PALM OS

Welcome to

Developing Palm OS 2.0 Applications

Part I: Interface Management

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PALM OS

U.S. Robotics®

Developing Palm OS™ 2.0 Applications

Part I

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About This Document

Developing Palm OS 2.0 Applications, Part I, is part of the Palm OS Software Development Kit. This introduction provides an overview SDK documentation, discusses what materials are included in this document and what conventions are used.

Palm OS SDK Documentation

The following documents are part of the SDK:

Document	Description
Palm OS 2.0 Tutorial	21 Phases step developers through using the different part of the system. Example applications for each phase are part of the SDK.
Developing Palm OS 2.0 Applications. Part I: Interface Management	A programmer's guide and reference document that introduces all important parts of developing an applications. See What This Guide Contains for details.
Developing Palm OS 2.0 Applications. Part II. System Management.	A programmer's guide and reference document for all system managers, such as the string manager or the system event manager.
Developing Palm OS 2.0 Applications, Part III. Memory and Communications Management	Programmer's guide and reference document about • Memory management; both the database manager and the memory manager. • The Palm OS communications library for serial communication. • The Palm OS net library, which provides basic network services.
Palm OS 2.0 Cookbook.	Information about using CodeWarrior for Pilot to create projects and executables. Also provides a variety of design guidelines, including localization design guidelines.

What This Guide Contains

This section provides an overview of the chapters in this guide.

- Chapter "Developing Palm OS Applications," helps you understand the basic principles of application development. The chapter provides information on:
  - steps involved in creating an application,
  - internal structure of an application
  - naming conventions
  - basic hardware
  - the different Palm OS devices
- Chapter 2, "Application Control Flow," explains how applications and the system work together using events and launch codes.
  - Events are posted by the system in response to user input and are then either handled by the system itself or by the application.
  - Launch codes are sent to the top level of the event loop. They are usually sent by the system and require an application response. Applications can, however, send launch codes themselves if desired.
- Chapter 3, "Palm OS User Interface Resources," provides detailed information about all the UI resources an application can use a templates for its user interface.
- Chapter 4, "Palm OS User Interface Objects," discusses the C structures applications can use to manipulate the UI resources discussed in chapter 3. Each object is related with one or more UI resources and has a number of fields and attributes an application program can change.
- Chapter 5, "Using Palm OS UI Managers," discusses the functionality of all managers related to the Palm OS user interface. For each manager, the chapter provides a functionality overview, discussion of how to use that functionality, and list of functions.
- Chapter 6, "Palm OS Events," provides reference-style information for each event.
- Chapter 7, "Palm OS User Interface Functions," provides reference-style information for each UI function.

Conventions Used in This Guide

This guide uses the following typographical conventions:

This style...	Is used for...
`fixed width font`	Code elements such as function, structure, field, bitfield.
`fixed width underline`	Emphasis (for code elements).
bold	Emphasis (for other elements).
blue and underlined	Hot links.
black and underlined	2.0 function names (headings only)
red and underlined	2.0 function names (in Table of Contents only)

1

Developing Palm OS Applications

This chapter helps you understand the basic principles of Palm OS application development. It discusses these topics:

- Overview of Application Development explains the steps involved in creating an application.
- Internal Structure of an Application provides some information about resources the system creates for each application and how they are used.
- Naming Conventions briefly explains naming conventions used for functions and structures.
- Basic Hardware gives some background information about the Palm OS device.
- Different Palm OS Devices discusses how to make 1.0 applications run on the new devices, and how to run 2.0 applications on a 1.0 device.

Overview of Application Development

This section provides an overview of the application development process for the Palm OS device. It introduces the different components of an application in the order that you'll most likely work with them, and provides many links to related sections in this guide and pointers to other relevant documentation included in your developer package.

You learn about these topics:

- Designing UI and Program Functionality
- Constructing UI Resources
- Using Managers and Filling Out the Program Logic
- Building, Debugging, and Testing
- Building the Application and Running it on the Device
- Using Other Components of the SDK

Designing UI and Program Functionality

The first step in application development is to envision what users will do as they interact with your application. After that, it's useful to implement a small prototype and have some users interact with it. When you're satisfied with the basic interface and user interaction, you can move on from the prototype to a complete application.

This section looks at the steps involved in creating a working user interface.

Designing Screen Layout and User Interaction

Careful UI design is critical for a Palm OS application because using a Palm OS device differs from using other computers. Here are a few points to consider when designing your application:

Do this...	**Because of this...**
Pay attention to pen-based user input paradigms.	Pen-based user input differs from keyboard-based user input.
Plan integration with the desktop early.	Your conduit/backup strategy and your integration with desktop software can make your program much more useful.
Offload some computationally intensive tasks to the desktop; use the device as a satellite viewer.	Device runs on batteries and doesn't have the same processing power than the desktop PC.
Limit data input where possible.	Graffiti and the popup keyboard are useful tools, but not as easy to use as a regular keyboard.
Design the layout carefully. Strive for a balance between providing enough information and overcrowding the screen.	Screen size is very limited.

The Palm OS development team has put together a set of design guidelines that were used as the basis for the four applications resident on the device (MemoPad, Address Book, etc.). These guidelines are summarized in Chapter 1 of the "Palm OS Cookbook." Some information, such as recommended font size or border width, is included for each resource in Chapter 3, "Palm OS User Interface Resources."

Note: Follow the design guidelines in chapter 1 of the "Palm OS Cookbook" to make your application easier to learn and to use.

Constructing UI Resources

The resource templates that were used to implement all the applications resident on the device are provided with your development environment.

The Palm OS 2.0 SDK Constructor tool lets you use the resource templates to create your own buttons, popup lists, menus, and other parts of the user interface.

The process of creating new resources is described in detail in the tutorial; the basic process consists of entering values into the attribute fields of the resource templates. Each resource has to have an ID; and may also need a width, height, label, or other attributes. The Constructor tool assigns the ID.

Macintosh users can also use ResEdit to create resources, but have to assign the IDs explicitly in that case.

The recommended (or required) values for the different fields in each resource are provided in Chapter 3, "Palm OS User Interface Resources."The "Palm OS Tutorial" provides "recipes" for creating each resource type in the Tutorial's "Resource Recipes" chapter.

When you build your program, the system converts the UI resources into data structures that the system can work with. Different resource types map to different data structures, that is, UI object type. For example, menu resources map to C structures that have system-defined behavior for turning highlighting on and off. Fields have system-defined behavior for positioning input cursors and processing user input. Note that there isn't a 1:1 mapping between resources and UI objects. This is explained in more detail in the relevant chapters.

The operating system provides quite a bit of default functionality for each UI object type. Your program logic can use, replace, or extend that functionality. Detailed information on all structures and their fields is provided in Chapter 4, "Palm OS User Interface Objects."

Using Managers and Filling Out the Program Logic

To successfully build a Palm OS application, you have to understand how the system itself is structured and how to structure your application. You learn about Using Events and Launch Codes and Using Palm OS Managers.

Using Events and Launch Codes

Palm OS applications are single-threaded, event-driven programs. The events are generated by the system, based on user input and system interrupts. The program logic may generate events as well. The programs are structured as a series of event handlers dispatched from a single event loop in each program.

Launch codes allow the system (or another application) to send a request to an application at the top level. For example, one application that supports global find may bring up the Find dialog and the system will query all currently loaded applications that handle the global find. In response to a launch code, an application doesn't necessarily display its user interface; instead, it only performs the requested action. This is described in more detail in How Launch Codes Control an Application.

Note: To make your application interact appropriately with other applications on the device and to avoid problems later, read Chapter 1 of the Palm OS Cookbook.

Using Palm OS Managers

The Palm OS system API is divided into functional areas called managers. Each manager has a distinct three-letter prefix used on all API calls and structures and is discussed separately below.

- All UI related managers, such as the graffiti or key manages, are discussed in "Using Palm OS UI Managers."
- All system related managers, such the string or system event manager, are discussed in "Using Palm OS System Managers" of "Developing Palm OS Applications, Part II."

- The memory manager, data manager, and resource manager are explained in Chapter 1, "Palm OS Memory Management" of "Developing Palm OS Applications, Part III."
- The communications API is explained in Chapter 2, "Palm OS Communications" of "Developing Palm OS Applications, Part III."

Note: Avoid using functions from standard desktop C libraries. These will significantly slow down and enlarge your program. Many will not work at all on the device. Use functions provided by the Palm OS managers instead.

Building, Debugging, and Testing

To build your application for initial debugging and testing, you use the CodeWarrior Interactive Development Environment (IDE) to build an executable. Documentation for the CodeWarrior IDE is provided with CodeWarrior.

On the Macintosh, you can then use the PalmPilot Simulator to run the executable on a simulated Palm OS device on the Macintosh screen. You can interact with the simulated buttons, menus, or fields, and even enter Graffiti characters using the mouse. You can also use the Simulator to test your application using an automated test suite called Gremlins. Using the Simulator is discussed in detail in Chapter 2, "Using the Palm OS Simulator," of the "Palm OS Cookbook."

On both Macintosh and PC, you can use the CodeWarrior Debugger to download the application to a device connected with the Desktop computer and test it there. The CodeWarrior debugging environment is also documented in the CodeWarrior Documentation folder.

Building the Application and Running it on the Device

When you've completed building and testing the application with the Simulator, you can build a second project inside CodeWarrior that lets you run your application on the device.

This process is described in Chapter 3, "Debugging in Standalone Mode on the Device" of the Palm OS Cookbook an in Phase 20 of the tutorial.

Phase 20 of the Palm OS Tutorial provides a sample project and step-by-step instructions for setting up a project to build an executable and for downloading and running the application on the device.

Note: When using the Palm OS 1.0 SDK, developers had to create a Makefile to create an executable they could download and run on the device. This is no longer necessary; instead, developers use a project that's built with different settings.

Using Other Components of the SDK

The Palm OS has provided the following additional items in the development kit to help you come up to speed quickly:

- The Palm OS tutorial provides step-by-step examples of developing an application from start to finish in its more than twenty phases. Examples, both resources and code that is incrementally changed, are included.
- The actual source code for the four PIM applications on the PalmPilot is included as examples on your SDK CD. The code can be a valuable aid when you develop your own program. The software development kit provides a royalty-free license that permits you to use any or all of the source code from the examples in your application.
- The Palm OS net library provides basic networking capabilities, compatible with the Berkeley Sockets API. The net library is discussed in Developing Palm OS Applications, Part III.

Internal Structure of an Application

Every application running under Palm OS must have certain minimum system (not UI) resources defined to be recognized by the Palm OS system software. These required resources are created for your application by the development environment. You may find that you need additional, application-specific resources.

Resources consist of a type and an ID, where the type is a 4-byte ASCII string like 'code' and the ID is a decimal integer preceded by a pound sign.

The 'code' #1 Resource

The system creates a 'code' #1 resource for every application. This resource is the entry point for the application and is where application initialization is performed. When the Palm OS device launches an application, it starts executing at the first byte of the 'code' #1 resource. All of the application code that you provide is included in this resource as well.

Typically, some startup code provided with the Palm OS development environment is linked in with your application code. This startup code works as follows:

- The startup code performs application setup and initialization.
- The startup code calls your `main` routine.
- When your `main` routine exits, control is returned to the startup code, which performs any necessary cleanup of your application and returns control to the Palm OS system software.

The 'pref' #0 Resource

The system creates a 'pref' #0 resource for every application. This resource contains startup information necessary for launching your application. The resource includes

- Required stack size
- Dynamic heap space required

- Task priority

Note that although the 'pref' #0 resource must be present, it's mainly for future use because user-interface applications currently don't get their own stack or priority.

The 'code' #0 and 'date' #0 Resources

The 'code' #0 and 'data' #0 resources contain the required size of your global data and an image of the initialized area of that global data. When your application is launched, the system allocates a memory chunk in the dynamic heap that's big enough to hold all your globals.The 'data' #0 resource is then used to initialize those globals.

Naming Conventions

The following conventions are used throughout the Palm OS API:

- Functions start with a capital letter.
- All functions belonging to a particular manager start with a two- or three-letter prefix, such as "Ctl" for control functions or "Ftr" for functions that are part of the feature manager.
- Events and other constants start with a lowercase letter.
- Structure elements start with a lowercase letter.
- Global variables start with a capital letter.
- Typedefs start with a capital letter and end with "type" (for example, `DateFormatType`, found in `DateTime.h`).
- Macintosh ResEdit resource types usually start with a lowercase letter followed by three capital letters, for example tSTR or tTBL. (Customized Macintosh resources provided with your developer package are all uppercase, for example, MENU. Some resources, such as Talt, don't follow the conventions.)
- Members of an enumerated type start with a lowercase prefix followed by a name starting with a capital letter, as follows:

```
enum formObjects {
  frmFieldObj,
  frmControlObj,
  frmListObj,
  frmTableObj,
  frmBitmapObj,
  frmLineObj,
  frmFrameObj,
  frmRectangleObj,
  frmLabelObj,
  frmTitleObj,
  frmPopupObj,
  frmGraffitiStateObj,
  frmGadgetObj};
typedef enum formObjects FormObjectKind;
```

Basic Hardware

This section helps you understand the device for which you're developing your application.

It discusses RAM and ROM, Palm OS Modes of Operation, Palm OS Connectivity, Real-Time Clock and Timer, Palm OS Device Screen and Sound Generation, Palm OS Device Screen and Sound Generation, and Palm OS Device Reset Switch.

RAM and ROM

The 1.0 and 2.0 versions of Palm OS run on the Motorola 68328 "DragonBall" processor. The first memory card shipped with the device has 128K of pseudostatic RAM and 512K of ROM for the system software and application code. A portion of the RAM (32K) is reserved for system use and is not available for storing user data. Both the ROM and RAM are on a memory module that users can replace. The Palm OS device does not have a disk drive or PCMCIA support.

Note: The PalmPilot Professional has additional RAM for use by the network library. This memory is not for application use.

Palm OS Modes of Operation

To minimize power consumption, Palm OS dynamically switches between three different modes of operation: sleep mode, doze mode, and running mode.

- In **sleep mode**, the device looks like it's turned off: the display is blank, the digitizer is inactive, and the main clock is stopped. The only circuits still active are the real-time clock and interrupt generation circuitry.

  The device enters this mode when there is no user activity for a number of minutes or when the user presses the off button. The device comes out of sleep mode only when there is an interrupt, for example, when the user presses a button.

- In **doze mode**, the main clock is running, the device appears to be turned on, and the processor's clock is running but it's not executing instructions (that is, it's halted). When the processor receives an interrupt, it comes out of halt and starts processing the interrupt.

  The device enters this mode whenever it's on but has no user input to process.
- In **running mode**, the processor is actually executing instructions.

  The device enters this mode when it detects user input (like a tap on the screen) while in doze mode or when it detects an interrupt while in doze or sleep mode. The device stays in running mode only as long as it takes to process the user input (most likely less than a second), then it immediately re-enters doze mode.

To maximize battery life, the processor on the Palm OS device is kept out of running mode as much as possible. Any interrupt generated on the device must therefore be capable of "waking" up the processor. The processor can receive interrupts from the serial port, the hard buttons on the case, the button on the cradle, the programmable timer, the memory module slot, the real-time clock (for alarms), the low-battery detector, and any built-in peripherals such as a pager or modem.

Palm OS Connectivity

The Palm OS device uses its serial port for implementing desktop PC connectivity or other external communication. The serial communication is fully interrupt-driven for receiving data. Currently, interrupt-driven transmission of data is not implemented in software, but the hardware does support it. Five external signals are used for this communication:

- SG (signal ground)
- TxD (transmit data)
- RxD (receive data)
- CTS (clear to send)
- RTS (request to send)

The Palm OS device has an external connector that provides:

- Five serial communication signals
- General-purpose output
- General-purpose input
- Cradle button input

Real-Time Clock and Timer

The Palm OS device has a real-time clock and programmable timer as part of the 68328 processor. The real-time clock maintains the current time even when the system is in sleep mode (turned off). It's capable of generating an interrupt to wake the device when an alarm is set by the user. The programmable timer is used to generate the system tick count interrupts (100 times/second) while the processor is in doze or running mode. The system tick interrupts are required for periodic activity such as polling the digitizer for user input, key debouncing, etc.

The Palm OS device has one memory module socket for installing modules that may contain ROM or RAM storage.

Palm OS Device Screen and Sound Generation

The first version of the Palm OS device has an LCD screen of 160x160 pixels. The LCD controller built into the 68328 maps a portion of system memory to the LCD. Currently, the software only supports 1 bit/pixel monochrome graphics, although the controller can support 2 bits/pixel gray scale.

The Palm OS device has a built-in digitizer overlaid onto the LCD screen and extending about an inch below the screen. This digitizer is capable of sampling accurately to within 0.35 mm (.0138 in) with up to 50 accurate points/second. When the device is in doze mode, an interrupt is generated when the pen is first brought down on the screen. After a pen down is detected, the system software polls the pen location periodically (every 20 ms) until the pen is again raised.

The Palm OS device has primitive sound generation. A square wave is generated directly from the 68328's PWM circuitry. There is frequency and duration control but no volume control.

Palm OS Device Reset Switch

Any reset is normally performed by sticking a bent-open paper clip or a large embroidery needle into the small hole in the back of the Pilot. This hole, known as the "reset switch" is in the middle of the serial number sticker. Depending on additional keys held down, the reset behavior varies, as follows:

Soft Reset

A soft reset clears all of the dynamic heap (Heap 0, Card 0). The storage heaps remain untouched. The operating system restarts from scratch with a new stack, new global variables, restarted drivers, and a reset comm port. All applications on the device receive a `SysAppLaunchCmdReset` message.

Soft Reset + Up Arrow

Holding the up-arrow down while pressing the reset switch with a paper clip causes the same soft reset logic with the following two exceptions:

- The `SysAppLaunchCmdReset` message is not sent to applications. This is useful if there is an application on the device that crashes upon receiving this message (not uncommon) and therefore prevents the system from booting.
- The OS won't load any system patches during startup. This is useful if you have to delete or replace a system patch database. If the system patches are loaded and therefore open, the cannot be replaced or deleted from the system.

Hard Reset

A hard reset is performed by pressing the reset switch with a paper clip while holding down the power key. This has all the effects of the soft reset. In addition, the storage heaps are erased. As a result, all programs, data, patches, user information, etc. are lost. A confirmation message is displayed asking the user to confirm the deletion of all data.

The `SysAppLaunchCmdReset` message is sent to the applications at this time. If the user selected the "Delete all data" option, the digitizer calibration screen comes up first. The default databases for the four main applications is copied out of the ROM.

If you hold down the up arrow key when the "Delete all data" message is displayed, and then press the other four application buttons while still holding the up arrow key, the system is booted without reading the default databases for the four main applications out of ROM.

Different Palm OS Devices

In spring 1997, two new Palm OS devices became available. As a result, there are now 3 devices:

- Palm OS 1.0 device (Pilot 1000 and Pilot 5000)
- Palm OS 2.0 device (PalmPilot and PalmPilot Professional)

This section summarizes migrating to Palm OS 2.0 by discussing Running 1.0 Applications on the 2.0 Device, Compiling 1.0 Applications With Palm OS 2.0, Using Palm OS 2.0 Features, and Retrieving the System Version Number.

Caution: The sample PIM applications (Date Book, Address Book, Memo Pad, To Do List) do not have OS version checking code in them because they are normally built into a 2.0 ROM and the check is unnecessary.
Compiling these samples and running them on a 1.0 device will cause the device to crash, but will not cause the loss of any data.

Running 1.0 Applications on the 2.0 Device

As a rule, all Palm OS applications developed with the Palm OS 1.0 SDK should run error-free on a 2.0 device. There are two possible pitfalls:

- **fldChangedEvent Change—**The operating system now correctly sends a `fldChangedEvent` whenever a field object is changed. Previously, the event was at times not sent, especially when a `fldSetText` operation was performed. If your application doesn't catch the events that are now sent, it may have problems.
- **Non-standard tools—**If your application was not developed with Metrowerks Code Warrior for Pilot, it may run into problems. One know problem can occur if the application:
  – was compiled with optimization turned on
  – uses system preferences

Compiling 1.0 Applications With Palm OS 2.0

If you want to compile your 1.0 application under 2.0, you need to be aware of a number of functions with a changed API. For any of these functions, the old function still exists with a V10 ("v one zero") suffix.

You can choose one of two options:

- Change the function name to keep using the old API. Your 1.0 application will then run error free on a 2.0 device.
- Update your application to use the new API. The application will then run error free and have access to some new functionality.

Using Palm OS 2.0 Features

Because Palm OS applications can now run on different operating system versions (on the different devices), it's important your application checks that the functionality it uses is actually supported. Most notably:

- All applications that use 2.0 features need to run on a Palm OS device version 2.0 (PalmPilot or PalmPilot Professional). They won't run on a Palm OS 1.0 device.
- All applications that use the network library can only run on a PalmPilot Professional system.

Running 2.0 Applications on a 1.0 Device

If you're writing an application under Palm OS that doesn't use any of the new features in 2.0, that application can run on a 1.0 device without any further modification. 2.0 applications are fully data-compatible with 1.0 applications.

Retrieving the System Version Number

To retrieve the system version number, call:

```
FtrGet(sysFtrCreator, sysFtrNumROMVersion);
```

The system returns:

- 0x01003001 for the 1.0 device
- 0x02003000 for both PalmPilot 2.0 and PalmPilot Professional

A more detailed discussion of version checking is in Chapter 1 of the Palm OS Cookbook.

2

Application Control Flow

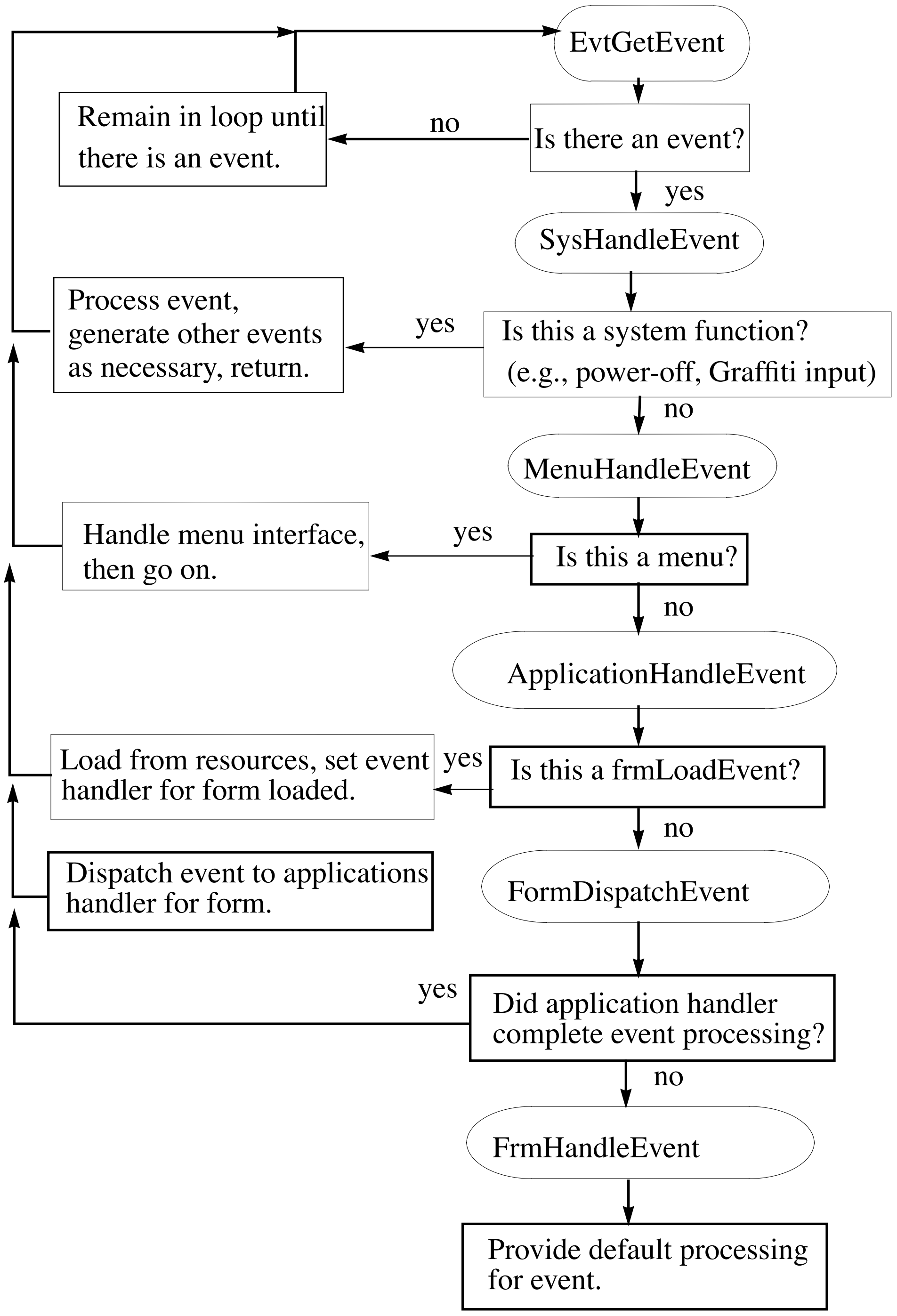
Palm OS applications are generally single-threaded, event-driven programs. They may use predefined UI elements (sometimes referred to as UI objects) or they may create their own UI elements. All applications must use the memory and data management facilities provided by the system and must be considerate of the system and other applications by periodically allowing system event handlers access to the event flow.

The flow of control in Palm OS is driven by two different mechanisms, discussed in some detail in this chapter:

- How Events Control an Application discusses the event manager, the main interface between the Palm OS system software and an application. It discusses in some detail what an application does in response to user input, providing code fragments as examples where needed.
- How Launch Codes Control an Application discusses how an application handles requests for immediate action at its top level (`PilotMain`). For example, there are launch codes for launching an application, for telling an application to search its data for a text string, and for notifying an application that data has been synchronized. Using launch codes, an application can request information or actions from another application.

Figure 2.1 illustrates control flow in a typical application.

Figure 2.1 Control Flow in a Typical Application


EvtGetEvent
Is there an event?
no
Remain in loop until there is an event.
yes
SysHandleEvent
Is this a system function? (e.g., power-off, Graffiti input)
yes
Process event, generate other events as necessary, return.
no
MenuHandleEvent
Is this a menu?
yes
Handle menu interface, then go on.
no
ApplicationHandleEvent
Is this a frmLoadEvent?
yes
Load from resources, set event handler for form loaded.
no
FormDispatchEvent
Dispatch event to applications handler for form.
Did application handler complete event processing?
yes
no
FrmHandleEvent
Provide default processing for event.

How Events Control an Application

This section starts with a high-level overview of the stages of a Palm OS application, then provides more information on the event loop.

Note that each event is discussed in some detail in Chapter 6, "Palm OS Events." The event flow for each User Interface resource is discussed in Chapter 3, "Palm OS User Interface Resources." The event flow for each User Interface object is discussed in Chapter 4, "Palm OS User Interface Objects."

Basic Application Stages

When an application receives the launch code `sysAppLauchCommandNormalLaunch` (see How Launch Codes Control an Application), it begins with a startup routine, then goes into an event loop, and finally exits with a stop routine.

- The Startup Routine is the application's opportunity to perform actions that need to happen once, and only once, at startup. A typical startup routine opens databases, reads saved state information (such as UI preferences), and initializes the application's global data.
- The Event Loop fetches events from the queue and dispatches them, taking advantage of default system functionality as appropriate.
- The Stop Routine provides an opportunity for the application to perform cleanup activities before exiting. Typical activities include closing databases and saving state information.

The following sections look at each of the stages in some detail. Note that for each phase, Palm OS provides a default behavior that can help you keep application code to a minimum. If your application has special requirements, your application may instead handle the bulk of the work itself.

The Startup Routine

During the startup routine, your application should perform these actions:

1. Get system-wide preferences (for example for numeric or date and time formats) and use them to initialize global variables that will be referenced throughout the application.
2. Find the application database by creator type. If none exists, create it and initialize it.
3. Get application-specific preferences and initialize related global variables.
4. Initialize any other global variables.

Listing 2.1 shows an example `StartApplication` function from the datebook application.

Listing 2.1 StartApplication from Datebook.c

```
static Word StartApplication (void)
{
  Word error = 0;
  Err err = 0;
  UInt mode;
  DateTimeType dateTime;
  DatebookPreferenceType prefs;
  SystemPreferencesType sysPrefs;
  Word prefsSize;

  // Determime if secret records should be displayed.
  PrefGetPreferences (&sysPrefs);
  HideSecretRecords = sysPrefs.hideSecretRecords;

  if (HideSecretRecords)
    mode = dmModeReadWrite;
  else
    mode = dmModeReadWrite | dmModeShowSecret;

  // Get the time formats from the system preferences.
  TimeFormat = sysPrefs.timeFormat;
```

```
// Get the date formats from the system preferences.
LongDateFormat = sysPrefs.longDateFormat;
ShortDateFormat = sysPrefs.dateFormat;

// Get the starting day of the week from the system preferences.
StartDayOfWeek = sysPrefs.weekStartDay;


// Get today's date.
TimSecondsToDateTime (TimGetSeconds (), &dateTime);
Date.year = dateTime.year - firstYear;
Date.month = dateTime.month;
Date.day = dateTime.day;


// Find the application's data file.  If it doesn't exist
// create it.
ApptDB = DmOpenDatabaseByTypeCreator(datebookDBType,
            sysFileCDatebook, mode);
if (! ApptDB)
  {
  error = DmCreateDatabase (0, datebookDBName, sysFileCDatebook,
            datebookDBType, false);
  if (error) return error;

  ApptDB = DmOpenDatabaseByTypeCreator(datebookDBType,
            sysFileCDatebook, mode);
  if (! ApptDB) return (1);

  error = ApptAppInfoInit (ApptDB);
  if (error) return error;
  }


// Read the preferences / saved-state information.  There is
// only one version of the DateBook preferences so don't worry
// about multiple versions.
prefsSize = sizeof (DatebookPreferenceType);
```

```
  if (PrefGetAppPreferences (sysFileCDatebook, datebookPrefID,
                             &prefs, &prefsSize,
    true) != noPreferenceFound)
    {
    DayStartHour = prefs.dayStartHour;
    DayEndHour = prefs.dayEndHour;
    AlarmPreset = prefs.alarmPreset;
    NoteFont = prefs.noteFont;
    SaveBackup = prefs.saveBackup;
    ShowTimeBars = prefs.showTimeBars;
    CompressDayView = prefs.compressDayView;
    ShowTimedAppts = prefs.showTimedAppts;
    ShowUntimedAppts = prefs.showUntimedAppts;
    ShowDailyRepeatingAppts = prefs.showDailyRepeatingAppts;
    }

  TopVisibleAppt = 0;
  CurrentRecord = noRecordSelected;


  // Laod the far call jump table.
  FarCalls.apptGetAppointments = ApptGetAppointments;
  FarCalls.apptGetRecord = ApptGetRecord;
  FarCalls.apptFindFirst = ApptFindFirst;
  FarCalls.apptNextRepeat = ApptNextRepeat;
  FarCalls.apptNewRecord = ApptNewRecord;
  FarCalls.moveEvent = MoveEvent;

  return (error);
}
```

The Event Loop

When startup is complete, the application enters an event loop. While in the loop, the application continuously checks for events on the event queue. If there are events on the queue, the application has to process them as determined in the event loop. As a rule, the events are passed on to the system, which knows how to handle them. For example, the system knows how to respond to pen taps on forms or menus.

The application typically remains in the event loop until the system tells it to shut itself down by sending an appStopEvent (not a launch code) through the event queue. The application must detect this event and terminate.

Listing 2.2 Top-Level Event Loop Example

```
static void EventLoop (void)
{
  Word error;
  EventType event;
  do
    {
    EvtGetEvent (&event, evtWaitForever);

    PreprocessEvent (&event);

    if (! SysHandleEvent (&event))

      if (! MenuHandleEvent (NULL, &event, &error))

        if (! ApplicationHandleEvent (&event))
          FrmDispatchEvent (&event);

    #if EMULATION_LEVEL != EMULATION_NONE
      ECApptDBValidate (ApptDB);
    #endif
    }
  while (event.eType != appStopEvent);
}
```

In the event loop, the application iterates through these steps (see Figure 2.1 and Listing 2.2)

1. Fetch an event from the event queue.
2. Call `PreprocessEvent` to allow the datebook event handler to see the command keys before any other event handler geta them. Some of the databook views display UI that dispappears automatically; This UI needs to be dismissed before the system event handler or the menu event handler display any UI objects.

   Note that not all applications need a `PreprocessEvent` functions. It may be appropriate to call `SysHandleEvent` right away.
3. Call `SysHandleEvent` to give the system an opportunity to handle the event.

   The system handles events like power on/ power off, Graffiti input, tapping silk-screened icons, or pressing buttons. During the call to `SysHandleEvent`, the user may also be informed about low-battery warnings or may find and search another application.

   Note that in the process of handling an event, `SysHandleEvent` may generate new events and put them on the queue. For example, the system handles Graffiti input by translating the pen events to key events. Those, in turn, are put on the event queue and are eventually handled by the application.

   `SysHandleEvent` returns `TRUE` if the event was completely handled, that is, no further processing of the event is required. The application can then pick up the next event from the queue.
4. If `SysHandleEvent` did not completely handle the event, the application calls MenuHandleEvent. `MenuHandleEvent` handles two types of events:
   – If the user has tapped in the area that invokes a menu, `MenuHandleEvent` brings up the menu.
   – If the user has tapped inside a menu to invoke a menu command, `MenuHandleEvent` removes the menu from the screen and puts the events that result from the command onto the event queue.

`MenuHandleEvent` returns `TRUE` if the event was completely handled.

5. If `MenuHandleEvent` did not completely handle the event, the application calls `ApplicationHandleEvent`, a function your application has to provide itself. `ApplicationHandleEvent` handles only the frmLoadEvent for that event; it loads and activates application form resources and sets the event handler for the active form.

6. If `ApplicationHandleEvent` did not completely handle the event, the application calls FrmDispatchEvent**.** `FrmDispatchEvent` first sends the event to the application's event handler for the active form. This is the event handler routine that was established in `ApplicationHandleEvent`. Thus the application's code is given the first opportunity to process events that pertain to the current form. The application's event handler may completely handle the event and return `TRUE` to calls from `FrmDispatchEvent.`In that case, calls `FrmDispatchEvent` returns to the application's event loop. Otherwise, calls `FrmDispatchEvent` calls `FrmDispatchEvent` to provide the system's default processing for the event.

   For example, in the process of handling an event, an application frequently has to first close the current form and then open another one, as follows:

   – The application calls FrmGotoForm to bring up another form. `FrmGotoForm` queues a frmCloseEvent for the currently active form, then queues frmLoadEvent and frmOpenEvent for the new form.

   – When the application gets the `frmCloseEvent,` it closes and erases the currently active form.

   – When the application gets the `frmLoadEvent`, it loads and then activates the new form. Normally, the form remains active until it's closed. (Note that this wouldn't work if you preload all forms, but preloading is really discouraged. Applications don't need to be concerned with the overhead of loading forms; loading is so fast that applications can do it when they need it.) The application's event handler for the new form is also established.

  – When the application gets the `frmOpenEvent`, it performs any required initialization of the form, then draws the form on the display.

After `FrmGotoForm` has been called, any further events that come through the main event loop and to `FrmDispatchEvent` are dispatched to the event handler for the form that's currently active. For each dialog box or form, the event handler knows how it should respond to events, for example, it may open, close, highlight, or perform other actions in response to the event. FrmHandleEvent invokes this default UI functionality.

After the system has done all it can to handle the event for the specified form, the application finally calls the active form's own event handling function. For example, in the datebook application, it may call `DayViewHandleEvent` or `WeekViewHandleEvent`.

Notice how the event flow allows your application to rely on system functionality as much as it wants. If your application wants to know whether a button is pressed, it has only to wait for ctlSelectEvent. All the details of the event queue are handled by the system.

Some events are actually requests for the application to do something, for example, frmOpenEvent. Typically, all the application does is draw its own interface, using the functions provided by the system, and then waits for events it can handle to arrive from the queue.

Only the active form should process events.

The Stop Routine

In the stop routine, an application should first flush all active records, then close the application's database, and finally save those aspects of the current state needed for startup. Listing 2.3 is an example of a `StopApplication` routine from `Datebook.c`.

Listing 2.3 Example of StopApplication Routine

```
static void StopApplication (void)
{
  DatebookPreferenceType prefs;

  // Write the preferences / saved-state information.
  prefs.noteFont = NoteFont;
  prefs.dayStartHour = DayStartHour;
  prefs.dayEndHour = DayEndHour;
  prefs.alarmPreset = AlarmPreset;
  prefs.saveBackup = SaveBackup;
  prefs.showTimeBars = ShowTimeBars;
  prefs.compressDayView = CompressDayView;
  prefs.showTimedAppts = ShowTimedAppts;
  prefs.showUntimedAppts = ShowUntimedAppts;
  prefs.showDailyRepeatingAppts = ShowDailyRepeatingAppts;

  // Write the state information.
  PrefSetAppPreferences (sysFileCDatebook, datebookPrefID,
    datebookVersionNum, &prefs, sizeof (DatebookPreferenceType),
    true);

  // Send a frmSave event to all the open forms.
  FrmSaveAllForms ();

  // Close all the open forms.
  FrmCloseAllForms ();

  // Close the application's data file.
  DmCloseDatabase (ApptDB);
}
```

How Launch Codes Control an Application

Launch codes allow direct communication between the system and an application and between two applications. This direct communication takes precedence over any events on an application's queue.

- **The system** uses launch codes to ask an application to do something, interrupting other activities if necessary. Examples include launch codes for launching an application, initializing databases, or resetting after the user performs a hard reset.

  Global find is a frequently used launch code that illustrates the usefulness of launch codes. It allows users to search all databases for a certain record, such as a name. In this case, it would be very wasteful to do a full launch—including the user interface—of each application only to access the application's databases in search of that item. Using a launch code avoids this overhead.

- **An application** can use a launch code to request that another application perform an action or modify its data. For example, a data collection application could instruct an email application to queue up a particular message to be sent.

Launch codes can be sent from the system's top level or from another application's thread. Isn most cases, an application's global variables are not available. Launch codes are delivered to an application at its highest level (through the `PilotMain` function). Each launch code may be accompanied by a Parameter Block which may in turn contain one or more Launch Flags. The parameter block is specifi to the launch code, while the launch flags can be sent with any launch code.

