Using Palm OS® Emulator

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About This Document

Using Palm OS® Emulator provides you with conceptual, guidance and reference information on how you can use Palm OS Emulator to test your Palm OS applications.

Who Should Read This Book

If you are a Palm OS application developer, whether you are writing your first Palm OS application or you are an experienced Palm OS application developer, then this book is for you. Palm OS Emulator is a valuable tool for testing and debugging Palm OS applications.

In most cases, you will need to download ROM images for Palm OS Emulator from the Palm OS Developer Program's Resource Pavilion. As a result, you should join the Palm OS Developer Program. For more information, see "Loading ROM Images" on page 22.

What This Book Contains

This book starts with a general overview of Palm OS Emulator, and continues with detailed procedural and reference information that describes how to use Emulator to test your Palm OS applications. It contains the following chapters:

- Chapter 1, "Understanding Palm OS Emulator Concepts," on page 15 provides a conceptual overview of Palm OS Emulator.
- Chapter 2, "Installing Palm OS Emulator," on page 19 describes what you need to do to get Palm OS Emulator installed and ready to use on your desktop computer.
- Chapter 3, "Running Palm OS Emulator," on page 29 describes how to customize and use emulation sessions.

- Chapter 4, "Palm OS Emulator User Interface Summary," on page 55 provides a reference for Emulator's command menus and keyboard input functions.
- Chapter 5, "Testing Applications Using Palm OS Emulator," on page 65 describes how to use Palm OS Emulator to test and debug programs you have written for Palm OS.
- Chapter 6, "Palm OS Emulator Error Handling," on page 91 provides details about Emulator's error handling and reporting features.
- Chapter 7, "Palm OS Emulator Advanced Topics," on page 107 describes how to use Emulator skin files, how to create a demonstration version of your application, and discusses how you can send commands to Emulator.
- Chapter 8, "Host Control API Reference," on page 119 describes the host control API, which provides functions that an emulated application can use to call into Palm OS Emulator for certain services.
- Chapter 9, "Debugger Protocol Reference," on page 187 describes the API for sending commands and responses between a debugging host, such as Palm Debugger, and a debugging target, which can be a Palm Powered™ handheld ROM or an emulator program such as Palm OS Emulator.
- Palm OS Emulator monitors applications for direct structure accesses. Appendix A, "Structure Access Notifications" on page 217 lists the conditions for when Emulator does not notify you of structure accesses.
- Emulator also monitors any application use of Palm OS system traps. Appendix B, "Unsupported Traps" on page 225 lists the traps that will not be supported in future Palm OS releases.

Palm OS SDK Documentation

The following documents, which are part of the Palm OS Software Development Kit documentation set, will also be useful when you are developing and testing Palm OS applications.

Document	Description
Palm OS Programmer's API Reference	An API reference document that contains descriptions of all Palm OS function calls and important data structures.
Palm OS Programmer's Companion, vol. I and *Palm OS Programmer's Companion*, vol. II, *Communications*	A guide to application programming for the Palm OS. These volumes contain conceptual and "how-to" information that complements *Palm OS Programmer's API Reference*.
Palm OS Programming Development Tools Guide	A guide to the tools that can be used to develop, test, and debug Palm OS applications: Palm Simulator, Palm Debugger, Palm Reporter, console window, and resource overlay tools.
Constructor for Palm OS	A guide describing how to use Constructor for Palm OS to build graphical user interfaces for Palm OS applications.
Palm File Format Specification	Data layout specifications of installable files (PRC), databases (PDB), and webclipping applications (PQA).
Web Clipping Developer's Guide	A guide for developing wireless applications using "lightweight" HTML.

Additional Resources

- Documentation

  Palm publishes its latest versions of this and other documents for Palm OS developers at

  `http://www.palmos.com/dev/support/docs/`

- Training

  Palm and its partners host training classes for Palm OS developers. For topics and schedules, check

  `http://www.palmos.com/dev/training/`

- Knowledge Base

  The Knowledge Base is a fast, web-based database of technical information. Search for frequently asked questions (FAQs), sample code, white papers, and the development documentation at

  `http://www.palmos.com/dev/support/kb/`

What's New for Palm OS Emulator 3.5

- Support for Palm m125, Palm m130, Palm515, and Palm i705.
- Support for HandEra TRGpro and HandEra 330.
- Allow access to UI data structures in support of PalmOSGlue. See Appendix A, "Structure Access Notifications" on page 217 for more information.

What's New for Palm OS Emulator 3.4

- Common, cross-platform dialog boxes.
- Support for multiple file selection in the Install Application dialog box.
- New preferences for control skin appearance.
- Detection of direct structure access.
- Detection of memory leaks.
- Detection of Overlay Manager errors.
- Enhanced support for processing when errors and warnings occur.
- Gremlin minimization function, including new Palm event files.
- Host Constrol API functions HostDbgClearDataBreak, HostDbgSetDataBreak, HostImportFileWithID, and HostSessionSave.

1

Understanding Palm OS Emulator Concepts

This chapter describes Palm OS® Emulator and provides overview information on how you can use it to test and debug programs you have written for Palm OS.

This edition covers Palm OS Emulator 3.5.

Note: Palm OS Emulator has previously been referred to as POSE or Poser. The name Palm OS Emulator is used throughout this book and in new versions of other Palm documentation. In this chapter, Emulator is sometimes used as an abbreviated form of Palm OS Emulator.

About Palm OS Emulator

Palm OS Emulator is a hardware emulator program for the Palm Powered™ platform, which means that it emulates the Palm hardware in software, providing you with the ability to test and debug Palm OS software on a Macintosh, Unix, or Windows-based desktop computer.

When you run a Palm OS application with Palm OS Emulator on your desktop computer, Palm OS Emulator fetches instructions, updates the handheld screen display, works with special registers, and handles interrupts in exactly the same manner as does the processor inside of Palm Powered handhelds. The difference is that

Palm OS Emulator executes these instructions in software on your desktop computer.

Feature Overview

Palm OS Emulator displays an on-screen image that looks exactly like a Palm Powered handheld, as shown in Figure 1.1.

Figure 1.1 Palm OS Emulator display

You can select which type of Palm Powered handheld you want to emulate. You can also specify whether you want Palm OS Emulator to display the screen in double size, which continues to provide an accurate representation and makes the Palm screen easier to view.

You can use the mouse on your desktop computer just as you use the stylus on a Palm Powered handheld. You can even use the Graffiti® power writing software with Palm OS Emulator and your mouse. And Palm OS Emulator includes additional keyboard shortcuts that you can use on your desktop computer.

You can use Palm OS Emulator to perform some debugging of your applications, and you can use Emulator with external debug tools to

perform extensive debugging of your applications. When you connect Emulator with Palm Debugger, you can debug in exactly the same manner as debugging with your application running on an actual hardware handheld. For more information about Palm Debugger, see *Palm OS Programming Development Tools Guide*.

Standard Handheld Features

Palm OS Emulator accurately emulates Palm Powered hardware, and includes the following features:

- an exact replica of the Palm Powered handheld display, including the Graffiti area and its surrounding icons
- emulation of the Palm stylus with the desktop computer pointing device (mouse)
- emulation of the Palm Powered handheld hardware buttons, including:
  - power on/off button
  - application buttons
  - up and down buttons
  - reset button
  - HotSync® button
- ability to zoom the display for enhanced readability and presentation
- screen backlighting
- communications port emulation for modem communications and synchronizing

Extended Emulation Features

Palm OS Emulator also provides the following capabilities on your desktop computer that extend the standard Palm Powered handheld interface.

- ability to enter text with the desktop computer
- configurable memory size, up to 16 MB

Debugging Features

Palm OS Emulator provides a large number of debugging features that help you to detect coding problems and unsafe application operations. Palm OS Emulator includes the following debugging features and capabilities:

- use of an automated test facility called Gremlins, which repeatedly generates random events
- support for external debuggers, including Palm Debugger, the Metrowerks CodeWarrior debugger, and gdb
- monitoring of application actions, including various memory access and memory block activities
- logging of application activities, including events handled, functions called, and CPU opcodes executed by the application
- profiling of application performance

Getting Help with Palm OS Emulator

Palm OS Emulator is constantly evolving, and Palm is always interested in hearing your comments and suggestions.

Palm provides a forum (emulator-forum@news.palmos.com) for questions and comments about Palm OS Emulator. To subscribe to the forum, see:

http://www.palmos.com/dev/support/forums/

You can get the latest information about Palm OS Emulator in the Palm developer zone on the Internet:

http://www.palmos.com/dev/

Note: The source code for Palm OS Emulator is available at:

http://www.palmos.com/dev/tools/emulator/

You can create your own emulator by modifying this source code.

2

Installing Palm OS Emulator

This chapter describes what you need to do to get Palm OS® Emulator installed and ready to use on your desktop machine.

Prerequisites

This section describes the software you need to use Palm OS Emulator.

Palm OS Emulator Runtime Requirements

Palm OS Emulator requires one of the following runtime environments:

- A 32-bit Windows platform: either Windows 95, Windows 98, Windows NT, Windows ME, Windows 2000, or Windows XP. Emulator is a multi-threaded 32-bit program. It does not run on Windows 3.1, even with Win32s installed.
- MacOS 8.6 or later with Carbon 1.2.5 or later
- Unix: some versions, including Linux

Using ROM Images

To run Palm OS Emulator, you need to transfer a ROM image to it. The ROM image contains all of the code used for a specific version of the Palm OS. You can obtain ROM images for different Palm OS

versions from the Palm Resource Pavilion, or you can tell Palm OS Emulator to download the ROM from a handheld that has been placed in the handheld cradle and connected to the desktop computer. For more information about transferring a ROM image to Palm OS Emulator, see "Loading ROM Images" on page 22.

When you download ROM images from the Palm Resource Pavilion, you can also obtain debug ROM images. Debug ROM images contain additional error checking and reporting functions that can help you debug Palm OS applications.

For more information about testing and debugging applications with Palm OS Emulator, see "Testing Applications Using Palm OS Emulator" on page 65.

Downloading Palm OS Emulator

The most recent released version of Palm OS Emulator for Macintosh, Windows, and Unix is always posted on the Internet in the Palm developer zone:

http://www.palmos.com/dev

Follow the links from the developer zone main page to the Emulator page to retrieve the released version of Emulator. If you want to test-drive the version of Palm OS Emulator that is currently under development, follow links from the developer zone page to the Emulator seed page.

The Palm OS Emulator package that you download includes the files shown in Table 2.1.

Note: For the Unix version of Palm OS Emulator, the source code is provided rather than the executables listed in the table below.

Table 2.1 Files Included in the Palm OS Emulator Package

File name	Description
• `Emulator.exe` (Windows) • `Palm OS Emulator` (Macintosh)	Main Palm OS Emulator executable
• `Emulator_Profile.exe` (Windows) • `Palm OS Emulator - Profile` (Macintosh)	Palm OS Emulator with added profiling facilities
`Docs` (directory)	Palm OS Emulator documents, including: • `_ReadMe.txt`, which describes the files in the `Docs` directory • `_News.txt`, which describes changes in the most recent version • `_OldNews.txt`, which describes previous version changes • `_Building.txt`, which describes how to build Emulator executables
• `ROM Transfer.prc` (Windows, Macintosh) • `ROM_Transfer.prc` (Unix)	Palm OS application used to transfer the ROM image from your handheld to your desktop.
`HostControl.h`	C/C++ header file declaring functions that can be used to control Palm OS Emulator. For more information about the Host Control API, see Chapter 8, "Host Control API Reference."

Versions of Palm OS Emulator

Each released version of Palm OS Emulator has a version number that uses the following scheme:

```
<majorVers>.<minorVers>
```

Each field has the following semantics:

`majorVers`	The major version number.
`minorVers`	The minor version number.

Profile Versions

Palm OS Emulator includes a profile version, which has the word profile appended to the program name. The profile version adds the ability to perform selective profiling of your program's execution, and to save the results to a file.

The code required to add profiling capability slows down your application, even when you are not using profiling. That means that you are better off using the non-profiling version of Palm OS Emulator if you don't expect to use the profiling capabilities.

For more information about profiling with Palm OS Emulator, see "Profiling Your Code" on page 87.

Loading ROM Images

Because Palm OS Emulator emulates the Palm Powered™ hardware, all components of the hardware must be present. This includes a ROM image file, which is not shipped with the Emulator. There are two ways to obtain a ROM image:

- download a ROM image from the Palm Resource Pavilion
- transfer a ROM image from a handheld

Downloading a ROM Image Obtained from Palm

To download a debug ROM image from Palm, see:

http://www.palmos.com/dev

The ROM image files are found in the Resource Pavilion.

The Resource Pavilion is an area for developers who have registered as members of the Palm OS Developer Program. You can find instructions for joining the Palm OS Developer Program at the developer site.

Transferring a ROM Image from a Handheld

To transfer a ROM image from a handheld, follow these steps:

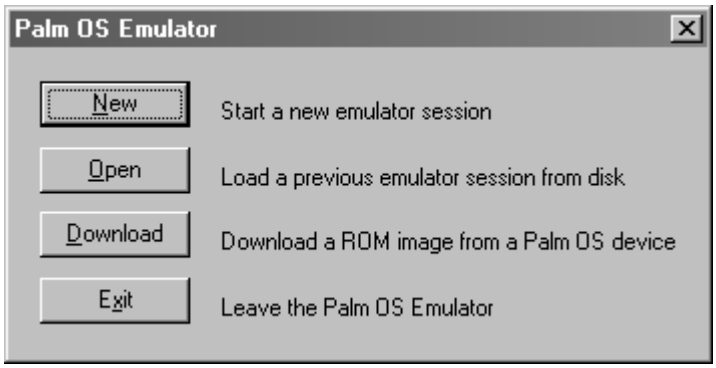
1. Install the Palm OS application named `ROM Transfer.prc` on your handheld. You can use the Install program in the Palm Desktop organizer software and then synchronize with the handheld to install this program.
2. Place the handheld in the HotSync® cradle that is connected to your desktop computer.
3. Follow the steps in the appropriate section below.

Transferring a ROM File in Windows

This section describes how to transfer a ROM image from a handheld on a Windows-based desktop computer. Before proceeding, you must have the `ROM Transfer.prc` program installed on the handheld, as described in the previous section.

If you are running the program for the first time, Palm OS Emulator presents the Startup dialog box shown in Figure 2.1. Click **Download** to begin the transfer of a ROM image from a handheld.

Figure 2.1 Palm OS Emulator Startup Dialog Box



If you are not running Palm OS Emulator for the first time, it usually restarts the session that you most recently ran, as described in "Palm OS Emulator Start Up" on page 35.

To transfer a new ROM image for Palm OS Emulator to use, you can right-click on the Palm OS Emulator display (the Palm Powered handheld image) and select **Transfer ROM**.

Palm OS Emulator opens a Transfer ROM dialog box that will guide you through the process.

Transferring a ROM File on a Macintosh

This section describes how to transfer a ROM image from a handheld on a Macintosh desktop computer. Before proceeding, you must have the `ROM Transfer.prc` program installed on the handheld, as described in the previous section.

If you are running the program for the first time, Palm OS Emulator presents the dialog box shown in Figure 2.2.

Figure 2.2 Running Palm OS Emulator for the First Time on a Macintosh System

You can dismiss this dialog box and choose **Transfer ROM** from the File menu.

If you are not running Palm OS Emulator for the first time, it usually restarts the session that you most recently ran. To transfer a new ROM image for Palm OS Emulator to use, select **Transfer ROM** from the File menu.

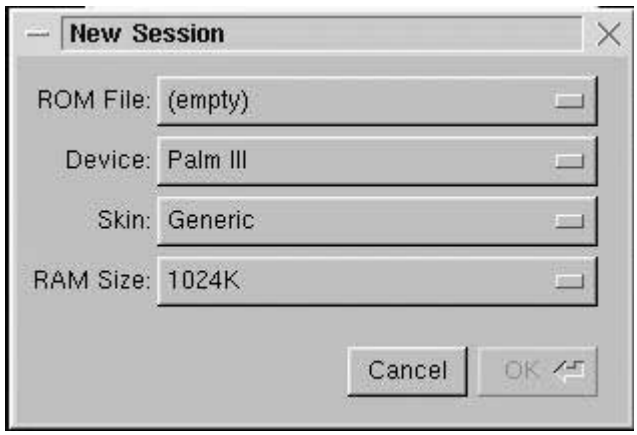
Palm OS Emulator opens a Transfer ROM dialog box that will guide you through the process.

Transferring a ROM File on a Unix System

This section describes how to transfer a ROM image from a handheld on a Unix-based desktop computer. Before proceeding, you must have the `ROM Transfer.prc` program installed on the handheld, as described in the previous section.

When running the program on a Unix system, Palm OS Emulator presents the dialog box shown in Figure 2.3.

Figure 2.3 Running Palm OS Emulator for the First Time on a Unix System



You can dismiss this dialog box and choose **Transfer ROM** from the File menu to begin the transfer of a ROM image from a handheld.

If you are not running Palm OS Emulator for the first time, it usually restarts the session that you most recently ran. To transfer a new ROM image for Palm OS Emulator to use, select **Transfer ROM** from the File menu.

Palm OS Emulator opens a Transfer ROM dialog box that will guide you through the process.

Transferring a ROM Image over a USB Connection

Palm OS Emulator supports transferring ROM images over a USB connection. To use a USB connection, Palm OS Emulator needs the USB driver support provided by the Palm Desktop software.

On Windows, you need to have Palm Desktop 4.0.1 or later installed to get the USB driver. You must make the library for the USB driver (the file `USBPort.dll`) available to Emulator. Either copy this file from the Palm Desktop software's directory to the Emulator directory, or move it into the Windows system directory.

On Macintosh, you need to have Palm Desktop 2.6.3 or later installed to get the USB driver.

Using a ROM Image in Palm OS Emulator

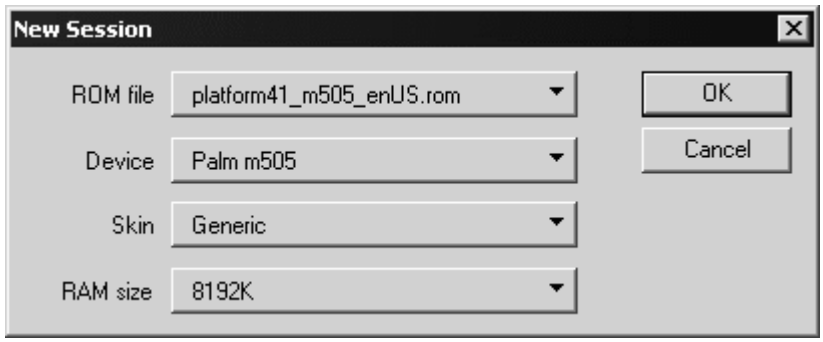
Once you have transferred a ROM image to disk, you need to create a new session that is based on the image. To initiate the new session, you select **New** from the popup menu. Table 2.2 shows the first step in creating a new session for each transfer method.

Table 2.2 Initiating a New Session after Transferring a ROM Image

Method Used to Initiate ROM Transfer	New Session Method
Clicked **Download** initial dialog box in Windows	Click **New** in the dialog box.
Selected **Transfer ROM** in Windows	Select either **New** or **Close** from the File menu.
Selected **Transfer ROM** on a Macintosh	Select **New** from the File menu.
Selected **Transfer ROM** on Unix	Select **New** from the File menu.

After you initiate the session, Palm OS Emulator presents the new session dialog box, which is described in "Configuring a New Session" on page 38. The Windows version of this dialog box is shown in Figure 2.4.

Figure 2.4 New Session Dialog Box



After you select your parameters and click **OK**, Palm OS Emulator begins an emulation session.

Dragging and Dropping a ROM Image

You can use drag and drop to start a new Emulator session in either of two ways:

- Drag and drop a ROM image file onto the Emulator screen to start a new session.
- Drag and drop a ROM image file onto the Emulator executable or shortcut (alias) to start the Palm OS Emulator program.

You can also drag and drop other file types, as described in "Dragging and Dropping Files" on page 40.

3

Running Palm OS Emulator

This chapter describes how to use emulation sessions and how to customize the emulation sessions.

Starting Palm OS Emulator

Run Palm OS Emulator just like you would any other program. When Palm OS Emulator starts up, it displays an image of a handheld, as shown in Figure 1.1 on page 16.

Command Line Options

If you are running Palm OS Emulator on a Windows-based desktop computer or on a Unix system, you can supply the session parameters as command-line parameters. For example:

```
Emulator -psf C:\Data\Session1.psf
```

Table 3.1 shows the options that you can specify on the Windows command line. You can also change most of these options by

starting a new session with the **New** menu, as described in "Configuring a New Session" on page 38.

Note that the command line option specifications are not case sensitive.

Table 3.1 Palm OS Emulator Command Line Options

Option syntax	Parameter values	Description
`-d <key>=<value>`	A preference file property and its associated value, as specified in the preference file.	Changes preferences that are stored in the preferences file. This option is a synonym for the `-preference` option. For more information, see "Preferences Files" on page 45.
`-horde <num>`	A Gremlin number	The number of the Gremlin to run after the session is created or loaded. Note that this is equivalent to supplying the same Gremlin number for the `horde_first` and `horde_last` options.
`-horde_first <num>`	A Gremlin number	The first Gremlin to run in a horde.
`-horde_last <num>`	A Gremlin number	The last Gremlin to run in a horde.

Table 3.1 Palm OS Emulator Command Line Options

Option syntax	Parameter values	Description
`-horde_apps <app name list>`	A comma-separated list of applications.	The list of applications to which the Gremlin horde is allowed to switch. The default is no restrictions. To specify a list of excluded applications, use a hyphen character before a list of application names. **Example:** `"-Prefs,HotSync"`
`-horde_save_dir <path>`	A path name	The name of the directory in which to save session and log files. The default log location is the directory in which the Palm OS Emulator application is stored.
`-horde_save_freq <num>`	An event count	The Gremlin snapshot frequency. The default value is to not save snapshots.
`-horde_depth_max <num>`	An event count	The maximum number of Gremlin events to generate for each Gremlin. The default value is no upper limit.

Table 3.1 Palm OS Emulator Command Line Options

Option syntax	Parameter values	Description
`-horde_depth_ switch <num>`	An event count	The number of Gremlin events to generate before switching to another Gremlin in the horde. The default is to use the same value as specified for the `horde_depth_max` option.
`-horde_quit_ when_done`	None	Emulator will exit after completing the Gremlin horde.

`-pref <key>=<value>`
 	
`-preference <key>=<value>`
	A preference file property and its associated value, as specified in the preference file.	This option changes preferences that are stored in the preferences file. For more information, see "Preferences Files" on page 45.

`-psf <fileName>`	Any valid `PSF` file name	The emulator session file to load upon start-up. You can also load a session file with the **Open** menu.
`-rom <fileName>`	Any valid ROM file name	The name of the ROM file to use.

`-ram <size>`
 	
or
 	
`-ramsize <size>`
	One of the following kilobyte size values:
	`128K`
	`256K`
	`512K`
	`1024K`
	`2048K`
	`4096K`
	`8192K`
	`16,384K`
		The amount of RAM to emulate during the session.

Table 3.1 Palm OS Emulator Command Line Options

Option syntax	Parameter values	Description
`-device <type>`	One of the following handheld type values: `Pilot, Pilot1000, Pilot5000, PalmPilot, PalmPilotPersonal, PalmPilotProfessional, PalmIII, PalmIIIc, PalmIIIe, PalmIIIx, PalmV, PalmVx, PalmVII, PalmVIIEZ, PalmVIIx, PalmM100, m100, PalmM105, m105, PalmM125, m125, PalmM130, m130, PalmM500, m500, PalmM505, m505, PalmM515, m515, PalmI705, i705, Symbol1500, Symbol1700, Symbol1740, TRGpro, HandEra330, Visor, VisorPlatinum, VisorPrism, VisorEdge`	The handheld type to emulate during the session. • `Pilot1000` and `Pilot5000` are synonyms for `Pilot`. • `PalmPilotPersonal` and `PalmPilotProfessional` are synonyms for `PalmPilot`. • The following handhelds are not supported: Palm IIIxe, Palm IIIse, Symbol handhelds other than those listed, Handspring handhelds other than those listed, all Acer handhelds, all Sony handhelds, all Samsung handhelds, all Kyocera handhelds, and all Qualcomm handhelds.
`-load_apps <file name list>`	A list of valid file names, separated by commas	A list of `PRC` files or other files to load into the session after starting up.

Table 3.1 Palm OS Emulator Command Line Options

Option syntax	Parameter values	Description
`-log_save_dir <path>`	A path name	The name of the directory in which to save the standard log file. The default log location is the directory in which the Palm OS Emulator application is stored.
`-minimize <pevFileName>`	The name of a Palm event file (`PEV`).	The Palm event file contains an event set you want to minimize. When you invoke Emulator with this command line option, Emulator goes though the event minimization process, writes the output files, and exits. See "Minimizing Gremlin Events" on page 80 for more information.
`-quit_on_exit`	None	If the `-run_app` option was specified, this option indicates that Palm OS Emulator should quit after that application terminates.

Table 3.1 Palm OS Emulator Command Line Options

Option syntax	Parameter values	Description
`-run_app <app name>`	Application name	The name of an application to run in the session after starting up. You must specify the name of the application, not the name of the application's file.

`-silkscreen <type>` or `-skin <type>`	The name of a skin. The skin names are defined by the handheld-specific `SKIN` files. For most handhelds, these skin names are available:
	`Generic`
	`Standard-English`
	`Standard-Japanese`
		The skin types to emulate during the session. For more information about skins, see "Changing Emulator's Appearance" on page 42.

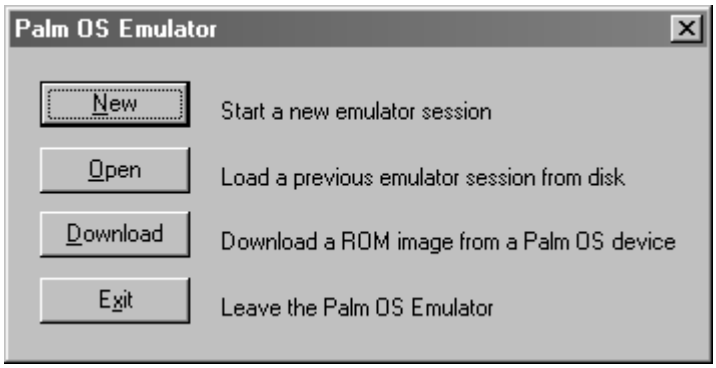
Palm OS Emulator Start Up

The most common scenario for starting Palm OS Emulator is without any command line parameters. In this case, Emulator restarts with saved information from the previous session.

When Palm OS Emulator starts execution, it determines its configuration by sequencing through the following rules:

1. If the CAPS LOCK key is on, the Startup dialog box is always displayed. The Startup dialog box is shown in Figure 3.1.

Figure 3.1 Palm OS Emulator Startup Dialog Box



NOTE: The dialog box shown in Figure 3.1 is displayed when you are running Palm OS Emulator on a Windows-based computer.

If you are using a Macintosh computer, the new session dialog box shown in Figure 2.2 on page 24 is displayed.

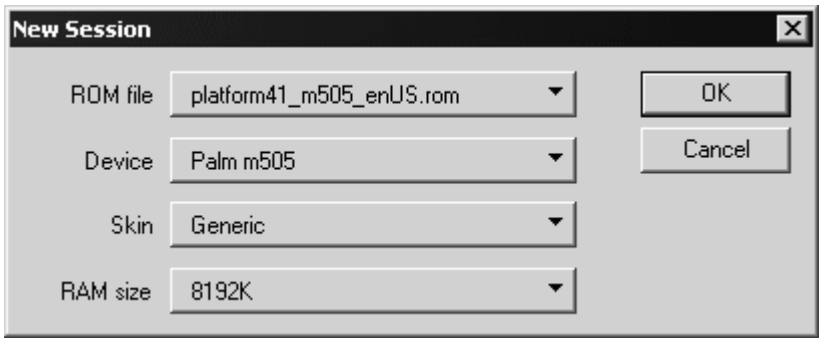
If you are using a Unix system, the new session dialog box shown in Figure 2.3 on page 25 is displayed.

2. If you are using Windows or Unix with command line options specified:
   - If the CAPS LOCK key is not on, Palm OS Emulator scans the command line for options. If an error is encountered on the command line, Palm OS Emulator displays an error message and then presents the Startup dialog box.
   - If a session (`PSF`) file was specified on the command line, Palm OS Emulator attempts to load the file. If the file cannot be loaded, Palm OS Emulator displays an error message and then presents the Startup dialog box.
   - If any other options are specified on the command line, Palm OS Emulator attempts to start a new session with those values. If any of the four values is missing, Palm OS

Emulator displays the session configuration dialog box, as shown in Figure 3.2.

If any of the command line options are not valid, or if the user cancels the dialog box, Palm OS Emulator displays an error message and then presents the Startup dialog box.

