Technical Reference Guide:

Handspring Treo™ Communicator Family

Release 0.92

Information herein is subject to change without notice.

TRADEMARK ACKNOWLEDGMENT

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Change History		
Revision	**Date**	**Description of Changes**
0.9	15 October 2001	Initial Pre-Release

0.91	January 21, 2002	Change API calls:
		
		    HsKeyRegChrToOptChr to HsKeyChrToOptChr
		    HsKeyOptChrToRegChr to HsKeyChrToRegChr
		Only support 3V SIMs
		Updated supported MMI codes
		Updated information on Ring Tone Database

0.92	May 1, 2002	Added information on Treo 90 Updated Blazer section

1. Introduction

The purpose of this document is to provide technical information on the Treo product for mobile operators and application developers. The technical information presented in this document covers a wide range of subjects from Application Programming Interfaces (APIs) to mechanical and electrical information. This document will also cover the special configurations that mobile operators can use to customize the product to their own networks.

This document is not a user's manual. The Treo product comes with a user's manual that describes the operation of the product.

For information about the Treo 90, please refer to Section 2 - Treo 90 Information. The rest of this document will cover the Treo 180.

The Handspring™ Treo provides a comprehensive suite of communications tools in a beautifully integrated package.

1.1 General Description

The Handspring™ Treo is the first truly compact communicator to integrate a mobile phone, wireless data applications (such as messaging and web browsing), and a Palm OS® organizer in one device. Treo comes in two versions: one using a built-in keyboard for data entry and one using the Graffiti® area for data entry. It also comes with two different versions of the GSM radio: one for North America (with operating frequencies of 900MHz and 1900MHz) and one for the rest of the world (with operating frequencies of 900MHz and 1800MHz).

The key differentiator for Treo is the tight integration of the main applications and the user interface that makes all of these applications easy to use. Treo's built-in applications include Phone Book, Short Messaging Service (SMS) Messaging, Blazer® (for web browsing), plus the standard Palm OS™ organizer applications (Datebook+, Memo Pad, To Do, Calculator, and more).

Figure 1 – Handspring Treo 180 is the first truly compact communicator

1.1.1   Compact Communicator

The Treo combines everything you need to stay connected, organized, and in-touch via phone, messaging, and the Internet in a single device.

The following list indicates the wide variety of features offered in this small package:

- Full-featured mobile phone, including speed dial, direct dialing from Phone Book, three way calling, call history, and personal speakerphone.

- SMS Messaging to send and receive quick messages to and from other mobile phones.

- Blazer® to browse the Web quickly and easily.

- Standard Palm OS® organizer functions such as Datebook+, To Do List, Memo Pad, Advanced Calculator, and more.

- o Treo is 100% Palm OS compatible enabling you to run thousands of existing Palm OS applications.

1.1.2 Full-featured phone

The Treo provides a full-featured phone that allows users to perform all phone operations using an intuitive user interface.

- Dial any phone number directly from your Phone Book. You can look up most names in three keystrokes.

- Create up to 50 named, one-touch speed dial numbers.

- One handed dialing using the rocker switch.

- Standard dial pad available to dial numbers that are not in the address book.

- Call History information for all incoming, outgoing, and missed calls.

- Easy 3-Way Conference Calling.

- Call Line Identification works with the Phone Book to display the name of the caller.

- Dual band world phone:
  - o North America version works with the GSM 900 and GSM 1900 networks
  - o European version work with GSM 800 and GSM 1800 networks

- "Hands free" operation using the included headset and "near hands free" operation using the personal speakerphone.

- GPRS upgradeable (*when available*).

1.1.3 Messaging

Messaging services available on the Treo allow you to choose the method of communication: SMS for short messages to other mobile phones and email for full-length messages sent via the Internet.

- Built-in keyboard or Graffiti® area allows for easy, fast text entry for all messaging applications

- SMS Messaging application allow user to easily manage, send, and receive SMS messages

- Easy email access:
  - o Included One-Touch Mail™ allows easy access to your POP3 email server
  - o Treo Mail

1.1.4 Internet

Treo includes the Blazer® web browser that allows access to many Internet sites.

- Access virtually and web site. Blazer® is not restricted to sites that are optimized for mobile devices. Blazer® supports sites written in HTML, WAP (WML/HDML), and cHTML

- Incorporates market-leading encryption technology that provides end-to-end security for Web browsing.

- View Web pages an average of four times faster than competitive web browsers

- View the first screen of virtually any Web page in five seconds or less with built-in content streaming and progressive rendering (actual speed is dependent on network provider service)

1.1.5 Palm OS® Organizer

Organize all of your business and personal information and keep it close at hand.

- Smallest Palm OS® organizer yet.

- Organize your life easily with a calendar (Datebook+), To Do List, Phone Book, Memo Pad, and Advanced Calculator.

- 100% compatible with the Palm OS®, so you can transfer your existing data easily into Treo and run *thousands* of applications that exist on the market today.

- Connects to your computer so you can synchronize with your desktop.

- Compatible with Microsoft Outlook so you can synchronize Treo with your desktop applications such as Microsoft Office Calendar (Windows Only), your contact list, and your company's email.

- Built-in keyboard makes navigating your Palm OS® organizer easy.

1.1.6 Simple navigation

Make calls, send and receive messages, and organize your life, quickly and easily.

- One-button access

  o Access the built-in application with a push of a button.

  o One-handed navigation Use the rocker switch to scroll through addresses and/or to select a phone number to dial.

- Clear lid allows users to view the screen without opening the lid

1.2 Treo Model Line

The Treo line consists of the following models:

Treo 90 – Color Organizer

- Color organizer based on the Treo 180 form factor. Runs Palm OS® 4.1 and includes a Secure Digital (SD) slot and keyboard. Wireless features are not built into this product.

- All applications have been optimized for built-in keyboard navigation.

Treo 180 – Communicator

- Phone, Palm OS® organizer, email, SMS text messaging and wireless web all in one compact device.

- All applications have been optimized for built-in keyboard navigation.

Treo 180g – Graffiti® Handwriting area

- Same as the Treo 180 but with a Graffiti® handwriting area instead of a built-in keyboard.

Treo 270 – Color Communicator

- A color communicator with a backlit keyboard.

2. Treo 90 Information

The Treo 90 is a small and lightweight Palm OS organizer with a built-in keyboard and a full-color screen. Based on the design of the award-winning Treo communicators, Treo 90 comes with 16MB of memory, SD expansion capabilities, and a long-lasting battery.

The following sections will talk about the various technical features of the Treo 90 product.

Figure 2 - Treo 90 Front View   **Figure 3 - Treo 90 Back View with SD Card**

2.1 Hardware

The Treo 90 contains the following hardware features:

- Built-in keyboard
    - Similar to the keyboard found on the Treo 180.
    - Keyboard does **not** have a backlight as the Treo 270.
- 160 x 160 pixel color display
- Dragonball VZ processor running at 33 MHz
    - Based on the Motorola 68K core.
- 16 MB memory
- Lithium Ion rechargeable battery
- Infrared Port located on top of the device
- Cradle connector identical to the Treo 180
- SD Card Expansion Slot

2.1.1 Color Screen

The Treo 90 contains a 12-bit color screen with a 160 by 160 pixel resolution that can be viewed easily under a variety of lighting conditions. Developers who wish to take advantage of the 12-bit color screen should use the standard color API that is part of the Palm OS SDK.

2.1.2 SD Card Support

The Treo 90 features a Secure Digital (SD) slot for expansion. This slot is compatible with SD cards as well as MultiMedia Cards (MMC). The SD slot on the Treo 90 will support memory cards only. SDIO cards are not supported on the device. Developers who are interested in developing SD format cards should look at the SD card development resources located on the Palm OS developer web site at,

http://www.palmos.com/dev

2.1.3 Keyboard Support

The Treo 90 contains a built-in keyboard for data entry. For information about the API for the keyboard, please refer to section 4.1.1.3 - Keyboard.

2.2 Operating System

The Treo 90 runs Palm OS version 4.1H. This is Handspring's version of the Palm OS. Programs that are written to run on Palm OS 4.0 will also run on the Treo 90. Developers who are targeting Palm OS 4.0 devices can use the Palm OS 4.0 SDK from the Palm OS developer web site to develop applications.

2.2.1 Compressed ROM

The contents of the Treo 90 ROM have been compressed in order to fit on the ROM chip. When the device is hard-reset, the system will decompress the ROM and place the uncompressed applications in RAM. Figure 4 shows the screen that is displayed to the user during the decompression process.

Figure 4 - Decompression Process

Because applications that used to be present in the ROM and are now part of RAM, developers should take care that they do not delete these applications. Table 1 lists the applications that have been decompressed and placed in RAM. The compressed versions of these applications are stored in ROM with the creator and type code of 'Lz7C' and the 'HsZ' prefix in their database name. Developers of backup conduits, 3rd party launchers, or other applications that list the available applications should ensure that they do not delete these applications. If an application is deleted, the system will restore the application on soft-reset.

Table 1 – Compresed Applications

Compressed Applications
Address Book
Calc
City Time
Date Book+

Compressed Applications
Expense
Launcher
Mail
Setup (Welcome App)
To Do

2.2.2 Contrast Dialog

As part of the new color screen, the Treo 90 software also includes an enhanced contrast/brightness dialog as shown in Figure 5.

Figure 5 - New Adjust Display Dialog
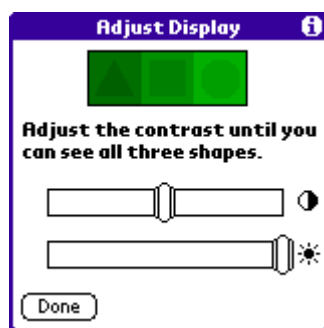
2.3 Development Tools

The development environment for the Treo 90 is identical to the environment used for other Handspring and Palm OS based products. The sections below describe some of the areas to watch out for when using the Treo 90 in your development environment.