Note: Static local variables are stored with the global variables on the system's dynamic heap. They are not accessible while executing launch codes other than normal launch.

Parameter Block

Many launch codes are accompanied by a parameter block. A parameter block is a pointer to a structure that contains several parameters. These parameters contain information necessary to handle the associated launch code.

Launch Flags

Launch flags provide some additional information on what exactly an application should do when it receives a launch code.

- If an application sends a launch code to another application, it should always set the launch flags to zero.
- The system sometimes uses flags with a launch code to indicate how the application should behave. For example, a flag could be used to specify whether the UI should be displayed or not.

Note that even if an application has decided to handle a certain launch code, it can still decide not to handle the associated launch flags.

See More About Launch Flags for additional information.

Launch Code Example

An application needs to checks for launch codes in its main function. Listing 2.4 shows **parts of** PilotMain from the datebook application as an example. To see the complete example, go to Palm OS `SDK: Examples:Datebook:Datebook.c`.

Listing 2.4 Code Fragment Checking for Launch Codes

```
static DWord DBPilotMain (Word cmd, Ptr cmdPBP, Word launchFlags)
{
  Word error;
  Boolean launched;

  // This app makes use of PalmOS 2.0 features.It will crash if
  // run on an earlier version of PalmOS. Detect and warn if this
  // happens, then exit.
  error = RomVersionCompatible (version20, launchFlags);
  if (error)
    return error;

  // Launch code sent by the launcher or the datebook button.
  if (cmd == sysAppLaunchCmdNormalLaunch)
    {
    error = StartApplication ();
    if (error) return (error);

    FrmGotoForm (DayView);
    EventLoop ();
    StopApplication ();
    }


  // Launch code sent by text search.
  else if (cmd == sysAppLaunchCmdFind)
    {
    Search ((FindParamsPtr)cmdPBP);
    }
  // This launch code might be sent to the app when it's already
  // running if the use hits the "Go To" button in the Find
  // Results dialog box.
  else if (cmd == sysAppLaunchCmdGoTo)
    {
    launched = launchFlags & sysAppLaunchFlagNewGlobals;
    if (launched)
      {
      error = StartApplication ();
      if (error) return (error);

      GoToItem ((GoToParamsPtr) cmdPBP, launched);

      EventLoop ();
      StopApplication ();
      }
    else
      GoToItem ((GoToParamsPtr) cmdPBP, launched);
    }

  // Launch code sent by sync application to notify the datebook
  // application that its database was been synced.
  // ...
  // Launch code sent by Alarm Manager to notify the datebook
  // application that an alarm has triggered.
  // ...
  // Launch code sent by Alarm Manager to notify the datebook
  // application that is should display its alarm dialog.
  // ...
  // Launch code sent when the system time is changed.
  // ...
  // Launch code sent after the system is reset. We use this time
  // to create our default database if this is a hard reset
  // ...
  // Launch code sent by the DesktopLink server when it create
  // a new database.  We will initializes the new database.
  return (0);
}
```

Summary of all Launch Codes

The following table lists all Palm OS standard launch codes in alphabetical order. More detailed information is provided immediately after the table (you can also click on the links to access it).

Table 2.1 Palm OS Launch Codes

Code	Request
sysAppLaunchCmdAlarmTriggered	Schedule next alarm or perform quick actions such as sounding alarm tones.
sysAppLaunchCmdCountryChange	Respond to country change.
sysAppLaunchCmdDisplayAlarm	Display specified alarm dialog or perform time-consuming alarm-related actions.
sysAppLaunchCmdFind	Find a text string.
sysAppLaunchCmdGoto	Go to a particular record, display it, and optionally select the specified text.
sysAppLaunchCmdInitDatabase	Initialize database.
sysAppLaunchCmdLookup	Look up data. In contrast to `sysAppLaunchCmdFind`, a level of indirection is implied. For example, look up a phone number associated with a name.
`sysAppLaunchCmdNormalLaunch`	Launch normally.
sysAppLaunchCmdPanelCalledFromApp	Tell preferences panel that it was invoked from an application, not the Preferences application.
sysAppLaunchCmdReturnFromPanel	Tell an application that it's restarting after preferences panel had been called.
sysAppLaunchCmdSaveData	Save data. Often sent before find operations.

Table 2.1 Palm OS Launch Codes

Code	Request
sysAppLaunchCmdSyncNotify	Notify applications that a HotSync has been completed.
sysAppLaunchCmdSystemLock	Sent to the Security application to request that the system be locked down.
sysAppLaunchCmdSystemReset	Respond to system reset. No UI is allowed during this launch code.
sysAppLaunchCmdSystemTimeChange	Respond to system time change.

More About Launch Codes

This section provides supplemental information about launch codes. For some launch codes, it lists the parameter block, which in some cases provides additional information about the launch code.

The section discusses all launch codes in alphabetical order. For a listing, see Table 2.1.

sysAppLaunchCmdAlarmTriggered

Perform quick action such as scheduling next alarm or sounding alarm.

Impact on Application

This launch code is sent as close to the actual alarm time as possible. An application may perform any quick, non-blocking action at this time. An opportunity to perform more time-consuming actions will come when sysAppLaunchCmdDisplayAlarm is sent.

sysAppLaunchCmdCountryChange

Respond to country change.

Impact on Application

Applications should change the display of numbers to use the proper number separators. To do this, call LocGetNumberSeparators, `StrLocalizeNumber`, and `StrDelocalizeNumber`.

sysAppLaunchCmdDisplayAlarm

Perform full, possibly blocking, handling of alarm.

Impact on Application

This is the application's opportunity to handle an alarm in a lengthy or blocking fashion. Notification dialogs are usually displayed when this launch code is received. This work should be done here, not when sysAppLaunchCmdAlarmTriggered is received. Multiple alarms may be pending at the same time for multiple applications, and one alarm display shouldn't block the system and prevent other applications from receiving their alarms in a timely fashion.

sysAppLaunchCmdFind

This launch command is used to implement the global find. It is sent by the system whenever the user enters a text string in a Find dialog. At that time, the system queries each application whether it handles this launch code and returns any records matching the find request.

The system, sends this launch code with the `FindParamsType` parameter block to each application. The system displays the results of the query in the Find dialog.

Impact on Application

Most applications that use text records should support this launch code. When they receive it, they should search all records for matches to the find string and return all matches.

An application can also integrate the find operation in its own user interface and send the launch code to a particular application.

Applications that support this launch code should support `sysAppLaunchCmdSaveData` and `sysAppLaunchCmdGoto` as well. See Phase 14 of the tutorial for an example.

sysAppLaunchCmdFind Parameter Block

Prototype

```
typedef struct {

// These fields are used by the applications.
  Word               dbAccesMode;
  Word               recordNum;
  Boolean            more;
  Char               strAsTyped [maxFindStrLen+1];
  Char               strToFind [maxFindStrLen+1];
// These fields are private to the Find routine
//and should NOT be accessed by applications.
  Word               numMatches;
  Word                 lineNumber;
  Boolean              continuation;
  Boolean              searchedCaller;
  LocalID              callerAppDbID;
  Word                 callerAppCardNo;
  LocalID              appDbID;
  Word                 appCardNo;
  Boolean              newSearch;
  DmSearchStateType    searchState;
  FindMatchType        match [maxFinds];
} FindParamsType;
```

Fields

`dbAccessMode`	Read mode. May be "show secret."
`recordNum`	Index of last record that contained a match.
`more`	`TRUE` if more matches to display.
`strAsTyped [maxFindStrLen+1]`	Search string as entered.
`strToFind [maxFindStrLen+1]`	Search string in lower case.
`numMatches`	System use only.
`lineNumber`	System use only.

`continuation`	System use only.
`searchedCaller`	System use only.
`callerAppDbID`	System use only.
`callerAppCardNo`	System use only.
`appDbID`	System use only.
`appCardNo`	System use only.
`newSearch`	System use only.
`searchState`	System use only.
`match [maxFinds]`	System use only.

sysAppLaunchCmdGoto

Sent in conjunction with `sysAppLaunchCmdFind` to allow users to actually inspect the record that the global find returned.

Impact on Application

Applications should do most of the normal launch actions, then display the requested item. The applications should continue running unless explicitly closed.

sysAppLaunchCmdGoto Parameter Block

Prototype

```
typedef struct {
  Word     searchStrLen;
  Word     dbCardNo;
  LocalID  dbID;
  Word     recordNum;
  Word     matchPos;
  Word     matchFieldNum;
  DWord    matchCustom;
  } GoToParamsType;
```

Fields

`searchStrLen`	Length of search string.
`dbCardNo`	Card number of the database.
`dbID`	Local ID of the database.
`recordNum`	Index of record containing a match.
`matchPos`	Position in record of the match.
`matchFieldNum`	Field number string was found in.
`matchCustom`	Application-specific information.

sysAppLaunchCmdInitDatabase

This launch code is sent by the Desktop Link server in response to a request to create a database. It is sent to the application whose creator ID matches that of the requested database.

The most frequent occurrence of this is when a 'data' database is being installed or restored from the desktop. In this case, HotSync creates a new database on the device and passes it to the application via a `sysAppLaunchCmdInitDatabase` command, so that the application can perform any required initialization. HotSync will then transfer the records from the desktop database to the device database.

When a PalmPilot application crashes while a database is installed using HotSync, the reason may be that the application is not handling the `sysAppLaunchCmdInitDatabase` command properly. Be especially careful not to access global variables.

Impact on Application

The system will create a database and pass it to the application for initialization. The application must perform any initialization required, then pass the database back to the system, unclosed.

sysAppLaunchCmdInitDatabase Parameter Block

Prototype

```
typedef struct {
   DmOpenRef  dbP;
   ULong      creator;
   ULong      type;
   UInt       version;
   } SysAppLaunchCmdInitDatabaseType;
```

Fields

`dbP`	Database reference.
`creator`	Database creator.
`type`	Database type.
`version`	Database version.

sysAppLaunchCmdLookup

The system or an application sends this launch command to retrieve information from another application. In contrast to Find, there is a level of indirection; for example, this launch code could be used to retrieve the phone number based on input of a name.

This functionality is currently supported by the standard PalmPilot Address Book.

Impact on Application

Applications that decide to handle this launch code must search their database for the string the user entered and perform the match operation specified in the launch code's parameter block.

If an application wants to allow its users to perform lookup in other applications, it has to send it properly, including all information necessary to perform the match. An example for this is in `Address.c` and `AppLaunchCmd.h` which are included in your SDK.

Parameter Block

The parameter block is defined by the application that supports this launch code. See `AppLaunchCmd.h` for an example.

sysAppLaunchCmdPanelCalledFromApp

`sysAppLaunchCmdPanelCalledFromApp` and sysAppLaunchCmdReturnFromPanel allow an application to let users change preferences without switching to the Preferences application. For example, for the calculator, you may launch the Formats preferences panel, set up a number format preference, then directly return to the calculator that then uses the new format.

`sysAppLaunchCmdPanelCalledFromApp` lets a preferences panel know whether it was switched to from the Preferences application or whether an application invoked it to make a change. The panel may be a preference panel owned by the application or a system preferences panel.

Examples of these system panels that may handle this launch code are:

- Network panel (called from network applications)
- Modem panel (called if modem selection is necessary)

Impact on Application

All preferences panels must handle this launch code. If a panel is launched with this command, it should:

- Display a Done button.
- NOT display the panel-switching pop-up trigger used for navigation within the preferences application.

sysAppLaunchCmdReturnFromPanel

This launch code is used in conjunction with sysAppLaunchCmdPanelCalledFromApp. It informs an application that the user is done with a called preferences panel. The system passes this launch code to the application when a previously-called preferences panel exists.

sysAppLaunchCmdSaveData

Instructs the application to save all current data. For example, before the system performs a Find operation, an application should save all data.

Impact on Application

Any application that supports the Find command and that can have buffered data should support this launch code. Generally, an application only has to respond if it's the currently running application. In that case, all buffered data should be saved when the launch code is received.

sysAppLaunchCmdSaveData Parameter Block

Prototype

```
typedef struct {
   Boolean  uiComing;
   } SysAppLaunchCmdSaveDataType;
```

Fields

`uiComing`	`TRUE` if system dialog is displayed before launch code arrives.

sysAppLaunchCmdSyncNotify

This launch code is sent to applications to inform them that a HotSync has occurred.

sysAppLaunchCmdSystemLock

Launch code sent to the system-internal security application to lock the device.

Impact on Application

As a rule, applications don't need to do respond to this launch code. If an application replaces the system-internal security application, it must handle this launch code.

sysAppLaunchCmdSystemReset

Launch code to respond to system soft or hard reset.

Impact on Application

Applications can respond to this launch code by performing initialization, indexing, or other setup that they need to do when the system is reset. For more information about resetting the device, see the Palm OS Cookbook.

sysAppLaunchCmdSystemReset Parameter Block

Prototype

```
typedef struct {
   Boolean hardReset;
   Boolean createDefaultDB;
   } SysAppLaunchCmdSystemResetType;
```

Fields

`hardReset`	`TRUE` if system was `hardReset.` `FALSE` if system was `softReset`.
`createDefaultDB`	If `TRUE`, application has to create default database.

sysAppLaunchCmdSystemTimeChange

Launch code to respond to a time change initiated by the user.

Impact on Application

Applications that are dependent on the current time or date need to respond to this launch code. For example, an application that sets alarms may want to cancel an alarm or set a different one if the system time changes.

More About Launch Flags

When an application is launched with any launch command, it also is passed a set of launch flags.

An application may decide not to handle the flags even if it handles the launch code itself. For applications that decide to include this launch code, the following table provides additional information:

Flag	Functionality
sysAppLaunchFlagNewThread	Creates a new thread for the application. Implies sysAppLaunchFlagNewStack.
sysAppLaunchFlagNewStack	Creates a separate stack for the application.
sysAppLaunchFlagNewGlobals	Creates a new globals world for the application. Implies new owner ID for memory chunks.
sysAppLaunchFlagUIApp	Notifies launch routine that this is a UI application being launched.
sysAppLaunchFlagSubCal	Notifies launch routine that the application is calling its entry point as a subroutine call. This tells the launch code that it's OK to keep the A5 (globals) pointer valid through the call.

Generally, the system sends launch flags along with all launch codes. Applications should just pass 0 (zero) when sending a launch code to another application.

Responding to Launch Codes

Launch codes may be sent to any application without negative effects. However, a launch code only has an effect if the application that receives it has been programmed to handle it. An application may decide not to handle the flags even if it handles the launch code itself.

When developing your application, be sure to handle as many of the standard launch codes as possible.

When an application receives a launch code, it must first check whether it can handle this particular code. For example, only applications that have text data should respond to a launch code requesting a string search. If an application can't handle a launch code, it exits without failure. Otherwise, it performs the action immediately and returns.

Determining Status When Receiving Launch Code

If an application receives a launch code other than `sysCmdAppNormalLaunch`, it can find out whether it's the current application by checking the launch flags, which are sent to the currently running application.

If the application is the currently running application, the `sysAppLaunchFlagSubCall` flag is set. This flag is set by the system and isn't (and shouldn't be) set by the sender of a launch code.

Note that if the launch code is sent to the currently running application, the launch code handler may access the application's global variables. Only the system can access these global variables.

Predefined Launch Codes

A number of launch codes are predefined by the system for handling certain system tasks, for example,

- Notifying the application when certain system preferences like date and time have changed
- Performing global find and goto operations
- Notifying the application that its data files have been updated by a sync operation

The launch code parameter is a 16-bit word value. All launch codes with values 0–32767 are reserved for use by the system and for future enhancements. Launch codes 32768–65535 are available for private use by applications.

Creating Your Own Launch Codes

In addition to the predefined launch codes defined in Table 2.1, developers can create their own launch codes to implement specific functionality. Both the sending and the receiving application must know about and handle any developer-defined launch codes.

An example is `PhoneLookup.c`.

3

Palm OS User Interface Resources

Palm OS User Interface resources are the elements of an application's GUI (graphical user interface).

This chapter helps you work with resources by providing information about these topics:

- Using Constructor to Work With Resources gives an overview of the Constructor tool and briefly explains how to use it.
- Project Resources provides information about project resources. These resources are created by instantiating a template. Examples are menu and menu bar or string.
- Catalog Resources provides information about resources that you can instantiate by dragging them from the catalog onto a form. Examples are buttons and check boxes.
- are discussed in the "Constructor for Palm OS" manual.

Note: For more information see the following manuals:
The Palm OS Tutorial provides more detailed instruction on how to create a GUI using the Constructor tool.
TheConstructor for Palm OS manual in the CodeWarrior Documentation folder provides detailed reference-style documentation as well as information on how to use each individual resource.

The relationship between the resources and the structures provided by Palm OS is discussed in Chapter 4, "Palm OS User Interface Objects."

Using Constructor to Work With Resources

In Palm OS 2.0, developers can choose how they want to create their resources:

- Using Constructor. This chapter describes how to use Constructor to create and manipulate resources.
- Macintosh users can also use ResEdit (as under Palm OS 1.0)

Creating Resources

Constructor has a graphical interface that allows you to quickly create and view a GUI for your application. Here's an overview of how it works. For detailed information, see the "Palm OS Tutorial."

1. **Open Constructor.**

   Constructor opens a catalog window that contains all catalog resources such as buttons, check boxes, or tables. If the catalog window isn't visible, you can type Cmd-Y to display it.

2. **From the File Menu, choose New Project File or Open Project File.**

   Constructor opens the Constructor project window that lets you instantiate project resources such as forms, menus, and strings and specify project settings.

3. **In the Constructor project window, select the Forms template and type Cmd–K.**

   Constructor instantiates the form; an icon representing it appears below the template.

4. **Double-click on the form.**

   Constructor opens a Form Editor, with information about the resource (left panel) and a graphical representation (right panel).

5. **Drag the additional desired UI elements from the catalog to the Forms window**

   After you've dragged a resouce icon onto the form, the resource information becomes visible in the left panel (Layout Properties).

6. **Instantiate special resource types, such as strings or bitmaps, in the project window and associate them with the related resource.**

Changing Resources

You can make changes to any resource as follows:

- To change a project resource, double-click on that resource in the project window and change the fields in the associated editor that appears.
- To change a catalog resource, you have several choices:
  - Move any UI element in the Layout Appearance panel of the Forms window.
  - Change the values in the left (Layout Properties) panel of the Forms window.
  - Double-click the UI element and change the values in the Inspector that appears.

Project Resources

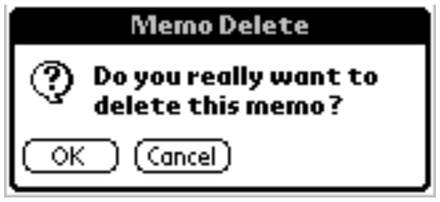
Catalog resources are available in the Catalog window and can be dragged directly on a form. All other resources, including the form itself, are instantiated from the projects window.

The following table lists all Palm OS project resources in alphabetical order by resource name. The Macintosh ResEdit resource name is include for reference only; it's not needed by developers who use Constructor exclusively, and not relevant for Windows developers.

Name	Resource	UI Name
Talt	Alerts	Alert
tFRM	Form Resource	Form
	Menu Resource	Menu
	Menu bar Resource	Menu bar
tSTR	String Resource	String
	Icons	
	Bitmaps	

Alerts

Example



Overview

The alert resource defines a modal dialog that displays a message, an icon, and one or more buttons.

A small icon indicates the category of the dialog box; for example, an exclamation mark for an error message. The icon appears on the left side of the dialog. The text is justified left but placed to the right of the dialog icon.

Type	Icon	Definition	Button	Example
Infor-mation	i	Lowest-level warning. Action shouldn't or can't be complet-ed but doesn't generate an error or risk data loss.	OK	An alarm setting must be between 1 and 99.
Confir-mation	?	Confirm an action or suggest options.	OK, Cancel	Change settings before switching applications? (For example, when pressing an application key with an open dialog box.)
Warn-ing	!	Ask if user wishes to continue a potentially dangerous action.	OK, Cancel	Are you sure you want to delete this entry?
Error	(stop sign)	Attempted action generated error and/or cannot be com-pleted.	OK	Disk full.

The Alert resource has the following attributes.

Attributes

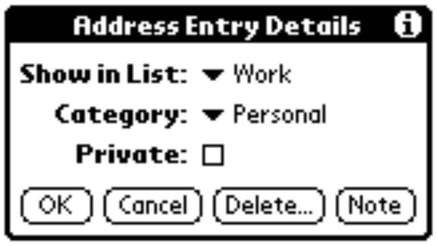
Alert Type	Determines the sound played and the icon displayed when the alert is drawn. There are four possible icons: • InformationAlert (Alert Number 0) • ConfirmationAlert (Alert Number 1) • WarningAlert (Alert Number 2) • ErrorAlert (Alert Number 3)
Help ID	The ID of a String resource that's the help text for the alert dialog box. If you provide a value, the system displays an "i" in the top right corner of the alert box.
Default Button ID	The number of a button that the system assumes is selected if the user switches to another application, forcing the form to go away without making a selection.
Title	Title of the alert form.
Message	Message displayed by the alert dialog. May contain ^1, ^2, ^3 as substitution variables for use in conjunction with FrmCustomAlert.
Button Text	Text of the button (e.g. OK or Cancel), determined by an entry in the resource of each button. To add a button, select Item Text 0, and type Cmd-K.

Form Resource

Overview A form is a container for one or more of the Catalog Resources.

Applications usually contain several different forms that the user triggers by tapping buttons or other control UI objects. Most UI objects are displayed only if they are contained within a form.

Example The example below shows a modal form. A form can also be as large as the screen.


Address Entry Details
Show in List: Work
Category: Personal
Private: ☐

Attributes

Left Origin	Window-relative position of left side of form. Valid values: 0 – 159
Top Origin	Window-relative position of top of form. Valid values: 0 – 159
Width	Width of the form in pixels. Valid values: 0 – 160
Height	Height of the form in pixels. Valid values: 1– 160
Usable	Not currently supported for forms.
Modal	If checked, form is modal. Modal forms ignore pen events outside their boundaries. Used for dialogs.
Save Behind	If checked, the region obscured by the form is saved when it's drawn and restored when it's erased. Used for dialogs.

Form ID	Form ID assigned by Constructor.
Help ID	ID number of a string that's displayed when the user taps the "i" icon. The system adds the icon to the form when you provide a value for this property. Currently, only modal dialogs have help resources.
Menu Bar ID	Contains the ID of a menu bar resource to be associated with this forms.
Default Button ID	Number of a button that the system assumes is selected if the user switches to another application, forcing the form to go away without making a selection.
Form Title	Title of that form. Use titles for dialogs, menu bars for views. By convention, the name of the application and the name of the screen, if possible, for example Address List or Address Edit. The title must be one line; it uses about 13 pixels of the top of the form.
Palm OS Version	Version of the device for which this form is created.

Comments

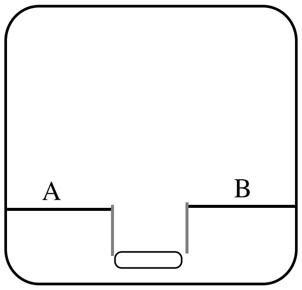
The total display on the PalmPilot device is 160 pixels by 160 pixels. If you want your whole form to be seen, make sure it fits within this display area. For pop-up dialogs, you can make the form smaller. Align a popup dialog with the bottom of the screen.

A form is the GUI area for each view of your application. For example the Address Book offers an Address List view, Address Edit view, and so on. Each application has to have one form, and most applications have more than one. To actually create the view, you have to add other UI elements to the form; either by dragging them onto the form from the catalog or by providing their ID as the value of some of the form's fields.

Here are some general design guidelines:

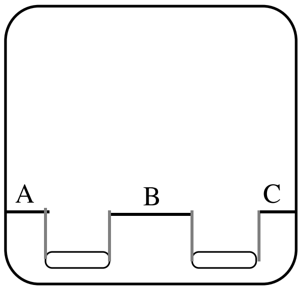
- Each form should have a title that displays the name or view of the application, or both.
- Scroll bars in fields and tables appear and disappear dynamically if you've selected that option for that UI element. Place them to the right of command buttons.
- Modal dialogs always occupy the full width of the screen and are justified to the bottom of the screen. They hide the command buttons of the base application but don't obscure the title bar of the base application if possible. There should be a minimum of three pixels between the top of the modal dialog title bar and the bottom of the application title bar. If the dialog is too large to accommodate this, the entire application title bar should be obscured.
- Screen command buttons should always be at the bottom of the screen.
- Dialog command buttons appear four pixels above the bottom of the dialog box frame. Two-pixel default ring is three pixels above the bottom, and the baseline of the text within the buttons should be aligned.
- Command buttons should be centered so that the spaces between the buttons are twice the width of the spaces between the edges and the border (see diagram below).

  If possible, all buttons should be the same width. At a minimum, they should be spaced equidistant, as illustrated below.



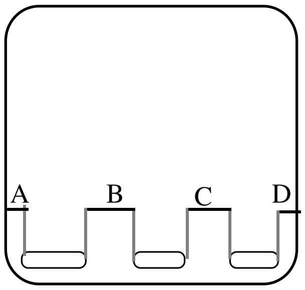
One button

Distance A = B



Two buttons

Distance B = 2 x A = 2 x C



Three buttons

Distance B = C = 2 x A = 2 x D

Event Flow

When a form is opened, a frmOpenEvent is triggered and the form's ID is stored. A winEnterEvent is triggered whenever a form is opened, and a winExitEvent is triggered whenever a form is closed.

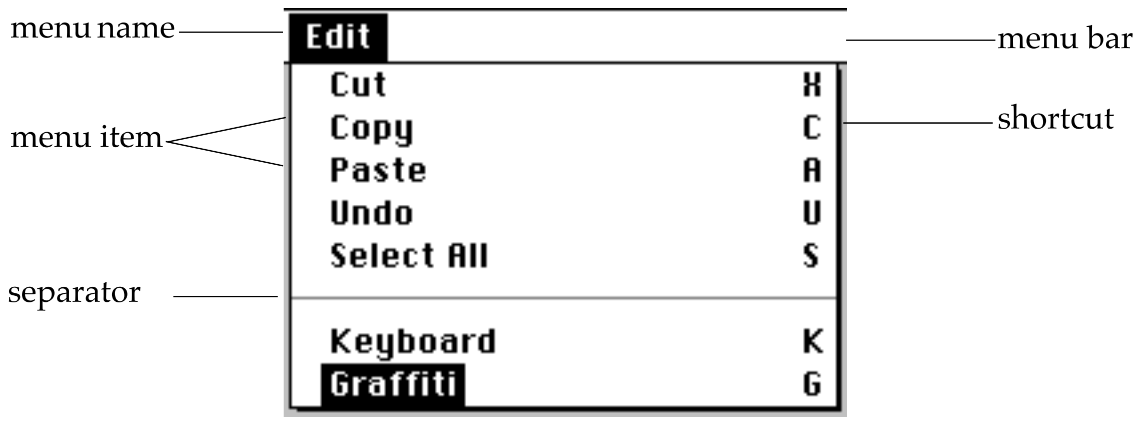
String Resource

Name	Strings
Overview	Stores data strings used by the program. String resources may be entered as text strings or as a series of hexadecimal characters.
Attributes	String — The text string to be stored, in decimal ASCII.
Comments	The string resource uses either the string or data. If both are entered, they are concatenated.

Menus and Menu Bars

This section first provides a Menu Overview, then steps you through Creating a Menu. This is followed by a discussion of the two resources: Menu Bar and Menu Resources. Finally, you learn about Menu User Interaction and Event Flow for Menu Resource.

Menu Overview



A menu assembly consists of a menu bar, menu names indicating the available menus, and the menus themselves with their commands:

- **Menu bar**. The menu bar at the top of the screen contains the names of the available menus. Each application has different sets of menu names; within an application, different views may have different menus.
- **Menu name**. Each menu is displayed below the menu name. The following menu names are commonly found:
  - Record—Place Record to the left of Edit (if applicable).
  - Edit—Screens that allow editing need an Edit menu. Note, however, that most editing is edit-in-place.
  - Options—Typically, the last menu. The About command, which provides version and creator information, should always be an Options command under Palm OS.
- **Menu**. The menus themselves consist of menu items and optional shortcuts. Under Palm OS, menu items should **not** duplicate functionality available via command buttons. Menus justify left with the active heading of the menu name when invoked. If the menu doesn't fit, it's justified to the right border of the screen.

Note: For each menu, provide shortcuts for all commands or for none at all. Don't assign the same shortcut twice within one application.

Creating a Menu

In Palm OS 2.0, you can interactively create the menu bar and all menus, then associate the menu bar with the form.

To create a menu assembly using Constructor, follow these steps:

1. **In the project window, select Menu Bars, then type Cmd–K.**

   Constructor creates a menu bar instance.

2. **Name the Menu Bar instance, then double-click on it.**

   Constructor opens the Menu Editor.

3. **Back in the project window, create one or more Menus, name them, and drag them onto the Menu Editor.**
4. **For each menu, replace the "untitled" default text with the menu name, such as Edit or File.**
5. **Type Cmd–K to add menu items, Cmd– (minus) to add separators to the menu.**
6. **To assign a shortcut key, you can do one of the following:**
   - Tab from the menu item to the shortcut region in the menu editor, then enter the shortcut letter.
   - Type Cmd-I and enter the shortcut in the property inspector that appears.

   The system will later add the shortcut symbol before the character.
7. **When you're finished with the assembly, close the window.**
8. **Finally, enter the ID of the menu bar you created into the Menu Bar ID property of a form.**

Note: The Palm OS Tutorial provides more detailed step-by-step instructions for creating a menu.

Menu Bar and Menu Resources

The only information provided for the menu and menu bar resource is the resource name and resource ID.

Menu User Interaction

- **Default Menu and Menu Item.** A pen-up on the menu icon displays the menu bar. The first time a menu is invoked after an application is launched, no menus are displayed unless there is only one menu available. Afterwards the menu and menu item of the last command executed from the menu are displayed. Graffiti command equivalents are ignored.

  For example, if the user selects Edit > Copy, the Edit menu is popped down and the Copy command is highlighted the next time the menu bar is displayed. This expedites execution of commonly used commands or of grouped commands (e.g., Copy/

Paste). The last menu heading is not saved if the user switches to a different view or a different application.

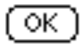
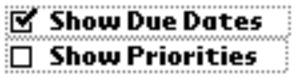
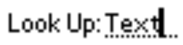
- **View-specific Menus.** Each view within an application can have a unique menu, that is, different menu headings and items.
- **Menu Display.** As a rule, a Palm OS application should try to have the menu visible on screen as rarely as possible:
  - After a menu command is executed, the menu bar is dismissed.
  - The menu bar is active when the menu headings in it are active. When not active, the menu bar is not visible.
  - There are no grayed-out menu headings or grayed-out menu items. A command not accessible in a certain mode doesn't appear at all.
- **Size.** The vertical active area of menu headings is 2 pixels beyond the ascender and 1 pixel below a potential descender of the menu heading text. The horizontal active area covers half the distance to the next menu heading, leaving no gaps between the headings. If the menu headings aren't as wide as the menu bar, part of the menu bar may be inactive.
- **Active Area.** The entire area of the menu, excluding the border, is active. Divider lines and status items on the launcher menu are inactive; that is, they do not highlight when tapped.

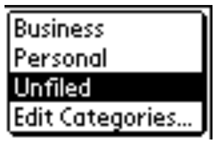
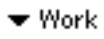
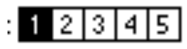
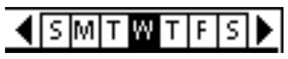
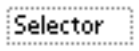
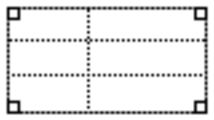
Event Flow for Menu Resource

User Action	System Response
Pen enters menu window.	winExitEvent to exit previous window. winEnterEvent to enter menu window. penDownEvent is also triggered, although the pen has not actually touched the screen.
User selects a menu item.	`WinExitEvent` to exit menu window. `WinEnterEvent` to enable the form the menu spawned. menuEvent (store ID number of the item in `EventType`). penUpEvent finally occurs.

Catalog Resources

You can add Constructor catalog resources to the user interface by dragging the corresponding icon onto a Form. The following catalog resources are available:

Name	Resource	Resource
tBTN	Button Resource	
tCBX	Check Box Resource	
tFLD	Field Resource	
tFBM	Form Bitmap Resource	(container for Bitmap resource)
tGDT	Gadget Resource	(application defined)

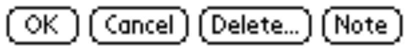
Name	Resource	Resource
tGSI	Graffiti Shift Indicator Resource	
tLBL	Label Resource	(container for a String)
tLST	List Resource	
tPUT	Popup Trigger Resource	
tPBN	Push Button Resource	
tREP	Repeating Button Resource	
	Scrollbar Resource	(see below)
tSLT	Selector Trigger Resource	
tTBL	Table Resource	

Button Resource

UI Structure ControlType

Overview A button is a clickable UI object, often used to trigger events in an application. A button displays as a text label surrounded by a rectangular frame. The frame has rounded corners. The label may be regular text or a glyph from one of the symbol fonts provided with your development environment, for example, an arrow.

Examples



Attributes

Object Identifier	Name of the object. Assigned by developer and used by Constructor during header file generation and update.
Button ID	ID of the object (assigned by Constructor).
Left Origin	Form-relative position of left side of button. Valid values: 0 – 159
Top Origin	Form-relative position of top of object. Valid values: 0 - 159
Width	Width of button in pixels. Size the buttons to allow 3–6 pixels of white space at each end of the label. Valid values: 0 – 160
Height	Height of the button in pixels. Should be 3 pixels larger than the font size, for example, height = 12 for 9-point labels. Valid values: 1 – 160

Usable	A nonusable object is not considered part of the application's interface and doesn't draw. Nonusable objects can programmatically be set to usable. If checked, the object is usable.
Anchor Left	Controls how the object resizes itself when its text label is changed. If checked, the left bound of the object is fixed; if unchecked, the right bound is fixed.
Frame	If checked, a rectangular frame with rounded corners is drawn around the button. Most buttons have frames. Buttons whose labels are single symbol characters, such as scroll buttons, don't have frames.
Non-bold Frame	If checked, a one-pixel-wide rectangular frame with rounded corners is drawn around the button. If unchecked, a bold frame (two pixels wide) is drawn around the button. Non-bold frames are the default.
Font	Font used to draw the text label of the button. Choose from the pop-up menu to select one of the 2.0 fonts.
Label	Text displayed inside the button: one line of text, or a single character from a symbol font to create an increment arrow. ??Symbol 7 only??

Comments

The label is centered in the button. If the label text is wider than the button, the whole label is centered and both the right and left sides are clipped.

Place command buttons at the bottom of table views and dialog boxes. Leave three pixels between the dialog bottom and buttons.

Increment arrows are a special case; they are buttons that let users increment the value displayed in a data field.

To create an increment arrow, use an arrow character from the Symbol font as a label. Several arrow styles and sizes are available.

Event Flow for Button Resource

User Action	System Response
Pen goes down on a button.	penDownEvent; store x and y coordinates in `EventType`. ctlEnterEvent; store button ID number in `EventType`.
Pen is lifted from button.	ctlSelectEvent; store button ID number in `EventType`. `ctlSelectEvent` can be triggered only if a `ctlEnterEvent` with the same button ID has just occurred. penUpEvent; store x and y coordinates in `EventType`.
Pen is lifted outside button.	Nothing happens.

Tip **Making a Button with a Bitmap Label**

It's not possible to make a bitmap the label of a button; the label always has to be a text string. However, the same effect can be achieved by

- Creating a bitmap the same size of a button
- Placing them at the same location.

Make sure the bitmap is a Form Bitmap, selected from the catalog.

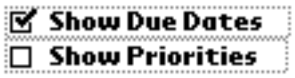
When the user selects the button, the system inverts the bitmap graphic as well.

Check Box Resource

UI Structure ControlType

Overview A check box is a small, square UI object with an optional text label to the right.

Example The figure below shows a checked and an unchecked check box with a label to the right (the default).



Attributes

Object Identifier	Name of the object. Assigned by developer and used by Constructor during header file generation and update.
Check Box ID	ID of the object (assigned by Constructor).
Left Origin	Form-relative position of left side of object. Valid values: 0 – 159
Top Origin	Form-relative position of top of object. Valid values: 0 – 159
Width	Width of the picking area around the check box. Valid values: 0 – 160
Height	Height of the picking area around the check box. Valid values: 1– 160
Usable	If this box is checked, the object is usable. A nonusable object is not considered part of the application interface and doesn’t draw. Nonusable objects can programmatically be set to usable.

Selected	Initial selection state of the checkbox. If the box is checked (the default), the checkbox is initially checked.
Group ID	Group ID of a check box that is part of an exclusive group. Ungrouped (nonexclusive) check boxes have 0 as a group ID. Valid values: 0 – 65535
Font	Font used to draw the text label of the button. Choose from the pop-up menu to select one of the 2.0 fonts.
Label	Text displayed to the right of the check box. This text is part of the activation area. To create a (non-active) label to the left of the check box, leave this attribute blank and create a separate Label resource.

Comments

Make sure that only one check box in a group is initially checked.

All check boxes are the same size. The Height and Width determine the toggle area, which is the screen area the user needs to press to check or uncheck the box.

If a label attribute is defined, it's part of the activation area.

Event Flow for Check Box Resource

User Action	System Response
Pen goes down on check box.	penDownEvent; store x and y coordinates in `EventType`. ctlEnterEvent; store check box's ID number in `EventType`. • If the check box is unchecked, a check appears. • If the check box is already checked and is grouped, there is no change in appearance. • If the check box is already checked and is ungrouped, the check disappears.
Pen is lifted from check box.	ctlSelectEvent; store check box's ID number in `EventType`, switch check box on (1) or off (0) internally. A `ctlSelectEvent` can be triggered only if a `ctlEnterEvent` with the same check box ID number has just occurred. penUpEvent; store x and y coordinates in `EventType`.
Pen is lifted outside box.	Nothing happens.

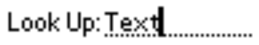
Field Resource

UI Structure `FieldType`

Overview The field UI object is for user data entry in an application. It displays one or more lines of editable text. A field can be underlined, justified left or right, and selectable or unselectable.

Text fields can be located anywhere but in menus and in the command button area.

