Microsoft® Mouse

Programmer's Reference Guide

Microsoft® Mouse Programmer's Reference Guide

for IBM® Personal Computers and Compatibles

Microsoft Corporation

If you have comments about this documentation or the software it describes, complete the Problem Report at the back of this manual and return it to Microsoft.

Document Number 990973002-600-R00-1186
Part Number 000-099-158

Contents

About This Guide

By now you're probably enjoying the convenience of the Microsoft® Mouse with the applications and the Microsoft Expert Mouse Menus that were included in your mouse package. This guide explains how you can create your own Mouse Menu programs for applications, as well as design a mouse interface for applications that you write yourself. It assumes that you have done some programming, understand basic program design concepts, and are familiar with the operation of the Microsoft Mouse.

This guide has two main parts:

- **Creating Mouse Menus** explains how to create a Mouse Menu program that allows you to use the Microsoft Mouse with an application that doesn't have built-in mouse support.
- **Designing Mouse Interfaces** explains how to build mouse support directly into one of your own applications.

In addition, four appendices give you technical information about the mouse command line switches, linking existing mouse programs with version 6.0 of the Microsoft Mouse Library, using the mouse with Borland Turbo Pascal programs, and using the Hercules Graphics Card with mouse programs.

PREADME.DOC

The Microsoft Mouse Tools disk that came with this guide may include a file named PREADME.DOC. Read this file for information that became available after this guide was printed.

Product Support

If you have a question about designing a mouse menu or mouse interface and can't find the answer in this guide, call our Product Support staff by dialing the telephone number on the registration card that came with the *Microsoft Mouse Programmer's Reference Guide.* They will be ready to give you the help you need in order to use the Microsoft Mouse with many applications.

When you call, please have the following information at hand:

- The product number on the Microsoft Mouse Tools disk
- The *Microsoft Mouse Programmer's Reference Guide*
- Your Microsoft Mouse type
- Your system configuration

Microsoft Software License Agreement Addendum

DISTRIBUTION OF MICROSOFT MOUSE LIBRARY

Microsoft grants you the royalty-free right to reproduce and distribute the Mouse Library provided that you (a) distribute the Mouse Library only in conjunction with and as part of your own software product; (b) do not use Microsoft's name, logo, or trademarks to market your software product; (c) include Microsoft's copyright notice for the Library on your product label and as part of the sign-on message for your software product; and (d) otherwise comply with the Microsoft License Agreement and this Addendum. The "Mouse Library" consists of the files described as "MOUSE.LIB", "OLDMOUSE.LIB", and "EGA.LIB".

If you distribute any portion of the Mouse Library, you agree to indemnify, hold harmless, and defend Microsoft from and against any claims or lawsuits, including attorney's fees, that arise or result from such distribution.

Disclaimer of Warranty

USE OF MICROSOFT MOUSE EXAMPLE SOURCE CODE

Your compilation of the source code included on the Microsoft Mouse Tools disk and/or described in this guide, and your subsequent use of the resultant programs, constitutes your acceptance of all results, intended or otherwise, of such use. The source code is meant solely as an example, and Microsoft does not warrant, guarantee, or otherwise make any claim concerning the usability or functionality of the programs defined by the source code.

Mouse Menus

Creating Mouse Menus

This section explains how to use the Mouse Menu programming language to create your own mouse menus for applications.

Chapter 1, "Creating Your Own Mouse Menu," gives an overview of the Mouse Menu programming language and explains how to create and run a Mouse Menu program.

Chapter 2, "Mouse Menu Language Statements," explains in detail how to use each of the Mouse Menu language statements.

Chapter 3, "Sample Mouse Menu Programs," provides the listings for two Mouse Menu programs that are both good examples for designing mouse menus and useful programs you may want to use yourself.

Chapter 4, "Mouse Menu Messages," lists the messages that the Mouse Menu programs can display, along with descriptions of possible causes and actions you should take.

1 Creating Your Own Mouse Menu

This chapter provides background information that you'll need before you create a Mouse Menu program. It includes:

- An overview of the Mouse Menu programming language
- A description of program statements and their components
- Descriptions of the various types of subroutines
- A discussion of how statements and subroutines are combined to form a Mouse Menu program

Once you're familiar with how a Mouse Menu program is put together, follow the procedure in "Creating a Mouse Menu" at the end of this chapter to create a working mouse menu.

Note Mouse menus cannot be used with programs that use graphics display modes or that have built-in mouse support.

Mouse Menu Language

The Mouse Menu programming language consists of 13 commands. These commands are used in statements, which assign different functions to the mouse, simulate pressing keys, and create menus.

The following table lists the commands in the Mouse Menu programming language:

Command	Purpose
ASSIGN	Assigns new values for the mouse.
BEGIN	Assigns initial values for the mouse.
EXECUTE	Specifies a sequence of statements executed when the mouse is moved, a mouse button is clicked, or a menu item is chosen.
MATCH	Specifies the action taken when a unique string of characters is displayed at a specific location on the screen.
MENU	Begins a Menu subroutine.
MEND	Ends a Menu subroutine.
NOTHING	Indicates that no action is taken. An alternative to the EXECUTE, TYPE, and MATCH statements.
OPTION	Defines an item in a Menu subroutine and the action taken when the item is selected.
POPUP	Begins a Popup subroutine.
PEND	Ends a Popup subroutine.
SELECT	Defines the action taken when an item is selected in a popup menu.
TEXT	Defines the text for a popup menu title or menu items.
TYPE	Specifies a key or keys typed when the mouse is moved, a mouse button is clicked, or a menu item is chosen.

Statement Format

You can enter statements in the Mouse Menu programming language in uppercase or lowercase letters. Most statements have the following format:

[label:] command [parameters ;comments]

The BEGIN statement and statements within Menu and Popup subroutines don't use this format because they don't require labels—BEGIN doesn't need a label because it's always the first statement in a program; statements within subroutines don't need labels because the program executes them sequentially.

The components of a statement are described next.

Labels

A *label* is the name you give a statement. For example, in the following statement "mat1" is the label of the MATCH statement:

```
mat1: MATCH 23,,INVERSE,"FORMAT",exec1,exec2
```

A label allows the program to execute statements in a different order than the order in which they appear.

When using labels, follow these rules:

- A statement's label must begin with a letter and be followed by a colon (:).
- Put at least one space between the colon and the command.
- Do not use command names or the words BACKSPACE, ENTER, ESCAPE, or TAB for labels.
- Use any printable standard ASCII characters except for a colon.
- Use labels that suggest what the statement does in the program. For example, use "menu1" as the label for the first Menu subroutine.

Parameters

A *parameter* is a variable that affects the action of the statement. Generally, when you use the statement, you must substitute an appropriate value for each parameter. All statements except NOTHING, MEND, and PEND have parameters.

Parameters come after the command word in a statement. Put a space between the command word and the first parameter. Commas must separate any parameters after the first one.

The EXECUTE and TYPE statements allow a variable number of parameters. These statements can have from 1 to 31 parameters. Other statements have a set number of parameters. If you don't want to use a parameter but want to use the parameters that follow, include an additional comma to hold the place of the unused parameter.

For example, in the following statement, "23", "INVERSE", "FORMAT", "exec1", and "exec2" are the values of MATCH statement parameters. The two commas (,,) indicate that the second parameter is not used:

```
mat1: MATCH 23,,INVERSE,"FORMAT",exec1,exec2
```

The program automatically uses a specific value (the default value) for any parameter that is left out of a statement that has a set number of parameters.

The Mouse Menu programming language uses three types of parameters: *numeric* parameters, *string* parameters, and *attribute* parameters.

Numeric parameters

Numeric parameters are used for numeric data, such as screen coordinates or movement-sensitivity values for the mouse. As the name suggests, you must use a number for a numeric parameter.

In the preceding example, "23", the row coordinate for the MATCH statement, is the value of a numeric parameter.

String parameters

Most string parameters specify text for menus or messages. Use a string of digits, letters, special characters, or spaces for a string parameter.

In the example above, "FORMAT", the string that the MATCH statement looks for, is the string parameter.

Display attribute parameters

A display attribute parameter specifies how a menu or message box appears on the screen. This parameter can have one of four values: "normal", "bold", "inverse", or, if your system uses a color display adapter and monitor, a number that designates specific foreground and background colors. Figure 1.1 shows how the values "normal", "bold", and "inverse" affect the text displayed by a popup menu.

1.1 Effects of Attribute Parameters

Normal *Bold* *Inverse*

If you do not specify an attribute parameter, the default attribute is used. The default attributes are included in the description of each statement in Chapter 2, "Mouse Menu Language Statements."

Color menus

If your system uses a color display adapter and color monitor, you can use the attribute parameter in a statement to specify particular colors for the background and foreground of a menu or message box. Text is displayed in the foreground color; the rest of the box is displayed in the background color.

The table on the next page lists the background and foreground colors available, and gives a corresponding value for each. (The exact shades of colors may vary somewhat on different equipment.) The value for a particular color differs depending on whether the color is being used for the foreground or background. The display attribute that specifies a particular color combination is the sum of the values for the desired foreground and background colors.

Note If you specify a display attribute value greater than 127, the foreground color will blink when the menu or message box is displayed.

Foreground and background color values

Color	Foreground	Background
Black	0	0
Blue	1	16
Green	2	32
Cyan (blue-green)	3	48
Red	4	64
Magenta	5	80
Brown	6	96
White	7	112
Gray	8	128
Light Blue	9	144
Light Green	10	160
Light Cyan	11	176
Light Red	12	192
Light Magenta	13	208
Yellow	14	224
White (high intensity)	15	240

If you want green text on a blue background, the value of the attribute parameter would be 18. The value for a green foreground is 2, and the value for a blue background is 16; add these two values together to get the final value of 18.

Specifying a value of 7 is equivalent to specifying the attribute parameter "normal". The value 7 is the sum of 0, the value for a black background, and 7, the value for a white foreground. Similarly, you can specify a "bold" menu by specifying the attribute value 15, and an "inverse" menu by specifying the value 112. "Bold" uses high-intensity white for the foreground (15) and black for the background (0); "inverse" uses black for the foreground (0) and white for the background (112).

Note A gray background (128) looks the same as a black background (0).

Comments

Comments describe what a statement does. Comments have no effect on how the statement is executed. They are used only to help you read and understand the program.

You can insert comments at the end of a statement or on a separate line. Precede a comment with a semicolon (;). If you include comments on the same line as the statement, separate the last parameter of the statement and the semicolon preceding the comments with a space.

Mouse Menu Program Structure

There are five types of statements in a Mouse Menu source program:

- Mouse Event Statements: BEGIN, ASSIGN

  Define what action is taken when a mouse event occurs (such as clicking a mouse button)
- Menu Subroutine Statements: MENU, OPTION, MEND

  Create single-column popup menus
- Popup Subroutine Statements: POPUP, TEXT, SELECT, PEND

  Create multiple-column menus and message boxes
- Action Statements: EXECUTE, TYPE, NOTHING

  Perform an action as a result of a Mouse Event, Menu Subroutine, or String Match Statement
- String Match Statement: MATCH

  Executes other statements depending on what is displayed on the screen

The following sections describe how each statement type is used in a Mouse Menu source program. (For specific information about statements and their parameters, see Chapter 2, "Mouse Menu Language Statements.")

Mouse Event Statements (BEGIN, ASSIGN)

Mouse Event statements specify which statements the program executes when the user clicks a mouse button or moves the mouse.

BEGIN statement

Use the BEGIN statement to specify the initial statements executed when particular mouse events occur and to set the initial mouse sensitivity. Always use BEGIN as the first statement in your program.

There are three types of parameters in the BEGIN statement:

- Button Parameters:

lfbtn	Left button
rtbtn	Right button
btbtn	Both buttons

  Define the action taken when one or both mouse buttons are pressed

- Movement Parameters:

lfmov	Mouse left
rtmov	Mouse right
upmov	Mouse up
dnmov	Mouse down

  Define the action taken when the mouse is moved. The cursor keys are often assigned to the mouse movement parameters in a TYPE statement.

- Movement Sensitivity Parameters:

hsen	Horizontal movement sensitivity
vsen	Vertical movement sensitivity

  Define how much the mouse must move (in *mickeys*, the unit of mouse movement) before the cursor moves. This is helpful in tailoring cursor movement to the different column and row widths found in spreadsheet programs. (For more information on mickeys, see Chapter 5, "The Mouse Interface.")

ASSIGN statement

Use the ASSIGN statement to assign new values to mouse events or mouse sensitivity. ASSIGN is useful if you want to execute different statements or subroutines depending on the mode of an application program or on other conditions that require the mouse to be used differently.

Menu Subroutine Statements (MENU, OPTION, MEND)

Menu subroutines create single-column popup menus. Single-column menus are bordered menus with a single column of menu items. (Figure 1.1, earlier in this chapter, shows examples of single-column menus.) The user chooses items in the menu by moving the mouse pointer to the desired item, then clicking either mouse button. If the user clicks both mouse buttons at once, the equivalent of a NOTHING statement is executed and the menu disappears.

Menu subroutines use this format:

```
label: MENU ["title",row,column,attribute]
       OPTION ["text",pointer]
       .
       .
       .
       MEND
```

MENU statement

A Menu subroutine begins with a MENU statement that specifies:

- The menu's title, enclosed in double quotation marks
- The row and column of the screen where the upper-left corner of the menu will appear
- The menu's display attribute (for more information, see "Parameters" earlier in this chapter)

OPTION statement

OPTION statements specify the menu items and action when an item is chosen. At least one OPTION statement should be included in each Menu subroutine as an exit point from the menu.

The pointer parameter is the label of the statement that is executed when the user chooses that menu item. If no pointer parameter is specified, the equivalent of a NOTHING statement is executed when that item is chosen and the menu disappears.

MEND statement

A MEND (or "menu end") statement always follows the last OPTION statement to end the Menu subroutine.

Sample Menu subroutine

This sample Menu subroutine produces the "Inverse Attribute" menu shown in Figure 1.1:

```
menu1: MENU     "BASIC Commands",5,20
         OPTION  "Cancel Menu"
         OPTION  "List",F1
         OPTION  "Run",F2
         OPTION  "Load",F3
         MEND

F1: TYPE 0,59    ;simulate pressing the F1 key
F2: TYPE 0,60    ;simulate pressing the F2 key
F3: TYPE 0,61    ;simulate pressing the F3 key
```

The menu produced by this subroutine appears at row 5, column 20. Because no attribute was specified, inverse screen characteristics (the default attribute) are used. When the menu appears on the screen, the cursor bar is always on the first menu item (in this case, "Cancel Menu").

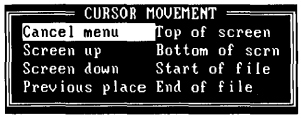
If the user chooses "Cancel Menu", the menu disappears because no pointer parameter is specified for that OPTION statement. If the user chooses any other item, the statement identified in the pointer parameter for that OPTION statement is executed.

Popup Subroutine Statements (POPUP, TEXT, SELECT, PEND)

Popup subroutines are used to create more complex menus or message boxes.

Multiple-column menus are used in the same way as single-column menus: the user chooses items by moving the mouse pointer to the item, then clicking either mouse button. Clicking both mouse buttons at once removes the menu from the screen. When the menu first appears on the screen, the highlight is always over the first menu item.

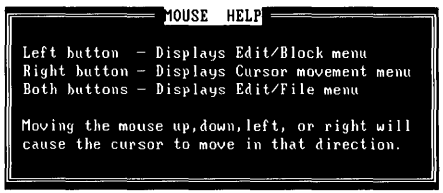
Figure 1.2 shows a sample multiple-column menu:



1.2 Multiple-Column Menu

Message boxes are simply popup menus that display messages instead of menu items. You can combine Popup subroutines with MATCH statements so that message boxes appear when the program mode changes, or when other conditions cause the screen display to change.

