screen. Tap and hold briefly as close to the center of the symbol as possible. When you lift the stylus, the symbol moves to another location on the screen. Tap and hold the center of the symbol again; lift the stylus, and the symbol moves again. In order to fully calibrate the touch screen, you must continue this process until you have tapped the center of the symbol five times. These five taps are used to calculate the horizontal and vertical offset parameters of the touch screen. If the symbol continues to move after the fifth tap, the calibration was unsuccessful and you must repeat the five taps. An unsuccessful calibration results when the offset calculated for one calibration point differs from another. If the calibration is successful, the “+” symbol is no longer visible. Tap the touch screen one more time, or press **[Enter]**, to save the calibration settings.

Touch screen calibration data is stored in the persistent registry (see section 4.3, “Registry” for more information). After the unit has been calibrated once, the calibration data is retained between re-boots. The touch screen calibration screen automatically appears when you boot the unit if there is no calibration data present in the registry.

### 4.1.2 PC Connection

Use the PC Connection control panel applet to enable or disable remote connections with a desktop PC (ActiveSync). Refer to Chapter 5, “Connect to a PC Via ActiveSync” on page 33 for more information about setting up an ActiveSync connection. Select the checkbox labeled, “Allow connection with desktop computer when device is attached” to enable remote PC connections with the TREQ-L (see Figure 9).

![Figure 9](image.png)

*Figure 9*  
*PC Connection Properties*

The default device used for remote connection is the USB-to-serial converter, which appears in Windows CE as the serial port device on COM5 (“USB COM5”).

Tap **[OK]** to save any changes and exit. Tap **[X]** to exit the dialog box without saving.
4.1.3 Backlight

Use the Backlight applet to specify the screen saver mode and to adjust the intensity of the display and keypad backlight. Double-tap the Display icon on the control panel, and the Display Properties dialog box is displayed, then tap the Backlight tab, as shown below.

![Display Properties, Backlight](image)

Tap [OK] to save any changes and exit. Tap [X] to exit the dialog box without saving.

4.1.3.1 Screen Saver

Use this applet to set up the screen saver, which will dim or turn off the backlight to save power when the TREQ-L is not in use. Select one or both of the following options.

**Dim Display Backlight**
In this mode, the display and keypad backlight is dimmed to a low level. Tap the drop-down box and select the number of seconds or minutes after which the backlight is dimmed.

**Power Off Display**
In this mode, the backlight and LCD display are both turned off. Tap the drop-down box and select the number of seconds or minutes after which the display is turned off.

The Dim and Power Off time-outs can be adjusted to a continuous range of time values via a programmatic interface (refer to section 6.3.2, “Backlight” on page 54). If a value is set that does not match any of those selectable in the drop-down list, the box displays “Custom” to indicate a non-standard setting.

4.1.3.2 Intensity

Use this applet to adjust the backlight intensity of the display and keypad. Tap and hold the slider and slide it up or down the slider bar to set the intensity from 0 to 100%.
4.1.4 Keyboard

Use the Keyboard applet to set the repeat delay and repeat rate for keyboard keys. These parameters apply to any connected USB keyboard as well as the TREQ-L keypad buttons. Double-tap the **Keyboard** icon on the control panel, and the Keyboard Properties dialog box is displayed, as shown below.

![Keyboard Properties dialog box]

**Enable Character Repeat**

Select this option to turn the key repeat feature on or off. If “on,” a key entry repeats if you hold down the key on the keyboard or keypad. Keypad keys have individual controls for repeat enable/disable (refer to section 6.3, “Software Drivers” on page 51). All keypad repeats are disabled if this checkbox is not selected.

**Repeat Delay**

If you enabled “character repeat,” use this function to select the delay time that you want between when a key is pressed and when it begins to repeat automatically. Tap and hold the slider and slide it up or down the slider bar to set the delay, or tap the left or right arrow button at the ends of the slider bar to move by smaller increments.

**Repeat Rate**

If you enabled “character repeat,” use this function to select the time that you want between each repeat when a key begins to repeat automatically. Tap and hold the slider and slide it up or down the slider bar to set the delay, or tap the left or right arrow button at the ends of the slider bar to move by smaller increments.

Tap in the data entry box at the bottom of the dialog box, and press a key to test the repeat delay and repeat rate. You can reset the delay and rate until the settings are right for you.

Tap [OK] to save any changes and exit. Tap [X] to exit the dialog box without saving.
4.1.5 Date/Time

Use this applet to set the time and date on the TREQ-L. Tap the Date/Time icon on the control panel, or tap the clock on the task bar (see Figure 12).

![Date/Time Properties](image)

**Figure 12**  
*Date/Time Properties*

To change the year, continuously change the month to successive or prior months until the desired year is reached. Alternatively, tap the year display, and type the year using the on-screen soft keyboard or an attached USB keyboard.

To change the month, tap the left-pointing arrow at the top of the calendar to select the previous month, or tap the right-pointing arrow to select the next month. Alternatively, tap the month display, and select the desired month from the pop-up list.

To select a date in a month, tap the date in the calendar.

To change the time, in the “Current Time” box, tap the hour, minute, or AM/PM position to select it, then tap the selection arrows to increase or decrease the number. Alternatively, tap the time display to select the hours, minutes, seconds, or “AM/PM” field, and enter the time using the on-screen soft keyboard or an attached USB keyboard.

To select a different time zone, tap the drop-down arrow for the “Time Zone” box and then tap the correct time zone in the drop-down list.

The checkbox “Automatically adjust clock for daylight saving” is selected by default. If the TREQ-L will be used in an area that does not follow daylight savings time, deselect this option.

**NOTE**  
The TREQ-L has been updated to be compliant with the latest dates for daylight savings time changes (per the U.S. daylight savings time zones and dates change for 2007).

Tap [Apply] to apply changes in the settings without exiting the dialog box. Tap [OK] to apply the changes and exit. Tap [X] to exit the dialog box without saving your settings.
4.1.6 Volume and Sounds

Use this applet to adjust the volume of system responses and to specify for which screen actions the TREQ-L will respond with a sound. Tap the Volume & Sounds icon on the control panel to display the Volume & Sounds Properties dialog box, as shown below.

![Volume & Sounds Properties](image)

Figure 13
Volume & Sounds Properties

To enable sounds and adjust the volume, tap the Volume tab.

Enable sounds for:

**Events**
If you want a sound emitted when the system gives a warning or a system event occurs, select this option.

**Applications**
If you want sounds generated by programs, select this option.

**Notifications**
If you want sounds emitted for alarms, appointments, and reminders, select this option.

Enable clicks and taps for:

**Key clicks**
Select this option if you want to hear clicks when you press a key on either the keypad or an external keyboard. If you select key clicks, also select whether you want the click sound to be **Loud** or **Soft**.

**Screen taps**
Select this option if you want to hear a sound when you tap the screen. If you select this option, also select whether you want the tap sound to be **Loud** or **Soft**.

**System Volume**
Use the slider at the left-hand side of the dialog box to select the overall volume of system sounds. Tap and hold the slider and slide it up or down the slider bar to adjust the sounds louder or softer, or tap the **Soft** or **Loud** arrows to adjust it in smaller increments. A sound is emitted as you make each adjustment so you can monitor the setting.

Tap **[OK]** to save the settings and exit the dialog box. Tap **[X]** to exit the dialog box without saving your settings.
4.1.7 Network and Dial-up Connections

The Network and Dial-up Connections control panel applet launches a Network Connections application (see Figure 14), which is used to set up and configure remote connections. An icon is created for each connection (connectoid). Once configured, the connectoid can be launched to initiate the remote connection.

There is only one default connectoid for TREQ-L remote connections: USB COM5. This connectoid uses an external USB-to-serial converter to establish a new serial port (COM5), which is used for ActiveSync communication. This converter is based on the FTDI chipset (refer to section 7.1, “USB” for more information about this peripheral).

The USB COM5 connection is automatic; COM5 automatically becomes available if the USB-to-serial converter is plugged into the USB port. Refer to Chapter 5, “Connect to a PC Via ActiveSync” for more information on how to set up ActiveSync over COM5.

4.1.8 Bluetooth Manager

A USB Bluetooth adapter may be inserted into one of the TREQ-L’s two USB ports (refer to section 7.4, “Bluetooth” for more information about this optional peripheral). If an adapter is inserted, the Bluetooth Manager applet is a simple utility that can be used to scan for other Bluetooth devices. Figure 15 shows the results of a scan that includes several services from the same PC with Bluetooth adapter.
To pair Bluetooth devices, select a device in the “Untrusted” box, and click [→] to move it to the “Trusted” box. The pairing process is mutual; the other Bluetooth devices must consider the TREQ-L a trusted device to complete the pairing.

Tap [OK] to save any changes and exit. Tap [X] to exit the dialog box without saving.

Refer to section 7.5, “Bluetooth” for more information on managing TREQ-M4 Bluetooth device connections.

4.2 TREQ Panel

The TREQ panel provides quick access to all of the TREQ-L hardware controls, including those for the display and keypad backlight, touch screen, speaker, keypad, and power saving/screen saver modes.

To open the TREQ Panel (see Figure 16), tap the TREQ Panel icon on the control panel, or tap the desktop shortcut.

Tap [OK] to save any changes and exit. Tap [X] to exit the dialog box without saving.

4.2.1 Keypad

The Enable Character Repeat, Repeat, and Delay controls are identical to those found in the Keyboard Control Panel applet. Refer to section 4.1.4, “Keyboard” for more information on these controls.
Registry System Settings

The keypad keys may be optionally mapped to mouse/cursor functions as described in section 3.3, “Keys” and section 6.3.1, “Keypad.” The Cursor Acceleration control affects the mouse pointer acceleration when it is controlled from a keypad key that is mapped for that function. Tap and hold the slider to increase or decrease the acceleration. Increased acceleration reduces the time required for the cursor to traverse a distance as the keypad key is held but also reduces the cursor accuracy.

4.2.2 Backlight Intensity

Use the Backlight controls to adjust the intensity of the display and keypad backlight. Tap and hold the slider and slide it up or down the slider bar to set the intensity from 0 to 100%.

4.2.3 Audio

Tap and hold the slider to increase or decrease the speaker volume. Use this control for more precision for the volume setting than the Volume and Sounds Control Panel applet provides.

4.2.4 Touch Screen

Tap the Touch Screen Calibration button to initiate the calibration procedure. Refer to section 4.1.1.2, “Recalibrate” for more details.

4.2.5 Power

Use this function to set up the screen saver, which will dim or turn off the backlight to save power when the TREQ-L is not in use. These controls are identical to those found in the Backlight Control Panel applet. Refer to section 4.1.3.1, “Screen Saver” for more information.

4.3 Registry

Windows CE uses a registry to store system settings and run-time configuration data. The TREQ-L supports a hive-based registry, meaning that the settings in the registry are maintained between power cycles. The hive registry is stored in special system files on the internal flash hard-disk. The memory resident registry is periodically (every few seconds) written to the hive files. You can modify the registry in several ways.