Figure 3.2 New Session Dialog Box



3. If no command line options are specified, Palm OS Emulator attempts to reopen the session file from the most recent session, if one was saved. If the file cannot be opened, Palm OS Emulator displays an error message, and then presents the Startup dialog box.
4. Palm OS Emulator attempts to create a new session based on the setting most recently specified by the user. If an error occurs, Palm OS Emulator displays an error message, and then presents the Startup dialog box.

NOTE: When it starts up, Palm OS Emulator looks for the most recently saved PSF file:
- On Windows and Unix, Emulator uses the full path name of that file.
- On Macintosh, Emulator uses aliases to locate the file.

If Emulator cannot find that file, it looks for the file name in the directory in which the Palm OS Emulator executable is located.

Using Emulation Sessions

Palm OS Emulator uses the concept of an emulation session, which is a testing or debugging session for a combination of the following items:

- the handheld type to emulate
- the amount of RAM to emulate
- the ROM file to use for the emulation

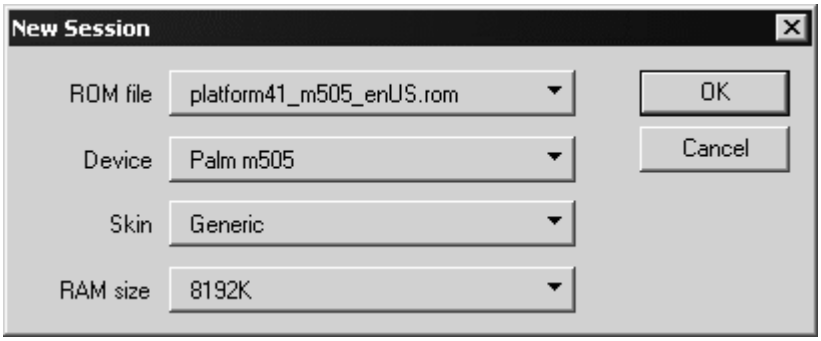
You can start new emulation sessions during a single run of Palm OS Emulator. You can also save the current state of a session and restore it in a later session. This session describes these features of Palm OS Emulator.

Configuring a New Session

You can start a new session in Palm OS Emulator by choosing **New** from the Palm OS Emulator menu. If you are already running an emulation session, Palm OS Emulator will optionally ask if you want to save the session in a Palm OS Emulator session (`PSF`) file before starting the new session. You set this option in your preferences.

Figure 3.3 shows the New Session dialog box, which Palm OS Emulator displays when you choose **New** from the menu.

Figure 3.3 Configuring a New Session



You need to make the following choices in this dialog box:

- Select the ROM file on your desktop computer that you want to use for the session. You can click on the arrow and select

Other... to navigate to the file. For more information about ROM files, see "Loading ROM Images" on page 22.

- Select the Palm Powered handheld that you want to emulate in the session. Only those handhelds that apply to the selected ROM will be shown in the list. The list may include the following choices:

- Pilot	- PalmPilot	- Palm III
- Palm IIIc	- Palm IIIe	- Palm IIIx
- Palm V	- Palm Vx	- Palm VII
- Palm VII (EZ)	- Palm VIIx	- Palm m100
- Palm m105	- Palm m125	- Palm m130
- Palm m100	- Palm m105	- Palm m125
- Palm m500	- Palm m505	- Palm m515
- Palm i705	- Symbol 1500	- Symbol 1700
- Symbol1740	- TRGpro	- HandEra 330
- Visor	- Visor Platinum	- Visor Prism
- Visor Edge		

- Select the skin that you want displayed on the emulation screen.

  Note that the skin is simply a graphic; it does not change the ROM or the handheld being emulated. The skin simply changes the appearance of the Emulator window.

  The skin choices available are dependent on the handheld selection. When you select a handheld, Emulator reads through the available SKIN files for the skin names that support the selected handheld.

  Alternative skins, such as the Japanese skin, are only available for certain handheld types. The **Generic** choice is always available, even when alternatives are not available. For additional information, see the section "Changing Emulator's Appearance" on page 42.

- Select the amount of memory that you want emulated. Note that Emulator filters out the sizes that are invalid for the handheld you have chosen to emulate. Depending on the handheld you are emulating, you can choose from the following RAM sizes:
  - 128 KB
  - 256 KB
  - 512 KB
  - 1024 KB
  - 2048 KB
  - 4096 KB
  - 8192 KB
  - 16,384 KB

  Note that 1 MB (1024 KB) is most often the right amount of RAM to emulate. Using 1 MB of RAM tells you if your application will work properly across the majority of hardware handhelds available.

After you click **OK**, Palm OS Emulator begins an emulation session.

The Difference between the New Menu Item and the Open Menu Item

Both **New** and **Open** can be used to initiate an emulator session. However, the **Open** menu item is used to open an existing session file (PSF file) that has been saved from a previous emulator session. The **Open** menu item does not allow you to change the ROM file or handheld being emulated.

Dragging and Dropping Files

You can drag and drop the following file type categories onto the Palm OS Emulator LCD screen:

- `PRC`, `PDB`, and `PQA` files
- `ROM` files
- `PSF` files

When dragging and dropping files, observe the following rules:

- You can drag and drop only one `ROM` file at a time.
- You can drag and drop only one `PSF` file at a time.
- You can drag and drop any number of `PRC`, `PDB`, and `PQA` files.

NOTE: Drag and drop is not currently supported for the Unix version of Palm OS Emulator.

Saving and Restoring Session State

You can save the current state of a Palm OS Emulator session to a session file for subsequent restoration. Palm OS Emulator saves a session to a session file. The Emulator uses Save and Save As in the standard manner, with one addition: you can automate what happens when closing a session by changing the Save options.

Saving the Screen

You can save the current screen to a bitmap file by selecting the **Save Screen** menu item, which saves the contents of the emulated Palm Powered handheld screen.

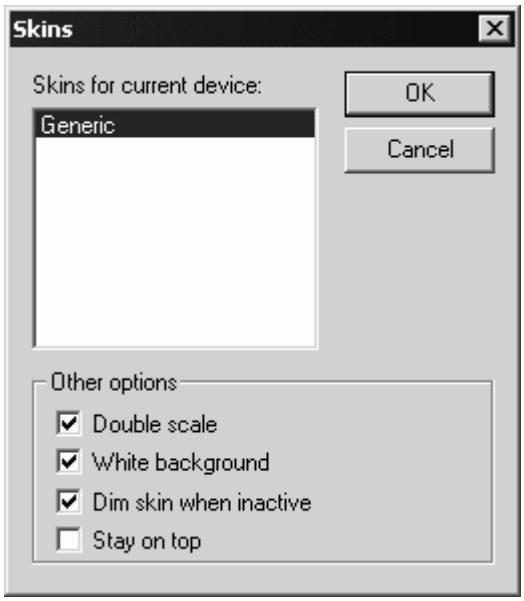
Figure 3.4 A Palm OS Emulator Screen Shot

Palm OS Emulator saves screen images on Windows-based systems as `BMP` bitmap images, saves screen images on MacOS-based systems as SimpleText image files, and saves screen images on Unix-based systems as `PPM` files.

Changing Emulator's Appearance

You can change the appearance of Palm OS Emulator by choosing **Settings>Skins**. This displays the Skins dialog box, which is shown in Figure 3.5.

Figure 3.5 Changing Palm OS Emulator Appearance



The Skins dialog box lists the skins that are available for the handheld that is being emulated.

Emulator comes with a built-in **Generic** skin, which is sufficient for testing your application. Note that the skin is simply a graphic. Selecting a skin changes the appearance of the Emulator window, but it does not change the ROM or the handheld being emulated.

You can download additional skins from:

http://www.palmos.com/dev/tools/emulator/

For more information about using skin files, see "Using Emulator Skin Files" on page 107.

Other Options on the Skins Dialog Box

In addition to selecting a skin, use the Skins dialog box to change these appearance options:

- Select **Double scale** to display the emulated handheld in double size; deselect it to display the emulated handheld in actual size.
- Select **White background** to display the emulated handheld LCD background color in white on your monitor. If you are emulating a handheld that has a green LCD, deselect **White background** to display the emulated LCD background color in green.
- Select **Dim skin when inactive** to cause the Emulator window to be dimmed when another window is the active window. This can be useful in combination with the **Stay on top** option.
- Select **Stay on top** to cause the Emulator window to stay on top of other windows even when Emulator is not the active window. This can be useful when you need to switch to other windows, such as a debugger window.

NOTE: The **Stay on top** option is supported only on Windows.

Modifying the Runtime Environment

This section describes how you can modify the Palm OS Emulator runtime environment, including changing the properties and installing applications in the emulator session.

Palm OS Emulator Properties

Use the Properties dialog box to modify characteristics of your Palm OS Emulator sessions. To display this dialog box, choose **Properties** on Windows or **Preferences** on Macintosh or Unix. The Properties dialog box is shown in Figure 3.6.

Figure 3.6 Changing Palm OS Emulator Properties

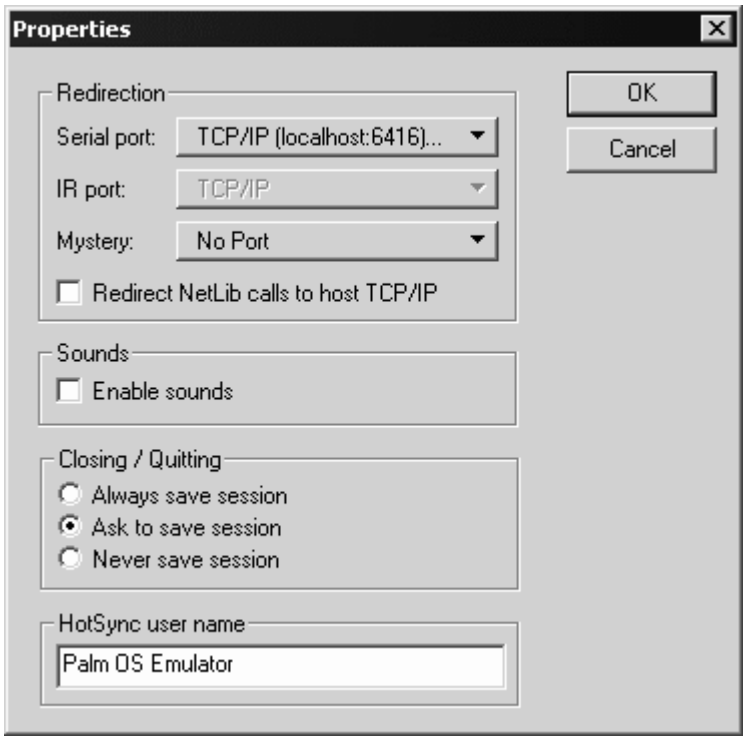


Table 3.2 describes the options available in the properties dialog box.

Table 3.2 Palm OS Emulator properties

Option	Description
Serial port	Specifies which serial port Palm OS Emulator uses to emulate serial communications on the handheld.
IR port	Specifies which port Palm OS Emulator uses to emulate infrared communications on the handheld. **NOTE:** This function is not currently supported.
Mystery	Reserved for future use. Not used for current handhelds.
Redirect Netlib calls to host TCP/IP	Redirects Netlib calls in emulated software to TCP/IP calls on the desktop computer.

Table 3.2 Palm OS Emulator properties *(continued)*

Option	Description
Enable sounds	Specifies whether Palm OS Emulator should enable emulation of handheld sounds.
Closing / Quitting	Selects what action Palm OS Emulator takes when you close a session or quit the program.
HotSync user name	Selects the user account name for synchronizing from Palm OS Emulator with the desktop computer HotSync® application.

Preferences Files

Your properties are stored in a preferences file on your computer. Each property is stored as a text string that you can view with a text editor. Emulator first looks for the preferences file in the folder containing the Emulator executable. Otherwise, the location of your preferences file depends on the type of computer that you are using, as shown in Table 3.3.

Table 3.3 Palm OS Emulator Preference File Locations

Platform	File name	File location
Macintosh	`Palm OS Emulator Prefs`	In the `Preferences` folder.
Windows	`Palm OS Emulator.ini`	In the `Windows System` directory.
Unix	`.poserrc`	In your home directory.

Installing Applications

Palm OS Emulator provides the following ways to install applications into an Emulator session:

- Drag and drop an application (PRC), database (PDB), or Palm Query Application (PQA) file directly onto the Emulator window. See "Dragging and Dropping Files" on page 40 for more information.

- Use the Install menu item from the Emulator pop-up menu. See "Using the Install Menu" on page 46 for more information.
- Use the autoload facility to create a directory of applications that are automatically installed into the Emulator session. See "Using the Autoload Facility" on page 46 for more information.

Using the Install Menu

Use **Install** to load applications or databases directly into the current Palm OS Emulator session.

- For Windows and Unix, right-click on the Palm OS Emulator screen display and choose **Install Application/Database**
- On a Macintosh system, select **Install Application/Database** from the File menu

Install displays an open file dialog box in which you can choose the applications (`PRC`), databases (`PDB`), or Palm Query Application (`PQA`) files that you want installed.

Palm OS Emulator immediately loads the selected files into emulated RAM. If Palm OS Emulator finds another application or database with the same creator ID, that application or database is deleted before the new version is loaded.

IMPORTANT: If you install an application while the Palm OS Launcher is running, the Launcher does not update its data structures, and thus does not reflect the fact that a database has been added or modified. Use **Install** while an application is running in the emulated session. A simple method to use is to switch to the Calculator application when using the **Install** menu item.

Using the Autoload Facility

Palm OS Emulator provides an autoload facility, which allows you to specify installable files that should be automatically installed into

the emulation session when you start Emulator. Here's how you can use the autoload facility:

- Create a directory named `autoload` in the same directory as the Emulator executable file.
- Place the files in the `autoload` directory that you want to have automatically installed. You can place application files (`PRC`), database files (`PDB`), and Palm Query Application (`PQA`) files in the `autoload` directory.

When Emulator starts, it will automatically install all of the files that it finds in the `Autoload` directory.

NOTE: On Windows and Unix, the `-load_apps` command line option causes Emulator to ignore the `Autoload` directory. The files listed with the `-load_apps` command line option are automatically installed rather than the files in the `Autoload` directory.

Using the Autorun Facility

Similar to using the Autoload facility, you can automatically load and run applications by creating an `autorun` directory. Place the applications you want automatically run in the `autorun` directory.

To have applications automatically run and quit, you create a directory with the name `autorunandquit`.

Using Serial Communication

Palm OS Emulator supports emulation of the Palm Powered handheld serial port connection. It does so by mapping Palm OS serial port operations to a communications port on the desktop computer. To select which port the Emulator uses, use **Properties** (on Macintosh and Unix computers, this is **Preferences**), as described in "Palm OS Emulator Properties" on page 43.

When emulated software accesses the processor serial port hardware registers, Palm OS Emulator performs the appropriate actions on the specified serial port on the desktop computer. This means that serial read and write operations work as follows:

- when outgoing data is written to the UART's `tx` register, the Emulator redirects that data to the desktop computer's serial port.
- when the emulated software attempts to read data from the UART's `rx` register, the Emulator reads data from the desktop computer's serial port and places the data into that register.

Using the HotSync Application

You can perform a HotSync operation from your emulated session in one of two ways:

- If you are using a Windows-based computer, you can use the Network HotSync option, which greatly simplifies your communications efforts. This method is described in the "Performing a Network Hotsync Operation with Palm OS Emulator on Windows" section below.
- Alternatively, you can use a null-modem cable to connect two serial ports together and perform a HotSync operation. This method is described in "Performing a HotSync Operation with a Null Modem Cable" on page 50.

Performing a Network Hotsync Operation with Palm OS Emulator on Windows

You do not need to be connected to a network to perform a Network HotSync operation with Palm OS Emulator. This method can be used with Emulator and a single Windows computer. However, other configurations are possible.

In general, you need these two:

- a Windows computer running HotSync Manager
- a computer running Emulator that can access the computer running HotSync Manager.

The computer running Emulator can be the same Windows computer that is running HotSync Manager, or it can be a second computer (either Windows, Macintosh, or Unix). If you are using a single Windows computer, you don't need to be connected to a network. However, if you are using a second computer, you will

need the actual IP address of the Windows computer running HotSync Manager for step 4 below.

Here is the complete process for performing a Network HotSync operation:

1. Ensure that you have the Network HotSync application on your emulated handheld:
   - If you are emulating a handheld that did not come with Network HotSync pre-installed (for example, a Palm III or Palm m100 handheld), you must first download and install the Network HotSync application on the emulated handheld. You can get the Network HotSync files from:

     http://www.palm.com/support/downloads/netsync.html
   - If you are emulating a handheld running Palm OS version 3.1 or later, then you may already have the Network HotSync application installed on the emulated handheld.
2. Configure the HotSync settings on your Windows computer:
   - Right-click (use mouse button two) on the HotSync icon in the system tray.
   - In the pop-up menu, select **Network** to enable Network HotSync. (A checkmark will appear next to the **Network** menu item if it is already enabled.)
3. Configure Palm OS Emulator to Redirect NetLib Calls to TCP/IP:
   - Right-click (use mouse button two) on Emulator.
   - In the pop-up menu, select **Settings>Properties...**
   - In the Properties dialog box, click the **Redirect NetLib Calls to TCP/IP** checkbox. Click **OK** to save the changed properties.
4. Configure the HotSync settings on the emulated handheld:
   - From the handheld's application launcher, tap the HotSync application to open it.
   - Tap **Menu** to display the HotSync application's menu.
   - Select **Options>Modem Sync Prefs...**

– In the Modem Sync Preferences dialog box, tap the **Network** button. Tap the **OK** button to save the changed preferences.

– Tap **Menu** to display the HotSync application's menu again.

– Select **Options>LANSync Prefs...**

– In the LANSync Preferences dialog box, tap the **LANSync** button. Tap the **OK** button to save the changed preferences.

– Tap **Menu** to display the HotSync application's menu again.

– Select **Options>Primary PC Setup...**

– In the Primary PC Setup dialog box, enter the **Primary PC Address** (the middle entry field):

- If you are running Emulator and HotSync manager on the same Windows computer, enter `127.0.0.1`

- If you are running Emulator on a second computer, then enter the actual IP address of the Windows computer running the Network HotSync operation.

Tap the **OK** button to save the changed preferences.

– In the HotSync application, tap **Modem**. Next, tap the **Select Service** button under the Modem Sync icon.

– In the Preferences dialog box, tap the **Tap to enter phone** field. In the Phone Setup dialog box, enter `00` in the **Phone #** entry field. Then tap the **OK** button. Then tap the **Done** button.

– To start the HotSync operation, tap the HotSync icon in the center of the HotSync dialog box.

Performing a HotSync Operation with a Null Modem Cable

You can perform a HotSync operation by connecting the serial port that the HotSync application uses to communicate with the handheld to another serial port that Palm OS Emulator uses. You connect these ports together with a null modem cable, such as a LapLink cable.

For example, if your HotSync application uses the COM1 port, follow these steps:

1. Select **Properties** (**Preferences** on a Macintosh or Unix) and specify the COM2 port for Palm OS Emulator.
2. Connect COM1 and COM2 together with a null modem cable.
3. Select **HotSync** from the Palm OS Emulator menu.

The HotSync application synchronizes with Palm OS Emulator just as it does with an actual hardware handheld.

TIP: The desktop HotSync application is CPU-intensive, which is not generally an issue; however, when you are using the HotSync application with Palm OS Emulator, the two programs are sharing the same CPU, which can dramatically slow the synchronization down.

A handy trick to deal with this problem is to click on the Palm OS Emulator window after the HotSync process starts. This brings the Emulator back into the foreground and allows it to use more CPU time, which improves the speed of the overall process.

If your desktop computer has two ports and you use a serial mouse on one of them, you can temporarily disable the mouse, perform a synchronization, and re-enable the mouse. Follow these steps:

1. Disable your mouse.
2. Restart Windows.
3. Connect the serial ports together with a null modem cable.
4. Start Palm OS Emulator.
5. Press SHIFT-F10 to display the menu, then H to begin the HotSync operation.
6. After the HotSync operation completes, re-enable your mouse.
7. Restart Windows again.

TIP: When you first perform a HotSync operation with Palm OS Emulator, the HotSync application asks you to select a user name. It is a good idea to create a new user account, with a different name, for use with the Emulator.

Emulating Expansion Memory

Palm OS 4.0 includes the Expansion Manager, which manages plug-in memory cards, and the Virtual File System manager, which supports the management of files on memory cards.

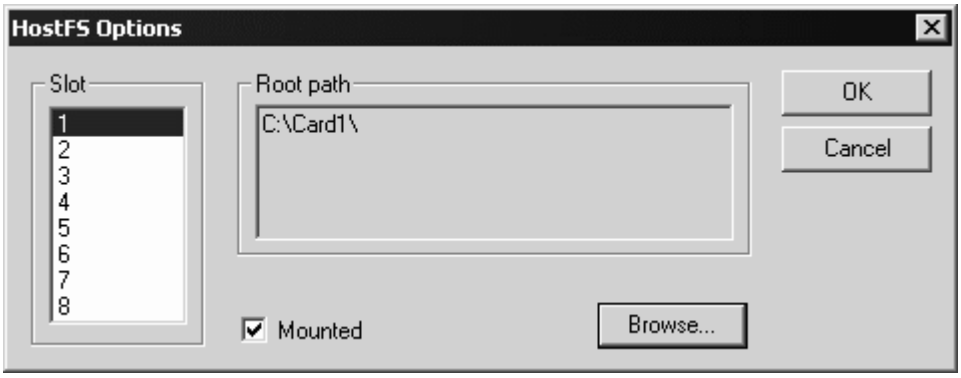
Palm OS Emulator can emulate these cards, which the Expansion Manager will recognize and mount in the same way it would mount an actual hardware expansion card. The Virtual File System Manager will then read from and write to the host operating system using the mount information associated with the emulated card. The host operating manipulation is performed using the many file-related host control functions available. (See "Host Control API Reference" on page 119 for more information on the host control API.)

Palm provides an implementation of a file system, called HostFS, that works in conjunction with Emulator's Host Control API to mount a local directory on the desktop as a volume or card. You can download the HostFS application from the Palm OS Emulator web page.

NOTE: Because Expansion Manager was added in Palm OS 4.0, the `HostFS.prc` application needs to be installed Emulator running a ROM file for Palm OS 4.0 or later. (See "Using ROM Images" on page 19 for more information on using ROM images with Emulator.)

Once you have installed `HostFS.prc` in an Emulator session running at least a Palm OS 4.0 ROM, you are ready to emulate expansion memory. To specify mount information for card emulation, use the HostFS Options dialog box shown in Figure 3.7.

Figure 3.7 Palm OS Emulator HostFS Options Dialog Box



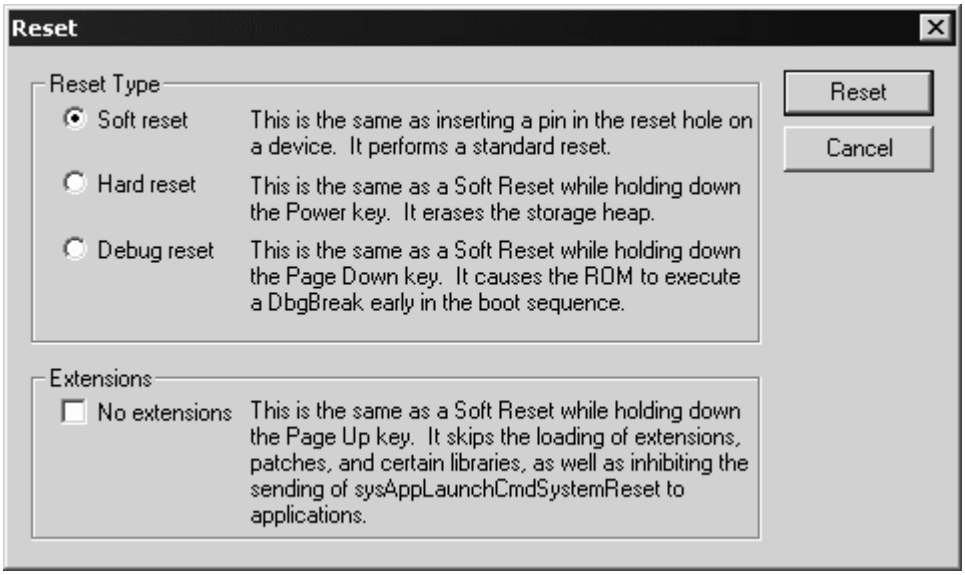
The HostFS Options dialog box supports the mounting of up to eight emulated cards. For each card, you can specify a directory in the host file system that will serve as the root for the card as managed by the Virtual File System Manager. You can also specify whether a particular card is actually mounted.

You can change the HostFS options settings while an emulation session is running. Changes regarding whether a card is mounted or not take place immediately; the Palm OS is notified that the card has been added or removed. Changes regarding the root path take effect only when the card is mounted.

Emulating a Handheld Reset

Palm OS Emulator can perform any of the standard handheld reset functions. To perform a reset, select **Reset...** to open the Reset dialog box, as shown in Figure 3.8 on page 54.

Figure 3.8 Reset Dialog Box



This dialog box is also available when you click **Reset** in an error message dialog box (see Figure 6.1 on page 93 for an example of an error message dialog box).

4

Palm OS Emulator User Interface Summary

This chapter provides a description of the user interface for Palm OS Emulator, including descriptions of the menus and keyboard usage.

Palm OS Emulator Display

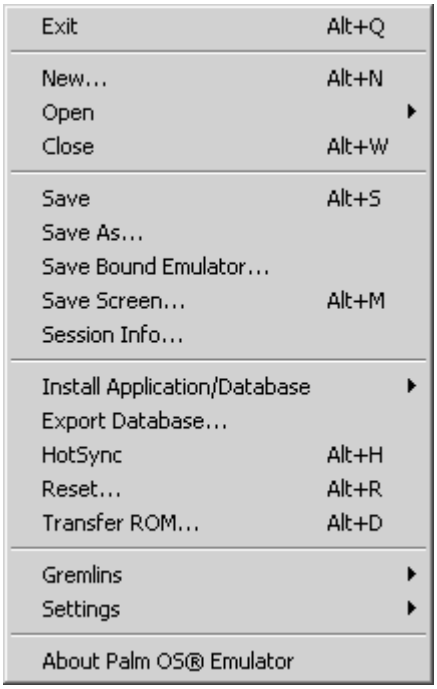
The Palm OS Emulator display looks very much like a real Palm Powered™ handheld. You can use your mouse to perform actions that you perform with the stylus on handhelds, and you can use the menus to access Palm OS Emulator functionality.

Using the Menus

You can also access features that are specific to Palm OS Emulator by choosing menu items:

- If you are using Windows, right-click on the Palm OS Emulator screen display to access the menu items, or press SHIFT-F10. The Palm OS Emulator menu displays, as shown in Figure 4.1.

Figure 4.1 Windows Version of the Palm OS Emulator Menus



NOTE: Note that the Windows shortcut keys use ALT rather than CTRL because CTRL combinations are already used to enter other Emulator commands. See "Using Control Keys" on page 62 for more information.

- If you are using a Macintosh, you can either select menu items from the menu bar or use CTRL-click to display the pop-up contextual menu. The Macintosh pop-up menu is shown in Figure 4.2.

Figure 4.2 Macintosh Version of the Palm OS Emulator Menus

The Macintosh version is only slightly different when compared to the Windows version: The Macintosh version uses **Quit** instead of **Exit**.

- If you are using Unix, use SHIFT-F10 to display the pop-up menu. Palm OS Emulator provides a pop-up menu similar to the Macintosh version.

Table 4.1 provides a brief description of the Palm OS Emulator menu items.

Table 4.1 The Palm OS Emulator Menu Items

Command	Description
Exit	Exits Palm OS Emulator. Palm OS Emulator prompts you to save the session to an emulator `PSF` file before exiting.
New	Displays the New Session dialog box. The New Session dialog box lets you select the session's ROM file, handheld, skin, and RAM size. Because only one session can be active, this command also closes the current emulation session.
Open	Displays the open file dialog box for opening a saved emulator session file. Because only one session can be active, this command also closes the current emulation session. Note that the **Open** menu is for opening saved session files (PSF files), not for opening ROM files. To change the ROM file for your emulator session, you need to use the **New** menu.
Close	Closes and optionally saves the current emulator session.
Save	Saves the current emulator session to an emulator `PSF` file.
Save As	Saves the current emulator session to an emulator `PSF` file.
Save Bound Emulator	Saves the current emulator session as an executable, which can be used for demonstration purposes. For more information, see "Creating Demonstration Versions of Palm OS Emulator" on page 115. This description includes important information about the legal use of a bound emulation session.
Save Screen	Saves the current screen image as a bitmap file. **TIP: Save Screen** is a very convenient means of capturing screen images for documentation of Palm OS applications.