Figure 1.3 shows a sample message box:



1.3 Message Box

Popup subroutines for multiple-column menus and message boxes use the following format:

Popup subroutine format

```
label: POPUP [row,column,attribute]
       [TEXT ["text string"]]
       .
       .
       .
       SELECT [row,col,width,pointer]
       .
       .
       .
       PEND
```

POPUP statement

Each Popup subroutine begins with a POPUP statement that specifies:

- The row and column of the menu's top-left corner
- The menu's display attribute. For more information on display attributes, see "Parameters" earlier in this chapter.

TEXT statements

Use TEXT statements to specify the menu title and menu items. Type in the title text, item text, and menu borders exactly as they'll appear on each line of the menu, and enclose them in double quotation marks. You can include ASCII graphics characters, such as "=" or "|", in the borders or item text.

The text will be located on the screen relative to the coordinates you specify in the POPUP statement.

SELECT statements

Use SELECT statements to define:

- The areas in which the user can choose each menu item. Specify the row, column, and width of the selection area, relative to the menu's top-left corner. The relative coordinates of the top-left corner of the popup menu are "1,1".
- The statement that is executed when the user chooses an item. As with the OPTION statement for a single-column menu, you specify the label of the statement that is executed.

You must include at least one SELECT statement in each Popup subroutine as an exit point.

PEND statement

A PEND (or "popup end") statement always follows the last SELECT statement to end the Popup subroutine.

Sample Popup subroutines

This sample Popup subroutine creates the multiple-column menu shown earlier, in Figure 1.2:

```
movmen: popup 2,1
         text " ======= CURSOR MOVEMENT ======= "
         text "| Cancel menu     Top of screen  |"
         text "| Screen up       Bottom of scrn |"
         text "| Screen down     Start of file  |"
         text "| Previous place  End of file    |"
         text " ================================ "
         select 2,3,15
         select 3,3,15,keyctrlr
         select 4,3,15,keyctrlc
         select 5,3,15,keyctrlqp
         select 2,16,15,keyctrlqe
         select 3,16,15,keyctrlqx
         select 4,16,15,keyctrlqr
         select 5,16,15,keyctrlqc
         pend
```

In this example, the top-left corner of the menu will be at row 2, column 1. Because no attribute parameter is specified, the menu will be displayed using the inverse display attribute.

The TEXT statements specify the menu items and their locations relative to the top-left corner. The first item starts at "relative" row 2, column 3 in the menu, but its actual coordinates are row 3, column 3. ASCII graphics characters are used to create solid menu borders.

When the menu appears on the screen, the first item (in this case, "Cancel menu") is highlighted.

The SELECT statements define the item selection areas. In the first item ("Cancel menu"), "2, 13, 15" define the row, column, and width of the selection area, respectively. Because the SELECT statement for "Cancel menu" does not specify a label for the pointer parameter, the menu will be cleared from the screen if the user chooses "Cancel menu." The other SELECT statements execute the statements named in their pointer parameters.

The following sample Popup subroutine creates the message box shown in Figure 1.3:

```
mousehlp: popup 2,1
   text " ================ MOUSE HELP ================== "
   text "|                                              |"
   text "| Left button  - Displays Edit/Block menu      |"
   text "| Right button - Displays Cursor movement menu |"
   text "| Both buttons - Displays Edit/File menu       |"
   text "|                                              |"
   text "| Moving the mouse up,down,left, or right will |"
   text "| cause the cursor to move in that direction.  |"
   text "|                                              |"
   text " ============================================== "
   select 1,18,10
   pend
```

The POPUP statement defines row 2, column 1 as the top-left-corner coordinates. Because no attribute parameter is specified, "inverse" will be used.

The TEXT statements define the message box border and the message text. The single SELECT statement defines an exit point for the menu. Because the message box has only one SELECT statement, the user cannot move the cursor within the message box.

Action Statements (EXECUTE, TYPE, NOTHING)

Action statements specify what action is taken when the user chooses a menu item, clicks one or both buttons, or moves the mouse.

EXECUTE statement

Use the EXECUTE statement to define a series of statements that will be executed when:

- The user clicks one or both mouse buttons
- The user chooses a menu item
- The user moves the mouse
- A MATCH statement is executed (see the next section, "String Match Statement")

Use statement labels to specify the statements that the EXECUTE statement will carry out. You can specify up to 31 labels for each EXECUTE statement. An

EXECUTE statement can carry out another EXECUTE statement to increase the number of statements that are carried out. You can link up to 31 EXECUTE statements in this manner.

Here is a sample EXECUTE statement with five labels:

```
exec1: EXECUTE dsk,s,a,s,exec4
```

This statement executes the statements labeled "dsk", "s", "a", "s", and "exec4".

TYPE statement

Use the TYPE statement to simulate pressing keys on the keyboard. For example, the following TYPE statement simulates pressing the *a* key:

```
key1: TYPE "a"
```

The following TYPE statement simulates typing the *diskcopy a: b:* command and pressing the ENTER key:

```
key15: TYPE "diskcopy a: b:",enter
```

You can indicate which key or sequence of keys is simulated in one of three ways:

- Use its key name, or a sequence of key names, enclosed in double quotation marks (for example, "A").
- Use the ASCII code for the character on the key (for example, 65 for "A"). You can use extended ASCII codes, ASCII control characters, and extended keyboard scan codes to simulate special keys or key sequences, such as ALT, CONTROL-Q, spacebar, and arrow keys. (See the IBM *BASIC* manual for a list of ASCII codes. For a list of ASCII control characters and extended keyboard scan codes, see "TYPE" in Chapter 2, "Mouse Menu Language Statements.")
- Use its symbolic name. The predefined symbolic keys are "enter", "tab", "backsp", and "esc".

Here are sample TYPE statements. The comments indicate which key(s) each statement simulates.

Label	Code	Comments
dir:	TYPE "dir"	;type the command "dir"
a:	TYPE "a:"	;type "a:"
lf:	TYPE 0,75	;simulate the left arrow key
rt:	TYPE 0,77	;simulate the right arrow key
up:	TYPE 0,72	;simulate the up arrow key
dn:	TYPE 0,80	;simulate the down arrow key
s:	TYPE 32	;type a space
ent:	TYPE enter	;simulate the ENTER key

The statements labeled "dir" and "a" simulate typing a character string by enclosing the characters in double quotation marks.

The next four statements define the arrow keys using extended keyboard scan codes. The statement labeled "s" simulates the spacebar by using the standard ASCII code.

The statement labeled "ent" simulates pressing ENTER by using the symbolic name for the key.

NOTHING statement

Use the NOTHING statement to specify that no action is taken. Most often, this statement is used with other statements when you want to disable a parameter.

String Match Statement (MATCH)

MATCH statements permit a Mouse Menu program to take different actions depending on what is displayed on the screen.

A MATCH statement specifies a string of characters, a row and column on the screen, and a display attribute. If a line on the screen matches the specified string, begins at the specified row and column, and appears in the specified display attribute, then the program executes a particular statement. This feature enables a Mouse Menu source program to respond to different operating modes of the application program or screen display.

For example, if an application program always displays "COMMAND" on line 22 of the screen when it is in command mode, and displays "ALPHA" in the same place when it is in alphanumeric mode, you can use a MATCH statement to take a different action depending on which mode the application program is in.

A MATCH statement uses the following format:

MATCH row,column,attribute,string,match,nomatch

- The "row" and "column" parameters describe where the "string" parameter must be located on the screen for a match.
- The "attribute" parameter indicates how the string must appear on the screen for a match. This parameter can have one of the symbolic values "normal", "bold", or "inverse", or a decimal value that denotes specific foreground and background colors. (For information on the attribute parameter, see "Parameters" earlier in this chapter.) If the attribute parameter is left blank or given the value of 0, all display attributes are matched.
- The "match" and "nomatch" parameters are the labels of the statements to be executed if the match is made or not made.

Sample program using MATCH statements

The following sample Mouse Menu source program shows how a MATCH statement is used:

```
BEGIN    menu1,chna,ent,lf,rt,up,dn
.
.
.
chna: MATCH 4,1,normal, "A",ex20,ex19
chnb: MATCH 4,1,normal, "B",ex21,chna
chnc: MATCH 4,1,normal, "C",ex19,chna
ana:  ASSIGN ,chna
anb:  ASSIGN ,chnb
anc:  ASSIGN ,chnc
ex19: EXECUTE cls,a,ent,ana     ;change to A:
ex20: EXECUTE cls,b,ent,anb     ;change to B:
ex21: EXECUTE cls,c,ent,anc     ;change to C:
ent:  TYPE enter
cls:  TYPE "cls",enter
a:    TYPE "a:"
b:    TYPE "b:"
c:    TYPE "c:"
```

This program changes the active disk when the user clicks the right mouse button. The program follows this procedure:

- When the user clicks the right mouse button, the MATCH statement labeled "chna" checks row 4, column 1 on the screen. If it finds an "A" in "normal" display, it executes the statement labeled "ex20".
- The "ex20" statement clears the screen, changes the active drive to "B:" and executes the statement labeled "anb", which reassigns the right button parameter to "chnb".
- Now if the user clicks the right mouse button, the MATCH statement labeled "chnb" checks row 4, column 1 on the screen. If it finds a "B" in "normal" display, it executes the statement labeled "ex21".
- The "ex21" statement clears the screen, changes the active drive to "C:" and executes the statement labeled "anc", which reassigns the right button parameter to "chnc".
- Now if the user clicks the right mouse button, the MATCH statement labeled "chnc" checks row 4, column 1 on the screen. If it finds a "C" in "normal" display, it executes the statement labeled "ex19".
- The "ex19" statement clears the screen, changes the active drive to "A:" and executes the statement labeled "ana", which reassigns the right button parameter to "chna". The program is now back to step 1.

Creating a Mouse Menu

You should now be able to start writing Mouse Menu programs. Follow the procedure below to create a source file and then an executable Mouse Menu program file from the source file.

Note The Microsoft Mouse Tools disk that came with this guide includes Mouse Menu source files for some commonly used applications that don't have built-in mouse support (such as WordStar). Use the following procedure to create mouse menus from these source files.

To create a mouse menu:

1. Write the Mouse Menu program into a source file using a text editor or word processing program. Save the source file with the filename extension ".DEF". This file is used by the MAKEMENU utility program to generate an executable Mouse Menu program (a .MNU file).

   Be sure to save the source file as a standard ASCII text file. Most simple editors save files in ASCII by default, but when using a word processing program, such as Microsoft Word, you usually need to select a special "unformatted" option to get ASCII text.

   If you want to create a mouse menu from one of the source files included on the Microsoft Mouse Tools disk, you can copy the source file and edit the copy to meet your specific needs.

   Note When a source file is converted to a .MNU file, it must not exceed 57K.

2. Use the MAKEMENU utility to create an executable menu file from the source file.

   To use MAKEMENU, type *makemenu* and press ENTER.

   At the prompt, type the name of the source file (without the ".DEF" extension), then press ENTER.

   If your file has no errors, MAKEMENU displays this message:

   ```
   Conversion completed
   ```

   and returns you to DOS. The mouse menu is ready to be tested following the procedure given below.

   If your file has errors, MAKEMENU displays the types of errors and statements containing the errors. (For more information on error messages, see Chapter 4, "Mouse Menu Messages.") Correct the source program and repeat this procedure.

Testing the mouse menu

When the Mouse Menu source file has been translated into an executable menu file, it is ready to be tested.

Note If, when you ran the Mouse Setup program, you did not specify that the mouse driver should be loaded automatically every time you start DOS, make sure you type *mouse* to install the mouse driver before you start your menu file.

To test the mouse menu:

1. Type *menu* <filename> at the DOS prompt and press ENTER to start the Mouse Menu program. In this command, <filename> is the name of the Mouse Menu program file without the .MNU extension.

   When the Mouse Menu file has been loaded, this message appears:

   ```
   Menu installed
   ```

2. Start your application program and try out the menu to ensure that it works under all conditions in your program.

   If it doesn't work as desired, end the Mouse Menu program by typing *menu off* at the DOS prompt and pressing ENTER.

   This message is displayed:

   ```
   Keyboard emulation off
   ```

   Correct the source file, then run the MAKEMENU utility program again.

Running a Mouse Menu Program

Follow these steps to run a Mouse Menu program:

1. Use the DOS COPY command to copy the executable Mouse Menu (.MNU) file and the MENU.COM file onto the disk that contains the application program with which you want to use the menu.
2. Type *menu* <filename> to run the Mouse Menu program for the application. In this command, <filename> is the name of the Mouse Menu program.

   Note To start a Mouse Menu program that is not in the current directory, include the path name of the directory that contains the Mouse Menu file. For more information, see the PATH command in your DOS manual.

   When the Mouse Menu file has been loaded, the following message appears:

   ```
   Menu installed
   ```

3. Run the application program according to the instructions in the program's documentation.

A Mouse Menu program runs independently of the corresponding application program. You should end the Mouse Menu program you're running and begin another whenever you end one application and begin another.

Ending a Mouse Menu program

To end the Mouse Menu program:

- Type *menu off* and press ENTER.

  This message is displayed:

  ```
  Keyboard emulation off
  ```

You can then load and run another Mouse Menu program.

Memory allocation for mouse menus

MENU.COM can allocate up to 57K of memory for a Mouse Menu program. (The size of MENU.COM (7K) plus the size of the .MNU file cannot exceed 64K.) If the menu file is less than 6K, MENU.COM allocates 6K of memory. If the menu file is greater than 6K, MENU.COM allocates the exact size of the file.

Every time you start DOS, the first menu file you load determines the amount of memory reserved for a menu file. If you plan to use more than one mouse menu before restarting your system, first load the .MNU file that requires the greatest amount of memory so that MENU.COM will have allocated enough memory to hold each menu file.

2 Mouse Menu Language Statements

This chapter describes in alphabetical order each of the statements used by the Mouse Menu programming language. Each statement description includes:

- The statement syntax
- A description of each parameter
- An example of how to use the statement

Statement syntax conventions

In the syntax diagram for each statement:

- The command word appears in capital letters.
- Labels appear in small letters. Each label must be separated from the command word by a colon (:) and a space.
- Parameters appear in small letters. Each parameter must be separated from other parameters by a comma (,). If a parameter is not used, the statement must include an additional comma where the parameter would have appeared. (For example, if the second parameter in a statement is not used, the statement would include two commas in a row (,,) after the first parameter.)
- If a parameter appears in brackets ([]), it is optional. If a parameter does not appear in brackets, it is required. If a parameter appears in double quotation marks (" "), the double quotation marks are required.
- If a parameter can appear more than once in a statement, the second occurrence of the parameter is enclosed in brackets and followed by an ellipsis (...).

ASSIGN

label: ASSIGN [lfbtn],[rtbtn],[btbtn],[lfmot],[rtmot], [upmot],[dnmot],[hsen],[vsen]

Description

ASSIGN redefines one or more of the mouse parameters given in the BEGIN statement or most recent ASSIGN statement. If a parameter value isn't specified in an ASSIGN statement, the last parameter value given (in either the BEGIN statement or another ASSIGN statement) is used. Statement labels are used for all parameters except "hsen" and "vsen".

All ASSIGN statements must be labeled.

Parameters

lfbtn	New label of the first statement executed when the user clicks the left mouse button.
rtbtn	New label of the first statement executed when the user clicks the right mouse button.
btbtn	New label of the first statement executed when the user clicks both mouse buttons at once.
lfmot	New label of the first statement executed when the user moves the mouse to the left.
rtmot	New label of the first statement executed when the user moves the mouse to the right.
upmot	New label of the first statement executed when the user moves the mouse forward.
dnmot	New label of the first statement executed when the user moves the mouse backward.
hsen	New value of the horizontal movement sensitivity parameter.
vsen	New value of the vertical movement sensitivity parameter.