The following is an underlined, left-justified field containing data:



Attributes

Object Identifier	Name of the object. Assigned by developer and used by Constructor during header file generation and update.
Field ID	ID of the object (assigned by Constructor).
Left Origin	Form-relative position of left side of object. Valid values: 0 – 159
Top Origin	Form-relative position of top of object. Valid values: 0 – 159
Width	Width of the object in pixels. Valid values: 0 – 160
Height	Height of the object in pixels. Valid values: 1– 160
Usable	If this box is checked, the object is usable. A nonusable object is not considered part of the application interface and doesn't draw. Nonusable objects can programmatically be set to usable.

Editable	Noneditable fields don't accept user input but can be changed programmatically. If this box is checked, the field is editable.
Underline	If set, each line of text is underlined with a gray line.
Single Line	If checked, the field doesn't scroll horizontally and doesn't accept Return or Tab characters. Only a single line of text is displayed. If the user attempts to enter text beyond this, the system beeps. Multiline text fields expand. An empty field may display one or more blank lines; for example, records in a To Do list or a text page.
Dynamic Size	If checked, the height of the field is expanded or compressed as characters are added or removed. Set this attribute to false if the Single Line attribute is set.
Left Justified	Text justification. Supported only for fields that have the Single Line attribute checked. Valid values: checked (left-justified)—recommended unchecked (right-justified)
Max characters	Maximum number of characters the field accepts. This is a limit on the number of characters a user can enter, but not on what can be displayed. All fields can display up to 32,767 characters regardless of this setting. Valid values: 0 – 32767
Font	Font used to draw the text label of the button. Choose from the pop-up menu to select one of the 2.0 fonts.

Auto-Shift	If checked, 2.0 auto-shift rules are applied. The system automatically uses an upper-case letter: • after an empty field • after a period or other sentence terminator (e.g. ? or !). • after two spaces
Has Scroll-bar	If checked, the system sends more frequent fld-HeightChangedEvents so the application can adjust the height appropriately.

Event Flow for Field Resource

User Action	System Response
Pen goes down on a field.	penDownEvent; store x and y coordinates in `EventType`. fldEnterEvent; store the field's ID number in `EventType`.
Pen is lifted.	penUpEvent; store x and y coordinates in `EventType`. A field remains selected until another field is selected or the form that contains the field is closed.
User enters characters into selected field.	keyDownEvent; store ASCII value in `EventType`.

Form Bitmap Resource

Overview

Places predefined bitmaps on a given form. Used for icons in Alert dialogs to indicate a warning, error, information, and so on. You have to associate a Bitmap with the Form Bitmap to actually make a picture appear.

Attributes

Object Identifier	Name of the object. Assigned by developer and used by Constructor during header file generation and update.
Left Origin.	Left bounds of bitmap.
Top Origin	Top bounds of bitmap.
Bitmap Resource ID	ID of a PICT resource containing the graphic. You can also assign an ID number, then click on Create and draw the picture in the bitmap editor that appears.
Usable	Checked if the bitmap should be drawn.

Gadget Resource

Name tGDT

UI Name Gadget

Overview A gadget object lets developers implement a custom UI gadget. The gadget resource contains basic information about the custom gadget, which is useful to the gadget writer for drawing and processing user input.

Attributes

Object Identifier	Name of the object. Assigned by developer and used by Constructor during header file generation and update.
Gadget ID	ID of the object (assigned by Constructor).
Left Origin	Form-relative position of left side of object. Valid values: 0 – 159
Top Origin	Form-relative position of top of object. Valid values: 0 – 159
Width	Width of the gadget in pixels. Valid values: 0 – 160
Height	Height of the gadget in pixels. Valid values: 1– 160
Usable	If this box is checked, the object is usable. A nonusable object is not considered part of the application interface and doesn't draw. Nonusable objects can programmatically be set to usable.

Graffiti Shift Indicator Resource

Overview

The Graffiti Shift Indicator resource specifies the window-relative or form-relative position of the Graffiti shift state indicator. The different shift states are punctuation, symbol, uppercase shift, and uppercase lock. These indicators will appear at the position of the Graffiti Shift resource.

Note: By convention, Graffiti Shift indicators are placed at the bottom-right of every form that has an editable text field.

Attributes

Object Identifier	Name of the object. Assigned by developer and used by Constructor during header file generation and update.
Left Origin	Form-relative position of left side of object. Valid values: 0 – 159
Top Origin	Form-relative position of top of object. Valid values: 0 – 159
Object ID	ID of the object (assigned by Constructor).

Label Resource

Overview The label resource displays noneditable text or labels on a form (dialog box or full-screen). It's used, for example, to have text appear to the left of a checkbox instead of the right.

Comments Pressing Return in a label wraps the text to the next line.

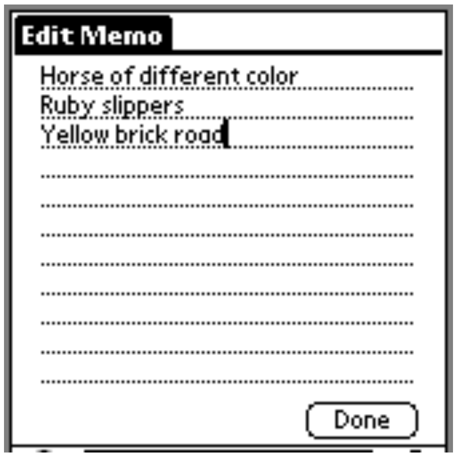
Attributes

Object Identifier	Name of the object. Assigned by developer and used by Constructor during header file generation and update.
Label ID	ID of the object (assigned by Constructor).
Left Origin	Form-relative position of left side of object. Valid values: 0 – 159
Top Origin	Form-relative position of top of object. Valid values: 0 – 159
Usable	If this box is checked, the object is usable. A nonusable object is not considered part of the application interface and doesn't draw. Nonusable objects can programmatically be set to usable.
Font	Font used to draw the text label of the button. Choose from the pop-up menu to select one of the 2.0 fonts.
Text	Text of the label.

List Resource

UI Structure `ListType`

Example



Overview A list provides a box with a list of choices to the user. The list is scrollable if the choices don't all fit in the box.

The list box appears as a vertical list of choices surrounded by a rectangular frame. The current selection of the list is inverted. Arrows for scrolling the list appear in the right margin if necessary.

Lists can appear as popup lists when used with popup triggers. See Popup Trigger Resource.

Attributes

Object Identifier	Name of the object. Assigned by developer and used by Constructor during header file generation and update.
List ID	ID of the object (assigned by Constructor).
Left Origin	Form-relative position of left side of object. Valid values: 0 – 159

Top Origin	Form-relative position of top of object. Valid values: 0 – 159
Width	Width of the list. Valid values: 0 – 160
Usable	If this box is checked, the object is usable. A nonusable object is not considered part of the application interface and doesn't draw. Nonusable objects can programmatically be set to usable.
Font	Font used to draw the text label of the button. Choose from the pop-up menu to select one of the 2.0 fonts.
Visible items	Height of the list box, in items (choices). For example, if the list has six items but only four fit, specify four.
Items	Items in the list.

Comments

Errors may occur if the number of visible items is greater than the actual number of items. An item's text is not clipped against the list box's borders. Set a list to not usable if it's linked to a popup trigger.

Use a list to let users choose between items of data; use a menu to activate a command.

If a list becomes too tall to fit below the trigger, it's justified up. If it becomes to large for the screen, it scrolls.

Event Flow for List Resource

User Action	System Response
Pen goes down on a list box.	penDownEvent; store x and y coordinates in `EventType`. lstEnterEvent; store list ID and selected item in `EventType`.
Pen is lifted from the list box.	lstSelectEvent is triggered; store button's ID number and number of selected item in `EventType`. penUpEvent; store x and y coordinates in `EventType`.

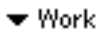
Popup Trigger Resource

UI structure `ControlType`

Overview The popup trigger shows the selection of a list. The user can press the popup trigger to pop up the list and change the selection.

A popup trigger displays a text label and a triangle to the left of the label that indicates the object is a popup trigger.

When the user selects a popup trigger, a list of items pops up.



Attributes

Object Identifier	Name of the object. Assigned by developer and used by Constructor during header file generation and update.
Popup ID	ID of the object (assigned by Constructor).
Left Origin	Form-relative position of left side of button. Valid values: 0 – 159
Top Origin	Form-relative position of top of button. Valid values: 0 – 159
Width	Width of the button’s picking area in pixels. Valid values: 1 – 160
Height	Height of the button’s picking area in pixels. Valid values: 1 –160
Usable	If this box is checked, the object is usable. A nonusable object is not considered part of the application interface and doesn’t draw. Nonusable objects can programmatically be set to usable.

Left anchor	Controls how the object resizes itself when its text label is changed. Valid values: checked (left bound fixed) unchecked (right bound fixed)
Font	Font used to draw the text label of the button. Choose from the pop-up menu to select one of the 2.0 fonts.
Label	Text displayed in the popup trigger (right of arrow).
List ID	ID of the List object that pops up when the user taps the pop-up trigger.

Event Flow for Popup Trigger Resource

User Action	System Response
Pen goes down on popup trigger.	penDownEvent; store x and y coordinates in `EventType`. ctlEnterEvent; store popup trigger ID number in `EventType`.
Pen is lifted from popup trigger.	ctlSelectEvent; store popup trigger ID number in `EventType`. A `ctlSelectEvent` can be triggered only if a `ctlEnterEvent` with the same popup trigger ID number has just occurred. winExitEvent; pass control to a popup list object.
Popup list pops up.	winEnterEvent penUpEvent; a `penDownEvent` to pop up the popup list.

User Action	System Response
Pen goes down on item in popup list.	`penDownEvent` occurs.
Pen is lifted from popup list.	lstSelectEvent; store the popup list ID and the selected item number in `EventType`. `winExitEvent` causes popup list to disappear; control passes back to the popup trigger. `winEnterEvent` occurs. `popSelectEvent` is triggered if an item was selected in the popup list; store popup trigger ID, the popup list ID, and the item number selected in `EventType`. `penUpEvent` occurs.

Push Button Resource

UI Structure

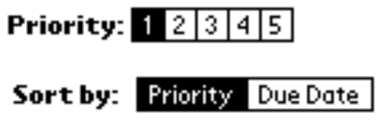
`ControlType`

Overview

Push buttons allow users to select an option from a group of items. The choices should have few characters; if the choices are long; check boxes are preferable.

Push buttons display a text label surrounded by a 1-pixel-wide rectangular frame. They appear in a horizontal or vertical row with no pixels between the buttons. The buttons share a common border so there appears to be a one pixel line between two controls. The current selection is highlighted.

.



The List By dialog of the Address Book and the Details dialog of the ToDo List contain examples of rows of push buttons.

Attributes

Object Identifier	Name of the object. Assigned by developer and used by Constructor during header file generation/update.
Button ID	ID of the object (assigned by Constructor).
Left Origin	Form-relative position of left side of button. Valid values: 0 – 159
Top Origin	Form-relative position of top of button. Valid values: 0 – 159
Width	Width of the button in pixels. Should be size of label plus two pixels at each end. Valid values: 1 – 160
Height	Height of the button in pixels. Should be font size plus two pixels. Valid values: 1 – 160
Usable	If this box is checked, the object is usable. A nonusable object is not considered part of the application interface and doesn't draw. Nonusable objects can programmatically be set to usable.
Group ID	Group ID of a push button that is part of an exclusive group. Only one push button in an exclusive group may be depressed at a time. Ungrouped (nonexclusive) push buttons have zero as a group ID. This feature must be enforced by the application. Valid values: 0 – 65535
Font	Font used to draw the text label of the button. Choose from the pop-up menu to select one of the 2.0 fonts.
Label	Text displayed inside the push button.

Comment To create a row of push buttons, create a number of individual push button resources with the same height and align them by specifying the same top position for each button.

Event Flow for Push Button Resource

User Action	System Response
Pen goes down on push button.	penDownEvent; store x and y coordinates in `EventType`. ctlEnterEvent; store push button ID number in `EventType`. Push button is highlighted. If push button is grouped and highlighted, no change. If push button is ungrouped and highlighted, it becomes unhighlighted.
Pen is lifted from push button.	ctlSelectEvent; store button ID number and its current state; on = 1; off = 0. `ctlSelectEvent` can be triggered only if a `ctlEnterEvent` with the same push button ID number just occurred. penUpEvent; store the x and y coordinates.

Repeating Button Resource

Overview

The repeating button object is identical to the button object in its appearance. The repeating button is used for buttons that need to be triggered continuously by holding the pen down on them.
A good example for a repeating button is the scroll arrow, which moves text as long as it's held down.

Attributes

Object Identifier	Name of the object. Assigned by developer and used by Constructor during header file generation and update.
Button ID	ID of the object (assigned by Constructor).
Left Origin	Form-relative position of left side of button. Valid values: 0 – 159
Top Origin	Form-relative position of top of button. Valid values: 0 – 159
Width	Width of the button in pixels. Valid values: 1 – 160
Height	Height of the button in pixels. Valid values: 1 – 160
Usable	If this box is checked, the object is usable. A nonusable object is not considered part of the application interface and doesn't draw. Nonusable objects can programmatically be set to usable.
Anchor Left	Controls how the object resizes itself when its text label is changed. If checked, the left bound of the object is fixed; if unchecked, the right bound is fixed.
Frame	If checked, a rectangular frame with rounded corners is drawn around the button.

Non-bold Frame	Determines the width of the rectangular frame drawn around the object. Valid values: checked (1-pixel-wide frame) unchecked (2-pixel-wide frame)
Font	Font used to draw the text label of the button. Choose from the pop-up menu to select one of the 2.0 fonts.
Label	Text displayed inside the button.

Comments The attributes match those of the Button Resource (tBTN); the behavior differs.

You can also use repeating buttons to create increment arrows. See Button Resource for more information.

Event Flow for Repeating Button Resource

A repeating button is similar in appearance to a button, but it generates different events. A button generates a ctlEnterEvent when it is pressed and a `ctlSelect` event when it is released. A repeating button generates a `ctlEnterEvent` when it is pressed and a ctlRepeatEvent as long as it remains pressed. Here's a more detailed discussion of the events:

User Action	System Response
Pen goes down on a repeating button.	penDownEvent; store x and y coordinates in `EventType`. `ctlEnterEvent`; store button's ID number in `EventType`.
Pen remains on repeating button.	For every given amount of time the pen is down on the repeat control object, a `ctlRepeatEvent` is generated.
Pen is dragged off the repeating button.	No additional `ctlRepeatEvent` occurs.

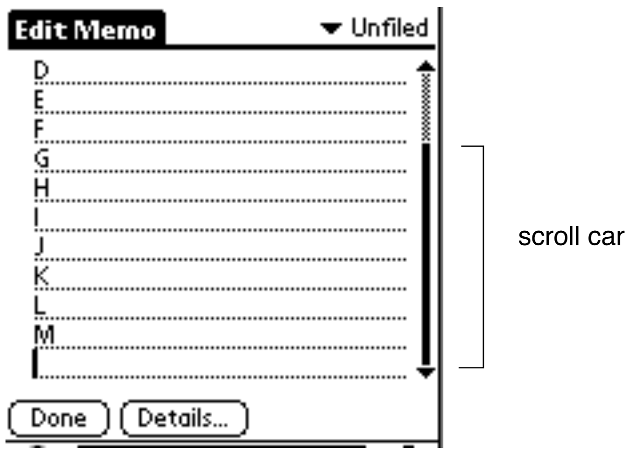
User Action	**System Response**
Pen is dragged back onto the button.	ctlRepeatEvent begins to occur again.
Pen is lifted.	penUpEvent; store x and y coordinates in `EventType`

Scrollbar Resource

Overview

The scroll bar resource helps developers to provide scrolling behavior for fields and tables.

Example



Attributes

Object Identifier	Name of the object. Assigned by developer and used by Constructor during header file generation and update.
Scrollbar ID	ID of the object (assigned by Constructor).
Left Origin	Form-relative position of left side of button. Valid values: 0 – 159

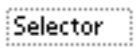
Top Origin	Form-relative position of top of button. Valid values: 0 – 159
Width	Width of the scroll bar in pixels. 7 (the default) is strongly recommended.
Height	Height of the scrollbar in pixels. Valid values: 1 – 160
Usable	If this box is checked, the object is usable. A nonusable object is not considered part of the application interface and doesn't draw. Nonusable objects can programmatically be set to usable.
Value	Current top value of the scroll bar's car (movable piece).
Min Value	Position of the scroll car when the scrollbar is at the top. Default should usually be 0.
Max Value	Position of the scroll car when the scrollbar is at the bottom. To compute this value, use the formula: Number of lines – Page size + Overlap.
Page Size	Number of lines to scroll at one time.

Selector Trigger Resource

UI Structure ControlType

Overview Users can tap a selector trigger to pop up a dialog that lets them select an item. The selected item becomes the label of the selector trigger. For example, a selector trigger for time pops up a time selector. The selected time is entered into the selector trigger.

A selector trigger displays a text label surrounded by a gray rectangular frame, as shown below:



Attributes

Object Identifier	Name of the object. Assigned by developer and used by Constructor during header file generation and update.
Selector Trigger ID	ID of the object (assigned by Constructor).
Left Origin	Form-relative position of the left side of the object. Valid values: 0 – 159
Top Origin	Form-relative position of top of object. Valid values: 0 – 159
Width	Width of the object in pixels. Valid values: 1– 160
Height	Height of the object in pixels. Height extends two pixels above and one pixel below the 9-point plain font. Height is one pixel above command buttons to accommodate the gray frame. Valid values: 1– 160

Usable	If this box is checked, the object is usable. A nonusable object is not considered part of the application interface and doesn't draw. Nonusable objects can programmatically be set to usable.
Anchor Left	Controls how the object resizes itself when its text label is changed. If checked, the left bound of the object is fixed, if unchecked, the right bound is fixed. Valid values: checked (left bound fixed) unchecked (right bound fixed)
Font	Font used to draw the text label of the button. Choose from the pop-up menu to select one of the 2.0 fonts.
Label	Text in the selector trigger.

Event Flow for Selector Trigger Resource

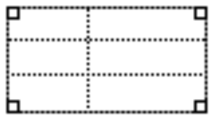
User Action	System Response
Pen goes down on a selector trigger.	penDownEvent; store x and y coordinates in `EventType`. ctlEnterEvent; store selector trigger ID number in `EventType`.
Pen is lifted from the selector trigger.	ctlSelectEvent; store selector trigger ID number in `EventType`. A `ctlSelectEvent` can only be triggered if a `ctlEnterEvent` with the same selector trigger ID number has just occurred. frmOpenEvent followed by a winExitEvent, control is passed to a form object. When control is passed back to the selector trigger, a winEnterEvent and a penUpEvent occur.

Table Resource

Overview The table object allows the developer to organize a collection of objects on the display. For example, a table might contain a column of labels that correspond to a column of fields. Under some circumstances, a one-column table may be preferable to a list.

Comments Since tables are scrollable, they may be larger than the display.

Example



Attributes

Object Identifier	Name of the object. Assigned by developer, used by Constructor during header file generation/ update.
Table ID	ID of the object (assigned by Constructor).
Left Origin	Form-relative position of left side of the object. Valid values: 0 – 159
Top Origin	Form-relative position of top of object. Valid values: 0 – 159
Width	Width of the object in pixels. Valid values: 1– 160
Height	Height of the object in pixels. Valid values: 1–160
Rows	Number of rows in the table.
Columns	Number of columns in the table.
Column width	Width of the nth column.

4

Palm OS User Interface Objects

A Palm OS UI object is a C structure that's linked with one or more items on the screen. By changing field values of the C structure, an application can manipulate its user interface. Note that Palm UI objects are just structures, not the more elaborate objects found in some systems. This is useful because a C structure is more compact than other objects could be.

This chapter helps you develop your application's user interface by providing information about each object's structure, associated events, associated UI resource files, and all API calls available for manipulating the structure. It discusses the following objects:

- Control Objects
- Date and Time Objects
- Field Objects
- Form Objects
- Insertion Point Object
- List Object
- Menu Objects
- Scrollbar Object
- Table Objects
- Window Objects

A Note on the Rectangle Structure

The `RectangleType` structure is used for describing the area of a rectangle throughout the resources and API. The `RectangleType` defines the top-left corner of a rectangle and its width and height (not the lower-left corner).

Control Objects

Control objects allow for user interaction when you add them to the forms in your application. There are six types of control objects:

- **Buttons** display a text label in a box. The default style for a button is a text string centered within a rounded rectangle. Buttons have rounded corners unless a rectangular frame is specified. A button without a frame inverts a rounded rectangular region when pressed.

  When the user taps a button with the pen, the button highlights until the user releases the pen or drags it outside the bounds of the button.
- **A popup trigger** displays a text label followed by a graphic element (always on the right) that signifies the control initiates a popup list. If the text label changes, the width of the control expands or contracts to the width of the new label plus the graphic element.
- **A selector trigger** displays a text label surrounded by a gray rectangular frame. If the text label changes, the width of the control expands or contracts to the width of the new label.
- **A repeat control** looks like a button. In contrast to buttons, however, users can repeatedly select repeat controls if they don't lift the pen when the control has been selected. The object is selected repeatedly until the pen is lifted.
- **Push buttons** look like buttons, but the frame always has square corners. Touching a push button with the pen inverts the bounds. If the pen is released within the bounds, the button remains inverted.
- **Check boxes** display a setting, either on (checked) or off (unchecked). Touching a check box with the pen toggles the setting. The check box appears as a square, which contains a check mark if the check box's setting is on. A check box can have a text label attached to it; selecting the label also toggles the check box.

Push buttons and check boxes can be arranged into exclusive groups; one and only one control in a group can be on at a time.

This section provides the following information about control objects:

Control Object Events

Control objects generate four types of events: `ctlEnterEvent`, `ctlExitEvent`, `ctlRepeatEvent`, and `ctlSelectEvent`. All these events are generated by the control event handler `CtlHandleEvent`. All events posted by the handler contain the ID of the control and a pointer to the control data structure

The following table provides an overview of how `CtlHandleEvent` deals with the different events.

When CtlHandleEvent receives...	CtlHandleEvent performs these actions...
`penDownEvent`; pen position in the bounds of the control object.	Adds a `ctlEnterEvent` to the event queue
`ctlEnterEvent`	Inverts the control and tracks the pen until the pen comes up or until the pen is dragged outside the bounds of the control. • If the pen comes up in the bounds of the control, a `ctlSelectEvent` is added to the event queue. • If the pen is dragged outside the bounds of the control, the control reverts to its original visual state and a `ctlExitEvent` is added to the event queue.

When CtlHandleEvent receives...	CtlHandleEvent performs these actions...
`ctlEnterEvent` for a repeat control	Sends a `ctlRepeatEvent`. When the repeat control receives a `ctlRepeatEvent`, it tracks the pen for a period of time and then sends another `ctlRepeatEvent` if the pen is still within the bounds of the control.
`ctlExitEvent`	Tracks the pen until the pen comes up or is dragged inside the bounds of the control. • If the pen is dragged into the control, a `ctlEnterEvent` is added to the event queue. • If the pen is released outside the control, no event is posted.

Structure of a Control

Listing 4.1 ControlType and Auxiliary Structures

```
typedef struct {
   Word                id;
   RectangleType       bounds;
   CharPtr             text;
   ControlAttrType     attr;
   ControlStyleType    style;
   FontID              font;
   Byte                group;
} ControlType;

typedef ControlType* ControlPtr;

typedef struct {
   Byte usable      :1;
   Byte enabled     :1;
   Byte visible     :1;
   Byte on          :1;
   Byte leftAnchor  :1;
   Byte frame      :3;
} ControlAttrType;

enum controlStyles {buttonCtl, pushButtonCtl,
           checkboxCtl, popupTriggerCtl,
           selectorTriggerClt, repeatingButtonCtl};
typedef enum controlStyles ControlStyleType;

enum buttonFrames {noButtonFrame,
             standardButtonFrame, boldButtonFrame,
             rectangleButtonFrame};
typedef enum buttonFrames ButtonFrameType;
```

Fields of a ControlType Structure

The following table lists the fields of a `ControlType` structure and discusses what they do.

Field	Function
`id`	Symbolic ID of the control, specified by the developer. By convention, this ID should match the resource ID (not mandatory).
`text`	Pointer to the control's label. If `text` is `NULL`, the control has no label. Only buttons, push buttons, and text boxes have text labels.
`bounds`	Bounds of the control, in window-relative coordinates. The control's text label is clipped to the control's bounds. The control's frame is drawn around (outside) the bounds of the control.
`attr`	Control attributes. The `attr` field is a bit field that contains the following members: • A control that doesn't have the `usable` attribute set is not considered to be part of the interface of the current application, and it doesn't appear on screen. • A control that doesn't have the `enable` attribute set appears "grayed out," and doesn't respond to the pen. Graying out UI elements is strongly discouraged because it's a poor use of screen real estate. Remove the control object instead. • The `visible` attribute is set and cleared internally when the control is drawn and erased. • The `leftAnchor` attribute is used by controls that expand and shrink their width when their label is changed. If the attribute is set, the left bound of the control is fixed. • The `frame` field specifies the type of frame drawn around the button controls. Only button controls use this attribute; for all other controls, the `ControlStyle` determines the frame.
`style`	Style of the control: button, push button, check box, popup trigger, popup selector, or repeating button. (See the `ControlStyleType` enum listed under Structure of a Control.)

Field	Function
`font`	Font to use to draw the control's label.
`group`	Group ID of a push button or a check box that is part of an exclusive group. The control routines don't automatically turn one control off when another is selected. It's up to the application or a higher-level object, like a dialog box, to manage this.

Associated Resources

Different resources are associated with different controls, as follows:

- Button—Button Resource (tBTN)
- Popup trigger— Popup Trigger Resource (tPUT)
- Selector trigger—Selector Trigger Resource (tSLT)
- Repeat control—Repeating Button Resource (tREP)
- Push button—Push Button Resource (tPBN)
- Check box—Check Box Resource (tCBX)

Control Functions

The following API calls can be used to manipulate control objects.

- CtlDrawControl
- CtlEraseControl
- CtlGetLabel
- CtlGetValue
- CtlHandleEvent
- CtlHideControl
- CtlHitControl
- CtlEnabled
- CtlSetEnabled
- CtlSetLabel
- CtlSetUsable
- CtlSetValue
- CtlShowControl

Date and Time Objects

The Palm OS UI provides two system resources for accepting date and time input values. These resources are dialog boxes that contain UI gadgetry for entering dates and times. The Palm OS UI also provides routines to manage the interaction with these resources.

There is no corresponding UI object.

Date and Time Functions

Currently defined date and time selection functions are `SelectDay` and `SelectTime`.

Field Objects

A field object displays one or more lines of editable text, supporting these features:

- Proportional fonts (only one font per field)
- Drag-selection
- Scrolling for multiline fields
- Cut, copy, and paste
- Left and right text justification
- Tab stops
- Editable/noneditable attribute
- Expandable field height (the height of the field expands as more text is entered)
- Underlined text (each line of the field is underlined)
- Maximum character limit (the field stops accepting characters when the maximum is reached)
- Special keys (Graffiti strokes) to support cut, copy, and paste
- Insertion point positioning with pen (the insertion point is positioned by touching the pen between characters)
- Scroll bars

The field object does **not** support overstrike input mode; horizontal scrolling; word selection; character filters (for example, only numeric characters accepted); numeric formatting; or special keys for page up, page down, left word, right word, home, end, left margin, right margin, and backspace.

Note: Field objects can handle line feeds—\0A—but not carriage returns—\0D. PilotRez translates any carriage returns it finds in any Palm OS resources into line feeds, but doesn't touch static data.

This section provides the following information about field objects:

- Field Object Events
- Structure of a Field
- Associated Resources
- Field Functions

Field Object Events

Events in field objects are handled by `FldHandleEvent`. `FldHandleEvent` handles events of type `penDownEvent`, `fldEnterEvent`, and `keyDownEvent`.

The following table provides an overview of how `FldHandleEvent` deals with the different events

When FldHandleEvent receives...	FldHandleEvent performs these actions...
`penDownEvent`; pen position in the bounds of the field object.	Adds a `fldEnterEvent` to the event queue.
`fldEnterEvent`	Sets the insertion point position to the position of the pen and tracks the pen until it is released. Drag-selection and drag-scrolling are supported.

When FldHandleEvent receives...	FldHandleEvent performs these actions...
A `keyDownEvent` with a special character:	
keyDownEvent with up arrow	Moves insertion point up a line.
keyDownEvent with down arrow	Moves insertion point down a line; the insertion point doesn't move beyond the last line that contains text.
keyDownEvent with left arrow	Moves insertion point one character position to the left. When the left margin is reached, move to the end of the previous line.
keyDownEvent with right arrow	Moves insertion point one character position to the right. When the right margin is reached, move to the start of the next line.
keyDownEvent with cut key	Cuts the current selection to the text clipboard.
keyDownEvent with copy key	Copies the current selection to the text clipboard.
keyDownEvent with paste key	Inserts clipboard text into the field at insertion point.

Structure of a Field

The `FieldType` structure and supporting structures are defined as follows:

Listing 4.2 FieldType Structure

```
typedef struct {
   Word              id;
   RectangleType     rect;
   FieldAttrType     attr;
   CharPtr           text;
   VoidHand          textHandle;
```

```
  LineInfoPtr       lines;
  Word              textLen;
  Word              textBlockSize;
  Word              maxChars;
  Word              selFirstPos;
  Word              selLastPos;
  Word              insPtXPos;
  Word              insPtYPos;
  FontID            fontID;
} FieldType;
typedef FieldType* FieldPtr;

typedef struct {
  Word usable       :1;
  Word visible      :1;
  Word editable     :1;
  Word singleLine   :1;
  Word hasFocus     :1;
  Word dynamicSize  :1;
  Word insPtVisible :1;
  Word dirty        :1;
  Word underlined   :2;
  Word justification:2;
  Word autoShift     :1;
  Word hasScrollBar  :1;
} FieldAttrType;

typedef struct {
  Word        start;
  Word        length;
} LineInfoType;

typedef LineInfoType* LineInfoPtr;
```

Fields of a Field Structure

The `field` structure has the following fields:

Field	Function
`id`	ID value specified by the application developer. This ID value is included as part of the event data of `fldEnterEvent`.
`rect`	Position and size of the field object.
`attr`	Field object attributes. The `attr` field is a bit field that contains the following members: `usable`, `visible`, `editable`, `singleLine`, `hasFocus`, `dynamicSize`, `insPtVisible`, `dirty`, `underlined`, `justification`, `autoShift`, `hasScrollBar`, and `numeric.` (see Field Attributes below)
`text`	Pointer to the `NULL`-terminated string that is displayed by the `field` object.
`textHandle`	Handle to the stored text.
`lines`	Pointer to an array of `LineInfoType` structures. There is one entry in this array for each visible line of the text. The `LineInfo-Type` structure contains the character position, in the field's text string, of the first character displayed by a line and the number of characters displayed.
`textLen`	Current number of characters in the string displayed by the field object; the null-terminator is excluded.
`textBlockSize`	Allocated size of the memory block that holds the field object's text string.
`maxChars`	Maximum number of characters the field object accepts.
`selFirstPos`	Starting character position of the current selection.
`selLastPos`	Ending character position of the current selection. When `selFirstPos` equals `selLastPos`, there is no selection.
`insPtXPos`	Column position of the insertion point.

Field	Function
`insPtYPos`	Display line where the insertion point is positioned. The first display line is zero.
`fontID`	Font ID for the field. See `Font.h` for more information.

Field Attributes

The `attr` field of the Field UI object can have the following values:

- A field object that doesn't have the `usable` attribute set is not considered part of the current interface of the application, and it doesn't appear on screen.
- The `visible` attribute is set or cleared internally when the field object is drawn or erased.
- A field object that doesn't have its `editable` attribute set doesn't accept Graffiti input or edit commands and the insertion point cannot be positioned with the pen.
- If the `singleLine` attribute is set, the height of the `singleLine` field doesn't expand to accommodate more text.
- The `hasFocus` attribute is set internally when the field has the current focus. The blinking insertion point appears in the field that has the current focus.
- If the `dynamicSize` attribute is set, the height of the field expands as characters are entered into the field.
- If the `insPtVisible` attribute is set, the insertion point is scrolled into view. This attribute is set and cleared internally.
- If a field has its `dirty` attribute set, the user has modified the field.
- If a field has its `underlined` attribute set each line of the field, including blank lines, is underlined.
- The `justification` attribute specifies the text alignment (left or right justification only; center justification is not supported).

Associated Resources

The Field Resource (tFLD) represents a field on screen.

Field Functions

The following API calls can be used to manipulate field objects.

- FldCalcFieldHeight
- FldCompactText
- FldCopy
- FldCut
- FldDelete
- FldDirty
- FldDrawField
- FldEraseField
- FldFreeMemory
- FldGetAttributes
- FldGetBounds
- FldGetFont
- FldGetInsPtPosition
- FldGetMaxChars
- FldGetNumberOfBlankLines
- FldGetScrollValues
- FldGetScrollPosition
- FldGetSelection
- FldGetTextAllocatedSize
- FldGetTextHandle
- FldGetTextHeight
- FldGetTextLength
- FldGetTextPtr
- FldGetVisibleLines
- FldGrabFocus
- FldHandleEvent
- FldInsert

- FldMakeFullyVisible
- FldPaste
- FldRecalculateField
- FldReleaseFocus
- FldScrollable
- FldScrollField
- FldSendChangeNotification
- FldSendHeightChangeNotification
- FldSetAttributes
- FldSetBounds
- FldSetDirty
- FldSetFont
- FldSetInsertionPoint
- FldSetInsPtPosition
- FldSetMaxChars
- FldSetScrollPosition
- FldSetSelection
- FldSetText
- FldSetTextAllocatedSize
- FldSetTextHandle
- FldSetTextPtr
- FldSetUsable
- FldUndo
- FldWordWrap

Form Objects

A form object is used as a container for all other UI objects. A form is a window and everything contained within it.

This section provides the following information about form objects:

- Form Object Events
- Structure of a Form
- Associated Resources
- Form Functions

Form Object Events

Events in form objects are handled by the `FrmHandleEvent` routine.

The following table provides an overview of how `FrmHandleEvent` deals with the different events.

When FrmHandleEvent receives...	FrmHandleEvent performs these actions...
`penDownEvent`; pen position in the bounds of the form object.	Checks the list of objects contained by the form to determine if the pen is within the bounds of one. If it is, the appropriate handler is called to handle the event, for example, if the pen is in a control, `CtlHandleEvent` is called. If the pen isn't within the bounds of an object, the event is ignored by the form.
`keyDownEvent`	Passes the event to the handler for the object that has the focus. If no object has the focus, the event is ignored.
`ctlEnterEvent`	Checks if the control is in an exclusive control group. If it is, it deselects the currently selected control of the group and passes the event and a pointer to the object the event occurred in to `CtlHandleEvent`. The object pointer is obtained from the event data.

When FrmHandleEvent receives...	FrmHandleEvent performs these actions...
`ctlRepeatEvent`	Passes the event and a pointer to the object the event occurred in to the appropriate handler. The object pointer is obtained from the event data.
`ctlSelectEvent`	Checks if the control is a Popup Trigger Control. If it is, the list associated with the popup trigger is displayed until the user makes a selection or touches the pen outside the bounds of the list. If a selection is made, a `popSelectEvent` is added to the event queue.
`popSelectEvent`	Sets the label of the popup trigger to the current selection of the popup list.
`lstEnterEvent` or `tblEnterEvent`	Passes the event and a pointer to the object the event occurred in to the appropriate handler. The object pointer is obtained from the event data.
`fldEnterEvent` or `fldHeightChangedEvent`	Checks if a field object or a table object has the focus and passes the event to the appropriate handler. The table object is also a container object, which may contain a field object. If `TblHandleEvent` receives a field event, it passes the event to the field object contained within it.
`frmCloseEvent`	Erases the form and releases any memory allocated for it.
`frmUpdateEvent`	Redraws the form.
`menuEvent`	Checks if the menu command is one of the system edit menu commands. The system provides a standard edit menu which contains the commands Undo, Cut, Copy, Paste, Select All, and Keyboard. `FrmHandleEvent` responds to these commands.

Structure of a Form

The `FormType` structure and supporting structures are defined as follows:

Listing 4.3 FormType Structure and Supporting Structures

```
typedef struct {
   WindowType           window;
   Word                 formId;
   FormAttrType         attr;
   WinHandle            bitsBehindForm;
   FormEventHandlerPtr  handler;
   Word                 focus;
   Word                 defaultButton;
   Word                 helpRscId;
   Word                 menuRscId;
   Word                 numObjects;
   FormObjListType*     objects;
} FormType;
typedef FormType * FormPtr;

typedef struct {
   Word usable        :1;
   Word enabled       :1;
   Word visible       :1;
   Word dirty         :1;
   Word saveBehind    :1;
   Word graffitiShift :1;
   Word reserved      :11;
} FormAttrType;

typedef struct {
   FormObjectKind   objectType;
   FormObjectType   object;
} FormObjListType;
```

```
typedef union {
    void *                      ptr;
    FieldType*                  field;
    ControlType*                control;
    ListType*                   list;
    TableType*                  table;
    FormBitmapType*             bitmap;
    FormLabelType *             label;
    FormTitleType*              title;
    FormPopupType*              popup;
    FormGraffitiStateType*      grfState;
    FormGadgetType*             gadget;
    ScrollBarType               scrollBar;
} FormObjectType;

enum formObjects {
    frmFieldObj,
    frmControlObj,
    frmListObj,
    frmTableObj,
    frmBitmapObj,
    frmLineObj,
    frmFrameObj,
    frmRectangleObj,
    frmLabelObj,
    frmTitleObj,
    frmPopupObj,
    frmGraffitiStateObj,
    frmGadgetObj,
    frmScrollbarObj
};
typedef enum formObjects FormObjectKind;

typedef struct {
    Word usable  :1;
} FormObjAttrType;

typedef struct {
    FormObjAttrType attr;
    PointType       pos;
    Word            rscID;
} FormBitmapType;

typedef struct {
    FormObjAttrType   attr;
    PointType         point1;
    PointType         point2;
} FormLineType;

typedef struct {
    Word            id;
    FormObjAttrType attr;
    RectangleType   rect;
    Word            frameType;
} FormFrameType;

typedef struct {
    FormObjAttrType attr;
    RectangleType   rect;
} FormRectangleType;

typedef struct {
    Word            id;
    PointType       pos;
    FormObjAttrType attr;
    FontID          fontID;
    char *          text;
} FormLabelType;
```

```
typedef struct {
  RectangleType  rect;
  char *         text;
} FormTitleType;

typedef struct {
  unsigned short   controlID;
  unsigned short   listID;
} FormPopupType;

typedef struct{
  PointerType    pos;
}FrmGraffitiStateType;

typedef struct{
  Word             id;
  FormObjAttrType  attr;
  RectangleType    rect;
  VoidPtr          date;
}FormGadgetType;
```

Fields of Form Objects

The `form` structure has the following fields:

Field	Function
`window`	Structure of the window object that corresponds to the form.
`formId`	ID number of the form, specified by the application developer. This ID value is part of the event data of `frmOpenEvent`. The ID should match the form's resource ID.