Table 4.1 The Palm OS Emulator Menu Items *(continued)*

Command	Description
Session Info	Opens the Session Info dialog, displaying information about the handheld name, RAM size, and ROM being emulated, and about the current Emulator `PSF` file, if you are currently using a `PSF` file.
Install Application/ Database	Lets you install an application into the emulator session, in the same way that a user would install it on the handheld with the Palm Install tool. For more information, see "Installing Applications" on page 45.
Export Database	Exports a database to your desktop computer as a `PDB` or `PQA` file, or exports an application to your desktop computer as a `PRC` file.
HotSync	Lets you synchronize the emulator session environment with the desktop computer. See "Using the HotSync Application" on page 48 for more information about the cabling requirements and other considerations for this menu item.
Reset	Resets the current emulation session. For more information see "Emulating a Handheld Reset" on page 53.
Transfer ROM	Lets you download a ROM image from a handheld, and save the ROM image to disk. You can then initiate a new session based on that ROM image. For more information, see "Transferring a ROM Image from a Handheld" on page 23.
Gremlins>New	Create a new Gremlin horde and start running it. For more information about Gremlins, see "Using Gremlins to Automate Testing" on page 74.
Gremlins>Step	Step a Gremlin, after stopping.
Gremlins>Resume	Resume running of the Gremlin.
Gremlins>Stop	Stop running the Gremlin.

Table 4.1 The Palm OS Emulator Menu Items *(continued)*

Command	Description
Gremlins>Replay	Resumes running of Gremlins from data that was previously saved in a Palm event file (`PEV`). For more information, see "Replaying Gremlin Events" on page 80.
Gremlins>Minimize	Takes Gremlin events stored in a Palm event file (`PEV`) and identifies the minimal set of events required to produce a crash. For more information, see "Minimizing Gremlin Events" on page 80.
Profiling>Start	Start profiling your application. This option is only available with the profiling version of Emulator. For more information, see "Profiling Your Code" on page 87.
Profiling>Stop	Stop profiling your application. This option is only available with the profiling version of Emulator. For more information, see "Profiling Your Code" on page 87.
Profiling>Dump	Save the profiling information to a file. This option is only available with the profiling version of Emulator. For more information, see "Profiling Your Code" on page 87.
Settings>Properties	Opens the properties dialog box, as described in "Palm OS Emulator Properties" on page 43.
Settings>Logging	Opens the logging options dialog box, as described in "Logging Options" on page 69.
Settings>Debugging	Opens the debug options dialog box, as described in "Debug Options" on page 65.
Settings>Error Handling	Opens the error handling options dialog box, as described in "Detecting an Error Condition" on page 92.
Settings>Tracing	Opens the tracing options dialog box, as described in "Tracing Your Code" on page 86.
Settings>Skins	Opens the skins dialog box, as described in "Changing Emulator's Appearance" on page 42.

Table 4.1 The Palm OS Emulator Menu Items *(continued)*

Command	Description
Settings>HostFS	Opens the HostFS options dialog box, as described in "Emulating Expansion Memory" on page 52.
Settings>Breakpoints	Opens the breakpoints dialog box, as described in "Setting Breakpoints" on page 81.

Using the Hardware Buttons

Palm OS Emulator emulates each of the hardware buttons on Palm Powered handhelds. You can click on a button to activate it, and you can press and hold down a button just as you would on a handheld. As an example, you can click the on/off button to turn a handheld off and on. Depending on the handheld you are emulating, you can also press and hold the on/off button to turn the backlighting off and on.

Palm OS Emulator also lets you activate the hardware buttons with keyboard equivalents, as shown in Table 4.2.

Table 4.2 Keyboard equivalents for the hardware buttons

Button	Keyboard equivalent
On/Off	ESC
Application Button 1 (usually Palm Date Book)	F1
Application Button 2 (usually Palm Address Book)	F2
Application Button 3 (usually Palm To Do List)	F3
Application Button 4 (usually Palm Memo Pad or Note Pad)	F4
Up	PAGE UP
Down	PAGE DOWN

Entering Data

Palm OS Emulator lets you use your desktop computer pointing device to tap and to draw Graffiti® characters, just as you do with the stylus on the handheld.

Emulator also lets you enter text from the desktop computer keyboard. For example, you can type the text for a note by tapping in the note text entry area and then using the keyboard.

In addition, Emulator supports copying text to and from the desktop computer's clipboard.

Copying text from a desktop computer to Emulator:

- Copy the text to the desktop computer's clipboard (for example, on Windows, use CTRL-C).
- Switch to the Emulator window.
- In the Emulator window, open an application that has an active field that can accept text data. Click on the active field.
- Use CTRL-C, then type the letter P. CTRL-C causes Emulator to enter the command stroke character ("/"), and the letter P enters the Paste command.

Copying text from Emulator to a desktop computer:

- In the Emulator window, open an application that has an active field containing text data. Click on the active field.
- Use CTRL-C, then type the letter C. CTRL-C causes Emulator to enter the command stroke character ("/"), and the letter C enters the Copy command.
- Switch to the desktop computer application where you want to paste the text data.
- Paste the text into the desktop computer application (for example, on Windows, use CTRL-V).

Using Control Keys

Palm OS Emulator also supports a set of control keys that you can use for input. These keys, which are shown in Table 4.3, are the same control keys that you can use with the Palm OS Simulator program.

Table 4.3 Palm OS Emulator Control Keys

Control key combination	Description
CTRL+A	Displays the menu
CTRL+B	Low battery warning
CTRL+C	Command character
CTRL+D	Confirmation character
CTRL+E	Displays the application launcher
CTRL+F	Displays the onscreen keyboard
CTRL+M	Enters a linefeed character
CTRL+N	Jumps to the next field
CTRL+P	Jumps to the previous field
CTRL+S	Automatic off character
CTRL+T	Sets or unsets hard contrasts
CTRL+U	Turns backlighting on or off

5

Testing Applications Using Palm OS Emulator

This chapter describes how you can use Palm OS® Emulator to test and debug programs you have written for Palm OS.

Testing Software

Testing software is probably the most common use of Palm OS Emulator. This section provides a quick summary of the steps to load and test an application.

Debug Options

Palm OS Emulator monitors the actions of your application while it is emulating the operation of the handheld. When your application performs an action that does not strictly conform to Palm OS's programming guidelines, the Emulator displays a dialog box that explains what is happening.

The debugging options dialog box, which is shown in Figure 5.1, lets you enable or disable the monitoring activities applied to your application. Use **Debug Options** to display this dialog box.

Figure 5.1 Palm OS Emulator Debug Options Dialog Box

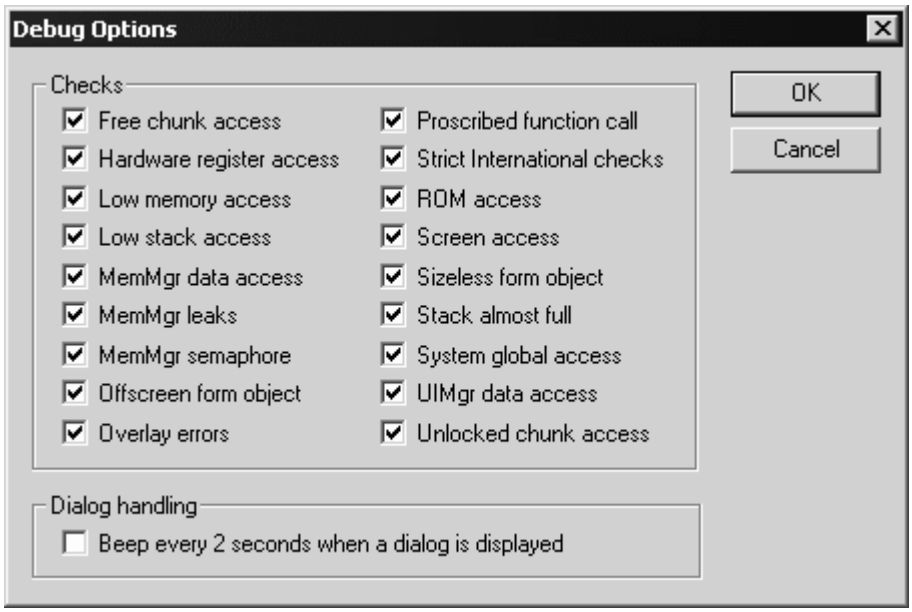


Table 5.1 describes each of the debugging options.

Table 5.1 Emulator Debugging Options

Option	Description
Free chunk access	Monitors access to free memory chunks. No process should ever access the contents of a chunk that has been deallocated by the `MemChunkFree`, `MemPtrFree`, or `MemHandleFree` functions.
Hardware register access	Monitors accesses to hardware registers by applications. For example, Emulator monitors memory ranges reserved for external LCD controllers, USB controllers, and Programmable Logic Devices (PLD).
Low memory access	Monitors low-memory access by applications. Low-memory access means an attempt to read from or write to a memory location in the range `0x0000` to `0x00FF`.

Table 5.1 Emulator Debugging Options *(continued)*

Option	Description
Low stack access	Monitors access to the range of memory below the stack pointer.
MemMgr data access	Monitors access to Memory Manager data structures, which is restricted to only the Memory Manager. Memory Manager data structures are the heap headers, master pointer tables, memory chunk headers, and memory chunk trailers. Emulator allows no access to data structures for which there are PalmOSGlue accessor routine defined.
MemMgr leaks	Detects memory leaks. Emulator checks for memory leaks on `SysAppExit`. If Emulator discovers any memory leaks, it writes information about the leaks to a log file, including memory location, memory contents, and a stack crawl of the context that allocated the leaked block of memory. It is a good idea to set your compiler's switch to embed debug symbols in your code so that you can easily interpret the stack crawl. With CodeWarrior, you should set the option Generate MacsBugs Debug Symbols. With GCC, you should use the Palm OS specific GCC option `-mdebug-labels`. With MacsBugs, you will get each function's name in the text section immediately after the function's code.

Table 5.1 Emulator Debugging Options *(continued)*

Option	Description
MemMgr semaphore	Monitors how long the Memory Manager semaphore has been acquired for write access using the `MemSemaphoreReserve` and `MemSemaphoreRelease` functions. Your applications should not be calling these functions; however, if you must call them, you should not hold the semaphore for longer than 10 milliseconds.
Offscreen form object	Checks for any use of offscreen form objects.
Overlay errors	This option controls a facility of Overlay Manager in the debug version of the ROM files. When this option is enabled, the `omFtrShowErrorsFlag` bit of the `omFtrCreator` feature is set to true. As a result, Overlay Manager reports the name of a database that it cannot validate and the reason why it did not validate.
Proscribed function call	Monitors calls to any of the functions on the proscribed function list. See Appendix B, "Unsupported Traps." on page 225 for a list of functions.
Strict International checks	Checks for multibyte character display routines.
ROM access	Monitors ROM access by applications.
Screen access	Monitors LCD screen buffer access by applications. LCD screen buffer access is defined as reading from or writing to the memory range indicated by the LCD-related hardware registers.
Sizeless form object	Checks for any use of sizeless form objects (objects whose height or width is zero).

Table 5.1 Emulator Debugging Options *(continued)*

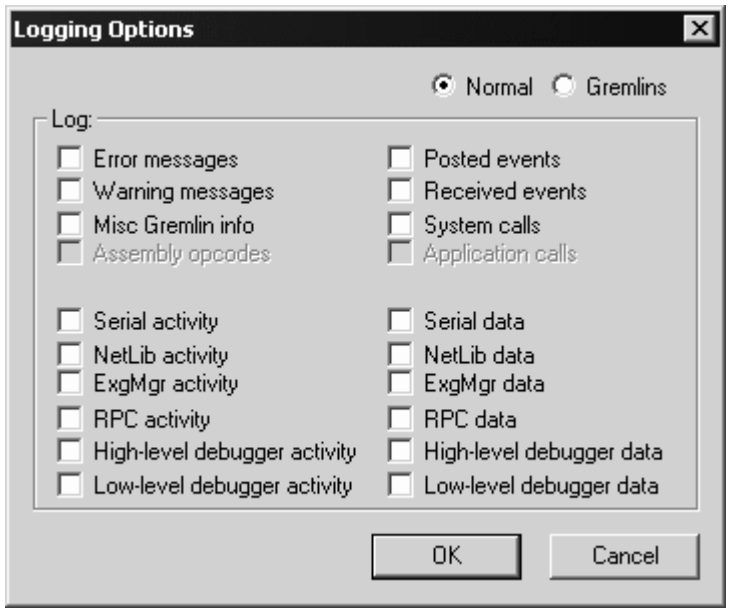
Option	Description
Stack almost full	Ensures that the stack pointer has not dipped below the space allocated for it by the kernel. When this option is enabled, Palm OS Emulator warns you when the application stack is getting close to full. Note that you are always notified of a stack overflow, even if this option is disabled.
System global access	Monitors access to system global variables by applications. System global variable access is defined as reading from or writing to a memory location in the range from `0x0100` to the end of the trap dispatch table.
UIMgr data access	Checks for any access of User Interface Manager data structures.
Unlocked chunk access	Monitors read access to uninitialized portions of memory chunks that have been allocated by the `MemHandleNew` function. Warns about the case where you use a stale pointer from when a moveable chunk is locked and unlocked. Also catches cases of misusing a pointer to one chunk to access a subsequent chunk.
Beep every 2 seconds when a dialog is displayed	Causes Emulator to beep every two seconds while a message dialog box is displayed. Emulator will stop beeping after one minute.

Logging Options

Palm OS Emulator also logs various actions taken by your application to help you debug and performance tune your code. The logged information is automatically written to a text file that is saved in the same directory as the Emulator executable.

You can control the logging activity with the logging options dialog box, which is shown in Figure 5.2. Use **Logging Options** to display this dialog box.

Figure 5.2 Palm OS Emulator Logging Options Dialog Box



The logging options dialog box features radio buttons to indicate logging during normal operations (**Normal**), and logging while a Gremlin is running (**Gremlins**). Both offer the same options, which are described in Table 5.2

Table 5.2 Emulator Logging Options

Option	Description
Error messages	Logs error messages that are generally fatal (messages where the **Continue** button is disabled in the dialog box containing the error message). **Examples:** Address errors, divide-by-zero errors, calls to `SysFatalAlert`.
Warning messages	Logs any message that is displayed in a dialog box that can be dismissed by tapping the **Continue** button. **Examples:** Low memory access, direct screen access, hardware register access.
Misc Gremlin info	Logs information about Gremlins that is mostly useful for debugging the Gremlins themselves.
Assembly opcodes	Logs assembly-level trace information, including registers, the program counter, opcodes, and related information. This option is not yet implemented.
Posted events	Logs events that have entered into the system by way of calls to the `EvtAddEventToQueue`, `EvtAddUniqueEventToQueue`, `EvtEnqueuePenPoint`, and `EvtEnqueueKey` functions.
Received events	Logs events returned by calls to the `EvtGetEvent`, `EvtGetPen`, and `EvtGetSysEvent` functions.
System calls	Logs calls to Palm OS functions.
Application calls	Logs calls to functions in your application. This option is not yet implemented.

Table 5.2 Emulator Logging Options *(continued)*

Option	Description
Serial activity	Logs changes in serial port settings, and the opening and closing of the serial port.
NetLib activity	Logs calls to `NetLib` functions, including parameter and return values.
ExgMgr activity	Logs calls to `ExgMgr` functions.
RPC activity	Logs remote procedure calls.
High-level debugger activity	Logs messages received back from an external debugger, and the messages sent back to the debugger.
Low-level debugger activity	Traces the low-level mechanisms that receive raw data from external debuggers and send data back to external debuggers.

Table 5.2 Emulator Logging Options *(continued)*

Option	Description
Serial data	Logs data sent and received over the serial port. Data is logged as it is being transferred over the host serial port Incoming data follows this path: 1. Serial port 2. Emulated hardware registers 3. Palm OS 4. Palm application Palm OS Emulator logs the serial port data. Outgoing data follows this path: 1. Palm application 2. Palm OS 3. Emulated hardware registers 4. Serial port Again, Palm OS Emulator logs the serial port data.
NetLib data	Logs data sent and received via `NetLib` calls.
ExgMgr data	Logs data sent and received via `ExgMgr` calls.
RPC data	Logs data sent and received via remote procedure calls.
High-level debugger data	Logs details of the messages sent to and received from an external debugger.
Low-level debugger data	Logs the raw data being sent to and received from an external debugger.

Using Gremlins to Automate Testing

You can use Gremlins to automate testing of an application. A **Gremlin** generates a series of user input events that test your application's capabilities. You can have a Gremlin generate a specified number of events, or to loop forever, which lets you set up a Gremlin and allow it to run overnight to thoroughly test your application.

A **Gremlin horde** is a range of Gremlins that you want Palm OS Emulator to run. The Emulator generates a stream of events for each Gremlin and then moves onto the next Gremlin. The Emulator cycles through the Gremlins until the maximum number of events have been generated for the horde.

Palm OS Emulator generates a stream of events for each Gremlin in the horde until one of the following conditions occurs:

- An error such as a hardware exception or illegal memory access is generated.
- The maximum number of events for a single Gremlin have been generated.
- The maximum number of events for the horde have been generated.
- You stop the horde by choosing **Stop** or **Step** from the Emulator menu or from the Gremlin Status dialog box.

If a Gremlin generates an error, it is halted and Palm OS Emulator does not include it when cycling through the horde again.

Gremlin Characteristics

Each Gremlin has the following characteristics:

- It generates a unique, random sequence of stylus and key input events to step through the user interface possibilities of an application.
- It has a unique "seed" value between 0 and 999
- It generates the same sequence of random events whenever it is run.
- It runs with a specific application or applications.

- It displays a report immediately when an error occurs.

Gremlin Horde Settings

For each Gremlin horde, you specify the following:

- The number of the first Gremlin to run. This must be a value between 0 and 999.
- The number of the last Gremlin to run. This must be a value between 0 and 999.
- The switching depth of the Gremlin horde. This is the number of events to run for each Gremlin before switching to another Gremlin. After this many events have been generated for the Gremlin, it is suspended, and the next Gremlin in the horde starts running.
- The maximum number of events for each gremlin in the horde. The Emulator stops running each Gremlin after it posts this many events, or after it terminates with an error.
- The first application the Gremlins are to run.
- The set of applications the Gremlins are to run. You can select a single application, a group of applications, or all applications.
- Whether warnings and errors are displayed as message dialogs or as messages written to a log file. See "Logging while Gremlins Are Running" on page 79 for more information.

When Palm OS Emulator runs a Gremlin horde, it actually maintains a separate stream for each Gremlin in the horde. When it starts a horde, the Emulator first saves the complete state of the emulation to a session (`PSF`) file. Then, the Emulator:

- Starts the first Gremlin. When the Gremlin has posted a number of events equal to the specified switching depth, the Emulator saves its state to a new file and suspends the Gremlin.
- Reloads the original session state.
- Starts the second Gremlin and run it until it posts that number of events, at which time its state is saved to another file, and the Gremlin is suspended.

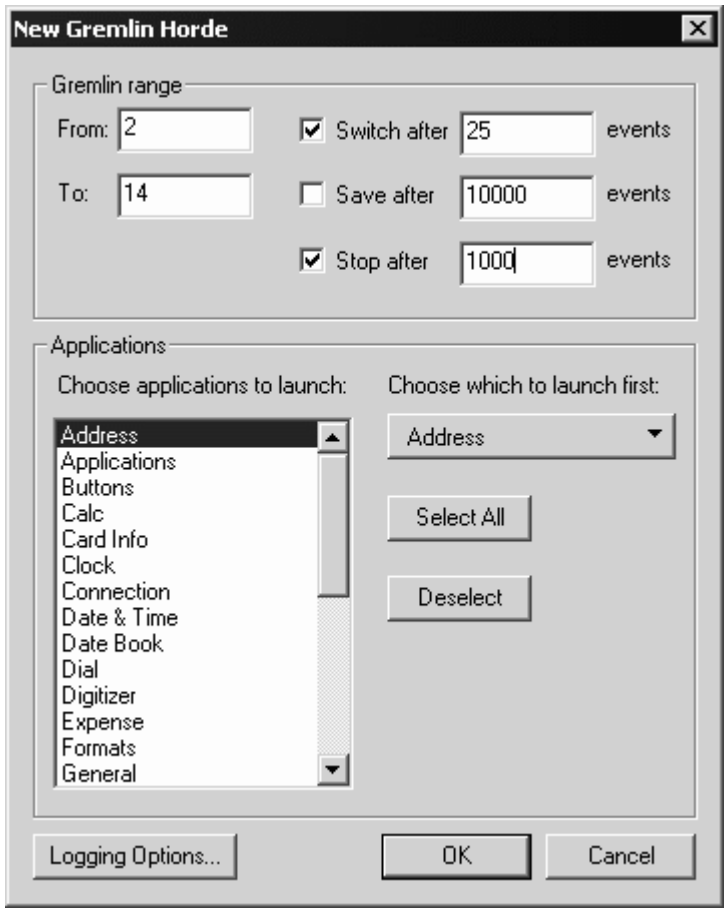
- Runs each Gremlin in the horde, until each has been suspended or terminated:
  - A Gremlin is terminated when an error occurs while the Gremlin is posting events.
  - A Gremlin is suspended when it has posted a number of events equal to the switching depth for the horde.
- Returns to the first suspended Gremlin in the horde, reloads its state from the saved file, and resumes its execution as if nothing else had happened in the meantime.
- Continues cycling through the Gremlins in the horde until each Gremlin has finished. A Gremlin finishes when either of these conditions occurs:
  - the Gremlin has terminated due to an error
  - the Gremlin has posted a total number of events equal to the maximum specified for the horde.

Running a Gremlin Horde

Select **Gremlins>New...** to start a Gremlin. The New Gremlin Horde dialog box displays, as shown in Figure 5.3. Use this dialog box to specify the characteristics of the Gremlin horde that you want to run.

TIP: If you wish to run a single Gremlin, simply set the Gremlin Start Number and Gremlin End Number fields to the same value.

Figure 5.3 New Gremlin Horde Dialog Box



When Palm OS Emulator runs the example shown in Figure 5.3, the horde will operate as follows:

- The Emulator will only run the Address application when generating key and stylus events for this horde.
- The Emulator will use a seed value of 2 for the first Gremlin in the horde and a seed value of 14 for the last Gremlin in the horde. It also runs all intervening Gremlins: numbers 3 through 13.
- The Emulator will generate 25 events for each Gremlin before switching to the next Gremlin in the horde.
- The Emulator will cycle through the Gremlins in the horde until a total of 1000 events have been generated for each Gremlin. Thus, a total of 13,000 events will be generated.

This means that the Emulator will generate the following sequence of Gremlin events:

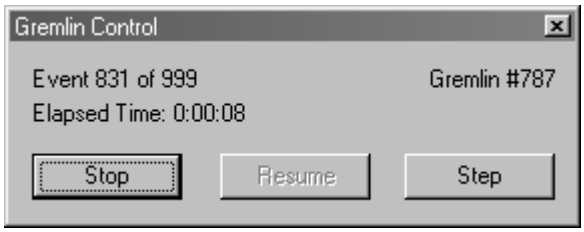
1. Gremlin #2 runs and receives twenty-five events, after which Gremlin 2 is suspended.
2. Gremlin #3 runs and receives twenty-five events, after which Gremlin #3 is suspended.
3. Similarly, each Gremlin (#4 through #14) runs and receives twenty-five events, after which it is suspended.
4. The Emulator loops back to Gremlin #2 and runs it, sending it twenty-five events before again suspending it.
5. Gremlin #3 runs again, receives twenty-five events, and suspends.
6. This looping through the Gremlins and sending each events until the switch depth (25) is reached continues until the maximum number of horde events (1000) have been generated.
7. All activity for the Gremlin horde completes.

NOTE: If an error occurs while a specific Gremlin is running, Palm OS Emulator halts that Gremlin rather than suspending it. This means that the Gremlin is not run when the Emulator next iterates through the horde.

Stepping and Stopping Gremlins

After the horde starts running, Palm OS Emulator displays the Gremlin control dialog box, which is shown in Figure 5.4. You can use the commands in this dialog box to stop, resume, and single-step a Gremlin. You can also use the **Gremlins** menu to perform these actions.

Figure 5.4 The Gremlin Control Dialog Box



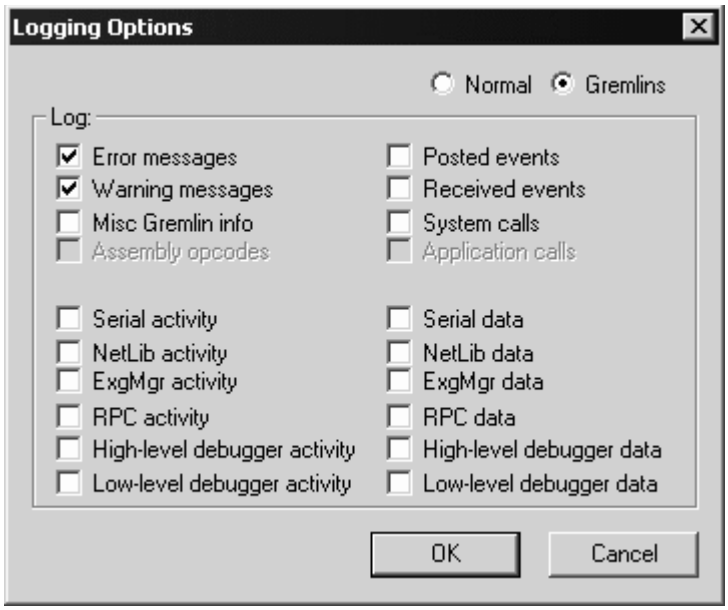
Gremlin Snapshots

When you start a new Gremlin horde, you can specify that you want Palm OS Emulator to take a snapshot on a regular basis. You specify a frequency value, as shown in Figure 5.3 on page 77, and the Emulator saves a session file each time that many Gremlins have run. Each snapshot is a `PSF` file that captures the current state of the emulation. You can open the snapshot in the Emulator as a new session and begin debugging from that state.

Logging while Gremlins Are Running

Palm OS Emulator lets you specify separate logging options to use while Gremlins are running. Figure 5.5 shows the Gremlin logging options dialog box. Each of the options is described in "Logging Options" on page 69.

Figure 5.5 Gremlin Logging Options Dialog Box



Using Gremlin Events

When Gremlins are running, all generated events are saved to a Palm event file (`PEV` file). This event file contains a snapshot of the initial session state and a list of all of the events that Gremlins generated.

Replaying Gremlin Events

To replay the events stored in a Palm event file, use **Gremlins>Replay...** to select the `PEV` file. Replaying events from a Palm event file is similar to running the same Gremlin on the same application over again; however, with the replay function, Emulator is reading the events from a file rather than generating the same random events to post to the application.

Minimizing Gremlin Events

Palm OS Emulator provides an event minimization function that takes events stored in a Palm event file (`PEV`) and identifies the minimal set of events required to produce a crash.

To use the Gremlin minimization function, use **Gremlins>Minimize...** to select the PEV file. Emulator will open the

Palm events file, and replay the events in it. The minimization function will go through an iterative process of removing ranges of events to see if the resulting subset of events still produces a crash.

If a crash still occurs with the subset of events, then those events are removed, and another range of events is similarly tested. If a crash does not occur, then the removed events are put back and the iterative process continues.

The end result is a minimal set of events that produces a crash. (The crash may not be exactly the same crash caused by the full set of events.) This minimized set of events is saved to a new Palm event file, which you can use with the **Gremlins>Replay...** function. The minimized set of events is also translated into a sequence of English instructions that you can use for debugging. This sequence list is written to a text in the same directory as the Palm events file.

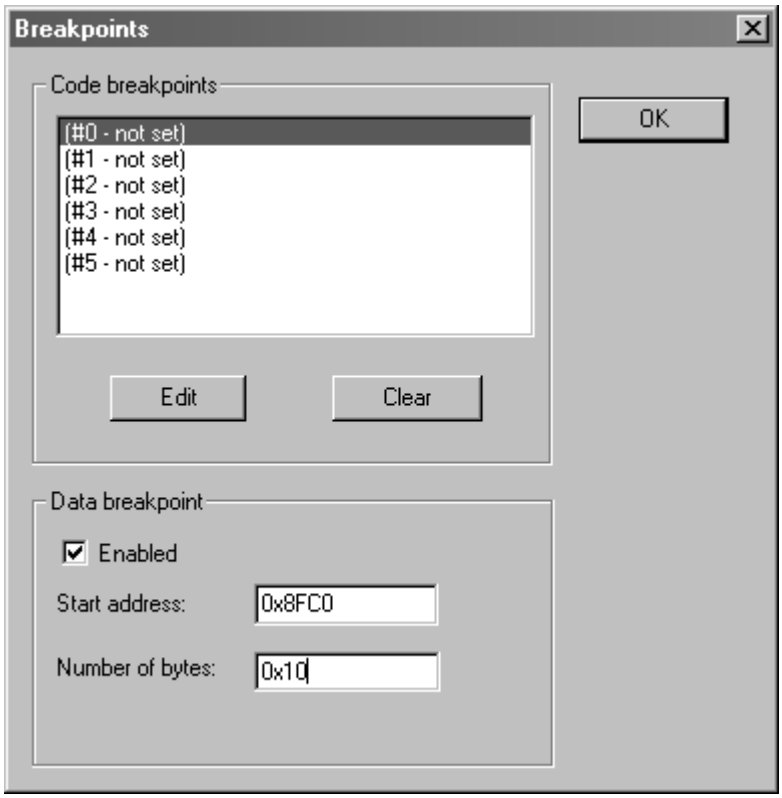
Setting Breakpoints

You can set breakpoints in your code with the Emulator. When Palm OS Emulator encounters a breakpoint that you have set, it halts and takes one of the following actions:

- If you are running the Emulator connected to a debugger, the Emulator sends a message to the debugger, informing it that the breakpoint was hit. The debugger then handles that command as it sees fit.
- If the Emulator is not connected to a debugger, the Emulator displays an error message.

