Developer's Toolkit for OS/2 2.0

Getting Started

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Note

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Preface

This book describes the individual components that make up the Developer's Toolkit for OS/2 2.0 (Toolkit). Use this book as an overview of the Toolkit, as a guide when installing the Toolkit components, and later as a reference.

Who Should Read This Book

This book is for the professional programmer who will be installing and using the components of the Toolkit. The reader is assumed to be familiar (as a user) with the online services — the tutorial, messages, and helps — provided by OS/2 2.0.

How This Book Is Organized

This book contains the following chapters.

Chapter 1, “Installing the Toolkit,” provides a step-by-step procedure of the installation of the Toolkit. A section on library, header, and include files also is included in this chapter.
Chapter 2, “Online Documents,” summarizes the contents of the online programming documents and provides a brief description of their features.
Chapter 3, “Sample Programs,” explains the OS/2 function every sample program demonstrates.
Chapter 4, “Application-Management Tools,” describes the tools that accept 32-bit application code and provides a command-line syntax for starting the tool.
Chapter 5, “Presentation Manager Tools,” describes the Resource, Information Presentation Facility, and System Object Model compilers; the Presentation Manager resource editors; and the Workplace Class List.
Chapter 6, “System Debug Support” describes the interface that installs the debug kernel, and the debug Presentation Manager interface, as well as other tools associated with system debugging.

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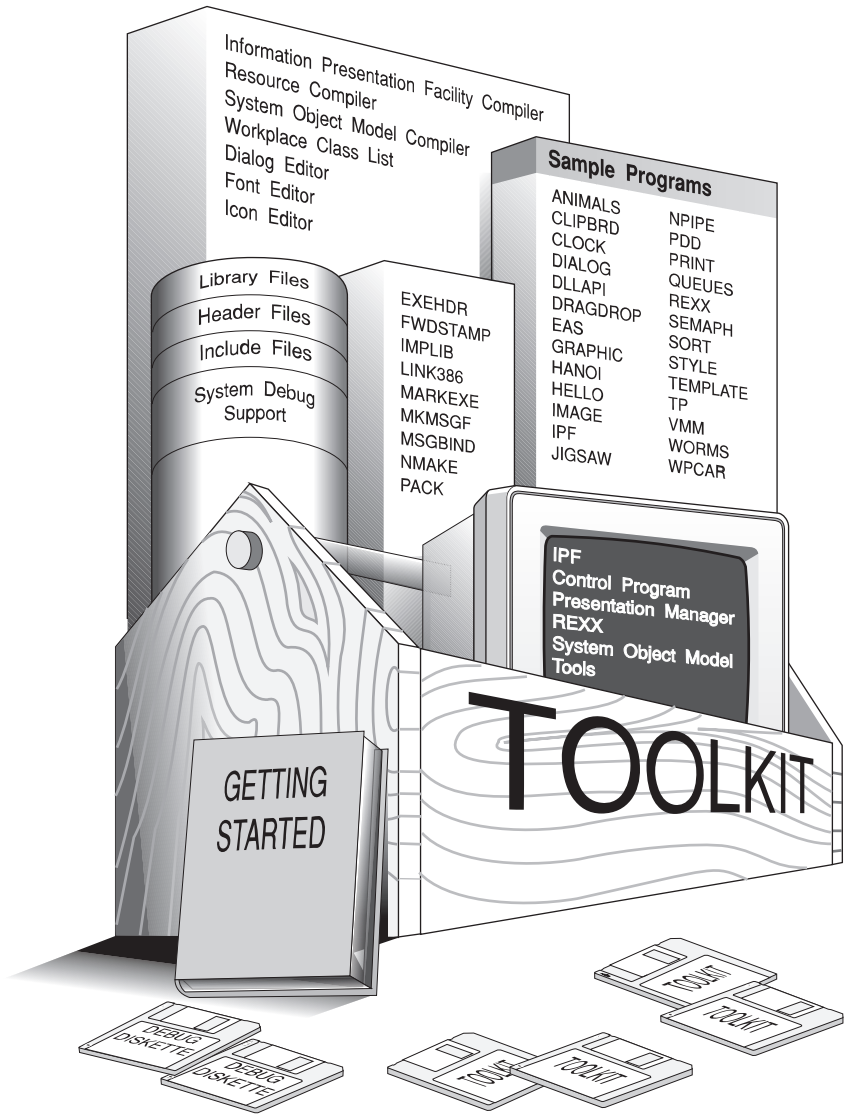
Chapter 7, “The OS/2 Technical Library,” describes each of the books that support OS/2 application development.

Developer's Toolkit for OS/2 2.0



Chapter 1. Installing the Toolkit

The Toolkit is a collection of sample application programs, programming tools, library files, header files, and online documents designed to aid you in developing applications for OS/2* 2.0 (OS/2).

System Requirements

This chapter provides a step-by-step procedure that guides you through installing the Toolkit using the program diskettes. Before we begin, make sure you have the following:

An IBM Personal System/2 (or equivalent) that has an Intel386** (or higher) microprocessor with the OS/2 operating system installed
A minimum of 4MB of memory
A high capacity 3.5-inch or 5.25-inch diskette drive
A hard disk drive with 22MB of free disk space.

We recommend that you install a mouse.

Installation Program

The Toolkit installation program is a Presentation Manager* application. Three components are available for installation: “Sample Programs,” “Online Information,” and “Development Tools.” The installation program is preset to install all three components on the drive the OS/2 operating system was installed on (the default drive). If you want to install the Toolkit on another drive, or install each of the components separately on different drives, you can do so using the installation program menus.

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Installation Procedure

While you are installing the Toolkit, few decisions are necessary. However, if you need help, you can get it by pressing the F1 key, by selecting the Help push button, or by choosing one of the help choices from the Help menu.

For example, suppose you want information about installing a component on a drive other than the default drive. To access the online help for Toolkit installation:

1. Select **Help** from the menu bar.
2. Select **General help**.

The Toolkit comes with 3.5-inch 2.0MB diskettes, or 5.25-inch 1.44MB diskettes. Using the appropriate diskettes, follow these steps to install the Toolkit:

1. Start an **OS/2 Window** or **OS/2 Full Screen** session.
2. Insert Toolkit installation *Diskette 1* in drive A.
3. Type the following at the command prompt:

   a:install

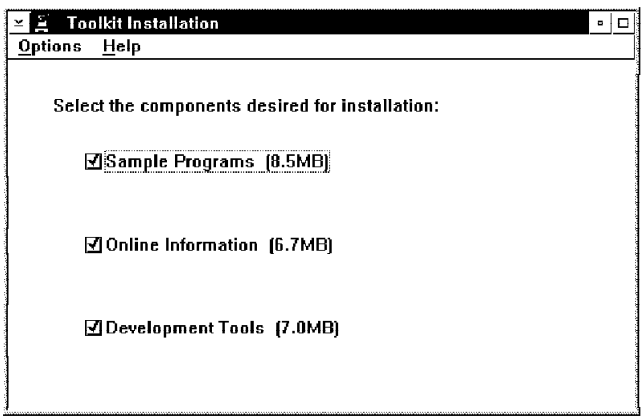
   Special Note

   If you have a system with multiple diskette drives, the Toolkit installation Diskette 1 can be inserted into a diskette drive other than A. For example, you can insert the diskette into drive B and type

   b:install

4. Press Enter and wait for the logo window to appear.

5. Select **OK**. The Toolkit Installation window appears.



6. Mark the box preceding the components to be installed.
7. Select **Options**.

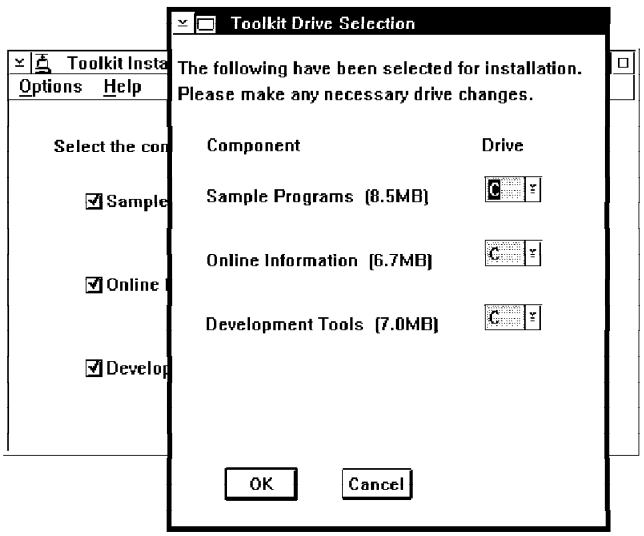
   To install one or more components on the default drive:

   a. Select **Install**.
   b. Follow the prompts in the message boxes to complete the installation on the default drive.

To install components on other drives:

a. Select **Set drives**.

   The Toolkit Drive Selection window shows the selected Toolkit component and the current drive assignment.



   If you did not select a component for installation on the previous window, it will not appear in THIS window. To install a component on another drive, select the Down arrow in the **Drive** field, then select the desired drive letter. After completing your changes, select **OK** to activate the change. The Toolkit Installation window re-appears.

b. Select **Options**.

c. Select **Install**.

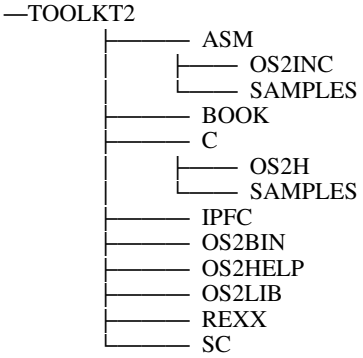
d. Follow the prompts in the message boxes to complete the installation.

You will swap diskettes several times during installation. The message Install successful on drive x appears under the name of each component at the completion of the installation. Remove the last diskette. Select **Options**, then **Exit**.

For changes to take effect, you need to shut down your system, then restart it.

Subdirectory Structure

The subdirectory TOOLKT20 is created when you install Toolkit components on a hard disk. The Toolkit can coexist with *OS/2 Version 1.3 Programming Tools and Information*. The following is the subdirectory structure for the Toolkit:



The subdirectories and their contents are:

ASM\OS2INC	Assembler language include files.
ASM\SAMPLES	Assembler language sample programs.
BOOK	Online documents.
C\OS2H	C language header files.
C\SAMPLES	C language sample programs.
IPFC	Information Presentation Facility header files.
OS2BIN	Programming tools.
OS2HELP	Help files for Presentation Manager resource editors.
OS2LIB	Library files.
REXX	REXX header files and sample programs.
SC	System Object Model class definition files.

Library Files

Because the OS/2 operating system provides different names and entry points for 16-bit and 32-bit functions, it is possible to mix 16- and 32-bit code within a single .OBJ module. You also can call 32-bit functions from a 16-bit C-language program or call 16-bit APIs from a 32-bit program. To support this mixed-mode programming, the Toolkit provides two sets of library files.

OS2286.LIB The library against which the system calls for 16-bit programs are resolved.

OS2386.LIB The library against which the system calls for 32-bit programs are resolved.

Header Files

Source 32-bit C-language header files (file name extension .H) are provided with the Toolkit. The OS2.H header file contains a set of files that has OS/2 API function definitions. Each of these files contains definitions and macros for most of the system functions, structures, data types, and constants associated with a specific group of API functions. The following list provides a brief description of these files:

OS2DEF.H
Defines common constants, types, error codes, and structures.

BSE*.H
Includes all control program (base) API functions.

PM*.H
Includes all Presentation Manager API functions.

REXX.H
Includes all REXX functions.

SOM*.H
System object model functions and definitions.

WP*.H
Workplace object methods.