2.3.1 Header Files

As mentioned above, the Treo 90 runs Palm OS v4.1H. Developers who which to use the Handspring Extension API for the Treo 90 should also download the Handspring 4.0 Headers from the developer section of the Handspring web site located at,

http://www.handspring.com/developers/sw_dev.jhtml

Please note that this is different from the Handspring Headers v3.52. Those headers are intended for Handspring's Palm OS 3.5 products (including the Treo 180).

2.3.2 Debugger

The Treo 90 contains a new USB controller chip that requires different USB drivers on the desktop computer. The Treo 90 desktop software will install and configure this driver with the HotSync manager. This USB driver is backwards compatible with the other Handspring products. There are two versions of the Palm-Debugger in the new tools installer:

- Palm-Debugger
- Palm-Debugger_Treo90

The Palm-Debugger application will work with all Handspring devices except the Treo 90. If the Treo 90 desktop is installed, one should use the Palm-Debugger_Treo90 for debugging. This debugger will support both the Treo 90 and other Handspring devices. USB Debugging is currently not supported on the Treo 90. Developers interested in debugging their application using the Palm Debugger should use the serial port.

3. Technical Information on Integrated Applications

3.1 Phone Book

The Phone Book is the application that controls all the aspects of the voice features of the communicator. This includes dialing the phone, managing the active calls, viewing your address book, managing your call history, and managing your mobile network preferences. The Phone Book application is an enhanced version of the Phone app that comes with the Visor Phone product.

The Phone Book application has four main screens that can be selected at any time:

- Speed Dial View

    o The Speed Dial View contains five pages of ten buttons allowing for 50 Speed Dial entries.

- Contacts View

    o The traditional address book is now part of the Phone Book application as the Contacts View.

- Dial Pad View

    o Used for dialing numbers that are not in the address book or to navigate a voice mail system.

- Call History View

    o Review incoming, outgoing, and missed called in this single list. One can dial the number or copy the number to the clipboard

Figure 6 - Speed Dial View

Figure 7 - Contacts View

Figure 8 - Dial Pad View

Figure 9 - Call History View
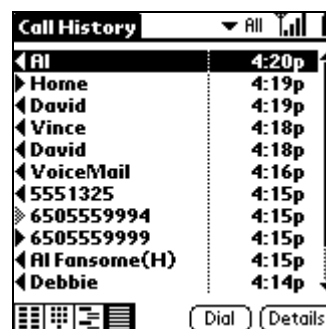
The Active Call Screen is available when there is an active call. This is used to manage the current call or select a different line for multi-line calls or three-way conference calls. This screen can be accessed by the new, right-most icon on the view icons on the bottom of the screen. All other views can be accessed while a call is in progress. The figures listed below show the different operations that are available during an active call.

Figure 10 - Active Call Screen

Figure 11 - 3-Way Conference Call
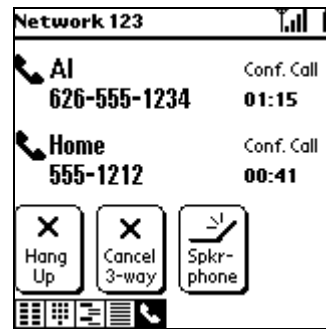
Figure 12 - Two Calls with one call on hold
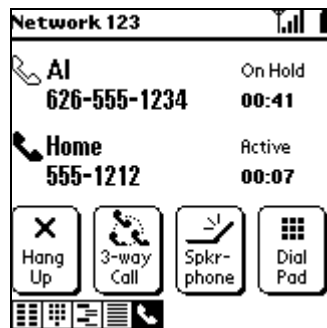
Figure 13 - Call on Hold
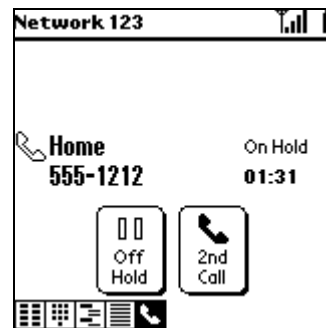
3.1.1 Speed Dial

The data for the speed dial list is stored in a separate database. When a user adds an entry to a speed dial button, the application will copy the entry into the speed dial database instead of making a link. When a phone number changes, the user must update the speed dial button.

3.1.2 Contacts

As mentioned above, the contact view of the Phone Book application is the same as the old Palm OS Address Book application (not included on the Treo). The database that is used for this view is the same database that is used by the old Address Book application and the Address Book conduit. Developers who wish to work with this database can take a look at the sample code provided on Palm's developer web site (www.palmos.com).

3.1.3 Call History

The call history database is also another separate database that contains the details of all the incoming, outgoing, and missed calls. This database also contains information about each call such as, call date and time, phone number, name, duration, and roaming status.

3.1.4 Phone Dialing

The phone application provides a helper service that allows other applications to tell it to dial the phone. Any application that requires the user to make a voice call can broadcast a special help notification. The Phone Book application will receive this event and dial the application. For more information about how to dial the phone from your application please take a look at the SampleDialer sample code located on our web site.

3.2 GSM Mobile Network Features

As the Treo is a mobile phone, there are several features of the Mobile Network that a mobile phone can take advantage of or are required to implement. This section explains the different GSM Mobile Network features as they relate to the Treo.

3.2.1 Telephony Services

Section 3.1 talks about the different functions available during an active call. This section will describe those features in detail.

3.2.1.1 Active Call Screen

See Figure 10

This screen is available during an active voice call. From this screen the user can place the call on hold, hang up, or enable the personal speakerphone. To navigate a voice mail system or other system that requires the user to send DTMF phones, the user can call up the Dial Pad View (Figure 8) to enter the appropriate numbers. Alternatively the user can enter the numbers on the built-in keyboard or write in the numbers in the Graffiti® area depending on the model. Volume adjustment can be done at any time with the rocker switch or the up/down buttons. The personal speakerphone is available by pressing the appropriate button. The system will maintain a separate volume setting for the speakerphone and standard speaker mode. The user can specify a predefined set of digits to be dialed on-demand. This feature is useful for entering passwords on voicemail systems. If the "extra digits" are defined, the "Dial Pad" button will change to an "Extra Digits" button.

3.2.1.2 Call Hold

See Figure 13

When a call is placed on hold, an additional button appears labeled "2nd Call" and tapping it returns the user to the default view to make a second call. The user can switch between the held call and the active call by tapping on the held call. If the user releases the active call then the held call automatically becomes the active call, whereas if the other party releases the active call the user is responsible for taking the call off hold.

3.2.1.3 Call Waiting

Figure 14 - Call Waiting Dialog

If Call Waiting is enabled and there is an incoming call during an active call the user hears the in-band call waiting tones and the Call Waiting dialog appears on screen and presents the user with three options:

- "Drop & Answer" releases the active call and answers the waiting call.

- "Hold & Answer" places the active call on hold and answers the waiting call.

- "Ignore" sends a (User Determined User Busy) UDUB to reject the waiting call and returns to the active call screen.

Alternatively the user may ignore the in-band call waiting tones and the on-screen dialog is dismissed when the network signals the waiting call is removed.

3.2.1.4   Multiparty Calls

See Figure 11

Treo supports three-way multiparty calls according to the GSM specifications. However once a 3-way multiparty call is activated, additional calls cannot be received or connected to the conference call. The multiparty call can only be requested when there is one held call and one active call in progress and is requested from the network when the user taps the "3-way Call" button in the Active Call screen. The "Cancel 3-way" button appears on-screen during the multiparty call and tapping it returns the connected calls to their previous active and held status.

3.2.2   Emergency Calls

The user initiates an Emergency Call from the Dial Pad by dialing "112". Additionally there may be country-specific emergency numbers which are enabled based on the Mobile Country Code (MCC) in the user's IMSI (e.g., "911" in the United States and Canada, or "999" in the United Kingdom).

3.2.3   Supplementary Services

Treo supports many of the supplementary services of the Service Provider. The Call Preferences menu in the Phone Application allows control for Call Forwarding Unconditional (CFU), Call Waiting (CW) and Temporary Invocation of Call Line Identification Restriction (CLIR). The first time the Call Preferences menu is accessed the status of the CFU and CW services are queried from the network and displayed. In addition to the Call Preferences menu, the public MMI is available through the Dial Pad (see Appendix A: MMI Codes supported).

3.2.3.1   USSD

Treo sends user-initiated Unstructured Supplementary Service Data (USSD) strings to the network and displays the response on the screen. USSD strings are entered through the Dial Pad or alternatively by programming the USSD string to a Speed Dial button. The user is required to dismiss the response by pressing an OK button. Treo also supports network-initiated USSD messages.

3.2.4   Data Services

Treo supports all GSM asynchronous data services up to 14.4 kbps. Access to data services is available only to Palm OS applications via the TCP/IP protocol stack using standard API calls. Further information for developers of data applications is available in the Developer Technical Support area of the Handspring web site.

The settings for making a connection to an ISP are contained in the "Network" section of the "Preferences" application, which is accessed from the main Launcher view. The settings include the Username, Password, Phone Number and DNS Settings. There is also a possibility to turn V.42bis on and off by adding AT commands in the "init string" section of the preference panel. Treo supports carrier-defined profiles for making a network connection discussed later in this document.

3.2.5   Network Selection

Treo is set by default to perform automatic network selection across both GSM bands according to the rules outlined in the GSM specifications. The user can search and attempt manual registration with other available networks through the "Select Network..." menu option in the Phone Application. If more than one network is found the user is presented with a list of the available networks and registration is attempted when the user highlights an alternative network and taps the OK button. If registration is unsuccessful Treo remains in automatic search mode and the dialog is dismissed.

3.2.6   SIM PIN/PUK

The SIM PIN entry dialog is displayed at power on if PIN1 is enabled on the SIM. After 3 unsuccessful PIN entry attempts the PIN entry dialog is replaced with the PUK entry dialog. The user is able to make an Emergency Call directly from the PIN entry dialog by tapping the dedicated Emergency Call button. The SIM PIN is enabled or disabled through the Phone Preferences menu option in the Phone Application.