To set a breakpoint, select **Breakpoints** from the **Settings** menu. The Breakpoints dialog box is displayed, as shown in Figure 5.6.

Figure 5.6 Setting a Breakpoint



Setting the Data Breakpoint

You can set exactly one data breakpoint. While your program is executing, the Emulator watches the specified address range; if it is written to, the Emulator generates a break. You can specify both the address and number of bytes in either hexadecimal (`0x`) or decimal.

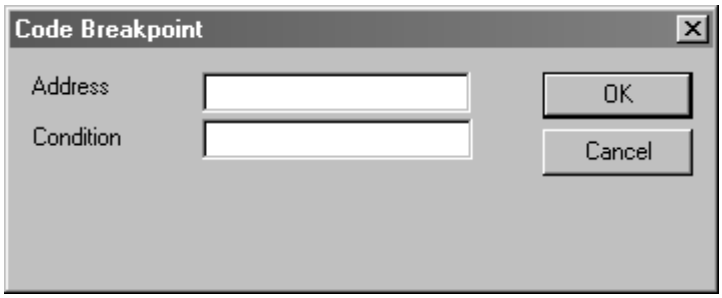
Setting Conditional Breakpoints

You can set up to six independent conditional breakpoints. The Emulator generates a break for a conditional breakpoint when both of the following are true:

- the program counter reaches the specifies address
- the specified condition is true

To set one of these breakpoints, select the breakpoint number in the list at the top of the dialog box, and click **Edit**. This displays the Code Breakpoint dialog box, which is shown in Figure 5.7.

Figure 5.7 Setting a code breakpoint



To set the breakpoint, specify an address and the break condition. You can specify the address in hexadecimal (0x) or decimal.

The condition that you specify must have the following format:

```
<register> <condition> <constant>
```

`register`	One of the registers: `A0`, `A1`, `A2`, `A3`, `A4`, `A5`, `A6`, `A7`, `D0`, `D1`, `D2`, `D3`, `D4`, `D5`, `D6`, or `D7`.
`condition`	One of the following operators: `==`, `!=`, `<`, `>`, `<=`, or `>=`.
`constant`	A decimal or hexadecimal constant value.

IMPORTANT: All comparisons are unsigned.

Debugging with External Debug Tools

Palm OS Emulator provides an interface that external debugger applications can use to debug an application. For example, Metrowerks has developed a plug-in module that you can use to debug an application that Palm OS Emulator is running, in exactly the same manner as you would debug an application running on the handheld. This plug-in module is shipped with the latest version of CodeWarrior for Palm OS.

Connecting Emulator with Palm Debugger

You can use Palm Debugger with Palm OS Emulator to perform extensive debugging of your applications. To use Palm Debugger with the Emulator, follow these steps:

1. Start Palm Debugger and Palm OS Emulator programs.
2. In the Palm Debugger Communications menu, select **Emulator**. This establishes the emulator program as the "device" with which Palm Debugger is communicating.
3. In the debugging window, type the `att` command.

You can now send commands from Palm Debugger to Palm OS Emulator.

Connecting Emulator with the GDB Debugger

You can use the gdb debugger with Palm OS Emulator to debug your applications. To use the gdb debugger with an emulator session, follow these steps:

1. When you build your application, both compile and link with the `-g` option (that is, using "`gcc -g ...`"). When you compile using the `-g` option, the compiler generates the necessary symbol information. When you link using the `-g` option, the linker forces the inclusion of a debug runtime routine that installs a breakpoint in `PilotMain`.
2. Start Palm OS Emulator, and install your application in the emulator session.
3. Start the gdb debugger, loading your application's symbol table (for example, using "`gdb myApp`"). Note that the file to be loaded is the `myApp` file created by the gcc linker, not the `myApp.prc` created by buildprc.
4. In the gdb debugger, enter "`target pilot localhost:2000`". The gdb debugger will respond with a message indicating that remote debugging is starting.
5. Start your application on Palm OS Emulator.
6. Wait for the gdb debugger to see the initial breakpoint and prompt you, then start debugging.

Connecting the Emulator with External Debuggers

Palm OS Emulator can communicate with external debuggers using the methods shown in Table 5.3.

Table 5.3 Palm OS Emulator Connections

Connection type	Platforms
TCP	All
PPC Toolbox	Macintosh
Memory-mapped files	Windows

NOTE: Currently, Palm Debugger uses TCP only when running on Windows. The CodeWarrior plug-in uses TCP if you select `Use sockets` in the debugger preference panel.

However, although you can configure the TCP port that Palm OS Emulator uses, you cannot configure which TCP port that either Palm Debugger or the CodeWarrior plug-in uses.

If you are communicating with a debugger using TCP, you can configure which socket port the debugger connects to by editing the value of the `DebuggerSocketPort` preference setting in your preferences file. You can disable the TCP connection by setting the value of the `DebuggerSocketPort` preference to `0`.

NOTE: In some versions of Palm OS Emulator, you may notice that an unwanted PPP dial-up starts whenever you begin a new emulation session. You can disable this behavior by disabling the use of TCP for communications, which you do by setting the `DebuggerSocketPort` preference to `0`.

Tracing Your Code

At times, regular debug tools can be disruptive to program execution or can require specific knowledge of where a bug is located. Tracing can be a less disruptive method for showing how a program is executing. Tracing functions write out information at the time the tracing functions are executed.

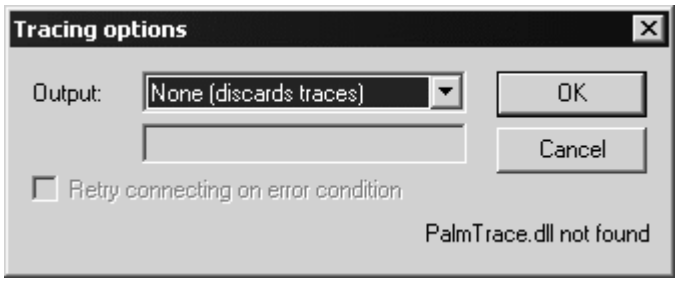
To use tracing in your code, you need to do the following:

- Install Palm Reporter.

  Palm Reporter is a trace utility that can be used with Emulator. As an application runs on Palm OS Emulator, it can send information in real time to Reporter. This information can help pinpoint problems that might be hard to identify when executing code step-by-step or when specifying breakpoints.

- Add trace calls to your application. The tracing functions are listed in Table 8.16 on page 185.
- Next, you need to specify where you want the tracing information to appear. Emulator's tracing options dialog box, which is shown in Figure 5.8, lets you specify the target for application trace information. Use **Settings>Tracing...** to display this dialog box.

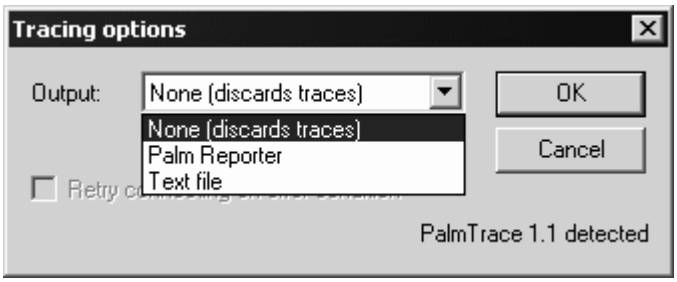
Figure 5.8 Tracing Options Dialog Box without PalmTrace



If you do not have Palm Reporter's `PalmTrace.dll` file on your system, then the default setting discards the tracing information.

When you have the `PalmTrace.dll` installed on Windows, then you will see a tracing options dialog box that looks like Figure 5.9.

Figure 5.9 Tracing Options Dialog Box with PalmTrace.dll on Windows



With `PalmTrace.dll` installed on Windows, you can set your tracing target to be either Palm Reporter or a text file.

When you have `PalmTrace` library installed on Macintosh, then you have an additional tracing target: you can set the tracing target to be either Palm Reporter, a text file, or the DCON console.

NOTE: Tracing is not available on Unix.

Using Reporter to View Realtime Traces

To view the realtime traces, simply run Reporter at the same time as you run your application on Palm OS Emulator. For more information about using Palm Reporter, see *Palm OS Programming Development Tools Guide*.

Profiling Your Code

One of the features of Palm OS Emulator that is most useful for developers is the ability to profile your application while it is running, and to save the resulting data to a file that you can examine.

When the Emulator profiles your application, it monitors and generates statistics about where your code is spending its time, which enables you to focus your optimization efforts in the most productive manner.

NOTE: In order to use the profiling features, you must be using a version of Palm OS Emulator with profiling enabled.

On Windows and Macintosh, this means that you must be using the executable with "`profile`" in its name. See Table 2.1 on page 21 for more information.

On Unix, this means that you must build the executable with the configure switch "`--enable-palm-profile`". (See the `_Building.txt` file mentioned in Table 2.1.)

You can start a profiling session by choosing **Profiling Start**. While profiling is active, Palm OS Emulator monitors which application and system functions are executed, and the amount of time executing each. The Emulator collects the timing information until you select **Profiling Stop**.

You can then save the profiling information to a file by selecting **Profiling Dump**. The information is saved to file in two different formats. Both of these files are stored in the directory in which the Emulator executable is located:

File name	Description
`Profile Results_ <number>.txt`	A text version of the profiling results. `<number>` is a four-digit number incremented each time the profiling results are saved.
`Profile Results_ <number>.mwp`	A Metrowerks Profiler version of the results. `<number>` is a four-digit number incremented each time the profiling results are saved. The `MWP` file can be used with the MW Profiler application bundled with CodeWarrior Pro. The MW Profiler is only available on Macintosh computers. The `MWP` file can also be used with other analysis tools. These tools are listed on the Emulator web page (http://www.palmos.com/dev/tools/emulator/).

You do not have to prepare your code in any special way for Palm OS Emulator to profile it, because the Emulator can determine when functions are entered and exited on its own. And the Emulator performs its profiling calculations between cycles, thus the timing information is quite accurate.

NOTE: It is a good idea to set your compiler's switch to embed debug symbols in your code so that you can easily interpret the profiling results. With CodeWarrior, you should set the option Generate MacsBugs Debug Symbols. With GCC, you should use the Palm OS specific GCC option `-mdebug-labels`. With MacsBugs, you will get each function's name in the text section immediately after the function's code.

6

Palm OS Emulator Error Handling

This chapter describes the error handling and reporting features of the Palm OS Emulator program, including the following information:

- which conditions are detected
- what the Emulator does upon detecting an error condition
- the message displayed for each error condition
- the options available to the user when an error condition occurs

This chapter has the following sections:

About Errors and Warnings

Errors and warnings are very similar. Both are considered *error conditions*, and both can trigger *error messages*. The only difference between errors and warnings is that an error is generally fatal; in the message dialog box for an error, the **Continue** button is disabled. For example, addressing errors, divide-by-zero calculations, or calls to `SysFatalAlert` are considered errors.

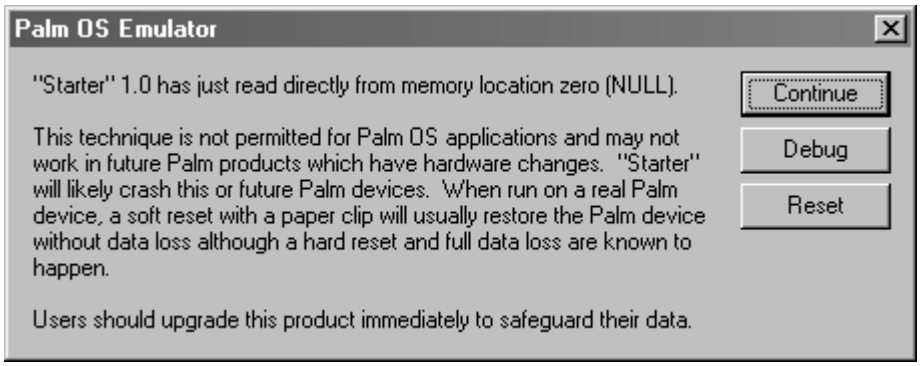
A warning is generally not fatal; in the message dialog box for a warning, the **Continue** button is enabled. For example, low memory accesses, direct screen accesses, and hardware register accesses are generally considered warnings. Since a warning is not fatal, Emulator provides a Debug Options dialog box where you can tell Emulator which conditions you are interested in checking. See "Debug Options" on page 65 for more information.

Detecting an Error Condition

By default, when Palm OS Emulator detects an error condition, it generates error message text and displays the error dialog box. If you click **Debug** in the error dialog box, Emulator attempts to connect to an external debugger such as Palm Debugger or CodeWarrior Debugger; if successful, Emulator then stops emulating opcodes until the external debugger sends a command specifying that it can resume emulation.

If Emulator cannot connect to a debugger, it presents the error text to the user in a dialog box like the one shown in Figure 6.1.

Figure 6.1 Palm OS Emulator Error Message Dialog Box



TIP: You can copy the text of the error message to your desktop computer's clipboard:

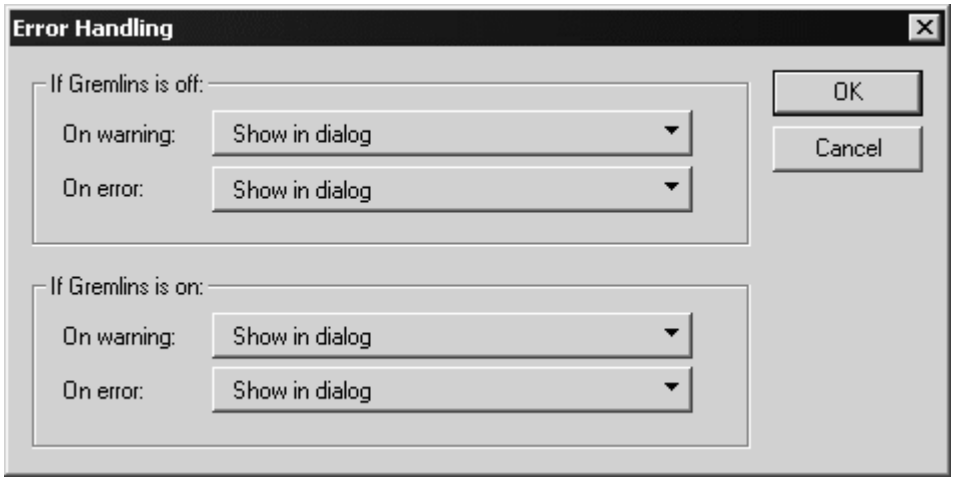
On Windows, use CTRL-C.
On Macintosh, use CMD-C.
On Unix, use the mouse to select the text.

In the error message dialog box, you can click one of the three buttons:

Button	Description
Continue	Continues emulation, if possible.
Debug	Enters the external debugger, if one is running.
Reset	Performs a reset on the emulated handheld ROM. You can select a soft reset, a hard reset or a debug reset.

You can change this default behavior with the Error Handling options dialog box. Select **Settings>Error Handling...** to open the Error Handling options dialog box, which is shown in Figure 6.2 on page 94.

Figure 6.2 Error Handling Options Dialog Box



For When Gremlins Are Not Running

- For warnings, you can choose:
  - To have warnings reported in message dialog boxes.
  - To have warnings ignored and have execution continue.
- For errors, you can choose:
  - To have errors reported in message dialog boxes.
  - To have errors cause Emulator to automatically quit.

For When Gremlins Are Running

- For warnings, you can choose:
  - To have warnings reported in message dialog boxes.
  - To have warnings ignored and have execution continue with the current Gremlin.
  - To have execution automatically switch to the next Gremlin.
- For errors, you can choose:
  - To have errors reported in message dialog boxes.
  - To have errors cause Emulator to automatically quit.
  - To have execution automatically switch to the next Gremlin.

Error Condition Types

Palm OS Emulator detects condition types:

- A *processor exception* involves the CPU pushing the current program counter and processor state onto the stack, and then branching through a low-memory vector.
- A *memory access exception* involves access to a memory location that the application is not supposed to access.
- An *application error message* is a message displayed when software running on the handheld calls a system function such as `ErrDisplayFileLineMsg` or `SysFatalAlert`.

Palm OS Emulator uses four levels of accessibility when checking memory accesses:

- Applications have the least access to memory. An application is generally software running in RAM on the handheld.
- The system has more access to memory than do applications. The system is any software running in ROM on the handheld.
- The memory manager has the most access to memory. The memory manager is any function operating within the context of a memory manager call, which means any function that runs while a memory manager function is still active.
- Some sections of memory cannot be accessed by any software.

Error Messages

Table 6.1 shows Palm OS Emulator error messages. Note that you can prevent some of these messages by disabling the relevant debugging option, as described in "Debug Options" on page 65.

Table 6.1 Palm OS Emulator Error Messages

Error type	Message example
Bus error	`<application> just <access-type> memory location <location>, causing a bus error. A "bus error" means that the application accessed a memory location that is not in RAM or ROM, nor corresponds to a memory-mapped hardware register.`
Address error	`<application> just <access-type> memory location <location>, causing an address error. An "address error" means that the application accessed a 2 or 4-byte value at an odd (i.e., not even) memory address.`
Illegal instruction	`<application> just executed an illegal or unknown machine language instruction. The opcode executed was <instruction>.`
Divide by zero	`<application> just divided an integer by zero.`
CHK instruction	`<application> just executed a CHK machine language instruction that failed. Invoking this instruction is not supported in Palm OS applications.`
TRAPV instruction	`<application> just executed a TRAPV machine language instruction that failed. Invoking this instruction is not supported in Palm OS applications.`
Privilege violation	`<application> just executed opcode <instruction>, a privileged machine language instruction. A "privileged machine language instruction" is one reserved for use by the operating system. Invoking such instructions is not supported in Palm OS applications.`

Table 6.1 Palm OS Emulator Error Messages *(continued)*

Error type	Message example
Trace	<application> just executed an instruction with the CPU's "trace" mode enabled. Normally, this mode is enabled by a debugger for the purpose of single-stepping through an application. However, no debugger is currently connected to handle trace mode.
Trap (A or F)	<application> just executed an illegal or unknown machine language instruction. The opcode executed was <instruction>.
Trap number	<application> just executed a "TRAP #<number>" machine language instruction. Invoking such instructions is not supported in Palm OS applications.
Trap #0	<application> just executed a "TRAP #0" machine language instruction. This instruction is often used by debuggers to set breakpoints. However, no debugger is currently connected to handle the breakpoint.
Trap #8	<application> just executed a "TRAP #8" machine language instruction. This instruction is generated when calling the DbgBreak function as a method for breaking into an external debugger. However, no debugger is currently connected.
Storage heap access	<application> just <access-type> memory location <location>, which is in the storage heap. In order to protect the integrity of the user's data, such direct access is not allowed. Instead, applications should use special Palm OS functions for this purpose.

Table 6.1 Palm OS Emulator Error Messages *(continued)*

Error type	Message example
Draw window error	<application> just <access-type> memory location <location>. This access usually indicates that the application is calling a Window Manager function without first establishing a valid DrawWindow.
Illegal global variable access	<application> just <access-type> memory location <location>. This access usually means that the application accessed a global variable after PilotMain was called with a launch code that does not support globals. The last launch code sent to the application was "<launch-code>".
Mac OS floating point error	<application> just performed a floating point operation using a calling sequence specific to the Mac OS. This indicates that the application was compiled with the incorrect Floating Point option in the development environment that created it.
Stack overflow error	<application> has overflowed the stack. The functions currently using the stack are: <stack-crawl>.
Unimplemented trap	<application> called Palm OS routine #<trap-number> (<trap-name>). This routine does not exist in this version of the Palm OS.
Shared library error	<application> called a function in a shared library using a reference number of <number>. This reference number does not correspond to any currently installed library and is invalid.

Table 6.1 Palm OS Emulator Error Messages *(continued)*

Error type	Message example
Corrupted dynamic heap	`During a regular checkup, Palm OS Emulator determined that the dynamic heap chunk with header address <location> got corrupted. <corruption-type>.`
Program counter error	`<application> just changed the emulated program counter to <location>. This address is invalid because <reason>. The program counter was changed when <when>.`
Low-memory access	`<application> just <access-type> memory location <location>, which is in low memory. "Low memory" is defined as the first 256 bytes of memory. It should not be directly accessed by applications under any circumstances.`
System variable access	`<application> just <access-type> memory location <location>, which is in the Palm OS global variables. "Palm OS global variables" are memory locations reserved for the private use of the Palm OS. They should not be directly accessed by applications under any circumstances.`
LCD screen buffer access	`<application> just <access-type> memory location <location>, which is in screen memory. "Screen memory" is the area of RAM containing the pixels appearing on the LCD display. It should not be directly accessed by applications under any circumstances. Instead, they should use the Window Manager functions for altering the contents of the display.`

Table 6.1 Palm OS Emulator Error Messages *(continued)*

Error type	Message example
Memory-mapped hardware register access	<application> just <access-type> memory location <location>, which is in the memory-mapped hardware registers. "Memory-mapped hardware registers" are memory locations that control the operation of your handheld device's hardware. They should not be directly accessed by applications under any circumstances.
ROM access	<application> just <access-type> memory location <location>, which is in the ROM. Such an access has no effect, and usually indicates an error in the application.
Memory Manager data structure access	<application> just <access-type> memory location <location>, which is in Memory Manager data structures. These data structures include things like the headers preceding each block in a heap, as well as the heap header itself. Such an access usually means that an application allocated a buffer (possibly with MemPtrNew) that wasn't large enough for its purpose. When the application then tries to write data to the buffer, it writes off the end of the buffer, accessing the start of the buffer following it in memory.
Memory Semaphore timeout	The Memory Manager semaphore has been held for longer than 1 minute. Palm recommends that applications not acquire the Memory Manager semaphore at all, but that if they do, they should not hold the semaphore any longer than that.

Table 6.1 Palm OS Emulator Error Messages *(continued)*

Error type	Message example
Unallocated memory access	<application> just <access-type> memory location <location>, which is in an unallocated chunk of memory. An "unallocated chunk of memory" is a chunk of memory that has not been reserved for use by the application through calling MemPtrNew or MemHandleNew. It should not be accessed by applications under any circumstances. Such an access usually means that an application is accessing a chunk that used to be allocated to the application but has since been returned with MemPtrFree or MemHandleFree.
Unlocked memory access	<application> just <access-type> memory location <location>, which is in an unlocked chunk of memory. An "unlocked chunk of memory" is one that has been allocated with MemHandleNew but that has not been locked with MemHandleLock. Such an access usually means that an application allocated a buffer with MemHandleNew, locked it with MemHandleLock, unlocked it with MemHandleUnlock, and then used the pointer that was returned by MemHandleLock.

Table 6.1 Palm OS Emulator Error Messages *(continued)*

Error type	Message example
Unused stack access	<application> just <access-type> memory location <location>, which is in the unused portion of the stack. The stack range is <stack-low> - <stack-high>, and the stack pointer is <stack-pointer>. The "stack" is the area of RAM used to contain function parameters and local variables. The used portion of the stack is indicated by the stack pointer. Applications may access the area of the stack above the stack pointer, but not below it.
Stack almost full	<application> is close to overflowing the stack. The functions currently using the stack are: <stack-crawl>.
Sizeless object use	Form object ID #<object-id> (left = <left>, top = <top>, right = <right>, bottom = <bottom>) from <application> has a height or width of zero. Applications should hide objects by calling FrmHideObject instead of setting their dimensions to zero. Another way to get this error message is to call FrmCopyTitle or FrmCopyLabel to change a title or label to a string larger than what was specified in the form resource. Doing this often corrupts other objects on the form.

Table 6.1 Palm OS Emulator Error Messages *(continued)*

Error type	Message example
Offscreen object use	`Form object ID #<object-id> (left = <left>, top = <top>, right = <right>, bottom = <bottom>) from <application> is completely offscreen. Applications should hide objects by calling FrmHideObject instead of placing them completely offscreen. Another way to get this error message is to call FrmCopyTitle or FrmCopyLabel to change a title or label to a string larger than what was specified in the form resource. Doing this often corrupts other objects on the form.`
Form access	`<application> just <access-type> memory location <location>, which is in the "<field>" field of the form starting at <form>. The data at this memory location is owned by the Form Manager. Applications should not access the data directly. Instead, they should make the appropriate Form Manager calls.`
Form object list access	`<application> just <access-type> memory location <location>, which is in the "<field>" field of the form object list entry with index #<index>, which belongs to the form starting at <form>. The data at this memory location is owned by the Form Manager. Applications should not access the data directly. Instead, they should make the appropriate Form Manager calls.`

Table 6.1 Palm OS Emulator Error Messages *(continued)*

Error type	Message example
Form object access	<application> just <access-type> memory location <location>, which is in the "<field>" field of the <type> starting at <object>, which belongs to the form starting at <form>. The data at this memory location is owned by the Form Manager. Applications should not access the data directly. Instead, they should make the appropriate Form Manager calls.
Window access	<application> just <access-type> memory location <location>, which is in the "<field>" field of the window starting at <window>. The data at this memory location is owned by the Window Manager. Applications should not access the data directly. Instead, they should make the appropriate Window Manager calls.
Bitmap access	<application> just <access-type> memory location <location>, which is in the "<field>" field of the bitmap starting at <bitmap>. The data at this memory location is owned by the Palm OS. Applications should not access the data directly. Instead, they should make the appropriate Palm OS calls.
Proscribed function call	<application> just called Palm OS routine "<function-name>". Applications should not call this function because <reason>.
Memory location access	<application> just <access-type> memory location <location>, changing it from <old-value> to <new-value>.

Table 6.1 Palm OS Emulator Error Messages *(continued)*

Error type	Message example
Memory location breakpoint	`<application> just <access-type> memory location <location>, which is in the range from <watch-start> to <watch-end> specified in the Breakpoint dialog box.`
Memory leaks	`Found <number> memory leaks for <application>. Information concerning the leaks can be found in the log file.`
SysFatalAlert call	`<application> called SysFatalAlert with the message: "<message>".`
DbgMessage call	`<application> called DbgMessage with the message: "<message>".`

Invalid ROM checksum	`The ROM you've chosen has an invalid checksum.`
	`The most common reason for an invalid checksum has been from the use of utility programs that modify the contents of the ROM without also updating its internal checksum.`
	`Palm, Inc. does not support the use of this ROM. Use it with caution.`

ROM with incorrect device emulation	`Unable to determine an appropriate device to emulate for this ROM file.` `Palm, Inc. does not support the use of this ROM. Use it with caution, as the operation of a ROM with an incorrect device emulation will certainly cause the ROM to crash, and may crash the Palm OS Emulator.`

Table 6.1 Palm OS Emulator Error Messages *(continued)*

Error type	Message example
Unsupported device ROM	`This ROM is for a device not supported by this version of the emulator. Palm, Inc. does not support the use of this ROM.`
Missing skin files	`Palm OS Emulator needs "skin" files in order to correctly display the hardware devices it emulates. The Emulator looks for these skins in a directory called "Skins". However, that directory was not found. Previous versions of the Emulator would look for any directory starting with the word "Skins" and search that directory for skin files. With the current Emulator, the directory must be named exactly "Skins". If you don't have any skin files at all, you can download them from the Emulator download Web page: <http://www.palmos.com/dev/tech/tools/emulator> Follow the instructions included with that archive for installing the files.`

7

Palm OS Emulator Advanced Topics

This chapter contains descriptions of the following topics:

Using Emulator Skin Files

Palm OS Emulator uses skin files to present the image of a handheld. Note that the skin is simply a graphic; it does not change the ROM or the handheld being emulated. The skin simply changes the appearance of the Emulator window.

The skin choices available are dependent on the handheld selection. When you select a handheld, Emulator reads through the available SKIN files for the skin names that support the selected handheld.

Palm OS Emulator comes with a built-in **Generic** skin. This skin is suitable for doing your own application testing and debugging.

However, there are times when you want Emulator to look more like a specific handheld, such as when you are using Emulator to demonstrate your application for others. This section describes how to use additional skins that are available, and how to modify or create your own skins.

How Skin Files Work

When Emulator starts an emulation session, it looks for a `Skins` directory:

- On Windows and Macintosh systems, Emulator looks for the `Skins` directory in the same directory as the Emulator executable file.
- On Unix, Emulator looks in the `$POSER_DIR`, `$HOME`, `/usr/local/share/pose`, and `/usr/share/pose` directories, stopping at the first one that has a directory called `Skins` or `skins`.

If Emulator cannot find a `Skins` directory, Emulator will display a warning message at startup. However, this warning message is only displayed once, so you will not have to be bothered by the message if you are not interested in using skin files.