Example

```
BEGIN esc,ent,mm1,lf,rt,up,dn
.
.
.
reassign: ASSIGN y,not,,,,not,not,16,18
```

In this example, the BEGIN statement assigns the initial values of all button and movement parameters. Because no values are specified for the sensitivity parameters ("vsen" and "hsen"), the default values are used.

The ASSIGN statement changes the values of the left button, right button, and up and down movement parameters. (If "Not" were the label of a NOTHING statement, the ASSIGN statement would disable any response to clicking the right mouse button or moving the mouse forward or backward.) It also changes the value of "hsen" to 16 and the value of "vsen" to 18. Commas are used for the parameters whose values aren't changed.

BEGIN

BEGIN [lfbtn],[rtbtn],[btbtn],[lfmot],[rtmot],[upmot],
[dnmot],[hsen],[vsen]

Description

BEGIN defines what actions are taken when the mouse is used. Because BEGIN is always the first statement in a menu source file, it doesn't require a statement label.

The parameters for BEGIN define the statements to be executed when the mouse buttons are clicked or the mouse is moved. It also defines the movement sensitivity for the mouse. All parameters are optional. If no value is given for a button or mouse movement parameter, the corresponding function is not used.

Note When a Menu subroutine is executed, the parameters for BEGIN do not affect the mouse functions. Either mouse button can be used to choose an item in a menu, and all mouse movement functions are active.

Statement labels are required for all parameters except the mouse movement parameters. These are the labels of the statements that are executed when the event governed by each parameter occurs.

The movement sensitivity parameters control the horizontal and vertical movement sensitivity of the mouse. Movement sensitivity is the distance the mouse must move (measured in mickeys, the unit of mouse movement) before the on-screen pointer moves. (For more information about mickeys, see Chapter 5, "The Mouse Interface.")

Parameters

lfbtn	Label of the first statement executed when the user clicks the left mouse button. If you don't specify a label, nothing happens when the user clicks the left mouse button.
rtbtn	Label of the first statement executed when the user clicks the right mouse button. If you don't specify a label, nothing happens when the user clicks the right mouse button.
btbtn	Label of the first statement executed when the user clicks both mouse buttons. If you don't specify a label, nothing happens when the user clicks both mouse buttons.
lfmot	Label of the first statement executed when the user moves the mouse to the left. If you don't specify a label, nothing happens when the user moves the mouse to the left.
rtmot	Label of the first statement executed when the user moves the mouse to the right. If you don't specify a label, nothing happens when the user moves the mouse to the right.
upmot	Label of the first statement executed when the user moves the mouse forward. If you don't specify a label, nothing happens when the user moves the mouse forward.
dnmot	Label of the first statement executed when the user moves the mouse backward. If you don't specify a label, nothing happens when the user moves the mouse backward.
hsen	Number between 0 and 32767 that defines how many mickeys the mouse must move vertically before the on-screen pointer moves. If 0 is specified, the mouse is disabled horizontally. If no value is specified, the default value of 4 mickeys is used. (One mickey is approximately 1/200 inch.)
vsen	Number between 0 and 32767 that defines how many mickeys the mouse must move vertically before the on-screen pointer moves. If 0 is specified, the mouse is disabled vertically. If no value is specified, the default value of 8 mickeys is used.

Example

```
BEGIN ent,esc,,lf,rt,up,dn

lf:  TYPE 0,75    ;simulate the left cursor key
rt:  TYPE 0,77    ;simulate the right cursor key
up:  TYPE 0,72    ;simulate the up cursor key
dn:  TYPE 0,80    ;simulate the down cursor key
esc: TYPE ESC     ;simulate the Esc key
ent: TYPE ENTER   ;simulate the enter key
```

The BEGIN statement in this example gives initial values for all parameters except "btbtn", "hsen", and "vsen". Because "btbtn" isn't specified, nothing happens when the user clicks both mouse buttons. Because no values are given for "hsen" and "vsen", the default values are used (4 and 8 mickeys, respectively).

EXECUTE

label: EXECUTE statement[,statement...]

Description

EXECUTE can carry out other statements when one of the following events occurs:

- A menu item is selected
- The mouse is moved
- One or both mouse buttons are clicked
- A MATCH statement is executed

Each EXECUTE statement may specify up to 31 other statements to be executed. EXECUTE can call other EXECUTE statements to increase the number even further; up to 31 EXECUTE statements can be linked in this manner. Statements within an EXECUTE statement are executed sequentially, starting with the first statement.

Parameters

label	Name of the EXECUTE statement. All EXECUTE statements must be labeled.
statement	Name(s) of the statement(s) to be executed. Any labeled statement can be used. (Using the calling statement may cause an endless loop.)

Example

```
dir:    TYPE "dir"   ;type dir
s:      TYPE 32      ;simulate the spacebar
                     ;" " may also be used
a:      TYPE "A:"    ;type  A:
ent:    TYPE ENTER   ;simulate the ENTER key
exec4: EXECUTE dir,s,a,ent
```

The EXECUTE statement labeled "exec4" executes the statements labeled "dir", "s", "a", and "ent". These statements simulate typing *dir A:* and pressing ENTER.

MATCH

label: MATCH row,column,attribute,string,match, nomatch

Description

MATCH executes other statements or subroutines depending on whether or not it finds a specified string in a given screen location.

Values for the row and column parameters are given in absolute screen coordinates. The starting coordinates for the screen are in the upper-left corner of the screen (row 1, column 1).

Parameters

label	Name of the MATCH statement. All MATCH statements must be labeled.
row	A number that specifies the row of the first character of the match string. If no value is specified, row 1 is assigned.
column	A number that specifies the column of the first character of the match string. If no value is specified, column 1 is assigned.
attribute	A value that specifies how the match string must appear on the screen for a match to occur. This can be one of the symbolic values "normal", "bold", or "inverse", or a decimal value that denotes specific foreground and background colors. (For more information, see "Parameters" in Chapter 1, "Creating Your Own Mouse Menu.") If the attribute parameter is left blank or given the value of 0, the MATCH statement matches any attribute value.

string	The string to match. This can be any string of up to 255 ASCII characters, enclosed in double quotation marks (" "). You must specify the string parameter.
match	Label of a statement or subroutine executed if the string is matched. This label must be present in the program.
nomatch	Label of a statement or subroutine executed if the string is not matched. This label must be present in the program.

Example

```
BEGIN   leftb,rightb,bothb,mousel,mouser,mouseu,moused,16,40

leftb:  MATCH 1,12,normal,"e",imen,chk33
chk33:  MATCH 1,12,,"n",imen,chkl
chkl:   MATCH 1,11,,":",emen,not

imen:   POPUP 2,1
        .
        .
        .
        PEND
emen:   POPUP 2,1
        .
        .
        .
        PEND
not:    NOTHING
```

This sample from the WS.DEF menu source file checks whether WordStar is displaying the BEGINNING MENU or the MAIN MENU.

When the user clicks the left mouse button:

- The MATCH statement labeled "leftb" looks for an "e" at row 1, column 12. This is the first character in the string "editing no file", which is on the screen in that position if WordStar version 3.2 is displaying the BEGINNING MENU.

If "leftb" finds the "e" in that position, it executes the statement labeled "imen". (In WS.DEF, "imen" displays the NO-FILE popup menu for WordStar.)

If "leftb" doesn't find the "e" in that position, it executes the statement labeled "chk33".

- The "chk33" statement looks for the letter "n" at row 1, column 12. This is the first character in the string "not editing", which is on the screen in that position if WordStar version 3.3 is displaying the BEGINNING MENU.

  If "chk33" finds the "n" in that position, it executes the statement labeled "imen". (In WS.DEF, "imen" displays the NO-FILE popup menu for WordStar.)

  If "chk33" doesn't find the "n" in that position, it executes the statement labeled "chkl".

- The "chkl" statement looks for a colon (:) after the disk drive identifier in the first line of the WordStar MAIN MENU display.

  If "chkl" finds a colon, it executes the statement labeled "emen". (In WS.DEF, "emen" displays the EDIT/BLOCK popup menu.)

  If "chkl" doesn't find a colon, the menu program does nothing.

MENU...MEND

```
label:  MENU  ["title"],[row],[column],[attribute]
        .
        .
        .
        MEND
```

Description

The MENU statement is the first statement in a Menu subroutine. A Menu subroutine creates a single-column popup menu. (For an example of the format of a Menu subroutine, see "Menu Sub- routine Statements" in Chapter 1, "Creating Your Own Mouse Menu.")

Menus created with a Menu subroutine are bordered, single-column menus. The specific dimensions of a menu are determined by the number of items in a menu and the largest number of characters in either the longest menu item or the menu title.

When the menu is displayed, the first menu item (if any) is highlighted. The user chooses any menu item by moving the mouse until that item is highlighted, then clicking either mouse button. If the user clicks both mouse buttons, the equivalent of a NOTHING statement is executed and the menu disappears.

The MEND ("menu end") statement indicates the end of a Menu subroutine. Each Menu subroutine must have a MEND statement. MEND statements are not labeled.

Parameters

label	Name of the Menu subroutine. All Menu subroutines must be labeled.
title	Text of the menu title, enclosed in double quotation marks (" "). The menu title is limited to one line above the rest of the menu. If you don't specify a title, a blank line is used.
row	A number that specifies the row where the top-left corner of the menu appears. Be sure to specify a value that allows the entire menu to be displayed. (For example, if the menu contains 20 items and you choose a row value greater than 5, then some of the screen items will not be displayed on the 25-row screen.) If you don't specify a row, the top-left corner is in row 1.
column	A number that specifies the column where the top-left corner of the menu appears. If you don't specify a column, the top-left corner is in column 1.
attribute	A value that specifies how the menu is displayed on the screen. This can be "normal", "bold", or "inverse", or a decimal value that specifies particular foreground and background colors. (For more information, see "Parameters" in Chapter 1, "Creating Your Own Mouse Menu.") If you don't specify a value, inverse is used. The colors of the mouse pointer depend on the display attribute value for the menu. (For detailed information on how the interaction between the mouse pointer and menu display determine the colors of the pointer, see "Graphics Cursor" in Chapter 5, "The Mouse Interface.")

Example

```
menu1: MENU    "Display Directory",5,5,normal
       OPTION  "Cancel"
       OPTION  "A:",ex1
       OPTION  "B:",ex2
       OPTION  "C:",ex3
       MEND

ex1:   EXECUTE dir,s,a,ent    ;dir A:
ex2:   EXECUTE dir,s,b,ent    ;dir B:
ex3:   EXECUTE dir,s,c,ent    ;dir C:
ent:   TYPE 13                ;simulate the enter key
dir:   TYPE "dir"             ;type dir
a:     TYPE "A:"              ;type A:
b:     TYPE "B:"              ;type B:
c:     TYPE "C:"              ;type C:
s:     TYPE 32                ;type a space
```

In this example, the MENU statement uses all four parameters. The menu title is "Display Directory". The top-left column of the menu is in row 5, column 5. The menu is displayed with a normal screen attribute.

The OPTION statements specify which statements are executed when the user chooses items from the menu. (For more information about the OPTION statement, see "OPTION" later in this chapter.)

NOTHING

label: NOTHING

Description

Use the NOTHING statement to specify that no action is taken when the user clicks a mouse button, moves the mouse, or chooses a menu option, or when a MATCH statement is executed. A NOTHING statement must be labeled.

Example

```
rightb:  MATCH 1,11,NORMAL, ":",movmen,nul
.
.
.
movmen:  POPUP 2,1
TEXT "======= CURSOR MOVEMENT ======"
.
.
.
nul:     NOTHING
```

This example from the WS.DEF Mouse Menu program determines which popup menu is displayed when the user clicks the right mouse button.

- If the MATCH statement finds the specified character, it executes the statement labeled "movmen" to display the CURSOR MOVEMENT popup menu.
- If the MATCH statement doesn't find the specified character, it executes the NOTHING statement labeled "nul", and the Mouse Menu program does nothing.

OPTION

[label:] OPTION [text],[pointer]

Description

OPTION statements define each menu item in a Menu subroutine. OPTION parameters define the text of the menu item and what happens when the user chooses the menu item.

OPTION statements are usually not labeled, although they can be. If they are labeled, the MAKEMENU program ignores the labels when assembling the source program.

Parameters

text	Legend text for the menu item. The legend text must be enclosed in double quotation marks (" "). If you don't specify legend text for a menu item, the menu displays a blank line for that item.
pointer	Label of the statement that is executed when the user chooses the menu item. If you don't include a pointer parameter, the menu is cleared from the screen when the user chooses the menu item. (For example, you'd leave out the pointer parameter for a "cancel menu" item.)

Example

```
menu5:   MENU    "Format",5,5,normal
         OPTION  "Cancel"
         OPTION  "A:",ex16
         OPTION  "B:",ex17
         OPTION  "C:",ex18
         MEND
```

This example shows OPTION statements that define four menu items. If the user chooses the first menu item, the menu is cleared from the screen because the OPTION statement has no pointer parameter. If the user chooses any other menu item, the specified statement is executed.

POPUP...PEND

```
label: POPUP  [row],[column],[attribute]
       .
       .
       .
       PEND
```

Description

The POPUP statement is the first statement in a Popup subroutine. A Popup subroutine creates a multiple-column menu or a message box. (For an example of the format of a Popup subroutine, see "Popup Subroutine Statements" in Chapter 1, "Creating Your Own Mouse Menu.")

The PEND ("popup end") statement indicates the end of a Popup subroutine. Each Popup subroutine must have a PEND statement. PEND statements are not labeled.

Parameters

label	Name of the Popup subroutine. All POPUP statements must be labeled.
row	A number that specifies the row where the top-left corner of the menu or message box appears. Be sure to specify a value that allows the entire menu or message box to be displayed. (For example, if the menu or message box takes up 20 lines and you choose a row value greater than 5, then some of the screen items will not be displayed on the 25-row screen.) If you don't specify a row, the top-left corner is in row 1.

column — A number that specifies the column where the top-left corner of the menu or message box appears. If you don't specify a column, the top-left corner is in column 1.

attribute — A value that specifies how the menu is displayed on the screen. This can be "normal", "bold", or "inverse", or a decimal value that specifies particular foreground and background colors. (For more information, see "Parameters" in Chapter 1, "Creating Your Own Mouse Menu.") If you don't specify a value, inverse is used. The colors of the mouse pointer depend on the display attribute value for the menu. (For detailed information on how the interaction between the mouse pointer and menu display determine the colors of the pointer, see "Graphics Cursor" in Chapter 5, "The Mouse Interface.")

Examples

This example from the VC.DEF Mouse Menu program is a Popup subroutine for a multiple-column menu:

```
DELETE:  POPUP 2,1,inverse
         TEXT "Delete: Row Column "
         SELECT 1,9,3,DR
         SELECT 1,13,6,DC
         PEND

DR:      TYPE "/dr"
DC:      TYPE "/dc"
```

The POPUP statement defines the top-left corner of the menu as row 2, column 1. The menu contains the menu title and the menu items on the same line, as shown by the single TEXT statement. The two SELECT statements define the item selection areas. (For more information about SELECT and TEXT, see "SELECT" and "TEXT" later in this chapter.)

This example from the WS.DEF Mouse Menu program is a Popup subroutine for a message box:

```
mousehlp: popup 2,1
   text " ================ MOUSE HELP ==================== "
   text "|                                                 |"
   text "| Left button  - Displays Edit/Block menu         |"
   text "| Right button - Displays Cursor movement menu    |"
   text "| Both buttons - Displays Edit/File menu          |"
   text "|                                                 |"
   text "| Moving the mouse up,down,left, or right will    |"
   text "| cause the cursor to move in that direction.     |"
   text "|                                                 |"
   text " ================================================= "
   select 1,18,10
   pend
```

In this example, ASCII graphics characters are used to create solid double borders for the menu. The single SELECT statement is used to clear the message box from the screen. (Since the label for an executable statement is not included in the SELECT statement, clicking a mouse button simply clears the message box from the screen.)