3.2.7   CPHS Features

Treo uses the CPHS Voicemail Indicator (6F11) and Mailbox number (6F17) from the SIM card to retrieve voicemail status and the service provider's voicemail number. When system receives a Voicemail "Set" message, the Phone Book will turn on the voice mail indicator (see Figure 15) and display a "New Voice Mail" dialog (see Figure 16). The voicemail indicator turns off when the system received a "Reset" message.

Figure 15 - Voicemail Indicator

Figure 16 - New Voicemail

3.2.8   Network Name Display

The Network Operator name is displayed at the time of registration, as well as in the title bar of the Speed Dial, Dial Pad and Active Call views. The Treo contains a database of network names and corresponding MCC and MNC codes. When the unit registers on the network, it will read this database to determine which network name to display. The network name database is compiled from the GSM Association specification SE.13 (PPIC&N – *Preferred Presentation of Country Identifier and Network* name) and the GSM North America Association NAPRD.10 (Long Name). Carriers can also request Handspring to configure a custom network name. Such a custom network name can be requested via the Handspring Device Customization Questionnaire.

Future versions of Treo will also be able to read the service provider name directly from the SIM card (Service Provider Name or Operator Name String fields).

3.2.9 Roaming Icon

If the MCC and MNC of the registered network differ from the MCC and MNC of the user's IMSI, the network name in the title bar alternates between the word, "Roaming" and the registered network name every four seconds.

3.2.10 SIM Phonebook

The Treo contains the SIM Phonebook application built into the ROM. This application is used to transfer speed dial entries between the ADN files on the SIM and the Speed Dial database of the Phone Application. The application allows users to copy and delete entries and dial or send a SMS message to the selected number.

3.3 SMS Application

Treo supports the point-to-point Short Message Service (SMS) that provides a means for sending short messages to and from a GSM phone. The SMS application is a separate application that is not merged with an email application. SMS is implemented using a Service Center, which acts as a store and forward center for short messages.

Two different point-to-point services are defined in the SMS specification: mobile-originated and mobile-terminated. Mobile-originated messages are transported from a GSM phone to a service center. These messages may be destined for other mobile users or an email gateway. Mobile-terminated messages are transported from the service center to a GSM phone. These messages may have originated from another GSM phone or a variety of other sources (e.g., email or website).

A message sent on the SMS network is limited to 160 characters. If a longer message is desired, then the message is segmented.

The SMS application in the Treo product uses a library as defined in an application note on our Developer Technical Support section of Handspring website (AN-18: *Using the SMS Library* document at http://www.handspring.com/developers/).

3.3.1 General UI

The SMS Application presents the user with a list of messages, as shown below. This view only displays messages in the SMS Application database; it does not display SMS messages that are still contained on the SIM.

3.3.1.1 List View

Figure 17 - List View (Inbox)

Figure 18 - List View with folder pop-up

The primary advantage of this new list view is to display the entire contents of the message rather than requiring the customer to open the record.

Status Indicators. The battery and signal strength indicators are located in the upper-right corner and the Message folders pop-up menu has moved to the left.

Message sender: Displays sender's name appears in bold if there is a match in the Phone app/address book, otherwise it displays the originating mobile number or email address.

Time/date: Time only is displayed for messages received during the current day. Date only is displayed for messages received the previous day or earlier.

Message body. The entire text of the message is displayed in plain font, indented, beneath the title.

Command buttons. These vary by folder for the type of message (incoming, outgoing) and state (pending, sent) determines the most frequently used operations and thus the options that should be readily available.

3.3.1.2 Single Message View

When a user taps on a message in a list view, the message is displayed in the single message view, as shown below. If a message in the Pending folder is opened, it should load directly into the Message Edit view. While this message is being edited, it is treated like any other instance of editing in that the message won't be sent even if the customer enters network coverage.

Figure 19 - Single Message List View

Figure 20 – Message Opened from Inbox

Figure 21 - Message opened from Sent Box

Figure 22 - Send Error
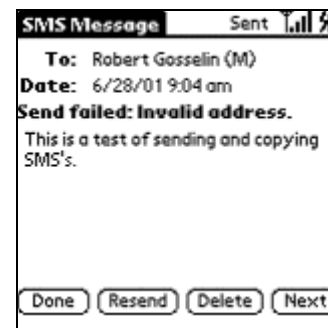
Sender / Recipient: For incoming messages (Inbox folder), the label text reads 'From:'; for outgoing messages (Sent folders), the label text reads 'To:'. The phone number of the sender / recipient is displayed. If the phone number exists in the address book database, the corresponding name is displayed instead.

Date: The date and time stamp (as defined in section 3.3.2.1) is displayed here using the date / time formats selected in the Formats preference panel. The full date (day, month, year) and time information is displayed.

'Send Failed' Alert: If this is an item in the Sent folder that could NOT be sent, a line of text with the message 'Send Failed.' appears below the date. The text of this alert depends on the cause of the failure.

Message Text: The remainder of the screen (except for the row of buttons at the bottom) is reserved for the message text. In the two small fonts, there is room for 9 lines of text. For the large font, there is room for 6 lines. This line count is reduced if the 'Send Failure' message is shown. If the actual text of the message exceeds available space, a scroll bar appears.

Buttons: At the bottom of the view, there is a row of buttons. The actual list of buttons is dependent on the context.

3.3.2 Message Databases

There are two different places where SMS messages can be stored: on the SIM and with the SMS App's database in the device's main memory.

Treo automatically stores incoming SMS messages on the SIM. Once a new message arrives, the SMS App copies the message from the SIM into the SMS App database. After it has been successfully stored in the database, it is removed from the SIM. This transfer of messages occurs regardless of which app is in the foreground or whether or not the device is turned on.

The logic behind this dual database structure is that a conventional SIM can only store about 10 messages. Furthermore, the SIM only stores incoming messages. To provide the user with a robust SMS application that supports an archived Sent messages requires a separate, larger database. Also, having the SMS database stored in the device's memory allows the database to be backed up during a HotSync™ operation. There is no artificial limit placed on the number of messages that can be stored in the database – other than available RAM.

3.3.2.1 Structure of the SMS App Database

Table 2 contains the list of fields in an individual record of the SMS message database. It is recommended that the application use the appropriate GSM Library APIs to access the database instead of accessing the database directly. Please refer to Application Note 18 for further information.

Table 2 - SMS Database Description

Field	Description
Category	Indicates what category the message is in (Inbox, Pending, or Sent)
Status	Current status of message (new, sent, etc.).
Recipient	Contains the recipient of an outgoing message or the sender for an incoming message.
Date	The field date contains the date and time of sending or receiving a message. For outgoing messages this is the date the message was given to the GSM module for sending as indicated by the built-in clock of the Palm OS device. If the message has not been sent, the date refers to the date of the message's creation For incoming messages the value is indicated by the service center (SMSC).
Text	Text of message (Palm OS encoding).

3.3.3 Message Folders

There are three different folders (or in PalmOS database parlance: "categories") in the SMS App database that can contain messages. Each category is used to hold different kinds of messages, as described below.

Inbox: The Inbox contains inbound messages. Incoming messages are originally stored on a database within the SIM card itself. Once these new messages arrive, the SMS App moves these messages to the Inbox folder of the SMS App database. They are then removed from the SIM.

Sent: The Sent folder contains outbound messages that have already been processed by the network. They can either be messages that were successfully sent by the network to the recipient or messages that could not be sent by the network. (Note that this is different than a message that could not be sent because the phone was off or out of coverage – those messages are still in the Pending folder.)

Pending: The Pending folder contains outbound messages that have been finished by the user but could not be immediately delivered either because the phone was off or out of coverage. Normally, if the phone is on and in coverage, the SMS App bypasses the Pending folder and sends the message immediately. Otherwise, the SMS App

leaves the message in the Pending folder. When the phone returns to coverage (or is turned on) the SMS App sends the message at that time. When the message is sent to the network, the network sends back a code indicating success or failure. Once this code is received, the message is moved to the Sent folder.

3.3.4 Text Encoding

- SMS messages are encoded with a special alphabet (see GSM 03.38, section 6.2.1). When a message is read from the SIM and stored in the database, its encoding is changed to the encoding used by Palm OS. If a message is given to the GSM module for sending, the message is encoded into the special SMS alphabet.

- The GSM alphabet contains some characters not available on Palm OS. Palm OS uses the same character encoding as Windows (see "Palm OS Localization Guidelines"). The table below lists all characters in the GSM alphabet not available on Palm OS. Any character not available is replaced by the short string equivalent of that character (e. g. the Greek letter Ω is replaced by the string "\Omega").

Field	Description
Δ	\Delta
Φ	\Phi
Γ	\Gamma
Λ	\Lambda
Ω	\Omega
P	\Product
Ψ	\Psi
Σ	\Sigma
θ	\Theta
Ξ	\Xi

3.3.5   Importing messages stored on a SIM

When the radio powers on and indicates the SIM is ready, the GSM Library checks for SMS messages on the SIM. If there are any SMS messages (either new or previously read), the GSM Library asks the user if they want to move the SMS messages from the SIM to the SMS App database.

If the GSM Library finds the SIM has no additional room to receive a new incoming SMS message, the following message is shown instead:

- Clicking Yes in either dialog moves the messages from the SIM to the SMS App database.

- Clicking No leaves the messages on the SIM until the same check is made the next time the radio is powered on.

If the user does not confirm the transfer of the stored messages, all messages remain on the SIM. The status of those messages does not change. If new messages are received, however, then that new message is downloaded to the SMS App database. If the SIM's SMS storage space is full, the device will not be able to receive new SMS messages.

The intent of this behavior is to prevent the SMS App from removing messages from a foreign SIM – not to prompt the user every time they receive an SMS message when the phone is off. When a phone is turned on, the GSM Library checks the SIM for messages *before* the network forwards new SMS messages to the phone during the network sign on process. A user who never switches SIMs should never see these messages. These messages appear only if the user inserts someone else's SIM that has existing messages on it.