- Windows CE provides an API (RegOpenKeyEx or RegQueryValueEx) and a C++ wrapper class (CReg via creg.hxx provided in the TREQ-L SDK) for use in applications as a programmatic interface.
- You can run the RegEditCE.exe registry editing application on the TREQ-L.
- Microsoft Visual Studio 2005/2008 and Microsoft Embedded Visual C++ each come with a suite of remote debugging tools, including remote registry editors. Refer to Chapter 6, “Application Development” for information on setting up a host PC to use these tools.
4.4 File System Filter

Certain system files included on the internal flash hard-disk are critical to the functioning of the TREQ-L terminal. In order to reduce the possibility of accidental deletion or corruption, Beijer Electronics has developed and installed a file system filter, which is a special device driver that prevents write access to a list of files specified in a registry key. The default contents of this registry key are as follows:

```
[HKEY_LOCAL_MACHINE\System\StorageManager\LockFiles]
 "Lock"=dword:00000001
 "Files"=multi_sz:"\HardDisk\nk.bin",
    "\HardDisk\ce.arg",
    "\HardDisk\bin\boot.bat",
    "\HardDisk\bin\ContrastCalibrateCE.exe",
    "\HardDisk\bin\ftdi_ser.dll",
    "\HardDisk\system.mfs",
    "\HardDisk\MFS"
```

The file system filter can be enabled or disabled by setting or clearing, respectively, the “Lock” registry value. The “Files” multi-string registry value contains the list of locked files and directories. Directories in the list are locked along with all sub-files and subdirectories.

One example of the reason for the file system filter is that if the `\HardDisk\nk.bin` file—the Windows CE operating system image—is corrupted or deleted, the TREQ-L will not boot. This filter protects against inadvertent delete operations.

The `\HardDisk\bin\LockCE.exe` program can be used from a command prompt shell to lock or unlock the files/directories in the list. LockCE 0 unlocks; LockCE 1 locks.

4.5 System Path

The default Windows CE system path on the TREQ-L is `\Windows;\HardDisk\bin;\HardDisk\fonts`. Windows will search the `\Windows` directory first, then the `\HardDisk\bin` directory for executables and supporting dynamically-linked libraries. For example, when `pword.exe` is executed from the root directory in the command shell, Windows will find `\Windows\pword.exe`.

The system path can be modified via a registry setting. Following is an example of the registry key in which two directories have been added to the default path.

```
[HKEY_LOCAL_MACHINE\Loader]
 "SystemPath"=multi_sz:"\HardDisk\bin\",
    "\HardDisk\fonts\"
    "\HardDisk\Programs\"
    "\Temp\"
```
4.6 Boot-up Configuration

There are three methods of configuring the TREQ-L to automatically launch applications or scripts at boot time.

The first and simplest method involves creating an application shortcut in or copying an application to the \HardDisk\Startup directory. The Windows CE graphical shell launches applications and application shortcuts that are present in this persistent storage location on boot. This method is dependent on launching the standard graphical shell (explorer.exe).

The second method of auto-launching applications is managed by a program called BootUpCE.exe that is launched when Windows CE boots. BootUpCE initiates touch screen calibration (if necessary), then launches a command shell and executes a batch file: \HardDisk\bin\boot.bat. This batch file can be used to launch an application or run a custom boot-up script. For example, to launch WordPad after boot, boot.bat should look something like the following:

```bash
@echo Launching WordPad
start \Windows\pword.exe
```

Because \HardDisk\bin\boot.bat is on the locked files list (refer to section 4.4, “File System Filter”), it must be unlocked before writing a modified version.

The third and more advanced method of configuring Windows CE to launch one or more applications in a specific order uses the [HKEY_LOCAL_MACHINE\Init] registry key. Following is an excerpt from Windows CE 5.0 Platform Builder Help.

### Configuring a Registry File to Run an Application at Startup

Update or add the HKEY_LOCAL_MACHINE\Init section of the registry file with the following code:

```
[HKEY_LOCAL_MACHINE\Init]
"launchnn"="defined_module_name"
"dependnn"=hex:xx,yy...
```

The following table shows descriptions of the parameters in the code you must update or add to the HKEY_LOCAL_MACHINE\Init section of the registry file.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>launchnn</td>
<td>Defines the order that the module is started in, where nn is 00-99.</td>
</tr>
<tr>
<td></td>
<td>Enclose this parameter in double quotation marks (&quot; &quot;).</td>
</tr>
<tr>
<td>defined_module_name</td>
<td>Specifies the name of the module to be started.</td>
</tr>
<tr>
<td></td>
<td>Enclose this parameter in double quotation marks (&quot; &quot;).</td>
</tr>
</tbody>
</table>
After your run-time image calls a module using the Init registry value, the application must call the SignalStarted function. SignalStarted indicates that the module is ready for the rest of the OS to continue processing. The value passed as the parameter to SignalStarted is the value passed on the command line of the module started from the Init key.

For reference, HKEY_LOCAL_MACHINE\Init contains the following default value on the TREQ-L:

```
[HKEY_LOCAL_MACHINE\init]
"Launch20"="device.exe"
"Launch30"="gwes.exe"
"Depend30"=hex:14,00
"Launch60"="services.exe"
"Depend60"=hex:14,00
"Launch50"="bootupCE.exe"
"Depend50"=hex:14,00,1e,00
"Launch70"="explorer.exe"
"Depend70"=hex:14,00,1e,00,32,00
"Depend99"=hex:14,00
"Launch99"="btgw.exe"
```

As the above registry values illustrate, the Windows CE graphical shell is launched as part of this boot-up procedure (explorer.exe). The “Launch70” registry value can be modified to point to an alternate program in order to launch a custom shell or to run a program without any shell.
4.7 Applications

4.7.1 Microsoft

Microsoft applications that come with the TREQ-L include, but are not limited to, the following:

<table>
<thead>
<tr>
<th>Application</th>
<th>Description</th>
<th>Path</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows Explorer</td>
<td>Standard graphical shell</td>
<td>\Windows\explorer.exe</td>
</tr>
<tr>
<td>Command Prompt</td>
<td>Command-line shell</td>
<td>\Windows\cmd.exe</td>
</tr>
<tr>
<td>Media Player(^a)</td>
<td>Video and audio decoder/player</td>
<td>\Windows\ceplayer.exe</td>
</tr>
<tr>
<td>Internet Explorer(^1)</td>
<td>Web browser</td>
<td>\Windows\iesample.exe</td>
</tr>
<tr>
<td>Wordpad</td>
<td>Graphical editor</td>
<td>\Windows\pword.exe</td>
</tr>
<tr>
<td>ActiveSync</td>
<td>Host PC synchronization and communi-</td>
<td>\Windows\replog.exe</td>
</tr>
<tr>
<td>Control Panel</td>
<td>Device configuration utilities</td>
<td>\Windows\ctlpnl.exe</td>
</tr>
<tr>
<td>Windows CE Load</td>
<td>CAB file installer</td>
<td>\Windows\wceload.exe</td>
</tr>
</tbody>
</table>

\(^{a}\) Included in professional license Windows CE versions only.

<table>
<thead>
<tr>
<th>Application</th>
<th>Description</th>
<th>Path</th>
</tr>
</thead>
<tbody>
<tr>
<td>CleanHiveCE</td>
<td>Causes the persistent registry to revert to</td>
<td>\HardDisk\bin\CleanHiveCE.exe</td>
</tr>
<tr>
<td></td>
<td>factory defaults. Reboot TREQ-L after</td>
<td></td>
</tr>
<tr>
<td></td>
<td>executing.</td>
<td></td>
</tr>
<tr>
<td>KeyShiftCE</td>
<td>Toggles the “shifted” state of the keypad</td>
<td>\HardDisk\bin\KeyShiftCE.exe</td>
</tr>
<tr>
<td></td>
<td>(refer to section 6.3.1, “Keypad” on page 51)</td>
<td></td>
</tr>
<tr>
<td>LockCE</td>
<td>Locks/unlocks protected files (refer to section</td>
<td>\HardDisk\bin\LockCE.exe</td>
</tr>
<tr>
<td></td>
<td>4.4, “File System Filter”). Single command line</td>
<td></td>
</tr>
<tr>
<td></td>
<td>parameter either 0 (unlock) or 1 (lock).</td>
<td></td>
</tr>
<tr>
<td>MintermCE</td>
<td>Serial port console and test program.</td>
<td>\HardDisk\bin\MintermCE.exe</td>
</tr>
<tr>
<td>PolygonsCE</td>
<td>Display test program.</td>
<td>\HardDisk\bin\PolygonsCE.exe</td>
</tr>
<tr>
<td>QeditCE</td>
<td>Small, simple graphical editor</td>
<td>\HardDisk\bin\QeditCE.exe</td>
</tr>
<tr>
<td>REditCE</td>
<td>MFC-based alternative to RegEditCE.</td>
<td>\HardDisk\bin\REditCE.exe</td>
</tr>
</tbody>
</table>

4.7.2 Beijer Electronics

Applications written and provided by Beijer Electronics include the following:

<table>
<thead>
<tr>
<th>Application</th>
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<th>Path</th>
</tr>
</thead>
<tbody>
<tr>
<td>CleanHiveCE</td>
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</tr>
<tr>
<td></td>
<td>factory defaults. Reboot TREQ-L after executing.</td>
<td></td>
</tr>
<tr>
<td>KeyShiftCE</td>
<td>Toggles the “shifted” state of the keypad</td>
<td>\HardDisk\bin\KeyShiftCE.exe</td>
</tr>
<tr>
<td></td>
<td>(refer to section 6.3.1, “Keypad” on page 51)</td>
<td></td>
</tr>
<tr>
<td>LockCE</td>
<td>Locks/unlocks protected files (refer to section</td>
<td>\HardDisk\bin\LockCE.exe</td>
</tr>
<tr>
<td></td>
<td>4.4, “File System Filter”). Single command line</td>
<td></td>
</tr>
<tr>
<td></td>
<td>parameter either 0 (unlock) or 1 (lock).</td>
<td></td>
</tr>
<tr>
<td>MintermCE</td>
<td>Serial port console and test program.</td>
<td>\HardDisk\bin\MintermCE.exe</td>
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<tr>
<td>PolygonsCE</td>
<td>Display test program.</td>
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<td>\HardDisk\bin\REditCE.exe</td>
</tr>
<tr>
<td>Application</td>
<td>Description</td>
<td>Path</td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>RegEditCE</td>
<td>Local registry editor tool (similar to Remote Registry Editor).</td>
<td>\HardDisk\bin\RegEditCE.exe</td>
</tr>
<tr>
<td>ScreenSnagCE</td>
<td>Screen capture program.</td>
<td>\HardDisk\bin\ScreenSnagCE.exe</td>
</tr>
<tr>
<td>SleepCE</td>
<td>Causes a delay of N milliseconds for the calling batch file where the number N is passed to the program as a command line parameter.</td>
<td>\HardDisk\bin\SleepCE.exe</td>
</tr>
<tr>
<td>spitCE</td>
<td>Serial port test program. Emits data from serial port specified as an argument. Responds to queries “?” and exits commands “xx” from a host.</td>
<td>\HardDisk\bin\spitCE.exe</td>
</tr>
<tr>
<td>TREQ Demo</td>
<td>Application written to demonstrate TREQ-L functionality and features. Source code provided for this application upon request to demonstrate application development for the TREQ-L, including custom device driver interfaces.</td>
<td>\HardDisk\TreqDemo2\treqdemo2.exe</td>
</tr>
<tr>
<td>TREQPanelCE</td>
<td>Refer to section 4.2, “TREQ Panel.”</td>
<td>\HardDisk\bin\TREQPanelCE.exe</td>
</tr>
<tr>
<td>WinVerCE</td>
<td>Displays the current version of the Windows CE kernel, firmware, and release date.</td>
<td>\HardDisk\bin\WinVerCE.exe</td>
</tr>
<tr>
<td>TemperatureCalibrateCE</td>
<td>ambient temperature in C] The argument is optional. If not provided, temperature is not calibrated, but current temperature is printed to screen. If provided, before and after temperatures are printed.</td>
<td>\HardDisk\bin\TemperatureCalibrateCE.exe</td>
</tr>
<tr>
<td>WaitForAPIsCE</td>
<td>[WinCE API enum value or values] Causes the calling process to delay execution until the specified Windows CE application programming interfaces are ready, e.g. SH_SHELL(21) and SH_WMGR(17). Multiple APIs may be specified, separated by spaces.</td>
<td>\HardDisk\bin\WaitForAPIsCE.exe</td>
</tr>
</tbody>
</table>
Notes
CHAPTER 5
CONNECT TO A PC VIA ACTIVESYNC

5.1 Introduction

You can use Microsoft ActiveSync to communicate directly between the TREQ-L and a PC computer, enabling features such as remote debugging for applications and remote tools (e.g. Remote Registry Editor). To set up an ActiveSync connection between your TREQ-L and a PC computer, do the following:

☐ Enable remote connections in the PC Connection control panel applet on the TREQ-L (refer to section 4.1.2, “PC Connection”).