Field	Function
`attr`	Form object attributes. The `attr` field is a bit field that contains the members `usable`, `enable`, `visible`, `dirty`, `saveBehind`, and `reserved.` • A form that doesn't have the `usable` attribute set is not considered part of the current interface of the application, and it doesn't appear on screen. • When the `saveBehind` attribute is set, the bits behind the form are saved when the form is drawn. • When the `visible` attribute is set or cleared internally when the field object is drawn or erased. • When the `dirty` attribute is set, the form has been modified in any way. Modifications include the changing of a field or check box. Currently, the system doesn't change the form's `dirty` attribute when elements of the form are changed. • The `reserved` attribute is reserved for system use.
`bitsBehind-Form`	Used to save all the bits behind the form so the screen can be properly refreshed when the form is closed. Use this attribute for modal forms.
`handler`	Routine called when the form needs to handle an event, typically set by the application in the `ApplicationHandleEvent` function.
`focus`	Index of a field or table object within the form that contains the focus. Any `keyDownEvent` is passed to the object that has the focus.
`defaultButton`	Index of the object defined as the default button. This value is used by the routine `FrmDoDialog`.
`helpRscId`	Resource ID number of the help resource. The help resource is a String resource (type tSTR).
`MenuRscId`	ID number of a menu bar to use if the form is a menu, or zero if the form is not a menu.
`numObjects`	Number of objects contained within the form.
`objects`	Pointer to the array of objects contained within the form.

Associated Resource

The Form Resource (tFRM) is used to represent forms on screen.

Form Functions

The following API calls can be used to manipulate form objects.

- FrmAlert
- FrmCloseAllForms
- FrmCopyLabel
- FrmCopyTitle
- FrmCustomAlert
- FrmDeleteForm
- FrmDispatchEvent
- FrmDoDialog
- FrmDrawForm
- FrmEraseForm
- FrmGetActiveForm
- FrmGetActiveFormID
- FrmGetControlGroupSelection
- FrmGetControlValue
- FrmGetFirstForm
- FrmGetFocus
- FrmGetFormBounds
- FrmGetFormId
- FrmGetFormPtr
- FrmGetGadgetData
- FrmGetLabel
- FrmGetNumberOfObjects
- FrmGetObjectBounds
- FrmGetObjectId
- FrmGetObjectIndex
- FrmGetObjectPosition
- FrmGetObjectPtr

- FrmGetObjectType
- FrmGetTitle
- FrmGetUserModifiedState
- FrmGetWindowHandle
- FrmGotoForm
- FrmHandleEvent
- FrmHelp
- FrmHideObject
- FrmInitForm
- FrmPointInTitle
- FrmPopupForm
- FrmReturnToForm
- FrmSaveAllForms
- FrmSetActiveForm
- FrmSetCategoryLabel
- FrmSetControlGroupSelection
- FrmSaveAllForms
- FrmSetActiveForm
- FrmSetCategoryLabel
- FrmSetControlGroupSelection
- FrmSetControlValue
- FrmSetEventHandler
- FrmSetFocus
- FrmSetGadgetData
- FrmSetMenu
- FrmSetNotUserModified
- FrmSetObjectBounds
- FrmSetObjectPosition
- FrmSetTitle
- FrmShowObject
- FrmUpdateScrollers
- FrmUpdateForm
- FrmVisible

Insertion Point Object

The insertion point is a blinking indicator that shows where text is inserted when users write Graffiti characters or paste clipboard text.

In general, an application doesn't need to be concerned with the insertion point; the Palm OS UI manages the insertion point.

Insertion Point Functions

For custom insertion point behavior, developers can use the following API calls:

- `InsPtEnable`
- `InsPtEnabled`
- `InsPtGetHeight`
- `InsPtGetLocation`
- `InsPtSetHeight`
- `InsPtSetLocation`

List Object

The list object appears as a vertical list of choices in a box. The current selection of the list is inverted. If there are more choices than can be displayed, the system draws small arrows (scroll indicators) in the right margin next to the first and last visible choice.

When the pen comes down and up on a scroll indicator, the list is scrolled. When the user scrolls down, the last visible item becomes the first visible item if there are enough items to fill the list. If not, the list is scrolled so that the last item of the list appears at the bottom of the list. The reverse is true for scrolling up. Scrolling doesn't change the current selection.

Bringing the pen down on a list item unhighlights the current selection and highlights the item under the pen. Dragging the pen through the list highlights the item under the pen. Dragging the pen above or below the list causes the list to scroll if it contains more choices than are visible.

When the pen is released over an item, that item becomes the current selection. When the pen is dragged outside the list, the item that was highlighted before the `penDownEvent` is highlighted again if it's visible. If it's not, no item is highlighted.

This section provides information about list objects by discussing these topics:

- List Object Events
- Structure of a List
- Associated Resources
- List Functions

List Object Events

The list object generates two types of event structures: `lstEnterEvent` and `lstSelectEvent`. Both events are generated by the list event-handler function `LstHandleEvent`.

The following table provides an overview of how `LstHandleEvent` deals with the different events.

When LstHandleEvent receives...	LstHandleEvent performs these actions...
`penDownEvent`	Adds a `lstEnterEvent` to the event queue if the pen position is within the bounds of the list.
`lstEnterEvent`	Tracks the pen until it's released. • If the pen is released on a list choice, a new selection is made (the data structure is modified) and a `lstSelectEvent` is added to the event queue. • If the pen is released outside the list, the selection is unchanged and no event is posted.

Structure of a List

The `ListType` structure and supporting structures are defined as follows:

Listing 4.4 List Structure

```
typedef struct {
  Word                  id;
  RectangleType         bounds;
  ListAttrType          attr;
  CharPtr*              itemsText;
  Word                  numItems;
  Word                  currentItem;
  Word                  topItem;
  FontID                font;
  WinHandle             popupWin;
  ListDrawDataFuncPtr  drawItemCallback;
} ListType;

typedef struct {
  Word usable        :1;
  Word enabled       :1;
  Word visible       :1;
  Word poppedUp      :1;
  Word hasScrollBar  :1.
  Word search        :1;
  Word reserved      :2;
} ListAttrType;
```

List Object Fields

The list object has the following fields:

Field	**Function**
`id`	ID value, specified by the application developer. This ID value is part of the event data of `lstEnterEvent` and `lstSelectEvent`.
`bounds`	Bounds of the list, relative to the window.
`attr`	List attributes: • A form that doesn't have the `usable` attribute set is not considered part of the current interface of the application, and it doesn't appear on screen. • If the `enable` attribute is set, the user can interact with the list. • The `visible` attribute is set or cleared internally when the field object is drawn or erased. • If the `poppedUp` attribute is set, choices are displayed in a popup window. This attribute is set and cleared internally. • If `hasScrollbar` is set, the field has a scroll bar. • If `search` is set, incremental search is enabled.
`itemsText`	Pointer to an array of pointers to the text of the choices.
`numItems`	Number of choices in the list.
`currentItem`	Currently-selected list choice (0 = first choice).
`topItem`	First choice displayed in the list.
`font`	ID of the font used to draw all list text strings.
`popupWin`	Handle of the window created when a list is displayed if the `poppedUp` attribute is set.

`drawItems-Callback`	Function used to draw an item in the list. If `NULL`, the default drawing routine is used instead.
	`void ListDrawDataFuncType (UInt itemNum,`
	`        RectanglePtr bounds, CharPtr *itemsText)`

Associated Resources

The List Resource (tLST), andPopup Trigger Resource (tPUT) are used together to represent an active list.

List Functions

The following API calls can be used to manipulate list objects.

- `LstDrawList`
- LstEraseList
- LstGetNumberOfItems
- LstGetSelection
- LstGetSelectionText
- LstGetVisibleItems
- LstHandleEvent
- LstMakeItemVisible
- LstPopupList
- LstScrollList
- LstSetDrawFunction
- LstSetHeight
- LstSetListChoices
- LstSetPosition
- LstSetSelection
- LstSetTopItem

Menu Objects

A menu bar is displayed whenever the user taps a menu icon. The menu bar, a horizontal list of menu titles, appears at the top of the screen in its own window, above all application windows. Pressing a menu title highlights the title and "pulls down" the menu below the title.

User actions have the following effect on a menu:

When...	Then...
User drags the pen through the menu.	Command under the pen is highlighted.
Pen is released over a menu item.	That item is selected and the menu bar and menu disappear.
Pen is released outside both the menu bar and the menu.	Both menu and menu bar disappear and no selection is made.
Pen is released in a menu title.	Menu bar and Menu remain displayed until a selection is made from the menu.
Pen is tapped outside menu and menu bar.	Both menu and menu bar are dismissed.
User selects a separator with the pen.	Menu is dismissed but no event is posted.

A menu has the following features:

- Item separators, which are lines to group menu items.
- Keyboard shortcuts; the shortcut labels are right justified in menu items.
- A menu remembers its last selection; the next time a menu is displayed the prior selection appears highlighted.
- The bits behind the menu bar and the menus are saved and restored by the menu routines.
- When the menu is visible, the insertion point is turned off.

This section provides information about menu objects by discussing these topics:

- Menu Events
- Structure of a Menu
- Associated Resources
- Menu Functions

Menu Events

Menu events are handled by the routine `MenuHandleEvent`, which handles events of type `penDownEvent` and `keyDownEvent`.

When a menu item is chosen, the menu event handler adds a `menuEvent` that identifies the chosen item to the event queue.

Structure of a Menu

The menu structure and supporting structures are defined as follows:

Listing 4.5 Menu Structure and Supporting Structures

```
typedef struct {
   WinHandle        barWin;
   WinHandle        bitsBehind;
   WinHandle        savedActiveWin;
   WinHandle        bitsBehindStatus;
   MenuBarAttrType  attr;
   SWord            curMenu;
   SWord            curItem;
   long             commandTick;
   SWord            numMenus;
   MenuPullDownPtr menus;
} MenuBarType;

typedef MenuBarType * MenuBarPtr;
typedef struct {
   Word visible         :1;
   Word commandPending  :1;
   Word insPtEnabled    :1;
} MenuBarAttrType;

typedef struct {
   WinHandle        menuWin;
   RectangleType    bounds;
   WinHandle        bitsBehind;
   RectangleType    titleBounds;
   CharPtr          title;
   Word             numItems;
   MenuItemType     *items;
} MenuPullDownType;

typedef MenuPullDownType * MenuPullDownPtr;

typedef struct {
   Word    id;
   char    command;
   CharPtr itemStr;
} MenuItemType;
```

Menu Object Fields

The menu object has the following fields:

Field	Function
`barWin`	Handle for the window that contains the menu bar.
`bitsBehind`	Handle for the window that contains the region obscured by the menu bar.
`savedActiveWin`	Stores currently active window behind the menu.
`bitsBehind-Status`	Stores the bits behind the status message so that when the message display terminates, the bits can be restored.
`attr`	Menu bar attributes. The `attr` field is a bit field that contains the members `visible`, `commandPending`, and `insPtEnabled`. • If `visible` is set, the menu bar is drawn. • If `commandPending`, the next key is a command. • If `insPtEnable` is set, the insertion point was on when the menu was drawn.
`curMenu`	Menu number for the currently visible menu. Menus are numbered sequentially, starting with 0. The value is preserved when the menu bar is dismissed. The next time the menu is displayed, the previously visible pull-down menu can also be redisplayed. A value of -1 indicates that there is no current pull-down menu.
`curItem`	Item number of the currently highlighted menu item. The items in each menu are numbered sequentially, starting with zero.
`commandTick`	Stores the tick count at which the status message should be erased.
`numMenus`	Number of pull-down menus on the menu bar.
`menus`	Array of `MenuPullDownType` structures. The `MenuPullDownType` structure defines a pull-down menu.

Menu Pull-Down Fields

The menu pulldown object has the following fields:

Field	Function
`menuWin`	Handle for the window that contains the menu.
`bounds`	Position and size, in pixels, of the pull-down menu.
`bitsBehind`	Handle of a window that contains the region obscured by the menu.
`title`	Pointer to the menu title (null-terminated).
`titleBounds`	Bounds of the title in the menubar.
`numItems`	Number of items in a menu. Separators count as items.
`items`	Array of `MenuItemType` structures. A `MenuItemType` structure defines a menu item.

Menu Item Fields

The menu item object has the following fields:

Field	Function
`id`	ID value specified by the application developer. This ID value is included as part of the event data of a `menuEvent`.
`command`	Shortcut key. If you provide shortcuts, make sure that each shortcut is unique among all commands available at that time.
`itemStr`	Pointer to the text display for a menu item. The shortcut key description is included in this string. The item label and the shortcut key description are delimited with a tab character.

Associated Resources

The resources MBAR (menu bar) and MENU (menu) are used jointly to represent a menu object on screen.

Menu Functions

The following API calls can be used to manipulate menu objects.

- MenuDispose
- MenuDrawMenu
- MenuEraseStatus
- MenuGetActiveMenu
- MenuHandleEvent
- MenuInit
- MenuSetActiveMenu

Scrollbar Object

Palm 0S 2.0 provides vertical scrollbar support. As a result, developers can now include scroll bars in forms or tables and the system sends the appropriate events when the end-user interacts with the scroll bar.

Here's what you have to do to include a scroll bar in your GUI:

1. **Create a scroll bar (tSCL) UI resource.**

   Provide the ID, the bounds for the scroll bar rectangle. The height has to match the object you want to attach it to (normally a text field). The width should be 7.

2. **Provide a minimum, and maximum value as well as a page size.**

   - minimum is usually 0
   - maximum is usually 0 and set programmatically
   - the page size determines by how many lines the system moves when the text scrolls.

3. **Make the scroll bar part of the form (for tables, place the scroll bar next to the table field programmatically.)**

   When you compile your application, the system creates the appropriate scroll bar UI object (see Scroll Bar UI Object)

   There are two ways in which the scroll bar and the field (or table field) that it's attached to need to interact:

   - When the user adds or removes text, the scroll bar needs to know about the change in size.
     To get this functionality, call `TableHasScrollBar` programatically. The table or field will then send events whenever the size changes. Your application can catch the events and process them appropriately.
   - When the user moves the scroll bar, the text needs to more accordingly. This can either happen dynamically or statically (i.e. after the user has released the scroll bar)
     As a rule, the scroll bar appears on screen as part of the form and is updated appropriately by the system. Applications therefore rarely have to call SclDrawScrollBar, SclGetScrollBar, or SclSetScrollBar. The application usually does call SclSetScrollBar at initialization time to set the initial position of the scroll bar.
   - The system sends the following scroll bar events:
     – `sclEnterEvent` is sent when a `penDownEvent` occurs within the bounds of the scroll bar.
     – `sclRepeatEvent` is sent when the user drags the scroll bar.
     – `sclExitEvent` is sent when the user lifts the pen. This event is sent regardless of previous `sclRepeatEvents`.

   Applications that want to support immediate-mode scrolling (that is, scrolling happens as the user drags the pen) need to watch for occurrences of `sclRepeatEvent`.

   Application that don't support immediate-mode scrolling should ignore occurrences of `sclRepeatEvent` and wait only for the `sclExitEvent`.

Listing 4.6 Scroll Bar UI Object

```
typedef struct {
  Word usable:        1;
```

```
   Word visible:       1;
   Word hilighted:     1;
   Word shown:         1;
   Word activeRegion:  4;
} ScrollBarAttrType;


typedef struct {
   RectangleType       bounds;
   Word                id;
   ScrollBarAttrType   attr;
   Short               value;
   Short               minValue;
   Short               maxValue;
   Short               pageSize;
   Short               penPosInCar;
   Short               savePos;
} ScrollBarType;

typedef ScrollBarType * ScrollBarPtr;
```

Scrollbar Fields

The scrollbar object has the following fields:

Field	Function
`bounds`	Bounds of the scrollbar
`id`	Developer-defined ID of the scrollbar.

Field	Function
`attr`	Attributes of the scrollbar. • When the `usable` attribute is set, the scrollbar is part of the UI. • When the `visible` attribute is set, the scrollbar is visible on screen. • When the `highlighted` attribute is set, the scrollbar is highlighted. • The `shown` attribute has to be true if the scrollbar is visible and if maxValue > minValue. • The `activeRegion` attribute indicates the active region of the scrollbar.
`value`	Current value of the scroll bar.
`minValue`	Minimum value (default should be zero).
`maxValue`	Maximum value. With the scroll car being the dark region in the scrollbar that indicates the position in the document and overlap the number of lines from the bottom of one page to be visible at the top of the next page, this value is usually computed as follows: number of lines – (page size + overlap) For example, if you have 100 lines, the scroll car is at maximum at line 90 or 91.
`pageSize`	Number of lines to scroll when user scrolls one page.
`penPosInChar`	Used internally.
`savePos`	Used internally.

Table Objects

The table object is used to organize several types of UI objects. The number of rows and the number of columns must be specified for each table object. A UI object can be placed inside a cell of a table. Tables often consist of rows or columns of the same object. For example, a table might have one column of labels and another column of fields. Tables can only be scrolled vertically. Tables can't include bitmaps.

This section provides information about table objects by discussing these topics:

- Table Event
- Structure of a Table
- Associated Resource
- Table Functions

Table Event

The table object generates the event `tblSelectEvent`. This event contains:

- The table's ID number
- The row of the selected table
- The column of the selected table

When `tblSelectEvent` is sent to a table, the table generates an event to handle any possible events within the item's UI object.

Structure of a Table

The table structure and supporting structures are defined as follows:

```
typedef struct {
   Word                   id;
   RectangleType          bounds;
   TableAttrType          attr;
   Word                   numColumns;
   Word                   numRows;
```

```
  Word                  currentRow;
  Word                  currentColumn;
  Word                  topRow;
  TableColumnAttrType * columnAttrs;
  TableRowAttrType *    rowAttrs;
  TableItemPtr          items;
  FieldType             currentField;
} TableType;
typedef TableType * TablePtr;

typedef struct {
  Word       visible:1;
  Word       editable:1;
  Word       editing:1;
  Word       selected:1;
  Word       hasScrollBAr:1.
} TableAttrType;

typedef struct {
  TableItemStyleType  itemType;
  FontID          fontID; //font for drawing text
  Word            intValue;
  CharPtr         ptr;
} TableItemType;
typedef TableItemType * TableItemPtr;

typedef struct {
  Word                  width;         // in 
pixels
  Boolean               usable;
  Word                  spacing;
  TableDrawItemFuncPtr  drawCallback;
  TableLoadDataFuncPtr  loadDataCallback;
  TabelSaveDataFuncPtr  SaveDataCallback;
} TableColumnAttrType;
```

```
typedef struct {
   Word            id;
   Word            height;  // row height in pixels
   DWord           data;
   Word            usable;
   Word            selectable;
   Word            invalid;//true if redraw needed
} TableRowAttrType;
```

Fields of a Table Structure

The table structure has the following fields:

Field	Function
`id`	ID value specified by the application developer.
`bounds`	Position and size of the table object.
`attr`	Table object's attributes. The `attr` field is a bit field that contains the following members: • If `visible` is set, the table is drawn on screen. • If `editable` is set, the user can modify the table. • If `editing` is set, the table is in edit mode. • If `selected` is set, the current item is selected. • If `hasScrollbar` is set, the table has a scroll bar. Note that this attribute can only be set programmatically.
`numColumns`	Number of columns in the table object.
`numRows`	Number of rows in the table object.
`currentRow`	Row of the table set to current.
`currentColumn`	Column of the table set to current.
`topRow`	First row in the table object.

Field	Function
`columnAttrs`	Column attributes, such as its width, its usability, and how the column draws itself.
`rowAttrs`	Row's attributes, such as its ID, height, and whether or not it is usable, selectable, or invalid.
`items`	Item attributes, such as the item type, font ID, an integer value, and a character pointer.
`currentField`	Field object the user is currently editing.

Associated Resource

The Table Resource (tTBL) represents a table on screen.

Table Functions

The following API calls can be used to manipulate table objects.

- TblDrawTable
- TblEditing
- TblEraseTable
- TblFindRowData
- TblFindRowID
- TblGetBounds
- TblGetColumnSpacing
- TblGetColumnWidth
- TblGetCurrentField
- TblGetItemBounds
- TblGetItemInt
- TblGetLastUsableRow
- TblGetNumberOfRows
- TblGetRowData
- TblGetRowHeight
- TblGetRowID

- TblGetSelection
- TblGrabFocus
- TblHandleEvent
- TblHasScrollBar
- TblInsertRow
- TblMarkRowInvalid
- TblMarkTableInvalid
- TblRedrawTable
- TblReleaseFocus
- TblRemoveRow
- TblRowInvalid
- TblRowSelectable
- TblRowUsable
- TblSelectItem
- TblSetBounds
- `TblSetColumnEditIndicator`
- TblSetColumnSpacing
- TblSetColumnUsable
- TblSetColumnWidth
- TblSetCustomDrawProcedure
- TblSetItemInt
- TblSetItemPtr
- TblSetItemStyle
- TblSetLoadDataProcedure
- TblSetRowData
- TblSetRowHeight
- TblSetRowID
- TblSetRowSelectable
- `TblSetRowStaticHeight`
- TblSetRowUsable
- TblSetSaveDataProcedure
- TblUnhighlightSelection

Window Objects

A window defines a drawing region. This region may be on the display or in a memory buffer (an off-screen window). Off-screen windows are useful for saving and restoring regions of the display that are obscured by other UI objects. All forms are windows, but not all windows are forms.

The window object is the portion of the form object that determines how the form's window looks and behaves. A window object contains viewing coordinates of the window and clipping bounds.

This section provides information about windows by discussing these topics:

- Window Events
- Structure of a Window
- Window Functions

No resources are associated with window objects.

Window Events

When a window becomes active, a `winEnterEvent` takes place. When the window is deactivated, a `winExitEvent` occurs. The `winEnterEvent` usually follows right after a `winExitEvent`; an old window is deactivated just before a new window is activated.

Structure of a Window

The `WinType` structure is defined as follows:

```
typedef struct WinTypeStruct {
   Word                        displayWidth;
   Word                        displayHeight;
   VoidPtr                     displayAddr;
   WindowFlagsType             windowFlags;
   RectangleType               windowBounds;
   AbsRectType                 clippingBounds;
   PointType                   viewOrigin;
```

```
    FrameBitsType           frameType;
    GraphicStatePtr         gstate;
    struct WinTypeStruct*   nextWindow;
  } WindowType;

  typedef WindowType * WinPtr;

  typedef WinPtr WinHandle;
```

Fields of a Window Structure

Field	Function
`displayWidth`	Width, in pixels, of the display memory buffer (video RAM) for on-screen windows and the width of a memory buffer for off-screen windows.
`displayHeight`	Height, in pixels, of the device display.
`displayAddr`	Pointer to the window's display memory buffer.
`windowFlags`	Window attributes: `format`, `offscreen`, `modal`, `focusable`, `enabled`, `visible`, `dialog`, and `compressed` (see next table).
`windowBounds`	Bounds of the window.
`clipping-Bounds`	Bounds for clipping any drawing within the window.
`viewOrigin`	Window origin point on the display.
`frameType`	Frame's corner diameter, width of shadow, and width of frame.
`gstate`	State of the graphic mode, pattern mode, font, and underline mode.
`nextWindow`	Pointer to the next window in a linked list of windows.

Window attributes are defined as follows:

Attribute	Set to 0	Set to 1
`format`	screen mode	generic mode
`offscreen`	on screen	off screen
`modal`	modeless window	modal window
`focusable`	non-focusable	focusable
`enabled`	disabled	enabled
`visible`	invisible	visible
`dialog`	nondialog	dialog
`compressed`	uncompressed	compressed

Window Functions

The following API calls can be used to manipulate window objects.

- WinAddWindow
- WinClipRectangle
- WinCopyRectangle
- WinCreateOffscreenWindow
- WinCreateWindow
- WinDeleteWindow
- WinDisableWindow
- WinDisplayToWindowPt
- WinDrawBitmap
- WinDrawChars
- WinDrawGrayLine
- WinDrawGrayRectangleFrame
- WinDrawInvertedChars
- WinDrawLine
- WinDrawRectangle
- WinDrawRectangleFrame
- WinDrawWindowFrame
- WinDrawWindowFrame
- WinEnableWindow
- WinEraseChars
- WinEraseLine
- WinEraseRectangleFrame
- WinEraseWindow
- WinFillLine
- WinFillRectangle
- WinGetActiveWindow
- WinGetClip
- WinGetDisplayExtent
- WinGetDisplayWindow
- WinGetDrawWindow

- WinGetFirstWindow
- WinGetFramesRectangle
- WinGetPattern
- WinGetWindowBounds
- WinGetWindowExtent
- WinGetWindowFrameRect
- WinGetWindowPointer
- WinInitializeWindow
- WinInvertChars
- WinInvertLine
- WinInvertRectangle
- WinInvertRectangleFrame
- WinModal
- WinRemoveWindow
- WinResetClip
- WinRestoreBits
- WinSaveBits
- WinScrollRectangle
- WinSetActiveWindow
- WinSetClip
- WinSetDrawWindow
- WinSetPattern
- WinSetUnderlineMode
- WinSetWindowBounds
- WinWindowToDisplayPt

5

Using Palm OS UI Managers

In contrast to desktop computer operating systems, Palm OS consists of only one library. This library, however, contains several managers, which are groups of functions that work together to implement certain functionality. As a rule, all functions that belong to one manager use the same three-letter prefix and work together to implement a certain aspect of functionality.

In this chapter, you learn about all Palm OS managers that aren't directly responsible for memory management or system management. As you investigate managers more closely you'll find that some of them are mostly services provided by the system, while others contain a large number of API calls.

The managers are presented in alphabetical order for easy access.

- The Alert Manager lets applications implement modal dialog boxes that display an alert dialog or prompt the user for a response to a question.
- The Graffiti Manager provides an interface to the Graffiti recognizer. The recognizer converts pen strokes into key events, which are then fed to an application through the event manager.

  Most applications never need to call the Graffiti manager directly because the event manager calls it automatically whenever it detects pen strokes in the Graffiti area of the digitizer.
- The Key Manager provides an interface to the hardware buttons on the Palm OS device. It converts hardware button presses into key events and implements auto-repeat of the buttons.

Most applications never need to call the key manager directly except to change the key repeat rate or poll the current state of the keys.

- The Pen Manager provides an interface to the digitizer hardware and converts input from the digitizer into pen coordinates.

  Most applications never need to call the pen manager directly because any pen activity is automatically returned to the application in the form of events.

The Alert Manager

The alert manager provides a simple way for an application to implement modal dialog boxes that display an alert message or prompt the user for a response to a question.

Given a resource ID that defines an alert, the alert manager creates and displays a modal dialog box. When the user taps one of the buttons in the dialog, the alert manager disposes of the dialog box and returns to the caller the item number of the button the user tapped.

There are four types of system-defined alerts:

- Question
- Warning
- Notification
- Error

The alert type determines which icon is drawn in the alert window and which sound plays when the alert is displayed.

Alert Resource Information

When the alert manager is invoked, it's passed an alert resource (see Alerts) that contains the following information:

- The rectangle that specifies the size and position of the alert window.
- The alert type (question, warning, notification, or error).
- The null-terminated text string; that is, the message the alert displays.
- The text labels for one or more buttons.

Alert Manager Functions

The following alert manager functions are available for application use:

- `FrmAlert`
- `FrmCustomAlert`

The Graffiti Manager

The Graffiti manager provides an API to the Palm OS Graffiti recognizer. The recognizer converts pen strokes into key events, which are then fed to an application through the event manager.

Most applications never need to call the Graffiti manager directly because it's automatically called by the event manager whenever it detects pen strokes in the Graffiti area of the digitizer.

Special-purpose applications, such as a Graffiti tutorial, may want to call the Graffiti manager directly to recognize strokes in other areas of the screen or to customize the Graffiti behavior.

Using GrfProcessStroke

`GrfProcessStroke` is a high-level Graffiti manager call used by the event manager for converting pen strokes into key events. The call

- Removes pen points from the pen queue
- Recognizes the stroke
- Puts one or more key events into the key queue

`GrfProcessStroke` automatically handles Graffiti ShortCuts and calls the user interface as appropriate to display shift indicators in the current window.

An application can call `GrfProcessStroke` when it receives a `penUpEvent` from the event manager if it wants to recognize strokes entered into its application area (in addition to the Graffiti area).

Using Other High-Level Graffiti Manager Calls

Other high-level calls provided by the Graffiti manager include routines for

- Getting and setting the current Graffiti shift state (caps lock on/off, temporary shift state, etc.)

- Notifying Graffiti when the user selects a different field. Graffiti needs to be notified when a field change occurs so that it can cancel out of any partially entered shortcut and clear its temporary shift state if it's showing a potentially accented character.

Special-Purpose Graffiti Manager Calls

The remainder of Graffiti manager API routines are for special-purpose use. They are basically all the entry points into the Graffiti recognizer engine and are usually called only by `GrfProcessStroke`. These special-purpose uses include calls to add pen points to the Graffiti recognizer's stroke buffer, to convert the stroke buffer into a Graffiti glyph ID, and to map a glyph into a string of one or more key strokes.

Accessing Graffiti ShortCuts

Other routines provide access to the Graffiti ShortCuts database. This is a separate database owned and maintained by the Graffiti manager that contains all of the shortcuts. This database is opened by the Graffiti manager when it initializes and stays open even after applications quit.

The only way to modify this database is through the Graffiti manager API. It provides calls for getting a list of all shortcuts, and for adding, editing, and removing shortcuts. The ShortCuts screen of the Preferences application provides a user-interface for modifying this database.

2.0 Note on Auto Shifting

The Palm OS 2.0 operating system automatically uses an upper-case letter under the following conditions:

- Period and space or Return.
- Other sentence terminator (such as ? or !) and space

This functionality requires no changes by the developer, but should be welcome to the end user.

2.0 Note on Graffiti Help

Applications can pop up Graffiti help by calling `SysGraffitiReferenceDialog` or by putting a special character—graffitiReferenceChr from Chars.h—on the queue.

Graffiti help is also available through the system Edit menu. As a result, any application that includes the system Edit menu allows users to access Graffiti Help that way. See: system:HSUtil.h, System:HTALSPI.h, System:SysConfig.Prv.h.

Graffiti Manager Functions

The following functions are available for application use.

- `GrfProcessStroke`
- `GrfGetState`
- `GrfSetState`
- `GrfFlushPoints`
- `GrfAddPoint`
- `GrfInitState`
- `GrfCleanState`
- `GrfMatch`
- `GrfGetMacro`
- `GrfGetAndExpandMacro`
- `GrfFilterPoints`
- `GrfGetNumPoints`
- `GrfGetPoint`
- `GrfFindBranch`
- `GrfMatchGlyph`
- `GrfGetGlyphMapping`
- `GrfGetMacroName`
- `GrfDeleteMacro`
- `GrfAddMacro`

The Key Manager

The key manager manages the hardware buttons on the Palm OS device. It converts hardware button presses into key events and implements auto-repeat of the buttons. Most applications never need to call the key manager directly except to change the key repeat rate or to poll the current state of the keys.

The event manager is the main interface to the keys; it returns a `keyDownEvent` to an application whenever a button is pressed. Normally, applications are notified of key presses through the event manager. Whenever a hardware button is pressed, the application receives an event through the event manager with the appropriate key code stored in the event record. The state of the hardware buttons can also be queried by applications at any time through the `KeyCurrentState` function call.

The `KeyRates` call changes the auto-repeat rate of the hardware buttons. This might be useful to game applications that want to use the hardware buttons for control. The current key repeat rates are stored in the key manager globals and should be restored before the application exits.

The following functions are available for application use.

- `KeyRates`
- `KeyCurrentState`

The Pen Manager

The pen manager manages the digitizer hardware and converts input from the digitizer into pen coordinates. Most applications never need to call the pen manager directly because any pen activity is automatically returned to the application in the form of events.

Pen coordinates are stored in the pen queue as raw, uncalibrated coordinates. When the system event manager routine for removing pen coordinates from the pen queue is called, it converts the pen coordinate into screen coordinates before returning.

The Preferences application provides a user interface for calibrating the digitizer. It uses the pen manager API to set up the calibration which is then saved into the Preferences database. The pen manager assumes that the digitizer is linear in both the x and y directions; the calibration is therefore a simple matter of adding an offset and scaling the x and y coordinates appropriately.

The following functions are available for application use.

- `PenResetCalibration`
- `PenCalibrate`

6

Palm OS Events

Palm OS events are structures that the system passes to the application when the user interacts with the graphical user interface. How Events Control an Application discusses in detail how this works. This chapter only provides reference-style information about each event. It discusses the following events in alphabetical order:

Event	UI Object
appStopEvent	N.A.
ctlEnterEvent, ctlExitEvent, ctlRepeatEvent, ctlSelectEvent	Control
daySelectEvent	N.A.
fldChangedEvent, fldEnterEvent, fldHeightChangedEvent	Field
frmCloseEvent.frmLoadEvent, frmOpenEvent, frmSaveEvent, frmUpdateEvent, frmTitleEnterEvent, frmTitleSelectEvent	Form
keyDownEvent	N.A.
lstEnterEvent, lstExitEvent, lstSelectEvent	List
menuEvent	Menu
nilEvent	N.A.
penDownEvent, penMoveEvent, penUpEvent	N.A. (pen)
popSelectEvent	Popup (Control)
sclEnterEvent, sclRepeatEvent, sclExitEvent	Scroll bar
tblEnterEvent, tblExitEvent, tblSelectEvent	Table
winEnterEvent, winExitEvent	Window

appStopEvent

When the system wants to launch a different application than the one currently running, the event manager sends this event to request the current application to terminate. In response, an application has to exit its event loop, close any open files and forms, and exit.

If an application doesn't respond to this event by exiting, the system can't start the other application.

ctlEnterEvent

The control routine `CtlHandleEvent` sends this event when it receives a `penDownEvent` within the bounds of a control.

The following data is passed with the event:

`controlID`	Developer-defined ID of the control.
`pControl`	Pointer to a control structure (`ControlType`).

ctlExitEvent

The control routine `CtlHandleEvent` sends this event. When `CtlHandleEvent` receives a `ctlEnterEvent`, it tracks the pen until the pen is lifted from the display. If the pen is lifted within the bounds of a control, a `ctlSelectEvent` is added to the event queue; if not, a `cltExitEvent` is added to the event queue.

The following data is passed with the event:

`controlID`	Developer-defined ID of the control.
`pControl`	Pointer to a control structure (`ControlType`).

ctlRepeatEvent

The control routine `CtlHandleEvent` sends this event. When `CtlHandleEvent` receives a `ctlEnterEvent` in a Repeat control (tREP), it sends a `ctlRepeatEvent`. When `CtlHandleEvent` receives a `ctlRepeatEvent` in a repeat control, it sends another `ctlRepeatEvent` if the pen remains down within the bounds of the control for 1/2 second beyond the last `ctlRepeatEvent`.

The following data is passed with the event:

`controlID`	Developer-defined ID of the control.
`pControl`	Pointer to a control structure (`ControlType`).
`time`	System-ticks count when the event is added to the queue.

ctlSelectEvent

The control routine `CtlHandleEvent` sends this event. When `CtlHandleEvent` receives a `ctlEnterEvent`, it tracks the pen until the pen is lifted. If the pen is lifted within the bounds of the same control it went down in, a `cltSelectEvent` is added to the event queue; if not, a `ctlExitEvent` is added to the event queue.

The following data is passed with the event:

`controlID`	Developer-defined ID of the control.
`pControl`	Pointer to a control structure (`ControlType`).
`on`	`TRUE` when the control is depressed; otherwise, `FALSE`.

daySelectEvent

The system-internal `DayHandleEvent` routine, which handles events in the day selector object, handles this event. When the day selector object displays a calendar month, the user can select a day by tapping on it.

This event is sent when the pen touches and is lifted from a day number.

The following data is passed with the event:

`pSelector`	Pointer to a day selector structure (`DaySelectorType`).
`selection`	Not used.
`useThisDate`	Set to `TRUE` to automatically use the selected date.

fldChangedEvent

The field routine `FldHandleEvent` sends this event when the text of a field has been scrolled as a result of drag-selecting. When `FldHandleEvent` receives a `fldEnterEvent`, it positions the insertion point and tracks the pen until it's lifted. Text is selected (highlighted) appropriately as the pen is dragged.

The following data is passed with the event:

`fieldID`	Developer-defined ID of the field.
`pField`	Pointer to a field structure (`FieldType`).

fldEnterEvent

The field routine `FldHandleEvent` sends this event when the field receives a `penDownEvent` within the bounds of a field. The following data is passed with the event:

`fieldID`	Developer-defined ID of the field.
`pField`	Pointer to a field structure (`FieldType`).

fldHeightChangedEvent

The field routine `FldHandleEvent` sends this event. The field API supports a feature that allows a field to dynamically resize its visible height as text is added or removed from it. Functions in the field API send a `fldHeightChangedEvent` to change the height of a field. Applications don't usually send or handle this event.

The following data is passed with the event:

`fieldID`	Developer-defined ID of the field.
`pField`	Pointer to a field structure (`FieldType`).
`newHeight`	New visible height of the field, in number of lines.
`currentPos`	Current position of the insertion point.

frmCloseEvent

The form routines `FrmGotoForm` and `FrmCloseAllForms` send this event. `FrmGotoForm` sends a `frmCloseEvent` to the currently active form; `FrmCloseAllForms` sends a `frmCloseEvent` to all forms an application has loaded into memory. If an application doesn't intercept this event, the routine `FrmHandleEvent` erases the specified form and releases any memory allocated for it.

The following data is passed with the event:

`formID`	Developer-defined ID of the form.

frmLoadEvent

The form routines `FrmGotoForm` and `FrmPopupForm` send this event. It's a request that the application load a form into memory.

The application is responsible for handling this event.

The following data is passed with the event:

`formID`	Developer-defined ID of the form.

frmOpenEvent

The form routines `FrmGotoForm` and `FrmPopupForm` send this event. It is a request that the application initialize and draw a form.