3.3.6   Multi-Part Messages

The GSM SMS Specification (GSM 03.40) includes support for messages longer than 160 characters. If a single message contains more than 160 characters, it is automatically segmented into sub-messages of 152 characters each.

Concatenation of multi-part inbound messages is **not** supported in the first version of the SMS application shipping with Treo. Each sub-message appears as a separate message in the Inbox. Creating multi-part outbound messages, however, **is** supported. The message appears as a single message in the Message Edit UI, but is broken up and sent as separate SMS messages on the network. Once sent, the message appears as several messages in either the Sent or Pending folder. The maximum number of characters in a message is 38,760 characters (as defined by the GSM specification).

3.4   Blazer Web Browser

Figure 23 - Handspring Blazer Home Page

Handspring's web browsing software, Blazer®, is part of the suite of applications built into the Treo ROM. Blazer provides users with an excellent out-of-box web browsing experience allowing them to visit many popular web sites. Blazer provides an intuitive graphical user interface that was optimized from the ground up for Palm OS handheld computers.

The current version of Blazer that is on the Treo ROM is 2.0.

Blazer supports the following markup languages:

- HTML 3.2

- WML 1.2

- HDML 3.0

- cHTML

- XHTML

For further information on Blazers web page rendering capabilities and how one can tune one's page for Blazer, please refer to the Blazer Design Guidelines (available at http://www.handspring.com/developers/documentation.jhtml).

Carriers will be able to provide a customized wireless web experience to end users through direct connect settings, a carrier-determined start page, and carrier-determined bookmarks.

3.5   Other applications

In addition to the voice and data application described above, Treo include a suite of standard Palm OS applications for managing appointments, to-dos, notes, and more. This section will describe the application that ship with Treo. Since Treo is 100% Palm OS compatible, it can run thousands of applications that are available for the Palm OS platform.

3.5.1   Calendar application

Date Book+ is an enhanced version of the standard Palm OS Date Book application. In addition to all the standard Date Book features, it provides a variety of advanced views and functions listed below.

- View To Do items in select calendar views.

- Display a chart of your appointments for one or two weeks complete with descriptions of each event.

- Display a calendar of an entire year.

- Display a list of your appointments in List View.

- Create unscheduled events that float from one day to the next until you complete them.

- Create a Daily Journal to track events with automatic time stamps.

- Save event templates and use them to quickly create similar events.

3.5.2   Calculator

Calculator enables you to perform addition, subtraction, multiplication, division and a variety of advanced math and scientific calculations as listed below.

- Select a view to perform specific types of calculations including: math, trigonometry, finance, logic, statistics, weight/temp, length, area, and volume.

- Store and retrieve values.

- Display the last series of calculations, which is useful for confirming a series of "chain" calculations.

- Create a custom view with the buttons you use most often.

- Switch to basic mode to perform simple calculations.

3.5.3   CityTime

CityTime helps you keep track of the time anywhere around the globe. Some of the features of CityTime are,

- Select a home city as a point of reference.

- Display the day and time in four other cities simultaneously.

- Display a world map with day and night sections

- Add definitions for additional cities.

- Display sunrise and sunset information for your home city.

3.5.4   Expense

Expense lets you keep track of your expenses and then transfer the information to a spreadsheet on your computer. Some of the features of the Expense application are,

- Record dates, types of expenses, amount spent, payment method, and other details associated with any money that you spend.

- Assign expense items to categories so that you can organize and view them in logical groups.

- Keep track of vendors (companies) and people involved with each particular expense.

- Log miles traveled for a particular date or expense category.

- Sort your expenses by date or expense type.

- Transfer your expense information to a Microsoft Excel spreadsheet (version 5.0 or later) on your computer. (Microsoft Excel is not included in the Visor Edge handheld package.)

3.5.5   Memo Pad

Memo Pad provides a place to take notes that are not associated with records in Date Book, Address, or To Do List. Some of the features of Memo Pad are,

- Take notes or write any kind of message on your handheld.

- Drag and drop memos into popular computer applications like Microsoft Word when you synchronize using Palm™ Desktop software and HotSync® technology.

- Assign memos to categories so that you can organize and view them in logical groups.

- Write down phone numbers and other types of information. Later, you can copy and paste this information to other applications.

3.5.6   To Do List

To Do List is a convenient place to create reminders and prioritize the things that you have to do. Some of the features of To Do are,

- Make a quick and convenient list of things to do.

- Assign a priority level to each task.

- Assign a due date for any or all of your To Do items.

- Assign To Do items to categories so that you organize and view them in logical groups.

- Sort your To Do items either by due date, priority level, or category.

- Attach notes to individual To Do items for a description or clarification of the task.

4. Other Programming Interfaces

Since Treo is a Palm OS-based product, developers can take advantage of a wide variety of resources to develop applications. The Palm OS developer community has over 150,000 developers. Handspring has over 11,000 registered developers. Developers who are getting started on Palm OS programming are encouraged to take a look at the development resources available on Palm's developer web site: http://www.palmos.com. To learn more about Handspring products and to learn how to take advantage of the special features, visit Handspring's developer web site at, http://www.handspring.com/developers.

4.1.1 Additional Hardware Features

Treo contains a few hardware features that are relatively new to Palm OS devices: Rocker Switch, Keyboard, and Flip Lid. This section will describe these features and how a programmer can take advantage of them in their application.

The new Treo devices include some new hardware features. Both devices include a 'rocker switch' that allows easy one-handed navigation. Additionally, one device includes a hard keyboard, which allows for data entry without using Graffiti.

Figure 24 - Integrated Rocker Switch

4.1.1.1 Checking the Hardware

The first thing one must do before using the additional hardware features is to check the existence of these features via software. The code below demonstrates how to use the "FtrGet" function to query the type of hardware installed.

```
#include <HsExt.h>

UInt32 keyboardType;

error = FtrGet (hsFtrCreator, hsFtrIDTypeOfKeyboard, &keyboardType);
if (!error && (keyboardType & hsFtrValKeyboardQwerty))
     hasQwerty = true;
if (!error && (keyboardType & hsFtrValKeyboardJog))
     hasJog = true;
```

4.1.1.2 Rocker Switch

The Rocker Switch allows easy one-handed navigations. The Phone Book and the SMS Messaging application take advantage of the rocker switch to browse phone book entries and SMS messages.

The rocker switch passes events to your application just like the scroll buttons. Table 3 lists the possible events the rocker switch and generate.

Table 3 - Rocker Switch Events

Event	Description
Jog Up	The jog up event looks just like a `keyDownEvent`. In this case, the character that is passed in the event is `vchrPageDown`.
Jog Down	The jog down event looks just like a `keyDownEvent`. In this case, the character that is passed in the event is `vchrPageUp`.
Jog Press	The jog press event looks just like a `keyDownEvent`. In this case, the character that is passed in the event is `hsChrJogScan`.

4.1.1.3 Keyboard

The Treo (non-Graffiti® version) also includes a keyboard for easy and fast data entry. They Treo keyboard has two different states: shift and option. The shift state behaves as a standard shift mode allowing for upper case characters. The option state allows the user to enter alternate characters (shown in blue). Applications can use certain APIs to detect and set the state of the keyboard. For example: the Phone Book sets the option state when in the Dial Pad view for easy entry of phone numbers. The corresponding APIs are part of the "HsExt.h" header file and are shown below.

```
// Extended version of KeyCurrentState() to allow detection of many more keys

// being pressed.

void HsKeyCurrentStateExt (UInt32 keys[3])


// Extended version of KeySetMask() to allow masking of many more keys

void HsKeySetMaskExt (UInt32 keyMaskNew[3], UInt32 keyMaskOld[3])


// Extended version of GrfSetState() to allow setting of an option and option

// lock state.

Err HsGrfSetStateExt (Boolean capsLock, Boolean numLock, Boolean optLock,

                      Boolean upperShift, Boolean optShift, Boolean autoShift)


// Extended version of GrfGetState() to allow an option and option lock state to

// be represented.

Err HsGrfGetStateExt (Boolean* capsLockP, Boolean* numLockP, Boolean* optLockP,

                      UInt16* tempShiftP, Boolean* autoShiftedP)
```

You may want to use the following functions for a field that you expect will only have numbers or only letters in it.

```
// Converts the code of a regular character into it's corresponding option

// character and modifier.

Err HsKeyChrToOptChr (UInt16 chr, UInt16* optChrP, UInt16* optModifiersP)


// Converts the code of an option character into it's corresponding regular
```

```
// character and modifier.
Err HsKeyChrToRegChr (UInt16 chr, UInt16* regChrP, UInt16* regModifiersP)
```

All the keys that are typed from the keyboard appear as standard `keyDownEvents`, just as if they were entered using graffiti.

4.1.1.4   Flip Lid

The Flip Lid is an active lid that will turn on the device and launch the Phone Book application. When the lid is closed, the system will turn off. If there is a phone call in progress, the system will hang up the phone and shut down. Developers can set their own application to be the default application that is launched when the lid is opened by using the following API.

```
HsPrefSet (hsPrefLidStatusChgCharAppCreator, kYourAppCreator, kYourAppCreatorSize)
```

When the lid is closed your application will receive a `keyDownEvent` with the `vchrPowerOff` character.

4.1.2   Ring tones

Treo uses the standard Palm OS MIDI file for the ring tones. All the popular tools for creating Palm OS system sounds can be applied to create ring tones for the Handspring communicator products. For more information on creating MIDI databases please refer to section 8.2.1.1.

4.1.2.1   Palm OS MIDI File Format

Database type: '*smfr*'

Each record in the database should contain one MIDI sound. The MIDI sound format is the *Format 0* Standard MIDI File (SMF). For more information on the database format, please consult the *Sound Manager* reference in the *Palm OS Reference Guide* and the *Sound* section of the *Palm OS Companion Guide* available at, http://www.palmos.com/dev/tech/docs/

4.1.2.2   Handspring Communicator Product Information

The ring tones for the Handspring communicator products are stored in a MIDI database similar to the Palm OS "System MIDI Sounds" database. Table 4 contains the details of the system ring tone database.