An include statement at the top of your source-code file automatically calls a hierarchy of header files. You can select the files you want to include by placing statements in your source code **before** the include statement; for example:

```
#define INCL_
#include <os2.h>
```

Where INCL_* represents a symbolic identifier (* represents an abbreviation that defines the include file or part of the include file where the API function is declared).

Include Files

Source assembler language include files are provided for the assembler language programmer. OS2.INC is the top-level include file used to call lower level control program (base) and Presentation Manager include files.

Installing the Toolkit on Other Operating Systems

If you have an operating system other than OS/2, you must use the TKXFER command to copy files to your hard disk. TKXFER is located on diskette 1. Copy TKXFER to the operating system you want to install the Toolkit on.

Some of the files on the diskettes are compressed. When the Toolkit is installed under OS/2, the data on the diskettes are *unpacked* automatically. When the Toolkit is installed under any other operating system, the files must be unpacked manually.

Files that are “packed” can be recognized by the @ symbol as the third character in the file-name extension. Extensions with only one character have blanks padded with underscores; for example:

Original	**Compressed**
FILE1.COM	FILE1.CO@
FILE2.H	FILE2.H_@

When unpacking manually, do not specify an output file name; TKXFER uses the original uncompressed file name and extension as the destination file name. It also preserves the date, time, and file attributes of the original uncompressed file from the header of the compressed file.

TKXFER copies files that are not compressed and handles file information, such as date, time, and file attributes in the same way the COPY command does. Therefore, a diskette can have both compressed and uncompressed files.

If You Want To:	**Type:**
Copy a compressed file from the current directory on drive A to drive C	TKXFER A:FILE.CO@ C:
Copy an entire diskette of compressed and uncompressed files from the current directory on drive A to the root directory on drive C	TKXFER A:\ . C:

The WorkFrame/2

The WorkFrame/2* is a companion product to the Toolkit. It takes full advantage of the OS/2 platform to create a graphical interface that makes developing applications simple and straightforward.

The WorkFrame/2 has its own set of tools, supplementing those of the Toolkit. It starts the Toolkit tools, as well as other IBM and non-IBM tools, from a menu.

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Adding Toolkit Tools

You can add several Toolkit tools to the WorkFrame/2 environment:

Dialog Editor
Font Editor
Icon Editor
Information Presentation Facility
Resource Compiler.

To help you do this, the Toolkit has the TOOLKT20.INI file in the \TOOLKT20\OS2BIN subdirectory.

At the OS/2 command prompt, type:

```
ADDTOOL \TOOLKT2 \OS2BIN\TOOLKT2 .INI
```

Press Enter. The message Addtool utility finished successfully appears at the completion of the installation.

To access the tools, select **Tools** from the WorkFrame/2 menu bar. A list of the installed tools appears.

To add other Toolkit tools to the WorkFrame/2 environment, see the *IBM WorkFrame/2 Introduction*.

Ordering Information

To order the WorkFrame/2 interface, contact your IBM authorized dealer or IBM representative and provide the appropriate part number:

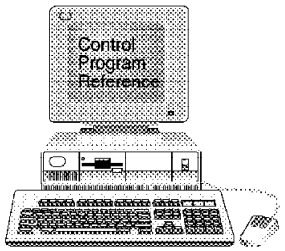
For 3.5-inch diskettes, order part number **10G2994**.

For 5.25-inch diskettes, order part number **10G3292**

Chapter 2. Online Documents

The Toolkit includes six online documents:

Control Program Reference
Information Presentation Facility Reference
Presentation Manager Reference
REXX Reference
System Object Model Reference
Tools Reference



Control Program Reference

The *Control Program Reference* provides the C-language syntax for each of the base operating-system application programming interface (API), including input and output parameters, data structures, data types, return codes, and example code. API functions (indicated by the prefix “Dos”) are presented by component; such as Error Management, Exception Management, and File System. The API functions, within each of the components to which they apply, are listed in alphabetic order. API functions also are available from a single alphabetic list. The online *Control Program Reference* duplicates the information in the *Control Program Programming Reference* book.

Information Presentation Facility Reference

The *Information Presentation Facility Reference* presents guidance and reference information for the design and development of online documents. It also presents guidance and reference information for a help facility that users of your application will access.

This online reference contains an alphabetic list of Information Presentation Facility (IPF) tags, symbols, and control words. IPF compiler error messages, window functions, dynamic data formatting functions, and help manager messages also are included. The

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online IPF document duplicates the information in the *Information Presentation Facility Guide and Reference* book.

Presentation Manager Reference

The *Presentation Manager Reference* provides the C-language syntax for all the API functions for the Presentation Manager, including input and output parameters, data structures, data types, return codes, and example code. API function prefixes include Dev (device), Drg (dragdrop), Ddf (dynamic data format), Gpi (graphics), Prf (profile), Spl (spooler), and Win (window). Also included are graphics orders, application hooks, Presentation Manager messages, and the new workplace (WP) methods. The online *Presentation Manager Reference* duplicates the information in these books:

Presentation Manager Programming Reference, Volume I
Presentation Manager Programming Reference, Volume II
Presentation Manager Programming Reference, Volume III

REXX Reference

The *REXX Reference* provides details of REXX functions, including call syntax, parameters, return values, and error messages. Code examples also are included. The information is presented by component, such as Subcommand Interface, System Exit, Macrospace, Variable Pool Interface, and Halt and Trace. The online *REXX Reference* duplicates the information in the *Procedures Language 2/REXX Programming Reference* book.

System Object Model Reference

The *System Object Model Reference* is a complete reference for each of the *Classes* and *Methods* used for the object-oriented programming environment. Also included are System Object Model (SOM) C-language bindings, the Object Interface Definition Language syntax, and the SOM compiler command syntax. The information in this online document duplicates the *System Object Model Guide and Reference* book.

Tools Reference

The *Tools Reference* presents a collection of the tools that support OS/2 applications development. They are:

EXEHDR
FWDSTAMP
IMPLIB
LINK386
MARKEXE
MKMSGF
MSGBIND
NMAKE
PACK

Also included are the Presentation Manager tools:

Dialog Editor
Font Editor
Icon Editor
Resource Compiler
Workplace Class List

Finally, a special tool that provides kernel debug support also is described.

Using Online Documents

The online documents in the Toolkit were developed with IPF. IPF displays information through a familiar user interface and lets you do the following:

View a table of contents from which you can quickly gain access to a category
View the category and select related topics from a menu
View multiple windows of related information for comparison values
Search for a topic throughout the document
Copy the contents of a topic to the system clipboard for editing with the OS/2 System Editor, the Enhanced Editor, or any other editor with this capability.

Copy the contents of a topic to a temporary file for editing with a full-screen editor.

When installed, the online documents are added to the **Information folder.** To access the online documents, select the folder, then select the appropriate book. A window that has a table of contents (Contents window) will appear. Figure 2-1 shows the Contents window for the *Control Program Reference*.

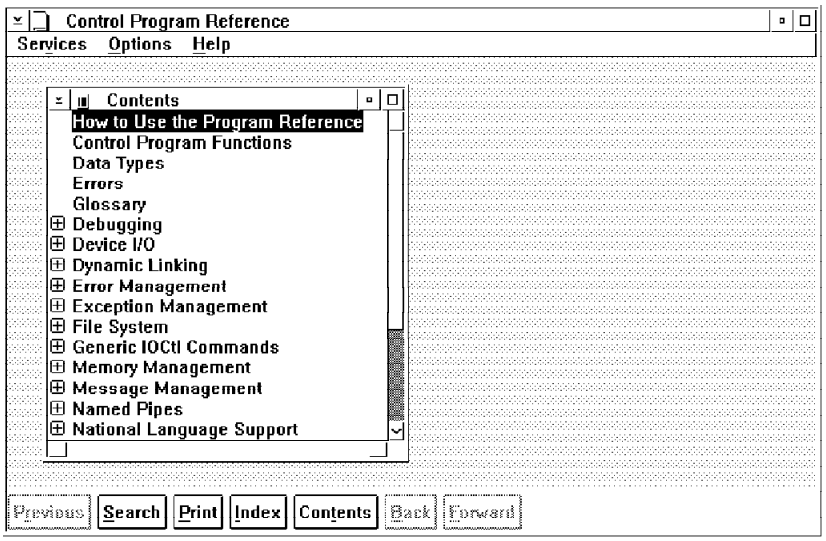

Figure 2-1. Control Program Reference. The Contents window lists available categories.

When the Contents window first appears, some categories have a plus sign (+) beside them. The plus sign indicates that additional topics are available. Click on the plus sign to expand the category.

For more information about using Toolkit online documents, see the "How to Use" sections in each of the documents.

Finding Help When Using the Enhanced Editor

The Enhanced Editor (available with the OS/2 operating system) has a feature that lets you obtain instant access to information in each of the Toolkit online documents. Suppose you invoke the Enhanced Editor, begin writing a window procedure using WinSetFocus, and need information for one of its parameters. To find this information, position the cursor at the beginning of the text string WinSetFocus and press Ctrl + H. The Enhanced Editor takes you directly to the WinSetFocus call in the online *Presentation Manager Reference* document. When you finish using WinSetFocus, exit back to the Enhanced Editor by pressing Alt + Esc.

Copying the Contents of a Window: You can also copy the contents of WinSetFocus (or any other online topic) for editing with the Enhanced Editor. Here's how:

1. Select **Services** from the menu bar.
2. Select **Copy**. A clock icon appears briefly, indicating that the system has placed a copy of the topic to the clipboard (a temporary holding place).
3. Toggle back (Alt + Esc) to the Enhanced Editor.
4. Move the mouse pointer to where you want the copy to appear. Select **Edit** from the menu bar.
5. Select **Paste**. A copy of the topic is inserted at the entry field of the Enhanced Editor file.

Chapter 3. Sample Programs

This chapter describes the sample programs available with the Toolkit. Most sample programs are written in C language and demonstrate the use of the API functions of the control program (base operating system) and the Presentation Manager interface. In addition to C language, there are assembler language and REXX sample programs. Each sample program serves as a template that can be easily modified for your own purposes. All C language samples contain the overhead routines necessary to create a Presentation Manager application, as well as stubs for the basic menu items that all applications should have. There are many comments within the source code that clarify technical information by presenting it in an alternate form. Names of the sample programs correspond to their Toolkit subdirectory names.

Starting a Sample Program

From the Desktop: When installed, most sample programs appear in the Sample Programs folder. To start a sample program, select the folder, then select the appropriate sample program.

From an OS/2 Command Prompt: To start a sample program from an OS/2 command prompt, type the name of the executable file and press Enter. If you have edited source code of a sample program and want to recompile, link, and run the files; change to the subdirectory where the sample program resides and type:

NMAKE */f samples.mak [samplename]*

where:

samplename
is the name of the sample program you want to build. To build all of the programs, set samplename to *all* (or omit it).

Your output is the executable file. For information about the NMAKE utility, see “NMAKE” on page 4-18.

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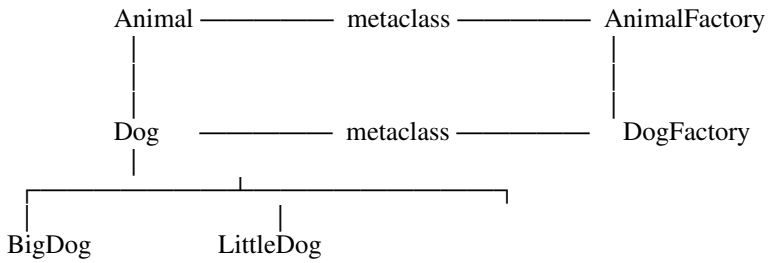
From WorkFrame/2: Perhaps you have installed both the Toolkit and the WorkFrame/2 product; if so, you can start a sample program (assuming you have set up a *project* for the sample program) from the WorkFrame/2 Project Control window. Select **Actions** from the menu bar, then select **Run**; a project window displays the sample program. You also can edit, compile, link, and run a sample program from the WorkFrame/2 (see "The WorkFrame/2" on page 1-8).