The application is responsible for handling this event.

The following data is passed with the event:

`formID`	Developer-defined ID of the form.

frmSaveEvent

The form routine `FrmSaveAllForms` sends this event. It is a request that the application save any data stored in a form.

The application is responsible for handling this event.

No data is passed with this event.

frmUpdateEvent

The form routine `FrmUpdateForm`, or in some cases the routine `FrmEraseForm`, sends this event when it needs to redraw the region obscured by the form being erased.

Generally, the region obscured by a form is saved and restored by the form routines without application intervention. However, in cases where the system is running low on memory, the form's routine may not save obscured regions itself. In that case, the application adds a `frmUpdateEvent` to the event queue. The form receives the event and redraws the region using the `updateCode` value.

An application can define its own `updateCode` and then use this event to also trigger behavior in another form, usually when changes made to one form need to be reflected in another form.

The following data is passed with the event:

`formID`	Developer-defined ID of the form.
`updateCode`	The reason for the update request. `FrmEraseForm` sets this code to zero. Application developers can define their own `updateCode`. The `updateCode` is passed as a parameter to `FrmUpdateForm`.

frmTitleEnterEvent

The control routine `FrmHandleEvent` sends this event when it receives a `penDownEvent` within the bound of the title of the form. Note that only the written title, not the whole title bar is active.

The following data is passed with the event:

`formID`	Developer-defined ID of the form.

frmTitleSelectEvent

The control routine `FrmHandleEvent` sends this event. `FrmHandleEvent` receives a `frmTitleEnterEvent`, it tracks the pen until the pen is lifted. If the pen is lifted within the bounds of the active same title bar region, a `frmTitleSelectEvent` is added to the event queue.

The following data is passed with the event:

`formID`	Developer-defined ID of the form.

keyDownEvent

This event is sent by the system when the user enters a Graffiti character, presses one of the buttons below the display, or taps one of the icons in the icon area; for example, the Find icon.

The following data is passed with the event:

`chr`	ASCII code of character, or zero if the key is a virtual key code; for example, the Find key.
`keyCode`	Virtual key code; for example, the Find key.
`modifiers`	One of the following:

`shiftKeyMask`	True if Graffiti is in case-shift mode.
`capsLockMask`	True if Graffiti is in cap-shift mode.
`numLockMask`	True if Graffiti is in numeric-shift mode.
`commandKeyMask`	True if the Graffiti glyph was the menu command glyph.
`optionKeyMask`	Not implemented. Reserved.
`controlKeyMask`	Not implemented. Reserved.
`autoRepeatKeyMask`	True if generated due to auto-repeat.
`doubleTapKeyMask`	Not implemented. Reserved.
`poweredOnKeyMask`	True if the key press caused the system to be powered on.

lstEnterEvent

The list routine `LstHandleEvent` sends this event when it receives a `penDownEvent` within the bounds of a list object.

The following data is passed with the event:

`listID`	Developer-defined ID of the list.
`pList`	Pointer to a list structure (`ListType`).
`selection`	Item number (zero-based) of the new selection.

lstExitEvent

The list routine `LstHandleEvent` sends this event. When `LstHandleEvent` receives a `lstEnterEvent`, it tracks the pen until the pen is lifted. If the pen is lifted within the bounds of a list, a `lstSelectEvent` is added to the event queue; if not, a `lstExitEvent` is added to the event queue.

The following data is passed with the event:

`listID`	Developer-defined ID of the list.
`pList`	Pointer to a list structure (`ListType`).

lstSelectEvent

The list routine `LstHandleEvent` sends this event. When `LstHandleEvent` receives a `lstEnterEvent`, it tracks the pen until the pen is lifted. If the pen is lifted within the bounds of a list, a `lstSelectEvent` is added to the event queue; if not, a `lstExitEvent` is added to the event queue.

The following data is passed with the event:

`listID`	Developer-defined ID of the list.
`pList`	Pointer to a list structure (`ListType`).
`selection`	Item number (zero-based) of the list selection.

menuEvent

The menu routine `MenuHandleEvent` sends this event:

- When the user selects an item from a pull-down menu
- When the user selects a menu command using the Graffiti Command shortcut followed by an available command; for example, Command-C for copy

The following data is passed with the event:

`itemID`	Item ID of the selected menu command.

nilEvent

A `nilEvent` is useful for animation, polling, and similar situations.

The event manager sends this event when there are no events in the event queue. This happens only if the routine `EvtGetEvent`, discussed in Developing Palm OS Applications, Part I, is passed a timeout value (a value other than `evtWaitForever`, -1). If `EvtGetEvent` is unable to return an event in the specified time, it returns a `nilEvent`.

penDownEvent

The event manager sends this event when the pen first touches the digitizer.

The following data is passed with the event:

`penDown`	Always `TRUE`.
`screenX`	Window-relative position of the pen in pixels (number of pixels from the left bound of the window).
`screenY`	Window-relative position of the pen in pixels (number of pixels from the top left of the window).

penMoveEvent

The event manager sends this event when the pen is moved on the digitizer. Note that several kinds of UI objects, such as controls and lists, track the movement directly, and no `penMoveEvent` is generated.

The following data is passed with the event:

`penDown`	Always `TRUE`.
`screenX`	Window-relative position of the pen in pixels (number of pixels from the left bound of the window).
`screenY`	Window-relative position of the pen in pixels (number of pixels from the top left of the window).

penUpEvent

The event manager sends this event when the pen is lifted from the digitizer. Note that several kinds of UI objects, such as controls and lists, track the movement directly, and no `penUpEvent` is generated.

The following data is passed with the event:

`penDown`	Always false.
`screenX`	Window-relative position of the pen in pixels (number of pixels from the left bound of the window).
`screenY`	Window-relative position of the pen in pixels (number of pixels from the top left of the window).
`start`	Display-relative start point of the stroke.
`end`	Display-relative end point of the stroke.

popSelectEvent

The form routine `FrmHandleEvent` sends this event when the user selects an item in a popup list.

The following data is passed with the event:

`controlID`	Developer-defined ID of the resource.
`pControl`	Pointer to the control structure (`Control-Type`) of the popup trigger object.
`listID`	Developer-defined ID of the popup list object.
`listP`	Pointer to the list structure (`ListType`) of the popup list object.
`selection`	Item number (zero-based) of the new list selection.
`priorSelection`	Item number (zero-based) of the prior list selection.

sclEnterEvent

The routine `SclHandleEvent` sends this event when it receives a `penDownEvent` within the bounds of a scroll bar.

Applications usually don't have to handle this event.

The following data is passed with the event:

`scrollBarID`	Developer-defined ID of the scroll bar re-source.
`pScrollBar`	Pointer to the scroll bar structure.

sclRepeatEvent

The routine `SclHandleEvent` sends this event when the pen is continually held within the bounds of a scroll bar.

Applications that implement dynamic scrolling should watch for this event. In dynamic scrolling, the display is updated as the user drags the scroll bar (not after the user releases the scroll bar).

The following data is passed with the event:

`scrollBarID`	Developer-defined ID of the scroll bar resource.
`pScrollBar`	Pointer to the scroll bar structure.
`value`	Initial position of the scroll bar.
`newValue`	New position of the scroll bar. Given `value` and `newValue`, you can actually tell how much you have scrolled.
`time`	System-ticks count when the event is added to the queue to determine when the next event should occur.

sclExitEvent

The routine `SclHandleEvent` sends this event when the user lifts the pen from the scroll bar.

Applications that want to implement non-dynamic scrolling should wait for this event, then scroll the text using the values provided in `value` and `newvalue`.

Note that this event is sent regardless of previous `sclRepeat-Events.`If, however, the application has implemented dynamic scrolling, it doesn't have to catch this event.

The following data is passed with the event:

`scrollBarID`	Developer-defined ID of the scroll bar re-source.
`pScrollBar`	Pointer to the scroll bar structure.
`value`	Initial position of the scroll bar
`newvalue`	New position of the scroll bar. Given `value` and `newValue`, you can actually tell how much you have scrolled.

tblEnterEvent

The table routine `TblHandleEvent` sends this event when it receives a `penDownEvent` within the bounds of an active item in a table object.

The following data is passed with the event:

`tableID`	Developer-defined ID of the table.
`pTable`	Pointer to a table structure (`TableType`).
`row`	Row of the item.
`column`	Column of the item.

tblExitEvent

The table routine `TblHandleEvent` sends this event. When `TblHandleEvent` receives a `tblEnterEvent`, it tracks the pen until it's lifted from the display. If the pen is lifted within the bounds of the same item it went down in, a `tblSelectEvent` is added to the event queue; if not, a `tblExitEvent` is added to the event queue.

The following data is passed with the event:

`TableID`	Developer-defined ID of the table.
`pTable`	Pointer to a table structure (`TableType`).
`row`	Row of the item.
`column`	Column of the item.

tblSelectEvent

The table routine TblHandleEvent sends this event. When TblHandleEvent receives a tblEnterEvent, it tracks the pen until the pen is lifted from the display. If the pen is lifted within the bounds of the same item it went down in, a tblSelectEvent is added to the event queue; if not, a tblExitEvent is added to the event queue.

The following data is passed with the event:

TableID	Developer-defined ID of the table.
pTable	Pointer to a table structure (TableType).
row	Row of the item.
column	Column of the item.

winEnterEvent

The event manager sends this event when a window becomes the active window. This can happen in two ways: a call to WinSetActiveWindow is issued (FrmSetActiveForm calls this routine), or the user taps within the bounds of a window that is visible but not active. All forms are windows, but not all windows are forms; for example, the menu bar is a window but not a form.

The following data is passed with the event:

enter-Window	Pointer to the window we are entering. If the window is a form, this is a pointer to a FormType structure; if not, it's a pointer to a WindowType structure.
exit-Window	Pointer to the window we are exiting, if there is currently an active window, or zero if there is no active window. If the window is a form, this is a pointer to a FormType structure; if not, it's a pointer to a Window-Type structure.

winExitEvent

This event is sent by the event manager when a window is deactivated. A window is deactivated when another window becomes the active window (see `winEnterEvent`).

The following data is passed with the event:

`enterWindow`	Pointer to the window we are entering. If the window is a form, then this is a pointer to a `FormType` structure; if not, it's a pointer to a `WindowType` structure.
`exitWindow`	Pointer to the window we are exiting. If the window is a form, then this is a pointer to a `FormType` structure; if not, it's a pointer to a `WindowType` structure.

7

Palm OS User Interface Functions

Category Functions

CategoryCreateList

Purpose Read a database’s categories and store them in a list.

Prototype

```
void CategoryCreateList (DmOpenRef db,
                         ListPtr listP,
                         Word currentCategory,
                         Boolean showAll,
                         Boolean showUneditables,
                         Byte numUneditableCategories,
                         DWord editingStrID,
                         Boolean resizeList)
```

Parameters

`db`	Opened database containing category info.
`listP`	List in which to place the categories.
`currentCategory`	Category to select.
`showAll`	`TRUE` to have an `All` category.
`showUneditables`	`TRUE` to show uneditable categories.
`numUneditableCategories`	Number of categories considered uneditable. These are stored first.

`editingStrID`	A resource type to string to edit categories.
`resizeList`	`TRUE` to resize the list to the number of categories. Set `TRUE` for popups, `FALSE` otherwise.

Result `CategoryListItemsHandle` is set to the list's choices.

See Also CategoryCreateListV10

CategoryCreateListV10

Purpose Read a database's categories and set categories.

Prototype

```
void CategoryCreateListV10 (DmOpenRef db,
                            ListPtr lst,
                            Word currentCategory,
                            Boolean showAll)
```

Parameters

`db`	Database containing categories to extract.
`lst`	List object to load categories into.
`currentCategory`	Will be set as the current selection in the resulting list.
`showAll`	`TRUE` if an `All` category should be included in the list.

Result Returns nothing.

See Also CategoryCreateList

CategoryEdit

Purpose Event handler for the “Edit Categories” dialog.

Prototype

```
Boolean CategoryEdit ( DmOpenRef db,
                       WordPtr categoryP,
                       DWord titleStrID)
```

Parameters

`db`	Database containing the categories to be edited.
`categoryP`	Set to the category selected when the dialog is done.
`titleStrID`	Resource ID of a string resource to display in the title bar of the “Edit Categories” dialog. If this is 0, the default string “Edit Categories” is used.

Result Returns `TRUE` if any of the following conditions are `TRUE`:

- The current category is renamed.
- The current category is deleted.
- The current category is merged with another category.

Caveat This function has been revised for Palm OS 2.0.

See Also CategoryEditV10

CategoryEditV10

Purpose Event handler for the Edit Categories dialog.

Prototype

```
Boolean CategoryEditV10 (DmOpenRef db,
                         WordPtr category)
```

Parameters

`db`	Database containing the categories to be edited.
`category`	Current category.

Result Returns `TRUE` if any of the following conditions are true:

the current category is renamed

the current category is deleted

the current category is merged with another category

See Also CategoryEdit

CategoryFind

Purpose Return the index of the category that matches the name passed.

Prototype

```
Word CategoryFind (DmOpenRef db, CharPtr name)
```

Parameters

`db`	Database to search for the passed category.
`name`	Category name.

Result Returns the category index.

CategoryFreeList

Purpose This routine unlocks or frees memory locked or allocated by `CategoryCreateList`.

Prototype

```
void CategoryFreeList (DmOpenRef db,
                       ListPtr listP,
                       Boolean showAll,
                       DWord editingStrID)
```

Parameters

`db`	Database containing the categories.
`listP`	Pointer to the category list.
`showAll`	`TRUE` if the list was created with an `All` category.
`editingStrID`	A resource type to string to edit categories.

Comment Calling this function doesn’t remove the categories from the passed database.

Result Returns nothing.

See Also CategoryFreeListV10

CategoryFreeListV10

Purpose Unlock or free memory locked or allocated by `CategoryCreateListV10` which was attached to the passed List object.

Prototype `void CategoryFreeListV10(DmOpenRef db, ListPtr lst)`

Parameters

`db`	Database containing the categories.
`lst`	Pointer to the category list containing the memory to be freed.

Result Returns nothing.

See Also CategoryFreeList

CategoryGetName

Purpose Return the name of the specified category.

Prototype

```
void CategoryGetName ( DmOpenRef db,
                       Word index,
                       CharPtr name)
```

Parameters

`db`	Database that contains the categories.
`index`	Category index.
`name`	Buffer to hold category name. Buffer should be `dmCategoryLength` in size.

Result Stores the category name in the `name` buffer passed.

CategoryGetNext

Purpose Return the index of the next category, given a category index this routine. Note that categories are not stored sequentially.

Prototype

```
Word CategoryGetNext (DmOpenRef db, Word index)
```

Parameters

`db`	Database that contains the categories.
`index`	Category index.

Result Category index of next category.

comment Don’t use this function to search for a category. Instead, use it to allow your users to cycle through categories, for example, using the hard-button scroll bars on the device.

2.0 Note In Palm OS 1.0, the system chose `Unfiled` as one category.

In Palm OS 2.0, the system skips both `Unfiled` and empty records.

CategoryInitialize

Purpose Initialize the category names, IDs and flags.

Prototype

```
void CategoryInitialize (
                          AppInfoPtr appInfoP,
                          Word localizedAppInfoStrID)
```

Parameters

`appInfoP`	Application info pointer.
`localizedAppInfoStrID`	Resource ID of the localized category names

Result Returns nothing.

CategoryTruncateName

Purpose	Truncate a category name so that it's short enough to display.	

Purpose Truncate a category name so that it's short enough to display.

Prototype

```
void CategoryTruncateName (   CharPtr name,
                              Word maxWidth)
```

Parameters

`name`	Category name to truncate.
`maxWidth`	Maximum size, in pixels, of truncated category (including ellipsis).

Result Returns nothing. Stores the changed category in `CharPtr.`

<u>CategorySetName</u>

Purpose Set the category name and rename bits. A `NULL` pointer removes the category name.

Prototype

```
void CategorySetName ( DmOpenRef db,
                       Word index,
                       CharPtr nameP)
```

Parameters

`db`	Database containing the categories to change.
`index`	Index of category to set.
`nameP`	A category name (null-terminated) or `NULL` pointer to remove the category.

Result Returns nothing.

CategorySetTriggerLabel

Purpose Set the label displayed by the category trigger. The category name is truncated if it's to long.

Prototype

```
void CategorySetTriggerLabel ( ControlPtr ctl,
                               CharPtr name)
```

Parameters

`ctl`	Pointer to control object to relabel.
`name`	Pointer to the name of the new category.

Result Returns nothing.

CategorySelect

Purpose Process the selection and editing of categories.

Prototype

```
Boolean CategorySelect (DmOpenRef db,
                   FormPtr frm,
                   Word ctlID,
                   Word lstID,
                   Boolean title,
                   WordPtr categoryP,
                   charPtr categoryName,
                   Byte numUneditableCategories,
                   DWord editingStrID)
```

Parameters

`db`	Database that contains the categories.
`frm`	Form that contains the category popup list.
`ctlID`	ID of the popup trigger.
`lstID`	ID of the popup list.
`title`	`TRUE` if the popup trigger is on the title line.
`categoryP`	Current category (index into db structure).
`categoryName`	Name of the current category.
`numUneditableCategories`	Number of categories that the user should not be able to edit. Uneditable categories must be kept together in the lowest category number. For the applications included on the device, there is one uneditable category: "Unfiled"
`editingStrID`	ID of string resource to use for editing categories. If 0, the default, "Edit categories" is used.

Result Returns `TRUE` if any of the following conditions are `TRUE`:

- The current category is renamed.
- The current category is deleted.
- The current category is merged with another category.

See Also CategorySelectV10

CategorySelectV10

Purpose Process the selection and editing of categories.

Prototype

```
Boolean CategorySelectV10 (DmOpenRef db,
                           FormPtr frm,
                           Word ctlID,
                           Word lstID,
                           Boolean title,
                           WordPtr categoryP,
                           CharPtr categoryName)
```

Parameters

`db`	Database that contains the categories.
`frm`	Form that contains the category popup list.
`ctlID`	ID of the popup trigger.
`lstID`	ID of the popup list.
`title`	`TRUE` if the popup trigger is on the title line.
`categoryP`	Current category (index into db structure).
`categoryName`	Name of the current category.

Result Returns `TRUE` if any of the following conditions are true:

- the current category is renamed
- the current category is deleted
- the current category is merged with another category

ClipBoard Functions

ClipboardAddItem

Purpose Add the item passed to the specified clipboard. The `format` parameter determines which clipboard (text, ink, etc.) the item is added to.

Prototype

```
void ClipboardAddItem (ClipboardFormatType format,
                         VoidPtr ptr,
                         Word length)
```

Parameters

`format`	Text, ink, bitmap, etc.
`ptr`	Pointer to the item to place on the clipboard.
`length`	Size of the item to place on the clipboard.

Result Returns nothing.

See Also `FldCut`, `FldCopy`

ClipboardGetItem

Purpose Return the handle of the contents of the clipboard of a specified type and the length of a clipboard item.

Prototype

```
VoidHand ClipboardGetItem
       (ClipboardFormatType format, WordPtr length)
```

Parameters

`format`	Text, ink, bitmap, etc.
`length`	Pointer to the length of the clipboard item.

Result Handle of the clipboard item.

Control Functions

CtlDrawControl

Purpose Draw a control object (and the text in it) on screen. The control is drawn only if its `usable` attribute is `TRUE`.

Prototype `void CtlDrawControl (ControlPtr ControlP)`

Parameters `ControlP` Pointer to the control object to draw.

Result Returns nothing.

Comments Sets the `visible` attribute to `TRUE`.

See Also `CtlSetUsable`, `CtlShowControl`

CtlEraseControl

Purpose Erase a usable and visible control object and its frame from the screen.

Prototype `void CtlEraseControl (ControlPtr ControlP)`

Parameters `ControlP` Pointer to control object to erase.

Comments Sets the `visible` attribute to `FALSE`.

CtlGetLabel

Purpose Return a character pointer to a control's text label.

Prototype `CharPtr CtlGetLabel (ControlPtr ControlP)`

Parameters `ControlP` Pointer to control object.

Result Returns a pointer to a null-terminated string.

See Also CtlSetLabel

CtlGetValue

Purpose Return the current value (on or off) of the specified control. This function is valid only for push buttons and check boxes. The return value is undefined for other control types.

Prototype `short CtlGetValue (ControlPtr ControlP)`

Parameters `ControlP` Pointer to a control object.

Result Returns the current value of the control; 0 = off, 1 = on.

See Also CtlSetValue

CtlHandleEvent

Purpose Handle event in the specified control object.

Prototype

```
Boolean CtlHandleEvent ( ControlPtr ControlP,
                         EventPtr EventP)
```

Parameters

`ControlP`	Pointer to control object.
`EventP`	Pointer to an `EventType` structure.

Result Returns `TRUE` if an event is handled by this function. Events that are handled are:

- `penDownEvent` — If the pen is within the bounds of the control
- `ctlEnterEvent`, `ctlRepeatEvent` and `ctlExitEvent`— If the control ID in the event data matches the control's ID.

Comments The control object's `usable`, `enabled`, and `visible` attributes must be TRUE. This routine handles three type of events: `penDownEvent`, `ctlEnterEvent`/`ctlRepeatEvent` and `ctlExitEvent`.

When this routine receives a `penDownEvent`, it checks if the pen position is within the bounds of the control object. If it is, a `ctlEnterEvent` is added to the event queue and the routine exits.

When this routine receives a `ctlEnterEvent`, the control object is inverted.

When this routine receives a `ctlEnterEvent` or `ctlRepeatEvent`, it checks that the control ID in the passed event record matches the ID of the specified control. If they match, this routine tracks the pen until it comes up or until it leaves the object's bounds. When that happens, `ctlSelectEvent` is sent to the event queue if the pen came up in the bounds of the control. If the pen exits the bounds, a `ctlExitEvent` is sent to the event queue.

CtlHideControl

Purpose Set a control's `usable` attribute to `FALSE` and erase the control from the screen. This function calls `CtlEraseControl`.

Prototype `void CtlHideControl (ControlPtr ControlP)`

Parameters

`ControlP`	Pointer to the control object to hide.

Result Returns nothing.

Comments A control that is not usable doesn't draw and doesn't respond to the pen.

Sets the `visible` and the `usable` attributes to `FALSE`.

See Also CtlShowControl

CtlHitControl

Purpose Simulate tapping a control. This function adds a `ctlSelectEvent` to the event queue.

Prototype `void CtlHitControl (ControlPtr ControlP)`

Parameters

`ControlP`	Pointer to a control object.

Result Returns nothing.

Comments Useful for testing.

CtlEnabled

Purpose	Return `TRUE` if the control is enabled. Disabled controls do not respond to the pen.
Prototype	`Boolean CtlEnabled (ControlPtr ControlP)`
Parameters	`ControlP` Pointer to control object.
Result	Returns `TRUE` if enabled; `FALSE` if not.
See Also	CtlSetEnabled

CtlSetEnabled

Purpose Set a control as enabled or disabled. Disabled controls do not respond to the pen.

Prototype

```
void CtlSetEnabled ( ControlPtr ControlP,
                     Boolean enable)
```

Parameters

`ControlP`	Pointer to a control object.
`enable`	`TRUE` to set enabled; `FALSE` to set not enabled.

Result Returns nothing.

See Also CtlEnabled

CtlSetLabel

Purpose Set the current label for the specified control object. If the control object currently has its `usable` and `visible` attributes set to `TRUE`, redraw it with the new label.

Prototype

```
void CtlSetLabel ( ControlPtr ControlP,
                   CharPtr newLabel)
```

Parameters

`ControlP`	Pointer to a control object.
`newLabel`	Pointer to the new text label. Must be a `NULL`-terminated string.

Result Returns nothing.

Comments This function resizes the width of the control to the size of the new label.

The pointer passed to this function is stored in the control's data structure; the control doesn't make a copy of the string passed.

See Also CtlGetLabel

CtlSetUsable

Purpose Set a control usable or not usable by changing the value of its `usable` attribute.

Prototype

```
void CtlSetUsable (  ControlPtr ControlP,
                     Boolean usable)
```

Parameters

`ControlP`	Pointer to a control object.
`usable`	`TRUE` to set usable; `FALSE` to set not usable.

Result Returns nothing.

Comments Function doesn't usually update the control.

See Also `CtlEraseControl`,

CtlSetValue

Purpose Set the current value (on or off) of the specified control. If the control is visible, it's visually updated.

Prototype

```
void CtlSetValue ( ControlPtr ControlP,
                   short newValue)
```

Parameters

`ControlP`	Pointer to a control object.
`newValue`	0 = off, non-zero = on.

Result Returns nothing.

Comments Function works only with push buttons and check boxes. Other controls ignore calls to this function.

See Also CtlGetValue

CtlShowControl

Purpose Set a control's `usable` attribute to `TRUE` and draw the control on the screen. This function calls `CtlDrawControl`.

Prototype `void CtlShowControl (ControlPtr ControlP)`

Parameters

`ControlP`	Pointer to a control object.

Result Returns nothing.

Comments If the control is already usable, this function is the functional equivalent of `CtlDrawControl`.

Sets the `visible` and the `usable` attributes to `TRUE`.

See Also CtlHideControl

Field UI Functions

FldCalcFieldHeight

Purpose Determine the height of a field for a string.

Prototype

```
Word FldCalcFieldHeight   (CharPtr chars,
                           Word maxWidth)
```

Parameters

`chars`	Pointer to a null-terminated string.
`maxWidth`	Maximum line width in pixels.

Result Returns total number of lines needed to draw the string passed.

FldCompactText

Purpose Compact the memory block that contains the text of the field to release any unused space.

Prototype `void FldCompactText (FieldPtr fld)`

Parameters `fld` Pointer to a field object (`FieldType` data structure).

Result Returns nothing.

Comments As characters are added to the text of a field, the block that contains the text is grown. The block is expanded in chunks so that it doesn't have to expand each time a character is added. This expansion results in some unused space in the text block.

Applications should call this function should on field objects that edit data records in place before the field is unlocked, or at any other time when a compact field is desirable; for example, when the form is being closed.

FldCopy

Purpose Copy the current selection to the text clipboard.

Prototype `void FldCopy (FieldPtr fld)`

Parameters `fld` Pointer to a field object (`FieldType` data structure).

Result Returns nothing.

Comments This function leaves the current selection highlighted.

This functions replaces anything previously in the text clipboard.

If there is no selection, this function does nothing.

See Also `FldCut`, `FldPaste`

FldCut

Purpose Copy the current selection to the text clipboard, delete the selection from the field, and redraw the field.

Prototype `void FldCut (FieldPtr fld)`

Parameters `fld` Pointer to a field object (`FieldType` data structure).

Result Returns nothing.

Comments Anything previously in the text clipboard is replaced by this function.

If there is no selection, this function does nothing.

See Also `FldCopy`, `FldPaste`

FldDelete

Purpose Delete the specified range of characters from the field and redraw the field.

Prototype

```
void FldDelete ( FieldPtr fld,
                 Word start,
                 Word end)
```

Parameters

`fld`	Pointer to the field object to delete from.
`start`	Starting character position.
`end`	Ending character position.

Result Returns nothing.

See Also FldInsert

FldDirty

Purpose Return `TRUE` if the field has been modified by the user since the text value was set (`FldSetText`).

Prototype

```
Boolean FldDirty (FieldPtr fld)
```

Parameters

`fld`	Pointer to a field object (`FieldType` data structure).

Result Returns `TRUE` if the field has been modified by the user, `FALSE` if the field has not been modified.

See Also FldSetDirty

FldDrawField

Purpose Draw the text of the field. The field's `usable` attribute must be `TRUE` or the field won't be drawn.

Prototype `void FldDrawField (FieldPtr fld)`

Parameters `fld` Pointer to a field object (`FieldType` data structure).

Result Returns nothing.

Comments This function doesn't erase the area behind the field before drawing.

If the field has the focus, the blinking insertion point is displayed in the field.

See Also FldEraseField

FldEraseField

Purpose Erase the text of a field and turn off the insertion point if it's in the field.

Prototype `void FldEraseField (FieldPtr fld)`

Parameters `fld` Pointer to a field object (`FieldType` data structure).

Result Returns nothing.

Comments The function doesn't modify the contents of the field.

If the field has the focus, the blinking insertion point is turned off.

See Also FldDrawField

FldFreeMemory

Purpose Release the memory allocated to the text of a field and the associated word-wrapping information.

Prototype

```
void FldFreeFieldMemory (FieldPtr fld)
```

Parameters

`fld`	Pointer to a field object (`FieldType` data structure).

Result Returns nothing.

Comments This function releases

- The memory allocated to the text of a field—the memory block that the `text` member of the `FieldType` data structure points to.
- The memory allocated to hold the display lines information—the memory block that the `lines` member of the `FieldType` data structure points to.

This function doesn't affect the display of the field.

FldGetAttributes

Purpose Return the attributes of a field.

Prototype

```
void FldGetAttributes (  FieldPtr fld,
                         FieldAttrPtr attrP)
```

Parameters

`fld`	Pointer to a `FieldType` structure.
`attrP`	Pointer to `FieldAttrType`, see Field.h.

Result Returns nothing.

See Also FldSetAttributes

FldGetBounds

Purpose Return the current bounds of a field.

Prototype

```
void FldGetBounds (  FieldPtr fld,
                     RectanglePtr rect)
```

Parameters

`fld`	Pointer to a field object (`FieldType` data structure).
`rect`	Pointer to a `RectangleType` structure.

Result Returns nothing. Stores the field's bounds in the `RectangleType` structure reference by `bounds`.

Comments Returns the `rect` field of the `FieldType` structure.

See Also FldSetBounds

FldGetFont

Purpose Return the ID of the font used to draw the text of a field.

Prototype

```
FontID FldGetFont (FieldPtr fld)
```

Parameters

`fld`	Pointer to a field object (`FieldType` data structure).

Result Returns the ID of the font.

See Also FldSetFont

FldGetInsPtPosition

Purpose Return the string position of the insertion point.

Prototype `Word FldGetInsPtPosition (FieldPtr fld)`

Parameters `fld` Pointer to a field object (`FieldType` data structure).

Result Returns the character position of the insertion point.

Comments The insertion point position number is to the left of the string position number. In multiline fields, line feeds are counted as part of the string and the position number after the line feed is the beginning of the next line.

See Also FldSetInsPtPosition

FldGetMaxChars

Purpose Return the maximum number of characters the field accepts.

Prototype `Word FldGetMaxChars (FieldPtr fld)`

Parameters `fld` Pointer to a field object (`FieldType` data structure).

Result Returns the maximum number of characters the user is allowed to enter.

See Also FldSetMaxChars

FldGetNumberOfBlankLines

Purpose Return the number of blank lines that are displayed at the bottom of a field. This routine is useful for updating a scroll bar after characters have been removed from the text in a field.

Prototype `Word FldGetNumberOfBlankLines (FieldPtr fld)`

Parameters `fld` Pointer to a `FieldType` structure.

Result Returns the number of blank lines visible.

FldGetScrollPosition

Purpose Return the string position of the first character in the first line of a field.

Prototype `Word FldGetScrollPosition (FieldPtr fld)`

Parameters `fld` Pointer to a field object (`FieldType` data structure).

Result Returns the character position of the first visible character.

See Also FldSetScrollPosition

FldGetScrollValues

Purpose Return the values necessary to update a scroll bar.

Prototype

```
void FldGetScrollValues (   FieldPtr fld,
                            WordPtr scrollPosP,
                            WordPtr textHeightP,
                            WordPtr fieldHeightP)
```

Parameters

`fld`	Pointer to a `FieldType` structure.
`scrollPosP`	Return scroll position here.
`textHeightP`	Return text height here.
`fieldHeightP`	Return field height here.

Result Returns nothing. Stores the position, text height, and field height in the parameters passed in.

FldGetSelection

Purpose Return the current selection of a field.

Prototype

```
void FldGetSelection ( FieldPtr fld,
                       WordPtr startPosition,
                       WordPtr endPosition)
```

Parameters

`fld` Pointer to a field object (`FieldType` data structure).

`startPosition`
Pointer to start-character position of selected range of characters.

`endPosition`
Pointer to end-character position of selected range of characters.

Result Returns the start and end position in `startPosition` and `endPosition`.

Comments The first character in a field is at position zero.

If the user has selected the first five characters of a field, `startPosition` will contain the value 0 and `endPosition` the value 5.

See Also FldSetSelection

FldGetTextAllocatedSize

Purpose Return the number of characters allocated to hold the field's text string. Don't confuse this number with the length of the text string.

Prototype `Word FldGetTextAllocatedSize (FieldPtr fld)`

Parameters `fld` Pointer to a field object.

Result Returns the number of characters allocated for the field's text.

See Also FldSetTextAllocatedSize

FldGetTextHandle

Purpose Return a handle to the block that contains the text string of a field.

Prototype `Handle FldGetTextHandle (FieldPtr fld)`

Parameters `fld` Pointer to a field object (`FieldType` data structure).

Result Returns the handle of the text string of a field; 0 is a possible value.

Comments If 0 is returned, no handle has been allocated for the field pointer.

See Also `FldSetTextHandle`, `FldGetTextPtr`

FldGetTextHeight

Purpose	Return the number of lines of text that the specified field has.
Prototype	`Word FldGetTextHeight (FieldPtr fld)`
Parameters	`fld` Pointer to a field object (`FieldType` data structure).
Result	Returns the number of lines with text.
Comments	Empty lines are not counted.
See Also	FldCalcFieldHeight

FldGetTextLength

Purpose	Return the length of the text string of a field object.
Prototype	`Word FldGetTextLength (FieldPtr fld)`
Parameters	`fld` Pointer to a field object (`FieldType` data structure).
Result	Returns the length of a field's text string.

FldGetTextPtr

Purpose Return a pointer to the text string of a field, or `NULL`.

Prototype `CharPtr FldGetTextPtr (FieldPtr fld)`

Parameters `fld` Pointer to a field object (`FieldType` data structure).

Result Returns a pointer to t text string of a field; `NULL` is a possible value.

See Also `FldSetTextPtr`, `FldGetTextHandle`

FldGetVisibleLines

Purpose Return the number of lines that can be displayed within the visible bounds of the field.

Prototype `Word FldGetVisibleLines (FieldPtr fld)`

Parameters `fld` Pointer to a field object (`FieldType` data structure).

Result Returns the number of lines.

FldGrabFocus

Purpose Turn the insertion point on (if the specified field is visible) and position the blinking insertion point in the field.

Prototype `void FldGrabFocus (FieldPtr fld)`

Parameters `fld` Pointer to a field object (`FieldType` data structure).

Result Returns nothing.

Comments This function sets the field attribute `hasFocus` to `TRUE`.

See Also FldReleaseFocus

FldHandleEvent

Purpose Handles the following events: `keyDownEvent`, `penDownEvent`, and `fldEnterEvent`. The field's `editable` and `usable` attributes must be set to `TRUE`.

Prototype

```
Boolean FldHandleEvent ( FieldPtr fld,
                         EventPtr EventP)
```

Parameters

`fld`	Pointer to a field object (`FieldType` data structure).
`EventP`	Pointer to an event (`EventType` data structure).

Result Returns `TRUE` if the event was handled.

Comments When a `keyDownEvent` occurs, the keystroke appears in the field if it's a printable character or manipulates the insertion point if it's a "movement" character. The field is automatically updated.

When a `penDownEvent` occurs, an "editable" field sends a `fldEnterEvent` to the event queue.

When a `fldEnterEvent` occurs, the field grabs the focus and the insertion point is placed in the specified position.

If the event alters the contents of the field, this function visually updates the field.

This function doesn't handle any events if the field is not editable.

FldInsert

Purpose Replace the current selection with the string passed.

Prototype

```
Boolean FldInsert (  FieldPtr fld,
                     CharPtr insertChars,
                     Word insertLen)
```

Parameters

`fld`	Pointer to the field object to insert to.
`insertChars`	Text string to be inserted.
`insertLen`	Length of the text string to be inserted.

Result Returns `TRUE` if string was successfully inserted; otherwise, `FALSE`.

Comments If there is no current selection, the string passed is inserted at the position of the insertion point.

See Also `FldPaste`, `FldDelete`, `FldCut`, `FldCopy`

FldMakeFullyVisible

Purpose Cause a dynamically resizable field to expand its height to make its text fully visible.

Prototype

```
Boolean FldMakeFullyVisible (FieldPtr fld)
```

Parameters

`fld`	Pointer to a field object.

Result Returns `TRUE` if the field was not fully visible; `FALSE` otherwise.

Comments If the field's height changes, this function sends a `fldHeightChangedEvent` via the event queue.

Caveats If the field is in a table, the table resizes it; otherwise, it's not resized.

FldPaste

Purpose Replace the current selection in the field with the contents of the text clipboard.

Prototype `void FldPaste (FieldPtr fld)`

Parameters `fld` Pointer to a field object (`FieldType` data structure).

Result Returns nothing

Comments The function performs these actions:

- Positions the insertion point after the last character inserted.
- Scrolls the field, if necessary, so the insertion point is visible.
- Inserts the clipboard text at the position of the insertion point if there is no current selection,
- Doesn't delete the current selection if there is no text in the clipboard.

See Also `FldInsert`, `FldDelete`, `FldCut`, `FldCopy`

FldRecalculateField

Purpose Update the structure that contains the word-wrapping information for each visible line.

Prototype

```
void FldRecalculateField ( FieldPtr fld,
                           Boolean redraw)
```

Parameters

`fld`	Pointer to a field object (`FieldType` data structure).
`redraw`	If `TRUE`, redraws the field.

Result Returns nothing.

Comments If necessary, this function reallocates the memory block that contains the displayed lines information, the block pointed to by the `lines` member in the `FieldType` data structure.

Call this function if the field's data structure is modified in a way that invalidates the visual appearance of the field.

FldReleaseFocus

Purpose Turn the blinking insertion point off if the field is visible and has the current focus, reset the Graffiti state, and reset the undo state.

Prototype

```
void FldReleaseFocus (FieldPtr fld)
```

Parameters

`fld`	Pointer to a field object (`FieldType` data structure).

Result Returns nothing.

Comments This function sets the field attribute `hasFocus` to `FALSE`.

See Also FldGrabFocus

FldScrollable

Purpose Return `TRUE` if the field is scrollable in the specified direction.

Prototype

```
Boolean FldScrollable (  FieldPtr fld,
                         DirectionType direction)
```

Parameters

`fld`	Pointer to a field object (`FieldType` data structure).
`direction`	Either the string “up” or the string “down”.