☐ Connect a null modem serial cable to the TREQ-L and to the PC. Be sure to turn off power to both devices before connecting the cable (see section 5.2, “Connect the Serial Cable”).

☐ Load ActiveSync on the PC to which the TREQ-L will be connected (see section 5.3, “Download/Install ActiveSync”).

☐ Verify that the baud rate on the TREQ-L is optimal for the cable length (see section 5.4, “Set the TREQ-L Baud Rate”).

☐ Start ActiveSync on the PC and on the TREQ-L (see section 5.5, “Connect the PC and TREQ-L”).

5.2 Connect the Serial Cable

You need to use a “null modem” RS232 serial cable to make an ActiveSync connection between a PC and the TREQ-L. You can also use a standard serial cable with a null modem adapter. The TREQ-L connection uses a female DB9 connector. Verify the serial connection used by the PC.

Following are the DB9 pin assignments for the TREQ-L connector. Verify that the serial cable and/or null modem adapter has all of the following pin connections as all of the listed RS232 signals are required by ActiveSync.

<table>
<thead>
<tr>
<th>RS232 Signal</th>
<th>First DB9 Pin #</th>
<th>Second DB9 Pin #</th>
</tr>
</thead>
<tbody>
<tr>
<td>DCD</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>RX</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>TX</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>DTR</td>
<td>4</td>
<td>1 and 6</td>
</tr>
<tr>
<td>GND</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>DSR</td>
<td>6</td>
<td>4</td>
</tr>
</tbody>
</table>
For best results, the cable should not exceed six feet in length for communications at 115200 baud.

The serial cable is wired symmetrically—either end of the cable can be connected to the TREQ-L (assuming the connectors match). Connect one end of the serial cable to COM5 on the TREQ-L. COM5 is available via the USB-to-serial converter. Connect the other end of the serial cable to a free port on the PC. If possible, note the name of the port you use (e.g., COM1, COM2, etc.). Refer to Figure 17.

<table>
<thead>
<tr>
<th>RS232 Signal</th>
<th>First DB9 Pin #</th>
<th>Second DB9 Pin #</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTS</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>CTS</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>RI</td>
<td>9</td>
<td>no connection</td>
</tr>
</tbody>
</table>

*NOTE* ☞ The USB extension cable (item 2 in Figure 17) is not strictly required, although it makes the USB-to-serial adapter/TREQ-L connection more convenient.

### 5.3 Download/Install ActiveSync

Download ActiveSync from the Microsoft Web site and install it on your PC as follows.

2. Type ActiveSync in the search box and begin the search.

3. ActiveSync 4.2 and 4.5 are the two latest versions as of January 2008. Both will work with TREQ-L. Follow the appropriate link and download the desired version.

4. Install ActiveSync on your PC by executing the downloaded installer file or executable and following the instructions.

5. When the installation is finished, ActiveSync automatically launches the “Get Connected” wizard that will search the PC’s serial ports for a connection. If you are not ready to connect to the TREQ-L, cancel this option.

5.4 Set the TREQ-L Baud Rate

The baud rate is the rate at which data is sent between the PC and the TREQ-L. Normally, you will want to set the baud rate to the highest rate supported by your hardware and cable length (see section 5.2, “Connect the Serial Cable” for cable length restrictions).

When connected, ActiveSync identifies the baud rate used by the TREQ-L. The default baud rate for the TREQ-L ports is 115200 bps.

**NOTE**

If you have communication problems with an ActiveSync connection, try selecting a slower baud rate.

To verify or change the baud rate for the TREQ-L, do the following on the TREQ-L:

1. Tap [Start] to display the Start menu, then tap Settings and Network & Dial-up Connections. The Network Connections dialog box is displayed.

2. Tap USB COM5. Select File, Properties from the menu.

3. Tap [Configure].

4. To change the baud rate, tap the down arrow to display a list of possible settings, and tap the baud rate that you want to use.

5.5 Connect the PC and TREQ-L

With the cable connected (see section 5.2, “Connect the Serial Cable”) and ActiveSync installed on your PC (see section 5.3, “Download/Install ActiveSync”), do the following to establish a connection between the PC and the TREQ-L:

1. On your PC, start ActiveSync.
2. Open the File menu, and select **Get Connected**, or select **Connection Settings** and then click **[Connect]**.

3. Click **[Next]**. The TREQ-L automatically responds to the PC’s ActiveSync connection request. (See Figure 18).

The first time you connect, the PC scans all available serial ports for the ActiveSync connection, which can take some time. For this reason, the TREQ-L or the PC may time out before the connection is found. It is typical to have to re-run one or both ActiveSync programs a few times before they find each other. This is especially true if your PC has several serial ports. Once ActiveSync identifies the port, all future connections will occur quickly.

**Figure 18**
ActiveSync, Get Connected

**NOTE**
If you know to which serial port on the PC the TREQ-L is connected, you can select the port in ActiveSync on the PC and save the scanning time. Refer to section 5.5.1, “Select the COM Port Manually.”

When the “Connecting to Host” message appears on the TREQ-L, the ActiveSync window on the PC displays “Connecting.....”
4. When the ActiveSync connection is established, the PC displays a window titled “New Partnership” (see Figure 19). Typically, you should select **No** and then click **[Next]**.

![Figure 19](image)

*ActiveSync Partnership*

The ActiveSync window then displays “Connected” (see Figure 20).

![Figure 20](image)

*ActiveSync, Connected*
5. You can now browse the TREQ-L file system by selecting the Explore option on the PC’s ActiveSync File menu (see Figure 21).

5.5.1 Select the COM Port Manually

You can save scanning time during the initial connection if you know to which serial port on the PC the TREQ-L is connected. Do the following to select the port:

1. In the ActiveSync program on the PC, select the Connection Settings option on the File menu (see Figure 22).

Figure 21
ActiveSync, Explore Device

Figure 22
ActiveSync, Connection Settings
2. Enable the “Allow connections to one of the following:” option, and select the appropriate COM port.

3. Tap [OK] to save the settings.
Notes


CHAPTER 6

APPLICATION DEVELOPMENT

6.1 Introduction

This chapter describes the process of developing and debugging applications for the TREQ-L and assumes familiarity with C programming language and Windows application remote debugging procedures. (If necessary, consult the Microsoft MSDN library or Embedded Visual C++ Help text for a refresher on remote debugging.) This information is intended for integrators and application developers as a guide in setting up the TREQ-L for application development and as a reference for programmatic interfaces (API) to software drivers for various terminal peripherals.

The TREQ-L is a Windows CE-based computer with specialized hardware peripherals that make it suitable for vehicular applications. Application development and debugging procedures for the TREQ-L, as well as the software driver API, are similar to other Windows CE-based devices. This chapter provides instructions and references for TREQ-L-specific functionality. For example, the TREQ-L has a serial port, but the serial port driver interface is not documented in this manual because the interface is a standard, well-known API.

6.1.1 Glossary

API
Application Program Interface

SDK
Software Development Kit

EVC4
Embedded Visual Studio C++ Version 4

IDE
Integrated Development Environment

6.1.2 Related Documents

- Microsoft Embedded Visual C++ Version 4.0 Help
- Microsoft Visual Studio 2005 MSDN Library
- Microsoft Visual Studio 2008 MSDN Library
- Windows Embedded CE 5.0 Documentation
6.2 Setup

6.2.1 Prerequisites

The following are required before setting up the TREQ-L for application development. Either an Ethernet or Serial connection is required (both are included here for completeness).

**Ethernet connection:**
The host can communicate with the TREQ-L during a remote debugging session over an Ethernet network. The TREQ-L should be connected to the same network and on the same subnet as the host.

The network can be established using an external USB adapter. Use the Windows CE Wireless Zero Configuration tool that automatically launches when the USB WiFi adapter is inserted to configure the wireless Ethernet connection (refer to section 7.2, “Wireless Ethernet”). Use the AX887721 connectoid to configure the USB-to-wired Ethernet adapter (refer to section 7.3, “Ethernet (over USB):”).

**Serial connection:**
The host communicates with the TREQ-L during a remote debugging session via ActiveSync over a serial connection. The connection must be a “full” serial port, meaning that all of the following serial protocol signals must be connected to and supported by the host PC: RX, TX, RTS, CTS, DTR, DSR, and DCD. The TREQ-L developer kit includes a USB-to-serial converter that can be used for the ActiveSync connection.

**Software Development Kit:**
The SDK is an MSI installable file distributed by Beijer Electronics. The SDK should be installed so that the host IDE knows how to connect to the TREQ-L. The SDK also provides headers and libraries that correspond to the available services and features included in the TREQ-L Windows CE image.

**Integrated Development Environment:**
Microsoft Visual Studio 2008, Microsoft Visual Studio 2005, and/or Embedded Visual C++ 4.0 should be installed as a development environment for the TREQ-L application. These programs are used to compile and remotely debug the application. The latest service packs and updates for these Microsoft programs must be installed.

6.2.2 SDK Installation

The latest Software Development Kit is available from the Beijer Electronics Web site (http://www.beijerelectronicsinc.com). The SDK and Windows CE image release dates should match to ensure that all features and services in the image correspond to those offered in the SDK. Use the latest available SDK version if the release date of the most recent Windows CE image supersedes that of the SDK.

To install the SDK on your PC host, download the .msi file from the Beijer Electronics Web site, right-click the file name, and select **Install**. After the installation is complete, verify that
“TreqGL Device” appears in the Tools, Configure Platform Manager dialog box in Embedded Visual Studio and that “TreqGL” appears in the Tools, Connect to Device dialog box in .NET.

### 6.2.3 Target Setup

#### 6.2.3.1 ActiveSync

You can use the ActiveSync protocol to establish a remote debugging connection with the Integrated Development Environment. Refer to Chapter 5, “Connect to a PC Via ActiveSync” for ActiveSync setup instructions.