SELECT

SELECT row,column,width[,pointer]

Description

The SELECT statement is used in Popup subroutines to define selection areas for items on the menu. It also specifies which statement is executed if the cursor is in the defined area. The defined area does not have to contain any text. (For more information about the TEXT statement, see "TEXT" later in this chapter.)

SELECT statements do not have labels.

Note The highlight in a menu or message box jumps from one defined selection area to another when the user moves the mouse. It is a good idea to define each part of a menu with a SELECT statement so that the movement of the highlight and the mouse are visually coordinated. However, make sure you don't define the same screen position with more than one SELECT statement.

Parameters

row	A number that defines the horizontal starting point (row) of the item selection area. The defined area is relative to the "row" and "column" coordinates specified in the POPUP statement.
column	A number that defines the vertical starting point (column) of the item selection area. The defined area is relative to the "row" and "column" coordinates specified in the POPUP statement.

width	The number of characters in the item selection area. If you don't specify a number, one character is assumed.
pointer	Label of the statement executed when the user chooses the menu item. If a pointer parameter isn't included, the menu is cleared from the screen.

Examples

For examples of how to use SELECT statements, see "Popup Subroutine Statements" in Chapter 1, "Creating Your Own Mouse Menu" and "POPUP...PEND" earlier in this chapter.

TEXT

TEXT "string"

Description

TEXT is used in Popup subroutines to define the menu title and the legend text for menu items. It is similar to the "title" and "text" parameters in the MENU and OPTION statements, but allows text to be placed anywhere on the screen below and to the right of the upper-left corner specified for the popup menu.

Parameter

string	Defines the popup menu title or the legend text of a menu item. Text may include ASCII graphics characters. All text must be enclosed in double quotation marks (" "). Text location on the screen is relative to the top-left corner of the popup menu. Text display attributes are determined by the attribute parameter in the POPUP statement.

Examples

For examples of how to use TEXT statements, see "Popup Subroutine Statements" in Chapter 1, "Creating Your Own Mouse Menu," and "POPUP...PEND" earlier in this chapter.

TYPE

label: TYPE key [,key . . .]

Description

A TYPE statement simulates typing one or more keystrokes. Keys are specified by enclosing the keystroke(s) in double quotation marks, using the ASCII code that corresponds to the key(s), using a predefined symbolic key name, or, for certain special-function keys, using the key's extended keyboard scan code.

Note All keys specified in the TYPE statement are inserted into a keyboard buffer when the menu program is running and are not output as keystrokes until the menu program becomes inactive.

Parameters

label — Name of the TYPE statement. Every TYPE statement must be labeled.

key — Name of the key. It can be:

- A single letter or number enclosed in double quotation marks (" "), or a sequence of keystrokes enclosed in double quotation marks (such as "dir")
- A standard ASCII code (characters 0 through 127), or an extended ASCII code (characters 128 through 255)
- An extended keyboard scan code
- Any of the following predefined symbolic keys: "enter", "tab", "backsp", "esc".

Note If you want to simulate typing a quotation mark ("), use ASCII code 34.

The ASCII control characters (0 through 31) and extended keyboard scan codes that you can use with the TYPE statement are listed after the examples below. Refer to the IBM *BASIC* manual for a complete list of ASCII character codes.

Examples

These TYPE statements use character strings to define the keystrokes:

```
dir:    TYPE "dir"   ;type the command "dir"
a:      TYPE "a:"    ;type "a:"
```

This TYPE statement uses an ASCII code to simulate typing a space:

```
s:      TYPE 32      ;type a space
```

These TYPE statements use extended keyboard scan codes to simulate the arrow keys:

```
lf:     TYPE 0,75    ;simulate the left arrow key
rt:     TYPE 0,77    ;simulate the right arrow key
up:     TYPE 0,72    ;simulate the up arrow key
dn:     TYPE 0,80    ;simulate the down arrow key
```

ASCII Control Characters and Extended Keyboard Scan Codes

This section lists the functions of the ASCII control characters and the extended keyboard scan codes when used with the TYPE statement. (See the IBM *BASIC* manual for a complete list of ASCII codes.) It also lists the key sequences that cannot be simulated using the TYPE statement.

Note The output characteristics listed for particular key functions are for a mouse menu running at the DOS level. A standard application may not interpret all keyboard operations in the same way. Applications that reprogram or directly access the keyboard, or bypass the DOS system facilities for keyboard input, may not function correctly with mouse menus.

ASCII Control Characters The following table lists the function of each ASCII control character when used with the TYPE statement:

ASCII code	Key equivalent	ASCII code	Key equivalent
0	none	16	CONTROL-P
1	CONTROL-A	17	CONTROL-Q
2	CONTROL-B	18	CONTROL-R
3	CONTROL-C	19	CONTROL-S
4	CONTROL-D	20	CONTROL-T
5	CONTROL-E	21	CONTROL-U
6	CONTROL-F	22	CONTROL-V
7	CONTROL-G	23	CONTROL-W
8	backspace	24	CONTROL-X
9	horizontal tab	25	CONTROL-Y
10	line feed	26	CONTROL-Z
11	CONTROL-K	27	ESCAPE
12	CONTROL-L	28	CONTROL-\
13	carriage return	29	CONTROL-]
14	CONTROL-N	30	CONTROL-^
15	CONTROL-O	31	CONTROL-_

Extended Keyboard Scan Codes Extended keyboard scan codes have two components: a character code (which is always 0) and a scan code (for example, "0,75"). The tables below list the scan codes you can use with the TYPE statement and the character code 0 to simulate specific keystrokes. (Standard or extended ASCII characters cannot be used as extended keyboard scan codes.)

Keystroke(s)	Scan code
HOME	71
CONTROL-HOME	119
up arrow key	72
down arrow key	80
left arrow key	75
CONTROL-left arrow key	115
right arrow key	77
CONTROL-right arrow key	116
END	79
CONTROL-END	117
PAGEUP	73
CONTROL-PAGEUP	132
PAGEDOWN	81
CONTROL-PAGEDOWN	118
CONTROL-PRINTSCREEN	114
INSERT	82
DELETE	83
SHIFT-TAB	15

Keystroke(s)	Scan code	Keystroke(s)	Scan code
F1	59	ALT-0	129
F2	60	ALT-1	120
F3	61	ALT-2	121
F4	62	ALT-3	122
F5	63	ALT-4	123
F6	64	ALT-5	124
F7	65	ALT-6	125
F8	66	ALT-7	126
F9	67	ALT-8	127
F10	68	ALT-9	128
SHIFT-F1 (F11)	84	ALT--	130
SHIFT-F2 (F12)	85	ALT-=	131
SHIFT-F3 (F13)	86	ALT-A	30
SHIFT-F4 (F14)	87	ALT-B	48
SHIFT-F5 (F15)	88	ALT-C	46
SHIFT-F6 (F16)	89	ALT-D	32
SHIFT-F7 (F17)	90	ALT-E	18
SHIFT-F8 (F18)	91	ALT-F	33
SHIFT-F9 (F19)	92	ALT-G	34
SHIFT-F10 (F20)	93	ALT-H	35

Keystroke(s)	Scan code	Keystroke(s)	Scan code
CONTROL-F1 (F21)	94	ALT-I	23
CONTROL-F2 (F22)	95	ALT-J	36
CONTROL-F3 (F23)	96	ALT-K	37
CONTROL-F4 (F24)	97	ALT-L	38
CONTROL-F5 (F25)	98	ALT-M	50
CONTROL-F6 (F26)	99	ALT-N	49
CONTROL-F7 (F27)	100	ALT-O	24
CONTROL-F8 (F28)	101	ALT-P	25
CONTROL-F9 (F29)	102	ALT-Q	16
CONTROL-F10 (F30)	103	ALT-R	19
ALT-F1 (F31)	104	ALT-S	31
ALT-F2 (F32)	105	ALT-T	20
ALT-F3 (F33)	106	ALT-U	22
ALT-F4 (F34)	107	ALT-V	47
ALT-F5 (F35)	108	ALT-W	17
ALT-F6 (F36)	109	ALT-X	45
ALT-F7 (F37)	110	ALT-Y	21
ALT-F8 (F38)	111	ALT-Z	44
ALT-F9 (F39)	112		
ALT-F10 (F40)	113		

Key Sequences That Cannot Be Simulated

Some key sequences cannot be simulated using the TYPE statement because they are suppressed in the ROM (Read-Only Memory) BIOS (Basic Input/Output System) keyboard routine. These include the following key combinations:

SHIFT-PRINTSCREEN

ALT-BACKSPACE

ALT-ESCAPE

ALT plus one of the following characters: [ ] ; ' ` , . / *

ALT plus one of the following keys: ENTER, CONTROL, SHIFT, CAPS LOCK, NUM LOCK, SCROLL LOCK

ALT plus one of the arrow keys

CONTROL plus one of the following characters: 1 3 4 5 7 8 9 0 = ; ' ` , . /

CONTROL plus one of the following keys: TAB, SHIFT, CAPS LOCK, NUM LOCK

CONTROL-BREAK

CONTROL-ALT-DELETE

CONTROL plus one of the arrow keys

CONTROL-INSERT

3 Sample Mouse Menu Programs

This chapter includes the source program listings for two basic Mouse Menu programs that simplify some of the tasks commonly performed on an IBM PC or compatible computer:

- The SIMPLE Mouse Menu program allows you to simulate pressing the ENTER, ESCAPE, INSERT, and arrow keys by either clicking or moving the mouse.
- The DOSOVRLY Mouse Menu program allows you to execute simple DOS commands by using the mouse to choose the commands from a menu rather than typing them on the keyboard.

You can type the source program listing for either mouse menu into a source file, run MAKEMENU to generate an executable Mouse Menu file, then start using the mouse menu immediately. Or you may want to use these listings as a basis for designing similar mouse menus that include additional features specific to your needs.

SIMPLE Mouse Menu Program

The SIMPLE Mouse Menu allows you to use the mouse instead of typing a few commonly used keys. It is most helpful when used with applications that require frequent use of the arrow keys. For example, in many spreadsheet applications you must press the arrow keys on your keyboard to move the cursor on the screen. If the SIMPLE Mouse Menu is installed, you can move the cursor on the screen by simply moving the mouse on your desk top. In addition, clicking the left mouse button is equivalent to pressing the ENTER key, clicking the right mouse button simulates pressing the ESCAPE key, and clicking both mouse buttons at once is the same as pressing the INSERT

key. If your application does not use one of these keys, and you click the corresponding mouse button(s) by accident, the application will respond as if you had typed the key on the keyboard. You can correct the mistake as you would any typing error.

SIMPLE Mouse Menu Source Program

```
; A menu to simulate arrow, enter, escape,
; and insert keys
;
;
begin ent,es,ins,lf,rt,up,dn,32,16
;
ent:  type enter
es:   type esc
ins:  type 0,82
;
lf:   type 0,75
rt:   type 0,77
up:   type 0,72
dn:   type 0,80
```

DOSOVRLY Mouse Menu Program

The DOSOVRLY Mouse Menu allows you to choose several commonly used DOS commands at the DOS command level by simply pointing to an option on a menu and clicking the mouse. In other words, this mouse menu "overlays" DOS.

In addition to a main menu, the DOSOVRLY Mouse Menu program has two submenus, "Directory" and "Change Directory," which each list additional DOS commands. The source program for DOSOVRLY is a good example of how you might create a hierarchy of menus and submenus in one of your own Mouse Menu programs.

The DOSOVRLY Mouse Menu provides several features that are useful at the DOS command level:

- Moving the mouse left and right simulates pressing the left and right arrow keys. This allows you to edit your DOS commands by just moving the mouse.
- Clicking the right mouse button simulates pressing the ENTER key.

- Clicking both mouse buttons at once simulates typing *cls*, the DOS command for clearing the screen.
- Clicking the left mouse button displays the DOSOVRLY main menu. Options on this menu allow you to clear the screen, execute the DATE or TIME command, or choose "DIRECTORY" or "CHANGE DIRECTORY" to view the corresponding submenus of DOS commands. To select a menu option, move the highlight to the option, then click either mouse button. From within a submenu, you can choose an option to move to the other submenu or click the left mouse button to return to the main menu.

Note In the DOSOVRLY source program, the lb, rb, bb, lm, and rm parameters specified in the BEGIN statement are labels for EXECUTE statements. These EXECUTE statements branch off to the appropriate TYPE statements. This format demonstrates how you can use the EXECUTE statement in your Mouse Menu programs. This program could be simplified by branching directly from the BEGIN statement to the TYPE statements using: BEGIN mnu1,return,cls,left,right

DOSOVRLY Mouse Menu Source Program

```
BEGIN lb,rb,bb,lm,rm
lb:  execute mnu1     ; main menu if left button
rb:  execute return   ; type enter if right button
bb:  execute cls      ; type CLS if both buttons
lm:  execute left     ; left arrow if left motion
rm:  execute right    ; right arrow if right motion
;
mnu1: MENU "Main Menu",2,55,NORMAL
   option "cancel              ",none
   option "clear the screen ",cls
   option "date                ",date
   option "time                ",time
   option "DIRECTORY           ",mnu3
   option "CHANGE DIRECTORY ",mnu2
   MEND
;
mnu2: MENU "Change Directory",2,55,NORMAL
   option "cancel              ",none
   option "cd ..               ",cd1
   option "cd                  ",cd2
   option "DIRECTORY           ",mnu3
   option "MAIN MENU           ",mnu1
   MEND
;
mnu3: MENU "Directory",2,55,NORMAL
   option "cancel              ",none
```

```
    option "dir                ",dir
    option "dir *.exe          ",dire
    option "dir *.bat          ",dirb
    option "dir *.bak          ",dirx
    option "dir *.sys          ",dirs
    option "dir *.doc          ",dird
    option "dir *.             ",dirz
    option "CHANGE DIRECTORY ",mnu2
    option "MAIN MENU          ",mnu1
    MEND
;
none:       nothing             ; do nothing
;
return:     type enter
cls:        type "cls",enter
left:       type 0,75           ; left arrow
right:      type 0,77           ; right arrow
date:       type "date",enter
time:       type "time",enter
cd1:        type "cd ..",enter
cd2:        type "cd
dir:        type "dir",enter
dire:       type "dir *.exe",enter
dirb:       type "dir *.bat",enter
dirx:       type "dir *.bak",enter
dirs:       type "dir *.sys",enter
dird:       type "dir *.doc",enter
dirz:       type "dir *."
```

4 Mouse Menu Messages

This chapter lists the messages that the MENU and MAKEMENU programs can display, along with descriptions of possible causes and what actions you may take in response to them.

Conversion completed

- *The MAKEMENU program finished creating an executable menu file.*

  No action is required. The DOS system prompt appears after MAKEMENU displays this message.

Error--Invalid statement: *xxxx*

- *Either the statement had no label, the statement's label didn't end with a colon (:), or the statement had an invalid parameter or syntax error.*

  Make sure that all statements (except the BEGIN statement and statements within Menu and Popup subroutines) are labeled. Make sure that all labels are followed by a colon. Check the statement syntax for correct use of commas and spaces.

Error--Label already used: */abel*

- *The same label was used to name more than one statement.*

  Make sure that labels are unique for each statement.

Error--Label not found: *xxxx*

- *A label specified for a parameter did not exist.*

  Make sure that the statements have labels and that the labels are correct.

Illegal function call at address *xxxxxx*

- *A TYPE or EXECUTE statement had too many parameters, a SELECT statement defined the item selection area outside of the menu, or a SELECT or an OPTION statement had quotation marks placed incorrectly.*

  Use the correct number of parameters, redefine the item selection area, or ensure that double quotation marks are used correctly to designate text strings.