ANIMALS

The Basic SOM Sample Program: ANIMALS demonstrates a system object model (SOM) program in an object-oriented programming context. ANIMALS also demonstrates basic concepts of subclassing and inheritance, polymorphism, encapsulation, and constructors using the analogy of a zoological taxonomy. This sample program consists of 6 classes containing 14 methods. The 6 classes and their parentage are shown below:



The *AnimalFactory* and *DogFactory* metaclass supply constructor methods. *BigDog* and *LittleDog* inherit the metaclass of their parent, DogFactory, and their constructors can be used to create BigDogs, LittleDogs, and generic Dogs.

CLIPBRD

The Clipboard Sample: CLIPBRD demonstrates how to provide a Presentation Manager interface to the clipboard. Initially, CLIPBRD displays a standard window with a bit map. The user can cut and paste data in this window, using the system clipboard as an intermediate storage area.

CLOCK

The Timer Services Sample: CLOCK demonstrates how to use and implement window timers and system-resource timers. This sample program displays both an analog and digital clock. To simulate elapsed seconds, the main Presentation Manager thread repeatedly sets a one-second window timer that updates the current time. CLOCK features an audible and visual alarm that the user can set. When the time expires, the sample makes use of the DOS timer services and notifies the user by sounding an alarm.

DIALOG

The Dialog Box Sample: DIALOG demonstrates how to associate a dialog box with a standard window. The dialog box is defined as a dialog template in a resource file. This sample program also demonstrates how to implement an entry field, push buttons, and message boxes.

DLLAPI

The Dynamic Link Library Sample: DLLAPI demonstrates how to write and use a dynamic link library (DLL). The sample has a DLL file and an executable (EXE) file. The DLL uses protected memory on its shared data, and exception management to validate the pointer parameters for a 32-bit API function. The EXE file demonstrates how to handle a divide-by-zero exception, and calls the function with invalid pointer parameters, followed by a call with valid pointer parameters.

DRAGDROP

The Direct Manipulation Sample: DRAGDROP demonstrates how to move files between directories with the dragging techniques of direct manipulation. This sample program creates a list box that contains a scrollable list of the current directory. To change the current directory to one lower in the directory tree, the user selects the directory name from the list and presses Enter. To change the current directory to one higher in the directory tree, the user selects **File** from the menu bar, then **Open.** The **Select subdirectory** window appears. The user types the name of the subdirectory, then selects **OK**.

The sample program must be started twice so there are two running instances of the sample. Then, using a mouse, the user:

Displays a directory file list from the first sample
Selects a file name from the second sample
Drags the file name (with mouse button 2) to the directory in the first sample
Drops the file name in the directory of the first sample.

The file is now moved into the chosen directory.

EAS

The Extended Attributes Editor Sample: EAS demonstrates a multithreaded application that retrieves, modifies, or sorts files by their extended attribute value. Included in this sample program are Presentation Manager procedures for dialog boxes and a standard client window. EAS lets the user select an extended attribute file name from a list, or enter a new name in an entry field. The user can select the extended attribute type from a table.

GRAPHIC

The Graphics Sample: GRAPHIC demonstrates how to use default viewing transformation functions of the Presentation Manager. It also demonstrates how to use an asynchronous drawing thread. The sample program lets the user load metafiles using a dialog box. The dialog box has a help push button. When the help push button is activated, it provides instructions on loading a metafile from another directory. The user also can print a metafile or graphic circle.

HANOI

The Multithreaded Presentation Manager Sample: HANOI demonstrates a multithreaded application with the familiar "towers of Hanoi" puzzle. When the sample program is started the user sees three poles (A, B, and C). Initially, pole *A* has on it a stack of disks starting with the largest disks on the bottom and succeeding smaller disks on the top. The main thread handles the Presentation Manager interface and lets the user start or stop the Hanoi routine. It also lets the user reset the number of working disks. The second thread is created when **Start** is selected from the Options menu. This thread starts the recursive execution of the Hanoi algorithm, runs in the background, and moves and paints the disks.

HELLO

The Standard Window Sample: HELLO demonstrates how to create and display a standard window. This sample program also demonstrates how to use resources defined in a resource script file. Initially, HELLO displays a standard window with the text "Hello." The menu bar contains the **Options** choice. If the choice is selected, the resulting menu contains three choices, each of which paint a different text string in the window.

IMAGE

The Presentation Manager Porting Sample: IMAGE demonstrates how to migrate from an existing OS/2 16-bit application to a 32-bit application. This program also demonstrates how to display an image using the GpiImage function. The image data comes from a file the user selects using the standard File Open dialog procedure.

IPF

The Information Presentation Facility Sample: IPF demonstrates how to use the Information Presentation Facility to create an online document and an application-controlled window that displays animation. The online document also features customized windows that display text and graphics.

Two files are associated with this sample:

The IPF online document (.INF) file
The OS/2 dynamic link library (.DLL) file.

The .INF file is the compiled IPF tag document. The source contains tagging that defines different types of windows. Tags that control the format and display of text also are included in this file.

The .DLL file is the compiled C-language source for the communication object that is called when the .INF file is read during run time. The bit map files used for the animation are also provided.

JIGSAW

The Retained Graphics Sample: JIGSAW demonstrates the use of bit maps in a graphics application. JIGSAW provides a jigsaw puzzle based on the decomposition of an arbitrary bit map loaded from a file. The user can jumble the pieces, then drag them with a mouse. The image can be made smaller or larger, or scrolled horizontally and vertically.

JIGSAW also demonstrates how to call the Information Presentation Facility help hook, to create a help instance and associate the instance with the active application window.

NPIPE

The Named Pipes Sample: NPIPE demonstrates two-way communication between two unrelated processes using named pipe functions. This sample program implements the game of tic-tac-toe with two executable files, CLINPIPE.EXE (the client) and SVRNPIPE.EXE (the server). The server is the computer, and the client is the user.

PDD

The Physical Device Driver Sample: PDD demonstrates how to construct a physical device driver. Features of this sample include:

Initializing a device driver
Defining a device driver header
Requesting device driver helper services.

Also included are such elements as a strategy routine and interrupt handlers.

PDD is an assembler language sample program. To run PDD, add a DEVICE statement to the bottom of the CONFIG.SYS file. Specify the path and complete file name to PDD. For example:

```
DEVICE=C:\TOOLKT2 \ASM\SAMPLES\PDD\PDD.SYS
```

PRINT

The Printer Sample: PRINT demonstrates how to display and print text, graphics, metafiles, and bit maps. It also demonstrates how to:

Query and display a system printer configuration
Interact with the printer drivers to change job properties
Query and display available printer and screen fonts
Print from an asynchronous thread.

QUEUES

The Interprocess Communication Queue Sample: QUEUES demonstrates interprocess communications (IPC) using 32-bit queuing APIs. It consists of two executable programs, SVRQUEUE.EXE and CLIQUEUE.EXE.

SVRQUEUE creates an IPC queue; a named, shared-memory buffer for queue elements; and a shared, named, mutex (mutual exclusive) semaphore. After initializing the queue, SVRQUEUE starts a thread to read from the queue, prints the contents of the messages read from the queue, and terminates at the user's request.

CLIQUEUE opens the queue and accesses the shared-memory element buffer and mutex semaphore, and starts a thread to write to the queue. CLIQUEUE requests a string of data from the user, allocates a shared-memory element from the buffer, puts the string in the shared-memory element, then uses an event semaphore to direct the thread to write the element to the queue. CLIQUEUE terminates at the user's request.

REXX

Five REXX sample programs are included with the Toolkit:

CALLREXX
DEVINFO
PMREXX
RXMACDLL
REXXUTIL

CALLREXX

The REXX Interpreter Invocation Sample: CALLREXX demonstrates how a C-language application calls a REXX application. To run the REXX application BACKWARD.FNC, CALLREXX.C issues RexxStart. RexxStart calls the REXX interpreter and passes in a parameter string. BACKWARD.FNC returns a result string to the C-language application.

DEVINFO

The REXX Variable Pool Interface Sample: This program issues DosDevConfig and returns the data in a collection of compound variables when all available items are requested, or a single variable when only one item is requested. This is a REXX subcommand handler and Variable Pool example. This sample can be run in an OS/2 full-screen session, an OS/2 text-window session, or in PMREXX.

PMREXX

The Presentation Manager REXX Interface Sample: This sample provides a Presentation Manager window in which the user can display the output from a REXX procedure or from any programs called by the REXX procedure. The window has an entry field into which the user can type.

RXMACDLL

The External Functions in REXX Macrospace Sample: This sample demonstrates the macrospace interface with two C-language programs: MACRO.C and RXNLSINF.C, which are compiled into two separate dynamic link libraries.

MACRO.C contains REXX external functions, which perform REXX macrospace operations. RXNLSINF.C contains a REXX external function that provides information related to National Language Support (for example, as a currency symbol and separator). RXMACDLL.CMD uses MACRO.DLL to load NLSMONEY.CMD into the macrospace and calls NLSMONEY.CMD several times to format currency amounts. NLSMONEY.CMD formats the amounts according to the specifications provided by RXNLSINF.DLL.

RXMACDLL can be run in an OS/2 full-screen session, an OS/2 window session, or in PMREXX.

REXXUTIL

The REXX Utility Functions Sample: REXXUTIL demonstrates a set of external functions packaged in a dynamic link library, including:

Use of OS/2 system functions in REXX external functions
Techniques for passing large amounts of data to a REXX program using REXX compound variables as arrays.

REXXUTIL can be run in an OS/2 full-screen session or an OS/2 window session. REXXUTIL cannot be run in PMREXX because some of the functions use video services.

SEMAPH

The Semaphore and Shared Memory Sample: SEMAPH demonstrates the use of mutex and event semaphores. In the sample, several threads share access to the same resource. A mutex semaphore is used to guarantee that only one thread has access to the resource at a time. An event semaphore is used to signal the thread to give up the resource. The event semaphore can be posted by the user or run in auto mode. In auto mode, the event semaphore will be posted at fixed time intervals. A mutex semaphore is used to check for a stop event or for a user signal to give up the resource.

Each thread can display as a different colored square; similarly, the resource can display as a rectangle, the color of which is that of the first thread that owns it.

SORT

The Multithreaded Process Sample: SORT demonstrates the use of multiple threads by performing multiple sorts at the same time. Each sorting algorithm runs from a separate thread. The main thread is used to handle the main window's messages, while the routine that updates the display is run from another thread.

STYLE

The Style-Guide Sample: STYLE demonstrates a Presentation Manager application that conforms with Common User Access* requirements and implements the following new controls:

- Container
- Notebook
- Slider
- Spin button
- Value set.

This sample program also demonstrates secondary windows, such as dialog and message boxes. The code in STYLE is structured so that the addition of a new function is handled in an efficient manner. For example, to add a new command to an existing menu, you need only add the command to the resource file, then add the appropriate message-processing routines to the STY_USER.C file.

TEMPLATE

The Application Template Sample: TEMPLATE demonstrates the structure common to all Presentation Manager applications. This sample program shows how to structure an application that has more than one source file. TEMPLATE also demonstrates how to:

- Create a standard window
- Load resources from a resource file
- Create a dialog box and a button control
- Display a message box
- Open a file
- Close a file
- Print text
- Paint a window
- Process a message from a menu
- Run a thread in the background
- Exit a process.

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TP

The Advanced SOM Sample Program: TP (text processing) demonstrates an advanced system object model (SOM) program in an object-oriented programming context. TP demonstrates the use of abstract superclasses, and public and private methods. This sample program also demonstrates subclassing, polymorphism, and encapsulation.