#### 6.2.3.2 Manual Server

If you do not use ActiveSync, you must set up a manual Ethernet client server on the TREQ-L. You must configure this server to respond to debug or download connection requests from the host PC’s IDE. ActiveSync has the advantage of easier setup because the IP address of the target is negotiated automatically; however, it also uses a slower connection over the serial port.

**EVC4**
At a TREQ-L command prompt window, execute the following command:

```
cemgrc.exe /T:tcpipc.dll /Q /D:<host IP address>:<port number>
```

The /D switch specifies the IP address of the host PC. <port number> must match the port number on the corresponding setup on the host PC (see section 6.2.4, “Microsoft Embedded Visual C++ 4.0” below). If there is an error connecting, you may need to re-execute the `cemgrc.exe` command.

**Visual Studio**

### 6.2.4 Microsoft Embedded Visual C++ 4.0

EVC4 must be configured to connect with the TREQ-L target. Take the following steps to configure EVC for use with manual server (Ethernet) remote debugging. (Refer to Figure 23.)

1. After installation of the SDK, “TreqGL Device” should be listed in Tools, Configure Platform Manager. Edit the properties of the TreqGL Device. At the “Transport” option, select **TCP/IP Transport for Windows CE**; at the “Startup Server” option, select **Manual Server**.
2. Select **Configure for the TCP/IP Transport**.
3. Select **Fixed Port**, and set the port number to match the port number used in the target setup in section 6.2.3, “Target Setup” above.

4. Select **Use Fixed Address**. The IP address in the box should be the IP address of your PC.

5. Select **Test** in the Device Properties window to test the connection.

6. Restart the server on the target (re-execute the cemgrc.exe command) after the test.

---

Building applications in EVC automatically download to the TREQ-L target, and debugging sessions automatically connect to the TREQ-L target. In addition, the remote tools accessed from EVC4’s Tools menu connect to the TREQ-L, including the Remote Registry Editor.

EVC4 can also be configured to connect to the TREQ-L target using ActiveSync. To configure EVC4 with ActiveSync, take the following steps.
1. Follow the instructions in section, “Connect to a PC Via ActiveSync.”

2. From the Tools menu, select Configure Platform Manager, and edit the properties for the TREQ-L. For the “Transport and Startup Server” option, select Microsoft ActiveSync.

6.2.5 Microsoft Visual Studio 2005/2008

Take the following steps to configure .NET to connect with the TREQ-L target. (Refer to Figure 24.)

1. From the Visual Studio Tools menu, select Options, Device Tools, Devices.

2. Select TreqGL from the “Show devices for platform” drop-down box. “TreqGL_PXA27X: ARMV4I_Release” should be the only device listed in the “Devices” box.


4. From the “Default output location on device” drop-down box, select the desired location for deploying the Visual Studio project executables and libraries. Select Root folder if you want to download to \HardDisk. The path to the directory in the root location is specified in the Visual Studio Project Properties dialog box.

5. Click [Configure].

6. If using ActiveSync, select Obtain an IP address automatically using ActiveSync.

   If using the ConMan Ethernet client, select Use specific IP address, and type in the IP address of the TREQ-L. Detailed instructions are available online at http://msdn2.microsoft.com/en-us/library/ms228708(VS.80).aspx.
Figure 24
TREQ-L Device Connection with Visual Studio
7. Verify the device connection. From the Tools menu, select **Connect to Device**. Refer to Figure 25.

![Figure 25](image)

*Figure 25*

**Visual Studio, Connect to TREQ-L Device**

8. Make sure the selected platform is “TreqGL,” and the device is “TreqGL_PXA27X: ARMV4I_Release.”

The status bar at the bottom of the Visual Studio workspace window should indicate a successful connection.

You can use Visual Studio to construct sample native and managed applications to test the Build, Deploy, and Debug process. Take the following steps.

### 6.2.5.1 Native

1. From the Visual Studio File menu, select **New Project**.

2. Select **Visual C++**, **Smart Device**, and **MFC Smart Device Application** in the window on the right.

3. Select a directory for the project, and click **[OK]**.

4. Click **[Next]**. Move the “TreqGL SDK” to the “Selected SDKs” column. It should be the *only* selected SDK (move any others to the left).

5. Continue to configure the application with the next few dialog boxes as desired.
6. Enable the Device toolbar from the View, Toolbars menu.

7. Make sure that the “Target Device” drop-down list shows “TreqGL_PXA27X: ARMV4I_Release.” If not, click [Device Options] (next to the drop-down list), and select TreqGL from the “Show devices for platform” drop-down list.

8. Right-click the project from the Solution Explorer window, and select Properties to bring up the Property Pages for the project.

9. In Configuration Properties, Debugging and Configuration Properties, Deployment, set the Remote Executable and Remote Directory parameters, respectively (see Figure 26). These parameters determine the path in the TREQ-L file system where the executable will be deployed and executed.

![Figure 26](image)

Visual Studio, Native Project Properties
6.2.5.2 Managed

The TREQ-L comes with the .NET Compact Framework v2.0 pre-installed.

Visual Studio 2008 offers a selection between v2.0 and v3.5 at the time of project creation (refer to step 2 below). If v3.5 is selected and “Deploy the latest version of the .NET Compact Framework” is checked (see Figure 27), Visual Studio will deploy, install, and debug with v3.5. Installation of v3.5 compact framework is not persistent if the TREQ-L is rebooted—it must be reinstalled.

Visual Studio 2005 does not have an option to deploy and install v3.5.

1. From the Visual Studio File menu, select New Project.

2. Select Other Languages, Visual C#, Smart Device, Windows CE 5.0, and Device Application in the window on the right.

   In Visual Studio 2008, select Visual C#, Smart Device, and Smart Device Project in the window on the right. In the “Add New Smart Device Project” dialog box, select Windows CE as the target platform, the desired .NET Compact Framework version, and Device Application from Templates.

3. Select a directory for the project, and click [OK].

4. Enable the Device toolbar from the View, Toolbars menu.

5. Make sure that the “Target Device” drop-down list shows “TreqGL_PXA27X: ARMV4I_Release.” If not, click [Device Options] (next to the drop-down list), and select TreqGL from the “Show devices for platform” drop-down list.

6. Right-click the project from the Solution Explorer window, and select Properties to bring up the Property Pages for the project.


8. In Devices, select the desired Output file folder (see Figure 27). This parameter determines the path in the TREQ-L file system where the executable will be deployed and executed.
6.2.6 Remote Tools

Microsoft provides several remote tools with the Visual Studio 2005, Visual Studio 2008, and Embedded Visual C++ installations, such as Remote Registry Editor and Remote Zoom In (for screen capture). These tools work over an established remote debugging connection. Follow the procedures outlined in sections 6.2.1 through 6.2.3 to set up this connection.

Note that there may be a delay the first time a remote tool requests to connect to the TREQ-L target. The platform manager framework copies required libraries and executables for running the remote tool during this time. Subsequent connection requests will not have this delay unless the TREQ-L has been rebooted since the last request.

Refer to the following MSDN links for additional information about the Microsoft remote tools:  
6.3 Software Drivers

Software access and control of specialized hardware peripherals on the TREQ-L are provided through device driver and registry interfaces. These interfaces utilize the standard Windows stream driver API (e.g., CreateFile, WriteFile, ReadFile, and DeviceIoControl) and registry access API (RegOpenKeyEx, RegQueryValueEx, etc.). Most TREQ-L peripherals do not fit the typical model for stream devices that transfer large amounts of data, thus the traditional operations like read and write are not supported. The primary access and control mechanism is the DeviceIoControl function, which provides flexibility via custom IOCTL codes. Refer to Microsoft documentation for a detailed description of the driver and registry API functions.

The following sections outline the behavior, supported IOCTL codes, and registry keys/values for each peripheral.

IOCTL codes are described in the form of sample C code and in-line comments. The inputs and outputs of each IOCTL are described. Sample calls are provided to illustrate proper usage for each IOCTL. IOCTL defines and enumeration values for input and output parameters to the DeviceIoControl function are described in the file `TreqPublic.h` that is included in the software development kit distribution (`\Program Files\Windows CE Tools\wce500\TreqGL\Include\Armv4i\TreqPublic.h`). For example, the keypad button key defines are listed in this header file. The sample code below references `TreqPublic.h` as appropriate.

Registry keys/values are listed in a standard [key] “value” format. These keys/values may be queried or set programmatically via the registry access API or by using a utility program like `RegEditCE.exe` (refer to section 4.7.2, “Beijer Electronics” on page 30).

**NOTE**
The code in the following sections is included “as is” for illustration purposes only. It is recommended that the application developer check the return value for success or failure of device driver API calls.

6.3.1 Keypad

The keypad driver initiates scans of the elastomeric function keys and reports presses to the GWES (graphical, window, and events) Windows CE subsystem. Single and multiple simultaneous presses are supported.

Auto-repeat is supported, including variable initial delay and repeat rate. These parameters apply globally to all keys in the built-in keypad and to any externally connected USB keyboard and can be set via keypad driver DeviceIoControl calls or via the Keyboard control panel applet (refer to section 4.1.4, “Keyboard” on page 21). Although repeat rate and initial delay are global, auto-repeat enable/disable is selectable per key via DeviceIoControl calls to the keypad driver.

Each key can be individually assigned a virtual key code. Supported virtual key codes include all Windows CE standard supported codes (defined in `winuser.h`, found in the TREQ-L SDK distribution located at `\Program Files\Windows CE Tools\wce500\TreqGL\Include\Armv4i\`) as well as custom codes enabling the assignment of mouse clicks and movements and the ability...
to launch applications and define key sequences. Key codes are assigned via DeviceIoControl calls to the keypad driver. Independent control of a press vs. a release key code is not supported; all actions occur on a press (as opposed to a key release). Refer to section 3.3, “Keys” for default key mappings.

When assigned the appropriate key code (e.g., VK_RUN_APP or VK_SEQ), a key can launch an application defined by a string that is set via a DeviceIoControl call to the keypad driver. The application is always launched on a key press.

When assigned the appropriate key code (e.g., VK_MOUSE_LEFT or VK_MOUSE_LEFT-CLICK) a key can control mouse cursor movement or simulate a mouse button click. If repeat is enabled for that key, and a mouse movement code is assigned, holding down that key causes the mouse to move and then accelerate. When the shift state is changed, any keys being held down will be “released” by the driver before the state change occurs (this prevents a stuck-down key state because held keys are not re-registered as new presses in the new shift state).

The keypad driver implements a shifted and non-shifted state. This should not be confused with the use of the SHIFT key (VK_SHIFT). The shift state applies globally to all keys and can be enabled/disabled via DeviceIoControl calls to the keypad driver. A shifted state allows a second set of key code assignments that can be quickly enabled or disabled via a single driver call. The program KeyShiftCE.exe is a sample application that toggles the keypad shift state (refer to section 4.7.2, “Beijer Electronics” on page 30). Every key and shifted key has its own set of repeat and extended data storage (path or sequence information), so shifting the keys provides a complete new set of keys. Note that when the keys are shifted, any keys being held down will be released by the driver before the actual shift takes place, preventing a stuck-down key state.