Keyboard emulation off

- *The Mouse Menu program is no longer running.*

  No action is required.

Keyboard emulation on

- *The Mouse Menu program is running.*

  No action is required.

Menu installed

- *You started up a Mouse Menu program, and it is running.*

  No action is required. Use the mouse menu as usual.

Name of file to convert:

- *You typed "makemenu" to create an executable Mouse Menu file.*

  Type in a Mouse Menu filename without the ".DEF" extension.

Mouse Interfaces

Designing Mouse Interfaces

This section provides the technical information you need to design a mouse interface for one of your own application programs. To build mouse support into your program, you'll include calls to a set of mouse functions. You can make mouse function calls from the BASIC interpreter, from assembly-language programs, and from programs in high-level languages such as Microsoft QuickBASIC, Pascal, FORTAN, and C.

Chapter 5, "The Mouse Interface," describes the interface between the computer screen and the Microsoft Mouse software.

Chapter 6, "Mouse Function Descriptions," describes the input, output, and operation of each function call your program can make to the mouse driver.

Chapter 7, "Making Mouse Function Calls," describes how to make mouse function calls from interpreted BASIC, assembly, and high-level-language programs. It also includes the source listing for the Piano demonstration program that came in your Microsoft Mouse package, and explains how to specify eight mouse cursor shapes.

Chapter 8, "Writing Mouse Programs for IBM EGA Modes," explains how to use the Microsoft EGA Register Interface when your program includes mouse support for IBM enhanced graphics modes D, E, F, and 10.

5 The Mouse Interface

This chapter describes the interface between the mouse software and the IBM PC. In particular, it discusses how the mouse software uses certain features of the computer to create a cursor on the screen and control its movement. This chapter talks about:

- Screen modes
- The virtual screen
- Graphics and text cursors
- Mouse buttons
- The mouse unit of distance: the mickey
- The internal cursor flag

Since many of the mouse functions use the interface, it is important for you to read the following sections carefully and understand them before you use the functions in application programs.

Screen Modes

The screen mode defines the number of pixels (points of light) on the screen and the types of objects that appear on the screen. The available screen modes depend on the adapter in your computer. These screen modes and the adapters on which they are supported are listed in the table on the next page. (Specific information about each screen mode is given in the documentation for each adapter.)

Screen Mode	Display Adapter	Virtual Screen (X x Y)	Cell Size	Bits/Pixel (Graphics Modes)
0	C,E,3270	640 x 200	16 x 8	—
1	C,E,3270	640 x 200	16 x 8	—
2	C,E,3270	640 x 200	8 x 8	—
3	C,E,3270	640 x 200	8 x 8	—
4	C,E,3270	640 x 200	2 x 1	2
5	C,E,3270	640 x 200	2 x 1	2
6	C,E,3270	640 x 200	1 x 1	1
7	M,E,3270	640 x 200	8 x 8	—
D	E	640 x 200	16 x 8	2
E	E	640 x 200	1 x 1	1
F	E	640 x 350	1 x 1	1
10	E	640 x 350	1 x 1	1
30	3270	720 x 350	1 x 1	1
—	H	720 x 348	1 x 1	1

Display adapters:

M = IBM Monochrome Display/Printer Adapter
C = IBM Color/Graphics Monitor Adapter
E = IBM Enhanced Graphics Adapter
3270 = IBM All Points Addressable Graphics Adapter (3270 PC)
H = Hercules Monochrome Graphics Card

The Virtual Screen

The mouse software operates on the computer screen as if it were a *virtual screen* of individual points arranged in a matrix of horizontal and vertical points. The "Virtual Screen" column in the table above gives the number of horizontal and vertical points in the matrix for each supported screen mode.

Whenever interrupt 10h is called to change the screen mode, the mouse software intercepts the call and determines which virtual screen to use. The mouse software also reads the screen mode and chooses the appropriate virtual screen whenever mouse function 0 is called to reset default parameter values in the mouse software.

Regardless of the screen mode, the software uses a pair of virtual-screen coordinates to locate an object on the screen. Each pair of coordinates defines a point on the virtual screen. The horizontal coordinate is given first.

Many mouse functions take virtual-screen coordinates as input or return them as output. Whenever you refer to a pixel or character in a mouse function, make sure that the horizontal and vertical coordinates are the correct values for the given screen mode. The mouse functions always return correct values for the given screen mode.

Graphics modes 6, E, F, 10, and 30

In graphics modes 6, E, F, 10, and 30, and for the Hercules graphics display modes, each point in the virtual screen has a one-to-one correspondence with each pixel on the screen. In these modes, the full range of coordinates in the "Virtual Screen" column is permitted.

Graphics modes 4 and 5

In graphics modes 4 and 5, the screen has half the number of pixels that it has in the other graphics modes. To compensate, the mouse software uses only even-numbered horizontal coordinates. This means that every *other* point in the virtual screen corresponds to a pixel.

Text modes 2, 3, and 7

In text modes 2, 3, and 7, only characters are permitted on the screen. Each character is an 8-by-8-pixel group (see the "Cell Size" column in the table).

Because the mouse software cannot access the individual pixels in a character, it uses the coordinates of the pixel in the upper-left corner of the cell for the character's location. Since each character is an 8-by-8-pixel group, both the horizontal and vertical coordinates are multiples of eight.

For example, the character in the upper-left corner of the screen has the coordinates (0,0), and the character immediately to the right of it has the coordinates (8,0).

Text modes 0 and 1

In text modes 0 and 1, as in text modes 2, 3, and 7, only characters are permitted on the screen. Each character is a 16-by-8-pixel group (see "Cell Size" in the table).

The mouse software uses the coordinates of just one pixel in a character for the character's location. However, the screen has only half as many pixels as in modes 2, 3, and 7. To compensate, the mouse software uses horizontal coordinates that are multiples of 16.

For example, the character in the upper-left corner of the screen has the coordinates (0,0), and the character immediately to the right of it has the coordinates (16,0).

Graphics and Text Cursors

The mouse has three different cursors:

- The *graphics cursor* is a shape (for example, an arrow) that moves over the images on the screen.
- The *software text cursor* is a character attribute (for example, an underscore) that moves from character to character on the screen.
- The *hardware text cursor* is a flashing block, half-block, or underscore that moves from character to character on the screen.

The mouse software supports only one of these cursors on the screen at any time. In your application program, you can choose which cursor is on the screen, and even switch back and forth between cursors.

Mouse functions 9 and 10 permit you to define the characteristics of these cursors in your application program. You can define the characteristics yourself, or use the characteristics of the sample cursors provided. For more information about the sample cursors, see Chapter 7, "Making Mouse Function Calls."

The following paragraphs describe the cursors in detail.

Graphics Cursor

The graphics cursor, used when the computer is in one of the graphics modes, is a block of pixels.

- In modes 6, E, F, 10, and 30, and for the Hercules Monochrome Graphics Card, it is 256 pixels in a 16-by-16-pixel square.
- In modes 4 and 5, it is 128 pixels in an 8-by-16-pixel square.

As the mouse moves, the block moves over the screen and interacts with the pixels directly under it. This interaction creates the cursor shape and background.

Screen mask and cursor mask

The interaction between the cursor points and screen pixels is defined by two 16-by-16-bit arrays: the *screen mask* and the *cursor mask*.

- The screen mask determines whether the cursor pixel is part of the shape or background.
- The cursor mask determines how the pixel under the cursor contributes to the color of the cursor.

In your application program, you can specify the shapes of the screen mask and cursor mask by defining them as arrays and passing these arrays as parameters in a call to mouse function 9. (For more information, see the description of function 9 in Chapter 6, "Mouse Function Descriptions.")

The interactions between the screen mask and the cursor mask differ somewhat between graphics modes 4, 5, 6, F, and 30 and the IBM Enhanced Graphics Adapter graphics modes E and 10.

Modes 4, 5, 6, F, and 30, and the Hercules Graphics Card

In modes 6, F, and 30, and for the Hercules Graphics Card, each bit in the masks corresponds to a pixel in the cursor block. In modes 4 and 5, each pair of bits corresponds to a pixel.

To create the cursor, the mouse software operates on the data in the computer's screen memory that defines the color of each pixel on the screen. First, the software logically ANDs the screen mask with the 256 bits of data that define the pixels under the cursor. Then, it logically XORs the cursor mask with the result of the AND operation. The following table shows how these operations affect the individual screen bits:

If the screen mask bit is	And the cursor mask bit is	The resulting screen bit is
0	0	0
0	1	1
1	0	unchanged
1	1	inverted

In modes 6, F, and 30, and for the Hercules Graphics Card, each screen bit defines the color of a single pixel. Therefore, one bit in the screen mask and one bit in the

cursor mask define the pixel's color when the cursor is over it. For example, if the first bit in the screen mask is 1 and the first bit in the cursor mask is 0, then the upper-left corner of the cursor block is transparent.

In modes 4 and 5, each *pair* of screen bits defines the color of a pixel. Therefore, a pair of bits in the screen mask and a pair in the cursor mask define a pixel's color.

Modes E and 10

In EGA four-plane modes E and 10, as in modes 6, F, and 30, each bit in the screen mask and cursor mask corresponds to a pixel in the cursor block.

The cursor mask and screen mask are stored in off-screen memory. Each plane has its own cursor mask and screen mask. Therefore, for each plane, the "resulting screen bit" in the table on the previous page is actually the bit used in the color table lookup on the EGA.

In modes E and 10, the mouse driver automatically sets the write mask register on the EGA to all 1s. Therefore, when your application program calls mouse function 9 to set the cursor shape, the cursor pixels may be either black, white, transparent, or inverted.

The mouse driver does not support color cursors in modes E and 10.

Graphics cursor "hot spot"

Whenever a mouse function refers to the graphics cursor location, it gives the point on the virtual screen that lies directly under the cursor's *hot spot*. The hot spot is the point in the cursor block that the mouse software uses to determine the cursor coordinates.

You can define the hot spot in the cursor block by passing the horizontal and vertical coordinates of the point to mouse function 9. The coordinates can be within the range −16 to 16; however, in modes 4 and 5, the horizontal coordinate must be an even number. In all graphics modes, the coordinates are relative to the upper-left corner of the cursor block.

Software Text Cursor

The software text cursor is used when the computer is in one of the text modes.

The text cursor affects how characters appear on the screen. Unlike the graphics cursor, the text cursor usually does not have a shape of its own. Instead, it changes the character attributes (such as foreground and background color, intensity, and underscoring) of the character directly under it. If the cursor does have a shape of

its own, it is one of the 256 characters in the ASCII character set.

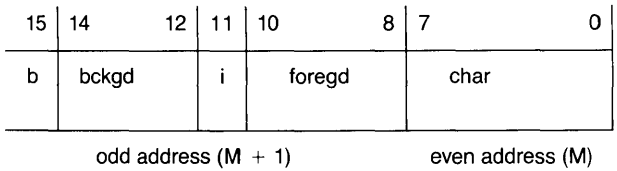
Screen mask and cursor mask

The effect of the text cursor on the character under it is defined by two 16-bit values called the *screen mask* and the *cursor mask*.

- The screen mask determines which of the character's attributes are preserved.
- The cursor mask determines how these attributes are changed to yield the cursor.

To create the cursor, the mouse software operates on the data that defines each character on the screen. The software first logically ANDs the screen mask and the 16 bits of screen data for the character under the cursor. It then logically XORs the cursor mask and the result of the AND operation.

The 16 bits of screen data for each character take the following form:



5.1 Screen Data for Character

In Figure 5.1:

Bit(s)	Purpose
15 (b)	Sets blinking or nonblinking character
12–14 (bckgd)	Set the background color
11 (i)	Sets high intensity or medium intensity
8–10 (foregd)	Set the foreground color
0–7 (char)	ASCII value of the character

The range of values for each field depends on the display adapter in the computer. (See the display adapter documentation for details.)

The screen mask and cursor mask are divided into the same fields as those shown in Figure 5.1. The values of these fields in the screen mask and cursor mask define the character's new attributes when the cursor is over the character.

For example, to invert the foreground and background colors, the screen mask and cursor mask should have the values shown in Figure 5.2:

5.2 Sample Screen/Cursor Mask Values

	b	bckgd	i	foregd	char	=
screen mask	0	111	0	111	11111111	&H77FF
cursor mask	0	111	0	111	00000000	&H7700

In your application program, you can define the values of the screen mask and cursor mask by passing their values as parameters to mouse function 10. (For more information, see the description of function 10 in Chapter 6, "Mouse Function Descriptions.")

Whenever a mouse function refers to the text cursor location, it gives the coordinates of the character under the cursor. The text cursor does not have a hot spot.

Hardware Text Cursor

The hardware text cursor is another cursor that can be used when the computer is in one of the text modes.

The hardware text cursor is actually the computer's cursor (the one you see on the screen after the DOS system-level prompt). The mouse software allows you to adapt this cursor to your needs.

Scan lines

The hardware cursor is 8 pixels wide and 8 to 14 pixels tall. Each horizontal set of pixels forms a line called a *scan line*. There are 8 to 14 scan lines.

A scan line can be on or off. If a scan line is on, it appears as a flashing bar on the screen. If a scan line is off, it has no effect on the screen. Your program can define which lines are on and which are off by passing the numbers of the first and last lines in the cursor to mouse function 10.

The number of lines in the cursor depends on the display adapter in the computer.

- If the computer has an IBM Color/Graphics Monitor Adapter, the cursor has 8 lines, numbered 0 to 7.
- If the computer has an IBM Monochrome Display and Printer Adapter, the cursor has 14 lines, numbered 0 to 13.
- If the computer has an IBM Enhanced Graphics Adapter and an IBM Color Display, the cursor has 8 lines, numbered 0 to 7. If the computer has an IBM Enhanced Graphics Adapter and an IBM Enhanced Color Display, the cursor has 14 lines, numbered 0 to 13.

Note Only block cursors are supported on the 3270 PC.

Mouse Buttons

Mouse functions 5 and 6 read the state of the mouse buttons and keep a count of the number of times the buttons are pressed and released.

A button state is *pressed* if the button is down, and *released* if the button is up. When a mouse function returns the state of the buttons, it returns an integer value in which the first 2 bits are set or cleared. Bit 0 represents the state of the left button, and bit 1 represents the state of the right button. If a bit is set (equal to 1), the button is down. If a bit is clear (equal to 0), the button is up.

The mouse software increments a counter each time the corresponding button is pressed or released. The software sets a counter to 0 after a reset (mouse function 0) or after a counter's contents are read.

Mouse Unit of Distance: The Mickey

The motion of the mouse track ball is translated into values that express the direction and duration of the motion. The values are given in a unit of distance called a *mickey*, which is approximately 1/200 inch.

When the user slides the mouse across a desk top, the mouse hardware passes to the mouse software a horizontal and vertical *mickey count*; that is, the number of mickeys the mouse ball has rolled in the horizontal and vertical directions. The software uses the mickey count to move the cursor a certain number of pixels on the screen.

Mouse sensitivity

The number of pixels that the cursor moves does not have to correspond one-to-one with the number of mickeys the track ball rolls. The mouse software defines a *sensitivity* for the mouse—the number of mickeys required to move the cursor 8 pixels on the screen. The sensitivity determines the rate at which the cursor moves on the screen.

In your application program, you can define the mouse's sensitivity by passing a mickey count to mouse function 15. The mickey count can be any value from 1 to 32767. For example, if you pass a count of 8, the sensitivity is 8 mickeys per 8 pixels. That is, the cursor will move 1 pixel for each mickey the ball rolls, or one character for every 8 mickeys the ball rolls.

The Internal Cursor Flag

The mouse software maintains an internal flag that determines when the cursor should be displayed on the screen. The value of this flag is always 0 or less.