When Emulator has found the `Skins` directory, then Emulator searches that directory and all subdirectories for `SKIN` files (files with filetype `skin`, that is, `*.skin`).

Installing Additional Skin Files

This section describes how to use existing skin files.

1. Download additional skins from:

   http://www.palmos.com/dev/tools/emulator/

   Archived skin file packages are available for Windows, Macintosh, and Unix.

2. Unarchive the skin file package you just downloaded.
3. Create a `Skins` directory, as described in the section "How Skin Files Work" on page 107.
4. Place the skin files (the unarchived contents of the downloaded package) into your `Skins` directory.
5. Start Palm OS Emulator. Emulator is now able to use the skins you have installed.

You can select the additional skins from either the New Session dialog box (Figure 7.1) or the Skins dialog box (Figure 7.2).

Figure 7.1 Choosing a Skin in the New Session Dialog Box

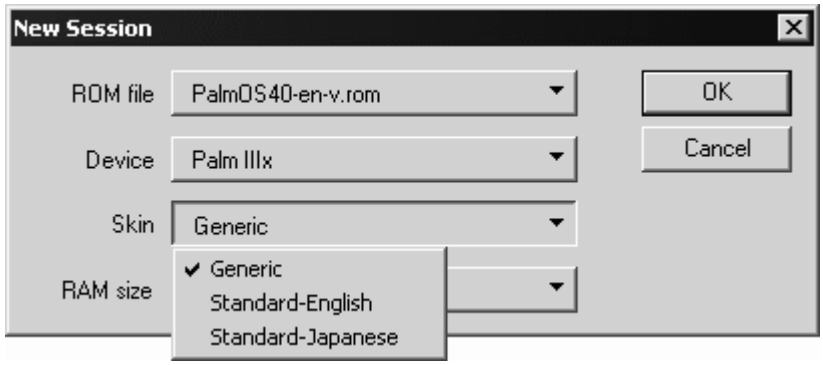
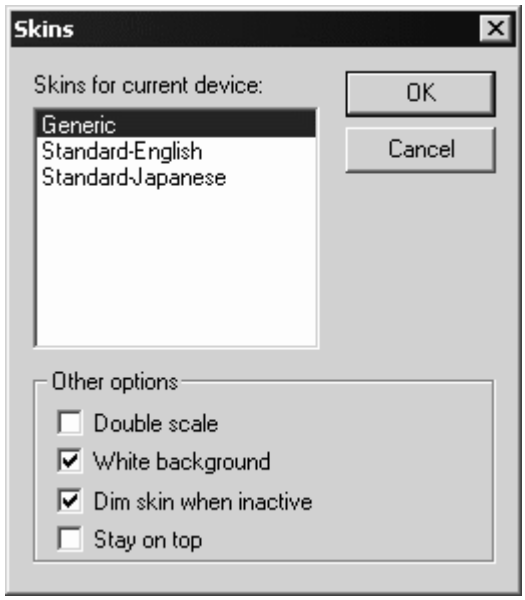


Figure 7.2 Choosing a Skin in the Skins Dialog Box



Modifying or Creating Skin Files

PalmSource, Inc. provides skin files for most existing Palm Powered™ handhelds. However, it is fairly easy to modify or create your own skin file if you need to.

Skins are defined by a pair of files: an image file and a `SKIN` file that describes the image file. The image file is a graphic; currently, only `JPEG` format is supported.

The associated `SKIN` file is a text file that describes the image. The text file is made up of a series of lines, each line defining an attribute of the image. Each definition is of the form:

```
<attribute>=<value>
```

This is similar to the way `INI` files are stored on Windows, and how the emulator saves its own preferences.

Conditions for Skin File Entries

The following conditions apply for the definitions in `SKIN` files:

- The attribute is case-sensitive. For example, `"Name"` and `"name"` are not equivalent.
- There can be only one definition of each attribute. For example, if the skin can be used with multiple handhelds, specify both handhelds on the same `"Devices"` definition. This definition is correct:

  ```
  Devices = Pilot1000, Pilot5000
  ```

  However, this definition is not correct:

  ```
  Devices = Pilot1000
  Devices = Pilot5000
  ```

- White space is optional, both around the equal sign and in the specification of the value. For example, `"color=1,2,3"` is the same as `"color = 1, 2, 3"`.
- The file can include comments, which are ignored when the file is parsed. Comments appear on their own lines, and start with "#" or ';'.
- Invalid files are detected and silently ignored. There is currently no error reporting when invalid values are encountered. Your only indication that something is wrong is that your skin won't show up in the Skins menu or dialog box.

Specifying Attributes in Skin Files

This list defines the attributes that you can use in skin files, and a describes how to specify the attribute's values.

Name	This is the name of the skin. The value is what appears in the Skin menu in the New Session dialog box and in the Skins dialog box.

Example:

```
Name = Keith's Cool Skin
```

File1x — This is the name of the single-scale image file.

Example:

```
File1x = MySkin1.jpg
```

File2x — This is the name of the double-scale image file.

Example:

```
File2x = MySkin2.jpg
```

Note: Two image files must be specified: one for single-scale and one for double-scale.

Image files are expected to be in the same directory as the `SKIN` file, though a relative path may be specified. Both image files must exist and be specified.

Macintosh relative-path format example:

```
File1x = :Small Images:MySkin.jpg
File2x = :Large Images:MySkin.jpg
```

Windows relative-path format example:

```
File1x = Small Images\MySkin.jpg
File2x = Large Images\MySkin.jpg
```

BackgroundColor — This field defines the normal color used when displaying the LCD area of Emulator's display. The value is specified as an RGB set of values. The three components are provided as hexadecimal or decimal values in the range from 0 to 255, separated by commas.

Example:

```
BackgroundColor = 0x7B, 0x8C, 0x5A
```

HighlightColor

This field define the backlighting color used when displaying the LCD area of Emulator's display. (That is, the color used for when the user turns on backlighting by holding down the power button.)

The value is specified as an RGB set of values. The three components are provided as hexadecimal or decimal values in the range from 0 to 255, separated by commas.

Example:

```
HighlightColor  = 132, 240, 220
```

Devices

Provides the list of handhelds with which this skin can be used. One or more handhelds can be provided, separated by commas. The current list of valid handhelds is:

`Pilot`, `Pilot1000`, `Pilot5000`, `PalmPilot`, `PalmPilotPersonal`, `PalmPilotProfessional`, `PalmIII`, `PalmIIIc`, `PalmIIIe`, `PalmIIIx`, `PalmV`, `PalmVx`, `PalmVII`, `PalmVIIEZ`, `PalmVIIx`, `PalmM100`, `m100`, `PalmM105`, `m105`, `PalmM125`, `m125`, `PalmM130`, `m130`, `PalmM500`, `m500`, `PalmM505`, `m505`, `PalmM515`, `m515`, `PalmI705`, `i705`, `Symbol1500`, `Symbol1700`, `Symbol1740`, `TRGpro`, `HandEra330`, `Visor`, Visor`Platinum`, `VisorPrism`, `VisorEdge`

Examples:

Devices = Pilot1000, Pilot5000

Devices = PalmIIIc

Element#

A class of attributes that describes the layout of the image. There is one attribute for each item in the image that can be clicked on. There are also attributes for the LCD and touchscreen areas.

The value for each attribute is a list of 5 items: the name of the element and its coordinates on the screen. The current set of valid element names is:

`PowerButton` - The hardware on/off button.

`UpButton` - The hardware scroll up button.

`DownButton` - The hardware scroll down button.

`App1Button` - The first application button (usually the Date Book application button).

`App2Button` - The second application button (usually the Address Book application button).

`App3Button` - The third application button (usually the To Do List application button).

`App4Button` - The fourth application button (usually the Memo Pad application button).

`CradleButton` - The HotSync® operation button.

`Antenna` - The trigger for raising the antenna.

`ContrastButton` - The hardware dial for setting screen contrast.

`Touchscreen` - The full screen area, including the Graffiti® text area.

`LCD` - The application screen area, excluding the Graffiti text area.

Symbol-specific Values:

`TriggerLeft`

`TriggerCenter`

`TriggerRight`

`UpButtonLeft`

`UpButtonRight`

`DownButtonLeft`

`DownButtonRight`

All elements except for `Touchscreen` and `LCD` are optional.

The coordinates of each element are provided by specifying the left coordinate, the top coordinate, the element width, and the element height. Only single-scale coordinates can be provided; double-scale coordinates are derived from these. Coordinate values can be specified in hexadecimal or decimal.

Each attribute name must start with the text "Element", and must be suffixed with characters that make it unique from all the other element-related attributes.

Listing 7.1 shows an example of a skin file.

Listing 7.1 Example of a Skin File

```
# This is a skin file for the Palm OS Emulator.  See the ReadMe.txt
# file in this directory for a description of its contents.

Name                    = Standard-English
File1x                  = Palm_III_16.jpg
File2x                  = Palm_III_32.jpg
BackgroundColor         = 0x7B, 0x8C, 0x5A
HighlightColor          = 0x64, 0xF0, 0xDC
Devices                 = PalmIII

#                                          x    y    w    h
#                                          ---- ---- ---- ----
Element1                = PowerButton,      10, 295,  16,  24
Element2                = UpButton,        110, 292,  20,  21
Element3                = DownButton,      110, 313,  20,  21
Element4                = App1Button,       37, 295,  23,  25
```

```
Element5                = App2Button,            76, 297,  23,  25
Element6                = App3Button,           141, 297,  23,  25
Element7                = App4Button,           180, 294,  23,  25
Element11               = Touchscreen,           39,  44, 160, 220
Element12               = LCD,                   39,  44, 160, 160
```

Creating Demonstration Versions of Palm OS Emulator

If you are running Palm OS Emulator on Windows NT or on Windows 2000, you can create an executable that binds the Emulator program with a ROM image and optionally a RAM image. The bound program can then be used for demonstrations, training, and kiosk systems.

To save a demonstration version of the Emulator session, you can right-click on the Palm OS Emulator display (the Palm Powered handheld image) and select **Save Bound Emulator...**

NOTE: You cannot create a bound emulation session on Macintosh or on Windows 98. You must be running Windows NT or Windows 2000 to create a bound emulation session.

Bound Emulation Session Limitations

Because bound emulation sessions are intended to be used as demonstration versions, bound emulation sessions are different from regular Emulator session:

- All options in the Logging options dialog box are turned off.
- All options in the Debug options dialog box are turned off.
- You cannot load a saved emulation session (`PSF` file) into a bound emulation session.
- The menu items are limited to the ones displayed in Figure 7.3.

Figure 7.3 Bound Emulator Menu Items

IMPORTANT: Because the bound emulation session contains a ROM image, you are restricted by your Palm OS Developer Program agreement from redistributing it. The Web Clipping ROM images are especially restricted because they contain strong encryption features.

For more information, review the Palm OS Developer Program's Prototype License and Confidentiality Agreement.

Sending Commands to Palm OS Emulator

You can use RPC packets to send commands to Palm OS Emulator. You can invoke any function in the Palm OS dispatch table, including the Host Control functions, which are described in Chapter 8, "Host Control API Reference."

The RPC packets use the same format as do packets that are sent to the debugger interface, which is described in Chapter 9, "Debugger Protocol Reference."

You use the socket defined by the `RPCSocketPort` preference to make RPC calls to Palm OS Emulator. When you send a packet to the emulator, you must set the `dest` field of the packet header to the value defined here:

```
#define slkSocketRPC (slkSocketFirstDynamic+10)
```

NOTE: You can disable the RPC command facility by setting the value of the `RPCSocketPort` preference to `0`.

You can send four kinds of command packets to the emulator:

- ReadMem
- WriteMem
- RPC
- RPC2

The first three packet types are described in Chapter 9, "Debugger Protocol Reference." The fourth packet type, RPC2, is an extension of the RPC packet format that allows support for a wider range of operations.

RPC2 Packet Format

```
#define sysPktRPC2Cmd    0x20
#define sysPktRPC2Rsp    0xA0

struct SysPktRPCParamInfo
{
    UInt8    byRef;
    UInt8    size;
    UInt16   data[1];
};

struct SysPktRPC2Type
{
    _sysPktBodyCommon;
    UInt16             trapWord;
    UInt32             resultD0;
    UInt32             resultA0;
    UInt16             resultException;
    UInt8              DRegMask;
    UInt8              ARegMask;
    UInt32             Regs[1];
    UInt16             numParams;
    SysPktRPCParamType param[1];
};
```

Almost all of the RPC2 packet format is the same as the RPC format that is described in Chapter 9, "Debugger Protocol Reference." The RPC2 packet includes the following additional fields:

`resultException`
: Stores the exception ID if a function call failed due to a hardware exception. Otherwise, the value of this field is `0`.

`DRegMask`
: A bitmask indicating which D registers need to be set to make this call.

`ARegMask`
: A bitmask indicating which A registers need to be set to make this call.

`Regs[1]`
: A variable-length array containing the values to be stored in the registers that need to be set.

  Only the registers that are being changed need to be supplied. Most of the time, `DRegMask` and `ARegMask` are set to zero and this field is not included in the packet.

  If more than one register needs to be set, then the register values should appear in the following order: D0, D1, ..., D6, D7, A0, A1, ..., A6, A7. Again, only values for the registers specified in `DRegMask` and `ARegMask` need to be provided.

8

Host Control API Reference

This chapter describes the host control API. The following topics are covered in this chapter:

- "About the Host Control API" - Conceptual information about the host control API.
- "Constants" on page 120 - A list of the constants that can be used with the host control functions.
- "Data Types" on page 125 - A list of the data types that can be used with the host control functions.
- "Functions" on page 131 - A list of all host control functions, sorted alphabetically.
- "Reference Summary" on page 177 - A summary of all host control functions, sorted by category.

About the Host Control API

You can use the host control API to call emulator-defined functions while your application is running under the Palm OS® Emulator. For example, you can make function calls to start and stop profiling in the emulator.

Host control functions are defined in the `HostControl.h` header file. These functions are invoked by executing a trap/selector combination that is defined for use by the emulator and other foreign host environments. Palm OS Emulator catches the calls intended for it that are made to this selector.

IMPORTANT: This chapter describes the version of the host control API that shipped with Palm OS Emulator 3.5. If you are using a different version, the features in your version might be different than the features described here.

Constants

This section lists the constants that you use with the host control API.

Host Error Constants

Several of the host control API functions return a `HostErrType` value.

```
enum
{
hostErrNone = 0,
hostErrBase = hostErrorClass,
hostErrUnknownGestaltSelector,
hostErrDiskError,
hostErrOutOfMemory,
hostErrMemReadOutOfRange,
hostErrMemWriteOutOfRange,
hostErrMemInvalidPtr,
hostErrInvalidParameter,
hostErrTimeout,
hostErrInvalidDeviceType,
hostErrInvalidRAMSize,
hostErrFileNotFound,
hostErrRPCCall,
hostErrSessionRunning,
hostErrSessionNotRunning,
hostErrNoSignalWaiters,
hostErrSessionNotPaused,
hostErrPermissions,
hostErrFileNameTooLong,
hostErrNotADirectory,
```

```
  hostErrTooManyFiles,
  hostErrFileTooBig,
  hostErrReadOnlyFS,
  hostErrIsDirectory,
  hostErrExists,
  hostErrOpNotAvailable,
  hostErrDirNotEmpty,
  hostErrDiskFull,
  hostErrUnknownError
  };
```

`hostErrNone` No error.

`hostErrBase` An administrative value for the `HostError` class. This value is not returned to applications.

`hostErrUnknownGestaltSelector`
The specified Gestalt selector value is not valid.

`hostErrDiskError`
A disk error occurred. The standard C library error code `EIO` is mapped to this error constant.

`hostErrOutOfMemory`
There is not enough memory to complete the request. The standard C library error code `ENOMEM` is mapped to this error constant.

`hostErrMemReadOutOfRange`
An out of range error occurred during a memory read.

`hostErrMemWriteOutOfRange`
An out of range error occurred during a memory write.

`hostErrMemInvalidPtr`
The pointer is not valid.

`hostErrInvalidParameter`
A parameter to a function is not valid. The standard C library error codes `EBADF`, `EFAULT` and `EINVAL` are mapped to this error constant.

`hostErrTimeout`
A timeout occurred.

`hostErrInvalidDeviceType`
: The specified handheld type is not valid.

`hostErrInvalidRAMSize`
: The specified RAM size value is not valid.

`hostErrFileNotFound`
: The specified file could not be found. The standard C library error code `ENOENT` is mapped to this error constant.

`hostErrRPCCall`
: A function that must be called remotely was called by an application. These functions include: `HostSessionCreate`, `HostSessionOpen`, `HostSessionClose`, `HostSessionQuit`, `HostSignalWait`, and `HostSignalResume`.

`hostErrSessionRunning`
: A session is already running and one of the following functions was called: `HostSessionCreate`, `HostSessionOpen`, or `HostSessionQuit`.

`hostErrSessionNotRunning`
: No session is running and the `HostSessionClose` function was called.

`hostErrNoSignalWaiters`
: The `HostSendSignal` function was called, but there are no external scripts waiting for a signal.

`hostErrSessionNotPaused`
: The `HostSignalResume` function was called, but the session has not been paused by a call to `HostSendSignal`.

`hostErrPermissions`
: The standard C library error code `EACCES` and `EPERM` are mapped to this error constant.

`hostErrFileNameTooLong`
: The standard C library error code `ENAMETOOLONG` is mapped to this error constant.

`hostErrNotADirectory`
: The standard C library error code `ENOTDIR` is mapped to this error constant.

`hostErrTooManyFiles`
: The standard C library error code `EMFILE` and `ENFILE` are mapped to this error constant.

`hostErrFileTooBig`
: The standard C library error code `EFBIG` is mapped to this error constant.

`hostErrReadOnlyFS`
: The standard C library error code `EROFS` is mapped to this error constant.

`hostErrIsDirectory`
: The standard C library error code `EISDIR` is mapped to this error constant.

`hostErrExists`
: The standard C library error code `EEXIST` is mapped to this error constant.

`hostErrOpNotAvailable`
: The standard C library error codes `ENOSYS` and `ENODEV` are mapped to this error constant.

`hostErrDirNotEmpty`
: The standard C library error code `ENOTEMPTY` is mapped to this error constant.

`hostErrDiskFull`
: The standard C library error code `ENOSPC` is mapped to this error constant.

`hostErrUnknownError`
: The standard C library error code values that are not mapped to any of the above error constants are mapped to this error constant.

Host Function Selector Constants

You can use the host function selector constants with the HostIsSelectorImplemented function to determine if a certain function is implemented on your debugging host. Each constant is the name of a function, with the `Host` portion replaced by `HostSelector`.

For a complete list of the constants available, see the `HostControl.h` header file.

Host ID Constants

The HostGetHostID function uses a Host ID value to specify the debugging host type.

```
enum
{
  hostIDPalmOS,
  hostIDPalmOSEmulator,
  hostIDPalmOSSimulator
};
```

`hostIDPalmOS` A Palm Powered™ hardware handheld.

`hostIDPalmOSEmulator`
The Palm OS Emulator application.

`hostIDPalmOSSimulator`
Returned for both Palm OS Simulator and the Macintosh Palm Simulator application.

Host Platform Constants

The HostGetHostPlatform function uses a `HostPlatform` value to specify operating system hosting the emulation.

```
enum
{
  hostPlatformPalmOS,
  hostPlatformWindows,
  hostPlatformMacintosh,
  hostPlatformUnix
```

```
};
```

`hostPlatformPalmOS`
: The Palm OS platform.

`hostPlatformWindows`
: The Windows operating system platform.

`hostPlatformMacintosh`
: The Mac OS platform.

`hostPlatformUnix`
: The Unix operating system platform.

Host Signal Constants

This section describes the host signal values, which you can use with the HostSendSignal.

```
enum
{
  hostSignalReserved,
  hostSignalIdle,
  hostSignalQuit
};
```

`hostSignalReserved`
: System-defined signals start here.

`hostSignalIdle`
: Palm OS Emulator is about to go into an idle state.

`hostSignalQuit`
: Palm OS Emulator is about to quit.

Data Types

This section describes the data types that you use with the host control API.

HostBoolType

The host control API defines `HostBoolType` for use as a Boolean value.

```
typedef long HostBoolType;
```

HostClockType

The host control API defines `HostClockType` as a platform-independent representation of the standard C library `clock_t` type.

typedef long HostClockType;

HostDirEntType

The host control API defines `HostDirEntType` as a return value for the `HostReadDir` function. The contents are platform-specific, usually a simple null-terminated file name.

```
struct HostDirEntType
{
  char    d_name[HOST_NAME_MAX + 1];
};

typedef struct HostDirEntType HostDirEntType;
```

HostDIRType

The host control API defines `HostDIRType` for use in directory-related functions. It is returned by HostOpenDir and used by HostReadDir and HostCloseDir. It represents an open directory whose contents can be read.

```
struct HostDIRType
{
  long    _field;
};
typedef struct HostDIRType HostDIRType;
```

HostFILEType

The host control API defines HostFILEType for the standard C library functions that take `FILE*` parameters. It is returned by HostFOpen and used by other host control functions. It represents an open file whose contents can be manipulated.

```
typedef struct HostFILEType
{
  long _field;
} HostFILEType;
```

HostGremlinInfoType

The host control API defines the `HostGremlinInfoType` structure type to store information about a horde of gremlins.

```
typedef struct HostGremlinInfoType
{
  long  fFirstGremlin;
  long  fLastGremlin;
  long  fSaveFrequency;
  long  fSwitchDepth;
  long  fMaxDepth;
  char  fAppNames[200];
};

typedef struct HostGremlinInfoType
HostGremlinInfoType;
```

HostGremlinInfo Fields

`fFirstGremlin`	The number of the first gremlin to run.
`fLastGremlin`	The number of the last gremlin to run.
`fSaveFrequency`	The gremlin snapshot frequency.
`fSwitchDepth`	The number of gremlin events to generate before switching to another gremlin.
`fMaxDepth`	The maximum number of gremlin events to generate for each gremlin.

`fAppNames`	A comma-separated string containing a list of application names among which the gremlin horde is allowed to switch. If this string is empty, all applications are available for use with the gremlins. If this string begins with a dash (`'-'`), the applications named in the string are excluded, rather than included in the list of available applications.

HostIDType

The host control API defines `HostIDType` for use as an identifier value.

```
typedef long HostIDType;
```

HostPlatformType

The host control API defines `HostPlatformType` for use as a platform identifier value.

```
typedef long HostPlatformType;
```

HostSignalType

The host control API defines `HostSignalType` for use in signal functions.

```
typedef long HostSignalType;
```

HostSizeType

The host control API defines `HostSizeType` as a platform-independent version of the standard C library `size_t` type.

```
typedef long HostSizeType;
```

HostStatType

The host control API defines `HostStatType` for status information about files.

```
struct HostStatType
{
        unsigned long   st_dev_;
        unsigned long   st_ino_;
        unsigned long   st_mode_;
        unsigned long   st_nlink_;
        unsigned long   st_uid_;
        unsigned long   st_gid_;
        unsigned long   st_rdev_;
        HostTimeType    st_atime_;
        HostTimeType    st_mtime_;
        HostTimeType    st_ctime_;
        unsigned long   st_size_;
        unsigned long   st_blksize_;
        unsigned long   st_blocks_;
        unsigned long   st_flags_;
};
typedef struct HostStatType HostStatType;
```

HostStatType Fields

`st_dev_`	Drive number of the disk containing the file (the same as `st_rdev_`).
`st_ino_`	Number of the information node for the file (Unix-specific information).
`st_mode_`	Bit mask for file-mode information. The `_S_IFDIR` bit indicates if this is a directory; the `_S_IFREG` bit indicates an ordinary file or handheld. User read/write bits are set according to the file's permission mode; user execute bits are set according to the filename extension.
`st_nlink_`	Always returns 1 on non-NTFS file systems.
st_uid_	Numeric identifier of the user who owns the file (Unix-specific information).
`st_gid_`	Numeric identifier of the group who owns the file (Unix-specific information).

st_rdev_	Drive number of the disk containing the file (the same as st_dev_).
st_atime_	Time of the last access of the file.
st_mtime_	Time of the last modification of the file.
st_ctime_	Time of the creation of the file.
st_size_	Size of the file in bytes.
st_blksize_	Block size for the file.
st_blocks_	Number of blocks.
st_flags_	File flags.

HostTimeType

The host control API defines `HostTimeType` as a platform-independent version of the standard C library `time_t` type.

```
typedef long HostTimeType;
```

HostTmType

The host control API defines `HostTmType` for use in time functions.

```
struct HostTmType
{
  long    tm_sec_;
  long    tm_min_;
  long    tm_hour_;
  long    tm_mday_;
  long    tm_mon_;
  long    tm_year_;
  long    tm_wday_;
  long    tm_yday_;
  long    tm_isdst_;
};
typedef struct HostTmType HostTmType;
```

HostTmType Fields

tm_sec_	Seconds after the minute: range from 0 to 59.
tm_min_	Minutes after the hour: range from 0 to 59.

`tm_hour_`	Hours since midnight: range from 0 to 23.
`tm_mday_`	Day of the month: range from 1 to 31.
`tm_mon_`	Months since January: range from 0 to 11.
`tm_year_`	Years since 1900.
`tm_wday_`	Days since Sunday: range from 0 to 6.
`tm_yday_`	Days since January 1: range from 0 to 365.
`tm_isdst_`	Daylight savings time flag.

HostUTimeType

The host control API defines `HostUTimeType`for use in time functions.

```
struct HostUTimeType
{
  HostTimeType crtime_;
  HostTimeType actime_;
  HostTimeType modtime_;
};
typedef struct HostUTimeType HostUTimeType;
```

HostUTimeType Fields

`crtime_`	Creation time.
`actime_`	Access time.
`modtime_`	Modification time.

Functions

This section describes the host control API functions.

NOTE: For host control API functions that return pointers to character strings (that is, functions that return type `char *`), the returned value is valid only until the next call to a function that returns a pointer to a character string. If you need ongoing access to a character string, you should make a copy of the string before making the subsequent host control function call.

HostAscTime

Purpose Returns a character string representation of the time encoded in `time`.

Prototype
```
char* HostAscTime(const HostTmType* time);
```

Parameters

`time`	The time structure.

Result The time as a character string.

HostClock

Purpose Returns an elapsed time.

Prototype
```
HostClockType HostClock(void);
```

Parameters None.

Result The elapsed time in terms of the operating system's clock function (usually the number clock ticks that have elapsed since the start of the process), or -1 if the function call was not successful.

HostCloseDir

Purpose Closes a directory.

Prototype
```
long HostCloseDir(HostDIRType* directory);
```

Parameters `directory` The directory to be closed.

Result Returns `0` if the operation was successful, and a non-zero value if not.

HostCTime

Purpose Converts the calendar time in `*timeofday` to a text representation.

Prototype
```
char* HostCTime(const HostTimeType* timeofday)
```

Parameters `timeofday` The calendar time.

Result The calendar time as a time string.

New HostDbgClearDataBreak

Purpose Clears all data breakpoints that have been set by the `HostDbgSetDataBreak` function.

Prototype
```
HostErr HostDbgClearDataBreak (void)
```

Parameters None.

Result Returns `0` if the operation was successful, and a non-zero value if not.

New HostDbgSetDataBreak

Purpose Sets a breakpoint for Emulator to enter an external debugger or to display a message if the bytes starting at the address (`addr`) and continuing for the given number of bytes (`size`) are accessed in any way (either written to or read from). This function provides the same function as the data breakpoint section of the Breakpoints dialog box (as described in "Setting Breakpoints" on page 81).

Prototype

```
HostErr HostDbgSetDataBreak (UInt32 addr, UInt32
size)
```

Parameters

`addr`	The starting address for the range of bytes to be monitored for access.
`size`	The number of bytes, starting from the address `addr`, that will be monitored for access.

Result Returns `0` if the operation was successful, and a non-zero value if not.

HostErrNo

Purpose Returns the value of `errno`, the standard C library variable that reflects the result of many standard C library functions. You can call this function after calling one of the Host Control functions that wraps the standard C library.

IMPORTANT: The HostErrNo function is only applicable to functions that wrap standard C library functions that affect `errno`. It is not applicable to all Host Control functions.

Prototype
```
long HostErrNo(void);
```

Parameters None.

Result The error number.

HostExportFile

Purpose Copies a database from the handheld to the desktop computer.

Prototype
```
HostErr HostExportFile(const char* fileName,
long cardNum, const char* dbName);
```

Parameters

`fileName`	The file name to use on the desktop computer.
`cardNum`	The number of the card on the handheld on which the database is contained.
`dbName`	The name of the handheld database.

Result Returns `0` if the operation was successful, and a non-zero value if not.

HostFClose

Purpose Closes a file on the desktop computer.

Prototype
```
long HostFClose(HostFILE* f);
```

Parameters

`f`	The file to close.

Result Returns `0` if the operation was successful, and a non-zero value if not.

HostFEOF

Purpose Determines if the specified file is at its end.

Prototype
```
long HostFEOF(HostFILE* f);
```

Parameters

`f`	The file to test.

Result Returns `0` if the specified file is at its end, and a non-zero value otherwise.