Table 4 - Type and Creator ID for System Ring Tone Database

Database Name:	System Ring Tones
Database Type:	smfr
Creator Code:	GSMr

In order for the system to recognize the new ring tone, it must be installed into this database using an alarm management tool. Developers who are creating ring tone management applications may wish to keep a separate database of archived ring tones. Handspring recommends that developers use the attributes listed in Table 5 for such database. One can also use standard Palm OS database calls to install the sound records into this database from their own application. Typically, one would create a MIDI sound database (see section entitled *Tools* for more information), install it on the device, and then use an alarm management program to copy the sounds into the system ring tone database.

Table 5 - Type and Creator ID for Developer Defined Ring Tone Database

Database Type:	smfr
Creator Code:	HSsf

4.1.2.3   Restoring the System Ring Tone database

The ring tone database is stored in RAM in order to allow applications to modify the database. The OS also has a copy of this database frozen in the ROM image. The database is copied to RAM after a hard reset or if the database has been deleted from RAM. If the user wishes to restore the original ring tones, they can simply delete the database.

4.1.2.4   Tools

Handspring has provided two tools to assist in converting existing Format 0 MIDI files to the Palm OS database format: `palm-bintool` and `palm-par`. These tools can be found in the "HandspringDatabaseTools" download at http://www.handspring.com/developers/sw_dev.jhtml For more information on generating the Format 0 MIDI files, please see the related section below.

4.1.2.4.1   Palm-BinTool

This tool is used for taking existing MIDI files and converting them to a Palm OS database record format. This is the first step in creating the ring tone database. The usage of the tool is shown below:

```
Palm-BinTool -type midi -name <track name> -midFile <midi file> -o <output record file>
```

`-type midi`	This tells the program to create a MIDI record
`-name <track name>`	This is name of the record and will be the display name on the Ringer Preference Panel
`-midFile <midi file>`	The Format 0 MIDI file
`-o <output record file>`	The database record that is generated by this program

Example:

```
Palm-BinTool -type midi -name "My Ring" -midFile track1.mid -o track1.rec
```

This creates a record titled *My Ring* from the MIDI file *track1.mid* and output the record to the file *track1.rec*.

4.1.2.4.2   Palm-Par

`Palm-Par` is based on the popular Palm OS database creation and manipulation tool called *Par* (see http://www.djw.org/product/palm/par/index.html for more information). This program is used to create a ring tone database from all the records that were generated by the above program. There are several options to this program. The usage for creating a ring tone database is shown below:

```
Palm-Par c <Database File.pdb> <Database Name> smfr XXXX <files …>
```

`c`	Option to create a database
`<Database File.pdb>`	The name of the database file to be generated. This is a PC file that is used by the install program.

`<Database Name>`	The Palm OS name of the database. This can be different than the Database Filename
`smfr`	The type code of the database. `smfr` is the Sound Manager resource type
`XXXX`	The creator code for this database. This should be the developer's unique creator code for his or her own project. Please see http://dev.palmos.com/creatorid/ for more information.
`<files …>`	The list of database record files to put in the database

Example:

```
Palm-Par c FansomeSounds.pdb "Big Red Album" smfr TECH track1.rec mytune.rec
foobar.rec
```

This creates a database file on the PC titled *FansomeSounds.pdb*. The database appears on the Palm OS device as *Big Red Album*. The database has a creator code of *TECH*. There are three records in this database. The titles of the records are determined by the track name specified in `Palm-BinTool`.

By default this tool assigns each record the same Unique ID (UID) of 0. Since the UIDs of *each* ring tone must be different, we need to change the UIDs for each record. In most cases, the alarm management tool takes care of the UID when installing the sound in the master database. If needed, the Palm-Par tool can be used to change the UID for each record using the command line options shown below:

```
Palm-Par u <Database File.pdb> -u <UID> index
```

`u`	Option to update a database
`<Database File.pdb>`	The name of the database file to be modified. This is a PC file that is used by the install program.
`-u <UID>`	The UID to be programmed in decimal
`index`	The record index to use for this update operation

Example:

```
Palm-Par u FansomeSounds.pdb -u 18281 0

Palm-Par u FansomeSounds.pdb -u 18282 1

Palm-Par u FansomeSounds.pdb -u 18283 2
```

This updates the three records in the *FansomeSounds.pdb* database to the new UIDs.

4.1.3   Data Communication

Treo supports data connection through the standard Palm OS serial library and/or NetLib. This enables all of the standard data Palm OS based communication applications to use Treo as a wireless "modem". Please refer to the "AN-09: Data Communications on the Springboard Platform (1.01)" application note on Handspring's website at http://www.handspring.com/developers/tech_notes.jhtml for more details.

4.1.4   SMS

The SMS Messaging application is the main interface to the SMS Database and SMS features of the system. In addition to this application, developers can create their own applications that take advantage of the SMS features.

By following the proper API, applications can register themselves to receive, send, and manage SMS messages. For more information on how to take advantage of the SMS API, please refer to Application Note #18, "Using the SMS Library" on our web site. On our software page, there is a Sample SMS application that demonstrates basic sending and receiving of SMS messages.

5. Configuration

The Treo contains several parameters that are specific to the Service Provider. These parameters can be stored in a variety of locations. This section will go over the difference configurations areas for the Service Providers

5.1 Data Connect

The data connect parameters are stored in a Service Provider configuration database that is contains on the software install CD-ROM that is bundled in the box. This database will contain information for Service Providers that have a distribution agreement with Handspring. During the install process, the install program reads the MCC/MNC codes from the user's SIM card. These codes are used to look up the appropriate information in the configuration database. The installer has the capability to download current information from a special web site. Based on the settings in the configuration database, the user has the following choices for network connections:

1) The service provider offers no circuit-switched data services

   a. Email and web browsing are not available

2) 3rd Party Internet Service Provider (ISP)

   a. The Service Provider allows data connections but does not provide an ISP for connecting to the Internet. The user must supply the connection information for a separate ISP

3) Bundled ISP / Traditional Login

   a. The Service Provider offers an ISP service for connecting to the Internet. The user must provide a unique username and password that is assigned by the service provider.

4) Bundled ISP / Single Login

   a. The Service Provider offers an ISP service for connecting to the Internet. The service uses a single username and password that is part of the configuration database.

If required, the installer program will ask the user for additional settings. These settings will then be transferred to the Treo.

5.1.1 Blazer

There are no network settings in the Blazer application. The Blazer application will use the network connection that is setup by the system.

6. SIM Application Toolkit

6.1 Overview

SIM Toolkit is a GSM Network feature that defines an API between the phone and the SIM. It allows the SIM to contain applications that can control functions of the phone. Using the SIM Toolkit APIs, the application can prompt the user for input, display text, play tones, set up a call, send an SMS, etc. The application developer should query the SIM Toolkit to determine which APIs are implemented on the device.

6.2 Access to SIM Toolkit Functionality

The SIM Toolkit functionality can be accessed in two different ways: initiated by the user and initiated by the SIM. Each method is described below.

6.2.1 User Initiated

The user can start a select a SIM Service by using the SIM Services application. This is a standard Palm OS application that is part of the Treo ROM and is accessible from the system launcher.

Figure 25 - SIM Services Main Menu

6.2.2 SIM Initiated

The SIM is also able to activate the SIM Toolkit session. The SIM Toolkit and the Palm OS work together to display the appropriate dialogs or request user input. This interface works on top of the existing application (see Figure 26).

Figure 26 - SIM Services Displaying a Dialog

6.2.3 Incoming Calls

An incoming call causes an active SIM Toolkit session to be immediately dismissed. This allows the Incoming Call Alert to be displayed.

6.3 Implemented Features

Here is a list of all the SIM Toolkit commands supported by Treo. Note that all SIM Toolkit commands must be acknowledged back to the SIM – otherwise the session is still active and any new SIM Toolkit actions cannot take place.

Table 6 - Supported Commands by SIM Toolkit

STK Class	Command Name	Handspring
1	ENV SMS-PP DATADOWNLOAD	SUPPORTED
1	PROACTIVE SERVING	SUPPORTED
1	PROFILE DOWNLOAD	SUPPORTED
1	REFRESH	SUPPORTED
2	DISPLAY TEXT	SUPPORTED
2	ENV CALL CONTROL BY SIM	TBD – IN PROGRESS
2	ENV CB DATADOWNLOAD	NOT SUPPORTED
2	GET INKEY	SUPPORTED
2	GET INPUT	SUPPORTED
2	MORE TIME	SUPPORTED
2	PLAY TONE	SUPPORTED
2	POLL INTERVAL	SUPPORTED
2	POLLING OFF	SUPPORTED
2	PROVIDE LOCAL INFO	SUPPORTED
2	SELECT ITEM	SUPPORTED
2	SEND DTMF	NOT SUPPORTED
2	SEND SMS	SUPPORTED
2	SEND SS	SUPPORTED
2	SEND USSD	SUPPORTED
2	SET UP CALL	SUPPORTED
2	SET UP MENU	SUPPORTED

STK Class	Command Name	Handspring
3	ENV EVENT DOWNLOAD	NOT SUPPORTED
3	ENV MO SMS CONTROL	TBD – IN PROGRESS
3	ENV TIMER EXPIRATION	SUPPORTED
3	SET UP EVENT LIST	NOT SUPPORTED
3	SET UP IDLE MODE TEXT	NOT SUPPORTED
3	TIMER MANAGEMENT	SUPPORTED
A	GET READER STATUS	NOT SUPPORTED
A	PERFORM CARD APDU	NOT SUPPORTED
A	POWER OFF CARD	NOT SUPPORTED
A	POWER ON CARD	NOT SUPPORTED
B	RUN AT COMMAND	NOT SUPPORTED
C	Browser Termination Event	NOT SUPPORTED
C	LAUNCH BROWSER	NOT SUPPORTED
D	Soft Key Support	NOT SUPPORTED
E	Channel Status Event	NOT SUPPORTED
E	CLOSE CHANNEL	NOT SUPPORTED
E	Data Channel Event	NOT SUPPORTED
E	GET CHANNEL STATUS	NOT SUPPORTED
E	OPEN CHANNEL	NOT SUPPORTED
E	RECEIVE DATA	NOT SUPPORTED
E	SEND DATA	NOT SUPPORTED

6.3.1   Display Text

The Display Text feature allows the SIM to present a string of alphanumeric text to the user (e.g. after a SIM Update message is received). The text string can be as long as the 240 characters. The text will be displayed in a dialog box, accompanied by a system beep. If the text is too long to fit into the dialog, scroll bars will be displayed.