- When the flag is 0, the cursor is displayed.
- When the flag is any other value, the cursor is hidden.

Application programs cannot access this flag directly. To change the flag's value, the program must call mouse functions 1 and 2. Function 1 *increments* the flag; function 2 *decrements* it. Initially, the flag's value is −1, so a call to function 1 displays the cursor.

Your program can call either function 1 or function 2 any number of times, but if it calls function 2, it must call function 1 later to restore the flag's previous value. For example, if the cursor is on the screen and your program calls function 2 five times, it must also call function 1 five times to return the cursor to the screen.

If the cursor is displayed, any additional calls to function 1 have no effect on the internal cursor flag, so one call to function 2 will always hide the cursor. In addition, your program can call mouse function 0 or change screen modes to reset the flag to −1 and hide the cursor.

6 Mouse Function Descriptions

This chapter describes the input, output, and operation of each mouse function call. The actual statements required to make the function calls depend on the programming language you're using. For specific instructions on making calls from the BASIC interpreter, assembly-language programs, and high-level-language programs, refer to Chapter 7, "Making Mouse Function Calls."

Note If you are designing an application program with mouse support that uses extended graphics modes D, E, F, and 10 on the IBM Enhanced Graphics Adapter (EGA), the program must interact with the adapter through the Microsoft EGA Register Interface. For instructions on using the EGA Register Interface, see Chapter 8, "Writing Mouse Programs for IBM EGA Modes."

Mouse Functions

The following table lists the mouse functions by function number:

Number	Function
0	Mouse Reset and Status
1	Show Cursor
2	Hide Cursor
3	Get Button Status and Mouse Position
4	Set Mouse Cursor Position
5	Get Button Press Information
6	Get Button Release Information
7	Set Minimum and Maximum Horizontal Cursor Position
8	Set Minimum and Maximum Vertical Cursor Position
9	Set Graphics Cursor Block
10	Set Text Cursor
11	Read Mouse Motion Counters
12	Set Interrupt Subroutine Call Mask and Address
13	Light Pen Emulation Mode On
14	Light Pen Emulation Mode Off
15	Set Mickey/Pixel Ratio
16	Conditional Off
19	Set Double-Speed Threshold
20	Swap Interrupt Subroutines
21	Get Mouse Driver State Storage Requirements
22	Save Mouse Driver State
23	Restore Mouse Driver State
29	Set CRT Page Number
30	Get CRT Page Number

Each function description in this chapter specifies the following:

- The parameters required to make the call (input) and the expected return values (output)
- Any special considerations regarding the function
- A BASIC interpreter program fragment that illustrates how to use the call. (For more information about calling mouse functions from the BASIC interpreter, see Chapter 7, "Making Mouse Function Calls.")

In the descriptions of all functions, the parameter names M1%, M2%, M3%, and M4% are dummy variable names. When making a call, use the names of the variables that you want to pass.

The dummy variable names include the percent sign (%) to emphasize that only integer variables can be used as parameters. Constants, single-precision variables, and double-precision variables are not allowed.

If the function description does not specify an input for a parameter, you don't need to supply a value for that parameter before making the call. If the function description does not specify an output value for a parameter, the parameter's value is the same before and after the call.

Caution All function calls require four parameters. The mouse software does not check input values, so be sure that the values you assign to the parameters are correct for the given function and screen mode. If you pass the wrong number of parameters or assign incorrect values, you will get unpredictable results.

Function 0: Mouse Reset and Status

Input	Output
M1%=0	M1%=mouse status M2%=number of buttons (2 if M1%=−1, otherwise 0)

Function 0 returns the current status of the mouse hardware and software. The mouse status is 0 if the mouse hardware and software are not installed or −1 if the hardware and software are installed.

This function also resets the mouse driver to the following default values:

Parameter	Value
cursor position	screen center
internal cursor flag	−1 (cursor hidden)
graphics cursor	arrow
text cursor	reverse video
interrupt call mask	all 0 (no interrupt subroutine specified)
light pen emulation mode	enabled
horizontal mickey/pixel ratio	8 to 8
vertical mickey/pixel ratio	16 to 8
horizontal min/max cursor position	0/current display-mode virtual screen x-value minus 1
vertical min/max cursor position	0/current display-mode virtual screen y-value minus 1
CRT page number	0

Example

This program fragment verifies that the mouse is installed, and returns an error message if it is not.

```
 100  '
 200  '  Is mouse present? If not, error.
 300  '
 400  DEF SEG=0
 500  MSEG=256*PEEK(51*4+3)+PEEK(51*4+2)
 600  MOUSE=256*PEEK(51*4+1)+PEEK(51*4)+2
 700  IF MSEG OR (MOUSE-2) THEN 60
 800  PRINT "Mouse not found":END
 900  DEF SEG=MSEG
1000  IF PEEK (MOUSE-2)=207 then 700
1100  M1%=0
1200  CALL MOUSE(M1%, M2%, M3%, M4%)
1300  IF NOT (M1%)THEN 700
```

Function 1: Show Cursor

Input	Output
M1%=1	—

Function 1 increments the internal cursor flag and, if the flag is 0, displays the cursor on the screen. The cursor tracks the motion of the mouse, changing position as the mouse changes position.

The current value of the internal cursor flag depends on the number of calls that have been made to functions 1 and 2. (For more information, see "The Internal Cursor Flag" in Chapter 5, "The Mouse Interface.") The default flag value is −1; therefore, after a reset (function 0), the program must call function 1 to redisplay the cursor.

If the internal cursor flag is already 0, this function does nothing.

Example

```
100  '
200  '  Show the cursor
300  '
400  M1%=1
500  CALL MOUSE(M1%, M2%, M3%, M4%)
```

Function 2: Hide Cursor

Input	Output
M1%=2	—

Function 2 removes the cursor from the screen and decrements the internal cursor flag. When the cursor is hidden, it continues to track the motion of the mouse, changing position as the mouse changes position.

Use this function before you change any area of the screen that contains the cursor. This will ensure that the cursor won't affect the data written to the screen.

Note If your program changes the screen mode, function 2 is called automatically so that the cursor will be drawn correctly the next time it is displayed.

Remember that each time your program calls function 2, it must call function 1 later to restore the internal cursor flag to its previous value. (For more information, see "The Internal Cursor Flag" in Chapter 5, "The Mouse Interface.")

Note At the end of your program, call function 2 to hide the mouse cursor. If the internal cursor flag is 0 when the program ends, the mouse cursor will remain on the screen.

Example

```
100  '
200  '  Hide the cursor
300  '
400  M1%=2
500  CALL MOUSE(M1%, M2%, M3%, M4%)
```

Function 3: Get Button Status and Mouse Position

Input	Output
M1%=3	M2%=button status M3%=cursor position (horizontal) M4%=cursor position (vertical)

Function 3 returns the state of the left and right mouse buttons and the horizontal and vertical coordinates of the cursor.

The button status is a single integer value. Bit 0 represents the left button; bit 1 represents the right button. These bits are 1 if the corresponding button is down, and 0 if it is up.

The cursor coordinates are always within the range of minimum and maximum values for the virtual screen. (For more information, see "The Virtual Screen" in Chapter 5, "The Mouse Interface.")

Example

```
100  '
200  '  Check button status
300  '
400  M1%=3
500  CALL MOUSE(M1%, M2%, M3%, M4%)
600  IF M2% AND 1 THEN PRINT "Left button down."
700  IF M2% AND 2 THEN PRINT "Right button down."
```

Function 4: Set Mouse Cursor Position

Input	Output
M1%=4	—
M3%=new cursor coordinate (horizontal)	
M4%=new cursor coordinate (vertical)	

Function 4 sets the cursor to the specified horizontal and vertical screen coordinates. The parameter values must be within the horizontal and vertical coordinate ranges for the virtual screen.

If the screen is not in a mode with a cell size of 1 x 1, the parameter values are rounded to the nearest horizontal or vertical coordinate values permitted for the current screen mode. (For more information, see "The Virtual Screen" in Chapter 5, "The Mouse Interface.")

Example

Assume that HMAX and VMAX are the maximum horizontal and vertical coordinate values for the virtual screen. This call to function 4 sets the cursor to the center of the screen:

```
100  '
200  '  Put cursor in center of screen
300  '
400  M1%=4
500  M3%=INT(HMAX/2)
600  M4%=INT(VMAX/2)
700  CALL MOUSE(M1%, M2%, M3%, M4%)
```

Function 5: Get Button Press Information

Input	Output
M1%=5	M1%=button status
M2%=button	M2%=number of button presses
	M3%=cursor (horizontal) at last press
	M4%=cursor (vertical) at last press

Function 5 returns the following:

- The current status of the specified button
- The number of times the specified button was pressed since the last call to this function
- The horizontal and vertical coordinates of the cursor the last time the specified button was pressed

The parameter M2% specifies which button is checked. If this parameter is 0, the left button is checked. If this parameter is 1, the right button is checked.

The button status is a single integer value. Bit 0 represents the left button and bit 1 represents the right button. These bits are 1 if the corresponding button is down, and 0 if it is up.

The number of button presses is always in the range 0 to 32767. Overflow is not detected. The count is set to 0 after the call.

The values for the horizontal and vertical coordinates are in the ranges defined by the virtual screen. These values represent the cursor position when the button was last pressed, not the cursor's current position.

Example

```
100  '
200  '  Get button press information
300  '
400  M1%=5
500  M2%=0    '  left button
600  CALL MOUSE(M1%, M2%, M3%, M4%)
700  IF(M1% AND 1) THEN PRINT "Left button down."
```

Function 6: Get Button Release Information

Input	Output
M1%=6	M1%=button status
M2%=button	M2%=number of button releases
	M3%=cursor (horizontal) at last release
	M4%=cursor (vertical) at last release

Function 6 returns the following:

- The current status of the specified button
- The number of times the specified button was released since the last call to this function
- The horizontal and vertical coordinates of the cursor the last time the specified button was released

The parameter M2% specifies which button is checked. If this parameter is 0, the left button is checked. If this parameter is 1, the right button is checked.

The button status is a single integer value. Bit 0 represents the left button and bit 1 represents the right button. These bits are 1 if the corresponding button is down, and 0 if it is up.

The number of button releases is always in the range 0 to 32767. Overflow is not detected. The count is set to 0 after the call.

The values for the horizontal and vertical coordinates are in the ranges defined by the virtual screen. These values represent the cursor position when the button was last released, not the cursor's current position.

Example

```
100  '
200  '  Get button release information
300  '
400  M1%=6
500  M2%=1      '   right button
600  CALL MOUSE(M1%, M2%, M3%, M4%)
700  IF (M1% AND 2) THEN PRINT "Right button down."
```

Function 7: Set Minimum and Maximum Horizontal Cursor Position

Input	Output
M1%=7	—
M3%=minimum position	
M4%=maximum position	

Function 7 sets the minimum and maximum horizontal cursor coordinates on the screen. All cursor movement after the call to function 7 is restricted to the specified area. The minimum and maximum values are defined by the virtual screen. (For more information, see "The Virtual Screen" in Chapter 5, "The Mouse Interface.")

If the minimum value is greater than the maximum value, the two values are swapped.

Example

```
100  '
200  ' Limit cursor to horizontal positions below 150
300  '
400  M1%=7
500  M3%=0
600  M4%=150
700  CALL MOUSE(M1%, M2%, M3%, M4%)
```

Function 8: Set Minimum and Maximum Vertical Cursor Position

Input	Output
M1%=8	—
M3%=minimum position	
M4%=maximum position	

Function 8 sets the minimum and maximum vertical cursor coordinates on the screen. After function 8 is called, cursor movement is restricted to the specified area. The minimum and maximum values are defined by the virtual screen. (For more information, see "The Virtual Screen" in Chapter 5, "The Mouse Interface.")

If the minimum value is greater than the maximum value, the two values are swapped.

Example

```
100  '
200  '  Limit cursor to vertical positions between
300  '  100 and 150
400  '
500  M1%=8
600  M3%=100
700  M4%=150
800  CALL MOUSE(M1%, M2%, M3%, M4%)
```

Function 9: Set Graphics Cursor Block

Input	Output
M1%=9	—
M2%=cursor hot spot (horizontal)	
M3%=cursor hot spot (vertical)	
M4%=pointer to screen and cursor masks	

Function 9 defines the shape, color, and center of the graphics cursor (the cursor used when the computer is in graphics mode). Your program must call function 1 to display the graphics cursor.

Function 9 uses the values found in the screen mask and cursor mask to build the cursor shape and color.

To pass the screen mask and cursor mask, assign their values to an integer array (packed 2 bytes per integer) and use the first element of the array as the parameter M4% in the call (see the example on the next page).

The cursor hot spot values must define one pixel within the cursor. The values must be within the range −16 to 16.

For more information about the screen mask, cursor mask, and the graphics cursor hot spot, see "Graphics and Text Cursors" in Chapter 5, "The Mouse Interface."

Note For more information about calling function 9 from programs in assembly language, see the section "Making Calls from Assembly-Language Programs" in Chapter 7, "Making Mouse Function Calls."

Example

To define a cursor in high-resolution graphics mode, first assign the values to the cursor array, then make the call:

```
 100  '
 200  ' Define the screen mask
 300  '
 400  CURSOR(0,0)=&HFFFF          '1111111111111111
 500  CURSOR(1,0)=&HFFFF          '1111111111111111
 600  CURSOR(2,0)=&HFFFF          '1111111111111111
 700  CURSOR(3,0)=&HFFFF          '1111111111111111
 800  CURSOR(4,0)=&HFFFF          '1111111111111111
 900  CURSOR(5,0)=&HFFFF          '1111111111111111
1000  CURSOR(6,0)=&HFFFF          '1111111111111111
1100  CURSOR(7,0)=&HFFFF          '1111111111111111
1200  CURSOR(8,0)=&HFFFF          '1111111111111111
1300  CURSOR(9,0)=&HFFFF          '1111111111111111
1400  CURSOR(10,0)=&HFFFF         '1111111111111111
1500  CURSOR(11,0)=&HFFFF         '1111111111111111
1600  CURSOR(12,0)=&HFFFF         '1111111111111111
1700  CURSOR(13,0)=&HFFFF         '1111111111111111
1800  CURSOR(14,0)=&HFFFF         '1111111111111111
1900  CURSOR(15,0)=&HFFFF         '1111111111111111
2000  '
2100  '  Define the cursor mask
2200  '
2300  CURSOR(0,1)=&H8000          '1000000000000000
2400  CURSOR(1,1)=&HE000          '1110000000000000
2500  CURSOR(2,1)=&HF800          '1111100000000000
2600  CURSOR(3,1)=&HFE00          '1111111000000000
2700  CURSOR(4,1)=&HD800          '1101100000000000
2800  CURSOR(5,1)=&H0C00          '0000110000000000
2900  CURSOR(6,1)=&H0600          '0000011000000000
3000  CURSOR(7,1)=&H0300          '0000001100000000
3100  CURSOR(8,1)=&H0000          '0000000000000000
3200  CURSOR(9,1)=&H0000          '0000000000000000
3300  CURSOR(10,1)=&H0000         '0000000000000000
3400  CURSOR(11,1)=&H0000         '0000000000000000
3500  CURSOR(12,1)=&H0000         '0000000000000000
3600  CURSOR(13,1)=&H0000         '0000000000000000
3700  CURSOR(14,1)=&H0000         '0000000000000000
3800  CURSOR(15,1)=&H0000         '0000000000000000
3900  '
4000  '  Set the mouse cursor shape, color, and
4050  '  hot spot
4100  '
4200  M1%=9
4300  M2%=0 '  horizontal hot spot
4400  M3%=0 '  vertical hot spot
4500  CALL MOUSE(M1%, M2%, M3%, CURSOR(0,0))
```

Function 10: Set Text Cursor

Input	Output
M1%=10	—
M2%=cursor select	
M3%=screen mask value/scan line start	
M4%=cursor mask value/scan line stop	

Function 10 selects the software or hardware text cursor. Your program must call function 1 to display the text cursor.