TP reads a free-form file of text and markup language and produces a formatted output file. The markup language is deliberately *made up* so that it is clearly defined as a simulation. The input file demonstrates the production of paginated, multi-column text with indentation, page numbers, unordered lists, headers, and footers.

VMM

The Virtual-Memory Management Sample: VMM demonstrates the use of virtual memory by using new memory-management functions to allocate and set the attributes of memory. Users can read or write data into memory and reset the attributes using a dialog box. The memory manager protects or opens the virtual memory to read or write operations according to the different attributes of each memory block. To free memory, the user enters the address of the memory.

WORMS

The Mixed-Mode Sample: WORMS demonstrates how to call video (Vio), keyboard (Kbd), and mouse (Mou) 16-bit function from a 32-bit code segment. This sample program displays earth worms aimlessly moving about the screen. Each worm is a separate thread with a unique color combination and movement pattern. When one worm encounters another worm, the color attribute of the first worm is set to red. The user can add or delete worms using the keyboard or mouse.

WPCAR

The Workplace Object Sample: WPCAR demonstrates how to create a workplace object using basic object-oriented programming techniques and the IBM System Object Model (SOM), including:

- Initializing an object
- Adding settings pages to an object
- Saving and restoring the state of an object
- Modifying object context menus (adding and deleting menu items)
- Querying of object class data
- Processing context menu items
- Implementing settings page dialog processing.

Chapter 4. Application-Management Tools

The Toolkit provides the following tools:

EXEHDR
FWDSTAMP
IMPLIB
LINK386
MARKEXE
MKMSGF
MSGBIND
NMAKE
PACK

This chapter provides a brief description of each tool with just enough detail to get you started at the OS/2 command line. If you are using WorkFrame/2, you can start and operate all the tools from a Presentation Manager menu (see “The WorkFrame/2” on page 1-8).

For complete information about the tools described here, please refer to the online *Tools Reference*.

EXEHDR

EXEHDR provides a listing of the contents of the executable-file header; it also provides a listing of the attributes of all segments in the file.

Uses of EXEHDR include:

Determining whether a file is an application or a dynamic link library
Modifying and viewing the attributes set by the module definition file
Viewing the number and size of code and data segments.

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Starting EXEHDR

You can start EXEHDR and specify all input from the command line. An example of the syntax follows:

EXEHDR *[options] filename*

where:

options
is the name of the EXEHDR option that modifies the file header. Regardless of *options*, EXEHDR always generates a listing of the file header. See the online *Tools Reference* for a description of EXEHDR options.

filename
is the name of the application or dynamic link library file. You can specify any number of files.

FWDSTAMP

FWDSTAMP adds entry points, called *forwarders*, to a dynamic link library file (.DLL). Forwarders point to API functions or other exported code or data. They contain an import reference so that the final target address of the forwarded entry is contained in a different module. A forwarder might be called an *imported export*.

When a file has a fix-up to a forwarded entry point, the loader resolves that fix-up to the address of the entry point that the forwarder imports by traversing the chain of forwarders until the end of the chain (a nonforwarded export) is reached. All forwarders are implicitly exported.

The imported entry point that a forwarder refers to may itself be another forwarder. The loader will process a chain of forwarders until a nonforwarder entry point is encountered.

There is no *run-time* cost to forwarders; however, there is a slight *load-time* cost as the loader resolves forwarder chains with their final addresses.

Using Forwarders

You use forwarders to combine several DLLs into one without having to relink old applications. For example, if MOUCALLS and VIOCALLS were combined into a single DLL called NEWLIB.DLL, then MOUCALLS and VIOCALLS could be replaced with special DLLs containing forwarders to NEWLIB.DLL.

Starting FWDSTAMP

You can start FWDSTAMP and specify all input from the command line. An example of the syntax follows:

FWDSTAMP *infile deffile outfile*

where:

infile
Specifies the name of the dynamic link library file that LINK386 created. Use the file-name extension of DLL.

deffile
Specifies the name of the module definition file (.DEF) that contains the forwarders.

outfile
Specifies the name of the .DLL file that will contain the added forwarders.

Forwarders are specified in the module definition file so that an exported name, which is also imported, is a forwarder. For example:

```
IMPORTS
     VIOMODEWAIT=NEWLIB.123
EXPORTS
      VIOMODEWAIT @ 25
```

In the example, a forwarder entry point for VIOMODEWAIT is created and contains an import reference to NEWLIB.123.

IMPLIB

IMPLIB is used to generate an *import library* (.LIB) file. IMPLIB takes a module definition file (.DEF) as input. For each export definition in the .DEF file, IMPLIB generates a corresponding import definition.

The .LIB file generated by IMPLIB is used as input to LINK386, which creates an executable (.EXE) file. The .LIB file provides LINK386 with information about imported dynamic link functions.

Creating an Import Library

Import libraries are created by IMPLIB and are used to link dynamic link libraries with applications.

Import libraries are similar in some respects to standard libraries:

- You specify import libraries and standard libraries in the same command-line field of LINK386.
- Both types of libraries resolve external references at link time.

However, import libraries differ from standard libraries in that they contain no executable code. Rather, they identify the dynamic link libraries where the executable code can be found at run time.

Creating import libraries is an extra step. Nevertheless, import libraries are recommended for use with all dynamic link libraries for two reasons:

- IMPLIB automates much of the program creation process for you. To use IMPLIB, you need to supply the .DEF file you already created for the dynamic link library. Without an import library, you must create a second .DEF file that explicitly defines all needed functions in the dynamic link library.
- Import libraries make it easier for one person to write a library and another to write the application. Much of the linking process (linking the .DLL file and creating the import library) can be done by the author of the dynamic link library. The import library and associated .DLL file can then be given as a unit to the person

linking the application — that person need not worry about creating a .DEF file.

Starting IMPLIB

You can start IMPLIB and specify all input from the command line. An example of the syntax follows:

IMPLIB *[options] implibname {deffile... | dllfile...}*

where:

options
is the name of the option that modifies the output of IMPLIB. All options are described in "IMPLIB Options."

implibname
is the name of the import library created.

deffile
is one or more module definition files that export routines in the dynamic link library.

dllfile
is one or more dynamic link libraries with exported entry points.

Note: You can specify any number of either module definition files or dynamic link libraries.

The following command creates the import library, MYLIB.LIB, from the module definition file, MYLIB.DEF.

```
IMPLIB MYLIB.LIB MYLIB.DEF
```

IMPLIB Options

Syntax ***Description***

/HELP Displays a short summary of IMPLIB syntax.

/IGNORECASE
Turns case sensitivity off. This is the default.

/NOIGNORECASE
Turns case sensitivity on.

/**NOLOGO** Suppresses the copyright screen when IMPLIB starts.

LINK386

LINK386 is used to translate object files and standard library files into a single executable file. LINK386 also generates dynamic link libraries and device drivers.

LINK386 uses the following files as input:

- One or more object files that are linked with any optional library files to form the executable file. Object files usually have a .OBJ extension.
- One or more library files. The library files contain object modules that are linked to the object files to form the executable file. Library files usually have a .LIB extension.
- A module definition file. The module definition file provides information to LINK386 about the executable file or dynamic link library file it is creating. The module definition file usually has a .DEF extension.

LINK386 produces three types of output files:

- An executable file that runs under OS/2 whenever you specify a module definition file that has a NAME statement. The executable file usually has a .EXE extension.
- A dynamic link library file. A dynamic link library is produced whenever you specify a module definition file that has a LIBRARY statement. A dynamic link library file usually has a .DLL extension.
- A device driver file. A virtual or physical device driver is produced whenever you specify a module definition file that has the VIRTUAL DEVICE or PHYSICAL DEVICE statements. A device driver file usually has a .DRV extension.

Starting LINK386

To link the object files and optional library files of your application, supply input to LINK386 by:

Responding to a series of LINK386 prompts
Typing commands directly at the command prompt
Creating a response file and entering the file name on the command line.

Responding to LINK386 Prompts

To start LINK386, type the following at the command prompt:

```
LINK386
```

Press Enter; a series of prompts appear, one at a time:

```
Object modules [.OBJ]:
Run file [basename.EXE]:
List file [NUL.MAP]:
Libraries [.LIB]:
Definitions file [NUL.DEF]:
```

You can respond using any combination of uppercase and lowercase letters. Enter your responses by pressing Enter.

To extend input to a new line, type a plus sign as the last character on the current line. When the same prompt appears on a new line, you can continue. Do not split a file name across lines.

To select the default response to a prompt, press Enter. The next prompt appears.

To select the default response to the current prompt and all remaining prompts, type a semicolon and press Enter. Note that you must enter the name of at least one object file.

Responses within a command line are separated by commas.

LINK386 supplies the following default file extensions: .OBJ, .EXE, .MAP, .LIB, and .DEF. You can override these extensions by typing the file extension of your choice.

Specifying LINK386 Options

You can specify options anywhere on the response line, except before a comma at the end of a line of characters. If you want to specify more than one option, either group them at the end of a response, or specify them at the end of several responses. Each option must begin with a forward slash (/). For a complete list of options and their descriptions, see the online *Tools Reference*.

To end the linking process at any point, press Ctrl+Break.

Typing Input on the Command Line

You can start LINK386 and specify all input from the command line. An example of the LINK386 command is:

LINK386 *[options] objfiles[,exefile,mapfile,libraries,deffile]*

where:

options
is the name of the LINK386 option. Any number of options may be specified.

objfiles
is the name of the object files that you want linked.

exefile
is the output file that LINK386 created. LINK386 produces either an executable file, a dynamic link library, or a device driver. If you do not specify a file name, LINK386 uses the name of the first object file. Use the file-name extension .EXE if it is an executable file, .DLL if it is a dynamic link library, and .DRV if it is a device driver.

mapfile
is the name of the file that contains the map listing. The default file name extension is .MAP. Use the /M option to include public symbols in this file. (For information on public symbols,

see the online *Tools Reference*.) Enter NUL if you do not want a map file.

libraries
is a list of libraries for LINK386 to search. These libraries include standard or import libraries, but not dynamic link libraries. The library names should be separated by plus signs (+) or blank spaces.

deffile
is the name of the module definition file for the executable file or dynamic link library.

Creating a Response File

To operate LINK386 using a response file, you must first create a file that contains the responses you want LINK386 to process. You can give the file any name, and create it with any text editor.

Type the following command at the command prompt:

LINK386 @*filename[.ext]*

The @ symbol tells LINK386 that *filename* is a response file. If the file is not in the working directory, you must specify the path. Begin using a response file at any point on the LINK386 command line or at any LINK386 prompt. The file should contain responses in the same order as the LINK386 prompts. Each response needs to be on a separate line. If you choose to place responses on the same line, separate them with commas.

If the file does not contain responses for all the prompts, LINK386 displays the appropriate prompt and waits for you to supply a response. End the response file with a semicolon.

You can use special characters in the response file the same way you would use them in responses entered at the keyboard.

Example of a Response File

The response file in the following example instructs LINK386 to generate an executable file called FUN.EXE, and four object modules, FUN, SUN, RUN, and GAMES.

If you specify the file name, FUNLIST, LINK386 will generate a map file named FUNLIST.MAP. Adding the /MAP option will cause LINK386 to include the public symbols of the application in the map file.

```
fun+sun+run+games /map
fun.exe
funlist
;
```

OS2STUB.EXE

OS2STUB.EXE is included in the executable file created by LINK386, if the STUB statement is included in the module definition file. The stub is invoked whenever the file is executed under DOS. By default, LINK386 adds its own standard stub for this purpose.

MARKEXE

MARKEXE lets you view and set the type of application. The type of application identifies the OS/2 sessions in which a program can run. You can use MARKEXE in conjunction with programs that you have created using LINK386 or with programs created by some other means.