Key sequences are distinctive. No mouse commands may be embedded in a key sequence, and the repeat flag does not work for a key inside a sequence. Instead, key sequences have a flag indicator to indicate whether or not to release the current key and all previous keys that were down. Not specifying the release flag simply means that the release will occur when the key goes up. To use auto-repeat with a sequence, mark the VK_SEQ identifier (the first key) as auto repeat. Besides the normal VK_keys given by WinCE, a VK_RUN_APP may be embedded in a key sequence. Using the VK_RUN_APP in a sequence always causes a release for previous keys in the sequence, regardless of whether or not the release flag was specified.

**API, described via code examples:**

```c
HANDLE hDevice;
hDevice = CreateFile(TEXT("KEY1:"), GENERIC_READ, 0, NULL, OPEN_EXISTING, 0, NULL);
WORD key; // See TreqPublic.h for key defines, e.g. TREQ_KEY0
WORD keyCode; // See TreqPublic.h for key code defines, e.g. VK_RETURN
// Use keyCode |= TREQ_KEY_REPEAT; to enable repeat for key,
// otherwise it is disabled
DWORD keyIn = (keyCode << 16) | key;

// set key mapping and repeat
DeviceIoControl(hDevice, IOCTL_KEYPAD_SET_KEY, &keyIn, sizeof(keyIn), NULL, 0, NULL, NULL);

// get key mapping and repeat
```

TREQ-L Mobile Data Terminal
Application Development  Software Drivers

DeviceIoControl(hDevice, IOCTL_KEYPAD_GET_KEY, &key, sizeof(key),
    &keyCode, sizeof(keyCode), NULL, NULL);
BOOL bRepeat = (keyCode & TREQ_KEY_REPEAT) != 0; // get repeat state

// Set shift state to "on" to access shifted key set
// Once in shift mode, set and get key will access the shifted set
int shift = 1;
DeviceIoControl(hDevice, IOCTL_KEYPAD_SET_SHIFT, &shift, sizeof(shift),
    NULL, 0, NULL, NULL);
// get shift state
DeviceIoControl(hDevice, IOCTL_KEYPAD_GET_SHIFT, NULL, 0,
    &shift, sizeof(shift), NULL, NULL);

// set cursor key acceleration
// applies only when mouse cursor key codes are used
int accel = 5; // 0 to TREQ_KEY_MAX_ACCEL, defined in TreqGLPublic.h
DeviceIoControl(hDevice, IOCTL_KEYPAD_SET_ACCEL, &accel, sizeof(accel),
    NULL, 0, NULL, NULL);
// get cursor key acceleration
DeviceIoControl(hDevice, IOCTL_KEYPAD_GET_ACCEL, NULL, 0,
    &accel, sizeof(accel), NULL, NULL);

// set and get the path to an executable program or a sequence of keys
// executed when the key is pressed (requires a VK_RUN_APP or VK_SEQ keycode)
// runApp launches MintermCE.exe
// string initializer includes null terminator
WCHAR runApp[] = { TREQ_KEY0, VK_RUN_APP, TEXT("\HardDisk\bin\MintermCE.exe") };
// VK_0 thru VK_9 are the same as ASCII '0' thru '9' (0x30 - 0x39)
enum { VK_0=0x30, VK_1, VK_2, VK_3, VK_4, VK_5, VK_6, VK_7, VK_8, VK_9 };
// VK_A thru VK_Z are the same as ASCII 'A' thru 'Z' (0x41 - 0x5A)
enum { VK_A=0x41, VK_B, VK_C, VK_D, VK_E, VK_F, VK_G, VK_H,
    VK_I, VK_J, VK_K, VK_L, VK_M, VK_N, VK_O, VK_P,
    VK_Q, VK_R, VK_S, VK_T, VK_U, VK_V, VK_W, VK_X,
    VK_Y, VK_Z };

// runSeq launches MintermCE.exe, then types "done"
// Can't use string initializer when data follows the path in
// the sequence (compiler limitation)
WCHAR runSeq[] = { TREQ_KEY1, VK_SEQ | TREQ_KEY_REPEAT, VK_RUN_APP,
    '\', 'H', 'a', 'i', 's', 'd', 'i', 's', 'k', 'o','u', 'n', 't', 'e', 'r', 'm', 'C', 'E', 'e', 'x', 'e', 0, // must null terminate!
    VK_D, VK_O, VK_N, VK_E | TREQ_KEY_RELEASE };

// otherSeq types "Hello World" followed by a return, and repeats
WCHAR otherSeq() = { TREQ_KEY2, VK_SEQ | TREQ_KEY_REPEAT,VK_LSHIFT,
    VK_H | TREQ_KEY_RELEASE, VK_E, VK_L, VK_L, VK_O,
    VK_SPACE, VK_LSHIFT,
    VK_W | TREQ_KEY_RELEASE, VK_O, VK_R, VK_L, VK_D,
    VK_RETURN | TREQ_KEY_RELEASE };
DWORD seqNumBytes = sizeof(runApp); // num bytes, including NULL terminator
DeviceIoControl(hDevice, IOCTL_KEYPAD_SET_KEY, runApp, seqNumBytes,
    NULL, 0, NULL, NULL);
DeviceIoControl(hDevice, IOCTL_KEYPAD_SET_KEY, runSeq, seqNumBytes,
    NULL, 0, NULL, NULL);
DeviceIoControl(hDevice, IOCTL_KEYPAD_SET_KEY, otherSeq, seqNumBytes,
    NULL, 0, NULL, NULL);
// find length of key data sequence for key 1
// To get returned length: retDataNumBytes/sizeof(WCHAR)
// Must pass at least a WORD to the output buffer to get the initial code:
// keyCode will be set to VK_SEQ if it is a sequence
int keyCode;
DWORD retDataNumBytes = 0;
DeviceIoControl(hDevice, IOCTL_KEYPAD_GET_KEY, &key, sizeof(key),
&keyCode, sizeof(keyCode), &retDataNumBytes, NULL);

// sequence string returned in retData
DWORD retPathNumBytes = retDataNumBytes;
DeviceIoControl(hDevice, IOCTL_KEYPAD_GET_KEY, &key, sizeof(key),
retData, retDataNumBytes, NULL, NULL);

// set auto repeat delay and rate (global)
#include <keybd.h> // from SDK, for struct defn
// all int32 struct members, only first 2 matter
// delay is in ms
// repeat rate is in keys/sec
KDIAUTOREPEATINFO ai = { delay, repeatRate, 0, 0 };
DeviceIoControl(hDevice, IOCTL_KBD_SET_AUTOREPEAT, &ai, sizeof(ai),
NULL, 0, NULL, NULL);

CloseHandle(hDevice);

Example registry settings:
This example shows the registry key settings for key 0 and cursor acceleration. To adjust
another key, change the 0 to the number of the desired key (0 through 11).

[HKEY_LOCAL_MACHINE\Drivers\BuiltIn\KEYPAD]
"CursorAccel" = dword:5
"Key0" = dword:200 ; VK_RUN_APP
"Key0Shift" = dword:201 ; VK_SEQ
"Key0Repeat" = dword:0
"Key0ShiftRepeat" = dword:0
"Key0Ext" = hex: 65,00, 78,00, 70,00, 6c,00, 6f,00, 72,00, 65,00, 72,00,
2e,00, 65,00, 78,00, 65,00, 00,00 ; run explorer.exe
"Key0ShiftExt" = hex: 45,00, 58,00, 50,00, 4c,00, 4f,00, 52,00, 45,00,
52,00, 6e,00, 45,00, 58,00, 45,80 ; type explorer.exe (key release at end)

Changes to these registry settings take effect only after a reboot.

6.3.2 Backlight

The backlight driver is responsible for enabling/disabling and setting the intensity levels of the
display and keypad backlights. The driver performs these operations in response to user inter-
action (programmatically or via a user interface) in order to reduce power consumption.

The intensities of the display and keypad can be independently controlled via driver DeviceIo-
Control calls. The display control panel, backlight tab includes a control for the backlight
intensity. This control is a slider that sets the display and keypad backlight intensities simulta-
neously (refer to section 4.1.3.2, “Intensity” on page 20). The TREQ Panel application
includes independent slider controls for these settings (refer to section 4.2, “TREQ Panel”).
The backlight driver contains a timer that can be used to enable power-down and/or power-off modes after a specified time has elapsed. This time can be set for both power-down and power-off via driver DeviceIoControl calls, the display control panel applet, or the TREQ Panel application. The applet provides discrete time selections only, but a continuous range is available programmatically. Set the power-off time or power-down time to zero to disable this feature. The power-off and power-down timers can also be disabled by setting the UsePowerOff and UsePowerDown registry values to zero (see below).

Power-down mode dims both the display and keypad backlights to the specified intensity. This power-down intensity level can be set via a DeviceIoControl call. Any user activity will return the backlight intensities to prior levels. Examples of user activity are pressing the touch screen or keypad, or using a USB mouse or keyboard (specifically, when the event defined in the [HKLM\System\GWE\ActivityEvent] registry key is signaled).

Power-off mode disables the display backlight, keypad backlight, and the LCD display. Any user activity will return the unit to its prior state.

**API, described via code examples:**

```c
HANDLE hDevice;

hDevice = CreateFile(TEXT("BLT1:"), GENERIC_READ, 0, NULL, OPEN_EXISTING, 0, NULL);

// get/set backlight intensity
int intensity = 80; // 0 to 100%
DeviceIoControl(hDevice, IOCTL_BACKLIGHT_SET_INTENSITY, &intensity, sizeof(intensity), NULL, 0, NULL, NULL);
DeviceIoControl(hDevice, IOCTL_BACKLIGHT_GET_INTENSITY, NULL, 0, &intensity, sizeof(intensity), NULL, NULL);

// get/set keypad backlight intensity
intensity = 80; // 0 to 100%
DeviceIoControl(hDevice, IOCTL_BACKLIGHT_KEYPAD_SET_INTENSITY, &intensity, sizeof(intensity), NULL, 0, NULL, NULL);
DeviceIoControl(hDevice, IOCTL_BACKLIGHT_KEYPAD_GET_INTENSITY, NULL, 0, &intensity, sizeof(intensity), NULL, NULL);

// get/set keypad AND display backlight power-down intensity
intensity = 15; // 0 to 100%
DeviceIoControl(hDevice, IOCTL_BACKLIGHT_POWERDOWN_SET_INTENSITY, &intensity, sizeof(intensity), NULL, 0, NULL, NULL);
DeviceIoControl(hDevice, IOCTL_BACKLIGHT_POWERDOWN_GET_INTENSITY, NULL, 0, &intensity, sizeof(intensity), NULL, NULL);

// set or get the backlight power down or power off timeout value
int pwrTime; // seconds
DeviceIoControl(hDevice, IOCTL_BACKLIGHT_SET_POWERDOWN, &pwrTime, sizeof(pwrTime), NULL, 0, NULL, NULL);
DeviceIoControl(hDevice, IOCTL_BACKLIGHT_GET_POWERDOWN, NULL, 0, &pwrTime, sizeof(pwrTime), NULL, NULL);
DeviceIoControl(hDevice, IOCTL_BACKLIGHT_SET_POWEROFF, &pwrTime, sizeof(pwrTime), NULL, 0, NULL, NULL);
DeviceIoControl(hDevice, IOCTL_BACKLIGHT_GET_POWEROFF, NULL, 0, &pwrTime, sizeof(pwrTime), NULL, NULL);
```
CloseHandle(hDevice);

Example registry settings:

[HKEY_CURRENT_USER\ControlPanel\BackLight]
"BacklightIntensity"=dword:00000064 ; 100%
"BacklightKeypadIntensity"=dword:00000064 ; 100%
"BacklightPowerDownIntensity"=dword:f ; 15%
"UsePowerOff"=dword:00000001
"UsePowerDown"=dword:00000001
"PowerOffTimeout"=dword:00000708 ; 1800s=30m
"PowerDownTimeout"=dword:00000258 ; 600s=10m

Changes to these registry settings take effect only after a reboot.