The value of the parameter M2% specifies which cursor is selected. If M2% is 0, the software text cursor is selected. If M2% is 1, the hardware text cursor is selected.

If the software text cursor is selected, parameters M3% and M4% must specify the screen mask and cursor mask. These masks define the attributes of a character when the cursor is over it. The mask values depend on the display adapter in the computer. (For more information, see "Software Text Cursor" in Chapter 5, "The Mouse Interface.")

If the hardware text cursor is selected, parameters M3% and M4% must specify the line numbers of the first and last scan lines in the cursor. These line numbers depend on the display adapter in the computer. (For more information, see "Hardware Text Cursor" in Chapter 5, "The Mouse Interface.")

```
100  '
200  '  Create text cursor that inverts foreground
300  '  and background colors
400  '
500  M1%=10
600  M2%=0            ' select software text cursor
700  M3%=&HFFFF       ' screen mask
800  M4%=&H7700       ' cursor mask
900  CALL MOUSE(M1%, M2%, M3%, M4%)
```

Function 11: Read Mouse Motion Counters

Input	Output
M1%=11	M3%=count (horizontal) M4%=count (vertical)

Function 11 returns the horizontal and vertical mickey count since the last call to this function. The mickey count is the distance that the mouse has moved, in 1/200 inch increments. (For more information, see "Mouse Unit of Distance: The Mickey" in Chapter 5, "The Mouse Interface.")

The mickey count is always within the range −32768 to 32767.

- A positive horizontal count indicates motion to the right. A negative horizontal count indicates motion to the left.
- A positive vertical count indicates motion to the bottom of the screen. A negative vertical count indicates motion to the top of the screen.

Overflow is ignored. The mickey count is set to 0 after the call is completed.

Example

```
100  '
200  '  Get the mickey count
300  '
400  M1%=11
500  CALL MOUSE(M1%, M2%, M3%, M4%)
```

Function 12: Set Interrupt Subroutine Call Mask and Address

Input	Output
M1%=12	—
M3%=call mask	
M4%=subroutine address	

Function 12 sets the call mask and subroutine address for mouse hardware interrupts.

The mouse hardware interrupts automatically stop execution of your program and call the specified subroutine whenever one or more of the conditions defined by the call mask occur. When the subroutine finishes, your program continues execution at the point of interruption.

The call mask is a single integer value that defines which conditions cause an interrupt. Each bit in the call mask corresponds to a specific condition, as shown in the following table:

Mask bit	Condition
0	Cursor position changes
1	Left button pressed
2	Left button released
3	Right button pressed
4	Right button released
5–15	Not used

To enable the subroutine for a given condition, set the corresponding call mask bit to 1 and pass the mask as parameter M3%.

To disable the subroutine for a given condition, set the corresponding bit to 0 and pass the mask as parameter M3%.

A call to function 0 automatically sets the call mask to 0.

Note Before your program ends, be sure to set the interrupt call mask to 0. If the call mask and subroutine remain defined when the program is no longer running, the subroutine will still be executed if one of the conditions defined by the call mask occurs.

When the mouse software makes a call to the subroutine, it loads the following information into the CPU registers:

Register	Information
AX	Condition mask (similar to the call mask except a bit is set only if the condition has occurred)
BX	Button state
CX	Cursor coordinate (horizontal)
DX	Cursor coordinate (vertical)
DI	Horizontal mouse counts (mickeys)
SI	Vertical mouse counts (mickeys)

Note The DS register contains the mouse driver data segments. The subroutine is responsible for setting DS as needed.

Calling from interpreted BASIC programs

To use function 12 with the BASIC interpreter:

1. Load an assembly-language subroutine into the BASIC interpreter's data segment. All exits from the subroutine must use a far return instruction.
2. Assign the entry address of the subroutine to an integer variable.
3. Pass this variable to function 12 as the fourth parameter.

Calling from high-level-language programs

To use function 12 in a high-level-language program:

1. Link an assembly-language subroutine with the program's object file(s). All exits from the subroutine must use a far return instruction.

2 Assign the entry address of the subroutine to an integer variable.

   In QuickBASIC programs and C small- and compact-model programs, the address is an offset only.

   In FORTRAN programs, Pascal programs, and C medium-, large-, and huge-model programs, the address consists of both a segment and an offset.

3 Pass this variable to function 12 as the fourth parameter.

Calling from assembly-language programs

For information on using function 12 in assembly-language programs, see "Making Calls from Assembly-Language Programs" in Chapter 7, "Making Mouse Function Calls."

Example

The following example calls function 12 from the BASIC interpreter. Assume that an assembly-language subroutine has been loaded into the BASIC interpreter's data segment and that the integer variable SKETCH% has been assigned the subroutine's entry address. The following BASIC statements set up calls to SKETCH% any time the user presses the left mouse button.

```
100  '
200  '  Call subroutine SKETCH on left button press
300  '
400  M1%=12
500  M3%=&H01
600  M4%=SKETCH%
700  CALL MOUSE(M1%, M2%, M3%, M4%)
```

Function 13: Light Pen Emulation Mode On

Input	Output
M1%=13	—

Function 13 allows the mouse to emulate a light pen. When the mouse emulates a light pen, calls to the PEN function (described in the IBM *BASIC* manual) return the cursor position at the last "pen down."

The mouse buttons control the "pen down" and "pen off the screen" states. The pen is down when both mouse buttons are down. The pen is off the screen when both mouse buttons are up.

The mouse software enables light pen emulation mode after each reset (function 0).

Example

```
100  '
200  '  Enable light pen
300  '
400  M1%=13
500  CALL MOUSE(M1%, M2%, M3%, M4%)
```

Function 14: Light Pen Emulation Mode Off

Input	Output
M1%=14	—

Function 14 disables light pen emulation. When light pen emulation is disabled, calls to the PEN function (described in the IBM *BASIC* manual) return information about the light pen only.

If a program uses both a light pen and the mouse, the program must disable the mouse light pen emulation mode to work correctly.

Example

```
100  '
200  '  Disable light pen
300  '
400  M1%=14
500  CALL MOUSE(M1%, M2%, M3%, M4%)
```

Function 15: Set Mickey/Pixel Ratio

Input	Output
M1%=15	—
M3%=mickey/pixel ratio (horizontal)	
M4%=mickey/pixel ratio (vertical)	

Function 15 sets the mickey-to-pixel ratio for horizontal and vertical mouse motion. The ratios specify the number of mickeys per 8 pixels. The values must be in the range 1 to 32767. (For more information, see "Mouse Unit of Distance: The Mickey" in Chapter 5, "The Mouse Interface.")

The default value for the horizontal ratio is 8 mickeys to 8 pixels. With this ratio, the mouse must travel 6.4 inches to move the cursor horizontally across the screen.

The default value for the vertical ratio is 16 mickeys to 8 pixels. With this ratio, the mouse must travel 4 inches to move the cursor vertically across the screen.

Example

```
100  '
200  '  Set mickey/pixel ratio at 16 to 8 and 32 to 8
300  '
400  M1%=15
500  M3%=16   ' horizontal ratio
600  M4%=32   ' vertical ratio
700  CALL MOUSE(M1%, M2%, M3%, M4%)
```

Function 16: Conditional Off

Input	Output
M1%=16	—
M4%=address of the region array	

Function 16 defines a region on the screen for updating. If the mouse pointer is in the defined region or moves into it, function 16 hides the mouse cursor while the region is being updated. After your program calls function 16, the program must call function 1 to show the cursor again.

The region is defined by placing the screen coordinate values in a four-element array. The elements of the array are defined as follows:

Array Offset	Value
1	Left x screen coordinate
2	Upper y screen coordinate
3	Right x screen coordinate
4	Lower y screen coordinate

Function 16 is similar to function 2, but is intended for advanced applications that require quicker screen updates.

Note For information on calling function 16 from assembly-language programs, see "Making Calls from Assembly-Language Programs" in Chapter 7, "Making Mouse Function Calls."

Example

```
 100  '
 200  '  Define screen region for conditional off
 300  '
 400  OFF%(1)=10   ' left x value of region
 500  OFF%(2)=30   ' upper y value of region
 600  OFF%(3)=40   ' right x value of region
 700  OFF%(4)=80   ' lower y value of region
 800  M1%=16
 900  CALL MOUSE(M1%, M2%, M3%, OFF%(0))
1000 '
1100 '  Screen update routine
  .
  .
  .
2200 '
2300 M1%=1
2400 CALL MOUSE(M1%, M2%, M3%, M4%)
```

Function 19: Set Double-Speed Threshold

Input	Output
M1%=19	—
M4%=threshold speed in mickeys/second	

Function 19 sets the threshold speed for doubling the cursor's motion on the screen. Using function 19 makes it easier to point at images widely separated on the screen.

Parameter M4% defines the mouse's threshold speed. If no value is given, or if the mouse is reset by a call to function 0, a default value of 64 mickeys per second is assigned. If the mouse moves faster than the value of M4%, cursor motion doubles in speed. The threshold speed remains set until function 19 is called again or until the mouse is reset by function 0.

Once your program turns on the speed-doubling feature, this feature is always on. However, the program can effectively turn off this feature by setting M4% to a speed faster than the mouse can physically move (for example, 10,000) and then calling function 19.

Example

```
 100  '
 110  '   Set threshold to 32 mickeys/sec
 120  '
 130  M1%=19
 140  M4%=32   '  mickeys/second
 150  CALL MOUSE (M1%, M2%, M3%, M4%)
  .
  .
  .
1000  '   Turn off speed doubling
1010  M1%=19
1020  M4%=10000    '  mickeys/second
1030  CALL MOUSE(M1%, M2%, M3%, M4%)
```

Function 20: Swap Interrupt Subroutines

Input	Output
M1%=20	M2%=segment of old subroutine
M2%=segment of new subroutine	M3%=old call mask
M3%=new call mask	M4%=offset of old subroutine
M4%=offset of new subroutine	

Function 20 sets new values for the call mask and subroutine address for mouse hardware interrupts and returns the values that were previously specified.

The mouse hardware interrupts automatically stop execution of your program and call the specified subroutine whenever one or more of the conditions defined by the call mask occur. When the subroutine finishes, your program continues execution at the point of interruption.

The call mask is an integer value that defines which conditions cause an interrupt. Each bit in the call mask corresponds to a specific condition, as shown in the following table:

Mask bit	Condition
0	Cursor position changes
1	Left button pressed
2	Left button released
3	Right button pressed
4	Right button released
5–15	Not used

To enable the subroutine for a given condition, set the corresponding call mask bit to 1 and pass the mask as parameter M3%.

To disable the subroutine for a given condition, set the corresponding bit to 0 and pass the mask as parameter M3%. Function 0 automatically disables all interrupts.

Note Before your program ends, be sure to restore the initial values of the call mask and subroutine address.

When the mouse software makes a call to the subroutine, it loads the following information into the CPU registers:

Register	Information
AX	Condition mask (similar to the call mask except a bit is set only if the condition has occurred)
BX	Button state
CX	Cursor coordinate (horizontal)
DX	Cursor coordinate (vertical)
DI	Horizontal mouse counts (mickeys)
SI	Vertical mouse counts (mickeys)

Note The DS register contains the mouse driver data segments. The subroutine is responsible for setting DS as needed.

Calling from interpreted BASIC programs

To use function 20 with the BASIC interpreter:

1. Load an assembly-language subroutine into the BASIC interpreter's data segment. All exits from the subroutine must use a far return instruction.
2. Assign the entry offset of the subroutine to an integer variable.
3. Pass this variable to function 20 as the fourth parameter.

If M2% is set to 0 in an interpreted BASIC program, the segment of the new subroutine is assumed to be identical to the BASIC data segment.

Calling from high-level-language programs

To use function 20 in a high-level-language program:

1. Link an assembly-language subroutine with the program's object file(s). All exits from the subroutine must use a far return instruction.
2. In FORTRAN programs, Pascal programs, and C medium-, large-, and huge-model programs, assign the subroutine's segment to an integer variable. In QuickBASIC programs, and C small- and compact-model programs, set this variable to 0.

3 Assign the subroutine's offset to an integer variable.

4 Pass the variable containing either the subroutine's segment or 0 to function 20 as the second parameter. Pass the variable containing the subroutine's offset as the fourth parameter.

If M2% is set to 0 in a high-level-language program, the segment of the new subroutine is assumed to be identical to the program's data segment.

Calling from assembly-language programs

For information on using function 20 in assembly-language programs, see "Making Calls from Assembly-Language Programs" in Chapter 7, "Making Mouse Function Calls."

Example

The following example calls function 20 from the BASIC interpreter. Assume that an assembly-language subroutine has been loaded into the BASIC interpreter's data segment and that the integer variable SKETCH% has been assigned the subroutine's entry offset. The following BASIC statements set up calls to SKETCH% any time the user presses the left mouse button.

```
100  '
200  '  Call subroutine SKETCH on left button press
300  '
400  M1%=20
500  M2%=0
600  M3%=&H01
700  M4%=SKETCH%
800  CALL MOUSE(M1%, M2%, M3%, M4%)
```

If your program does not change the return values of M1%, M2%, M3%, and M4%, you can restore the previous interrupt subroutine call mask and address by adding the following statement after the initial call to function 20.

```
CALL MOUSE(M1%, M2%, M3%, M4%)
```

Function 21: Get Mouse Driver State Storage Requirements

Input	Output
M1%=21	M2%=buffer size required for mouse driver state

Function 21 returns the size of the buffer required to store the current state of the mouse driver. It is used with functions 22 and 23 when you want to temporarily interrupt a program that is using the mouse and execute another program that also uses the mouse, such as one of the Microsoft Expert Mouse Menu programs.

Example

```
100  '
200  '  Get required storage size
300  '
400  M1%=21
500  CALL MOUSE(M1%, M2%, M3%, M4%)
600  BufSIZE%=M2%
```

Function 22: Save Mouse Driver State

Input	Output
M1%=22	—
M4%=pointer to the buffer	

Function 22 saves the current mouse driver state in a buffer allocated by your program. It is used with functions 21 and 23 when you want to temporarily interrupt a program that is using the mouse and execute another program that also uses the mouse.

Before your program calls function 22, the program should call function 21 to determine the buffer size required for saving the mouse driver state, then allocate the appropriate amount of memory.

Note For information on calling function 22 from an assembly-language program, see "Making Calls from Assembly-Language Programs" in Chapter 7, "Making Mouse Function Calls."

Example

Assume that the buffer size was obtained by calling function 21 and has been allocated in the BASIC interpreter's data segment. Assume also that BUFPTR contains the address of the buffer.

```
100  '
200  '  Save the mouse driver state
300  '
400  M1%=22
500  M4%=BUFPTR
600  CALL MOUSE(M1%, M2%, M3%, M4%)
```

Function 23: Restore Mouse Driver State

Input	Output
M1%=23	—
M4%=pointer to the buffer	

Function 23 restores the last mouse driver state saved by function 22. It is used with functions 21 and 22 when you want to temporarily interrupt a program that is using the mouse and execute another program that also uses the mouse. To restore the mouse driver state saved by function 22, call function 23 at the end of the interrupt program.

Note For information on calling function 23 from an assembly-language program, see "Making Calls from Assembly-Language Programs" in Chapter 7, "Making Mouse Function Calls."

Example

Assume that function 22 saved the mouse driver state in a buffer allocated by the program. Assume also that BUFPTR contains the address of the buffer.

```
100  '
200  '  Restore the mouse state
300  '
400  M1%=23
500  M4%=BUFPTR
600  CALL MOUSE(M1%, M2%, M3%, M4%)
```

Function 29: Set CRT Page Number

Input	Output
M1%=29	—
M2%=CRT page for mouse cursor display	

Function 29 specifies the CRT page on which the mouse cursor will be displayed.