Starting MARKEXE

The MARKEXE command has the following form:

MARKEXE *[force] [no] [display|dllinit|dllterm|type|lfns] filename*

where:

force
Marks the executable file with OS/2 as the target operating system even though the file was marked for another operating system. Using *force* may produce internally inconsistent executable files.

no
Sets the command to the opposite condition.

display
Displays the application type in a message. Does not change the file.

dllinit
Sets per process initialization for the dynamic link library.

dllterm
Sets per process termination for the dynamic link library.

type
specifies the application type of the executable file. It can be one of the following:

WINDOWAPI	Uses the API function provided by the Presentation Manager. It must be executed in a Presentation Manager window.
WINDOWCOMPAT	Runs (compatible) in a Presentation Manager window or in a full-screen session.
NOTWINDOWCOMPAT	The application must execute in a full-screen session only.

UNSPECIFIED The application type is unknown. By default, OS/2 runs an unspecified application type in a full-screen session.

If *type* is not specified, MARKEXE simply displays the current type of the executable file.

lfns
specifies that the program supports long file names.

filename
specifies the executable file to be marked. Any number of files can be marked.

MARKEXE does not modify the file if the application type of the executable file is the same as the requested type. It displays the message unchanged to indicate this.

Viewing the Application Type

You can view the application type of MYPROG.EXE by typing the following:

```
MARKEXE MYPROG.EXE
```

MARKEXE displays the type in a message that looks like this:

```
MYPROG.EXE: OS/2 2. , WINDOWCOMPACT, LFNS
```

Setting the Application Type

You can set the application type for MYPROG.EXE to WINDOWCOMPAT by typing:

```
MARKEXE windowcompat myprog.exe
```

If you have more than one executable file to be set to the same application type, you can supply the file names in a single command line, as in the following example:

```
MARKEXE windowcompat myprog.exe abc.exe xyz.exe
```

MKMSGF

MKMSGF converts a text message file to an output (binary) message file that DosGetMessage uses to display messages. Text messages in OS/2 full-screen applications do not need to be loaded into memory with the application; they can reside on disk until needed.

You can use the output message file by specifying a message file name and a message number in the DosGetMessage parameter list. The messages also can be bound to the executable file by MSGBIND (see “MSGBIND” on page 4-17).

Creating a Message File

The input message file is a standard ASCII file that contains three types of lines:

Comment
Component identifier
Component message.

Comment lines are the first lines of a file and must begin with a semicolon. A component-identifier is a three-character name identifier (for example, “DOS”) that precedes all MKMSGF message numbers. Component-message lines consist of a message header and an ASCII text message.

The following is an example of a text message source file.

```
;This is an example
;of a text message
;file
DOS
DOS 1  E: File not found
DOS 1 1?:
DOS 1 2H: Usage: del [drive:][path] filename
DOS 1 3?:
DOS 1 4I: 1% files copied
DOS 1 5?:
DOS 1 6W: Warning! All data will be erased!
DOS 1 7?:
DOS 1 8?:
DOS 1 9P: Do you wish to apply these patches (Y or N)? %
```

where:

DOS0100E — DOS0109P
identifies message numbers in sequence. The first three characters indicate the component identifier; the four-digit number indicates the message number, which is followed by a letter (described below), then a colon and blank space. If a message number is not used, type the number, end it with a question mark (?), and leave an empty entry.

E, H, I, P, W
indicates the type of message. Categories include error (E), help (H), information (I), prompt (P), and warning (W).

%0
displays a prompt for input from the user, after which a carriage return and line feed are inserted.

Starting MKMSGF

To start MKMSGF, type:

MKMSGF *infile outfile [option]*

where:

infile
specifies the input file that contains message profiles.

outfile
names the outfile using the three-character component identifier and the .MSG file extension; for example, MES.MSG.

option
Specifies the name of the option that modifies the output file.

For a complete list of options and their description, see the online *Tools Reference*.

Starting MKMSGF Using a Message Control File

A message control file is used to create multiple code page message files. An example of the command-line syntax follows:

MKMSGF @controlfile

where:

@controlfile
is the name of the file that contains the control statements used to generate a multiple code page message file.

The @ symbol is not part of the file name; it is a required delimiter.

An example of a message control file follows:

```
root.in root.out /Pcodepage
/Ddbcsrang/ctryid /LlangID,VerId /V
sub.  1 sub1.out /Pcodepage
/Ddbcsrang/ctryid /LlangID,VerId
⋮
sub.  n subn.out /Pcodepage
/Ddbcsrang/ctryid /LlangID,VerId
```

MSGBIND

When the DosGetMessage function is issued, it searches for the message in the message segment bound to the application's executable file, and then the application's message file on a a hard disk. To ensure that a message is displayed quickly, you can bind it to the application's executable file by using the MSGBIND utility program. For each executable file, MSGBIND specifies which message files to scan; for each message file, it specifies which message to include in the executable file.

Starting MSGBIND

To start MSGBIND, type:

MSGBIND [infile]

where:

infile
specifies the input file that contains the executable files, output message files, and message numbers that are to be bound.

Binding the Message File

The input file contains three types of lines:

> Executable file
< Message file
Message numbers.

An example of an input file follows:

```
>PROG1.EXE
<\MESSAGES\PRGMSG.MSG
PRG 1
PRG 1 1
PRG 1 2
<\MESSAGES\APP.MSG
APP  1
APP  2
APP  3
```

Where:

>PROG1.EXE
is the executable file to be modified

<
defines the first message of a series to be bound, delimited either by the end of the series or a less-than symbol (<).

<\MESSAGES\PRGMSG.MSG and <\MESSAGES\APP.MSG
names the files containing the binary versions of the messages (created by MKMSGF) and their identifying numbers: the three-character component identifier and the four-digit message number.

NMAKE

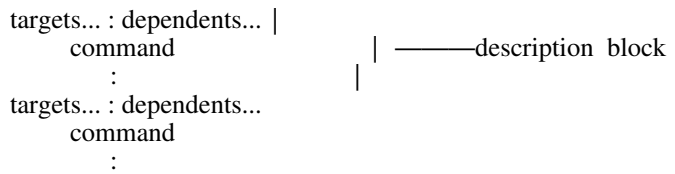
NMAKE carries out all tasks needed to update a program after one or more of the source files in the program have changed. NMAKE compares the modification dates for one set of files — the target files — with those of another set of files — the source files. NMAKE then carries out a given task only if a target file is out of date. NMAKE does not compile and link all files just because one file was updated.

This can save time when creating programs that have many source files or that take several steps to complete.

Using NMAKE

To use NMAKE, create a description file (or make file). A description file, in its simplest form, lists which files depend on others and which commands need to be executed if a file changes. You can create an NMAKE description file with any text editor that produces ASCII files.

A description file looks like this:



A dependent relationship among files is defined in a *description block*. A description block indicates the relationship among various parts of the program. It contains commands to bring all components up-to-date. The description file can contain any number of description blocks.

Use NMAKE description files for creating backup files, configuring data files, and running programs when data files are modified.

Starting NMAKE

You can start NMAKE and specify all input from the command line. An example of the syntax follows:

NMAKE *[options][macrodefinitions] [targets][/F filename]*

where:

options
is the name of the option that modifies the action of NMAKE. For information about NMAKE options, refer to the online *Tools Reference*.

macrodefinitions
is the name of the macro that replaces one text string for another in the description file. For a list of predefined macros to use with NMAKE, see the *Tools Reference*.

targets
is the name of one or more target files you want NMAKE to create. If you do not list any targets, NMAKE creates the first target in the description file.

/F filename
is the name of the option that specifies *filename* as the name of the description file to use. If a dash (—) is entered instead of a file name, NMAKE reads a description file from the standard input device.

PACK

PACK reduces the size of a file by compressing its data. You can use PACK for a single file or a group of files, thereby reducing the disk space required for your OS/2 application. UNPACK restores a compressed file to its original size and copies it to a specified directory.

Starting PACK

You can start PACK with a single command from the command line. The input required can be specified in one of two ways:

You can type the names of all the files you want to compress directly in the command line (method 1).
You can type the name of a single file that contains a list of all the files you want to compress (method 2).

When using PACK, select the method that is suitable for you. Include the drive and path if the files are not in the working directory. You can specify file names with any combination of uppercase and lowercase letters. File-name extensions are not required; however, if you specify a file name that has an extension, also type the extension.

Examples of the command-line syntax follow:

Method 1:

PACK *sourcefile [packedfile]*
[/H:headerpath\|/H:headerfile|/H:headerpath\headerfile]
[/D:headerdate] [/T:headertime] [/C] [/A] [/R]

Method 2:

PACK *listfile [packedfile] /L*
[/H:headerpath\|/H:headerfile|/H:headerpath\headerfile]
[/D:headerdate] [/T:headertime] [/C]

where:

sourcefile
Specifies the name of the file you want packed (compressed). This parameter is required. Include the drive and path if the file is not in the working directory. Global file-name characters are permitted.

When the data is compressed, the name of the source file is placed in the header of the compressed file and is used as the destination file name during unpacking.

listfile
Specifies the name of the file that contains a list of files that are to be compressed. When naming a list file, do not use global file-name characters.

For information about list files, see “Creating a List File” on page 4-23.

packedfile
Specifies the name of the file that will contain the compressed data. Files that contain compressed data can be recognized by the @ symbol as the last character in the file name. If you do not specify this parameter, PACK places the compressed data in *sourcefile* and modifies its name to contain the @ symbol.

/H:headerpath\ or /H:headerfile or /H:headerpath\headerfile
These parameters can be used separately or paired.

/H:headerpath

Specifies the destination path (drive letters are not permitted) to be placed in the header of the file that contains the compressed data. Unless this path is overridden with the UNPACK command, it will be the destination path when the file is uncompressed. *Headerpath* must end with a backslash (\).

/H:headerfile

Specifies the name of the file to be placed in the header of the compressed file. This file name will be used as the destination file for the uncompressed data and cannot be overridden.

If a header file name is not specified, PACK automatically uses *sourcefile* as the name of the file that is placed in the header of the compressed file.

/H:headerpath\ headerfile

Specifies that both a destination path and a destination file name are to be placed in the header of the file that has the compressed data.

/D:headerdate

Records the date in the header of the file that has the compressed data, and also in the destination file when it is uncompressed.

The date must follow the format /D:MM-DD-YYYY. For example: /D:08-20-1991 and /D:12-30-2010.

/T:headertime

Records the time in the header of the file that has the compressed data, and also in the destination file when it is uncompressed.

The time must follow the format /T:HH.MM. For example /T:02.06 and /T:14.54. Hour 00 represents 12 a.m. and hour 12 represents 12 p.m.

/A

Adds data from *sourcefile* to the data in *packedfile*.

The source file can be either in a compressed or uncompressed state. If the source file is in an uncompressed state, the data is

compressed before being added to the file containing the compressed data.

/C

Specifies that the current path be placed in the header of the file that contains the compressed data. When the UNPACK command is used, this path will be the destination path for the file that contains the uncompressed data.

You cannot use /C when the *headerpath* is used.

/L

Indicates that *filename* is a list file. A list file is not compressed; it simply contains a listing of the names of the files that are to be compressed.

/R

Removes the file specified by *sourcefile* from the file that contains only compressed data. The *sourcefile* parameter must specify the path and file name exactly as they appear in the header of the file with the compressed data; otherwise, the following error message

The specified file to remove was not found.

appears on the screen.

The /R parameter is valid only when used in conjunction with *sourcefile* and *packedfile*.

Note: The path and file-name information stored in the header of the file that contains the compressed data can be displayed by using the /SHOW option available with UNPACK. For information about the /SHOW option, see the UNPACK command in the online *OS/2 Command Reference*.