6.3.3 EMP (Emergency Power)

The EMP driver is responsible for responding to low input voltage and voltage recovery events from the TREQ-L’s power backup circuitry and reporting them to the system.

There are three voltage thresholds and three corresponding operating system events generated, as follows:

- **Main Power Low** – the input voltage drops below the highest threshold.
- **Backup Power** – the input voltage drops below the threshold at which backup power is applied. This threshold is at a lower voltage than Main Power Low.
- **Main Power High** – the input voltage has risen above the Main Power Low threshold plus an additional hysteresis band.

**NOTE**

*The Main Power High event is not generated during boot as the system powers up.*

In order to avoid race conditions with regulated voltage supplies, the Main Power High event can be signaled no sooner than 0.5 second after a preceding Main Power Low event, provided that the voltage increases past the threshold. After a Main Power Low event occurs, a check is made every 0.5 second to determine whether the input voltage has satisfied the conditions for signaling a Main Power High event. Thus Main Power High events are only signaled after an elapsed time that is a multiple of 0.5 second from the last Main Power Low event.

The EMP driver takes successively more significant measures to reduce power consumption as the input voltage drops. The Main Power Low event causes the keypad and display backlight to dim to an intensity that can be set via a DeviceIoControl call to the backlight driver for power down intensity (section 6.3.2, “Backlight”). The Backup Power event causes the USB ports, keypad backlight, display backlight, and LCD display to be completely disabled. The EMP driver can be configured to leave USB power on to both ports during a Backup Power event (see “Example registry setting” below). Only a Main Power High event will return the unit to its state prior to experiencing power failure events.
If the input voltage drops suddenly and drastically, it is possible that the Backup Power event may be signaled before the Main Power Low event. The monitor thread for the Backup Power has a higher priority because of the importance of taking measures to reduce power consumption in a low input voltage state.

The power consumption in the Backup Power state (backlights and display disabled) is between 1.3W and 1.7W, depending on USB device power consumption.

Windows CE power notifications are generated to signal the occurrence of the above three events. The RequestPowerNotifications function can be used with a message queue to register to receive EMP event notifications. The EMP driver generates messages of type PBT_TRANSITION in a POWER_BROADCAST structure. The Flags member of this structure is set to a power state enumeration defined in TreqPublic.h. The Power Manager knows nothing of these three custom states; they are only used in the power notification process (e.g. GetSystemPowerState() will never return POWER_STATE_MAIN_PWR_LOW).

API, described via code examples:

```c
// Sample code to be run from a separate thread for
// monitoring power failure events

UCHAR buf[QUEUE_SIZE];
HANDLE hNotifications = NULL, hReadMsgQ = NULL;
MSGQUEUEOPTIONS msgOptions = { 0 };
DWORD dwBytesInQueue, dwFlags;
POWER_BROADCAST pB = (POWER_BROADCAST)buf;

// Create a message queue for Power Manager notifications.
msgOptions.dwSize = sizeof(MSGQUEUEOPTIONS);
msgOptions.dwFlags = 0;
msgOptions.dwMaxMessages = QUEUE_ENTRIES;
msgOptions.cbMaxMessage = sizeof(POWER_BROADCAST) + MAX_NAMELEN;
msgOptions.bReadAccess = TRUE;

// Check return value for NULL
hReadMsgQ = CreateMsgQueue(NULL, &msgOptions);

// Request Power notifications, check return value for NULL
hNotifications = RequestPowerNotifications(hReadMsgQ, PBT_TRANSITION);

while (TRUE) {
    dwBytesInQueue = dwFlags = 0;
    memset(buf, 0, QUEUE_SIZE);

    // Read message from queue. Check for 0 return value
    if (!ReadMsgQueue(hReadMsgQ, buf, QUEUE_SIZE, 
                      &dwBytesInQueue, INFINITE, &dwFlags)) {
        break; // error with ReadMsgQueue
    }

    if (dwBytesInQueue < sizeof(POWER_BROADCAST)) {
        // error: not enough bytes received
        break;
    }
}
if (PBT_TRANSITION == pB->Message) {
    switch (POWER_STATE(pB->Flags)) {
    case POWER_STATE_MAIN_PWR_LOW:
        // Main Power Low event received
        break;
    case POWER_STATE_MAIN_PWR_HIGH:
        // Main Power High event received
        break;
    case POWER_STATE_BACKUP_PWR:
        // Backup Power event received
        break;
    default:
        break;
    }
    break;
} // while(TRUE)

StopPowerNotifications(hNotifications);
CloseMsgQueue(hReadMsgQ);

Example registry setting:
[HKEY_LOCAL_MACHINE\Drivers\BuiltIn\EMP]
"ManageUSBPower" = dword:1 ; set to 0 to force USB devices on in backup power mode

6.3.4 Power

The Power Management driver can be used to control power state transitions for the TREQ-L system or for specific peripherals. User applications may use the Windows CE Power Management API (e.g., the SetSystemPowerState and SetDevicePower functions) to control and set system or device power states. The power states for the system are specified via specific strings, for example, “useridle.” The power states for peripherals are specified with the Windows CE power state enumerations D0–D4.

Refer to the Power Management functions documentation on MSDN (http://msdn2.microsoft.com/en-us/library/ms895437.aspx), the pm.h header file that is included in the SDK (Program Files\Windows CE Tools\wce500\TreqGL\Include\Armv4\pm.h), and the CEDEVICE_POWER_STATE enumeration at http://msdn2.microsoft.com/en-us/library/aa447663.aspx. The following table shows the available TREQ-L system power states, specified as both strings and enumerations (when available).
The following are examples illustrating how to put the system and backlight, display, and USB peripheral devices into a specific power state.

```c
// Be sure to check return values for Power Management functions
#include <pm.h>

#define BACKLIGHT_DEVICE_NAME PMCLASS_GENERIC_DEVICE TEXT("\BLT1:" )
#define DISPLAY_DEVICE_NAME PMCLASS_DISPLAY TEXT("\pxa27x_lcd")
#define USB_DEVICE_NAME PMCLASS_GENERIC_DEVICE TEXT("\HCD1:" ) DWORD
DWORD dwDummy;
CEDEVICE_POWER_STATE cps;
TCHAR buf[50];

///////////
// System

// Get system power state
GetSystemPowerState(buf, 50, &dwDummy);
// buf contains the current power state string, e.g. "on"

// Perform a soft reset using the Power Manager API
// These two calls do the same thing
SetSystemPowerState("reboot", 0, 0x0);
SetSystemPowerState(NULL, POWER_STATE_RESET, 0x0);
```
// Put the TREQ-L system in the system idle state, then
// go back to the on state
SetSystemPowerState("systemidle", 0, 0x0);
SetSystemPowerState("on", 0, 0x0);

////////////////
// Peripherals
// Backlight
// cps will have the current state
GetDevicePower(BACKLIGHT_DEVICE_NAME, POWER_NAME, &cps)
// Set the backlight driver's power state to D2 "standby" state.
// The backlight is dimmed, but not off in D2
SetDevicePower(BACKLIGHT_DEVICE_NAME, POWER_NAME, D2);

// Display
// cps will have the current state
GetDevicePower(DISPLAY_DEVICE_NAME, POWER_NAME, &cps)
// Set the display driver's power state to D4 "off" state,
// which turns the display off.
SetDevicePower(DISPLAY_DEVICE_NAME, POWER_NAME, D4);

// USB
// cps will have the current state
GetDevicePower(USB_DEVICE_NAME, POWER_NAME, &cps)
// Set the USB driver's power state to D4 "off" state,
// which disables bus power to any connected USB devices.
SetDevicePower(USB_DEVICE_NAME, POWER_NAME, D0);

6.3.5 Serial Ports

Refer to the following MSDN Web site regarding programming serial connections for information about and examples of the Windows CE serial port API:

The COM driver uses the stream driver interface. COM1 and COM5 drivers have port names of COM1: and COM5:, which can be passed to the CreateFile function to open these ports. COM5 is a virtual COM port that is available when a USB-to-serial converter is attached.

The MinTermCE.exe application is a simple terminal program (refer to section 4.7.2) that can be used to test communications over the TREQ-L serial ports. COM1 or COM5 may be selected for communications in the MinTermCE dialog box. Refer to Figure 28 to see an example communications test on COM1.
COM1 may be configured in software as either an EIA-232 port with hardware flow control or an EIA-422 port. This configuration is performed programmatically via driver DeviceIoControl calls (see below). The serial port driver configures the terminal for the requested mode (232 or 422) and stores the mode in internal non-volatile memory. When the TREQ-L is rebooted, the bootloader configures the serial port based on the stored mode.

The COM1 serial port mode is not stored in the Windows CE registry in order to support the correct configuration early in the boot cycle. Early configuration minimizes the time that the serial port is not configured while the TREQ-L is powered, preventing possible conflicts with external devices connected to the serial port. Therefore, there are no Windows CE registry settings that reflect or control the configurable serial port mode.

The default mode for COM1 is EIA-232. The serial port mode will be preconfigured by Beijer Electronics as part of the testing process according to the serial port mode in the requested TREQ-L terminal configuration. Contact Beijer Electronics technical support for more details regarding your TREQ-L terminal configuration.

API, described via code examples:

```c
DWORD dwIn;
DWORD dwOut = 0, dwActualOut = 0;
HANDLE hDevice;

hDevice = CreateFile(TEXT("COM1:"), GENERIC_READ|GENERIC_WRITE, 0, NULL,
                      OPEN_EXISTING, 0, NULL);