Result Returns `TRUE` if the field is scrollable; `FALSE` otherwise.

See Also FldScrollField

FldScrollField

Purpose Scroll a field up or down by the number of lines specified.

Prototype

```
void FldScrollField (  FieldPtr fld,
                       Word linesToScroll,
                       DirectionType direction)
```

Parameters

`fld`	Pointer to a field object (`FieldType` data structure).
`linesToScroll`	Number of lines to scroll.
`direction`	Either the string “up” or the string “down”.

Result Returns nothing.

Comments This function can’t scroll horizontally, that is, right or left.

The field object is redrawn if it’s scrolled.

See Also FldScrollable

FldSendChangeNotification

Purpose Send a `fldChangedEvent` via the event queue.

Prototype

```
void FldSendChangeNotification (FieldPtr fld)
```

Parameters

`fld`	Pointer to a field object.

Result Returns nothing.

FldSendHeightChangeNotification

Purpose Send a `fldHeightChangedEvent` via the event queue.

Prototype

```
void FldSendHeightChangeNotification
                 ( FieldPtr fld,
                   Word pos,
                   Short numLines)
```

Parameters

`fld`	Pointer to a field object.
`pos`	Character position of the insertion point.
`numLines`	New number of lines in the field.

Result Returns nothing.

FldSetAttributes

Purpose Set the attributes of a field.

Prototype

```
void FldSetAttributes (  FieldPtr fld,
                         FieldAttrPtr attrP)
```

Parameters

`fld`	Pointer to a `FieldType` structure.
`attrP`	Pointer to the attributes.

Result Returns nothing.

See Also FldGetAttributes

FldSetBounds

Purpose Change the position or size of a field.

Prototype

```
void FldSetBounds (FieldPtr fld, RectanglePtr rect)
```

Parameters

`fld`	Pointer to a field object (`FieldType` data structure).
`rect`	Pointer to a `RectangleType` structure that contains the new bounds of the display.

Result Returns nothing.

Comments If the field is visible, the field is redrawn within its new bounds.

The memory block that contains the word-wrapping information will be resized if the number of visible lines is changed. The insertion point is assumed to be off when this routine is called.

Caveats Don't change the width of the object while it's visible.

See Also FldGetBounds

FldSetDirty

Purpose Set whether the field has been modified.

Prototype `void FldSetDirty (FieldPtr fld, Boolean dirty)`

Parameters

`fld`	Pointer to a field object.
`dirty`	`TRUE` if the text is modified.

Result Returns nothing.

See Also FldDirty

FldSetFont

Purpose Set the font of the field, update the word-wrapping information, and draw the field if the field is visible.

Prototype `void FldSetFont (FieldPtr fld, FontID fontID)`

Parameters

`fld`	Pointer to a field object (`FieldType` data structure).
`fontID`	ID of new font.

Result Returns nothing.

See Also FldGetFont

FldSetInsertionPoint

Purpose Set the location of the insertion point based on a specified string position. This routine differs from `FldSetInsPtPosition` in that it doesn't make the character position visible.

Prototype `void FldSetInsertionPoint (FieldPtr fld, Word pos)`

Parameters

`fld`	Pointer to a `FieldType` structure.
`pos`	Character position in the text of the field

Result Nothing.

Caution `FldSetInsertionPoint` doesn't make the field the current focus of input if it was not already.

FldSetInsPtPosition

Purpose Set the location of the insertion point for a given string position.

Prototype `void FldSetInsPtPosition (FieldPtr fld, Word pos)`

Parameters

`fld`	Pointer to a field object (`FieldType` data structure).
`pos`	Character position of insertion point.

Result Returns nothing.

Comments If the position is beyond the visible text, then the insertion point is disabled.

See Also FldGetInsPtPosition

FldSetMaxChars

Purpose Set the maximum number of characters the field accepts.

Prototype `void FldSetMaxChars (FieldPtr fld, Word maxChars)`

Parameters

`fld`	Pointer to a field object (`FieldType` data structure).
`maxChars`	Maximum number of characters the user may enter.

Result Returns nothing.

Comments Line feed characters are counted when the number of characters is determined.

See Also FldGetMaxChars

FldSetScrollPosition

Purpose Set the string position of the first character in the first line of a field. Redraw the field if necessary.

Prototype `void FldSetScrollPosition (FieldPtr fld, Word pos)`

Parameters

`fld`	Pointer to a field object (`FieldType` data structure).
`pos`	Character position of first visible character.

Result Returns nothing.

See Also FldGetScrollPosition

FldSetSelection

Purpose Set the current selection in a field and highlight the selection if the field is visible.

Prototype

```
void FldSetSelection ( FieldPtr fld,
                       Word startPosition,
                       Word endPosition)
```

Parameters

`fld` Pointer to a field object (`FieldType` data structure)

`startPosition`
Starting character position of the character range to highlight.

`endPosition`
Ending character position of the character range to highlight.

Result Returns nothing.

Comments This function doesn't affect the display; the highlight is not redrawn until the field is redrawn.

To cancel a selection, set both `startPosition` and `endPosition` to the same value.

If `startPosition` equals `endPosition`, then the current selection is unhighlighted.

FldSetText

Purpose

Set the text value of the field, update the word-wrapping information, and place the insertion point after the last visible character.

Prototype

```
void FldSetText (  FieldPtr fld,
                   VoidHand textHandle,
                   Word offset,
                   Word size)
```

Parameters

`fld`	Pointer to a field object (`FieldType` data structure).
`textHandle`	Handle of a block containing a null-terminated text string.
`offset`	Offset from start of block to start of the text string.
`size`	Allocated size of text string, ***not*** the string length.

Result

Returns nothing.

Comments

The pointer passed is stored in the field's structure; in other words, this function doesn't make a copy of the string passed.

If a size of zero is passed, the size is computed as the block size, minus the offset passed. If more text is set than there is room for in memory, an error occurs.

Warning: This routine doesn't free the memory block that holds the current text value.

See Also

`FldSetTextPtr`, `FldSetTextHandle`

FldSetTextAllocatedSize

Purpose Set the number of characters allocated to hold the field's text string. Don't confuse this with the length of the text string.

Prototype

```
void FldSetTextAllocatedSize ( FieldPtr fld,
                               Word allocatedSize)
```

Parameters

`fld`	Pointer to a field object.
`allocatedSize`	Number of characters to allocate for the text.

Result Returns nothing.

See Also FldGetTextAllocatedSize

FldSetTextHandle

Purpose Set the handle of the block that contains the text string of a field.

Prototype

```
void FldSetTextHandle (  FieldPtr fld,
                         Handle textHandle)
```

Parameters

`fld`	Pointer to a field object (`FieldType` data structure).
`textHandle`	Handle of a field's text string; 0 is a possible value.

Result Returns nothing.

See Also `FldSetTextPtr`, `FldSetText`

FldSetTextPtr

Purpose Set the field's text to point to a text string.

Prototype `void FldSetTextPtr (FieldPtr fld, CharPtr textP)`

Parameters

`fld`	Pointer to a field object (`FieldType` data structure).
`textP`	Pointer to a null-terminated string.

Result Returns nothing.

Comments Since the field cannot resize a pointer (only handles can be resized), the field must be not editable and must be single line. If the field is editable or has more than one line, an error occurs.

This function does **not** visually update the field.

See Also `FldSetTextPtr`, `FldSetTextHandle`

FldSetUsable

Purpose Set a field usable or nonusable.

Prototype `void FldSetUsable (FieldPtr fld, Boolean usable)`

Parameters

`fld`	Pointer to a `FieldType` structure.
`usable`	`TRUE` to set usable; `FALSE` to set nonusable.

Result Returns nothing.

Comments A nonusable field doesn't display or accept input.

See Also `FldEraseField`, `FldDrawField`

FldUndo

Purpose Undo the last change made to the field object. Changes include typing, backspaces, delete, paste, and cut.

Prototype `void FldUndo (FieldPtr fld)`

Parameters

`fld`	Pointer to the field that has the focus.

Result Returns nothing.

See Also `FldPaste`, `FldCut`, `FldCopy`

FldWordWrap

Purpose Given a string and a width, return the number of characters that can be displayed using the current font.

Prototype `Word FldWordWrap (CharPtr chars, Word maxWidth)`

Parameters

`chars`	Pointer to a null-terminated string.
`maxWidth`	Maximum line width in pixels.

Result Returns the number of characters.

Font Functions

FntAccentHeight

Not currently implemented.

FntAscent

Not currently implemented.

FntAverageCharWidth

Purpose Return the average character width in the current font.

Prototype `short FntAverageCharWidth (void)`

Parameters None.

Result Returns the average character width (in pixels).

FntBaseLine

Purpose Return the distance from the top of character cell to the baseline for the current font.

Prototype `short FntBaseLine (void)`

Parameters None.

Result Returns the baseline of the font (in pixels).

FntCharHeight

Purpose Return the character height, in the current font including accents and descenders.

Prototype

```
short FntCharHeight (void)
```

Parameters None

Result Height of the characters in the current font, expressed in pixels.

FntCharsInWidth

Purpose Find the number of characters in a string that fit within a passed width. Spaces at the end of a string are ignored and removed. Characters after a carriage return are ignored, the string is considered truncated.

Prototype

```
void FntCharsInWidth ( CharPtr string,
                       Int *stringWidthP,
                       Int *stringLengthP,
                       Boolean *fitWithinWidth)
```

Parameters

`string`	Pointer to the char string.
`stringWidthP`	Maximum width to allow.
`stringLengthP`	Maximum characters to allow (assumes current Font).
`fitWithinWidth`	Set to `TRUE` if string is considered truncated.

Result When the call is completed, the information is updated as follows:

`stringWidthP`	Set to the width of the chars allowed.
`stringLengthP`	Set to the number of chars within the width.
`fitWithinWidth`	`TRUE` if the string is considered truncated, `FALSE` if it isn't.

FntCharsWidth

Purpose Return the width of the specified character string. The Missing Character Symbol is substituted for any character which does not exist in the current font.

Prototype `short FntCharsWidth (CharPtr pChars, Word length)`

Parameters

`pChars`	Pointer to a string of characters.
`length`	Number of character in the string.

Result Returns the width of the string, in pixels.

FntCharWidth

Purpose Return the width of the specified character. If the specified character does not exist within the current font, the Missing Character Symbol is substituted.

Prototype `short FntCharWidth (char ch)`

Parameters

`ch`	Character whose width is needed.

Result Returns the width of the specified character (in pixels).

FntDescenderHeight

Purpose Return the height of a character's descender in the current font. The height of a descender is the distance between the base line an the bottom of the character cell.

Prototype `short FntDescenderHeight (void)`

Parameters None.

Result Returns the height of a descender, expressed in pixels.

FntGetFont

Purpose Return the Font ID of the current font.

Prototype `FontID FntGetFont (void)`

Parameters None.

Result Returns the Font ID of the current font.

FntGetFontPtr

Purpose Return a pointer to the current font.

Prototype `FontPtr FntGetFontPtr (void)`

Parameters None.

Result Returns the `FontPtr` of the current font.

FntGetScrollValues

Purpose Return the values needed to update a scroll bar based on a specified string and the position within the sting.

Prototype

```
void FntGetScrollValues (   CharPtr chars,
                            Word width,
                            Word scrollPos,
                            WordPtr linesP,
                            WordPtr topLineP)
```

Parameters

`chars`	Null-terminated string.
`width`	Width to word wrap at, in pixels.
`scrollPos`	Character position of the first visible character.
`linesP`	(returned) number of lines of text.
`topLineP`	(returned) top visible line.

Result Returns nothing. Stores the number of lines of text in `linesP` and the top visible line in `topLineP`.

FntLineHeight

Purpose Return the height of a line in the current font. The height of a line is the height of the character cell plus the space between lines (the external leading).

Prototype `short FntLineHeight (void)`

Parameters None.

Result Returns the height of a line in the current font.

FntLineWidth

Purpose Return the width of the specified line of text, taking tab characters in to account. The function assumes that the characters passed are left-aligned and that the first character in the string is the first character drawn on a line. In other words, this routine doesn't work for characters that don't start at the beginning of a line.

Prototype

```
short FntLineWidth (CharPtr pChars, Word length)
```

Parameters

`pChars`	Pointer to a string of characters.
`length`	Number of character in the string.

Result Returns the line width (in pixels).

FntProportionalFont

Purpose Indicate whether the current font is proportionally spaced or fixed width.

Prototype

```
Boolean FntProportionalFont (void)
```

Parameters None.

Result Returns `TRUE` if the current font is proportionally spaced, `FALSE` if it's fixed width.

FntSetFont

Purpose	Set the current font.
Prototype	`FontID FntSetFont (FontID fontID)`
Parameters	`fontID` ID of the font to make the active font.
Result	Returns the ID of the current font before the change.

FntWordWrap

Purpose	Given a string, determine the number of characters that can be displayed within the specified width.
Prototype	`Word FntWordWrap (CharPtr chars, Word maxWidth)`
Parameters	`chars` Pointer to a null-terminated string. `maxWidth` Maximum line width in pixels.
Result	Returns the length of the line, in characters.

FntWordWrapReverseNLines

Purpose Word wrap a text string backwards by the number of lines specified. The character position of the start of the first line and the number of lines that are actually word wrapped are returned.

Prototype

```
void FntWordWrapReverseNLines (   CharPtr chars,
                                 Word maxWidth,
                                 WordPtr linesToScrollP,
                                 WordPtr scrollPosP)
```

Parameters

`chars`	Pointer to a null-terminated string.
`maxWidth`	Maximum line width in pixels.
`linesToScrollP`	Passed: lines to scroll returned: lines scrolled.
`scrollPosP`	Passed: first character returned: first character after wrapping.

Result Returns nothing. Stores the first character after wrapping and the number of lines scrolled in `scrollPosP` and `linesToScrollP`.

Form Functions

FrmAlert

Purpose Create a modal dialog from an alert resource and display it until the user selects a button in the dialog.

Prototype `Word FrmAlert (Word alertId)`

Parameters `alertId` ID of the alert resource.

Result Returns the item number of the button the user selected. A button's item number is determined by its order in the alert dialog; the first button has the item number 0 (zero).

See Also `FrmDoDialog`, `FrmCustomAlert`

FrmCloseAllForms

Purpose Send a `frmCloseEvent` to all open forms.

Prototype `void FrmCloseAllForms (void)`

Parameters None.

Comments Applications can call this function to ensure that all forms are closed cleanly before exiting `PilotMain();` that is, before termination.

See Also FrmSaveAllForms

FrmCopyLabel

Purpose Copy the passed string into the data structure of the specified label object in the active form.

Prototype

```
void FrmCopyLabel (  FormPtr frm,
                     Word labelID,
                     CharPtr newLabel)
```

Parameters

`frm`	Pointer to memory block that contains the form.
`labelID`	ID of form label object.
`newLabel`	Pointer to a null-terminated string.

Result Returns nothing.

Comments The size of the new label ***must not*** exceed the size of the label defined in the resource. When defining the label in the resource, specify an initial size at least as big as any of the strings that will be assigned dynamically. Redraw the label if the form's `usable` attribute and the label's `visible` attribute are set.

See Also FrmGetLabel

FrmCopyTitle

Purpose Copy the title passed over the form's current title. If the form is visible, the new title is drawn.

Prototype

```
void FrmCopyTitle (FormPtr frm, CharPtr newTitle)
```

Parameters

`frm`	Memory block that contains the form.
`newTitle`	Pointer to the new title string.

Result Returns nothing.

Comments The size of the new title **must not** exceed the title size defined in the resource. When defining the title in the resource, specify an initial size at least as big as any of string to be assigned dynamically.

See Also FrmGetTitle

FrmCustomAlert

Purpose Create a modal dialog from an alert resource and display the dialog until the user taps a button in the alert dialog.

Prototype

```
Word FrmCustomAlert (  Word alertId, CharPtr s1,
                       CharPtr s2, CharPtr s3)
```

Parameters

`alertId`	Resource ID of the alert.
`s1`, `s2`, `s3`	Strings to replace ^1, ^2, and ^3 (see Comment).

Result Returns the button number the user tapped (first button is zero).

Comments A button's item number is determined by its order in the alert template; the first button has the item number zero.

Up to three strings can be passed to this routine. They are used to replace the variables ^1, ^2 and ^3 that are contained in the message string of the alert resource.

See Also `FrmAlert`, `FrmDoDialog`

FrmDeleteForm

Purpose	Release the memory occupied by a form. Any memory allocated to objects in the form is also released.
Prototype	`void FrmDeleteForm (FormPtr frm)`
Parameters	`frm` Pointer to memory block that contains the form.
Result	Returns nothing.
Comments	This function doesn't modify the display.
See Also	`FrmInitForm`, `FrmReturnToForm`

FrmDispatchEvent

Purpose	Dispatch an event to the application's handler for the form.
Prototype	`Boolean FrmDispatchEvent (EventPtr eventP)`
Parameters	`eventP` Pointer to an event.
Result	Returns nothing.
Comments	The event is dispatched to the current form unless the form ID is specified in the event data, as, for example, with `frmOpenEvent`.
See Also	`FrmSetEventHandler`, `FrmHandleEvent`

FrmDoDialog

Purpose Display a modal dialog until the user taps a button in the dialog.

Prototype `Word FrmDoDialog (FormPtr frm)`

Parameters `frm` Pointer to memory block that contains the form.

Result Returns the number of the button the user tapped (first button is zero).

Comments A button's item number is determined by its order in the alert template; the first button has an item number of 0 (zero).

See Also `FrmInitForm`, `FrmCustomAlert`

FrmDrawForm

Purpose Draw all objects in a form and the frame around the form.

Prototype `void FrmDrawForm (FormPtr frm)`

Parameters `frm` Pointer to the memory block that contains the form.

Result Returns nothing.

Comments Saves the bits behind the form using the `bitsBehindForm` field.

See Also FrmEraseForm, FrmInitForm

FrmEraseForm

Purpose Erase a form from the display.

Prototype `void FrmEraseForm (FormPtr frm)`

Parameters `frm` Pointer to the memory block that contains the form.

Result Returns nothing.

Comments If the region obscured by the form was saved by `FrmDrawForm`, this function restores that region.

See Also FrmDrawForm

FrmGetActiveForm

Purpose Return the currently active form.

Prototype `FormPtr FrmGetActiveForm (void)`

Parameters None.

Result Returns the pointer to the memory block that contains the form.

See Also `FrmGetActiveFormID`, `FrmSetActiveForm`

FrmGetActiveFormID

Purpose Return the ID of the currently active form.

Prototype `Word FrmGetActiveFormID (void)`

Parameters None.

Result Returns the currently active form's ID number.

See Also FrmGetActiveForm

FrmGetControlGroupSelection

Purpose Return the item number of the control selected in a group of controls.

Prototype

```
Byte FrmGetControlGroupSelection ( FormPtr frm,
                                   Byte groupNum)
```

Parameters

`frm`	Pointer to memory block that contains the form.
`groupNum`	Control group number.

Result Returns the item number of the selected control; returns -1 if none is selected.

Comments The item number is the index into the form object's data structure.

See Also `FrmGetObjectId`, `FrmGetObjectPtr`, `FrmSetControlGroupSelection`

FrmGetControlValue

Purpose Return the on/off state of a control.

Prototype

```
short FrmGetControlValue ( FormPtr frm,
                           Word objIndex)
```

Parameters

`frm`	Pointer to memory block that contains the form.
`objIndex`	Item number of the object.

Result Returns the state of the control: 1 = on; 0 = off.

Comments The caller must specify a valid index. This function is used only for push button and check box control objects.

See Also FrmGetObjectIndex, FrmSetControlValue

FrmGetFirstForm

Purpose Return the first form in the window list.

Prototype

```
FormPtr FrmGetFirstForm (void)
```

Parameters None.

Result Returns a pointer to a form, or NULL if there are no forms.

Comments The window list is a LIFO stack. The last window created is the first window in the window list.

FrmGetFocus

Purpose Return the item (index) number of the object (UI element) that has the focus.

Prototype `Word FrmGetFocus (FormPtr frm)`

Parameters

`frm`	Pointer to memory block that contains the form.

Result Returns the index of the object (UI element) that has the focus, or -1 if none does.

See Also `FrmGetObjectId`, `FrmGetObjectPtr`, `FrmSetFocus`

FrmGetFormBounds

Purpose Return the visual bounds of the form; the region returned includes the form's frame.

Prototype `void FrmGetFormBounds (FormPtr frm, RectanglePtr r)`

Parameters

`frm`	Pointer to memory block that contains the form.
`r`	Pointer to a `RectangleType` structure that will contain the bounds.

Result Returns the bounds of the form in `r`.

FrmGetFormId

Purpose Return the resource ID of a form.

Prototype `Word FrmGetFormId (FormPtr frm)`

Parameters `frm` Pointer to memory block that contains the form.

Result Returns form resource ID.

See Also FrmGetFormPtr

FrmGetFormPtr

Purpose Return a pointer to the form that has the specified ID.

Prototype `FormPtr FrmGetFormPtr (Word formId)`

Parameters `formId` Form ID number.

Result Returns a pointer to the memory block that contains the form, or `NULL` if the form is not in memory.

See Also FrmGetFormId

FrmGetGadgetData

Purpose Return the value stored in the `data` field of the gadget object.

Prototype

```
VoidPtr FrmGetGadgetData ( FormPtr frm,
                           Word objIndex)
```

Parameters

`frm`	Pointer to memory block that contains the form.
`objIndex`	Item number of the gadget object.

Result Returns a pointer to the custom gadget's data.

Comments Gadget objects provide a way for an application to attach custom gadgetry to a form. In general, the `data` field of a gadget object contains a pointer to the custom object's data structure.

See Also FrmSetGadgetData

FrmGetLabel

Purpose Return pointer to the text of the specified label object in the specified form.

Prototype

```
CharPtr FrmGetLabel (FormPtr frm, Word labelID)
```

Parameters

`frm`	Pointer to memory block that contains the form.
`labelID`	ID of the label object.

Result Returns a pointer to the label string.

Comments Does not make a copy of the string; returns a pointer to the string. The object must be a label.

See Also FrmCopyLabel

FrmGetNumberOfObjects

Purpose Return the number of objects in a form.

Prototype `Word FrmGetNumberOfObjects (FormPtr frm)`

Parameters

`frm`	Pointer to memory block that contains the form.

Result Returns the number of objects in the specified form.

See Also `FrmGetObjectPtr`, `FrmGetObjectId`

FrmGetObjectBounds

Purpose Retrieve the bounds of an object given its form and index.

Prototype

```
void FrmGetObjectBounds (   FormPtr frm,
                            Word ObjIndex,
                            RectanglePtr r)
```

Parameters

`frm`	Pointer to memory block that contains the form.
`ObjIndex`	Index of an object in the form.
`r`	Pointer to the rectangle containing the object bounds.

Result Returns nothing. The object's bounds are returned in `r`.

See Also `FrmGetObjectPosition`, `FrmGetObjectIndex`, `FrmSetObjectPosition`

FrmGetObjectId

Purpose Return the ID of the specified object.

Prototype `Word FrmGetObjectId (FormPtr frm, Word objIndex)`

Parameters

`frm`	Pointer to memory block that contains the form.
`objIndex`	Index of an object in the form.

Result Returns the ID number of a object.

Comments The application developer specifies a unique object ID.

See Also `FrmGetObjectPtr`, `FrmGetObjectIndex`

FrmGetObjectIndex

Purpose Return the item number of an object. The item number is the position of the object in the form's objects list.

Prototype `Word FrmGetObjectIndex (FormPtr frm, Word objID)`

Parameters

`frm`	Pointer to memory block that contains the form.
`objID`	ID of an object in the form.

Result Returns the item number of an object (the first item number is 0).

See Also `FrmGetObjectPtr`, `FrmGetObjectId`

FrmGetObjectPosition

Purpose Return the coordinate of the specified object relative to the form.

Prototype

```
void FrmGetObjectPosition (FormPtr frm,
                           Word objIndex,
                           SWordPtr x,
                           SWordPtr y)
```

Parameters

`frm`	Pointer to memory block that contains the form.
`objIndex`	Item number of the object.
`x, y`	Pointer to window-relative x and y position.

Result Returns nothing.

See Also `FrmGetObjectBounds`, `FrmSetObjectPosition`

FrmGetObjectPtr

Purpose Return a pointer to the data structure of an object in a form.

Prototype

```
void * FrmGetObjectPtr (FormPtr frm, Word objIndex)
```

Parameters

`frm`	Pointer to memory block that contains the form.
`objIndex`	Item number of the object.

Result Returns a pointer to an object in the form.

See Also `FrmGetObjectIndex`, `FrmGetObjectId`

FrmGetObjectType

Purpose Return the type of an object.

Prototype

```
FormObjectKind FrmGetObjectType (   FormPtr frm,
                                    Word objIndex)
```

Parameters

`frm`	Pointer to memory block that contains the form.
`objIndex`	Item number of the object.

Result Returns `FormObjectKind` of the item specified.

FrmGetTitle

Purpose Return a pointer to the title string of a form.

Prototype

```
CharPtr FrmGetTitle (FormPtr frm)
```

Parameters

`frm`	Pointer to memory block that contains the form.

Result Returns a pointer to title string.

Comments This is a pointer to the internal structure itself, ***not*** to a copy.

See Also `FrmCopyTitle`, `FrmSetTitle`

FrmGetUserModifiedState

Purpose Return `TRUE` if an object in the form has been modified by the user since it was initialized or since the last call to `FrmSetNotUserModified`.

Prototype `Boolean FrmGetUserModifiedState (FormPtr frm)`

Parameters `frm` Pointer to the memory block that contains the form.

Result Returns `TRUE` if an object was modified; `FALSE` otherwise.

Comments Returns `TRUE` if the `dirty` attribute of the form has been set.

See Also FrmSetNotUserModified

FrmGetWindowHandle

Purpose Return the window handle of a form.

Prototype `WinHandle FrmGetWindowHandle (FormPtr frm)`

Parameters `frm` Pointer to memory block that contains the form.

Result Returns the handle of the memory block that the form is in. Since the form structure begins with the `WindowType` structure, this is also a `WinHandle`.

FrmGotoForm

Purpose Send a `frmCloseEvent` to the current form; send a `frmLoadEvent` and a `frmOpenEvent` to the specified form.

Prototype

```
void FrmGotoForm (Word formId)
```

Parameters

`formId`	ID of the form to display.

Result Returns nothing.

Comments The form event handler (`FrmHandleEvent`) erases and disposes of a form when it receives a `frmCloseEvent`.

See Also FrmPopupForm

FrmHandleEvent

Purpose Handle the event that has occurred in the form.

Prototype

```
Boolean FrmHandleEvent ( FormPtr frm,
                         EventPtr event)
```

Parameters

`frm`	Pointer to the memory block that contains the form.
`event`	Pointer to the event data structure.

Result Returns `TRUE` if the event was handled.

See Also FrmDispatchEvent

FrmHelp

Purpose Display the specified help message until the user taps the Done button in the help dialog.

Prototype `void FrmHelp (Word helpMsgId)`

Parameters

`helpMsgId`	Resource ID of help message string.

Result Returns nothing.

Comments The ID passed is the resource ID of a string resource that contains the help message. The help message is displayed in a modal dialog that has vertical scrolls if necessary.

FrmHideObject

Purpose Erase the specified object and set its attribute data so that it does not redraw or respond to the pen.

Prototype `void FrmHideObject (FormPtr frm, Word objIndex)`

Parameters

`frm`	Pointer to memory block that contains the form.
`objIndex`	Item number of the object.

Result Returns nothing.

See Also `FrmGetObjectIndex`, `FrmShowObject`

FrmInitForm

Purpose Load and initialize a form resource.

Prototype `FormPtr FrmInitForm (Word rscID)`

Parameters

`rscID`	Resource ID of the form.

Result Returns a pointer to the form memory block.

Displays an error message if the form has already been initialized.

Comments This function does not affect the display nor make the form active.

See Also `FrmDoDialog`, `FrmDeleteForm`

FrmPointInTitle

Purpose Returns `TRUE` if the coordinate passed is within the bounds of form's title.

Prototype

```
Boolean FrmPointInTitle (  FormPtr frm,
                           Short x,
                           Short y)
```

Parameters

`frm`	Memory block that contains the form.
`x, y`	Window-relative x and y coordinate.

Result Returns `TRUE` if the specified coordinate is in the form's title.

FrmPopupForm

Purpose Send a `frmOpenEvent` to the specified form. This routine differs from `FrmGotoForm` in that the current form is not closed.

Prototype `void FrmPopupForm (Word formId)`

Parameters

`formID`	Resource ID of form to open.

Result Returns nothing.

See Also FrmGotoForm

FrmReturnToForm

Purpose Erase and delete the currently active form and make the specified form the active form.

Prototype `void FrmReturnToForm (Word formId)`

Parameters

`formID`	Resource ID of the form to return to.

Result Returns nothing.

Comments It is assumed that the form being returned to is already loaded into memory and initialized. Passing a form ID of 0 returns to the first form in the window list, which is the last form to be loaded.

See Also `FrmGotoForm`, `FrmPopupForm`

FrmSaveAllForms

Purpose Send a `frmSaveEvent` to all open forms.

Prototype `void FrmSaveAllForms (void)`

Parameters None.

Result Returns nothing.

See Also FrmCloseAllForms

FrmSetActiveForm

Purpose Set the active form. All input (key and pen) is directed to the active form.

Prototype `void FrmSetActiveForm (FormPtr frm)`

Parameters `frm` Pointer to memory block that contains the form.

Result Returns nothing.

Comments A `penDownEvent` outside the form but within the display area is ignored.

See Also FrmGetActiveForm

FrmSetCategoryLabel

Purpose Set the category label displayed on the title line of a form. If the form's `visible` attribute is set, redraw the label.

Prototype

```
void FrmSetCategoryLabel ( FormPtr frm,
                           Word objIndex,
                           CharPtr newLabel)
```

Parameters

`frm`	Pointer to memory block that contains the form.
`objIndex`	Item number of the object.
`newLabel`	Pointer to the name of the new category.

Result Returns nothing.

Comments The pointer to the new label is saved in the object.

FrmSetControlGroupSelection

Purpose Set the selected control in a group of controls.

Prototype

```
void FrmSetControlGroupSelection (FormPtr frm,
                                  Byte groupNum,
                                  Word controlID)
```

Parameters

`frm`	Pointer to memory block that contains the form.
`groupNum`	Control group number.
`controlID`	ID of control to set.

Result Returns nothing.

Comments Function unsets all the other controls in the group. The display is updated.

See Also FrmGetControlGroupSelection

FrmSetControlValue

Purpose Turn a control on or off.

Prototype

```
void FrmSetControlValue (   FormPtr frm,
                            Word objIndex,
                            short newValue)
```

Parameters

`frm`	Pointer to memory block that contains the form.
`objIndex`	Item number of the object.
`newValue`	New control value (non-zero equals on).

Result Returns nothing.

Comments The display is not changed.

See Also FrmGetControlValue

FrmSetEventHandler

Purpose Set the event handler callback routine for the specified form.

Prototype

```
void FrmSetEventHandler (FormPtr frm,
                         FormEventHandlerPtr handler)
```

Parameters

`frm`	Pointer to memory block that contains the form.
`handler`	Address of a function.

Result Returns nothing.

Comments `FrmHandleEvent` calls this handler whenever it receives an event.

This routine should be called right after a form resource is loaded. The callback routine is the mechanism for dispatching events to an application. The tutorial explains how to use callback routines.

See Also FrmDispatchEvent

FrmSetFocus

Purpose Set the focus of a form to the specified object.

Prototype

```
void FrmSetFocus (FormPtr frm, Word objIndex)
```

Parameters

`frm`	Pointer to memory block that contains the form.
`objIndex`	Item number of the object (UI element) that gets the focus.

Result Returns nothing.

See Also `FrmGetFocus`, `FrmGetObjectIndex`

FrmSetGadgetData

Purpose Store the value passed in the `data` field of the gadget object.

Prototype

```
void FrmSetGadgetData (   FormPtr frm,
                          Word objIndex,
                          VoidPtr data)
```

Parameters

`frm`	Pointer to memory block that contains the form.
`objIndex`	Item number of the object.
`data`	Application-defined value.

Result Returns nothing.

Comments Gadget objects provide a way for an application to attach custom gadgetry to a form. In general, the data field of a gadget object contains a pointer to the custom object's data structure.

See Also `FrmGetGadgetData`, `FrmGetObjectIndex`

FrmSetNotUserModified

Purpose Clear the flag that keeps track of whether or not the form has been modified by the user.

Prototype

```
void FrmSetNotUserModified (FormPtr frm)
```

Parameters

`frm`	Pointer to memory block that contains the form.

Result Returns nothing.

See Also FrmGetUserModifiedState

FrmSetMenu

Purpose Change a form's menu bar.

Prototype

```
void FrmSetMenu (FormPtr frm, Word menuRscID)
```

Parameters

`frm`	Memory block that contains the form.
`menuRscID`	Resource ID of the menu.

Result Returns nothing.

FrmSetObjectBounds

Purpose Set the bounds of the specified form object.

Prototype

```
void FrmSetObjectBounds (   FormPtr frm,
                            Word objIndex,
                            RectanglePtr bounds)
```

Parameters

`frmPtr`	Memory block that contains the form.
`objIndex`	Item number of the object.
`bounds`	Window-relative bounds.

Result Returns nothing.

FrmSetObjectPosition

Purpose Set the window-relative coordinate of the specified object.

Prototype

```
void FrmSetObjectPosition (FormPtr frm,
                           Word objIndex,
                           SWord x,
                           SWord y)
```

Parameters

`frm`	Pointer to memory block that contains the form.
`objIndex`	Item number of the object.
`x`	Window-relative coordinate.
`y`	Window-relative coordinate.

Result Returns nothing.

Comments Doesn’t update the display. Presently, only label objects are affected.

Caveat This function currently doesn’t work when used on a bitmap.

See Also `FrmGetObjectPosition`, `FrmGetObjectIndex`, `FrmGetObjectBounds`

FrmSetTitle

Purpose Set the title of a form. If the form is visible, draw the new title.

Prototype `void FrmSetTitle (FormPtr frm, CharPtr newTitle)`

Parameters

`frm`	Pointer to memory block that contains the form.
`newTitle`	Pointer to the new title string.

Result Returns nothing.

Comments Draws the title if the form is visible.

Saves the pointer to the passed title string. Does ***not*** make a copy.

See Also `FrmGetTitle`, `FrmCopyTitle`, `FrmCopyLabel`

FrmShowObject

Purpose Set an object (UI element) inside a form as usable. If the form is visible, draw the object.

Prototype `void FrmShowObject (FormPtr frm, Word objIndex)`

Parameters

`frm`	Pointer to memory block that contains the form.
`objIndex`	Item number of the object.

Result Returns nothing.

See Also `FrmHideObject`, `FrmGetObjectIndex`

FrmUpdateScrollers

Purpose Visually update the field scroll arrow buttons.

Prototype

```
void FrmUpdateScrollers (   FormPtr frm,
                            Word upIndex,
                            Word downIndex,
                            Boolean scrollableUp,
                            Boolean scrollableDown)
```

Parameters

`frm`	Pointer to a form.
`upIndex`	Index of the up-scroller button.
`downIndex`	Index of the down-scroller button.
`scrollableUp`	`TRUE` if the up-scroll should be active.
`scrollableDown`	`TRUE` if the down-scroll should be active.

Result Returns nothing.

See Also FrmGetObjectIndex

FrmUpdateForm

Purpose Send a `frmUpdateEvent` to the specified form.

Prototype

```
void FrmUpdateForm (Word formId, Word updateCode)
```

Parameters

`formId`	Resource ID of form to open.
`updateCode`	If the update code is `frmRedrawUpdateCode`, the form reinitializes its global variables and redraws itself. Otherwise, the form reinitializes its global variables but does not redraw itself.

Result Returns nothing.

FrmVisible

Purpose Return `TRUE` if the form is visible (is drawn).

Prototype `Boolean FrmVisible (FormPtr frm)`

Parameters

`frm`	Pointer to memory block that contains the form.

Result Returns `TRUE` if visible; `FALSE` if not visible.

See Also `FrmDrawForm`, `FrmEraseForm`

Character Attribute Functions

GetCharAttr

Purpose Return a pointer to the character attribute. This array is used by the character classification and character conversion macros (such as is-alpha and toascii).

Prototype `WordPtr GetCharAttr (void)`

Parameters None

Result A pointer to the attributes array. See CharAttr.h for an explanation of the attributes.

GetCharCaselessValue

Purpose Return a pointer to an array that maps all characters to an assigned caseless and accentless value. Use this function for finding text.

Prototype `BytePtr GetCharCaselessValue (void)`

Parameters None.

Result Returns a pointer to the sort array.

The compiler pads each byte out to a word so each index position contains two characters.

Note: array[x].high = sort value for character 2x+1.

Comment The `GetCharCaselessValue` conversion table converts each character into a numeric value that is caseless and sorted according to Microsoft Windows sorting rules:

- Punctuation characters have the lowest values,
- followed by numbers,
- followed by alpha characters.

  All forms of each alpha character have equivalent values, so that e = E = e-grave = e-circumflex, etc.

This conversion table is used by all the Palm OS sorting and comparison routines to yield caseless searches and caseless sorts in the same order as Windows-based programs.

GetCharSortValue

Purpose Return a pointer to an array that maps all characters to an assigned sorting value. Use this function for ordering (sorting) text.

Prototype `BytePtr GetCharSortValue (void)`

Parameters None.

Result Returns a pointer to the attributes array.

The compiler pads each byte out to a word so each index position contains two characters.

Note: array[x].low = sort value for character 2x.

Graffiti Manager Functions

GrfAddMacro

Purpose Add a macro to the macro list.

Prototype
```
Err GrfAddMacro (  CharPtr nameP,
                   BytePtr macroDataP,
                   Word dataLen)
```

Parameters

`nameP`	Name of macro.
`macroDataP`	Data of macro.
`dataLen`	Size of macro data in bytes.

Result Returns 0 if no error; returns `grfErrNoMacros`, `grfErrMacroPtrTooSmall`, `dmErrNotValidRecord`, `dmErrWriteOutOfBounds` if an error occurs.

See Also `GrfGetMacro`, `GrfGetMacroName`, `GrfDeleteMacro`

GrfAddPoint

Purpose Add a point to the Graffiti point buffer.