Creating a List File

To use a list file with PACK, you must first create a file that contains the names of the files you want to compress. You can give the list file any name. Following is an example of specifying a list file at the command line:

```
PACK DEVICE.LST DEVICE.DRV /L
```

The /L indicates that DEVICE.LST is a list file. If the list file is not in the working directory, you must specify the drive and path. Global file-name characters are not permitted in the list-file name. DEVICE.DRV is the destination file for the end-to-end-compressed data. (End-to-end compressed data is the data from each of the files contained in the list file. This data is stored in a contiguous format in the destination file.)

The syntax used in the list file is similar to that used in the command line. The syntax for a single line in the list file follows:

sourcefile [/H:headerpath\|/H:headerfile|/H:headerpath\ headerfile]
[/D:headerdate] [/T:headertime] [/C]

Remember, when using the list-file method (method 2), global file-name characters are not permitted in the source-file name. Notice also that "PACK" is excluded, and *packedfile* is not permitted in the list file, because they were specified on the command line. You can include comments or blank lines by entering a semicolon as the first character of the line. An example of a list file follows:

```
;This is a comment
C:\OS2\COMMAND.COM
CONFIG.SYS /H:CONFIG.BAK /C
\OS2\INSTALL\DDINSTAL.EXE /H:\OS2\DDINSTAL.TMP /D:1 -15-91 /T:11.45
```

Starting UNPACK

UNPACK restores a file of compressed data to its original size and copies it to a specified drive and path. To start the UNPACK command, type:

UNPACK *sourcefile [destinationdrive:] [destinationpath]*
[/SHOW] [/N:singlefile] [/V] [/F]

where:

sourcefile
Specifies the name of an existing file that contains compressed data. If this file contains one or more files of compressed data, UNPACK restores each file within the file.

destinationdrive:

Specifies the name of the drive to which you want UNPACK to copy one or more restored files.

When you specify a destination drive, but not a path, UNPACK uses the path information stored in the header of the file that contains the compressed data.

destinationpath

Specifies the name of the directory (and its subdirectories) to which you want UNPACK to copy one or more restored files.

When specified, the destination path overrides the path information stored in the header of the file that contains the compressed data.

/**SHOW**

Displays the destination path and file-name information that are saved in the header of each file containing compressed data.

/**N:singlefile**

Extracts and uncompresses one file from a file that contains multiple files of compressed data.

/**V**

Verifies that sectors written to the target disk are recorded properly. This parameter lets you know that critical data has been correctly recorded.

This parameter causes UNPACK to run slower because a check is made for each entry recorded on the disk.

/**F**

Specifies that files with *extended attributes* should not be unpacked or copied if the destination file system does not support extended attributes.

Chapter 5. Presentation Manager Tools

This chapter describes the Presentation Manager tools that let you:

- Develop a user-help interface or online documents
- Add resources to your applications, such as message strings, menus, and dialog boxes
- Create dialog boxes or change controls in existing dialog boxes
- Modify raster fonts to construct images, such as lines, circles or other geometric shapes
- Create icons, pointers, and bit maps
- Implement workplace objects
- Create workplace object classes and instances of workplace object classes.

Information Presentation Facility Compiler

The Information Presentation Facility (IPF) is a set of tools used to create an online help facility for an application. IPF also is used to create online information that can be viewed independent of an application. It is a tool for both the information author and the application programmer.

As an author of online information, you can define the windows in which information is displayed. For example, a window can be split so that scrollable text can be displayed beside a stationary illustration that the text describes. Figure 5-1 shows an IPF split-window design that describes the IBM* Personal System/2* Model 90 XP 486 series.**

* Trademark of the IBM Corporation

** Trademark of Intel Corporation

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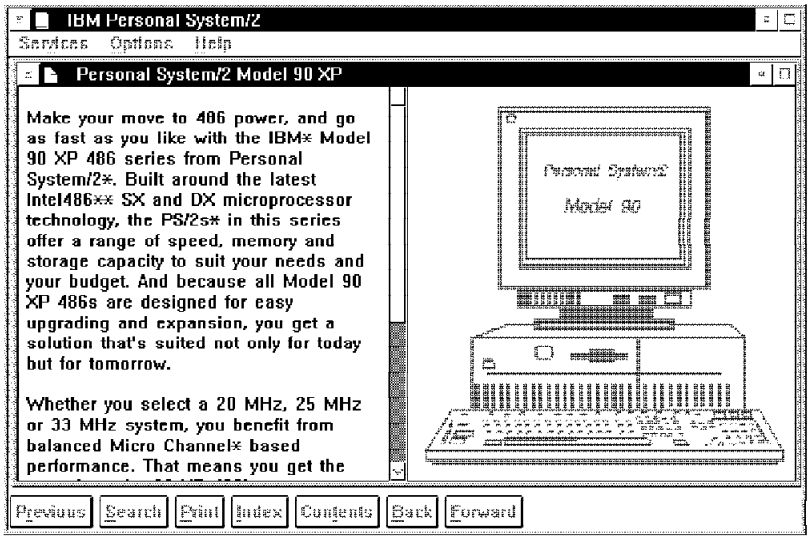


Figure 5-1. IPF Split Window. The split window was created with the IPF tagging language.

Developing Online Information

IPF makes it possible for you to design your information in two types of formats:

An online document format for tutorials or reference books
A help-window format for fields within application programs.

To produce either format, you must create a text file using a text editor program and two IPF elements:

The IPF tagging language — it consists of the instructions for formatting and displaying your document on the screen.

The IPF compiler — it interprets the tags and converts the source file into an IPF format.

Starting the IPF Compiler

You can start the IPF compiler and specify all input from the command line. An example of the syntax follows:

IPFC *filename [/INF] [/S] [/X] [/W] [> messageoutputfilename*]

where:

filename
Specifies the name of your IPF source file.

If you do not give a file-name extension, the IPF compiler uses .IPF by default. If your file has a file-name extension other than IPF, include that file-name extension in the command line.

/INF
Compiles the source file as an online document.

If this parameter is not included, the default is to compile the source file as a help library, whose extension is .HLP.

/S
Suppresses the performance of the Search function. This parameter increases compression of compiled data by about 10% to further reduce the storage it requires.

/X
Generates and displays a cross-reference list.

/W*n*
Generates and displays a list of error messages. The *n* indicates the level of error messages you want to receive. Values you can specify for *n* are 1, 2, or 3.

Warning Level 1 (the most severe)
Warning Level 2 (moderately severe)
Warning Level 3 (the least severe).

messageoutputfilename
Specifies the name of the file where error and cross reference messages are sent. If you do not specify this parameter, messages generated by **/X** and **/W***n* are sent to the display screen.

Compiling Help Files

To compile a source file that is intended as a help-text window, use the IPFC command without the /INF option. For example:

```
IPFC myhelp.hlp
```

Compiling with International Language Considerations

The following parameters provide international language support:

/COUNTRY=*nnn* (*nnn* is the 3-digit country code)

/CODEPAGE=*nnn* (*nnn* is the 3-digit code page)

/LANGUAGE=*xxx* (*xxx* is a 3-letter identifier that indicates an international languages file is to be used).

An example of the command-line syntax follows:

IPFC *myfile.txt /INF /COUNTRY= 33 /CODEPAGE=437 /LANGUAGE=FRA*

Viewing an Online Document

If you want to see your formatted online document, you can use the VIEW command to display it.

An online document has an extension of INF. It can be viewed by entering its name as a parameter to the VIEW command; for example:

```
VIEW myfile
```

You do not need to include the INF file extension.

Note: You cannot use VIEW to display help-text windows for application programs.

For complete information about this tool, see the online *Information Presentation Facility Reference*.

Resource Compiler

The OS/2 Resource Compiler is a tool that lets you add application resources, such as message strings, pointers, menus, and dialog boxes, to your application's executable file. The primary purpose of the Resource Compiler is to prepare data for applications that use functions such as WinLoadString, WinLoadPointer, WinLoadMenu, and WinLoadDlg. These functions load resources from the application's executable file or another specified executable file. The application then can use the loaded resources as needed.

The Resource Compiler and the resource functions let you define and modify application resources without recompiling the application itself. The Resource Compiler can modify the resources in an executable file at any time without affecting the rest of the file. You can create custom applications from a single executable file by using the Resource Compiler to add the custom resources you need to each application. The Resource Compiler is especially important for international language support because it lets you define all language-dependent data, such as message strings, as resources. Preparing the application for a new language is simply a matter of adding new resources to the existing executable file.

Creating a Resource Script File

All resources are defined in a resource script file. You use a text editor to create a resource script file that has an RC extension. Resources are defined either explicitly in statements in the resource script file, or in other files (such as output files from the resource editors). The .RC file is the input file to the Resource Compiler; the output has an RES extension. The .RC file can contain statements that define resources and that include resources from other files. Text-based resources such as menus, shortcut keys, and text strings are defined in the .RC file. Non-text-based resources are specified in the .RC file as file names of the external files where these resources reside. Such resources include icons, pointers, and bit maps. The syntax for including external files in a resource script varies according to the nature of the resources defined or contained in the files. Fonts have a resource file to themselves.

Make sure that none of the include files in your resource script file contain an end-of-file character. When the Resource Compiler sees an end-of-file character, it assumes it to be the end of all input.

For an example of a resource script file, see the sample program "TEMPLATE" on page 3-11.

Starting the Resource Compiler

You can start the resource compiler in three ways:

Compile a resource script file and bind it to an executable file
Compile a resource script file but do not bind it to the executable file
Compile a resource script file and put it in a dynamic link library.

Compiling and Binding Resources to an Executable File: To compile the resource script file EXAMPLE.RC and bind the resulting compiled resource (.RES) file to the executable file, EXAMPLE.EXE, use the following command:

```
RC EXAMPLE
```

You do not need to specify the .RC extension for EXAMPLE. The Resource Compiler program creates the resource file EXAMPLE.RES and then adds the compiled resource to the executable file EXAMPLE.EXE.

Compiling Without Binding Resources to an Executable File: To compile the resource script file, EXAMPLE.RC, into a resource file without binding the resources to an executable file, use the following command:

```
RC -R EXAMPLE
```

The compiler creates the resource file EXAMPLE.RES.

Putting Resources in a Dynamic Link Library: Instead of binding a resource file to your application, you can put it in a dynamic link library. To add the compiled resources to a dynamic link library, use the following command:

```
RC EXAMPLE.RES DYNALINK.DLL
```

You can then link the file at run time and load the resources into your application by using the DosLoadModule or GpiLoadFonts functions. However, you cannot switch from binding resources to putting resources into a dynamic link library without changing your application source code. For information on how to put resources into a dynamic link library, see the *Application Design Guide*. For complete information about the Resource Compiler, see the online *Tools Reference*.

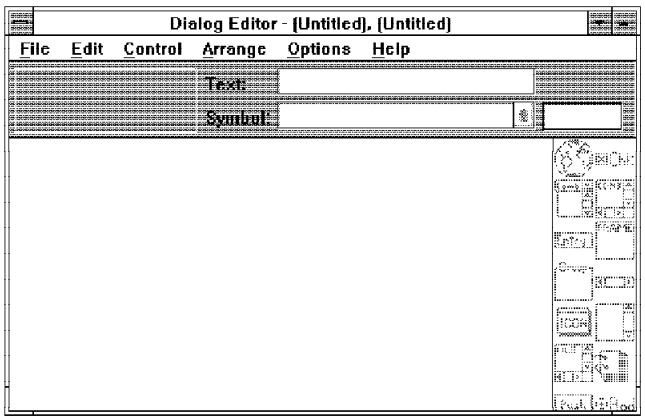
Dialog Editor

The Dialog Editor is used to create and modify dialog boxes and specify the controls and text within dialog boxes. As you create a dialog box and add controls, the Dialog Editor draws it to the screen. You can resize and reposition the dialog box, then test its controls before you incorporate it in your application.