HostFError

Purpose Retrieves the error code from the most recent operation on the specified file.

Prototype
```
long HostFError(HostFILE* f);
```

Parameters

`f`	The file.

Result The error code from the most recent operation on the specified file. Returns `0` if no errors have occurred on the file.

HostFFlush

Purpose Flushes the buffer for the specified file.

Prototype
```
long HostFFlush(HostFILE* f);
```

Parameters

`f`	The file to flush.

Result Returns `0` if the operation was successful, and a non-zero value if not.

HostFGetC

Purpose Retrieves the character at the current position in the specified file.

Prototype
```
long HostFGetC(HostFILE* f);
```

Parameters

`f`	The file.

Result The character, or `EOF` to indicate an error.

HostFGetPos

Purpose Retrieves the current position in the specified file.

Prototype
```
long HostFGetPos(HostFILE* f, long* posn);
```

Parameters

`f`	The file.
`posn`	Upon successful return, the current position in the file.

Result Returns `0` if the operation was successful, and a non-zero value if not.

HostFGetS

Purpose Retrieves a character string from the selected file and returns a pointer to that string.

Prototype
```
char* HostFGetS(char* s, long n, HostFILE* f);
```

Parameters

`s`	A pointer to the string buffer to be filled with characters from the file.
`n`	The number of characters to retrieve.
`f`	The file.

Result The character string, or `NULL` to indicate an error.

HostFOpen

Purpose Opens a file on the desktop computer.

Prototype
```
HostFILE* HostFOpen(const char* name,
const char* mode);
```

Parameters

`name`	The name of the file to open.
`mode`	The mode to use when opening the file.

Result The file stream pointer, or `NULL` to indicate an error.

HostFPrintF

Purpose Writes a formatted string to a file.

Prototype
```
long HostFPrintF(HostFILE* f, const char* format,
...);
```

Parameters

`f`	The file to which the string is written.
`format`	The format specification.
`...`	String arguments.

Result The number of characters actually written.

HostFPutC

Purpose Writes a character to the specified file.

Prototype
```
long HostFPutC(long c, HostFILE* f);
```

Parameters

`c`	The character to write.
`f`	The file to which the character is written.

Result The number of characters written, or `EOF` to indicate an error.

HostFPutS

Purpose Writes a string to the specified file.

Prototype
```
long HostFPutS(const char* s, HostFILE* f);
```

Parameters

`s`	The string to write.
`f`	The file to which the character is written.

Result A non-negative value if the operation was successful, or a negative value to indicate failure.

HostFRead

Purpose Reads a number of items from the file into a buffer.

Prototype
```
long HostFRead(void* buffer, long size,
long count, HostFILE* f);
```

Parameters

`buffer`	The buffer into which data is read.
`size`	The size of each item.
`count`	The number of items to read.
`f`	The file from which to read.

Result The number of items that were actually read.

HostFree

Purpose Frees memory on the desktop computer.

Prototype
```
void HostFree(void* p);
```

Parameters

`p`	A pointer to the memory block to be freed.

Result None.

HostFReopen

Purpose Changes the file with which the stream `f` is associated. `HostFReopen` first closes the file that was associated with the stream, then opens the new file and associates it with the same stream.

Prototype

```
HostFILE* HostFReopen(const char* name,
const char* mode, HostFILE *f);
```

Parameters

`name`	The name of the file to open.
`mode`	The mode to use when opening the file.
`f`	The file from which to read.

Result The file stream pointer, or `NULL` to indicate an error.

HostFScanF

Purpose Reads formatted text from a file.

Prototype

```
long HostFReopen(HostFILE* f, const char *fmt, …);
```

Parameters

`f`	The file from which to read input.
`fmt`	A format string, as used in standard C-library calls such as `scanf`.
...	The list of variables into which scanned input are written.

Result The number of items that were read, or a negative value to indicate an error.

Returns `EOF` if end of file was reached while scanning.

HostFSeek

Purpose Moves the file pointer to the specified position.

Prototype

```
long HostFSeek(HostFILE* f, long offset,
long origin);
```

Parameters

`f`	The file.
`offset`	The number of bytes to move from the initial position, which is specified in the `origin` parameter.
`origin`	The initial position.

Result Returns `0` if the operation was successful, and a non-zero value if not.

HostFSetPos

Purpose Sets the position indicator of the file.

Prototype

```
long HostFSetPos(HostFILE* f, long posn);
```

Parameters

`f`	The file.
`posn`	The position value.

Result Returns `0` if the operation was successful, and a non-zero value if not.

HostFTell

Purpose Retrieves the current position of the specified file.

Prototype

```
long HostFTell(HostFILE* f);
```

Parameters

`f`	The file.

Result Returns `-1` to indicate an error.

HostFWrite

Purpose Writes data to a file.

Prototype

```
long HostFWrite(const void* buffer, long size,
long count, HostFILE* f);
```

Parameters

`buffer`	The buffer that contains the data to be written.
`size`	The size of each item.
`count`	The number of items to write.
`f`	The file to which the data is written.

Result The number of items actually written.

HostGestalt

Purpose Currently does nothing except return an "invalid selector" error. In the future, this function will be used for queries about the runtime environment.

Prototype

```
HostErr HostGestalt(long gestSel, long* response);
```

Parameters

`gestSel`

`response`

HostGetDirectory

Purpose Gets a directory, in support of the operating system file chooser dialog box.

Prototype
```
const char* HostGetDirectory(const char* prompt,
const char* defaultDir);
```

Parameters

`prompt`

`defaultDir` The default directory to get.

Result Returns the directory as a character string.

HostGetEnv

Purpose Retrieves the value of an environment variable.

Prototype
```
char* HostGetEnv(char* varName);
```

Parameters

`varName` The name of the environment variable that you want to retrieve.

Result The string value of the named variable, or `NULL` if the variable cannot be retrieved.

HostGetFile

Purpose Gets a file, in support of the operating system file chooser dialog box.

Prototype
```
const char* HostGetFile(const char* prompt,
const char* defaultFile)
```

Parameters

`prompt`

`defaultFile` The default fileto get.

Result Returns the file as a character string.

HostGetFileAttr

Purpose Get the attribute settings of a file or directory. This function can tell you whether the file is read-only, hidden, or a system file.

Prototype
```
long HostGetFileAttr(const char* fileOrPathName,
long* attrFlag)
```

Parameters

`fileOrPathName` The file name or directory path for which you want to get the file attribute setting.

`attrFlag` One of the following attribute flags:

- `hostFileAttrReadOnly`
- `hostFileAttrHidden`
- `hostFileAttrSystem`

The file attribute flags match the EmFileAttr flags:

```
enum
{
   hostFileAttrReadOnly = 1,
   hostFileAttrHidden = 2,
   hostFileAttrSystem = 4
}
```

Result The file attribute.

HostGetHostID

Purpose Retrieves the ID of the debugging host. This is one of the constants described in Host ID Constants. Palm OS Emulator always returns the value `hostIDPalmOSEmulator`.

Prototype
```
HostID HostGetHostID(void);
```

Parameters None.

Result The host ID.

HostGetHostPlatform

Purpose Retrieves the host platform ID, which is one of the values described in Host Platform Constants.

Prototype
```
HostPlatform HostGetHostPlatform(void);
```

Parameters None.

Result The platform ID.

HostGetHostVersion

Purpose Retrieves the version number of the debugging host.

Prototype
```
long HostGetHostVersion(void);
```

Parameters None.

Result The version number.

Comments This function returns the version number in the same format that is used by the Palm OS, which means that you can access the version number components using the following macros from the `SystemMgr.h` file:

```
sysGetROMVerMajor(dwROMVer)
sysGetROMVerMinor(dwROMVer)
sysGetROMVerFix(dwROMVer)
sysGetROMVerStage(dwROMVer)
sysGetROMVerBuild(dwROMVer)
```

HostGetPreference

Purpose Retrieves the specified preference value.

Prototype

```
HostBool HostGetPreference(const char* prefName,
char* prefValue);
```

Parameters

`prefName`	The name of the preference whose value you want to retrieve.
`prefValue`	Upon successful return, the string value of the specified preference.

Result A Boolean value that indicates whether the preference was successfully retrieved.

Comments Each preference is identified by name. You can view the preference names in the Palm OS Emulator preferences file for your platform, as shown in Table 8.1.

Table 8.1 Palm OS Emulator preferences file names and locations

Platform	File name	File location
Macintosh	`Palm OS Emulator Prefs`	In the `Preferences` folder
Windows	`Palm OS Emulator.ini`	In the `Windows System` directory
Unix	`.poserrc`	In your home directory

See Also The HostSetPreference function.

HostGMTime

Purpose Returns time structure representation of the time, expressed as Universal Time Coordinated, or UTC (UTC was formerly Greenwich Mean Time, or GMT).

Prototype
```
HostTmType* HostGMTime(const HostTimeType* time);
```

Parameters time

Result The time structure.

HostGremlinCounter

Purpose Returns the current event count of the currently running gremlin.

Prototype
```
long HostGremlinCounter(void);
```

Parameters None.

Result The event count.

Comments This return value of this function is only valid if a gremlin is currently running.

HostGremlinIsRunning

Purpose Determines if a gremlin is currently running.

Prototype
```
HostBool HostGremlinIsRunning(void);
```

Parameters None.

Result A Boolean value indicating whether a gremlin is currently running.

HostGremlinLimit

Purpose Retrieves the limit value of the currently running gremlin.

Prototype
```
long HostGremlinLimit(void);
```

Parameters None.

Result The limit value of the currently running gremlin.

Comments This return value of this function is only valid if a gremlin is currently running.

HostGremlinNew

Purpose Creates a new gremlin.

Prototype
```
HostErr HostGremlinNew(
const HostGremlinInfo* info);
```

Parameters

`info`	A `HostGremlinInfo` structure with information about the new horde of gremlins

HostGremlinNumber

Purpose Retrieves the number of the currently running gremlin.

Prototype
```
long HostGremlinNumber(void);
```

Parameters None.

Result The gremlin number of the currently running gremlin.

Comments This return value of this function is only valid if a gremlin is currently running.

HostImportFile

Purpose Copies a database from the desktop computer to the handheld, and stores it on the specified card number. The database name on the handheld is the name stored in the file.

Prototype

```
HostErr HostImportFile(const char* fileName,
long cardNum);
```

Parameters

`fileName`	The file on the desktop computer that contains the database.
`cardNum`	The card number on which the database is to be installed. You almost always use `0` to specify the built-in RAM.

Result Returns `0` if the operation was successful, and a non-zero value if not.

New HostImportFileWithID

Purpose Copies a database from the desktop computer to the handheld, stores it on the specified card number, and returns the local ID of the installed database. The database name on the handheld is the name stored in the file.

Prototype

```
HostErr HostImportFileWithID(const char* fileName,
long cardNum, LocalID* newIDP);
```

Parameters

`fileName`	The file on the desktop computer that contains the database.
`cardNum`	The card number on which the database is to be installed. You almost always use `0` to specify the built-in RAM.

`newIDP`	The local ID of the installed database.

Result Returns `0` if the operation was successful, and a non-zero value if not.

HostIsCallingTrap

Purpose Determines if Palm OS Emulator is currently calling a trap.

Prototype

```
HostBool HostIsCallingTrap(void);
```

Parameters None.

Result TRUE if Palm OS Emulator is currently calling a trap, and FALSE if not.

HostIsSelectorImplemented

Purpose Determines if the specified function selector is implemented on the debugging host.

Prototype

```
HostBool HostIsSelectorImplemented(long selector);
```

Parameters

`selector`	The function selector. This must be one of the constants described in Host Function Selector Constants.

Result TRUE if the specified function selector is implemented on the host, and FALSE if not

HostLocalTime

Purpose Returns time structure representation of the time, expressed as local time.

Prototype
```
HostTmType* HostLocalTime(const HostTimeType*
time);
```

Parameters

`time`	The time structure.

Result The time structure.

HostLogFile

Purpose Returns a reference to the file that the Emulator is using to log information. You can use this to add your own information to the same file.

Prototype
```
HostFILE* HostLogFile(void);
```

Parameters None.

Result A pointer to the log file, or `NULL` if not successful.

HostMalloc

Purpose Allocates a memory block on the debugging host.

Prototype
```
void* HostMalloc(long size);
```

Parameters

`size`	The number of bytes to allocate.

Result A pointer to the allocated memory block, or `NULL` if there is not enough memory available.

HostMkDir

Purpose Creates a directory.

Prototype
```
long HostMkDir(const char* directory);
```

Parameters

`directory`	The directory to create.

Result Returns `0` if the operation was successful, and a non-zero value if not.

HostMkTime

Purpose Alters the parameter values to represent an equivalent encoded local time, but with the values of all members within their normal ranges.

Prototype
```
HostTimeType HostMkTime(HostTmType* time)
```

Parameters

`time`	The time structure.

Result Returns the calendar time equivalent to the encoded time, or returns a value of -1 if the calendar time cannot be represented

HostOpenDir

Purpose Opens a directory.

Prototype
```
HostDIRType* HostOpenDir(const char* directory);
```

Parameters

`directory`	The directory to open.

Result Returns a directory structure.

HostProfileCleanup

Purpose Releases the memory used for profiling and disables profiling.

Prototype

```
HostErr HostProfileCleanup(void);
```

Parameters None.

Result Returns `0` if the operation was successful, and a non-zero value if not. Returns `hostErrProfilingNotReady` if called out of sequence. For information on profiling sequence, see "HostProfileInit" on page 155.

Comments This function is available only in the profiling version of the emulator.

See Also The HostProfileStart, HostProfileStop, and HostProfileDump functions.

HostProfileDetailFn

Purpose Profiles the function that contains the specified address.

Prototype

```
HostErr HostProfileDetailFn(void* addr,
HostBool logDetails);
```

Parameters

`addr`	The address in which you are interested.
`logDetails`	A Boolean value. If this is TRUE, profiling is performed at a machine-language instruction level, which means that each opcode is treated as its own function.

Result Returns `0` if the operation was successful, and a non-zero value if not.

Comments This function is available only in the profiling version of the emulator.

See Also The HostProfileInit, HostProfileStart, HostProfileStop, HostProfileDump, and HostProfileCleanup functions.

HostProfileDump

Purpose Writes the current profiling information to the named file.

Prototype

```
HostErr HostProfileDump(const char* filename);
```

Parameters

`filename`	The name of the file to which the profile information gets written.

Result Returns `0` if the operation was successful, and a non-zero value if not.

Comments This function is available only in the profiling version of the emulator. Returns `hostErrProfilingNotReady` if called out of sequence. For information on profiling sequence, see "HostProfileInit" on page 155.

See Also The HostProfileInit, HostProfileStart, HostProfileStop, and HostProfileCleanup functions.

HostProfileGetCycles

Purpose Returns the current running CPU cycle count.

Prototype

```
long HostProfileGetCycles(void)
```

Parameters None.

Result Returns the current running CPU cycle count.

Comments This function is available only in the profiling version of the emulator.

See Also The HostProfileInit, HostProfileStart, HostProfileStop, HostProfileDump, and HostProfileCleanup functions.

HostProfileInit

Purpose Initializes and enables profiling in the debugging host.

Prototype

```
HostErr HostProfileInit(long maxCalls,
long maxDepth);
```

Parameters

`maxCalls`	The maximum number of calls to profile. This parameter determines the size of the array used to keep track of function calls. A typical value for `maxCalls` is 65536.
`maxDepth`	The maximum profiling depth. This parameter determines the size of the array used to keep track of function call depth. A typical value for `maxDepth` is 200.

Result Returns `0` if the operation was successful, and a non-zero value if not. Returns `hostErrProfilingNotReady` if called out of sequence.

Comments This function is available only in the profiling version of the emulator.

The host control profiling functions are intended to be called in sequence:

1. HostProfileInit - All profiling starts with the HostProfileInit function, which initializes and enables profiling.
2. HostProfileStart - This function turns profiling on.
3. HostProfileStop - This function turns profiling off. After calling HostProfileStop, you can either call HostProfileStart to restart profiling or call HostProfileDump, which disables profiling and writes data to a file.

4. HostProfileDump - This function disables profiling and writes data to a file. If you need to do more profiling after calling HostProfileDump, you need to call HostProfileInit to re-enable profiling.
5. HostProfileCleanup - This function releases the memory used for profiling and disables profiling.

See Also The HostProfileStart, HostProfileStop, HostProfileDump, and HostProfileCleanup functions.

HostProfileStart

Purpose Turns profiling on.

Prototype

```
HostErr HostProfileStart(void);
```

Parameters None.

Result Returns `0` if the operation was successful, and a non-zero value if not. Returns `hostErrProfilingNotReady` if called out of sequence. For information on profiling sequence, see "HostProfileInit" on page 155.

Comments This function is available only in the profiling version of the emulator.

See Also The HostProfileInit, HostProfileStop, HostProfileDump, and HostProfileCleanup functions.

HostProfileStop

Purpose Turns profiling off.

Prototype

```
HostErr HostProfileStop(void);
```

Parameters None.

Result Returns `0` if the operation was successful, and a non-zero value if not. Returns `hostErrProfilingNotReady` if called out of sequence. For information on profiling sequence, see "HostProfileInit" on page 155.

Comments This function is available only in the profiling version of the emulator.

See Also The HostProfileInit, HostProfileStop, HostProfileDump, and HostProfileCleanup functions.

HostPutFile

Purpose Writes a file, in support of the operating system "Save As" dialog box.

Prototype

```
const char* HostPutFile(const char* prompt, const
char* defaultDir, const char* defaultName);
```

Parameters

`prompt`

`defaultDir` The default directory to use.

`defaultName` The default file name to use.

Result Returns the file name as a character string.

HostReadDir

Purpose Reads a directory.

Prototype
```
HostDirEntType* HostReadDir(HostDIRType*
directory);
```

Parameters

`directory`	The directory to read.

Result Returns a character array for the directory.

HostRealloc

Purpose Reallocates space for the specified memory block.

Prototype
```
void* HostRealloc(void* ptr, long size);
```

Parameters

`ptr`	A pointer to a memory block that is being resized.
`size`	The new size for the memory block.

Result A pointer to the allocated memory block, or `NULL` if there is not enough memory available.

HostRemove

Purpose Deletes a file.

Prototype
```
long HostRemove(const char* name);
```

Parameters

`name`	The name of the file to be deleted.

Result Returns `0` if the operation was successful, and a non-zero value if not.

HostRename

Purpose Renames a file.

Prototype
```
long HostRemove(const char* oldName,
const char* newName);
```

Parameters

`oldName`	The name of the file to be renamed.
`newName`	The new name of the file.

Result Returns `0` if the operation was successful, and a non-zero value if not.

HostRmDir

Purpose Removes a directory.

Prototype
```
long HostRmDir(const char* directory);
```

Parameters

`directory`	The directory to remove.

Result Returns `0` if the operation was successful, and a non-zero value if not.

HostSaveScreen

Purpose Saves the LCD frame buffer to the given file name.

Prototype
```
HostErrType HostSaveScreen(const char* fileName)
```

Parameters

`fileName`	The name of the file to which the current LCD frame buffer is to be saved.

Result Returns `0` if the operation was successful, and a non-zero value if not.

HostSessionClose

Purpose Closes the current emulation session.

Prototype

```
HostErr HostSessionClose(const char* psfFileName);
```

Parameters

`psfFileName`	The name of the file to which the current session is to be saved.

Result Returns `0` if the operation was successful, and a non-zero value if not.

Comments This function is defined for external RPC clients to call; the effect of calling it for Palm OS applications running on the emulated handheld is undefined.

HostSessionCreate

Purpose Creates a new emulation session.

Prototype

```
HostErr HostSessionCreate(const char* device,
long ramSize, const char* romPath);
```

Parameters

`device`	The name of the handheld to emulate in the session.
`ramSize`	The amount of emulated RAM in the new session.
`romPath`	The path to the ROM file for the new session.

Result Returns `0` if the operation was successful, and a non-zero value if not.

Comments This function is defined for external RPC clients to call; the effect of calling it for Palm OS applications running on the emulated handheld is undefined.

IMPORTANT: This function is not implemented in the current version of Palm OS Emulator; however, it will be implemented in the near future.

HostSessionOpen

Purpose Opens a previously saved emulation session.

Prototype
```
HostErr HostSessionOpen(const char* psfFileName);
```

Parameters

`psfFileName`	The name of the file containing the saved session that you want to open.

Result Returns `0` if the operation was successful, and a non-zero value if not.

Comments This function is defined for external RPC clients to call; the effect of calling it for Palm OS applications running on the emulated handheld is undefined.

IMPORTANT: This function is not implemented in the current version of Palm OS Emulator; however, it will be implemented in the near future.

HostSessionQuit

Purpose Asks Palm OS Emulator to quit. Returns an error if a session is already running.

Prototype
```
HostErr HostSessionQuit(void);
```

Parameters None.

Result Returns `0` if the operation was successful, and a non-zero value if not.

Comments This function is defined for external RPC clients to call; the effect of calling it for Palm OS applications running on the emulated handheld is undefined.

IMPORTANT: This function is defined for external RPC clients to call, and returns an error if you call it from within a Palm application.

New HostSessionSave

Purpose Saves a session to a file with the specified name.

Prototype
```
HostBoolType HostSessionSave(const char*
saveFileName);
```

Parameters `saveFileName` A file name for the session that you are saving.

Result Returns false when saving a session to a file, whether or not the save attempt is successful. When the session file is reloaded, execution starts at the point where `HostSessionSave` is returning, and it then returns true.

Comments This function can be useful when you want to save a session file for later analysis. When you reload the session file later, you can break into a debugger.

Example
```
void MyFunc (void)
{
   // Check to see if our application's data is internally
   // consistant. If not, save the state for later analysis.

   if (ASSERT_VALID () == false)
      if (HostSessionSave ("c:\\temp\foo.psf"))
        DbgBreak ();
}
```

HostSetFileAttr

Purpose Set the attribute settings of a file or directory. This function can set the read-only, hidden, or system-file attribute for the file or directory.

Prototype

```
long HostSetFileAttr(const char* fileOrPathName,
long* attrFlag)
```

Parameters

`fileOrPathName` The file name or directory path for which you want to set the file attribute setting.

`attrFlag` One of the following attribute flags:

- `hostFileAttrReadOnly`
- `hostFileAttrHidden`
- `hostFileAttrSystem`

The file attribute flags match the EmFileAttr flags:

```
enum
{
   hostFileAttrReadOnly = 1,
   hostFileAttrHidden = 2,
   hostFileAttrSystem = 4
}
```

Result The file attribute.

HostSetLogFileSize

Purpose Determines the size of the logging file that Palm OS Emulator is using.

Prototype

```
void HostSetLogFileSize(long size);
```

Parameters

`size` The new size for the logging file, in bytes.

Result None.

Comments By default, Palm OS Emulator saves the last 1 megabyte of log data to prevent logging files from becoming enormous. You can call this function to change the log file size.

HostSetPreference

Purpose Sets the specified preference value.

Prototype

```
void HostSetPreference(const char* prefName,
const char* prefValue);
```

Parameters

`prefName`	The name of the preference whose value you are setting.
`prefValue`	The new value of the preference.

Result None.

Comments Each preference is identified by name. You can view the preference names in the Palm OS Emulator preferences file for your platform, as shown in Table 8.1.

See Also The HostGetPreference function.

HostSignalResume

Purpose Restarts Palm OS Emulator after it has issued a signal.

Prototype

```
HostErr HostSignalResume(void);
```

Parameters None.

Result Returns `0` if the operation was successful, and a non-zero value if not.

Comments Palm OS Emulator waits to be restarted after issuing a signal to allow external scripts to perform operations.

See Also The HostSignalSend and HostSignalWait functions.

IMPORTANT: This function is defined for external RPC clients to call, and returns an error if you call it from within a Palm application.

HostSignalSend

Purpose Sends a signal to any scripts that have HostSignalWait calls pending.

Prototype

```
HostErr HostSignalSend(HostSignal signalNumber);
```

Parameters

`signalNumber`	The signal for which you want to wait. This can be a predefined signal or one that you have defined.

Result Returns `0` if the operation was successful, and a non-zero value if not.

Comments Palm OS Emulator halts and waits to be restarted after sending the signal. This allows external scripts to perform operations. The external script must call the HostSignalResume function to restart Palm OS Emulator.

If there are not any scripts waiting for a signal, Palm OS Emulator does not halt.

The predefined signals are:

- `hostSignalIdle`, which Palm OS Emulator issues when it detects that it is going into an idle state.
- `hostSignalQuit`, which Palm OS Emulator issues when it is about to quit.

See Also The HostSignalResume and HostSignalWait functions.

IMPORTANT: This function is defined for external RPC clients to call, and returns an error if you call it from within a Palm application.

HostSignalWait

Purpose Waits for a signal from Palm OS Emulator, and returns the signalled value.

Prototype

```
HostErr HostSignalWait(long timeout,
HostSignal* signalNumber);
```

Parameters

`timeout`	The number of milliseconds to wait for the signal before timing out.
`signalNumber`	The number of the signal that occurred.

Result Returns `0` if the operation was successful, and a non-zero value if not. Returns the number of the signal that occurred in `signalNumber`.

Comments Palm OS Emulator waits to be restarted after issuing a signal to allow external scripts to perform operations.

The predefined signals are:

- `hostSignalIdle`, which Palm OS Emulator issues when it detects that it is going into an idle state.
- `hostSignalQuit`, which Palm OS Emulator issues when it is about to quit.

See Also The HostSignalResume and HostSignalSend functions.

IMPORTANT: This function is defined for external RPC clients to call, and returns an error if you call it from within a Palm application.

HostSlotHasCard

Purpose Ask whether Emulator is emulating a Virtual File System card for a specific slot number.

Prototype

```
HostBoolType HostSlotHasCard(long slotNo)
```

Parameters

`slotNo`	The slot number. This number can be in the range from 1 up to and including the number returned by function HostSlotMax.

Result A Boolean value that indicates whether Emulator is emulating a Virtual File System card in the slot specified by `slotNo`. This function is provided in support of Expansion Manager emulation.

Comments This function may return `FALSE` if the user has not selected to emulate a Virtual File System card in the given slot, or if Emulator is emulating a different kind of card in that slot.

HostSlotMax

Purpose Returns the number of Virtual File System cards that Emulator is emulating.

Prototype

```
long HostSlotMax(void)
```

Parameters None.

Result A `long` value indicating the number of Virtual File System cards Emulator is emulating. This function is provided in support of Expansion Manager emulation.

Comments The functions that accept card numbers, HostSlotHasCard and HostSlotRoot, accept numbers from 1 up to and including the number returned by HostSlotMax.

HostSlotRoot

Purpose Returns a string representing the root directory of the emulated slot.

Prototype

```
const char* HostSlotRoot(long slotNo)
```

Parameters

`slotNo`	The slot number. This number can be in the range from 1 up to and including the number returned by function HostSlotMax.

Result The character string representing the directory to be used as the root for the given Virtual File System card. This function is provided in support of Expansion Manager emulation.

Comments The string returned is in host path format. This function may return NULL if there is no Virtual File System card mounted in the slot specified by `slotNo` or if the user has not selected a root directory for that slot.

HostStat

Purpose Returns status information about a file.

Prototype

```
long HostStat(const char* filename, HostStatType*
buffer);
```

Parameters

filename	The name of the file or directory for which you want status information
buffer	The structure that stores the status information

Result Returns `0` if the operation was successful, and a non-zero value if not.

HostStrFTime

Purpose Generates formatted text, under the control of the format parameter and the values stored in the time structure parameter.

Prototype

```
HostSizeType HostStrFTime(char* string,
HostSizeType size, const char* format, const
HostTmType* time)
```

Parameters

`string`	The formatted text
`size`	The size of an array element in the formatted text
`format`	The format definition
`time`	A time structure

Result Returns the number of characters generated, if the number is less than the `size` parameter; otherwise, returns zero, and the values stored in the array are indeterminate.

HostTime

Purpose Returns the current calendar time.

Prototype
```
HostTimeType HostTime(HostTimeType* time);
```

Parameters

`time`	The time structure.

Result Returns the current calendar time if the operation is successful, and returns -1 if not.

HostTmpFile

Purpose Returns the temporary file used by the debugging host.

Prototype
```
HostFILE* HostTmpFile(void);
```

Parameters None.

Result A pointer to the temporary file, or `NULL` if an error occurred.

HostTmpNam

Purpose Creates a unique temporary file name.

Prototype
```
char* HostTmpNam(char* s);
```

Parameters

`s`	Either be a `NULL` pointer or a pointer to a character array. The character array must be at least `L_tmpnam` characters long. If `s` is not NULL, the newly created temporary file name is stored into `s`.

Result A pointer to an internal static object that the calling program can modify.

HostTraceClose

Purpose Closes the connection to the external trace reporting tool.

Prototype

```
void HostTraceClose(void);
```

Parameters None.

Result None.

HostTraceInit

Purpose Initiates a connection to the external trace reporting tool.

Prototype

```
void HostTraceInit(void);
```

Parameters None.