Prototype
```
Err GrfAddPoint (PointType* ptP)
```

Parameters

`ptP`	Pointer to point buffer.

Result Returns 0 if no error; returns `grfErrPointBufferFull` if an error occurs.

See Also GrfFlushPoints

GrfCleanState

Purpose Remove any temporary shifts from the dictionary state.

Prototype `Err GrfCleanState (void)`

Parameters None

Result Returns 0 if no error, or `grfErrNoDictionary` if an error occurs.

See Also GrfInitState

GrfDeleteMacro

Purpose Delete a macro from the macro list.

Prototype `Err GrfDeleteMacro (Word index)`

Parameters

`index`	Index of the macro to delete.

Result Returns 0 if no error, or `grfErrNoMacros`, `grfErrMacroNotFound` if an error occurs.

See Also GrfAddMacro

GrfFindBranch

Purpose	Locate a branch in the Graffiti dictionary by flags.
Prototype	`Err GrfFindBranch (Word flags)`
Parameters	`flags` Flags of the branch you're searching for.
Result	Returns 0 if no error, or `grfErrNoDictionary` or `grfErrBranchNotFound` if an error occurs.
See Also	`GrfCleanState`, `GrfInitState`

GrfFilterPoints

Purpose	Filter the points in the Graffiti point buffer.
Prototype	`Err GrfFilterPoints (void)`
Parameters	None.
Result	Always returns 0.
See Also	GrfMatch

GrfFlushPoints

Purpose Dispose of all points in the Graffiti point buffer.

Prototype

```
Err GrfFlushPoints (void)
```

Parameters None.

Result Always returns 0.

See Also GrfAddPoint

GrfGetAndExpandMacro

Purpose Look up and expand a macro in the current macros.

Prototype

```
Err GrfGetAndExpandMacro(CharPtr nameP,
                         BytePtr macroDataP,
                         WordPtr dataLenP)
```

Parameters

`nameP`	Name of macro to look up.
`macroDataP`	Macro contents returned here.
`dataLenP`	On entry, size of `macroDataP` buffer; on exit, number of bytes in macro data.

Result Returns 0 if no error, or `grfErrNoMacros` or `grfErrMacroNotFound` if an error occurs.

See Also `GrfAddMacro`, `GrfGetMacro`

GrfGetGlyphMapping

Purpose Look up a glyph in the dictionary and return the text.

Prototype

```
Err GrfGetGlyphMapping(  Word glyphID,
                         WordPtr flagsP,
                         void* dataPtrP,
                         WordPtr dataLenP,
                         WordPtr uncertainLenP)
```

Parameters

`glyphID`	Glyph ID to look up.
`flagsP`	Returned dictionary flags.
`dataPtrP`	Where returned text goes.
`dataLenP`	On entry, size of `dataPtrP`; on exit, number of bytes returned.
`uncertainLenP`	Return number of uncertain characters in text.

Result Returns 0 if no error, or `grfErrNoDictionary` or `grfErrNoMapping` if an error occurs.

See Also GrfMatch

GrfGetMacro

Purpose Look up a macro in the current macros.

Prototype

```
Err GrfGetMacro( CharPtr nameP,
                 BytePtr macroDataP,
                 WordPtr dataLenP)
```

Parameters

`nameP`	Name of macro to lookup.
`macroDataP`	Macro contents returned here.
`dataLenP`	On entry: size of `macroDataP` buffer. On exit: number of bytes in macro data.

Result Returns 0 if no error or `grfErrNoMacros`, `grfErrMacroNotFound`.

See Also GrfAddMacro

GrfGetMacroName

Purpose Look up a macro name by index.

Prototype

```
Err GrfGetMacroName (Word index, CharPtr nameP)
```

Parameters

`index`	Index of macro.
`nameP`	Name returned here.

Result Returns 0 if no error, or `grfErrNoMacros` or `grfErrMacroNotFound` if an error occurs.

See Also `GrfAddMacro`, `GrfGetMacro`

GrfGetNumPoints

Purpose Return the number of points in the point buffer.

Prototype `Err GrfGetNumPoints (WordPtr numPtsP)`

Parameters

`numPtsP`	Returned number of points.

Result Always returns 0.

See Also GrfAddPoint

GrfGetPoint

Purpose Return a point out of the Graffiti point buffer.

Prototype `Err GrfGetPoint (Word index, PointType* pointP)`

Parameters

`index`	Index of the point to get.
`pointP`	Returned point.

Result Returns 0 if no error, or `grfErrBadParam` if an error occurs.

See Also `GrfAddPoint`, `GrfGetNumPoints`

GrfGetState

Purpose Return the current Graffiti shift state of.

Prototype

```
Err GrfGetState(   Boolean* capsLockP,
                   Boolean* numLockP,
                   WordPtr tempShiftP,
                   Boolean* autoShiftedP)
```

Parameters

`capsLockP`	Returns `TRUE` if caps lock on.
`numLockP`	Returns `TRUE` if num lock on.
`tempShiftP`	Current temporary shift.
`autoShiftedP`	Returns `TRUE` if shift not set by the user but by the system, for example, at the beginning of a line.

Result Always returns 0.

2.0 Note 2.0 has more more user-friendly auto shifting. It uses an upper case letter under these conditions:

- after an empty field
- after a period or other sentence terminator (such as ? or !).
- after two spaces

See Also GrfSetState

GrfInitState

Purpose Reinitialize the Graffiti dictionary state.

Prototype

```
Err GrfInitState (void)
```

Parameters None.

Result Always returns 0.

See Also `GrfGetState`, `GrfSetState`

GrfMatch

Purpose Recognize the current stroke in the Graffiti point buffer and return with the recognized text.

Prototype

```
Err GrfMatch (   WordPtr flagsP,
                 void* dataPtrP,
                 WordPtr dataLenP,
                 WordPtr uncertainLenP,
                 GrfMatchInfoPtr matchInfoP)
```

Parameters

`flagsP`	Glyph flags are returned here.
`dataPtrP`	Return text is placed here.
`dataLenP`	Size of `dataptr` on exit; number of characters returned on exit.
`uncertainLenP`	Return number of uncertain characters.
`matchInfoP`	Array of `grfMaxMatches`, or nil.

Result Returns 0 if no error, or `grfErrNoGlyphTable`, `grfErrNoDictionary`, or `grfErrNoMapping` if an error occurs.

See Also `GrfAddPoint`, `GrfFlushPoints`

GrfMatchGlyph

Purpose Recognize the current stroke as a glyph.

Prototype

```
Err GrfMatchGlyph (  GrfMatchInfoPtr matchInfoP,
                     Word maxUnCertainty,
                     Word maxMatches)
```

Parameters

`matchInfoP`	Pointer to array of matches to fill in.
`maxUnCertainty`	Maximum number of errors to tolerate.
`maxMatches`	Size of `matchInfoP` array.

Result Returns 0 if no error, or `grfErrNoGlyphTable` if an error occurs.

See Also GrfMatch

GrfProcessStroke

Purpose Translate a stroke to keyboard events using Graffiti.

Prototype

```
Err GrfProcessStroke (   PointType* startPtP,
                         PointType* endPtP,
                         Boolean upShift)
```

Parameters

`startPtP`	Start point of stroke.
`endPtP`	End point of stroke.
`upShift`	Set to `TRUE` to feed an artificial upshift into the engine.

Result Returns 0 if recognized.

Comments Called by `SysHandleEvent` when a penUpEvent is detected in the writing area. This routine recognizes the stroke and sends the recognized characters into the key queue. It also flushes the stroke out of the pen queue after recognition.

See Also `SysHandleEvent (`documented in “Developing Palm OS Applications, Part II”`)`

GrfSetState

Purpose Set the current shift state of Graffiti.

Prototype

```
Err GrfSetState( Boolean capsLock,
                 Boolean numLock,
                 Boolean upperShift)
```

Parameters

`capsLock`	Set to `TRUE` to turn on caps lock.
`numLock`	Set to `TRUE` to turn on num lock.
`upperShift`	Set to `TRUE` to put into upper shift.

Result Always returns 0.

See Also GrfGetState

SysShortCutListDialog

Purpose Pop up the Graffiti ShortCut list as a field object with the focus.

Prototype

```
void SysGrfShortCutListDialog (void)
```

Parameters

`event`	Pointer to an `EventType` structure.

Result The field's text chunk is changed.

See Also `GrfGetMacro`, `GrfGetMacroName`

Functions for System Use Only

GrfFieldChange

Prototype

```
Err GrfFieldChange(  Boolean resetState,
                     UIntPtr characterToDelete)
```

WARNING: System Use Only.

GrfFree

Prototype

```
Err GrfFree(void)
```

WARNING: System Use Only.

GraffitiShift Functions

GsiEnable

Purpose Enable or disable the Graffiti-shift state indicator.

Prototype `void GsiEnable (Boolean enableIt)`

Parameters `enableIt` `TRUE` to enable, `FALSE` to disable.

Result Returns nothing.

Comments Enabling the indicator makes it visible, disabling it makes the insertion point invisible.

GsiEnabled

Purpose Return `TRUE` if the Graffiti-shift state indicator is enabled, or `FALSE` if it's disabled.

Prototype `Boolean GsiEnabled (void)`

Parameters None.

Result `TRUE` if enabled, `FALSE` if not.

GsiInitialize

Purpose Initialize the global variables used to manage the Graffiti-shift state indicator.

Prototype `void GsiInitialize (void)`

Parameters None.

Result Returns nothing.

GsiSetLocation

Purpose Set the display-relative position of the Graffiti-shift state indicator.

Prototype `void GsiSetLocation (short x, short y)`

Parameters

`x, y`	Coordinate of left side and top of the indicator.

Result Returns nothing.

Comments The indicator is not redrawn by this routine.

GsiSetShiftState

Purpose Set the Graffiti-shift state indicator.

Prototype

```
void GsiSetShiftState (  Word lockFlags,
                         Word tempShift)
```

Parameters

`lockFlags`	`glfCapsLock` or `glfNumLock`.
`tempShift`	The current temporary shift.

Result Returns nothing.

Comment This function affects only the state of the UI element, not the underlying Graffiti engine.

See Also GrfSetState

Insertion Point Functions

InsPtEnable

Purpose Enable or disable the insertion point. When the insertion point is disabled, it's invisible; when it's enabled, it blinks.

Prototype `void InsPtEnable (Boolean enableIt)`

Parameters

`enableIt`	`TRUE` = enable; `FALSE` = disable

Result Returns nothing.

Comments This function is called by the Form functions when a text field loses or gains the focus, and by the Windows function when a region of the display is copied (`WinCopyRectangle`).

See Also InsPtEnabled

InsPtEnabled

Purpose Return `TRUE` if the insertion point is enabled or `FALSE` if the insertion point is disabled.

Prototype `Boolean InsPtEnabled (void)`

Parameters None.

Result Returns `TRUE` if the insertion point is enabled (blinking); returns `FALSE` if the insertion point is disabled (invisible).

See Also InsPtEnable

InsPtGetHeight

Purpose Return the height of the insertion point.

Prototype `short InsPtGetHeight (void)`

Parameters None.

Result Returns the height of the insertion point, in pixels.

InsPtGetLocation

Purpose Return the screen-relative position of the insertion point.

Prototype `void InsPtGetLocation (short *x, short *y)`

Parameters

`x, y`	Pointer to top-left position of insertion point's x and y coordinate.

Result Returns nothing. Stores the location in `x` and `y`.

Comments This function is called by the Field functions. An application would not normally call this function.

InsPtSetHeight

Purpose Set the height of the insertion point.

Prototype `void InsPtSetHeight (short height)`

Parameters

`height`	Height of the insertion point in pixels.

Result Returns nothing.

Comments Set the height of the insertion point to match the character height of the font used in the field that the insertion point is in. When the current font is changed, the insertion point height should be set to the line height of the new font.

If the insertion point is visible when its height is changed, it's erased and redrawn with its new height.

See Also InsPtGetHeight

InsPtSetLocation

Purpose Set the screen-relative position of the insertion point.

Prototype `void InsPtSetLocation (short x, short y)`

Parameters

`x, y`	Number of pixels from the left side (top) of the display.

Result Returns nothing.

Comments The position passed to this function is the location of the top-left corner of the insertion point.

This function should be called only by the Field functions.

See Also InsPtGetLocation

Functions for System Use Only

InsPtCheckBlink

Prototype

```
void InsPtCheckBlink (void)
```

WARNING: For System Use Only.

InsPtInitialize

Prototype

```
void InsPtInitialize (void)
```

WARNING: For System Use Only.

Key Manager Functions

KeyCurrentState

Purpose Return bit field with bits set for each key that is currently depressed.

Prototype `DWord KeyCurrentState (void)`

Parameters None.

Result Returns a `DWord` with bits set for keys that are depressed. See `keyBitPower`, `keyBitPageUp`, `keyBitPageDown`, etc., in `KeyMgr.h`.

Comments Called by applications that need to poll the keys.

See Also KeyRates

KeyRates

Purpose Get or set the key repeat rates.

Prototype

```
Err KeyRates (   Boolean set,
                 WordPtr initDelayP,
                 WordPtr periodP,
                 WordPtr doubleTapDelayP,
                 BooleanPtr queueAheadP)
```

Parameters

`set`	If `TRUE`, settings are changed; if `FALSE`, current settings are returned.
`initDelayP`	Initial delay in ticks for a auto-repeat event.
`periodP`	Auto-repeat rate specified as period in ticks.
`doubleTapDelayP`	Maximum double-tap delay, in ticks.
`queueAheadP`	If `TRUE`, auto-repeating keeps queueing up key events if the queue has keys in it. If `FALSE`, auto-repeat doesn't enqueue keys unless the queue is already empty.

Result Returns 0 if no error.

See Also KeyCurrentState

Functions for System Use Only

KeyBootKeys

Prototype `DWord KeyBootKeys (void)`

WARNING: This function for use by system software only.

KeyHandleInterrupt

Prototype

```
ULong KeyHandleInterrupt(   Boolean periodic,
                            DWord status)
```

WARNING: This function for use by system software only.

KeyInit

Prototype

```
Err KeyInit (void)
```

WARNING: This function for use by system software only.

KeyResetDoubleTap

Prototype

```
Err KeyResetDoubleTap (void)
```

WARNING: This function for use by system software only.

KeySleep

Prototype

```
Err KeySleep (   Boolean untilReset,
                 Boolean emergency)
```

WARNING: This function for use by system software only.

KeyWake

Prototype

```
Err KeyWake (void)
```

WARNING: This function for use by system software only.

List UI Functions

LstDrawList

Purpose Draw the list object if it's usable. Set it's `visible` attribute to TRUE.

Prototype `void LstDrawList (ListPtr list)`

Parameters

`list`	Pointer to list object (`ListType` data structure).

Result Returns nothing.

Comments If there are more choices than can be displayed, this function ensures that the current selection is visible. If possible, the current selection is displayed at the top. The current selection is highlighted.

If the list is disabled, it's drawn grayed-out (strongly discouraged). If it's empty, nothing is drawn. If it's not usable, nothing is drawn.

See Also `FrmGetObjectPtr`, `LstPopupList`, `LstEraseList`

LstEraseList

Purpose Erase a list object.

Prototype `void LstEraseList (ListPtr ListP)`

Parameters

`ListP`	Pointer to a list object (`ListType` data structure).

Result Returns nothing.

Comments The `visible` attribute is set to `FALSE` by this function.

See Also `FrmGetObjectPtr`, `LstDrawList`

LstGetNumberOfItems

Purpose Return the number of items in a list.

Prototype `Word LstGetNumberOfItems (ListPtr ListP)`

Parameters `ListP`	Pointer to a list object (`ListType` data structure).

Result Returns the number of items in a list.

See Also `FrmGetObjectPtr`, `LstSetListChoices`

LstGetVisibleItems

Purpose Return the number of visible items.

Prototype `Int LstGetVisibleItems (ListPtr pList)`

Parameters `pList`	Pointer to list object

Result The number of items visible.

LstGetSelection

Purpose Return the currently selected choice in the list. If there is no selection, return `NoListSelection` (-1).

Prototype `Word LstGetSelection (ListPtr ListP)`

Parameters

`ListP`	Pointer to list object.

Result Returns the item number of the current list choice. The list choices are numbered sequentially, starting with 0; -1 = none.

See Also `FrmGetObjectPtr`, `LstSetListChoices`, `LstSetSelection`, `LstGetSelectionText`

LstGetSelectionText

Purpose Return a pointer to the text of the specified item in the list, or `NULL` if no such item exists.

Prototype

```
CharPtr LstGetSelectionText (   ListPtr ListP,
                                Word itemNum)
```

Parameters

`ListP`	Pointer to list object.
`itemNum`	Item to select (0 = first item in list).

Result Returns a pointer to the text of the current selection, or `NULL` if out of bounds.

Comments This is a pointer within `ListType` structure, not a copy.

See Also `FrmGetObjectPtr`, `LstSetListChoices`

LstHandleEvent

Purpose Handle event in the specified list; the list object must have its `usable` and `visible` attribute set to `TRUE`.This routine handles two type of events, `penDownEvent` and `lstEnterEvent`; see Comments.

Prototype

```
Boolean LstHandleEvent (ListPtr listP,
                                EventPtr pEvent)
```

Parameters

`listP`	Pointer to a list object (`ListType` data structure).
`pEvent`	Pointer to an `EventType` structure.

Result Return `TRUE` if the event was handled. The following cases will result in a return value of `TRUE`:

- A `penDownEvent` within the bounds of the list
- A `lstEnterEvent` with a list ID value that matches the list ID in the list data structure

Comments When this routine receives a `penDownEvent`, it checks if the pen position is within the bounds of the list object. If it is, this routine tracks the pen until the pen comes up. If the pen comes up within the bounds of the list, a `lstEnterEvent` is added to the event queue, and the routine is exited.

When this routine receives a `lstEnterEvent`, it checks that the list ID in the event record matches the ID of the specified list. If there is a match, this routine creates and displays a popup window containing the list's choices and the routine is exited.

If a `penDownEvent` is received while the list's popup window is displayed and the pen position is outside the bounds of the popup window, the window is dismissed. If the pen position is within the bounds of the window, this routine tracks the pen until it comes up. If the pen comes up outside the list object, a `lstEnterEvent` is added to the event queue.

LstMakeItemVisible

Purpose Make an item visible, preferably at the top. If the item is already visible, make no changes.

Prototype

```
LstMakeItemVisible (    ListPtr ListP,
                        Word itemNum)
```

Parameters

`ListP`	Pointer to a list object (`ListType` data structure).
`itemNum`	Item to select (0 = first item in list).

Result Returns nothing.

Comments Does ***not*** visually update the list. You must call `LstDrawList` to update it.

See Also `FrmGetObjectPtr`, `LstSetSelection`, `LstSetTopItem`, `LstDrawList`

LstPopupList

Purpose Display a modal window that contains the items in the list.

Prototype

```
short LstPopupList (ListPtr ListP)
```

Parameters

`ListP`	Pointer to list object.

Result Returns the list item selected, or -1 if no item was selected.

Comments Saves the previously active window. Creates and deletes the new popup window.

See Also FrmGetObjectPtr

LstScrollList

Purpose Scroll the list up or down a number of times.

Prototype

```
Boolean LstScrollList( ListPtr pList,
                       enum directions direction,
                       short itemCount)
```

Parameters

`pList`	Pointer to list object
`direction`	Direction to scroll
`itemCount`	Items to scroll in direction

Result Returns `TRUE` when the list is actually scrolled, `FALSE` otherwise. May return `FALSE` if a scroll past the end of the list is requested.

LstSetDrawFunction

Purpose Set a callback function to draw each item instead of drawing the item's text string.

Prototype

```
void LstSetDrawFunction (ListPtr list,
                         ListDrawDataFuncPtr func)
```

Parameters

`list`	Pointer to list object.
`func`	Pointer to function which draws items.

Result Returns nothing.

Comments This function also adjusts `topItem` to prevent a shrunken list from being scrolled down too far. Use this function for custom draw functionality.

See Also `FrmGetObjectPtr`, `LstSetListChoices`

LstSetHeight

Purpose Set the number of items visible in a list.

Prototype

```
void LstSetHeight (  ListPtr ListP,
                     Word visibleItems)
```

Parameters

`ListP`	Pointer to list object.
`visibleItems`	Number of choices visible at once.

Result Returns nothing.

Comments This function doesn't redraw the list if it's already visible.

See Also FrmGetObjectPtr

LstSetListChoices

Purpose Set the items of a list to the array of text strings passed to this function. This function doesn't affect the display of the list. If the list is visible, erases the old list items.

Prototype

```
void LstSetListChoices ( ListPtr ListP,
                         char ** itemsText,
                         UInt numItems)
```

Parameters

`ListP`	Pointer to a list object.
`itemsText`	Pointer to an array of text strings.
`numItems`	Number of choices in the list.

Result Returns nothing.

See Also `FrmGetObjectPtr`, `LstSetSelection`, `LstSetTopItem`, `LstDrawList`, `LstSetHeight`, `LstSetDrawFunction`

LstSetPosition

Purpose Set the position of a list.

Prototype
```
void LstSetPosition (  ListPtr ListP,
                       short x,
                       short y)
```

Parameters

`ListP`	Pointer to a list object
`x, y`	Left and top bound.

Result Returns nothing.

Comments List is not redrawn. Don't call this function when the list is visible.

See Also FrmGetObjectPtr

LstSetSelection

Purpose Set the selection for a list.

Prototype
```
void LstSetSelection (   ListPtr ListP,
                         Word itemNum)
```

Parameters

`ListP`	Pointer to a list object.
`itemNum`	Item to select (0 = first item in list; -1 = none).

Result Returns nothing.

Comments The old selection, if any, is unselected. If the list is visible, the selected item is visually updated. The list is scrolled to the selection, if necessary.

See Also `FrmGetObjectPtr`, `LstSetSelection`

LstSetTopItem

Purpose Set the item visible. The item cannot become the top item if it's on the last page.

Prototype `void LstSetTopItem (ListPtr ListP, UInt itemNum)`

Parameters

`ListP`	Pointer to list object.
`itemNum`	Item to select (0 = first item in list).

Result Returns nothing.

Comments Does ***not*** update the display.

See Also `FrmGetObjectPtr`, `LstSetSelection`, `LstMakeItemVisible`, `LstDrawList`, `LstEraseList`

Menu Functions

MenuDispose

Purpose Release any memory allocated to support the menu management.

Prototype `void MenuDispose (MenuBarPtr MenuP)`

Parameters

`MenuP`	Pointer returned by `MenuInit`; this is a pointer to a `MenuBarType` data structure.

Result Returns nothing.

Comments This function is useful for applications that have multiple menu bars. It frees all memory allocated by a menu, resets the command status, and restores the saved bits to the screen.

See Also `MenuInit`, `MenuDrawMenu`

MenuDrawMenu

Purpose Draw the current menu bar and the last pull-down that was visible.

Prototype `void MenuDrawMenu (MenuBarPtr MenuP)`

Parameters

`MenuP`	Pointer to a `MenuBarType` data structure.

Result Returns nothing.

Comments If a pull-down menu was visible the last time the menu bar was visible, the pull-down menu is also drawn. The first time a menu bar is drawn, no pull-down menu is displayed.

The menu bar and the pull-down menu are drawn in front of all the applications windows.

Screen regions obscured by the menus are saved by this function and restored by `MenuEraseStatus`.

See Also `MenuInit`, `MenuEraseStatus`, `MenuDispose`

MenuEraseStatus

Purpose Erase the menu command status.

Prototype `void MenuEraseStatus (MenuBarPtr MenuP)`

Parameters

`MenuP`	Pointer to a `MenuBarType` data structure, or `NULL` for the current menu.

Result Returns nothing.

See Also MenuInit

MenuGetActiveMenu

Purpose Returns a pointer to the current menu.

Prototype `MenuBarPtr MenuGetActiveMenu (void)`

Parameters None.

Result Returns a pointer to the current menu, `NULL` if there is none.

See Also MenuSetActiveMenu

MenuHandleEvent

Purpose Handle events in the current menu. This routine handles two types of events, penDownEvent and winEnterEvent.

Prototype

```
Boolean MenuHandleEvent (  MenuBarPtr MenuP,
                           EventPtr event,
                           WordPtr error)
```

Parameters

`MenuP`	Pointer to a `MenuBarType` data structure.
`event`	Pointer to an `EventType` structure.
`error`	Error (or 0 if no error).

Result Returns `TRUE` if the event is handled; that is, if the event is a penDownEvent within the menu bar or the menu, or the event is a keyDownEvent that the menu supports.

Comments When `MenuHandleEvent` receives a penDownEvent, it checks if the pen position is within the bounds of the menu object. If it is, `MenuHandleEvent` tracks the pen until it comes up. If the pen comes up within the bounds of the menu, a winEnterEvent is added to the event queue, and the routine is exited.

When `MenuHandleEvent` receives a winEnterEvent, it checks that the menu ID in the event record matches the ID of the specified menu. If there is a match, `MenuHandleEvent` creates and displays a popup window containing the menu's choices, and the routine is exited.

If a penDownEvent is received while the menu's popup window is displayed and the pen position is outside the bounds of the popup window, the menu is dismissed. If the pen position is within the bounds of the window, `MenuHandleEvent` tracks the pen until it comes up. If the pen comes up in the menu, a winExitEvent is added to the event queue.

MenuInit

Purpose Load a menu resource from a resource file.

Prototype `MenuBarPtr MenuInit (Word resourceId)`

Parameters

`resourceId`	ID that identifies the menu resource.

Result Returns the pointer to a memory block allocated to hold the menu resource (a pointer to a `MenuBarType` data structure).

Comments The menu is not usable until `MenuSetActiveMenu` is called.

See Also `MenuSetActiveMenu`, `MenuDispose`

MenuSetActiveMenu

Purpose Set the current menu.

Prototype `MenuBarPtr MenuSetActiveMenu (MenuBarPtr MenuP)`

Parameters

`MenuP`	Pointer to the memory block that contains the new menu, or NULL for none.

Result Returns a pointer to the menu that was active before the new menu was set, or `NULL` if no menu was active.

See Also `MenuGetActiveMenu`

Miscellaneous User Interface Functions

AbtShowAbout

Purpose Displays the info dialog box. The application name is picked up from either the application name resource, defined in constructor, or the name of the application database (which is assigned in the makefile).

Prototype

```
void AbtShowAbout (ULong creator)
```

Parameters

`creator`	Creator ID of this application.

Result Returns nothing.

DayHandleEvent

Purpose Handle event in the specified control. This routine handles two type of events, penDownEvent and ctlEnterEvent.

Prototype

```
Boolean DayHandleEvent ( DaySelectorPtr pSelector,
                         EventPtr pEvent)
```

Parameters

`pSelector`	Pointer to control object (`ControlType`)
`pEvent`	Pointer to an EventType structure.

Result `TRUE` if the event was handled or `FALSE` if it was not.

Posts a `daySelectEvent` with information on whether to use the date.

A date is used if the user selects a day in the visible month.

LocGetNumberSeparators

Purpose Get localized number separators.

Prototype

```
void LocGetNumberSeparators(
                  NumberFormatType numberFormat,
                  Char *thousandSeparator,
                  Char *decimalSeparator)
```

Parameters

`numberFormat`	The format to use
`thousandSeparator`	Return a localized thousand separator here (allocate 1 char).
`decimalSeparator`	Return a localized decimal separator here (allocate 1 char).

Result Returns nothing

See Also `StrLocalizeNumber`, `StrDelocalizeNumber` (documented in "Developing Palm OS Applications, Part II)

KeySetMask

Purpose Specify which keys generate `kbdDownEvents`.

You can specify this either by using this function or by using the `powerOn` modifier.

Prototype

```
DWord KeySetMask(DWord keyMask)
```

Parameters

`keyMask`	Mask with bits set for those keys to generate `keyDownEvents` for.

Result Returns the old `keyMask`.

Pen Manager Functions

PenCalibrate

Purpose Set the calibration of the pen.

Prototype

```
Err PenCalibrate (   PointType* digTopLeftP,
                     PointType* digBotRightP,
                     PointType* scrTopLeftP,
                     PointType* scrBotRightP)
```

Parameters

`digTopLeftP`	Digitizer output from top-left coordinate.
`digBotRightP`	Digitizer output from bottom-right coordinate.
`scrTopLeftP`	Screen coordinate near top-left corner.
`scrBotRightP`	Screen coordinate near bottom-right corner.

Result Returns 0 if no error.

Comments Called by Preferences application when calibrating pen.

See Also PenResetCalibration

PenResetCalibration

Purpose Reset the calibration in preparation for calibrating the pen again.

Prototype `Err PenResetCalibration (void)`

Parameters None.

Result Always returns 0.

Comments Called by Preferences application before capturing points when calibrating the pen.

See Also PenCalibrate

WARNING: The digitizer is off after calling this routine and must be calibrated again!

Functions for System Use Only

PenClose

Prototype `Err PenClose (void)`

WARNING: This function for use by system software only.

PenGetRawPen

Prototype `Err PenGetRawPen (PointType* penP)`

See Instead `EvtDequeuePenPoint` (documented in "*Developing Palm OS Applications, Part II*")

WARNING: This function for use by system software only.

PenOpen

Prototype

```
Err PenOpen (void)
```

WARNING: This function for use by system software only.

PenSleep

Prototype

```
Err PenSleep (void)
```

WARNING: This function for use by system software only.

PenRawToScreen

Prototype

```
Err PenRawToScreen (PointType* penP)
```

WARNING: This function for use by system software only.

PenScreenToRaw

Prototype

```
Err PenScreenToRaw (PointType* penP)
```

WARNING: This function for use by system software only.

PenWake

Prototype

```
Err PenWake (void)
```

WARNING: This function for use by system software only.

Scrollbar Functions

SclDrawScrollBar

Purpose Draw a scroll bar.

Prototype

```
void SclDrawScrollBar (ScrollBarPtr bar)
```

Parameters

`bar`	Pointer to a scroll bar structure.

Result Nothing.

SclGetScrollBar

Purpose Retrieve a scrollbar's current position, its range, and the size of a page. If the scroll bar is visible, it's redrawn.

Prototype

```
void SclGetScrollBar ( ScrollBarPtr bar,
                       ShortPtr valueP,
                       ShortPtr minP,
                       ShortPtr maxP,
                       ShortPtr pageSizeP)
```

Parameters

`bar`	Pointer to a scroll bar structure.
`valueP`	Pointer to current value (position).
`minP`	Pointer to minimum value.
`maxP`	Pointer to maximum value.
`pageSizeP`	Pointer to size of a page (used when page scrolling).

Result: Returns nothing.

Stores the current values in `valueP`, `minP`, `maxP`, and `pageSizeP`.

See Also SclSetScrollBar

SclHandleEvent

Purpose Handles the three scrollbar events

Prototype

```
Boolean SclHandleEvent ( ScrollBarPtr bar,
                         EventPtr event)
```

Parameters

`bar`	Pointer to a scroll bar structure.
`event`	Pointer to an event (`EventType` data structure).

Result Returns `TRUE` if the event was handled.

Comment When the user touches a scroll bar with a pen, the system sends a `sclEnterEvent`. Generally, applications don't need to respond to that event.

When the user holds and drags the scroll bar with the pen, the system sends a `sclRepeatEvent`. Applications that implement dynamic scrolling should catch this event and move the text each time one arrives.

When the user releases the pen from the scroll bar, the system sends a `sclExitEvent`. Applications that implement non-dynamic scrolling should catch this event and move the text when `sclExitEvent` arrives. Applications that implement dynamic scrolling can ignore this event.

SclSetScrollBar

Purpose Set the scrollbar's current position, its range, and the size of a page. If the scroll bar is visible, it's redrawn.

Prototype

```
void SclSetScrollBar ( ScrollBarPtr bar,
                       Short value,
                       Short min,
                       Short max,
                       Short pageSize)
```

Parameters

`bar`	Pointer to a scroll bar structure.
`value`	Current value (position); one of the initialization values
`min`	Minimum value.
`max`	Maximum value.
`pageSize`	Size of a page (used when page scrolling).

Result Returns nothing.

See Also SclGetScrollBar

Functions for System Use Only

Find

Prototype

```
void Find (GoToParamsPtr goToP)
```

WARNING: System Use Only!

FindDrawHeader

Prototype

```
Boolean FindDrawHeader ( FindParamsPtr params,
                         CharPtr title)
```

WARNING: System Use Only!

FindGetLineBounds

Prototype

```
void FindGetLineBounds ( FindParamsPtr params,
                         RectanglePtr r)
```

WARNING: System Use Only!

FindSaveMatch

Prototype

```
Boolean FindSaveMatch (  FindParamsPtr params,
                         UInt recordNum,
                         Word pos,
                         UInt fieldNum,
                         DWord appCustom,
                         UInt dbCardNo,
                         LocalID dbID)
```

WARNING: System Use Only!

FindStrInStr

Prototype

```
Boolean FindStrInStr ( CharPtr strToSearch,
                       CharPtr strToFind,
                       WordPtr posP)
```

WARNING: System Use Only!

UIInitialize

Prototype

```
void UIInitialize (void)
```

WARNING: System Use Only!

UIReset

Prototype

```
void UIReset (void)
```

WARNING: System Use Only!

Time Selection Functions

SelectDay

Purpose Display a form showing a date; allow user to select a different date.

Prototype

```
Boolean SelectDay (  SelectDayType selectDayBy,
                     SWord *month,
                     SWord *day,
                     SWord *year,
                     CharPtr title)
```

Parameters

`selectDayBy`	
`month, day, year`	Month, day, and year selected.
`title`	String title for the dialog.

Result `TRUE` if the OK button was pressed. If `TRUE`, `month`, `day`, and `year` contain the new date.

See Also SelectDayV10

SelectDayV10

Purpose Display a form showing a date, allow user to select a different date.

Prototype

```
Boolean SelectDay (int *month, int *day,
                  int *year, CharPtr title)
```

Parameters

`month, day, year`	Month, day and year selected.
`title`	String title for the dialog.

Result Returns `TRUE` if the OK button was pressed. In that case, the parameters passed are changed.

See Also SelectDay

SelectTime

Purpose Display a form showing the time and allow the user to select a different time.

Prototype

```
Boolean SelectTime ( TimePtr startTimeP,
                     TimePtr EndTimeP,
                     Boolean untimed,
                     CharPtr title,
                     SWord startOfDay)
```

Parameters

`startTimeP, EndTimeP`
Pointers to values of type `TimeType`. Pass values to display in these two parameters. If the user makes a selection and taps the OK button, the selected values are returned here.

`untimed`	Pass in `TRUE` to indicate that no time is selected. If the user sets the time to no time then `startTime` and `endTime` are both set to the constant `noTime (-1)`.
`title`	A pointer to a string to display as the title. Doesn't change as the function executes.
`startofDay`	The hour that the hour list displays at its top. To see earlier hours, the user can scroll the list up. The value must be between 0 to 12, inclusive.

Result Returns `TRUE` if the user selects OK and `FALSE` otherwise. If `TRUE` is returned expect the values that `startTimeP` and `endTimeP` are likely to be changed.

See Also SelectDay

Table Functions

TblDrawTable

Purpose Draw a table.

Prototype `void TblDrawTable (TablePtr table)`

Parameters `table` Pointer to a table object.

Result Returns nothing.

See Also `TblEraseTable`, `TblRedrawTable`, `TblSetCustomDrawProcedure`

TblEditing

Purpose Check whether a table is in edit mode.

Prototype `Boolean TblEditing (TablePtr table)`

Parameters `table` Pointer to a table object.

Result Returns `TRUE` if the table is in edit mode, `FALSE` otherwise.

Comments The table is in edit mode while the user edits a text item.

TblEraseTable

Purpose Erase a table object.

Prototype

```
void TblEraseTable (TablePtr table)
```

Parameters

`table`	Pointer to a table object.

Result Returns nothing.

See Also `TblDrawTable`, `TblSetCustomDrawProcedure`, `TblRedrawTable`

TblFindRowData

Purpose Return the row number that contains the specified data value.

Prototype

```
Boolean TblFindRowData ( TablePtr table,
                         ULong data,
                         WordPtr rowP)
```

Parameters

`table`	Pointer to a table object.
`data`	Row data to find.
`rowP`	Pointer to the row number (return value).

Result Returns `TRUE` if a match was found, `FALSE` otherwise.

See Also `TblGetRowData`, `TblFindRowID`

TblFindRowID

Purpose Return the number of the row that matches the specified ID.

Prototype

```
Boolean TblFindRowID ( TablePtr table,
                       Word id,
                       WordPtr rowP)
```

Parameters

`table`	Pointer to a table object.
`id`	Row ID to find.
`rowP`	Pointer to the row number (return value).

Result Returns `TRUE` if a match was found, `FALSE` otherwise.

See Also TblFindRowData

TblGetBounds

Purpose Return the bounds of a table.

Prototype

```
void TblGetBounds (TablePtr table, RectanglePtr r)
```

Parameters

`table`	Pointer to a table object.
`r`	Pointer to a `RectangleType` structure.

Result Returns nothing. Stores the bounds in `r`.

See Also TblGetItemBounds

TblGetColumnSpacing

Purpose Return the spacing after the specified column.

Prototype

```
Word TblGetColumnSpacing ( TablePtr table,
                           Word column)
```

Parameters

`table`	Pointer to a table object.
`column`	Column number (zero-based).

Result Returns the spacing after column (in pixels).

See Also `TblGetColumnWidth`, `TblSetColumnSpacing`, `TblSetColumnUsable`

TblGetColumnWidth

Purpose Return the width of the specified column.

Prototype

```
Word TblGetColumnWidth ( TablePtr table,
                         Word column)
```

Parameters

`table`	Pointer to a table object.
`column`	Column number (zero-based).

Result Returns the width of a column (in pixels).

See Also `TblGetColumnSpacing`, `TblSetColumnWidth`, `TblSetColumnUsable`

TblGetCurrentField

Purpose Return a pointer to the `FieldType` structure in which the user is currently editing a text item.

Prototype

```
FieldPtr TblGetCurrentField (TablePtr table)
```

Parameters

`table`	Pointer to a table object.

Result Returns `FieldPtr`, or `NULL` if the table is not in edit mode.

See Also TblGetSelection

TblGetItemBounds

Purpose Return the bounds of an item in a table.

Prototype

```
void TblGetItemBounds (  TablePtr table,
                         Word row,
                         Word column,
                         RectanglePtr r)
```

Parameters

`table`	Pointer to a table object.
`row`	Row of the item (zero-based).
`column`	Column of the item (zero-based).
`r`	Pointer to a structure that holds the bounds of the item.