// chose 232 or 422 mode
```
dwIn = GPIO_MP_RS232;    // refer to TreqPublic.h for defines
// dwIn = GPIO_MP_RS422;

DeviceIoControl(hDevice, IOCTL_SERIAL_SET_MPORT_CONFIG, &dwIn,
    sizeof(dwIn),
    NULL, NULL, NULL, NULL);

DeviceIoControl(hDevice, IOCTL_SERIAL_GET_MPORT_CONFIG, NULL, NULL,
    &dwOut, sizeof(dwOut), &dwActualOut, NULL);

dwOut &= 0x0000FFFF;  // the upper 16 bits contain internal driver
    information

// dwActualOut is set to sizeof(DWORD) = 4
// dwOut is set to GPIO_MP_RS232 in this example

CloseHandle(hDevice);

6.3.6 Network

Windows CE provides a standard API called Winsock for programming with TCP/IP-based
network connections. Network connections are available for multiple interfaces and peripherals on the TREQ-L, such as external USB-to-wired Ethernet adapter, external USB to WiFi adapter, and external Bluetooth Personal Area Network adapter. Refer to Chapter 7, “Optional Peripherals” for additional information on these interfaces and peripherals.

Refer to the following MSDN articles for detailed information and programming reference for the Winsock Windows CE API:

Refer to the following MSDN article for Winsock programming samples:

Following are some MSDN articles describing networking, connectivity, and using sockets with the .NET Compact Framework:
CHAPTER 7

OPTIONAL PERIPHERALS

7.1 USB

USB mass storage devices may be accessed programmatically via the standard C file I/O routines (e.g., fopen, fwrite, etc.) or the Windows API functions: CreateFile, ReadFile, WriteFile, and so on. Refer to the documents listed in section 6.1.2, “Related Documents” for more information.

The USB-to-serial converter used for the ActiveSync connection described in Chapter 5, “Connect to a PC Via ActiveSync” is an optional USB peripheral. This device uses an FTDI chipset for the USB to serial conversion. The TREQ-L includes driver support for this chipset. USB-to-serial converters with other chipsets are not natively supported and will require additional third-party Windows CE drivers. The standard COM port interface described in section 6.3.5, “Serial Ports” can be used to interface with this device.

Many other optional USB device peripherals may be attached to the TREQ-L. Wired Ethernet, 802.11b/g WiFi, and Bluetooth adapters are also supported (refer to sections 7.2, 7.3, and 7.4). A USB 802.11b/g WiFi adapter is also supported (refer to section 7.2, “Wireless Ethernet”). Other devices may be attached and used provided there are available Windows CE 5.0 drivers that will run on an ARM platform. APIs for these devices must be provided by a third party or from drivers written from scratch.

7.2 Wireless Ethernet

The TREQ-L provides 802.11b/g wireless Ethernet capability via an external USB WiFi adapter: Xterasys model XN-3135G. For more information about the adapter refer to the following Web site: http://www.xterasys.com/product/xn3135g.htm. This device utilizes the Ralink RT2501USB chipset.

Drivers for this device are included in the TREQ-L file distribution. Other USB WiFi devices that include the same Ralink chipset may work with the Xterasys drivers on the TREQ-L.

Windows CE provides a programmatic interface for using the WiFi adapter via the Winsock API. Refer to section 6.3.6, “Network” for more information on Winsock.

Wireless Ethernet adapter configuration in Windows CE is provided by the Wireless Zero Configuration service. For more information about this service refer to: http://msdn2.microsoft.com/en-us/library/ms885812.aspx.

Figure 29 illustrates the Wireless Zero Configuration after the USB WiFi adapter has been inserted.
7.3 Ethernet (over USB):

The TREQ-L supports USB-to-wired Ethernet adapters based on the ASIX AX88772 chipset. Drivers for devices based on this chipset are included in the file distribution. Nintendo® Wii™ USB LAN adapters based on the AX88772 chipset will work with the TREQ-L.

When the adapter is inserted, the TREQ-L will display a new connectoid labeled AX887721 in the Network and Dial-up Connections dialog box (see Figure 30 below).

The AX887721 connection automatically obtains IP configuration (address, subnet mask, and gateway) if DHCP is enabled. Right-click, or select **File, Properties** from the menu for the...
AX887721 connectoid to configure DHCP or static values as well as name servers for this connection. DHCP is enabled by default.

Running `ipconfig` from the command shell (`Start`, `Programs`, `Command Prompt`) lists detailed information for the TREQ-L network connections.

### 7.4 Bluetooth

The TREQ-L supports USB Bluetooth adapters based on the Cambridge Silicon Radio chipset.

Several connectivity options are available when a supported adapter is inserted and paired with another Bluetooth device. Virtual serial port, personal area network, and human interface device connectivity options are described in detail in this section. These options have some native application support that allows use and testing of the Bluetooth connection. Other options are available via APIs and Bluetooth Profiles provided by Windows CE. Refer to the following MSDN articles for more information about these topics:


#### 7.4.1 Pairing

Use the Bluetooth Manager Control Panel applet to pair Bluetooth devices (refer to section 4.1.8, “Bluetooth Manager”).

![Bluetooth Manager](image)

*Figure 31*  
*Bluetooth Manager*

Initiate pairing as follows.

1. Select one of the “Untrusted” entries, and then press `-->` to move the selected device to the “Trusted” window. A prompt appears asking if you need to authenticate the device with which you are trying to pair.

2. First try pairing with a device without authenticating. Tap **[No]** at the prompt. If successful, the pairing operation will finish by adding the device entry to the “Trusted” window.
3. Now try to pair with authentication by tapping [Yes] when prompted for authentication. A PIN code dialog box appears as shown in Figure 32. This is the security code that is used for authentication and encryption with the other Bluetooth device.

In the example illustrated, a USB to Bluetooth adapter was used on the PC to pair with a TREQ-M4 terminal.

![Figure 32 Bluetooth Manager Requesting Pairing Authentication](image)

4. Enter a code of your choice. It is recommended to use at least eight random characters. The device with which you are trying to pair should open a similar dialog box prompting for a security code.

![Figure 33 PC Requesting Pairing Authentication](image)

5. Enter the same code on the remote device immediately. The two devices should be paired at this point. Pairing is confirmed when the Bluetooth Manager moves the “Untrusted” device to the “Trusted” window.
### 7.4.2 Virtual Serial Port

The TREQ-L’s Bluetooth device can be used to establish a virtual serial port connection with another Bluetooth device (such as a PC with a Bluetooth adapter).

1. First scan and pair with a remote device that supports the serial port profile. The serial port service is identified by an icon consisting of a blue circle enclosing two arrows that appear to chase one another.

2. After moving this service to the “Trusted” window in the Bluetooth Manager, right-click on the service, and select the **Active** option from the resulting menu (see Figure 34). This registers a virtual com port or Bluetooth serial port on the terminal, and it assigns the new serial port a device name with the prefix BSP. At this point, the index associated with this prefix is unknown to the user.

3. Launch the MinTermCE program on the TREQ-L (refer to section 4.7.2, “Beijer Electronics”).

4. Select a new serial port from the COM Port drop-down list that starts with “BSP.” You may need to obtain the latest version of the MinTermCE executable that includes the BSP port handles.

   The Bluetooth Manager does not identify which index is assigned to the new virtual serial port (suffix). If this is the first Bluetooth serial port created on the device, the index is one, thus the desired port would be “BSP1.” You will need to use trial-and-error in MinTermCE to find the correct Bluetooth serial port because invalid ports cause an error. Figure 35 shows an active virtual serial port connection using MinTermCE.
You can also check the HKEY_LOCAL_MACHINE\Drivers\Active registry keys for a “BSP#” device to determine the correct port. Figure 36 shows how the RegEditCE program (see section 4.7.2, “Beijer Electronics”) can be used to check these keys.

Figure 36
Examining Active Driver Registry Keys With RegEditCE
5. After selecting the correct serial port in MinTermCE, activate the port by pressing the Port Open icon. This connects the serial port service of the terminal with the serial port service of the remote device. Follow the steps required by the remote device to accept the virtual serial port connection.

6. Open a terminal emulator on the remote device (such as HyperTerm on a PC), and select the proper serial port for the remote device’s Bluetooth serial port.

7. Once the terminal emulator is connected, type some test messages and send them to the terminal. Do the same on the terminal to ensure that the terminal can both send and receive messages over the Bluetooth serial port. Figure 37 shows an example session from a terminal emulation program running on a PC’s Bluetooth serial port (COM3).

![Figure 37](image.png)

**Figure 37**

*Bluetooth PC Virtual Serial Port Connection*

Without a specialized application, the terminal will only act as a client that initiates these Bluetooth serial port connections.

The standard COM port interface described in section 6.3.5, “Serial Ports” can be used to programmatically interface with the Bluetooth serial port device. Use BSP#: as the driver port name instead of COM#:.

### 7.4.3 Personal Area Network

The TREQ-L’s Bluetooth device can be used to establish a Personal Area Network (PAN) connection with another Bluetooth device (such as a PC with a Bluetooth adapter).
1. First scan and pair with a remote device that supports the Personal Area Networking profile. The PAN service is identified by an icon consisting of two PC monitors with a drawn wire connection.

2. After moving this service to the “Trusted” window in the Bluetooth Manager, right-click the service, and select the **Active** option from the resulting menu (see the third service icon in Figure 34 above). This registers a new network connection with Windows CE.

![Figure 38](image)

*Figure 38
Activate Bluetooth Network Service*

3. The Network and Dial-up Connections Control Panel applet contains an additional connectoid called “BTPAN1” that reflects the newly registered network connection. Use the Properties dialog box for this connectoid to set IP configuration parameters. You may configure DHCP or static values, as well as name servers for this connection. DHCP is enabled by default. Running `ipconfig` from the command shell lists detailed information for the BTPAN1 connection.

Figure 39 illustrates the Properties for the Bluetooth connectoid and some sample IP parameters. This example shows a connection with a static IP address.

![Figure 39](image)

*Figure 39
Bluetooth Connectoid IP Configuration*
4. Follow a similar setup on the paired device. On a PC running Windows XP, use the Bluetooth Network Connections dialog box to set up IP configuration parameters. This dialog box is accessible from the Network Connections Control Panel application. Figure 40 illustrates this setup. This example shows a connection with a static IP address that is on the same subnet as the TREQ-L device.

![Bluetooth PC Connection IP Configuration and Ping Test](image)

**Figure 40**  
Bluetooth PC Connection IP Configuration and Ping Test

5. Use the ping program to test the PAN connection. Figures 40 and 41 show a successful ping test.
7.4 Human Interface Device

The TREQ-L’s Bluetooth device can be used to support Bluetooth-enabled mice, keyboards, and other Human Interface Devices (HID).

1. First enable a keyboard and mouse for discovery, and then perform a scan operation in the Bluetooth Manager. This scan should produce entries in the “Untrusted” window.

2. Pair with the HID devices by selecting them one at a time and moving them to the “Trusted” window.

   During the pairing operation, the selection of whether or not to use authentication will depend on the keyboard or mouse that is being paired. The behavior of these devices varies. This is because there is no method for entering a security code of your choice on the remote device. Often, these devices will have some means for providing a secure authentication but the TREQ-L may not support this. If you are unsure, use an unauthenticated pairing procedure.