NOTE: The tracing functions are used in conjunction with an external trace reporting tool. You can call these functions to send information to the external tool in real time.

Result None.

HostTraceOutputB

Purpose Outputs a buffer of data, in hex dump format, to the external trace reporting tool.

Prototype

```
void HostTraceOutputB(unsigned short moduleId,
const void* buffer,
unsigned long len/*size_t*/);
```

Parameters

`moduleId`	The ID of the Palm OS subsystem from which this output originates. You can use this with the external tracing tool to filter traces according to their origin. The ID must match one of the error classes defined in the `SystemMgr.h` file.
`buffer`	A pointer to a buffer of raw data.
`len`	The number of bytes of data in the buffer.

Result None.

HostTraceOutputT

Purpose Outputs a text string to the external trace reporting tool.

Prototype

```
void HostTraceOutputT(unsigned short moduleId,
const char* fmt, …);
```

Parameters

`moduleId`	The ID of the Palm OS subsystem from which this output originates. You can use this with the external tracing tool to filter traces according to their origin. The ID must match one of the error classes defined in the `SystemMgr.h` file.

`fmt`	A format string, as used in standard C-library calls such as `printf`. The format string has the following form: `% flags width type`
...	The list of variables to be formatted for output.

Table 8.2 shows the flag types that you can use in the format specification for the tracing output functions.

Table 8.2 Trace function format specification flags

Flag	Description
`-`	Left-justified output.
`+`	Always display the sign symbol.
`space`	Display a space when the value is positive, rather than a '+' symbol.
`#`	Alternate form specifier.

Table 8.3 shows the output types that you can use in the format specification for the tracing output functions.

Table 8.3 Trace function format specification types

Flag	Description
`%`	Displays the '%' character.
`s`	Displays a null-terminated string value.
`c`	Displays a character value.
`ld`	Displays an Int32 value.
`lu`	Displays a UInt32 value.
`lx or lX`	Displays a UInt32 value in hexadecimal.
`hd`	Displays an Int16 value.
`hu`	Displays a UInt16 value.
`hx or hX`	Displays an Int16 or UInt16 value i hexadecimal.

Result None.

HostTraceOutputTL

Purpose Outputs a text string, followed by a newline, to the external trace reporting tool. This function performs the same operation as the `HostTraceOutputT` function, and adds the newline character.

Prototype

```
voidHostTraceOutputTL(unsigned short moduleId,
const char* fmt, …);
```

Parameters

`moduleId`	The ID of the Palm OS subsystem from which this output originates. You can use this with the external tracing tool to filter traces according to their origin. The ID must match one of the error classes defined in the `SystemMgr.h` file.
`fmt`	A format string, as used in standard C-library calls such as `printf`. For more information about the formatting specification, see the description of the HostTraceOutputT function.
...	The list of variables to be formatted for output.

Result None.

HostTraceOutputVT

Purpose Outputs a text string to the external trace reporting tool.

Prototype

```
void HostTraceOutputVT(unsigned short moduleId,
const char* fmt, va_list vargs);
```

Parameters

`moduleId`	The ID of the Palm OS subsystem from which this output originates. You can use this with the external tracing tool to filter traces according to their origin. The ID must match one of the error classes defined in the `SystemMgr.h` file.
`fmt`	A format string, as used in standard C-library calls such as `printf`. For more information about the formatting specification, see the description of the HostTraceOutputT function.
`vargs`	A structure containing the variable argument list. This is the same kind of variable argument list used for standard C-library functions such as `vprintf`.

Result None.

HostTraceOutputVTL

Purpose Outputs a text string, followed by a newline, to the external trace reporting tool. This function performs the same operation as the `HostTraceOutputVT` function, and adds the newline character.

Prototype

```
void HostTraceOutputVTL(unsigned short moduleId,
const char* fmt, va_list vargs);
```

Parameters

`moduleId`	The ID of the Palm OS subsystem from which this output originates. You can use this with the external tracing tool to filter traces according to their origin. The ID must match one of the error classes defined in the `SystemMgr.h` file.
`fmt`	A format string, as used in standard C-library calls such as `printf`. For more information about the formatting specification, see the description of the HostTraceOutputT function.
`vargs`	A structure containing the variable argument list. This is the same kind of variable argument list used for standard C-library functions such as `vprintf`.

Result None.

HostTruncate

Purpose Extends or truncates the file associated with the file handle to the length specified by the size.

Prototype

```
long HostTruncate(const char* filename, long
filesize);
```

Parameters

`filename`	The name of the file.

	`filesize`	The size of the file.

Result Returns the value 0 if the file is successfully changed, or returns -1 if there was an error.

HostUTime

Purpose Sets the modification time for a file.

Prototype

```
long HostUTime (const char* filename,
HostUTimeType* buffer);
```

Parameters

filename	The filename of the file.
buffer	The stored time values.

Result Returns 0 if the file-modification time was successfully changed, or returns -1 if there was an error.

Reference Summary

The tables in this section summarize the host control API functions.

Host Control Database Functions

Table 8.4 Host Control Database Functions

Function	Description
`HostExportFile`	Copies a database from the handheld to the desktop computer.
`HostImportFile`	Copies a database from the desktop computer to the handheld, and stores it on the specified card number. The database name on the handheld is the name stored in the file.

Table 8.4 Host Control Database Functions *(continued)*

Function	Description
HostImportFileWithID	Copies a database from the desktop computer to the handheld, stores it on the specified card number, and returns the local ID of the installed database.
HostSaveScreen	Saves the LCD frame buffer to a file.

Host Control Directory Handler Functions

Table 8.5 Host Control Directory Handler Functions

Function	Description
HostCloseDir	Closes a directory.
HostMkDir	Makes a directory.
HostOpenDir	Opens a directory.
HostReadDir	Reads a directory.
HostRmDir	Removes a directory.

Host Control Environment Functions

Table 8.6 Host Control Environment Functions

Function	Description
HostGestalt	Currently does nothing except to return an "invalid selector" error.
HostGetHostID	Retrieves the ID of the debugging host. Palm OS Emulator always returns the value `hostIDPalmOSEmulator`.
HostGetHostPlatform	Retrieves the host platform ID.
HostGetHostVersion	Returns the version number of the debugging host.

Table 8.6 Host Control Environment Functions *(continued)*

Function	Description
HostIsCallingTrap	Returns a Boolean indicating whether the specified function selector is implemented on the debugging host.
HostIsSelectorImplemented	Returns a Boolean indicating whether the specified function selector is implemented on the debugging host.

Host Control File Chooser Support Functions

Table 8.7 Host Control File Chooser Support Functions

Function	Description
HostGetDirectory	Gets a directory, in support of the operating system file chooser dialog box.
HostGetFile	Gets a file, in support of the operating system file chooser dialog box.
HostPutFile	Writes a file, in support of the operating system file chooser dialog box.

Host Control Gremlin Functions

Table 8.8 Host Control Gremlin Functions

Function	Description
HostGremlinCounter	Returns the current count for the currently running gremlin.
HostGremlinIsRunning	Returns a Boolean value indicating whether a gremlin is currently running.
HostGremlinLimit	Returns the limit value of the currently running gremlin.

Table 8.8 Host Control Gremlin Functions *(continued)*

Function	Description
HostGremlinNew	Creates a new gremlin.
HostGremlinNumber	Returns the gremlin number of the currently running gremlin.

Host Control Debugging Functions

Table 8.9 Host Control Debugging Functions

Function	Description
HostDbgSetDataBreak	Sets a breakpoint for Emulator to enter an external debugger to display a message if the specified address range is accessed.
HostDbgClearDataBreak	Clears all data breakpoints that have been set by the HostDbgSetDataBreak function.

Host Control Logging Functions

Table 8.10 Host Control Logging Functions

Function	Description
HostLogFile	Returns a reference to the file that Palm OS Emulator is using to log information.
HostSetLogFileSize	Modifies the size of the logging file.

Host Control Preference Functions

Table 8.11 Host Control Preference Functions

Function	Description
HostGetPreference	Retrieves the value of a preference.
HostSetPreference	Sets a new value for a preference.

Host Control Profiling Functions

Table 8.12 Host Control Profiling Functions

Function	Description
HostProfileCleanup	Releases the memory used for profiling and disables profiling.
HostProfileDetailFn	Profiles the function that contains the specified address.
HostProfileDump	Writes the current profiling information to the named file.
HostProfileGetCycles	Returns the current running CPU cycle count.
HostProfileInit	Initializes and enables profiling in the debugging host.
HostProfileStart	Turns profiling on.
HostProfileStop	Turns profiling off.

Host Control RPC Functions

Table 8.13 Host Control RPC Functions

Function	Description
HostSessionClose	Closes the current emulation session
HostSessionCreate	Creates a new emulation session.
HostSessionOpen	Opens a previously saved emulation session.
HostSessionQuit	Asks Palm OS Emulator to quit.
HostSessionSave	Saves a session to a file with a specified name.
HostSignalResume	Resumes Palm OS Emulator after it has halted to wait for external scripts to handle a signal.
HostSignalSend	Sends a signal to external scripts.
HostSignalWait	Waits for Palm OS Emulator to send a signal.

Host Control Standard C Library Functions

Table 8.14 Host Control Standard C Library Functions

Function	Description
HostErrNo	Returns the error number from the most recent host control API operation.
HostFClose	Closes a file on the desktop computer. Returns 0 if the operation was successful, and a non-zero value if not.
HostFEOF	Returns 0 if the specified file is at its end, and a non-zero value otherwise.
HostFError	Returns the error code from the most recent operation on the specified file. Returns 0 if no errors have occurred on the file.
HostFFlush	Flushes the buffer for the specified file.
HostFGetC	Returns the character at the current position in the specified file. Returns EOF to indicate an error.
HostFGetPos	Retrieves the current position in the specified file. Returns 0 if the operation was successful, and a non-zero value if not.
HostFGetS	Retrieves a character string from the selected file and returns a pointer to that string. Returns NULL to indicate an error.
HostFOpen	Opens a file on the desktop computer and returns a HostFILE pointer for that file. Returns NULL to indicate an error.
HostFPrintF	Writes a formatted string to a file, and returns the number of characters written.
HostFPutC	Writes a character to the specified file, and returns the character written. Returns EOF to indicate an error.

Table 8.14 Host Control Standard C Library Functions

Function	Description
HostFPutS	Writes a string to the specified file, and returns a non-negative value to indicate success.
HostFRead	Reads a number of items from the file into a buffer. Returns the number of items that were actually read.
HostFree	Frees memory on the desktop computer.
HostFReopen	Associates a file stream with a different file.
HostFScanF	Scans a file for formatted input.
HostFSeek	Moves the file pointer to the specified position, and returns `0` to indicate success.
HostFSetPos	Sets the position indicator of the file, and returns `0` to indicate success.
HostFTell	Retrieves the current position of the specified file. Returns `-1` to indicate an error.
HostFWrite	Writes data to a file, and returns the actual number of items written.
HostGetEnv	Retrieves the value of an environment variable.
HostMalloc	Allocates a memory block on the debugging host, and returns a pointer to the allocated memory. Returns NULL if there is not enough memory available.
HostRealloc	Reallocates space for the specified memory block.
HostRemove	Deletes a file.
HostRename	Renames a file.
HostTmpFile	Returns the temporary file used by the debugging host.
HostTmpNam	Creates a unique temporary file name.

Host Control Time Functions

Table 8.15 Host Control Time Functions

Function	Description
HostAscTime	Returns a character string representation of the time.
HostClock	Returns an elapsed time.
HostCTime	Converts calendar time to a text representation.
HostGMTime	Returns time structure representation of the time expressed as Universal Time Coordinated (UTC). UTC was formerly Greenwich Mean Time (GMT).
HostLocalTime	Returns time structure representation of the time expressed as local time.
HostMkTime	Alters the parameter values to represent an equivalent encoded local time, but with the values of all members within their normal ranges.
HostStrFTime	Generates formatted text, under the control of the format parameter and the values stored in the time structure parameter.
HostTime	Returns the current calendar time.
HostUTime	Sets the modification time for a file.

Host Control Tracing Functions

Table 8.16 Host Control Tracing Functions

Function	Description
HostTraceClose	Must be called when done logging trace information.
HostTraceInit	Must be called before logging any trace information.
HostTraceOutputT	Outputs text to the trace log using printf-style formatting.
HostTraceOutputTL	Outputs text to the trace log using printf-style formatting, and appends a newline character to the text.
HostTraceOutputVT	Outputs text to the trace log using vprintf-style formatting.
HostTraceOutputVTL	Outputs text to the trace log using vprintf-style formatting, and appends a newline character to the text.
HostTraceOutputB	Outputs a buffer of raw data to the trace log in hex dump format.

9

Debugger Protocol Reference

This chapter describes the debugger protocol, which provides an interface between a debugging target and a debugging host. For example, the Palm Debugger and the Palm OS® Emulator use this protocol to exchange commands and information.

IMPORTANT: This chapter describes the version of the Palm Debugger protocol that shipped on the Metrowerks CodeWarrior for the Palm™ Operating System, Version 6 CD-ROM. If you are using a different version, the features in your version might be different from the features described here.

This chapter covers the following topics:

About the Palm Debugger Protocol

The Palm debugger protocol allows a *debugging target*, which is usually a handheld ROM or an emulator program such as the Palm OS Emulator, to exchange information with a *debugging host*, such as the Palm Debugger or the Metrowerks debugger.

The debugger protocol involves sending packets between the host and the target. When the user of the host debugging program enters a command, the host converts that command into one or more command packets and sends each packet to the debugging target. In

most cases, the target subsequently responds by sending a packet back to the host.

Packets

There are three packet types used in the debugger protocol:

- The debugging host sends *command request packets* to the debugging target.
- The debugging target sends *command response packets* back to the host.
- Either the host or the target can send a *message packet* to the other.

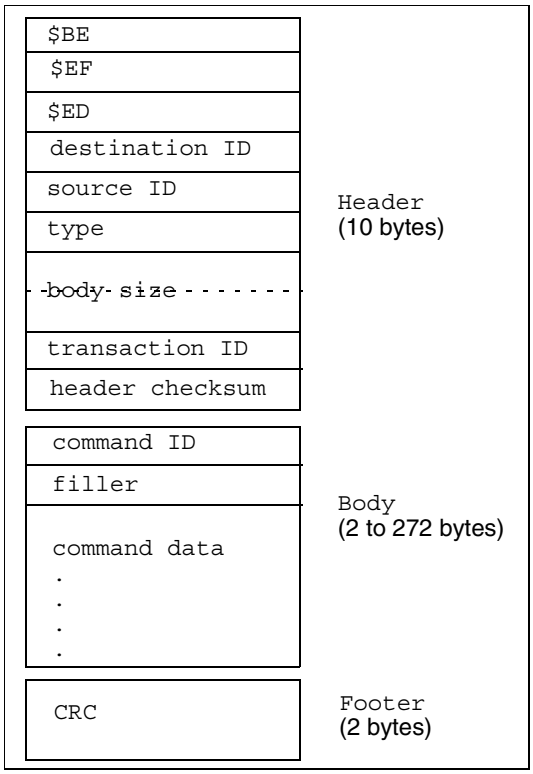
Although the typical flow of packets involves the host sending a request and the target sending back a response, although there are a some exceptions, as follows:

- The host can send some requests to the target that do not result in a response packet being returned. For example, when the host sends the `Continue` command packet to tell the target to continue execution, the target does not send back a response packet.
- The target can send response packets to the host without receiving a request packet. For example, whenever the debugging target encounters an exception, it sends a `State` response packet to the host.

Packet Structure

Each packet consists of a packet header, a variable-length packet body, and a packet footer, as shown in Figure 9.1.

Figure 9.1 Packet Structure



The Packet Header

The packet header starts with the 24-bit key value `$BEEFFD` and includes header information and a checksum of the header itself.

The Packet Body

The packet body contains the command byte, a filler byte, and between `0` and `270` bytes of data. See " SysPktBodyCommon" on page 192 for a description of the structure used to represent the two byte body header (the command and filler bytes), and see Table 9.1 for a list of the command constants.

The Packet Footer

The packet footer contains a 16-bit CRC of the header and body. Note that the CRC computation does not include the footer.

Packet Communications

The communications protocol between the host and target is very simple: the host sends a request packet to the target and waits for a time-out or for a response from the target.

If a response is not detected within the time-out period, the host does not retry the request. When a response does not come back before timing out, it usually indicates that one of two things is happening:

- the debugging target is busy executing code and has not encountered an exception
- the state of the debugging target has degenerated so badly that it cannot respond

The host has the option of displaying a message to the user to inform him or her that the debugging target is not responding.

Constants

This section describes the constants and structure types that are used with the packets for various commands.

Packet Constants

```
#define sysPktMaxMemChunk256
#define sysPktMaxBodySize(sysPktMaxMemChunk+16)
#define sysPktMaxNameLen32
```

`sysPktMaxMemChunk`
: The maximum number of bytes that can be read by the `Read Memory` command or written by the `Write Memory` command.

`sysPktMaxBodySize`
: The maximum number of bytes in a request or response packet.

`sysPktMaxNameLen`
: The maximum length of a function name.

State Constants

```
#define sysPktStateRspInstWords15
```

`sysPktStateRespInstWords`
: The number of remote code words sent in the response packet for the `State` command.

Breakpoint Constants

```
#define dbgNormalBreakpoints5
#define dbgTempBPIndexdbNormalBreakpoints
#define dbgTotalBreakpoints(dbgTempBPIndex+1)
```

`dbgNormalBreakpoints`
: The number of normal breakpoints available in the debugging target.

`dbgTempBPIndex`
: The index in the breakpoints array of the temporary breakpoint.

`dbgTotalBreakpoints`
: The total number of breakpoints in the breakpoints array, including the normal breakpoints and the temporary breakpoint.

Command Constants

Each command is represented by a single byte constant. The upper bit of each request command is clear, and the upper bit of each response command is set. Table 9.1 shows the command constants.

Table 9.1 Debugger protocol command constants

Command	Request constant	Response constant
Continue	sysPktContinueCmd	N/A
Find	sysPktFindCmd	sysPktFindRsp
Get Breakpoints	sysPktGetBreakpointsCmd	sysPktGetBreakpointsRsp
Get Routine Name	sysPktGetRtnNameCmd	sysPktGetRtnNameRsp

Table 9.1 Debugger protocol command constants *(continued)*

Command	Request constant	Response constant
Get Trap Breaks	sysPktGetTrapBreaksCmd	sysPktGetTrapBreaksRsp
Get Trap Conditionals	sysPktGetTrapConditionalsCmd	sysPktGetTrapConditionalsRsp
Message	sysPktRemoteMsgCmd	N/A
Read Memory	sysPktReadMemCmd	sysPktReadMemRsp
Read Registers	sysPktReadRegsCmd	sysPktReadRegsRsp
RPC	sysPktRPCCmd	sysPktRPCRsp
Set Breakpoints	sysPktSetBreakpointsCmd	sysPktSetBreakpointsRsp
Set Trap Breaks	sysPktSetTrapBreaksCmd	sysPktSetTrapBreaksRsp
Set Trap Conditionals	sysPktSetTrapConditionalsCmd	sysPktSetTrapConditionalsRsp
State	sysPktStateCmd	sysPktStateRsp
Toggle Debugger Breaks	sysPktDbgBreakToggleCmd	sysPktDbgBreakToggleRsp
Write Memory	sysPktWriteMemCmd	sysPktWriteMemRsp
Write Registers	sysPktWriteRegsCmd	sysPktWriteRegsRsp

Data Structures

This section describes the data structures used with the request and response packets for the debugger protocol commands.

_SysPktBodyCommon

The `_SysPktBodyCommon` macro defines the fields common to every request and response packet.

```
#define _sysPktBodyCommon \
    Byte command; \
```

```
    Byte _filler;
```

Fields

`command`	The 1-byte command value for the packet.
`_filler`	Included for alignment only. Not used.

SysPktBodyType

The `SysPktBodyType` represents a command packet that is sent to or received from the debugging target.

```
typedef struct SysPktBodyType
{
    _SysPktBodyCommon;
    Byte data[sysPktMaxBodySize-2];
} SysPktBodyType;
```

Fields

`_SysPktBodyCommon`	The command header for the packet.
`data`	The packet data.

SysPktRPCParamType

The SysPktRPCParamType is used to send a parameter in a remote procedure call. See the RPC command for more information.

```
typedef struct SysPktRPCParamInfo
{
    Byte  byRef;
    Byte  size;
    Word  data[?];
} SysPktRPCParamType;
```

Fields

`byRef`	Set to `1` if the parameter is passed by reference.
`size`	The number of bytes in the data array. This must be an even number.
`data`	The parameter data.

BreakpointType

The `BreakpointType` structure is used to represent the status of a single breakpoint on the debugging target.

```
typedef struct BreakpointType
{
    Ptr     addr;
    Boolean enabled;
    Boolean installed;
} BreakpointType;
```

Fields

`addr`	The address of the breakpoint. If this is set to `0`, the breakpoint is not in use.
`enabled`	A Boolean value. This is `TRUE` if the breakpoint is currently enabled, and `FALSE` if not.
`installed`	Included for correct alignment only. Not used.

Debugger Protocol Commands

This section describes each command that you can send to the debugging target, including a description of the response packet that the target sends back.

Continue

Purpose Tells the debugging target to continue execution.

Comments This command usually gets sent when the user specifies the `Go` command. Once the debugging target continues execution, the debugger is not reentered until a breakpoint or other exception is encountered.

NOTE: The debugging target does not send a response to this command.

Commands

The `Continue` request command is defined as follows:

```
#define sysPktContinueCmd    0x07
```

Request Packet

```
typedef struct SysPktContinueCmdType
{
    _sysPktBodyCommon;
    M68KresgType  regs;
    Boolean       stepSpy;
    DWord         ssAddr;
    DWord         ssCount;
    DWord         ssCheckSum;
}SysPktContinueCmdType;
```

Fields

`<—` `_sysPktBodyCommon`
: The common packet header, as described in _SysPktBodyCommon.

`—>` `regs`
: The new values for the debugging target processor registers. The new register values are stored in sequential order: `D0` to `D7`, followed by `A0` to `A6`.

`—>` `stepSpy`
: A Boolean value. If this is `TRUE`, the debugging target continues execution until the value that starts at the specified step-spy address changes. If this is `FALSE`, the debugging target continue execution until a breakpoint or other exception is encountered.

`—>` `ssAddr`
: The step-spy starting address. An exception is generated when the value starting at this address, for `ssCount` bytes, changes on the debugging target.

`—>` `ssCount`
: The number of bytes in the “spy” value. This value must be set to 4.

`—>` `ssCheckSum`
: This value is not used.

Find

Purpose Searches for data in memory on the debugging target.

Comments .

Commands The `Find` request and response commands are defined as follows:

```
#define sysPktFindCmd0x13
#define sysPktFindRsp0x93
```

Request Packet

```
typedef struct SysPktFindCmdType
{
    _sysPktBodyCommon;
    DWord     firstAddr;
    DWord     lastAddr;
    Word      numBytes
    Boolean   caseInsensitive;
    Byte      searchData[?];
}SysPktFindCmdType;
```

Fields

—> `_sysPktBodyCommon` The common packet header, as described in _SysPktBodyCommon.

—> `firstAddr` The starting address of the memory range on the debugging target to search for the data.

—> `lastAddr` The ending address of the memory range on the debugging target to search for the data.

—> `numBytes` The number of bytes of data in the search string.

—> `searchData` The search string. The length of this array is defined by the value of the `numBytes` field.

Response Packet

```
typedef struct SysPktFindRspType
{
    _sysPktBodyCommon;
```

```
    DWord   addr;
    Boolean found;
}SysPktFindRspType
```

Fields

<— _sysPktBodyCommon
: The common packet header, as described in _SysPktBodyCommon.

<— addr
: The address of the data string in memory on the debugging target.

<— found
: A Boolean value. If this is TRUE, the search string was found on the debugging target, and the value of addr is valid. If this is FALSE, the search string was not found, and the value of addr is not valid.

Get Breakpoints

Purpose Retrieves the current breakpoint settings from the debugging target.

Comments The body of the response packet contains an array with dbgTotalBreakpoints values in it, one for each possible breakpoint.

If a breakpoint is currently disabled on the debugging target, the enabled field for that breakpoint is set to 0.

If a breakpoint address is set to 0, the breakpoint is not currently in use.

The dbgTotalBreakpoints constant is described in "Breakpoint Constants" on page 191.

Commands The Get Breakpoints command request and response commands are defined as follows:

```
#define sysPktGetBreakpointsCmd0x0B
#define sysPktGetBreakpointsRsp0x8B
```

Request Packet

```
typedef struct SysPktGetBreakpointsCmdType
{
  _sysPktBodyCommon;
}SysPktGetBreakpointsCmdType
```

Fields

—> `_sysPktBodyCommon`
The common packet header, as described in _SysPktBodyCommon.

Response Packet

```
typedef struct SysPktGetBreakpointsRspType
{
  _sysPktBodyCommon;
  BreakpointType db[dbgTotalBreakpoints];
}SysPktGetBreakpointsRspType
```

Fields

<— `_sysPktBodyCommon`
The common packet header, as described in _SysPktBodyCommon.

<— `bp`
An array with an entry for each of the possible breakpoints. Each entry is of the type BreakpointType.

Get Routine Name

Purpose Determines the name, starting address, and ending address of the function that contains the specified address.

Comments The name of each function is embedded into the code when it gets compiled. The debugging target can scan forward and backward in the code to determine the start and end addresses for each function.

Commands The `Get Routine Name` command request and response commands are defined as follows:

```
#define sysPktGetRtnNameCmd0x04
#define sysPktGetRtnNameRsp0x84
```

Request Packet

```
typedef struct SysPktRtnNameCmdType
{
    _sysPktBodyCommon;
    void*   address
}SysPktRtnNameCmdType;
```

Fields

—> `_sysPktBodyCommon`
: The common packet header, as described in _SysPktBodyCommon.

—> `address`
: The code address whose function name you want to discover.

Response Packet

```
typedef struct SysPktRtnNameRspType
{
    _sysPktBodyCommon;
    void*   address;
    void*   startAddr;
    void*   endAddr;
    char    name[sysPktMaxNameLen];
}SysPktRtnNameRspType;
```

Fields

<— `_sysPktBodyCommon`
: The common packet header, as described in _SysPktBodyCommon.

<— `address`
: The code address whose function name was determined. This is the same `address` that was specified in the request packet.

<— `startAddr`
: The starting address in target memory of the function that includes the address.

<— `endAddr`	The ending address in target memory of the function that includes the address. If a function name could not be found, this is the last address that was scanned.
<— `name`	The name of the function that includes the `address`. This is a null-terminated string. If a function name could not be found, this is the null string.

Get Trap Breaks

Purpose Retrieves the settings for the trap breaks on the debugging target.

Comments Trap breaks are used to force the debugging target to enter the debugger when a particular system trap is called.

The body of the response packet contains an array with `dbgTotalBreakpoints` values in it, one for each possible trap break.

Each trap break is a single word value that contains the system trap number.

Commands The `Get Trap Breaks` request and response commands are defined as follows:

```
#define sysPktGetTrapBreaksCmd0x10
#define sysPktGetTrapBreaksRsp0x90
```

Request Packet

```
typedef struct SysPktGetTrapBreaksCmdType
{
    _sysPktBodyCommon;
}SysPktGetTrapBreaksCmdType;
```

Fields

—> `_sysPktBodyCommon`
The common packet header, as described in _SysPktBodyCommon.

Response Packet

```
typedef struct SysPktGetTrapBreaksRspType
{
    _sysPktBodyCommon;
    Word trapBP[dbgTotalTrapBreaks];
}SysPktGetTrapBreaksRspType;
```

Fields

`<— _sysPktBodyCommon` The common packet header, as described in _SysPktBodyCommon.

`<— trapBP` An array with an entry for each of the possible trap breaks. A value of `0` indicates that the trap break is not used.

Get Trap Conditionals

Purpose Retrieves the trap conditionals values from the debugging target.

Comments Trap conditionals are used when setting A-Traps for library calls. You can set a separate conditional value for each A-Trap.

The body of the response packet contains an array with `dbgTotalBreakpoints` values in it, one for each possible trap break.

Each trap conditional is a value; if the value of the first word on the stack matches the conditional value when the trap is called, the debugger breaks.

Commands The `Get Trap Conditionals` request and response commands are defined as follows:

```
#define sysPktGetTrapConditionsCmd0x14
#define sysPktGetTrapConditionsRsp0x94
```

Request Packet

```
typedef struct SysPktGetTrapConditionsCmdType
{
    _sysPktBodyCommon;
}SysPktGetTrapConditionsCmdType
```

Fields

—> `_sysPktBodyCommon`
The common packet header, as described in _SysPktBodyCommon.

Response Packet

```
typedef struct SysPktGetTrapConditionsRspType
{
    _sysPktBodyCommon;
    Word trapParam[dbgTotalTrapBreaks];
}SysPktGetTrapConditionsRspType
```

Fields

<— `_sysPktBodyCommon`
The common packet header, as described in _SysPktBodyCommon.