Although the Dialog Editor draws box outlines and controls to the screen so that you can view it from a user's perspective, the Dialog Editor does not save it as a graphic. Instead, the Dialog Editor stores a description of the dialog box and its controls in a text file that has a file-name extension of DLG. It also creates a compiled form of the .DLG file into a resource file that has an extension of RES. The dialog-box and resource files can each contain descriptions of more than one dialog box. The resource file can contain other application resources, such as icons, bit maps, and string tables. It is attached to the application's executable (.EXE) file during the compile and link processes.

Starting the Dialog Editor

To start the Dialog Editor, select the **PM Development Tools** folder, them select **Dialog Editor**. The following window appears.



The **File** and **Edit** menu bar choices provide two ways to create a dialog box:

From the **File** menu, select **New**. This opens new resource files with the extensions .RES and .DLG, but the Dialog Editor does not tell you that it has opened the resource files. You can open a new include file or an existing one.

From the **Edit** menu, select **New Dialog**. The editor opens new files with the extensions .RES and .DLG. This opens a new include file, but the Dialog Editor does not tell you that it has opened the include file.

Both of the above methods have the same effect.

When you edit a dialog box, the names of the resource and include files are shown in the title bar of the Dialog Editor. If you are editing a new file that has not yet been named or saved, *(Untitled)* appears in the title bar in place of a name. If *(Untitled)** appears in the title bar in place of a name, there are unsaved changes.

For more information about the many functions of the Dialog Editor, see the online *Tools Reference*.

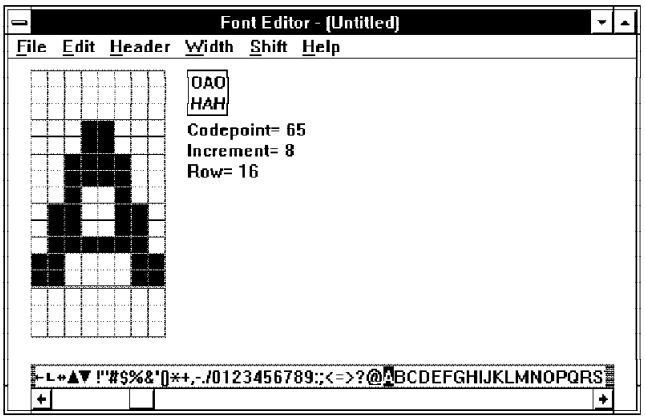
Font Editor

The Font Editor is used to design and save fonts for use in applications. A font is a set of alphanumeric characters, punctuation marks, and other symbols that share a common typeface design and line weight.

When the Font Editor creates a font file, it supplies an FNT file-name extension. The font file contains a header, which describes the font in general terms, and a section that contains bit maps of the characters themselves.

Starting the Font Editor

To start the Font Editor select the **PM Development Tools** folder, then select **Font Editor**. The following window appears.



The quadrille to the left of the screen has within it an enlarged version of the character selected from the long, scrollable, horizontal box at the bottom of the screen. To edit the enlarged version of the character in the quadrille, use the mouse to switch the enlarged representation to black or white. You can change a series of pels by holding mouse button 1 down and moving the pointer through the pels.

Several choices are available from the menu bar that enable you to tailor individual fonts. With these choices you can:

Create a font file or open an existing file
Edit a new or existing font
Define the characteristics of the font
Specify character spacing (fixed or proportional)
Name the typeface
Identify a type style (italic, underscored)
Change the width and weight of individual characters
Insert or delete a column in the character.

Font Resource Files

All resources, except fonts, can be bound to the application's executable file or compiled into a dynamic link library (DLL). Fonts must be put in a separate DLL using the Resource Compiler. You then link the file at run time and load the resources into your application by using the DosLoadModule or GpiLoadFonts function. A DLL containing font resources must have a file-name extension of FON. The .FON file can be installed on the system.

For more information about the Font Editor, see the online *Tools Reference*.

Icon Editor

The Icon Editor is used to to create icons, pointers, and bit maps. In the Presentation Manager, an icon is a graphic symbol that identifies a data object, a system action, or a minimized application. A pointer is a small shape on the screen that reflects the movement of the mouse. Pointers have a *hot spot* that identifies their exact location on the screen.

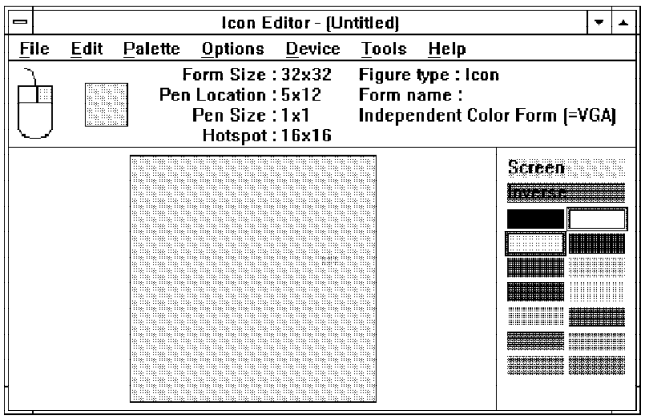
Icons, pointers, and bit maps produced by the Icon Editor are graphic symbols comprised of pels in any of the following display states:

Black
White
Color

Screen (background color)
Inverse screen (inverse of background color).

Starting the Icon Editor

To start the Icon Editor, select the **PM Development Tools** folder, then select **Icon Editor**. The following window appears:



Notice the information area at the top of the Icon Editor window; the items displayed from left to right include:

A two-button mouse, showing the color currently selected for each button
An actual-size image of the current figure that you are editing
A status area that provides:
- Size (in pels using x and y coordinates)
- Pen location
- Pen size (from 1-by-1 to 9-by-9)
- Hot spot (for icons and pointers, but not bit maps)
- Figure type (icon, pointer, or bit map)
- Form name.

The palette window, in the lower-right corner, displays the colors that are available for use during editing. The colors currently selected are marked with frames.

The editing window is the largest part of your working area. Use the mouse to paint the enlarged representation with the selected color.

The menu-bar choices provide access to the many functions of the Icon Editor. These choices enable you to:

- Create a new icon, pointer, or bit map
- Edit an existing icon, pointer, or bit map
- Test the new icon or pointer
- Superimpose a grid over the editing window (for drawing a symmetrical figure)
- Restrict a drawing to straight vertical or horizontal lines
- Make transparent pels (for icons or pointers) visible
- Change the shape and size of the pen
- Select system preferences (to set prompts or suppress warnings)
- Define hot spots (where the mouse pointer is directed).

For more information about the features of the Icon Editor, see the online *Tools Reference*.

System Object Model Compiler

The OS/2 2.0 operating system has introduced a programming interface that allows applications to implement desktop objects. This programming interface enables you to create desktop objects that conform to the new CUA architecture using basic object-oriented programming techniques. The interface is implemented using the IBM System Object Model (SOM).

Setting the SMINCLUDE Environment Variable

The SOM compiler uses an environment variable called SMINCLUDE to locate included class definitions. Because every SOM class will have an include file for its parent class definition, you must set SMINCLUDE before running the SOM compiler. Its form is similar to the OS/2 PATH or DPATH environment variables, in that it can consist of one or more directory names, separated by a semicolon. Directory names can be specified with absolute or relative path names. For example:

```
SET  SMINCLUDE=.;..\mySCdir;C:\TOOLKT2 \C\INCLUDE;
```

Starting the SOM Compiler

The SOM compiler is actually a precompiler and a collection of code emitters that produce binding files from the output of the precompiler. The files have several forms, including C-header files, a C-implementation template, and the language-neutral version of the class definition file.

To start the SOM precompiler from the command line, type:

SC *[-options] filename [csc]*

where:

options
is the name of the SOM compiler option. Options can be specified individually, as a string of option characters, or as a combination of these forms. Any option that takes an argument must be specified individually or be the final option in a string of option characters.

For a complete list of SOM compiler options, see the online *System Object Model Reference*.

filename
is the name of a file that contains an OIDL class definition. If you do not specify a file-name extension, the compiler uses .CSC by default.

The SOM compiler (SC.EXE) produces .SOF and .SCF files using the file name you specify.

Running SOM Emitters

You complete the SOM compilation process by running the emitters. You can control the output of the emitters from the command line by typing:

COMMAND *[-o filename] [-a name[=value]] filestem*

where:

command
is one of the following:

EMITH
EMITPH
EMITIH
EMITC
EMITDEF
EMITSC
EMITPSC
EMITCSC

-o
is an explicit name (including drive, path, and file-name extension) for the emitted output file. If this option is not specified, the output file is placed in the current directory, and the file-name extension defaults to a type appropriate to the selected emitter program.

-a name[=value]
adds a global attribute. Attributes are listed in the online *System Object Model Reference*.

filestem
is the file stem of the .SOF file produced by SC.EXE to use as the basis for emissions.

Workplace Class List

The workplace class list is a tool that creates a workplace object class and an instance of a workplace object class. Workplace objects are constructed using the SOM protocol and are instances of one of the following workplace object classes:

Predefined
These classes are defined by the system. Examples of predefined workplace object classes are WPObject, WPFileSys, and WPAbstract.

Subclass

These classes are derived from existing predefined workplace object classes. They add or remove function; however, they retain the basic behavior of that class.

Replaced

These classes replace the class being *subclassed*. They modify the behavior of an instance of a predefined workplace object class without the instance being aware of the new class.

Starting Workplace Class List

To start Workplace Class List, select the **PM Development Tools** folder, then select **Workplace Class List.** The following window appears:

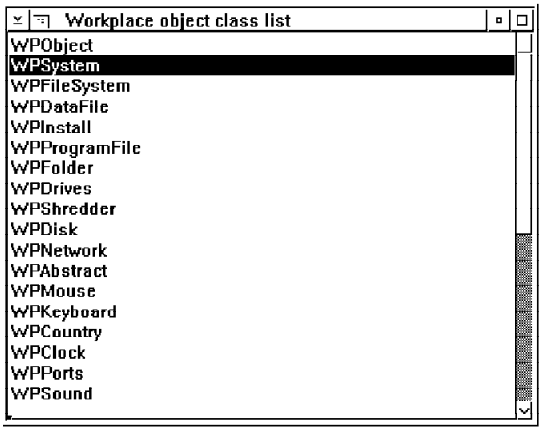


Figure 5-2. The workplace object hierarchy.

Using this window, you can:

Add, delete, and browse registered Workplace Class Objects
Create an instance of a Workplace Class Object
View the registered Workplace Class Object in the system

For more information about this tool, see the online *Tools Reference*.

Chapter 6. System Debug Support

The chapter introduces you to the interface that installs the debug kernel, symbol files, and debug version of the Presentation Manager. It also describes tools that support your debugging efforts.

Communications

Local and remote debugging are the same, except for the location of the system to be debugged (also known as the *system under test*). If the system to be debugged is close to the debug terminal, use a null modem cable to connect them. If the system is physically distant, use modems. The default setup for the communication port of the debug kernel is:

Baud rate	9600
Parity	none
Data bits	8
Stop bits	1

The Debug Files

The files described in this section are referred to as either a *retail* or *debug* version. “Retail” stands for the files that came with your OS/2 2.0 operating system; “debug” stands for the files that came with the Toolkit Debug Diskettes.

Debug Kernel

The debug kernel, a special version of the OS/2 kernel, makes it possible to set breakpoints and trace programs. It also permits the use of symbolic addresses. You can interact with the debug kernel by using a modem or null modem and a second asynchronous debug terminal.