There are two parameters the SIM can use when displaying text:

Priority: A priority value of 0 indicates that the message should only be displayed if the phone is idle and not in an active mode. A priority of 1 indicates the message should be shown at all times. Active mode conditions include during a call or other interaction with the network.

Clear Mode: A value of 0 indicates the dialog should be cleared automatically after 3 seconds (or earlier if the user hits the OK button). A value of 1 indicates the user is responsible for clearing the dialog. The dialog is dismissed if the user hits the OK button, if another phone event occurs, or if another application is launched.

6.3.2   ENV SMS-PP DATADOWNLOAD

ENV SMS-PP DATADOWNLOAD is used to download data to the SIM card using the SMS Point-to-Point bearer service. Transferal of information over the SIM-ME interface uses the ENVELOPE command.

The SMS-PP DATADOWNLOAD operation is automatic and happens in the background without any user interaction.

6.3.3   Get Input

Get Input allows the SIM to proactively request input data from the user. When this feature is requested by the SIM, Treo should display the following dialog:

Figure 27 - SIM Services Get Input
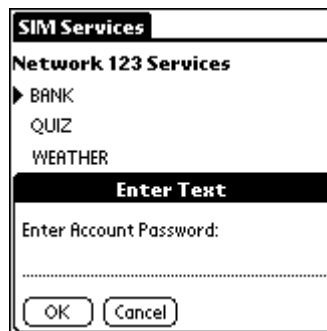
6.3.4   Get Inkey

Get Inkey is identical to the Get Input feature, with one exception: Get Inkey only allows a single character to be entered.

6.3.5   Profile Download

The terminal sends the Profile Download instruction to the SIM as part of the SIM initialization procedure. During this operation, Treo sends its profile (i.e., list of supported SIM Application Toolkit commands) to the SIM so that the SIM Application Toolkit knows which operations the terminal supports.

The Profile Download operation is automatic and happens in the background without any user interaction.

6.3.6   Provide Local Info

This command requests Treo to send current local information to the SIM. Treo returns the following local information: the mobile country code (MCC), mobile network code (MNC), location area code (LAC), the cell ID of the current serving cell, and the device's IMEI.

6.3.7   Select Item

The Select Item feature has a very similar UI to the Set Up Menu feature. As a general rule, Select Item is used to display lower level menus while Set Up Menu is used to display top-level items. To facilitate menu navigation, Select Item adds a 'Back' button, as shown below. The Back button is used to return to the previous menu. All other features should function identically to Set Up Menu. All navigation items from the Set Up Menu section above apply to Select Item as well.

Figure 28 - SIM Services Select Item

6.3.8   Send SMS

The SIM can originate an SMS to the network and at the same time provide additional text to the user. If the SIM requests that additional text be displayed, a message box should be displayed, with scroll bars if necessary (this behavior is identical to the Display Text message box). The dialog should be accompanied by a system beep. The dialog is dismissed if the user hits the OK button, if another phone event occurs, or if another application is launched.

6.3.9   Send SS

This command is similar to SEND SMS in behavior. SEND SS allows the SIM card to send a Supplementary Service string to the network.

6.3.10 Send USSD

This command is similar to SEND SMS in behavior.   SEND USSD allows the SIM card to send an USSD string to the network.

6.3.11 Setup Call

The SIM can proactively request the user to confirm making a call to the network. If the user taps 'Yes', the Phone App active call screen is displayed and the SIM Toolkit application ends.

Figure 29 - SIM Services Setup Call

6.3.12 Set Up Menu

The SIM proactively indicates support for the Set Up Menu feature if suitable SIM Toolkit applications reside on the SIM. As mentioned in section 2.1.1, the user can request that this menu be displayed by selecting the 'Services' app from the PalmOS launcher. This menu contains a list of the available SIM Toolkit applications. As shown below, these applications are reported as a list:

Figure 30 - SIM Services Setup Menu
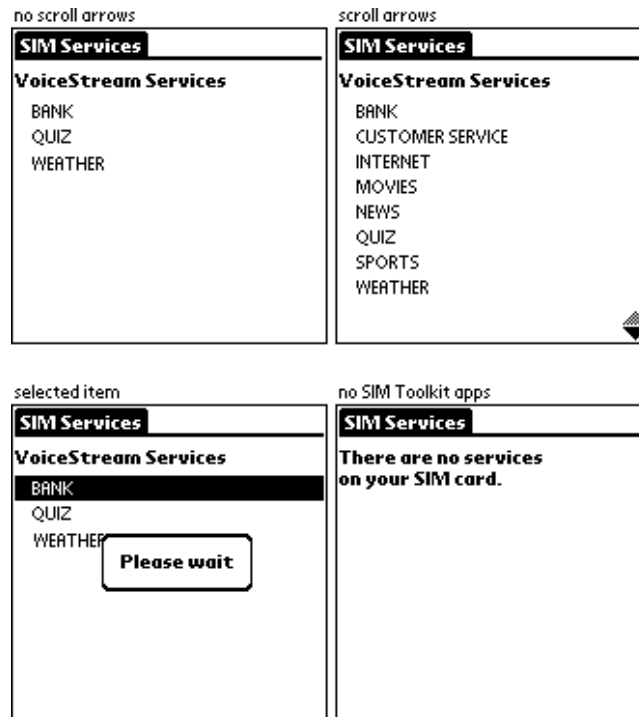
An item is selected by tapping on it with the stylus or pressing enter with the keyboard. When an item is selected, the Please Wait dialog is displayed until the next response is available. While waiting, the selected item should be reversed out as shown. As with any other PalmOS application, returning to the launcher or switching to another application with a hardware button aborts the SIM Toolkit activity. If the user launches the "Services" app and there are not SIM Toolkit applications on the SIM, an error message should be displayed instead (as shown above).

6.3.13 Play Tone

The SIM can proactively request that Treo plays a tone accompanied by some optional text. The SIM Toolkit specification provides for two different types of tones: "Standard Supervisory Tones" (dial tone, line busy, network busy, radio path acknowledge, call dropped, error, call waiting, incoming call) and "Proprietary Tones" (general beep, positive ack, and negative ack). The specification also allows for the duration of the tone to be specified.

On Treo, only a subset of Play Tone is supported. Treo will only support the three Proprietary Tones. These tones should map to the appropriate PalmOS system tones (i.e. general beep = sndInfo, positive ack = sndConfirmation, and negative ack = sndError). The tone duration should be ignored. If the SIM requests other tone types, a 'not supported' return code should be sent back to the SIM. If optional text is specified, it appears as an alert on top of the existing application (similar to the Display Text feature) as follows:

Figure 31 - SIM Services Play Tone
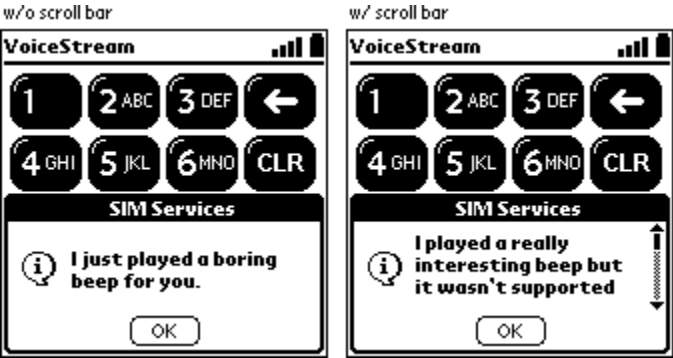
7. Technical Specification

7.1 Content of product box

The US version of the Treo box contains the following items:

- Treo unit

- Standard 2A Ault AC wall adapter for recharging battery

- Hands-free Active headset

- 'Start Here' card (2 sheets thick – sized to fit over the entire box contents)

- USB HotSync™ travel cable

- Handspring collateral pack containing the following (shrink-wrapped together):

  o English-only 'Quick Reference' guide (approx. 30 pages)

  o CD-ROM (includes Desktop & synchronization software, data app software, user guide)

Most international SKUs contain the following changes:

- Add 2 power plug adapters (EU & UK, AU & UK, or EU & AU – depending on geography)

- Replace English 'Quick Reference' Guide with multi-lingual 'Quick Reference' Guide (approx. 200 pages)

7.2 Supported languages

The Treo communicator will be produce in the following languages:

- English

- French

- German

- Italian

- Spanish

Some Treo devices will be multi-lingual devices where the user selects the desired language (from the list above) at the time of initial device setup.

In addition to the standard built-in languages, Treo also supports Palm OS language overlays (e.g., Chinese).