3. Once paired, right-click on the device in the “Trusted” window of the Bluetooth Manager and select Active. This should perform the operations needed to use the service specified by the entry in the “Trusted” window. Perform these steps for each HID device.

4. Move the mouse, or type on the keyboard to ensure that the Bluetooth devices are working properly with the TREQ-L.
# CHAPTER 8

## SPECIFICATIONS

### Display

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>TFT color WVGA LCD display</td>
<td>256,000 colors</td>
</tr>
<tr>
<td>Size</td>
<td>178 mm (7”) diagonal</td>
</tr>
<tr>
<td></td>
<td>154 mm x 93 mm “live area”</td>
</tr>
<tr>
<td>Pixels</td>
<td>800 x 480</td>
</tr>
<tr>
<td>Dot Pitch</td>
<td>0.19 mm</td>
</tr>
<tr>
<td>Lighting</td>
<td>LED&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Brightness is software controllable</td>
</tr>
<tr>
<td>Touch Screen</td>
<td>Analog resistive</td>
</tr>
</tbody>
</table>

### Interface

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial ports</td>
<td>One serial port configurable to EIA-232, -422, or -485</td>
</tr>
<tr>
<td>USB ports</td>
<td>Two USB ports (one on front, one on back)</td>
</tr>
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</table>

### Audio

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speaker</td>
<td>Built-in 40 mm sealed speaker on back of unit</td>
</tr>
</tbody>
</table>

### Physical

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Four-bolt stud-mount</td>
<td></td>
</tr>
<tr>
<td>Size</td>
<td>200 x 159 x 50 mm</td>
</tr>
<tr>
<td>Mass</td>
<td>1.2 kg</td>
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### Environmental

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>Operating -20 to 60 °C</td>
</tr>
<tr>
<td></td>
<td>Storage -40 to 85 °C</td>
</tr>
<tr>
<td>Humidity</td>
<td>0 to 95% non-condensing</td>
</tr>
<tr>
<td>Vibration</td>
<td>10 to 1000 Hz, 4 g RMS</td>
</tr>
<tr>
<td>Shock</td>
<td>20 g, 11 ms, any axis</td>
</tr>
<tr>
<td>Electrical transient and noise</td>
<td>As specified in J1455 standard</td>
</tr>
<tr>
<td>ESD</td>
<td>8 kV contact, 15 k V air discharge on all surfaces</td>
</tr>
</tbody>
</table>

### Power

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage range</td>
<td>8 to 32 VDC (exceeds J1455)</td>
</tr>
<tr>
<td>Average power consumption</td>
<td>6–7 Watts (500–580mA @ 12 VDC)</td>
</tr>
</tbody>
</table>
Specifications

1. TREQ-L Revision 1 display lighting is CCFL.
2. TREQ-L Revision 1 compact flash standard is 256 Mbytes.

**CPU**

| ARMV5TE Marvell PXA270 with Intel XScale technology |
| Speed: 416 MHz |
| Cache: 32 kB instruction cache, 32 kB L2 data cache, 2 kB L1 data cache |

**Memory**

| SDRAM: 128 Mbytes standard, 32 bit wide bus, 100 Mhz => 400 MB/s transfer rate |
| Compact Flash: 2 Gbytes² |

**Software**

| Operating system: Microsoft Windows CE version 5.0 Professional |

**Customizing**

Pad-printed logo may be customized with minimum order.
Text or symbols on the elastomeric keypad may be customized with minimum order.
Custom configurations available with setup fee and minimum order quantity.

**Certification**

| FCC Part 15, Class A |
| CE |
9.1 Layout and Dimensions
**Figure 43**
*TREQ-L Back View*

**Figure 44**
*TREQ-L Side View*
9.2 Connector Pinouts

<table>
<thead>
<tr>
<th>Color Code</th>
<th>TREQ 232 Function</th>
<th>TREQ 422 Function</th>
<th>Molex 2x4 Minifit Jr. (ref)</th>
</tr>
</thead>
<tbody>
<tr>
<td>white</td>
<td>Power</td>
<td>Power</td>
<td>1</td>
</tr>
<tr>
<td>red</td>
<td>Rx</td>
<td>Rx+</td>
<td>2</td>
</tr>
<tr>
<td>white/red</td>
<td>Tx</td>
<td>Tx−</td>
<td>3</td>
</tr>
<tr>
<td>—</td>
<td>N.C.</td>
<td>N.C.</td>
<td>4</td>
</tr>
<tr>
<td>black</td>
<td>Ground</td>
<td>Ground</td>
<td>5</td>
</tr>
<tr>
<td>drain</td>
<td>Shielded Ground</td>
<td>Shielded Ground</td>
<td>6</td>
</tr>
<tr>
<td>green</td>
<td>CTS</td>
<td>Rx−</td>
<td>7</td>
</tr>
<tr>
<td>white/green</td>
<td>RTS</td>
<td>Tx+</td>
<td>8</td>
</tr>
</tbody>
</table>

Figure 45
TREQ-L Integral Cable

**NOTE** Your cable configuration may be customized with a different connector type. Contact Beijer Electronics technical support at [http://www.beijerelectronicsinc.com/support/contact/?type=tech](http://www.beijerelectronicsinc.com/support/contact/?type=tech) if you have cable connector questions.
9.3 Demo Cable

![Diagram of Demo Cable](image)

<table>
<thead>
<tr>
<th>Female DB9</th>
<th>Function w/respect to PC</th>
<th>Molex 2x4 Minifit Jr. (ref.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DCD</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>Rx</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Tx</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>DTR</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>Ground</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>DSR</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>RTS</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>CTS</td>
<td>8</td>
</tr>
<tr>
<td>9</td>
<td>Power</td>
<td>1</td>
</tr>
</tbody>
</table>

*Figure 46*

*TREQ-L Demo Cable*
CHAPER 10

TECHNICAL SUPPORT

10.1 Software Upgrades

This section provides instructions to install future software releases for the TREQ-L. You can obtain the latest releases of TREQ-L firmware and Windows CE operating system software from the Beijer Electronics Web site (http://www.beijerelectronicsinc.com/support/files or http://www.beijerelectronicsinc.com/engfiles/treq.php).

A USB keyboard is required for the following upgrade operations.

10.1.1 Operating System

The TREQ-L Windows CE-based operating system is contained in an image file called NK.bin. This file is packaged along with several other files and directories to form a system package distribution. The TREQ-L has an internal flash-based hard drive that is programmed at the factory with the system package distribution. Periodically, Beijer Electronics creates new versions of the operating system image (NK.bin), other files/directories in the distribution, or the directory structure of the distribution. Revisions to any of these results in a new release of the system package distribution. Upgrading the system package is the only way to install new versions of items in the package, including the operating system image.

Beijer Electronics has developed an update and package manager application called UpgradeCE.exe. This program can be used to upgrade the system package with updates from the Beijer Electronics Web site, as well as to install custom application packages. One advantage of using UpgradeCE.exe rather than a CAB file or other update/install method is that registry settings are preserved, even after installation of a new operating system image (normally, installing a new NK.bin causes registry settings to revert to factory defaults).


For detailed information about UpgradeCE.exe, refer to the following Web site: http://www.beijerelectronicsinc.com/engfiles/TREQ/Apps/UpgradeCE.html.

The WinVerCE.exe utility (refer to section 4.7.2, “Beijer Electronics” on page 30) can be used to determine the current system package version. Run WinVerCE.exe from the Start Menu on the TREQ-L task bar in the Beijer Electronics shortcut folder. The “Project Version” and “Build Date” fields indicate the version and build date of the system package, respectively (see Figure 47). These fields are updated when a new version of the system package is installed. “Kernel Version” refers to the Windows CE kernel version and license level.
To upgrade the TREQ-L system package, take the following steps:

1. Download the latest system package zip file. This file is available from two locations on the Beijer Electronics Web site: http://www.beijerelectronicsinc.com/support/files/#TREQ-L or http://www.beijerelectronicsinc.com/engfiles/treq.php. The latter may include previous images and other items for download in addition to the latest system package zip file.
   The zip file contains the latest version of UpgradeCE.exe, the system package distribution, and release notes.

   **NOTE** Be sure to read the release notes for the system package distribution! It is important to be aware of changes to the system that could potentially affect applications and general behavior before upgrading. The release notes are located next to the zip file on the http://www.beijerelectronicsinc.com/engfiles/treq.php Web site.

2. Unzip the system package zip file to a USB memory drive. Retain any directory structure.

3. Make sure the TREQ-L is powered on and any applications are closed.

4. Insert the USB memory drive and attach a USB keyboard to the TREQ-L. Make sure these are the only USB devices attached.

5. Open a command prompt window and type:
   ```
   cd \usbharddisk
   UpgradeCE
   ```
This will initiate the system package upgrade process. (Refer to Figure 48.) UpgradeCE displays a status line for each file in the package, indicating whether that file is up-to-date or needs to be updated. Larger files that need to be updated (e.g., NK.bin) will take longer and display multiple status lines indicating copy progress.

Figure 48
System Package Upgrade

6. Once complete, UpgradeCE will indicate success and ask for confirmation to reboot. (See Figure 49.) Answer y or n. The installation is not complete and UpgradeCE is disabled for further upgrades until after a reboot.

Figure 49
System Package Upgrade Complete
UpgradeCE will request a reboot only if files requiring an update are in use or if the NK.bin operating system image needs to be updated. It is common for the NK.bin image to require updating in system package upgrades.

7. After rebooting the TREQ-L, run the WinVerCE.exe program to verify that the system package was successfully upgraded.

10.1.2 Bootloader

**IMPORTANT** This procedure should not be attempted without the guidance of a Beijer Electronics technical support engineer, and could render the TREQ-L nonfunctional if done improperly.

The TREQ-L Bootloader upgrade procedure involves reprogramming an internal FLASH IC with a ~32KB binary image file. The bootloader has the ability to upgrade itself from an image file in the root directory of the internal hard drive. A special file with an upgrade directive must also be present in the root directory.

1. Obtain a bootloader upgrade image file from Beijer Electronics technical support (http://www.beijerelectronicsinc.com/support/contact/?type=tech). Transfer this file to the TREQ-L's HardDisk directory, and rename it “bloader.bin.” Use a USB memory drive or ActiveSync to perform this transfer.

2. Unlock protected system files using the LockCE.exe program (refer to section 4.4, “File System Filter”). Open a command prompt window, and type:
   ```
   lockce 0 [enter]
   ```

3. Create the bootloader upgrade directive file, “ce.arg.” In the command prompt window type:
   ```
   echo upgrade=bloader.bin > \HardDisk\ce.arg [enter]
   ```

4. Reboot the terminal using the recessed reset button (refer to section 3.1.3, “Reset the TREQ-L”). The bootloader will be upgraded as the unit reboots.

5. Remove the upgrade files. Open a command prompt window and type:
   ```
   lockce 0 [enter]
   del \HardDisk\bloader.bin [enter]
   del \HardDisk\ce.arg [enter]
   lockce 1 [enter]
   ```

6. Close the command prompt window. The bootloader upgrade is complete.

Diagnostic messages are produced by the bootloader during the upgrade process. These messages are sent out the main TREQ-L serial port. They may be observed using a PC and a serial terminal program (e.g., HyperTerm). If the TREQ-L’s serial port is configured as EIA-232, connect the PC serial port to the TREQ-L via a cable adapter that routes TREQ-L Tx to PC Rx. Otherwise a converter is required (e.g., for EIA-422). Contact Beijer Electronics technical support for more details.
Following are samples of diagnostic messages.

** ERROR--Unable to find bootloader update file ‘bloader.bin’

The bootloader could not find the upgrade image file. The file may not have been successfully transferred to the TREQ-L internal hard drive’s root directory. Double-check that the file is present with Windows Explorer or the Command Prompt window on the TREQ-L.

** WARNING--Update file ‘BLOADER.BIN’ version matches current - skipping upgrade...

The upgrade image file version matches the currently loaded bootloader. No upgrade is necessary.

** WARNING--Upgrading bootloader - please await reboot!

** WARNING--Update file 'BLOADER.BIN' version matches current - skipping upgrade...

The upgrade was successful. The bootloader automatically reboots the terminal after a successful update, which results in another attempt to upgrade because the ce.arg directive is still present, hence the second message.
Notes