Result Returns nothing. Stores the bounds in `r`.

TblGetItemInt

Purpose Return the integer value stored in a table item.

Prototype

```
Word TblGetItemInt (    TablePtr table,
                        Word row,
                        Word column)
```

Parameters

`table`	Pointer to a table object.
`row`	Row of the item to select (zero-based).
`column`	Column of the item to select (zero-based).

Result Returns the integer value.

See Also TblSetItemInt

TblGetLastUsableRow

Purpose Return the last row in a table that is usable (visible).

Prototype

```
Word TblGetLastUsableRow (TablePtr table)
```

Parameters

`table`	Pointer to a table object.

Result Returns the row index (zero-based) or -1 if there are no usable rows.

See Also `TblGetRowData`, `TblGetRowID`

TblGetNumberOfRows

Purpose Return the number of rows in a table.

Prototype `Word TblGetNumberOfRows (TablePtr table)`

Parameters

`table`	Pointer to a table object.

Result Returns the number of rows in the specified table.

TblGetRowData

Purpose Return the data value of the specified row. The data value is a placeholder for application-specific values.

Prototype `ULong TblGetRowData (TablePtr table, Word row)`

Parameters

`table`	Pointer to a table object.
`row`	Row of the item to select (zero-based).

See Also `TblGetRowID`, `TblSetRowData`

TblGetRowHeight

Purpose	Return the height of the specified row.	
Prototype	`Word TblGetRowHeight (TablePtr table, Word row)`	
Parameters	`table`	Pointer to a table object.
	`row`	Row to get (zero-based).
Result	Returns the height in pixels.	
See Also	`TblGetItemBounds`, `TblSetRowHeight`	

TblGetRowID

Purpose	Return the ID value of the specified row.	
Prototype	`Word TblGetRowID (TablePtr table, Word row)`	
Parameters	`table`	Pointer to a table object.
	`row`	Row for which the ID will be returned (zero-based).
Result	Returns the ID value of the row in the table.	
See Also	`TblGetRowData`, `TblSetRowHeight`	

TblGetSelection

Purpose Return the row and column of the currently selected table item.

Prototype

```
Boolean TblGetSelection (  TablePtr table,
                           WordPtr rowP,
                           WordPtr columnP)
```

Parameters

`table`	Pointer to a table object.
`rowP, columP`	Pointer to a `Word` variable in which to store the row /column (zero-based).

Result Returns `TRUE` if the item is highlighted, `FALSE` if not.

See Also TblSetRowSelectable

TblGrabFocus

Purpose Put a table into edit mode.

Prototype

```
void TblGrabFocus (  TablePtr table,
                     Word row,
                     Word column)
```

Parameters

`table`	Pointer to a table object.
`row`	Current row to be edited (zero-based).
`column`	Current column to be edited (zero-based).

Result Returns nothing.

Comments Displays an error if the row or column passed is out of bounds. An editable field must exist in the coordinates passed to this function.

See Also TblReleaseFocus

TblHandleEvent

Purpose Handle an event for the table.

Prototype

```
Boolean TblHandleEvent ( TablePtr table,
                         EventPtr event)
```

Parameters

`table`	Pointer to a table object.
`event`	The event to be handled.

Result Returns `TRUE` if the event was handled, `FALSE` if it was not.

TblHasScrollBar

Purpose Set the `hasScrollBar` attribute in the table. A table that has its attribute set will initialize the associated field object such that it will send `fldChanged` events when that scroll bar needs to be updated.

Prototype

```
void TblHasScrollBar ( TablePtr table,
                       Boolean hasScrollBar)
```

Parameters

`table`	Pointer to a table object
`hasScrollBar`	`TRUE` to set the attribute, `FALSE` to unset it.

Result Returns nothing.

TblInsertRow

Purpose Insert a row into the table before the specified row.

The number of rows in the table is not increased; the last row in the table is removed.

Prototype `void TblInsertRow (TablePtr table, Word row)`

Parameters

`table`	Pointer to a table object.
`row`	Row to insert (zero-based).

Result Returns nothing.

Comments If the `row` parameter is greater than or equal to the number of rows in the table, an error is displayed.

See Also `TblRemoveRow`, `TblSetRowUsable`, `TblSetRowSelectable`, `TblMarkRowInvalid`

TblMarkRowInvalid

Purpose Mark the image of the specified row invalid.

Prototype `void TblMarkRowInvalid (TablePtr table, Word row)`

Parameters

`table`	Pointer to a table object.
`row`	Row of the item to select (zero-based).

Comments After calling this function, call `TblRedrawTable` to redraw all rows marked invalid. Rows not marked invalid are not redrawn.

Result Returns nothing.

See Also `TblRemoveRow`, `TblSetRowUsable`, `TblSetRowSelectable`, `TblMarkTableInvalid`, `TblRowInvalid`

TblMarkTableInvalid

Purpose Mark the image of all the rows in a table invalid.

Prototype `void TblMarkTableInvalid (TablePtr table)`

Parameters

`table`	Pointer to a table object.

Result Returns nothing.

Comments After calling this function, you must call `TblRedrawTable` to redraw all rows. Rows not marked invalid are not redrawns.

See Also `TblEraseTable`, `TblRedrawTable`, `TblMarkTableInvalid`

TblRedrawTable

Purpose Redraw the rows of the table that are marked invalid.

Prototype `void TblRedrawTable (TablePtr table)`

Parameters `table` Pointer to a table object.

Result Returns nothing.

See Also TblMarkTableInvalid

TblReleaseFocus

Purpose Release the focus.

Prototype `void TblReleaseFocus (TablePtr table)`

Parameters `table` Pointer to a table object.

Result Returns nothing.

Comments If the current item is a text item, the memory allocated for editing is released and the insertion point is turned off.

See Also TblGrabFocus

TblRemoveRow

Purpose Remove the specified row from the table.

Prototype `void TblRemoveRow (TablePtr table, Word row)`

Parameters

`table`	Pointer to a table object.
`row`	Row to remove (zero-based).

Result Returns nothing.

Comments The number of rows in the table is not decreased; an unusable row is added to the end of the table. If an invalid row is specified, an error is displayed.

This function does not visually update the display.

See Also `TblInsertRow`, `TblSetRowUsable`, `TblSetRowSelectable`, `TblMarkRowInvalid`

TblRowInvalid

Purpose Determine whether a row is invalid. Invalid rows need to be re-drawn.

Prototype `Boolean TblRowInvalid (TablePtr table, Word row)`

Parameters

`table`	Pointer to a table object.
`row`	Row number (zero-based).

Result Returns `TRUE` if the row is invalid, `FALSE` if it's valid.

See Also TblMarkRowInvalid

TblRowSelectable

Purpose Determine whether the specified row is selectable. Rows that are not selectable don't highlight when touched.

Prototype `Boolean TblRowSelectable (TablePtr table, Word row)`

Parameters

`table`	Pointer to a table object.
`row`	Row of the item to select (zero-based).

Result Returns `TRUE` if the row is selectable, `FALSE` if it's not.

TblRowUsable

Purpose Determine whether the specified row is usable.

Prototype `Boolean TblRowUsable (TablePtr table, Word row)`

Parameters

`table`	Pointer to a table object.
`row`	Row number (zero-based).

Result Returns `TRUE` if the row is usable, `FALSE` if it's not.

Comments Rows that are not usable do not display.

See Also `TblRowSelectable`, `TblGetLastUsableRow`

TblSelectItem

Purpose Select (highlight) the specified item. If there is already a selected item, it is unhighlighted.

Prototype

```
void TblSelectItem ( TablePtr table,
                     Word row,
                     Word column)
```

Parameters

`table`	Pointer to a table object.
`row`	Row of the item to select (zero-based).
`column`	Column of the item to select (zero-based).

Result Returns nothing.

See Also `TblRowSelectable`, `TblGetItemBounds`, `TblGetItemInt`

TblSetBounds

Purpose Sets the bounds of a table.

Prototype

```
void TblSetBounds (TablePtr table, RectanglePtr r)
```

Parameters

`table`	Pointer to a table object.
`r`	Pointer to a `RectangleType` structure that specifies the bounds for the table.

Result Returns nothing.

TblSetColumnEditIndicator

Purpose Set the column attribute that controls whether a column highlights when the table is in edit mode.

Prototype

```
void TblSetColumnEditIndicator (
                     TablePtr table,
                     Word column,
                     Boolean editIndicator)
```

Parameters

`table`	Pointer to a table object
`column`	Column of the item (zero based)
`editIndicator`	`TRUE` to highlight, `FALSE` to turn off highlight.

Result Returns nothing.

TblSetColumnSpacing

Purpose Set the spacing after the specified `column`.

Prototype

```
void TblSetColumnSpacing ( TablePtr table,
                           Word column,
                           Word spacing)
```

Parameters

`table`	Pointer to a table object.
`column`	Column number (zero-based).
`spacing`	Spacing after the column.

Result Returns nothing.

See Also TblSetColumnUsable

TblSetColumnUsable

Purpose Set a column in a table usable or unusable.

Prototype

```
void TblSetColumnUsable (  TablePtr table,
                           Word row,
                           Boolean usable)
```

Parameters

`table`	Pointer to a table object.
`row`	Row of the item to select (zero-based).
`usable`	`TRUE` for usable or `FALSE` for not usable.

Result Returns nothing.

Comments Columns that are not usable do not display.

See Also TblMarkRowInvalid

TblSetColumnWidth

Purpose Set the width of the specified column.

Prototype

```
void TblSetColumnWidth ( TablePtr table,
                         Word column,
                         Word width)
```

Parameters

`table`	Pointer to a table object.
`column`	Column number (zero-based).
`width`	Width of the column (in pixels).

Result Returns nothing.

See Also TblGetColumnWidth

TblSetCustomDrawProcedure

Purpose Set the custom draw callback procedure for the specified column.

Prototype

```
void TblSetCustomDrawProcedure(TablePtr table,
                               Word column,
                               VoidPtr drawCallback)
```

Parameters

`table`	Pointer to a table object.
`column`	Column of table.
`drawCallback`	Callback function.

Result Returns nothing.

Comments The custom draw callback function is used to draw table items with a `TableItemStyleType` of `customTableItem` (see `table.h`).

The callback procedure should have this prototype:

```
void drawCallback (
   VoidPtr table,
   Word row,
   Word column,
   RectanglePtr bounds);
```

See Also TblDrawTable

TblSetItemInt

Purpose Set the integer value of the specified item.

Prototype

```
void TblSetItemInt (    TablePtr table,
                        Word row,
                        Word column,
                        Word value)
```

Parameters

`table`	Pointer to a table object.
`row`	Row of the item (zero-based).
`column`	Column of the item (zero-based).
`value`	Any byte value (an integer).

Result Returns nothing.

Comments An application can store what it wants in an item’s integer value.

See Also `TblGetItemInt`, `TblSetItemPtr`

TblSetItemPtr

Purpose Set the item to the specified pointer value.

Prototype

```
void TblSetItemPtr (   TablePtr table,
                       Word row,
                       Word column,
                       VoidPtr value)
```

Parameters

`table`	Pointer to a table object.
`row`	Row of the item (zero-based).
`column`	Column of the item (zero-based).
`value`	Pointer to data to display in the table item.

Result Returns nothing.

Comments An application can store whatever it wants in the table item.

See Also TblSetItemInt

TblSetItemStyle

Purpose Set the item to display its data in a style; for example, text, numbers, dates, and so on.

Prototype

```
void TblSetItemStyle ( TablePtr table,
                       Word row,
                       Word column,
                       TableItemStyleType type)
```

Parameters

`table`	Pointer to a table object.
`row`	Row of the item (zero-based).
`column`	Column of the item (zero-based).
`type`	See `Table.h`.

Result Returns nothing.

See Also TblSetCustomDrawProcedure

TblSetLoadDataProcedure

Purpose Set the load-data callback procedure for the specified column.

Prototype

```
void TblSetLoadDataProcedure(
            TablePtr table,
            Word column,
            TableLoadDataFuncPtr loadDataCallback)
```

Parameters

`table`	Pointer to a table object.
`column`	Column of table.
`loadDataCallback`	Callback procedure.

Result Returns nothing.

Comments The callback procedure is used to obtain the data values of a table item. It should have this prototype:

```
VoidHand LoadDataCallback
   (VoidPtr table,
    Word row,
    Word column,
       Boolean editable,
    WordPtr dataOffset,
    WordPtr dataSize);
```

For a text style item, the callback procedure should return the handle of a block that contains a null-terminated text string, the offset from the start of the block to the start of the string, and the amount of space allocated for the string.

See Also TblSetCustomDrawProcedure

TblSetRowData

Purpose Set the data value of the specified row.

The data value is a placeholder for application-specific values.

Prototype

```
void TblSetRowData ( TablePtr table,
                     Word row,
                     ULong data)
```

Parameters

`table`	Pointer to a table object.
`row`	Row of the item to select (zero-based).
`data`	Application-specific data.

Result Returns nothing.

See Also TblGetRowData

TblSetRowHeight

Purpose Set the height of the specified row.

Prototype

```
void TblSetRowHeight ( TablePtr table,
                       Word row,
                       Word height)
```

Parameters

`table`	Pointer to a table object.
`row`	Row to set (zero-based).
`height`	New height in pixels.

Result Returns nothing.

See Also TblGetRowHeight, TblSetRowStaticHeight

TblSetRowID

Purpose Set the ID value of the specified row.

Prototype

```
void TblSetRowID ( TablePtr table,
                   Word row,
                   Word id)
```

Parameters

`table`	Pointer to a table object.
`row`	Row of the item to select (zero-based).
`id`	ID to identify a row.

Result Returns nothing.

See Also TblGetRowID

TblSetRowSelectable

Purpose Set a row in a table to selectable or nonselectable.

Prototype

```
void TblSetRowSelectable ( TablePtr table,
                           Word row,
                           Boolean selectable)
```

Parameters

`table`	Pointer to a table object.
`row`	Row of the item to select (zero-based).
`selectable`	`TRUE` or `FALSE`.

Result Returns nothing.

Comments Rows that are not selectable don't highlight when touched.

See Also `TblRowSelectable`, `TblSetRowUsable`

TblSetRowStaticHeight

Purpose Set the static height attribute of a row. A row that has its static height attribute set will not expand or contract the height of the row as text is added or removed from a text item.

Prototype

```
void TblSetRowStaticHeight ( TablePtr table,
                             Word row,
                             Boolean staticHeight)
```

Parameters

`table`	Pointer to a table object
`row`	Row of the item to select (zero based)
`staticHeight`	`TRUE` to set the static height, `FALSE` to unset it.

Result Nothing.

TblSetRowUsable

Purpose Set a row in a table to usable or unusable. Rows that are not usable do not display.

Prototype

```
void TblSetRowUsable ( TablePtr table,
                       Word row,
                       Boolean usable)
```

Parameters

`table`	Pointer to a table object.
`row`	Row of the item to select (zero-based).
`usable`	`TRUE` or `FALSE`.

Result Returns nothing.

See Also `TblRowUsable`, `TblSetRowSelectable`

TblSetSaveDataProcedure

Purpose Set the save-data callback procedure for the specified column.

Prototype

```
void TblSetSaveDataProcedure(TablePtr table,
                             Word column,
                             VoidPtr saveDataCallback)
```

Parameters

`table`	Pointer to a table object.
`column`	Column of table.
`saveDataCallback`	Callback function.

Comments The callback procedure is called when the table object determines the data of a text object needs to be saved.

The callback procedure should have this prototype:

```
VoidPtr SaveDataCallback
   (VoidPtr table,
    Word row,
    Word column);
```

Result Returns nothing.

See Also TblSetCustomDrawProcedure

TblUnhighlightSelection

Purpose Unhighlight the currently selected item in a table.

Prototype

```
void TblUnhighlightSelection (TablePtr table)
```

Parameters

`table`	Pointer to a table object.

Result Returns nothing.

Window Functions

WinAddWindow

Purpose Add the specified window to the active windows list.

Prototype `void WinAddWindow (WinHandle winHandle)`

Parameters

`winHandle`	Handle of a window.

Result Returns nothing.

Comment The active windows list contains all windows in the current application's user interface.

See Also `WinCreateWindow`, `WinRemoveWindow`

WinClipRectangle

Purpose Clip a rectangle to the clipping rectangle of the draw window.

Prototype `void WinClipRectangle (RectanglePtr r)`

Parameters

`r`	Pointer to a structure holding the rectangle to clip.

Comment The draw window is the window to which all drawing functions send their output.

The rectangle returned in `r` is the intersection of the rectangle passed and the draw window's clipping bounds.

Result Returns nothing.

See Also `WinCopyRectangle`, `WinDrawRectangle`, `WinEraseRectangle`, `WinGetClip`

WinCopyRectangle

Purpose Copy a rectangular region from one place to another (either between windows or within a single window).

Prototype

```
void WinCopyRectangle (WinHandle srcWin,
                       WinHandle dstWin,
                       RectanglePtr srcRect,
                       SWord destX,
                       SWord destY,
                       ScrOperation mode)
```

Parameters

`srcWin`	Window from which the rectangle is copied.
`dstWin`	Window to which the rectangle is copied.
`srcRect`	Bounds of the region to copy.
`destX`	Top bound of the rectangle in destination window.
`destY`	Left bound of the rectangle in destination window.
`mode`	The method of transfer from the source to the destination window (see `window.h`).

Result Returns nothing.

Comments Copies the bits of the window inside the rectangle region.

WinCreateWindow

Purpose Create a new window and add it to the window list.

Prototype

```
WinHandle WinCreateWindow (  RectanglePtr bounds,
                             FrameType frame,
                             Boolean modal,
                             Boolean focusable,
                             WordPtr error)
```

Parameters

`bounds`	Display relative bounds of the window.
`frame`	Type of frame around the window (see `window.h`).
`modal`	`TRUE` if the window is modal.
`focusable`	`TRUE` if the window can be the active window.
`error`	Pointer to any error encountered by this function.

Result Returns a handle for the new window.

Comments Windows created by this routine draw to the display. See `WinCreateOffscreenWindow` for information on drawing off screen.

New windows are created disabled, and must be enabled before they accept input.

See Also `WinCreateOffscreenWindow`, `WinDeleteWindow`, `WinInitializeWindow`

WinCreateOffscreenWindow

Purpose Create a new off-screen window and add it to the window list.

Prototype

```
WinHandle WinCreateOffscreenWindow (
          SWord width,
          SWord height,
          WindowFormatType format,
          WordPtr error)
```

Parameters

`width, height`	Width and height of the window in pixels.
`format`	Either `screenFormat` or `genericFormat`.
`error`	Pointer to any error this function encounters.

Result Returns the handle of the new window.

Comments Windows created with this routine draw to a memory buffer instead of the display.

The memory buffer has two formats: screen format and generic format. Screen format is the native format of the video system, windows in this format can be copied to the display faster. The generic format is device-independent.

See Also `WinCreateWindow`, `WinAddWindow`

WinDeleteWindow

Purpose Remove a window from the window list and free the memory used by the window.

Prototype

```
void WinDeleteWindow ( WinHandle winHandle,
                       Boolean eraseIt)
```

Parameters

`winHandle`	Handle of window to delete.
`eraseIt`	If `TRUE`, the window is erased before it is deleted.

Result Returns nothing.

See Also WinCreateWindow

WinDisableWindow

Purpose Disable a window but leave it on the active windows list (list of all windows in the system).

Prototype

```
void WinDisableWindow (WinHandle winHandle)
```

Parameters

`winHandle`	Handle of window to disable.

Result Returns nothing.

Comments Disabled windows ignore all pen input and cannot be made the current window or the draw window. Windows are usually disabled when they are removed from the screen.

This function does not affect the visual appearance of the window.

See Also WinEnableWindow, WinDeleteWindow

WinDisplayToWindowPt

Purpose Convert a display-relative coordinate to a window-relative coordinate. The coordinate returned is relative to the display window.

Prototype
```
void WinDisplayToWindowPt (   SWordPtr extentX,
                              SWordPtr extentY)
```

Parameters

`extentX, extentY`	Pointer to x and y coordinate to convert.

Result Returns nothing.

Comments WinWindowToDisplayPt

WinDrawBitmap

Purpose Draw a bitmap at the given x and y coordinates.

Prototype
```
void WinDrawBitmap ( BitmapPtr bitmapP,
                     SWord x,
                     Sword y)
```

Parameters

`bitmapP`	Pointer to a bitmap.
`x, y`	The x and y coordinates of the top-left corner.

Result Returns nothing.

See Also WinEraseRectangle

WinDrawChars

Purpose Draw the specified characters in the draw window.

Prototype

```
void WinDrawChars (  CharPtr chars,
                     Word len,
                     SWord x,
                     SWord y)
```

Parameters

`chars`	Pointer to the characters to draw.
`len`	Number of characters to draw.
`x, y`	Left and top bound of first character to draw.

Result Returns nothing.

Comment Before calling this function, consider calling `WinSetUnderlineMode` and `FntSetFont`.

See Also `WinDrawInvertedChars`, `WinEraseChars`, `WinSetUnderlineMode`

WinDrawGrayLine

Purpose Draw a line in the draw window.

Prototype

```
void WinDrawGrayLine (   SWord x1, SWord y1,
                         SWord x2, SWord y2)
```

Parameters

`x1, y1`	x and y coordinates of the start of the line.
`x2, y2`	x and y coordinate of the end of the line.

Result Returns nothing.

See Also WinDrawLine

WinDrawGrayRectangleFrame

Purpose Draw a gray rectangular frame in the draw window.

Prototype

```
void WinDrawGrayRectangleFrame ( FrameType frame,
                                 RectanglePtr r)
```

Parameters

`frame`	Type of frame to draw.
`r`	Pointer to the rectangle to frame.

Result Returns nothing.

Comments The standard gray pattern is not used by this routine; rather, the frame is drawn so that the top-left pixel of the frame is always on.

See Also WinDrawRectangleFrame

WinDrawInvertedChars

Purpose Draw the specified characters inverted (background color) in the draw window.

Prototype

```
void WinDrawInvertedChars( CharPtr chars, Word len,
                           SWord x, SWord y)
```

Parameters

`chars`	Pointer to the characters to draw.
`len`	Number of characters to draw.
`x, y`	Left and top bound of first character to draw.

Result Returns nothing.

Comments The characters are drawn in the background color and the off pixels are drawn in the foreground color.

Before calling this function, consider calling `WinSetUnderlineMode` and `FntSetFont`.

See Also WinDrawChars

WinDrawLine

Purpose Draw a line in the draw window.

Prototype

```
void WinDrawLine ( short x1, short y1,
                   short x2, short y2)
```

Parameters

`x1, y1`	x and y coordinates of the start of the line.
`x2, y2`	x and y coordinate of the end of the line.

Result Returns nothing.

See Also `WinDrawGrayLine`, `WinEraseLine`, `WinFillLine`

WinDrawRectangle

Purpose Draw a black rectangle in the draw window; the rectangle can have square or round corners.

Prototype

```
void WinDrawRectangle (  RectanglePtr r,
                         Word cornerDiam)
```

Parameters

`r`	Pointer to the rectangle to draw.
`cornerDiam`	Diameter of rounded corners. Zero for square corners.

Result Returns nothing.

Comments The `cornerDiam` parameter specifies the diameter of four imaginary circles used to form the rounded corners. An imaginary circle is placed within each corner tangent to the rectangle on two sides.

See Also `WinFillRectangle`, `WinEraseRectangle`

WinDrawRectangleFrame

Purpose Draw a rectangular frame around the specified region in the draw window.

Prototype

```
void WinDrawRectangleFrame ( FrameType frame,
                             RectanglePtr r)
```

Parameters

`frame`	Type of frame to draw.
`r`	Pointer to the rectangle to frame.

Result Returns nothing.

Comments The frame is drawn outside the specified region.

See Also `WinEraseRectangleFrame`, `WinGetFramesRectangle`, `WinDrawGrayRectangleFrame`, `WinDrawWindowFrame`

WinDrawWindowFrame

Purpose Draw the frame of the current drawing window.

Prototype

```
void WinDrawWindowFrame (void)
```

Parameters None.

Result Returns nothing.

See Also WinDrawRectangleFrame, WinGetDrawWindow

WinEnableWindow

Purpose Enable a window.

Prototype

```
void WinEnableWindow (WinHandle winHandle)
```

Parameters

`winHandle`	Handle of the window to enable.

Result Returns nothing.

Comments An enabled window accepts pen input and can be made the active window.

This routine does not affect the visual appearance of the window.

See Also WinDisableWindow, WinSetActiveWindow

WinEraseChars

Purpose Erase specified characters in the draw window.

Prototype

```
void WinEraseChars ( CharPtr chars, Word len,
                     SWord x, SWord y)
```

Parameters

`chars`	Pointer to the characters to erase.
`len`	Number of characters to erase.
`x, y`	Left and top bound of first character to erase.

Result Returns nothing.

See Also WinDrawChars

WinEraseLine

Purpose Erase a line in the draw window.

Prototype

```
void WinEraseLine (  SWord x1, SWord y1,
                     SWord x2, SWord y2)
```

Parameters

`x1, y1`	x and y coordinate of the start of the line.
`x2, y2`	x and y coordinate of the end of the line.

Result Returns nothing.

See Also WinDrawLine

WinEraseRectangle

Purpose Erase a rectangle in the draw window. (The rectangle can have round or square corners; see `WinDrawRectangle`.)

Prototype

```
void WinEraseRectangle (   RectanglePtr r,
                           Word cornerDiam)
```

Parameters

`r`	Pointer to the rectangle to erase.
`cornerDiam`	Diameter of rounded corners; zero for square corners.

Result Returns nothing.

See Also WinDrawRectangle

WinEraseRectangleFrame

Purpose Erase a rectangular frame in the draw window.

Prototype

```
void WinEraseRectangleFrame (   FrameType frame,
                                RectanglePtr r)
```

Parameters

`frame`	Type of frame to erase.
`r`	Pointer to the rectangular frame.

Result Returns nothing.

See Also WinDrawRectangleFrame

WinEraseWindow

Purpose Erase the contents of the draw window. This routine doesn't erase the frame around the draw window.

Prototype

```
void WinEraseWindow (void)
```

Parameters None.

Result Returns nothing.

See Also WinEnableWindow

WinFillLine

Purpose Fill a line in the draw window with the current pattern. You can set the current pattern with `WinSetPattern`.

Prototype

```
void WinFillLine ( SWord x1, SWord y1,
                   SWord x2, SWord y2)
```

Parameters

`x1, y1`	x and y coordinate of the start of the line.
`x2, y2`	x and y coordinate of the end of the line.

Result Returns nothing.

See Also `WinSetPattern`, `WinDrawLine`

WinFillRectangle

Purpose Draw a rectangle with current pattern. (The rectangle can have square or round corners.)

Prototype

```
void WinFillRectangle (  RectanglePtr r,
                         Word cornerDiam)
```

Parameters

`r`	Pointer to the rectangle to draw.
`cornerDiam`	Diameter of rounded corners. Zero for square corners.

Result Returns nothing.

Comments You can set the current pattern with `WinSetPattern`.

See Also `WinSetPattern`. `WinDrawRectangle`

WinGetActiveWindow

Purpose Return the window handle of the active window.

Prototype `WinHandle WinGetActiveWindow (void)`

Parameters None.

Result Returns the handle of the active window.

See Also `WinSetActiveWindow`, `WinGetDisplayWindow`, `WinGetFirstWindow`, `WinGetDrawWindow`, `WinRemoveWindow`

WinGetClip

Purpose Return the clipping rectangle of the draw window.

Prototype `void WinGetClip (RectanglePtr r)`

Parameters

`r`	Pointer to a structure to hold the clipping bounds.

Result Returns nothing.

See Also WinSetClip

WinGetDisplayExtent

Purpose Return the width and height of the display (the screen).

Prototype

```
void WinGetDisplayExtent ( SWordPtr extentX,
                           SWordPtr extentY)
```

Parameters

`extentX`	Pointer to the width of the display.
`extentY`	Pointer to the height of the display.

Result Returns nothing.

WinGetDisplayWindow

Purpose Return the window handle of the display window.

Prototype

```
WinHandle WinGetDisplayWindow (void)
```

Parameters None.

Result Returns the handle of display window.

Comments The display window is created by the system at start-up; it has the same size as the physical display (screen).

See Also `WinGetDisplayExtent`, `WinGetActiveWindow`, `WinGetDrawWindow`

WinGetDrawWindow

Purpose Return the window handle of the current draw window.

Prototype `WinHandle WinGetDrawWindow (void)`

Parameters None.

Result Returns handle of draw window.

See Also `WinGetDisplayWindow`, `WinGetActiveWindow`, `WinSetDrawWindow`

WinGetFirstWindow

Purpose Return a pointer to the first window in the linked list of windows.

Prototype `WinHandle WinGetFirstWindow (void)`

Parameters None.

Result Returns handle of first window.

Comments This function is usually used by the system only.

See also `WinAddWindow`, `WinGetActiveWindow`

WinGetFramesRectangle

Purpose Return the region needed to draw a rectangle with the specified frame around it.

Prototype

```
void WinGetFramesRectangle (FrameType frame,
                            RectanglePtr r,
                            RectanglePtr obscuredRect)
```

Parameters

`frame`	Type of frame drawn around the rectangle.
`r`	Pointer to the rectangle to frame.
`obscuredRect`	Pointer to the rectangle obscured by the frame.

Result Returns nothing.

Comments Frames are always drawn around (outside) a rectangle.

See Also WinGetWindowBounds

WinGetPattern

Purpose Return the current fill pattern.

Prototype `void WinGetPattern (CustomPatternType pattern)`

Parameters `pattern` Pattern buffer to hold pattern.

Result Returns nothing.

Comments The fill pattern is used by `WinFillLine` and `WinFillRectangle`.

A pattern defines an 8-x-8 bit pattern. The pattern is tiled to fill the specified region. The pattern structure is eight bytes long, the first byte is the first row of the pattern.

See Also WinSetPattern

WinGetWindowBounds

Purpose Return the bounds of the current draw window in display-relative coordinates.

Prototype `void WinGetWindowBounds (RectanglePtr r)`

Parameters `r` Pointer to a rectangle.

Result Returns nothing.

See Also WinGetWindowExtent

WinGetWindowExtent

Purpose Return the width and height of the current draw window.

Prototype

```
void WinGetWindowExtent (   SWordPtr extentX,
                            SWordPtr extentY)
```

Parameters

`extentX`	Pointer to the width of the draw window.
`extentY`	Pointer to the height of the draw window.

Result Returns nothing.

See Also `WinGetWindowBounds`, `WinGetWindowFrameRect`,

WinGetWindowFrameRect

Purpose Return a rectangle, in display-relative coordinates, that defines the size and location of a window and its frame.

Prototype

```
void WinGetWindowFrameRect (  WinHandle winHandle,
                              RectanglePtr r)
```

Parameters

`winHandle`	Handle of window whose coordinates are desired.
`r`	Pointer to the coordinates of the window.

Result Returns nothing.

See Also WinGetWindowBounds

WinGetWindowPointer

Purpose Return a pointer to the specified window's `WindowType` structure.

Prototype `WinPtr WinGetWindowPointer (WinHandle winHandle)`

Parameters `winHandle` Handle of a window.

Result Returns pointer to the specified window's `WindowType` structure.

See Also WinGetActiveWindow

WinInitializeWindow

Purpose Initialize the screen-dependent members of a `WindowType` structure and set the window's clipping bounds to the window's bounds.

Prototype `void WinInitializeWindow (WinHandle winHandle)`

Parameters `winHandle` Handle of a window.

Result Returns nothing.

See Also WinCreateWindow

WinInvertChars

Purpose Invert the specified characters in the draw window.

Prototype

```
void WinInvertChars (  CharPtr chars, Word len,
                       SWord x, SWord y)
```

Parameters

`chars`	Pointer to the characters to invert.
`len`	Number of characters to invert.
`x, y`	Left and top bound of first character to invert.

Result Returns nothing.

See Also `WinDrawInvertedChars`, `WinDrawChars`

WinInvertLine

Purpose Invert a line in the draw window.

Prototype

```
void WinInvertLine ( SWord x1, SWord y1,
                     SWord x2, SWord y2)
```

Parameters

`x1, y1`	x and y coordinate of the start of the line.
`x2, y2`	x and y coordinate of the end of the line.

Result Returns nothing.

See Also `WinInvertRectangle`, `WinInvertRectangleFrame`, `WinDrawLine`, `WinEraseLine`

WinInvertRectangle

Purpose Invert a rectangle in the draw window. (The rectangle can have square or round corners.)

Prototype

```
void WinInvertRectangle (  RectanglePtr r,
                           Word cornerDiam)
```

Parameters

`r`	Pointer to the rectangle to invert.
`cornerDiam`	Diameter of rounded corners; zero for square corners.

Result Returns nothing.

See Also `WinInvertLine`, `WinInvertRectangleFrame`, `WinDrawRectangle`

WinInvertRectangleFrame

Purpose Invert a rectangular frame in the draw window.

Prototype

```
void WinInvertRectangleFrame ( FrameType frame,
                               RectanglePtr r)
```

Parameters

`frame`	Type of frame to invert.
`r`	Pointer to the rectangular frame to invert.

Result Returns nothing.

See Also `WinInvertRectangle`, `WinInvertLine`, `WinDrawRectangleFrame`, `WinEraseRectangleFrame`

WinModal

Purpose	Return `TRUE` if the specified window is modal.
Prototype	`Boolean WinModal (WinHandle winHandle)`
Parameters	`winHandle` Handle of a window.
Result	Returns `TRUE` if modal, otherwise `FALSE`.
Comments	A window is modal if it cannot lose the focus.

WinRemoveWindow

Purpose	Remove the specified window from the window list.
Prototype	`void WinRemoveWindow (WinHandle winHandle)`
Parameters	`winHandle` Handle of a window.
Result	Returns nothing.
Comments	Doesn't free the memory used by the window.
See Also	`WinAddWindow`, `WinDeleteWindow`, `WinGetFirstWindow`

WinResetClip

Purpose Reset the clipping rectangle of the draw window to the portion of the draw window that is within the bounds of the display.

Prototype

```
void WinResetClip (void)
```

Parameters None.

Result Returns nothing.

See Also WinSetClip

WinRestoreBits

Purpose Copy the contents of the specified window to the draw window and delete the passed window.

Prototype

```
void WinRestoreBits (   WinHandle winHandle,
                        SWord destX,
                        SWord destY)
```

Parameters

`winHandle`	Handle of window to copy and delete.
`destX, destY`	x and y coordinate in the draw window to copy to.

Result Returns nothing.

Comments This routine is generally used to restore a region of the display that was saved with `WinSaveBits`.

See Also WinSaveBits

WinSaveBits

Purpose Create an offscreen window and copy the specified region from the draw window to the offscreen window.

Prototype

```
WinHandle WinSaveBits (  RectanglePtr sourceP,
                         WordPtr error)
```

Parameters

`sourceP`	Pointer to the bounds of the region to save, relative to the display.
`error`	Pointer to any error encountered by this function.

Result Returns the handle of the window containing the saved image, or zero if an error occurred.

Comments The offscreen window is the same size as the region to copy.

See Also WinRestoreBits

WinScrollRectangle

Purpose Scroll a rectangle in the draw window.

Prototype

```
void WinScrollRectangle (RectanglePtr r,
                         DirectionType direction,
                         SWord distance,
                         RectanglePtr vacated)
```

Parameters

`r`	Pointer to the rectangle to scroll.
`direction`	Direction to scroll (up, down, left, or right).
`distance`	Distance to scroll in pixels.
`vacated`	Pointer to the rectangle that needs to be redrawn because it has been vacated as a result of the scroll.

Result Returns nothing.

Comments The rectangle scrolls within its own bounds. Any portion of the rectangle that is scrolled outside its bounds is clipped.

WinSetActiveWindow

Purpose Make a window the active window.

Prototype `void WinSetActiveWindow (WinHandle winHandle)`

Parameters `winHandle` Handle of a window

Result Returns nothing.

Comments The active window is not actually set in this routine; flags are set to indicate that a window is being exited and another window is being entered. The routine `EvtGetEvent` sends a `winExitEvent` and a `winEnterEvent` when it detects these flags. The active window is set by `EvtGetEvent` when it sends the `winEnterEvent`. The draw window is also set to the new active window when the active window is changed.

All user input is directed to the active window.

See Also `WinAddWindow`, `WinGetActiveWindow`,`EvtGetEvent` (documented in "Developing Palm OS Applications, Part I")

WinSetClip

Purpose Set the clipping rectangle of the draw window.

Prototype `void WinSetClip (RectanglePtr r)`

Parameters r Pointer to a structure holding the clipping bounds.

Result Returns nothing.

See Also `WinClipRectangle`, `WinSetClip`, `WinGetClip`

WinSetDrawWindow

Purpose Set the draw window. (All drawing operations are relative to the draw window.)

Prototype `WinHandle WinSetDrawWindow (WinHandle winHandle)`

Parameters `winHandle` Handle of a window.

Result Returns the draw window.

See Also WinGetDrawWindow, WinSetActiveWindow

WinSetPattern

Purpose Set the current fill pattern.

Prototype `void WinSetPattern (CustomPatternType pattern)`

Parameters `pattern` Pattern to use.

Result Returns nothing.

Comments The fill pattern is used by `WinFillLine` and `WinFillRectangle`.

See Also WinGetPattern

WinSetUnderlineMode

Purpose Set the graphic state to enable or disable the underlining of characters.

Prototype

```
UnderlineModeType
     WinSetUnderlineMode (UnderlineModeType mode)
```

Parameters

`mode`	New underline mode type, one of `noUnderline`, `grayUnderline`, `solidUnderline`.

Result Returns the previous underline mode type.

See Also WinDrawChars

WinSetWindowBounds

Purpose Set the bounds of the window to display relative coordinates.

Prototype

```
void WinSetWindowBounds (   WinHandle winHandle,
                            RectanglePtr r)
```

Parameters

`winHandle`	Handle for the window for which to set the bounds.
`r`	Pointer to a rectangle to use for bounds.

Result Returns nothing.

WinWindowToDisplayPt

Purpose Convert a window-relative coordinate to a display-relative coordinate.

Prototype
```
void WinWindowToDisplayPt (   SWordPtr extentX,
                              SWordPtr extentY)
```

Parameters `extentX`, extentY Pointer to x and y coordinate to convert.

Result Returns nothing.

Comments The coordinate passed is assumed to be relative to the draw window.

See Also WinDisplayToWindowPt

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