7.3 Physical characteristics

Table 7 - Treo Physical Characteristics

Characteristics	Details
Weight	154 grams, including battery
Size	• Thickness at Window area: 20.7mm • Thickness at Hinge area: 24.2mm • Width: 70mm • Length without antenna: 109.0mm • Length with antenna: 130.0mm
Input methods	There are two types of input, depending on the device chosen: • Keyboard: Complete alpha-numeric thumb keyboard (34 keys) and Six Palm OS keys • Standard Palm OS Graffiti input area
Jog Rocker	Includes four functions: up, down, push, push & hold
CPU	Motorola MC68VZ328 Dragonball-VZ (33MHz)
Internal Memory	4 MB masked ROM, 16 MB SDRAM
Operating System	Palm OS 3.5H4
Software in ROM	Standard Palm OS Applications: • Date Book+ • Advanced Calculator • Memo Pad • To Do • City Time • Expense New Treo Applications • Phone Book • Blazer • SMS • SIM Book • SIM Services Additional Libraries and Resources • MathLib • GSM Library (for 3rd party SMS applications)

Characteristics	Details
Screen	.6 mm glass TDF LCD with plastic digitizer screen 160x160 pixels 16 shades of gray, 30 dpi pitch - LCD Active area 47.98mm x 47.98mm
UART	Integrated onto CPU
IR	Standard Palm OS Infrared
LED	Red/Green flashing LED indicating battery charging and radio coverage
Lid	- Clear polycarbonate section allows screen to be viewed when closed - Covers keyboard but not application buttons - Embedded speaker - Magnetic switch - Hinge design allows for force down on flat surface without breaking
Cradle Interface	USB, Serial (TX/RX, TTL level) with power connection for recharging
Stylus	Integrated removable stylus
Battery	Li-Ion Rechargeable (600 mAh)
Power control	Power on/off button for Phone power control and active lid for organizer power
Ring Tone	Ring profile switch: 2 positions for preset ring tones (10 available)
Audio	Integrated microphone and speaker
Headphone	Hosiden four-pin headset jack with flash button (supporting active headset with button)
Vibrator	Can be chosen as another method of notification of calls or alarms.
Speaker	Integrated hands free speaker
Color	Steel Blue

7.4 Radio Features

Table 8 - Radio Features

Features	Specifications
Radio Module	Wavecom Wizmo 3C with 2MB Flash ROM
Band	- Dual Band GSM/GPRS component (EGSM900/1800 or 900/1900) - Compliant with ETSI GSM Phase 2+ standard - GPRS implementation will be SMG32 compliant
Sensitivity	Receiver sensitivity –104dBm

Features	Specifications
Power	• Class 4 (2W @ 900 MHz) • Class 1 (1W @ 1800 MHz) • Class x (1W @ 1900 MHz)
Class	GPRS Class B mode of operation, multi slot class 2 (software upgrade on availability)
Voice	• GSM mode • Telephony • Emergency calls • Tri-codec: Full Rate, Enhanced Full Rate and Half Rate (FR/EFR/HR) • Dual Tone Multi Frequency function (DTMF)
GSM circuit Data/Fax features	Data circuit asynchronous, transparent and non transparent up to 14,400 bits/s, V.42bis
SMS	• Short Messages Services features (GSM or GPRS mode): • Text and PDU • Point to point (MT/MO)
SIM Support	Size: Small form factor in the SIM Card holder on the back of the device Voltage: 3V SIM support only.
SIM Toolkit	GSM 11.14 Class 2 support
Antenna	Screw-in antenna
Others	• Call Forwarding • Multiparty calls • Call Waiting and Call Hold • Calling Line Identity • USSD • SIM lock • Real Time Clock

7.5   Environmental, Reliability and Package Tests

7.5.1   Environmental Tests

Table 9 - Environmental Tests

Environmental	Environmental
ETS 300-019-1 Environment	ETS 300-019-1 Environment

7.5.2 Package Testing

Table 10 - Package Testing

Test Name
ASTM D 4169-98, Distribution Cycle 13
Schedule A - Handling
Schedule C - Vehicle Stacking
Schedule F - Loose Load Vibration
Schedule E Vehicle Vibration

7.5.3 Temperature Ranges (To be confirmed)

Table 11 - Temperature Ranges

Test Name	Result
Operating	0°C to 40°C
Storage	-20°C to 60°C
Charging	0°C to 40°C

7.6 Battery & Talk times

The Treo product includes a 600mAh Li-Ion Rechargeable Battery. Here is the performance of the product.

Table 12 - Battery Life

Features	Time (Target in hours)
Standby time	60
Talk time[1]	2
PDA Use only (radio off)	To Be Completed
Data Retention (radio is turn-off at one point)	To Be Completed
Battery recharge duration	To Be Completed

7.7 List of optional accessories

The following list provides a list of accessories designed to support your Treo. Check with the Handspring website at www.handspring.com for a complete list of accessories and their availability in your area.

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[1] Using normal volume/headset/speakerphone

Table 13 - Optional Accessories

Accessory	Details/features
Car Lighter Adapter (CLA)	Lets you recharge Treo using your car lighter receptacle
Travel Kit	Power charger (100-240v) and international plug adapters for Australia, Europe, and UK.
USB HotSync™ cable	Replacement or second cable for your home or office.
Serial HotSync™ cable	Required for non-USB computers and those running Windows 95 or NT
Headset	Standard headset replacement (available via web only)
USB HotSync™ cradle	Replacement or second cradle for your home or office.
Stylus 3-pack	Replacements or extra styli.
Cases	Pouch Case • Cushions and protects Treo • Pocket for convenient handling and storage of earpiece • Belt loop attachment for convenience and easy access Leather Belt Clip • Contoured molded leather face • Keeps screen visible while in the case • Access to up/down buttons • Neoprene sides hold device securely in place • Swivel clip allows comfortable wearing and easy access

7.8 Treo Connector Specifications

This section is intended to provide a starting point for developers when developing products or accessories to complement Treo. This information will be continually updated, so make sure that you are using the latest information when making design decisions.

7.8.1 External Connectors

7.8.1.1 Treo Bottom Connector
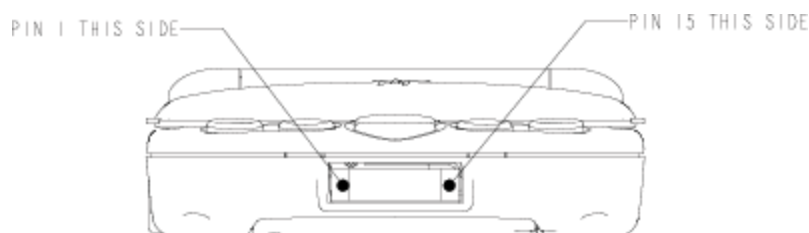
7.8.1.2 Description

The Connector on the bottom of Treo is a 15-position connector, sometimes used on PCMCIA cards that interface with an external cable. Drawings of the connector used on Treo (Handspring P/N 13-0102-00) and the connector that mates with it (Handspring P/N 13-0108-00) are available on Handspring's website at: http://www.handspring.com/developers/dev_mechanical.jhtml

7.8.1.3 Treo Mating Connector

Handspring P/N 13-0108-00

This is the connector that mates with the connector on the bottom of Treo. This is the connector that developers would typically want to order if they are interested in interfacing with the connector on the bottom of Treo.

7.8.1.4 Treo Connector On Treo Handheld

Handspring P/N 13-0102-00

This is the connector that is used on the bottom of Treo. Developers would typically not need to order this connector.

7.8.1.5 Source for Purchasing Connectors

In order to purchase any of these connectors, please contact ATL. Use the Handspring part numbers when ordering these connectors from ATL.

Contact at ATL:	Rhett Abegglen
E-mail:	rhetta@atlconnect.com
Phone:	801-489-9100

7.8.1.6 Pin out

This section defines the functions of the signals on the 15-pin Cradle Connector. The signals are described in alphabetical order following the table below. Active-low signals have a "*" at the end of their names.

Table 14 - Treo Bottom Connector Pin Summary

Pin	Name	I/O/P[1]	Function
1	RXD	I	Receive Data
2	TXD	O/P	Transmit Data/Power
3	No Connect		No Connect
4	HS2*	I	Serial Cradle Detect
5	HS1*	I	HotSync Interrupt
6	GND	P	Ground
7	USB_D-	I/O	USB Data
8	USB_D+	I/O	USB Data
9	No Connect		No Connect

Pin	Name	I/O/P[1]	Function
10	No Connect		No Connect
11	No Connect		No Connect
12	GND	P	Ground
13	GND	P	Ground
14	VDOCK	P	Cradle Power (charging)
15	VDOCK	P	Cradle Power (charging)

[1]I = input, O = output, P = power

7.8.1.7   Cradle Interface Signal Descriptions

Active-low signals are denoted with an asterisk ("*").

Ground   **GND**

GND is the ground connection to the handheld. This signal must be connected to the ground reference in the cradle or peripheral.

HotSync Interrupt   **HS1***

This active-low interrupt pin is asserted low in order to initiate a HotSync with the handheld. In a cradle application, a push button would momentarily short this signal to GND to begin a HotSync. This signal is pulled up internally through the CPU.

HotSync2   **HS2***

This active-low pin is held low in order to indicate the presence of a keyboard or a serial cradle.

Receive Data   **RXD**

RXD connects to the Treo CPU UART. **Note that RXD is TTL level, not RS-232 level**. This signal is used for asynchronous serial communications between the handheld and a cradle or peripheral. RXD is an input to the handheld and an output from a cradle or peripheral.

Transmit Data/Power   **TXD**

TXD connects to the CPU's UART. **Note that TXD is TTL level, not RS-232 level**. This signal is used for asynchronous serial communications between the handheld and a cradle or peripheral. TXD is an output from the handheld and an input to a cradle or peripheral. Internally, this pin is the output of the gate with the series resistor. This pin provides up to 3 mA maximum at 2.7V when KBD* is asserted for low-power peripherals, such as keyboards. The short circuit current is 6mA minimum

USB Data   **USB_D+, USB_D-**

USB_D+ is the positive signal in the USB differential pair. USB_D- is the negative signal. This signal and USB_D- implement the USB signaling protocol for communicating with a USB master, such as a PC or a Mac.

Cradle Power   **VDOCK**

These pins provide a charging path to Treo. The voltage provided to these pins should be 5.2V +/- 5% at 1A for best compatibility. These ratings are based on the specification of the AC/DC charging adapter that Handspring will provide. (For Treo, 5.2V +/- 5% at 600mA should be sufficient for charging, but using an adapter that matches the 5.2V @ 1A specification is strongly suggested.)