<— `trapParam` An array with an entry for each of the possible trap breaks. A value of `0` indicates that the trap conditional is not used.

Message

Purpose Sends a message to display on the debugging target.

Comments Application can compile debugger messages into their code by calling the `DbgMessage` function.

The debugging target does not send back a response packet for this command.

Commands The `Message` request command is defined as follows:

```
#define sysPktRemoteMsgCmd0x7F
```

Request Packet

```
typedef struct SysPktRemoteMsgCmdType
{
    _sysPktBodyCommon;
    Byte text[1];
}SysPktRemoteMsgCmdType;
```

Fields

—> `_sysPktBodyCommon`
The common packet header, as described in _SysPktBodyCommon.

—> `text` The message text.

Read Memory

Purpose Reads memory values from the debugging target.

Comments This command can read up to `sysPktMaxMemChunk` bytes of memory. The actual size of the response packet depends on the number of bytes requested in the request packet.

Commands The `Read Memory` command request and response commands are defined as follows:

```
#define sysPktReadMemCmd0x01
#define sysPktReadMemRsp0x81
```

Request Packet

```
typedef struct SysPktReadMemCmdType
{
    _sysPktBodyCommon;
    void*   address;
    Word    numBytes;
}SysPktReadMemCmdType;
```

Fields

—> `_sysPktBodyCommon`
The common packet header, as described in _SysPktBodyCommon.

—> `address` The address in target memory from which to read values.

—> `numBytes` The number of bytes to read from target memory.

Response Packet

```
typedef struct SysPktReadMemRspType
{
```

```
    _sysPktBodyCommon;
    //Byte  data[?];
}SysPktReadMemRspType;
```

Fields

<— _sysPktBodyCommon
: The common packet header, as described in _SysPktBodyCommon.

<— data
: The returned data. The number of bytes in this field matches the numBytes value in the request packet.

Read Registers

Purpose Retrieves the value of each of the target processor registers.

Comments The eight data registers are stored in the response packet body sequentially, from D0 to D7. The seven address registers are stored in the response packet body sequentially, from A0 to A6.

Commands The Read Registers command request and response commands are defined as follows:

```
#define sysPktReadRegsCmd0x05
#define sysPktReadRegsRsp0x85
```

Request Packet

```
typedef struct SysPktReadRegsCmdType
{
    _sysPktBodyCommon;
}SysPktReadRegsCmdType;
```

Fields

—> _sysPktBodyCommon
: The common packet header, as described in _SysPktBodyCommon.

Response Packet

```
typedef struct SysPktReadRegsRspType
```

```
{
    _sysPktBodyCommon;
    M68KRegsType  reg;
}SysPktReadRegsRspType;
```

Fields

<— _sysPktBodyCommon
: The common packet header, as described in _SysPktBodyCommon.

<— reg
: The register values in sequential order: D0 to D7, followed by A0 to A6.

RPC

Purpose Sends a remote procedure call to the debugging target.

Commands The RPC request and response commands are defined as follows:

```
#define sysPktRPCCmd0x0A
#define sysPktRPCRsp0x8A
```

Request Packet

```
typedef struct SysPktRPCType
{
    _sysPktBodyCommon;
    Word  trapWord;
    DWord resultD0;
    DWord resultD0;
    Word  numParams;
    SysPktRPCParamTypeparam[?];
}
```

Fields

—> _sysPktBodyCommon
: The common packet header, as described in _SysPktBodyCommon.

—> trapWord
: The system trap to call.

—> resultD0
: The result from the D0 register.

—> resultA0
: The result from the A0 register.

—> `numParams`	The number of RPC parameter structures in the `param` array that follows.
—> `param`	An array of RPC parameter structures, as described in SysPktRPCParamType. Note that the parameters should appear in the reverse order of how they appear in the function declaration. For example, if you have the following function declaration: `Err DmDeleteDatabase (UInt16 cardNo, LocalID dbID)` you should a `SysPktRPCParamType` record to `SysPktRPCType` for `dbID` first and a `SysPktRPCParamType` record for `cardNo` second.

Set Breakpoints

Purpose Sets breakpoints on the debugging target.

Comments The body of the request packet contains an array with `dbgTotalBreakpoints` values in it, one for each possible breakpoint. If a breakpoint is currently disabled on the debugging target, the enabled field for that breakpoint is set to `0`.

The `dbgTotalBreakpoints` constant is described in Breakpoint Constants.

Commands The `Set Breakpoints` command request and response commands are defined as follows:

```
#define sysPktSetBreakpointsCmd0x0C
#define sysPktSetBreakpointsRsp0x8C
```

Request Packet

```
typedef struct SysPktSetBreakpointsCmdType
{
  _sysPktBodyCommon;
  BreakpointType db[dbgTotalBreakpoints];
}SysPktSetBreakpointsCmdType
```

Fields

—> `_sysPktBodyCommon`
The common packet header, as described in _SysPktBodyCommon.

—> `bp` An array with an entry for each of the possible breakpoints. Each entry is of the type BreakpointType.

Response Packet

```
typedef struct SysPktSetBreakpointsRspType
{
  _sysPktBodyCommon;
}SysPktSetBreakpointsRspType
```

Fields

<— `_sysPktBodyCommon`
The common packet header, as described in _SysPktBodyCommon.

Set Trap Breaks

Purpose Sets breakpoints on the debugging target.

Comments The body of the request packet contains an array with `dbgTotalBreakpoints` values in it, one for each possible trap break. If a trap break is currently disabled on the debugging target, the value of that break is set to `0`.

The `dbgTotalBreakpoints` constant is described in Breakpoint Constants.

Commands The `Set Breakpoints` command request and response commands are defined as follows:

```
#define sysPktSetTrapBreaksCmd0x0C
#define sysPktSetTrapBreaksRsp0x8C
```

Request Packet

```
typedef struct SysPktSetTrapBreakssCmdType
{
  _sysPktBodyCommon;
```

```
  Word trapBP[dbgTotalBreakpoints];
}SysPktSetTrapBreaksCmdType
```

Fields

—> `_sysPktBodyCommon`
The common packet header, as described in _SysPktBodyCommon.

—> `trapBP` An array with an entry for each of the possible trap breaks. If the value of an entry is 0, the break is not currently in use.

Response Packet

```
typedef struct SysPktSetTrapBreaksRspType
{
  _sysPktBodyCommon;
}SysPktSetTrapBreaksRspType
```

Fields

<— `_sysPktBodyCommon`
The common packet header, as described in _SysPktBodyCommon.

Set Trap Conditionals

Purpose Sets the trap conditionals values for the debugging target.

Comments Trap conditionals are used when setting A-Traps for library calls. You can set a separate conditional value for each A-Trap.

The body of the request packet contains an array with `dbgTotalBreakpoints` values in it, one for each possible trap break.

Each trap conditional is a value; if the value of the first word on the stack matches the conditional value when the trap is called, the debugger breaks.

Commands The `Set Trap Conditionals` request and response commands are defined as follows:

```
#define sysPktSetTrapConditionsCmd0x15
#define sysPktSetTrapConditionsRsp0x95
```

Request Packet

```
typedef struct SysPktSetTrapConditionsCmdType
{
    _sysPktBodyCommon;
    Word trapParam[dbgTotalTrapBreaks];
}SysPktSetTrapConditionsCmdType
```

Fields

—> `_sysPktBodyCommon`
The common packet header, as described in _SysPktBodyCommon.

—> `trapParam` An array with an entry for each of the possible trap breaks. A value of `0` indicates that the trap conditional is not used.

Response Packet

```
typedef struct SysPktSetTrapConditionsRspType
{
    _sysPktBodyCommon;
}SysPktSetTrapConditionsRspType
```

Fields

<— `_sysPktBodyCommon`
The common packet header, as described in _SysPktBodyCommon.

State

Purpose Sent by the host program to query the current state of the debugging target, and sent by the target whenever it encounters an exception and enters the debugger.

Comments The debugging target sends the `State` response packet whenever it enters the debugger for any reason, including a breakpoint, a bus error, a single step, or any other reason.

Commands The `State` request and response commands are defined as follows:

```
#define sysPktStateCmd0x00
#define sysPktStateRsp0x80
```

Request Packet

```
typedef struct SysPktStateCmdType
{
    _sysPktBodyCommon;
} SysPktStateCmdType
```

Fields

—> `_sysPktBodyCommon`
The common packet header, as described in _SysPktBodyCommon.

Response Packet

```
typedef struct SysPktStateRspType
{
    _sysPktBodyCommon;
    Boolean       resetted;
    Word          exceptionId;
    M68KregsType  reg;
    Word        inst[sysPktStateRspInstWords];
    BreakpointTypebp[dbgTotalBreakpoints];
    void*         startAddr;
    void*         endAddr;
    char          name[sysPktMaxNameLen];
    Byte          trapTableRev;
} SysPktStateRspType;
```

Fields

<— `_sysPktBodyCommon`
The common packet header, as described in _SysPktBodyCommon.

<— `resetted` A Boolean value. This is `TRUE` if the debugging target has just been reset.

<— `exceptionId` The ID of the exception that caused the debugger to be entered.

<— `reg` The register values in sequential order: `D0` to `D7`, followed by `A0` to `A6`.

<— `inst`	A buffer of the instructions starting at the current program counter on the debugging target.
<— `bp`	An array with an entry for each of the possible breakpoints. Each entry is of the type BreakpointType.
<— `startAddr`	The starting address of the function that generated the exception.
<— `endAddr`	The ending address of the function that generated the exception.
<— `name`	The name of the function that generated the exception. This is a null-terminated string. If no name can be found, this is the null string.
<— `trapTableRev`	The revision number of the trap table on the debugging target. You can use this to determine when the trap table cache on the host computer is invalid.

Toggle Debugger Breaks

Purpose Enables or disables breakpoints that have been compiled into the code.

Comments A breakpoint that has been compiled into the code is a special `TRAP` instruction that is generated when source code includes calls to the `DbgBreak` and `DbgSrcBreak` functions.

Sending this command toggles the debugging target between enabling and disabling these breakpoints.

Commands The `Toggle Debugger Breaks` request and response commands are defined as follows:

```
#define sysPktDbgBreakToggleCmd0x0D
#define sysPktDbgBreakToggleRsp0x8D
```

Request Packet

```
typedef struct SysPktDbgBreakToggleCmdType
{
```

```
    _sysPktBodyCommon;
}SysPktDbgBreakToggleCmdType;
```

Fields

—>`_sysPktBodyCommon`
The common packet header, as described in _SysPktBodyCommon.

Response Packet

```
typedef struct SysPktDbgBreakToggleRspType
{
    _sysPktBodyCommon;
    Boolean   newState
}SysPktDbgBreakToggleRspType;
```

Fields

<— `_sysPktBodyCommon`
The common packet header, as described in _SysPktBodyCommon.

<— `newState` A Boolean value. If this is set to `TRUE`, the new state has been set to enable breakpoints that were compiled into the code. If this is set to `FALSE`, the new state has been set to disable breakpoints that were compiled into the code.

Write Memory

Purpose Writes memory values to the debugging target.

Comments This command can write up to `sysPktMaxMemChunk` bytes of memory. The actual size of the request packet depends on the number of bytes that you want to write.

Commands The `Write Memory` command request and response commands are defined as follows:

```
#define sysPktWriteMemCmd0x02
#define sysPktWriteMemRsp0x82
```

Request Packet

```
typedef struct SysPktWriteMemCmdType
```

```
{
    _sysPktBodyCommon;
    void*   address;
    Word    numBytes;
    //Byte  data[?]
}SysPktWriteMemCmdType;
```

Fields

—> `_sysPktBodyCommon`
The common packet header, as described in _SysPktBodyCommon.

--> `address` The address in target memory to which the values are written.

--> `numBytes` The number of bytes to write.

--> `data` The bytes to write into target memory. The size of this field is defined by the `numBytes` parameter.

Response Packet

```
typedef struct SysPktWriteMemRspType
{
    _sysPktBodyCommon;
}SysPktWriteMemRspType;
```

Fields

<-- `_sysPktBodyCommon`
The common packet header, as described in _SysPktBodyCommon.

Write Registers

Purpose Sets the value of each of the target processor registers.

Comments The eight data registers are stored in the request packet body sequentially, from `D0` to `D7`. The seven address registers are stored in the request packet body sequentially, from `A0` to `A6`.

Commands

The `Write Registers` command request and response commands are defined as follows:

```
#define sysPktWriteRegsCmd0x06
#define sysPktWriteRegsRsp0x86
```

Request Packet

```
typedef struct SysPktWriteRegsCmdType
{
    _sysPktBodyCommon;
    M68KRegsType  reg;
}SysPktWriteRegsCmdType;
```

Fields

`-->_sysPktBodyCommon`
The common packet header, as described in _SysPktBodyCommon.

`—> reg` The new register values in sequential order: `D0` to `D7`, followed by `A0` to `A6`.

Response Packet

```
typedef struct SysPktWriteRegsRspType
{
    _sysPktBodyCommon;
}SysPktWriteRegsRspType;
```

Fields

`<— _sysPktBodyCommon`
The common packet header, as described in _SysPktBodyCommon.

Summary of Debugger Protocol Packets

Table 9.2 summarizes the command packets that you can use with the debugger protocol.

Table 9.2 Debugger protocol command packets

Command	Description
Continue	Tells the debugging target to continue execution.
Find	Searches for data in memory on the debugging target.
Get Breakpoints	Retrieves the current breakpoint settings from the debugging target.
Get Routine Name	Determines the name, starting address, and ending address of the function that contains the specified address.
Get Trap Breaks	Retrieves the settings for the trap breaks on the debugging target.
Get Trap Conditionals	Retrieves the trap conditionals values from the debugging target.
Message	Sends a message to display on the debugging target.
Read Memory	Reads memory values from the debugging target.
Read Registers	Retrieves the value of each of the target processor registers.
RPC	Sends a remote procedure call to the debugging target.
Set Breakpoints	Sets breakpoints on the debugging target.
Set Trap Breaks	Sets breakpoints on the debugging target.
Set Trap Conditionals	Sets the trap conditionals values for the debugging target.
State	Sent by the host program to query the current state of the debugging target, and sent by the target whenever it encounters an exception and enters the debugger.
Toggle Debugger Breaks	Enables or disables breakpoints that have been compiled into the code.

Table 9.2 Debugger protocol command packets *(continued)*

Command	Description
Write Memory	Writes memory values to the debugging target.
Write Registers	Sets the value of each of the target processor registers.

A

Structure Access Notifications

In general, your Palm OS application should not directly access the fields of structures for windows, forms, and form objects. Palm OS Emulator recognizes when structure access is valid, and will notify you if your application attempts any prohibited structure access.

The PalmOSGlue library, which is described in *Palm OS Programmer's API Reference*, provides functions that you should use in your application rather than using direct structure access.

Some versions of Palm OS have implemented an accessor trap function which prevents any access of data structures. The PalmOSGlue library checks for this accessor trap by checking for the `sysFtrNumAccessorTrapPresent` feature:

```
FtrGet (sysFtrCreator, sysFtrNumAccessorTrapPresent, &value)
```

Palm OS Emulator allows structure access for the structures listed in Table A.1, given that the accessor trap is not present. The Palm OS structures listed in the table can be accessed for the conditions described in the "Description" column.

Table A.1 Palm OS Structure Access Notification Exceptions

Palm OS Structure	Access Allowed	Description
`ControlType attr`	Read	Always allowed, primarily for PalmOSGlue functions `CtlGlueGetGraphics` and `FrmGlueGetObjectUsable`
`ControlType attr`	Read/Write	Always allowed, primarily for PalmOSGlue functions `CtlGlueNewSliderConstrol` and `CtlGlueSetLeftAnchor`
`ControlType bitmapID`	Read	For graphic controls, always allowed, primarily for PalmOSGlue function `CtlGlueGetGraphics`
`ControlType font`	Read/Write	Always allowed, primarily for PalmOSGlue functions `CtlGlueGetFont` and `CtlGlueSetFont`
`ControlType selectedbitmapID`	Read	For graphic controls, always allowed, primarily for graphic controls for PalmOSGlue function `CtlGlueGetGraphics`
`ControlType style`	Read	Always allowed, primarily for PalmOSGlue function `CtlGlueGetControlStyle`
`FieldType attr`	Read/Write	Before Palm OS 3.3
`FieldType lines`	Read	Always allowed, primarily for PalmOSGlue function `FldGlueGetLineInfo`
`FormBitmapType attr`	Read	Always allowed, primarily for PalmOSGlue function `FrmGlueGetObjectUsable`

Table A.1 Palm OS Structure Access Notification Exceptions

Palm OS Structure	Access Allowed	Description
`FormBitmapType attr`	Read/Write	Before Palm OS 3.2. The function `FrmHideObject` changes the `usable` attribute automatically after Palm OS 3.2, but before Palm OS 3.2, your application needed to change the `usable` attribute directly.
`FormGadgetType` (all fields)	All Access	No restrictions. Generally, your gadget code should use the correct accessor functions like any other form object. However, in a gadget callback function, your code needs to have direct access to the gadget's structure fields. Emulator makes no distinction for whether the access in the callback function, so the structure access is not restricted. Your application should still access gadgets using the correct accessor functions whenever possible.
`FormLabelType attr`	Read	Always allowed, primarily for PalmOSGlue function `FrmGlueGetObjectUsable`
`FormLabelType font`	Read/Write	Always allowed, primarily for PalmOSGlue functions `FrmGlueGetLabelFont` and `FrmGlueSetLabelFont`
`FormType defaultButton`	Read/Write	Always allowed, primarily for PalmOSGlue functions `FrmGlueGetDefaultButtonID` and `FrmGlueSetDefaultButtonID`

Table A.1 Palm OS Structure Access Notification Exceptions

Palm OS Structure	Access Allowed	Description
`FormType handler`	Read	Always allowed, primarily for PalmOSGlue function `FrmGlueGetEventHandler`
`FormType helpRscID`	Read/Write	Always allowed, primarily for PalmOSGlue functions `FrmGlueGetHelpID` and `FrmGlueSetHelpID`
`FormType menuRscID`	Read	Always allowed, primarily for PalmOSGlue function `FrmGlueGetMenuBarID`
`ListType attr`	Read/Write	Always allowed, primarily for PalmOSGlue functions `FrmGlueGetObjectUsable` and `LstGlueSetIncrementalSearch`
`ListType font`	Read/Write	Always allowed, primarily for PalmOSGlue function `LstGlueGetFont` and `LstGlueSetFont`
`ListType itemsText`	Read	Always allowed, primarily for PalmOSGlue function `LstGlueGetItemsText`
`ListType topItem`	Read	Before Palm OS 4.0. For Palm OS 4.0 and later, use `LstGetTopItem`. For compatibility, use PalmOSGlue function `LstGlueGetTopItem`.
`TableType attr`	Read/Write	Before Palm OS 4.0. For Palm OS 4.0 and later, use `TblSetSelection`. For compatibility, use PalmOSGlue function `TblGlueSetSelection`.

Table A.1 Palm OS Structure Access Notification Exceptions

Palm OS Structure	Access Allowed	Description
`TableType currentColumn`	Read/Write	Before Palm OS 4.0. For Palm OS 4.0 and later, use `TblSetSelection`. For compatibility, use PalmOSGlue function `TblGlueSetSelection`.
`TableType currentRow`	Read/Write	Before Palm OS 4.0. For Palm OS 4.0 and later, use `TblSetSelection`. For compatibility, use PalmOSGlue function `TblGlueSetSelection`.
`TableType numColumns`	Read	Before Palm OS 4.0. For Palm OS 4.0 and later, use `TblGetNumberofColumns` or `TblSetSelection`. For compatibility, use PalmOSGlue functions `TblGlueGetNumberofColumns` or `TblGlueSetSelection`.
`TableType numRows`	Read	Before Palm OS 4.0. For Palm OS 4.0 and later, use `TblSetSelection`. For compatibility, use PalmOSGlue function `TblGlueSetSelection`.
`TableType topRow`	Read	Before Palm OS 4.0. For Palm OS 4.0 and later, use `TblGetTopRow`. For compatibility, use PalmOSGlue function `TblGlueGetTopRow`.
`ScrollBarType attr`	Read	Always allowed, primarily for PalmOSGlue function `FrmGlueGetObjectUsable`

Table A.1 Palm OS Structure Access Notification Exceptions

Palm OS Structure	Access Allowed	Description
`ScrollBarType attr`	Read/Write	Before Palm OS 3.5. The functions `FrmShowObject` and `FrmHideObject` did not show and hide scrollbars before Palm OS 3.5, so your application needed to change the `usable` attribute directly.
`WindowType bitmapP`	Read	Before Palm OS 3.5. Do not directly access the memory used for the display buffer. Use the functions `WinDrawBitmap` or `WinPaintBitmap`, or use an offscreen window with `WinGetBitmap` and `BmpGetBits`. **NOTE:** This field did not exist before Palm OS 3.5. It replaced the field `gDeviceP` which was defined before Palm OS 3.5.
`WindowType displayWidthV20`	Read	Before Palm OS 2.0. Use the function `WinGetDisplayExtent` instead.
`WindowType displayHeightV20`	Read	Before Palm OS 2.0 Use the function `WinGetDisplayExtent` instead.

Table A.1 Palm OS Structure Access Notification Exceptions

Palm OS Structure	Access Allowed	Description
`WindowType displayAddrV20`	Read	Before Palm OS 3.5. Do not directly access the memory used for the display buffer. Use the functions `WinDrawBitmap` or `WinPaintBitmap`, or use an offscreen window with `WinGetBitmap` and `BmpGetBits`.
`WindowType frameType`	Read/Write	Always allowed, primarily for Palm OSGlue functions `WinGlueGetFrameType` and `WinGlueSetFrameType`

B

Unsupported Traps

Palm OS Emulator will warn you if your application uses any of the unsupported traps listed in this appendix.

System Use Only Traps

Table B.1 System Use Only Traps

AlmAlarmCallback	PenClose
AlmCancelAll	PenGetRawPen
AlmDisplayAlarm	PenOpen
AlmEnableNotification	PenRawToScreen
AlmInit	PenScreenToRaw
AlmTimeChange	ScrCompressScanLine
DmInit	ScrCopyRectangle
EvtDequeueKeyEvent	ScrDeCompressScanLine
EvtGetSysEvent	ScrDrawChars
EvtInitialize	ScrDrawNotify
EvtSetKeyQueuePtr	ScrLineRoutine
EvtSetPenQueuePtr	ScrRectangleRoutine
EvtSysInit	ScrScreenInfo
ExgInit	ScrSendUpdateArea
FrmAddSpaceForObject	SlkProcessRPC
FtrInit	SlkSysPktDefaultResponse
GrfFreeGrfInit	SndInit
InsPtCheckBlink	SysBatteryDialog
InsPtInitialize	SysColdBoot
MemCardFormat	SysDoze
MemHandleFlags	SysInit
MemHandleOwner	SysLaunchConsole
MemHandleResetLock	SysNewOwnerID
MemHeapFreeByOwnerID	SysReserved10Trap1
MemHeapInit	SysReserved31Trap1
MemInit	SysSemaphoreSet
MemInitHeapTable	SysUILaunch
MemKernelInit	SysWantEvent
MemPtrFlags	TimInit
MemPtrOwner	UIInitialize
MemPtrResetLock	UIReset
MemStoreInit	WinAddWindow
MemStoreSetInfo	WinRemoveWindow

Internal Use Only Traps

Table B.2 Internal Use Only Traps

AttnAllowClose
AttnDoEmergencySpecialEffects
AttnEffectOfEvent
AttnEnableNotification
AttnHandleEvent
AttnIndicatorAllow
AttnIndicatorAllowed
AttnIndicatorCheckBlink
AttnIndicatorGetBlinkPattern
AttnIndicatorSetBlinkPattern
AttnIndicatorTicksTillNextBlink
AttnInitialize
BltCopyRectangle
BltDrawChars
BltFindIndexes
BltGetPixel
BltLineRoutine
BltPaintPixel
BltPaintPixels
BltRectangleRoutine
BltRoundedRectangle
BltRoundedRectangleFill
DayHandleEvent
DbgControl
DbgSerDrvClose
DbgSerDrvControl
DbgSerDrvOpen
DbgSerDrvReadChar
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HwrIRQ3Handler
HwrIRQ4Handler
HwrIRQ5Handler
HwrIRQ6Handler
HwrLCDBaseAddrV33
HwrLCDContrastV33
HwrLCDGetDepthV33
HwrModelInitStage2
HwrModelInitStage3
HwrModelSpecificInit
HwrNVPrefGet
HwrNVPrefSet
HwrPluggedIn
HwrPostDebugInit
HwrPreDebugInit
HwrResetNMI
HwrResetPWM
HwrSetCPUDutyCycle
HwrSetSystemClock
HwrSleep
HwrSoundOff

Table B.2 Internal Use Only Traps

HwrSoundOn	ScrScreenUnlock
HwrTimerInit	ScrUpdateScreenBitmap
HwrWake	SndInterruptSmfIrregardless
KeyBootKeys	SndPlaySmfIrregardless
KeyHandleInterrupt	SndPlaySmfResourceIrregardless
KeyInit	SysFatalAlertInit
MemHeapPtr	SysKernelClockTick
MemStoreSearch	SysNotifyBroadcastFromInterrupt
OEMDispatch2	SysNotifyInit
PalmPrivate3	SysReserved30Trap1
ScrCompress	SysReserved30Trap2
ScrDecompress	SysUnimplemented
ScrGetColortable	TimGetAlarm
ScrGetGrayPat	TimSetAlarmUIColorInit
ScrPalette	WinGetFirstWindow
ScrScreenInit	WinMoveWindowAddr
ScrScreenLock	WinPrvInitCanvas
	WinScreenInit

Kernel Traps

These traps are not implemented because 68K applications do not have access to the kernel API functions.

Table B.3 Kernel Traps

SysEvGroupCreate	SysResSemaphoreRelease	SysTaskSwitching
SysEvGroupRead	SysResSemaphoreReserve	SysTaskTrigger
SysEvGroupSignal	SysSemaphoreCreate	SysTaskUserInfoPtr
SysEvGroupWait	SysSemaphoreDelete	SysTaskWait
SysKernelInfo	SysSemaphoreSignal	SysTaskWaitClr
SysMailboxCreate	SysSemaphoreWait	SysTaskWake
SysMailboxDelete	SysTaskCreate	SysTimerCreate
SysMailboxFlush	SysTaskDelete	SysTimerDelete
SysMailboxSend	SysTaskIDSysTaskResume	SysTimerRead
SysMailboxWait	SysTaskSetTermProc	SysTimerWrite
SysResSemaphoreCreate	SysTaskSuspend	SysTranslateKernelErr
SysResSemaphoreDelete		

Obsolete Traps

These traps are not implemented because they are obsolete Palm OS 1.0 traps (or an esoteric obsolete trap such as `WiCmdV32`).

Table B.4 Obsolete Traps

FplAdd	FplFloatToLong	FplMul
FplAToF	FplFloatToULong	FplSub
FplBase10Info	FplFToA	WiCmdV32
FplDiv	FplLongToFloat	

Unimplemented Traps

These traps were never implemented in Palm OS (although they appear in `CoreTraps.h`), but they are listed for completeness.

Table B.5 Unimplemented Traps

ClipboardCheckIfItemExist	WinDrawArc	WinFillPolygon
CtlValidatePointer	WinDrawPolygon	WinInvertArc
FrmSetCategoryTrigger	WinEraseArc	WinInvertPolygon
FrmSetLabel	WinErasePolygon	WinPaintArc
MenuEraseMenu	WinFillArc	WinPaintPolygon
SysUICleanup		

Unimplemented NOP Traps

These traps should not be called by applications. Some third-party applications call these traps and it is safer to treat them as NOPs for backwards compatibility.

Table B.6 Unimplemented NOP Traps

FplFree	SerReceiveISP	TimSleep
FplInit	SrmSleep	TimWake
HwrTimerSleep	SrmWake	WinDisableWindow
HwrTimerWake	SysDisableInts	WinEnableWindow
PenSleep	SysRestoreStatus	WinInitializeWindow
PenWake	TimHandleInterrupt	

Unimplemented Rare Traps

These are traps that applications would not use.

Table B.7 Unimplemented Rare Traps

ConGetS	FlashProgram	SrmOpenBackground
ConPutS	IntlGetRoutineAddress	SrmPrimeWakeupHandler
DayDrawDays	MemGetRomNVParams	SrmReceiveWindowClose
DayDrawDaySelector	MemNVParams	SrmReceiveWindowOpen
DbgCommSettings	OEMDispatch	SrmSetWakeupHandler
DbgGetMessage	ResLoadForm	SysNotifyBroadcast
DlkDispatchRequest	SerPrimeWakeupHandler	SysNotifyBroadcastDeferred
DlkStartServer	SerReceiveWindowClose	SysNotifyDatabaseAdded
DmMoveOpenDBContext	SerReceiveWindowOpen	SysNotifyDatabaseRemoved
DmOpenDBWithLocale	SerSetWakeupHandler	SysSetTrapAddress
FlashCompress	SlkSetSocketListener	
FlashErase		

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