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Debug Presentation Manager Interface

The debug Presentation Manager interface is a special version of the Presentation Manager dynamic link libraries. The debugger detects errors in your Presentation Manager application and issues messages to the terminal.

Installing the Debug Installation Program

The menu-based debug installation program installs debug replacement files for the kernel and the Presentation Manager interface. Once the program is installed, you can install other debug files, or restore retail files, from the OS/2 command prompt.

During initial installation, two files are copied to the root directory of your specified installation drive:

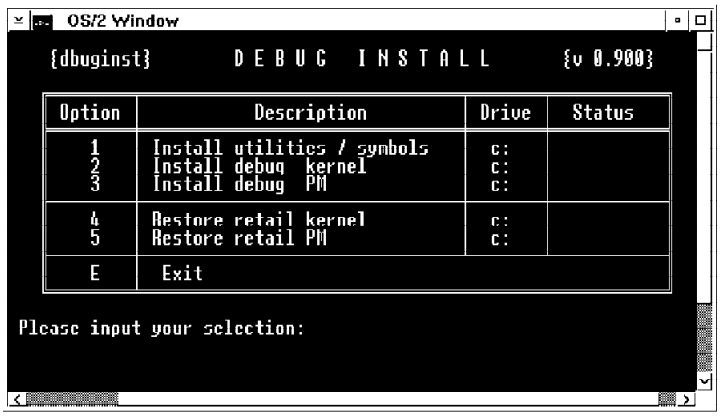
DBINST.CMD	A command file that can be executed separately. This file calls DBUGINST.EXE with the requested installation drive as a command-line argument.
DBUGINST.EXE	This executable file is the user interface. The user can choose which parts of the debug system to install, or which parts to restore to the retail version.

To install and start the debug installation program:

1. Insert Debug Diskette 1 in drive A.
2. At the OS/2 command prompt, type the following to install the program on your designated installation drive (in this case, drive C).

   ```
   a:install c
   ```

   Note: Do not type a colon after the installation drive letter.
3. Press Enter. The following screen appears.



The user interface consists of a menu that provides installation choices in three optional parts. It also provides the ability to restore two of those parts to their corresponding retail versions.

When prompted to enter a debug installation option, choose the options in the order they appear on the screen.

Editing the CONFIG.SYS FILE

When you complete the debug installation procedure, you must edit your CONFIG.SYS file.

For the Debug Kernel

If you installed only the debug kernel, modify the DEVICE statement that has the PMDD.SYS line as follows:

DEVICE=C:\OS2\PMDD.SYS /C*n*

The statement includes the C drive as the installation drive, and adds the /C switch with *n* as the communication port for the debug output. If you do not specify a value for *n*, the default communication port is COM2 (if one is present) and COM1 (if one is not present).

Restoring the Kernel

To restore the retail kernel, restore the DEVICE statement as follows:

DEVICE=C:\OS2\PMDD.SYS

For the Debug Presentation Manager Interface

If you have installed the debug version of the Presentation Manager interface, modify the DEVICE statement with the PMDD.SYS line as follows:

DEVICE=C:\OS2\DEBUG\DLL\PMDD.SYS \C*n*

The DEVICE statement includes the C drive as the installation drive and allows you to call the debug version of PMDD.SYS from the OS2\DEBUG\DLL subdirectory. The /C switch is set with *n* as the communication port for the debug output.

Modify the LIBPATH statement by adding the DEBUG DLL subdirectory as follows:

LIBPATH=C:\OS2\DEBUG\DLL; ....

Restoring the Presentation Manager Interface

To restore the retail Presentation Manager, you only need to restore the DEVICE statement:

DEVICE=C:\OS2\PMDD.SYS

You do not need to restore the LIBPATH statement. The Presentation Manager Restore option removes the debug versions of the DLL from the DEBUG DLL subdirectory.

For a detailed description of the Installation and Restore options available with this interface, see the online *Tools Reference*.

MAPSYM

MAPSYM is used to generate binary files that the debug kernel uses to associate a symbolic name with an address in memory.

Starting MAPSYM

MAPSYM creates public symbol (.SYM) files from map (.MAP) files. You must start MAPSYM from the directory in which the map file is located. An example of the syntax follows:

MAPSYM *filename [options]*

where:

filename
is the name of the map file. You do not have to type the .MAP file-name extension.

options
is the name of the MAPSYM option that modifies the action of MAPSYM. For information about MAPSYM options, refer to the online *Tools Reference*.

Note: Be sure the .SYM files are in the same subdirectory as their corresponding DLLs.

T (Terminal Emulator)

T is a terminal emulator and is used by the debug kernel to communicate with the system to be debugged. You can use any ASCII terminal emulator; the Toolkit provides T. A terminal emulator allows a device, such as a personal computer, to enter and receive data from a computer system as if it were a particular type of attached terminal. For example, you use T to send and receive ASCII files.

Hardware Requirements

Make sure your system has a properly installed asynchronous-port and communication-port driver, and that your CONFIG.SYS file has the following line.

```
DEVICE=C:\OS2\COM.SYS
```

Starting T

You can start T at the command line by typing its executable name:
T

A blank screen appears. Press the F1 key; a menu appears that lets you:

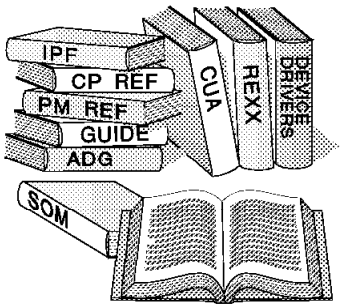
Display function-key assignments
Set up communication-port parameters
Set the file name and start sending
View the text that has scrolled off the screen
Send the text that was written to a screen, to a file (capture mode)
Toggle to the capture mode
Set the file name or delete the current capture file
Exit from the terminal program.

Note: Capture mode can be started automatically when T is executed by placing the line Capture=yes in the initialization file.

For more information about T, see the online *Tools Reference*.

Chapter 7. The OS/2 Technical Library

This chapter describes the *OS/2 Technical Library* and the individual books that support an OS/2-based applications development environment. Take some time to read about the books in this technical library and determine which ones you need to use. The entire library can be ordered with a single part number. You also can order each book separately (see "Ordering Information" on page 7-6).



Application Design Guide

This book provides an overview of OS/2 programming concepts, including guidance on using the System Object Model (SOM) to develop applications and create workplace objects. Use this book when building executable files or dynamic link libraries, when writing code for an object-oriented environment, or when migrating from DOS or OS/2 16-bit applications.

Programming Guide

This three volume book provides guidance information and code examples to enable you to start writing source code using the application programming interfaces (APIs). Volume I describes the Control Program for programming functions that are internal to applications, including file system, memory management, exception management, and multitasking functions. Volume II describes the Presentation Manager windowed user interface, including messages and message queues, window classes, frame windows, control windows, and window controls. This book also describes how to write a Presentation Manager application so that it conforms to CUA guidelines. Volume 3 describes the graphics programming interface, including graphic primitives, and graphics segments, bit maps, and

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transformation functions. This book also describes printing and device support.

Information Presentation Facility Guide and Reference

This book is for both the application programmer designing help windows, as well as the author developing online documents. It provides guidance in using the IPF tagging language and the IPF compiler and serves as a reference for window functions, dynamic data functions, and help manager messages. The information in this book also is available as an online document (see “Information Presentation Facility Reference” on page 2-1).

System Object Model Guide and Reference

This book describes the System Object Model (SOM), and the tools that support its use. The book is aimed primarily at the experienced C-language programmer, who has knowledge of object-oriented programming concepts. It covers the Object Interface Definition Language (OIDL), and the SOM compiler. It is a reference for C-language bindings and SOM programming interface functions. The information in this book also is available as an online document (see “System Object Model Reference” on page 2-2).

Control Program Programming Reference

Refer to this book for functions of the base operating system (functions with a prefix of “Dos”). Dos functions are listed in alphabetic order, and each one includes a C-language code example and pointers to related functions. The information in this book also is available as an online document (see “Control Program Reference” on page 2-1).

Presentation Manager Programming Reference

This three-volume book provides a detailed reference for programming to the Presentation Manager interface. Volume I has an alphabetic listing of the Ddf (dynamic data format), Dev (device), Drg (dragdrop), Gpi (graphics), Prf (profile), and Spl (spooler) API functions. Volume II has an alphabetic listing of the Win (window) API functions and the new WP (workplace) methods. Volume III contains related information such as, graphics-orders, graphics-orders data types, application hooks and procedures, and Presentation Manager messages. The information in these books also is available as an online document (see “Presentation Manager Reference” on page 2-2).

Procedures Language 2/REXX User's Guide

This book describes the REXX language. Each chapter is divided into two sections: “Basics” includes frequently used features; “Advanced Topics” describes special features and includes examples. The book is for the user who wants to learn how to program in REXX.

Procedures Language 2/REXX Programming Reference

Refer to this book for a list of the REXX functions supported by the OS/2 operating system. This book is a more detailed description of the REXX programming language. The book contains detail descriptions of C language APIs for those who wish to extend their applications with REXX as a macro language. The information in this book also is available as an online document (see “REXX Reference” on page 2-2).

Physical Device Driver Reference

Use this book to write OS/2 physical device drivers. It provides category, function code, and calling conventions for I/O control (IOCtl) functions. Calling conventions also are described for DevHlp routines. This book is written for system programmers as well as application programmers.

Virtual Device Driver Reference

This book is for writing virtual device drivers. It provides information on virtual DevHlp routines and describes virtual device driver architecture, operations, and inter-device driver communication. It also includes a detailed description of each of the virtual device drivers available with the OS/2 operating system. This book is written for system programmers as well as application programmers.

Presentation Driver Reference

The information in this book is for experienced system programmers who are developing presentation drivers for devices operating in an OS/2 program environment. It describes the internal interface between the Presentation Manager interface and the driver, and between the driver and the I/O subsystem. This book also contains information about queue drivers and port drivers. Detailed descriptions of control structures, data structures, and I/O formats also are included.

Systems Application Architecture: Common User Access Guide to User Interface Design

This book is for software and user-interface designers. It describes the principles, components, and techniques of user-interface design in general, as applied to a variety of software products for a variety of operating systems. It also describes the process of designing a product with a Common User Access (CUA*) interface.

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Systems Application Architecture: Common User Access Advanced Interface Design Reference

This book lists all of the fundamental and recommended guidelines for designing and developing a product with a CUA interface. Refer to this book when developing a user interface that needs to be consistent within your application and across other applications.

Ordering Information

To order the technical library, call 1-800-IBM-PCTB (1-800-426-7282). In Canada call toll free 1-800-465-1234. In British Columbia call toll free 112-800-465-1234. In Alaska call 1-414-633-8108. You can also order copies of these books from an IBM authorized dealer or IBM representative.

To order the complete OS/2 Technical Library, specify part number **10G3356**. To order each book separately, select the appropriate part number from the following table:

Title	Part No.
Application Design Guide	10G6260
Programming Guide, Volume I	10G6261
Programming Guide, Volume II	10G6494
Programming Guide, Volume III	10G6495
Control Program Programming Reference	10G6263
Presentation Manager Programming Reference, Volume I	10G6264
Presentation Manager Programming Reference Volume II	10G6265
Presentation Manager Programming Reference Volume III	10G6272
Information Presentation Facility Guide and Reference	10G6262
System Object Model Guide and Reference	10G6309
Procedures Language 2/REXX User's Guide	10G6269
Procedures Language 2/REXX Reference	10G6268
Physical Device Driver Reference	10G6266
Virtual Device Driver Reference	10G6310
Presentation Driver Reference	10G6267
Systems Application Architecture: Common User Access Guide to User Interface Design	SC34-4289
Systems Application Architecture: Common User Access Advanced Interface Design Reference	SC34-4290

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