7.8.2   Treo Headset Jack

7.8.2.1   Description

The Treo headset jack is a 4-pole standard 2.5mm plug configured as follows:

Table 15 - Treo Headset Jack Pin out

Pin	Name
Tip	Speaker+
Ring A	Mic+
Ring B	Speaker-
Sleeve	Mic-

7.8.2.2   Microphone

The microphone can be a standard electret element with 1k-2k effective impedance when biased. The microphone should be driven differentially.

7.8.2.3   Speaker

The speaker should have a minimum impedance of 150 ohms. A typical configuration would be to connect an external amplifier with high input impedance is to Speaker+ and Speaker-. The speaker should be driven differentially.

7.8.2.4   Answer Button

The answer button on the headset works by shorting the Mic+ and Mic- signals together. The effective impedance of this short should be 50 ohms maximum.

7.8.3   Treo Mechanical Files

All mechanical files relevant to develop product for Treo are available on Handspring's Developer web site at: http://www.handspring.com/developers/dev_mechanical.jhtml

2-D drawings are provided in AutoCAD and PDF format and 3-D models in Pro/E (shrink-wrap), IGES, and STEP formats.

8. Related Information

8.1 Blazer Design Guidelines

The Treo product includes the Handspring web browser Blazer. Handspring produced a content formatting guideline document that is published on the web at:

> http://www.handspring.com/developers/documentation.jhtml

This document contains up to date information about the web browser.

8.2 Links

- Handspring main page

  http://www.handspring.com

- Handspring Developer Area

  http://www.handspring.com/developers

- Palm OS Developers Site

  http://www.palmos.com

8.2.1.1 Ring Tone Resources

The following web site contain some useful information for creating Format 0 MIDI sounds

- The ABC Page

  http://www.gre.ac.uk/~c.walshaw/abc/

  abc is a language designed to notate tunes in ASCII format. Use this in conjunction with abc2midi to generate the appropriate Format 0 MIDI file

- abc2midi

  http://abc.sourceforge.net/abcMIDI/

  Converts abc files to MIDI

- Palm OS Sound Manager – Palm OS KB 1774

  http://oasis.palm.com/dev/kb/manuals/1774.cfm

  Goes over the Palm OS Sound Manager. Includes the data structure for the Palm OS MIDI record

9. Appendix A: MMI Codes supported

Code	Use
`*#30#`	CLIP interrogation
`*30#`	CLIP activation
`#30#`	CLIP deactivation
`*#31#`	CLIR interrogation
`*#43#`	Call Waiting interrogation
`*43#`	Call Waiting activation
`#43#`	Call Waiting deactivation
`*#06#`	IMEI display
`**04*old_PIN*new_PIN*new_PIN#`	PIN change
`*#21#`	CFU interrogation
`*21*number#`	CFU subscription & activation
`*21#`	CFU activation
`#21#`	CFU deactivation
`##21#`	CFU erasure
`*#67#`	CFB interrogation
`*67*number#`	CFB subscription & activation
`*67#`	CFB activation
`#67#`	CFB deactivation
`##67#`	CFB erasure
`*#61#`	CFNRy interrogation
`*61*number#`	CFNRy subscription & activation
`*61#`	CFNRy activation
`#61#`	CFNRy deactivation
`##61#`	CFNRy erasure
`*#62#`	CFNRc interrogation
`*62*number#`	CFNRc subscription & activation
`*62#`	CFNRc activation
`#62#`	CFNRc deactivation
`##62#`	CFNRc erasure
`#002#`	All CF deactivation
`##002#`	All CF erasure
`*#33#`	BAOC interrogation
`*33*pwd#`	BAOC activation
`#33*pwd#`	BAOC deactivation
`*#331#`	BOIC interrogation
`*331*pwd#`	BOIC activation
`#331*pwd#`	BOIC deactivation
`*#332#`	BOIC exc home PLMN interrogation
`*332*pwd#`	BOIC exc home PLMN

Code	Use
	activation
#332*pwd#	BOIC exc home PLMN deactivation
*#35#	BAIC interrogation
*35*pwd#	BAIC activation
#35*pwd#	BAIC deactivation
*#351#	BAIC when roaming interrogation
*351*pwd#	BAIC when roaming activation
#351*pwd#	BAIC when roaming deactivation

10. Appendix B: Treo Glossary

The following terms should be used in conjunction with Treo.

Term	Meaning
"+" instructions	Used to indicate simultaneous pressing of keys. For example, Option + Return to acknowledge the "OK" command in a pop-up menu. The Option and Return keys must be pressed simultaneously.
"then" instructions	Used to indicate sequential pressing of keys – not simultaneous. For example, press the Shift key and *then* a letter to capitalize that letter.
3-way Call / 3-way Conference Call	Connecting 3 callers (Treo user included) together in conference. Use the term "3-way" to clarify how many callers can be joined together in a conference call – we don't want to imply an unlimited number.
Buttons	Refer to specific application and *scroll buttons*.
Buttons/Keys	Buttons and keys are pressed.
Call History	The application view that shows a list of previous incoming, outgoing, and missed calls.
Caller Line Identification	The feature that shows the phone number of the calling party, and possibly the name if that person's contact information is in the Phonebook.
CallerID	See *"Caller Line Identification."*
Communicator	A compact communications tool that integrates a mobile phone, email, SMS text messaging, a PalmOS® organizer, and the Internet in one indispensable device.
Coverage Area	Places where any GSM service provider has functional network services.
Datebook button	The button on the front of Treo that gives you instant access to your calendar program.
Dial Pad	One of the three views of the Phonebooks. This view shows a typical 12-key numeric button pad, and can be used to dial numbers not in the Phonebook or Speed Dial List.
Email	One kind of messaging available on Treo. Email is full length, unlimited text messages that are sent via the Internet. Email accounts could be stored in POP3 or IMAP type servers.
Handheld device	A term used *only* to describe the size of communicator in the following context "Treo integrates voice, messaging, a Palm OS organizer, and the Internet in one small device." The term "communicator" should be used in any other context.
Headset	The speaker/microphone on a wire which plugs into the side of Treo
Icons	Icons in the Launcher and Graffiti writing area are *tapped*.
Instant Lookup	Quick Search, Fast Lookup (which is a different feature, hidden in Handspring's version of the Palm OS. A feature on Treo that lets one look up a contact's name using the keyboard. Simply type in the first initial and begin to type the last name. Treo searches thousands of contacts instantly, delivering the matches quickly.
Internet Access button	The button on the front of Treo that gives you instant access to the Internet via Blazer browser.

Internet Service Provider	The company providing access to the Internet. The service provider should always be referred to as the Internet Service Provider so as to distinguish from a Wireless Service Provider.
Jack or headset jack	The barrel connector on the side of Treo that the headset plugs into.
Rocker Switch	The dial on the side of Treo that controls the phone volume and provides some navigation options.
Key Pad	This screen is entered by tapping on the Key Pad button in the Active Call screen. It is used to enter numbers like PIN numbers or extensions after a call is connected.
Keyboard keys	All buttons on the keyboard are referred to as keys so as to distinguish from application and scroll buttons.
LED	The light on top of Treo that flashes either green or red depending on whether or not the phone is charging or in service.
ListType key	Provides access to accents and additional symbols or characters.
Messaging button	The button on the front of Treo that gives you instant access to the email and SMS text messaging functionality.
Messages / Messaging	A generic term for any type of wireless messaging, including email or SMS text messaging, or instant messaging. Only use this term when you can only use *one* word to describe all types. Its better to be very specific and refer to the type of message (email and/or SMS text messaging) depending on the context.
Mobile Network	Physical equipment that carries the signal between the radio base stations and fixed telecom networks.
Mobile Phone	The term mobile phone has greater international recognition than either alternative term.
Not Registered to a Network	When the phone is on but is unable to communicate with the Network because there are no network base stations nearby
Option key	Press once for blue characters/features; press twice for Option Lock; press again to release.
Phonebook button	The button on the front of Treo that gives you instant access to the phone application plus address contact list. The default screen that appears when this button is pressed is the Dial Pad view.
Phone Book	The application that allows you to dial the phone, allows you to manage active calls, and displays a history of your phone calls.
Power button	Power for the handheld, for the backlight and for the "wireless mode."
Registered to a Network	When the phone is on and is able to communicate with the Network.
Roaming	When users are registered to a network that is not operated by their service provider.
Scroll buttons	The up and down buttons for navigating in menus or between data entry fields.
Shift key	Press once for Caps, twice for Caps Lock and again to release.
Short text message	See "*Text Message*"
Silent mode switch	Switch at top of communicator that allows the user to turn off all alarms and sounds.

SIM Card	The small card that contains all your account information, including your phone number. GSM phones cannot work without the SIM card. You can move your SIM card to another GSM phone, and your phone number, account information, etc. will be transferred to the new phone.
SMS Messaging	The application that allows you to create and manage SMS text messages. Also see *"Text Messaging"*
SMS Text Messaging	See *"Text Messaging"*
Speaker	The area on Treo from which sounds emanate. Three small holes on the plastic define the speaker area.
Speed Dial	The 5 pages of 10 buttons used for one-touch dialing
Status Bar	The status bar in the Phonebook application indicates the status of the phone including battery, signal strength, voice mail, network status (registered to network) and whether the wireless mode is on or off.
Text Message	The actual messages that can be written and received using the SMS Text Messaging Application.
Text messaging	SMS text messages are a specific type of message that is sent via the mobile phone carrier. It is limited to only a few characters and it's meant to be more of a paging message than an email message.
Travel charger	A cable and power adaptor that allows you to recharge the Lithium Ion battery in the Treo. It is included inside the Treo box.
Web browser	The generic noun we use in association with Blazer.
Wireless mode	The radio inside the device. This term is used to describe the mode in which the user can use. This is necessary since there is a distinct power on/off mode for the radio versus the organizer.
Wireless Service Provider	The company providing the wireless service and from which the service bill comes. The service provider should always be referred to as the Wireless Service Provider so as to distinguish from an Internet Service Provider or ISP.
Your Coverage Area	Places where the customer's service provider has functional network services.