For information on the number of CRT pages available in each display mode your adapter supports, see the documentation that came with the graphics adapter.

Example

```
100  '
200  '  Display mouse cursor on page 3
300  '
400  M1%=29
500  M2%=3
600  CALL MOUSE(M1%, M2%, M3%, M4%)
```

Function 30: Get CRT Page Number

Input	Output
M1%=30	M2%=CRT page number of current cursor display

Function 30 returns the number of the CRT page on which the mouse cursor is displayed.

Example

```
100  '
200  '  Get CRT page number
300  '
400  M1%=30
500  CALL MOUSE(M1%, M2%, M3%, M4%)
```

7 Making Mouse Function Calls

The statements and instructions required to call the mouse functions depend on the language you're using for your application program. This chapter explains how to make mouse function calls from the following types of programs:

- BASIC programs running under the BASIC interpreter
- Assembly-language programs
- Programs in Microsoft high-level languages

Additional examples

This chapter also includes the BASIC source program listing for the Piano demonstration program that came in your Microsoft Mouse package.

The last section in this chapter describes eight sample mouse cursors you can use in high-resolution graphics mode.

Making Calls from the BASIC Interpreter

To make a mouse function call from a BASIC program running under the BASIC interpreter:

1. Assign the offset and segment of the BASIC entry point into the mouse driver to a pair of integer variables in your program. The mouse entry offset and segment are in memory. To get these values, insert the following statements into your program:

```
10 DEF SEG=0
20 MSEG=256*PEEK(51*4+3)+PEEK(51*4+2)
30 MOUSE=256*PEEK(51*4+1)+PEEK(51*4)+2
40 IF MSEG OR (MOUSE-2) THEN 60
50 PRINT "Mouse Driver not found":END
60 DEF SEG=MSEG
70 IF PEEK(MOUSE-2)=207 then 50
```

   Be sure that these statements appear before any calls to mouse functions.

2. Use the CALL statement to make the call. The statement should have the form

```
CALL MOUSE(M1%, M2%, M3%, M4%)
```

   where MOUSE is the variable containing the offset of the BASIC entry point into the mouse driver, and M1%, M2%, M3%, and M4% are the names of the integer variables you have chosen for parameters in this call. (Constants and noninteger variables are not allowed.) All of the parameters must appear in the CALL statement even if no value is assigned to one or more of them.

   To ensure that the variables are integer variables, use the percent sign (%) as part of all the variable names. You may also use the DEFINT statement at the beginning of your program. For example, the statement

```
10 DEFINT A-Z
```

   defines all variables as integer variables. If this statement appears at the beginning of the program, the variable names don't need to include the percent sign.

Example

Assuming that the variable MOUSE has the offset of the BASIC entry point into the mouse driver, use the following statements to set the cursor position to 320 (horizontal) and 100 (vertical):

```
100  '
200  '  Set cursor position to (320,100)
300  '
400  M1%=4              'Function number is 4
500  M3%=320            'Horizontal coordinate
600  M4%=100            'Vertical coordinate
700  CALL MOUSE(M1%, M2%, M3%, M4%)
```

Note For additional examples of making calls from the BASIC interpreter, see the sample source code after the description of each function in Chapter 6, "Mouse Function Descriptions," and the section "Piano Program Listing" later in this chapter.

Making Calls from Assembly-Language Programs

To make a mouse function call from an assembly-language program:

1. Include statements in your program that check if the mouse driver is installed. These statements must appear before any calls to mouse functions. (See the assembly-language program example on the next page.)
2. Load the appropriate CPU registers (AX, BX, CX, DX, SI, DI, and/or ES) with the parameter values.
3. Execute software interrupt 51 (33H).

For all mouse functions except functions 9, 12, 16, 20, 22, and 23, the AX, BX, CX, and DX registers correspond to the M1%, M2%, M3%, and M4% parameters defined for the BASIC interpreter in Chapter 6, "Mouse Function Descriptions."

The parameter definitions for functions 9, 12, 16, 20, 22, and 23 are given in the following table:

Function	Input	Output
9	AX = 9 BX = cursor hot spot (horizontal) CX = cursor hot spot (vertical) ES:DX = address of first element in screen and cursor masks array	—
12	AX = 12 CX = call mask ES:DX = subroutine address	—
16	AX = 16 CX = upper x screen coordinate DX = left y screen coordinate SI = lower x screen coordinate DI = right y screen coordinate	—
20	AX = 20 CX = new call mask ES:DX = new subroutine address	CX = old call mask ES:DX = old subroutine address
22	AX = 22 ES:DX = start of buffer address	—
23	AX = 23 ES:DX = start of buffer address	—

Example

Assembly-language program

The following assembly-language program puts an IBM Color/Graphics Adapter into 640 x 200 graphics mode and displays the default mouse cursor (the standard cursor shape described under "Sample Cursors" later in this chapter). Clicking the left mouse button returns the video display to 80-column, black-and-white text mode, and ends the program.

```
stack  segment stack   'stack'
               db      256 dup(?)
stack   ends
;
data      segment public  'data'
          msg1    db   "Microsoft Mouse not found","$"
```

```
msg2    db   "Press the left mouse button to EXIT","$"
data    ends
;
code    segment public   'code'
        assume cs:code, ds:data, es:data; ss:stack

start:
        push  bp
        mov   bp,sp
        mov   ax,seg data       ;Set DS to the
        mov   ds,ax             ;data segment

        push  es                ;Save PSP segment address
        mov   ax,03533h         ;Get int 33h vector
        int   21h               ;by calling int 21
        mov   ax,es             ;Check segment and
        or    ax,bx             ;offset of int 33
        jnz   begin             ;vector. If 0 or pointing to
        mov   bl,es:[bx]        ;IRET, driver not installed
        cmp   bl,0cfh
        jne   begin             ;Exit

        mov   dx,offset msg1    ;Get not found message offset
        mov   ah,09h            ;Output message to screen
        int   21h
        pop   es
        jmp   short exit        ;Exit

begin:
        mov   ax,0              ;Initialize mouse
        int   33h
        cmp   ax,0              ;Is mouse installed?
        jz    exit              ;No, exit
        mov   ax,0006h          ;Set up for 640x200 resolution
        int   10h               ;graphics mode (CGA mode 6)
        mov   ax,4              ;Function 4-set cursor position
        mov   cx,200            ;M3 = 200
        mov   dx,100            ;M4 = 100
        int   33h
        mov   ax,7              ;Function 7
        mov   cx,150            ;M3 = 150
        mov   dx,450            ;M4 = 450
        int   33h
        mov   ax,8              ;Function 8
        mov   cx,50             ;M3 = 50
        mov   dx,150            ;M4 = 150
        int   33h
        mov   ax,1              ;Show the mouse cursor
        int   33h

        mov   dx,offset msg2    ;Get exit message
        mov   ah,09h            ;Output message to screen
        int   21h
        xor   ax,ax
```

```
around:
            mov     ax,3                ;Get mouse status
            int     33h
            cmp     bx,0001h            ;Left mouse button
            jne     around              ;pressed? Branch if not

            mov     ax,0
            int     33h                 ;Reset mouse
            mov     ax,0003h            ;Set up 80x25
            int     10h                 ;character text mode
exit:
            mov     sp,bp
            pop     bp
            mov     ax,04c00h           ;Terminate
            int     21h
;
code        ends
end         start
```

Making Calls from High-Level-Language Programs

Mouse function calls from high-level-languages can be included as ordinary procedure calls in the source program. After the program is compiled, it must be linked with the Microsoft Mouse Library (MOUSE.LIB), which is included on the Microsoft Mouse Tools disk. MOUSE.LIB contains procedures that give access to all the mouse functions.

This section describes how to make function calls from the following high-level languages:

- Microsoft QuickBASIC
- Microsoft Pascal (version 3.30 or later)
- Microsoft FORTRAN (version 3.30 or later)
- Microsoft C (version 3.0 or later)

For information about linking programs written for earlier versions of the Microsoft Mouse Library, see Appendix B, "Linking Existing Mouse Programs with MOUSE.LIB (Version 6.0)."

For information on accessing the mouse functions from a program written in Borland Turbo Pascal, see Appendix C, "Making Calls from Borland Turbo Pascal Programs."

Making Calls from Microsoft QuickBASIC

To make a mouse function call from a program in Microsoft QuickBASIC (version 1.0 or later):

1. Include statements in your program that check if the mouse driver is installed. These statements must appear before any calls to mouse functions. (See the QuickBASIC program example on the next page.)
2. Call the mouse library procedure "MOUSE" as a regular QuickBASIC external subroutine.
3. Compile the program and link it with MOUSE.LIB.

   If you are using version 2.0 of the QuickBASIC compiler, you can compile and link in one step from within the QuickBASIC editor following the procedure given below. (For instructions on linking with MOUSE.LIB outside of the QuickBASIC editor, see your documentation on Microsoft QuickBASIC.)

Linking with MOUSE.LIB within QuickBASIC

To simultaneously compile a QuickBASIC program (version 2.0) and link the program with MOUSE.LIB, first set up a special library subroutine called "USERLIB.EXE".

Setting up USERLIB.EXE

To set up USERLIB.EXE:

1. Create a QuickBASIC source file that contains the single statement:

   ```
   CALL MOUSE
   ```

2. Compile this source file outside of the QuickBASIC editor. To do this, type the following at the DOS prompt:

   qb <filename>;

   and press the ENTER key. (<filename> is the name of the source file.)
3. Make sure the compiled QuickBASIC file, MOUSE.LIB, and the QuickBASIC utilities BUILDLIB.EXE and BRUN20.LIB are in the current directory.

4 To create the USERLIB.EXE file, type the following at the DOS prompt:

buildlib <filename>*,userlib,,mouse;*

and press the ENTER key. (<filename> is the name of the compiled QuickBASIC file.)

Linking within QuickBASIC

To compile a QuickBASIC program and link it with MOUSE.LIB in one step:

1 Make sure the USERLIB.EXE file is in the same directory as the QuickBASIC compiler (QB.EXE) before you start QuickBASIC.

2 To start QuickBASIC, type *qb/l* (not *qb*) and press the ENTER key.

3 Compile the mouse application program within the QuickBASIC editor. This also automatically links the program with MOUSE.LIB.

Example

QuickBASIC program

The following program puts an IBM Color/Graphics Adapter into 640 x 200 graphics mode and displays the default mouse cursor (the standard cursor shape described under "Sample Cursors" later in this chapter). This program calls the subroutine "chkdrv", which is shown in the assembly-language program that follows.

```
' Mouse library call test in QuickBASIC V2.0

  call chkdrv

  screen 0

  m1%=0                    ' function 0
  call mouse(m1%,m2%,m3%,m4%)
  if ( m1% = 0 ) then
     print "Microsoft Mouse not found"
     end
  end if

  m1%=4                    ' function 4
  m3%=200
  m4%=100
  call mouse(m1%,m2%,m3%,m4%)

  m1%=7                    ' function 7
  m3%=150
  m4%=450
  call mouse(m1%,m2%,m3%,m4%)
```

```
m1%=8                    ' function 8
m3%=50
m4%=150
call mouse(m1%,m2%,m3%,m4%)

screen 2

print "Cursor limited to the center of the screen."
print "Press the left mouse button to EXIT."

m1% = 1
call mouse(m1%,m2%,m3%,m4%)

m2% = 99
while ( m2% <> 1 )
  m1% = 3
  call mouse(m1%,m2%,m3%,m4%)
wend

screen 0

end
```

chkdrv subroutine

In the following assembly-language source program, "chkdrv" checks if the mouse driver is installed.

```
;
mdata       segment byte public 'data'
            msg     db   "Mouse Driver not installed","$"
mdata       ends

mcode       segment para public 'CODE'
            assume  cs:mcode
;
            public  chkdrv
;
chkdrv      proc    far
            push    bp
            push    es

            mov     ax,03533h       ;Get int 33h by
            int     21h             ;calling int 21
            mov     ax,es           ;Check segment and offset
            or      ax,bx           ;of int 33 vector. If
            jnz     back            ;0 or pointing to IRET,
            mov     bl,es:[bx]      ;driver not installed
            cmp     bl,0cfh
            jne     back            ;Exit

            mov     ax,seg mdata    ;Set up DS to
            mov     ds,ax           ;point to data seg
            mov     dx,offset msg   ;Get message
            mov     ah,09h          ;output to screen
            int     21h
            pop     es
            pop     bp
```

```
                mov     ax,04c00h       ;Terminate
                int     21h

    back:
                pop     es
                pop     bp
                ret
chkdrv          endp
;
mcode           ends
                end
```

Making Calls from Microsoft Pascal

To make a mouse function call from a program in Microsoft Pascal (version 3.30 or later):

1. Include statements in your program that check if the mouse driver is installed. These statements must appear before any calls to mouse functions. (See the Pascal program example below.)
2. Declare the mouse library procedure "MOUSES" as an external procedure. The parameters can be declared as either INTEGER or WORD. Use one of the following statements to declare MOUSES as an external procedure:

```
PROCEDURE MOUSES(VARS m1,m2,m3,m4:INTEGER);EXTERN;
```

or

```
PROCEDURE MOUSES(VARS m1,m2,m3,m4:WORD);EXTERN;
```

3. Use Microsoft Pascal calling conventions to make the call.
4. Link the compiled program with MOUSE.LIB. (For details about using the LINK command, see your documentation on Microsoft Pascal.)

Example

Pascal program

The following program puts an IBM Color/Graphics Adapter into 640 x 200 graphics mode and displays the default mouse cursor (the standard cursor shape described under "Sample Cursors" later in this chapter). This program calls two procedures, "graf" and "chkdrv". These procedures are shown in the assembly-language listing that follows this program.

```
program mtest (output);

procedure mouses(vars m1,m2,m3,m4:word);extern;
procedure chkdrv;extern;
procedure graf;extern;

var
  m1, m2, m3, m4: word;

begin {demo}

  chkdrv;               {Mouse driver installed?    }
                        {No, exit                   }
  M1:=0;                {Yes, initialize mouse      }
  mouses(m1,m2,m3,m4);
  if ( m1 = 0 ) then
     writeln('Microsoft Mouse not found')
  else
     begin

       m1 := 4;         {function call 4, set mouse }
       m3 := 200;       {horizontal cursor position }
       m4 := 100;       {vertical cursor position   }
       mouses( m1, m2, m3, m4 );


       m1 := 7;         {function call 7, set mouse }
       m3 := 150;       {minimum horizontal position}
       m4 := 450;       {maximum horizontal position}
       mouses( m1, m2, m3, m4 );


       m1 := 8;         {function call 8, set mouse }
       m3 := 50;        {minimum vertical position  }
       m4 := 150;       {maximum vertical position  }
       mouses( m1, m2, m3, m4 );

       graf;            {change into graphics mode  }

       writeln('Cursor limited to the center of the screen.');
       writeln('Press the left mouse button to EXIT.');

       m1 :=1;          {function call 1            }
       mouses(m1,m2,m3,m4);   {show mouse cursor    }

       m2 := 999;       {dummy value for loop       }
       repeat           {until ....                 }
         m1 := 3;       {function call 3            }
         mouses( m1, m2, m3, m4 ); {Get current mouse status}
       until m2 = 1;    {left mouse button pressed  }

     end

end. {demo}
```

graf and chkdrv procedures

In the following assembly-language source program, "graf" changes the display mode to 640 x 200 graphics mode (CGA mode 6) and "chkdrv" checks if the mouse driver is installed.

```
;
mdata   segment byte public 'data'

        msg     db   "Mouse Driver not installed","$"

mdata   ends

mcode   segment para public 'CODE'
        assume  cs:mcode
;
        public  graf
;
graf    proc    far
        push    bp
        mov     ax,06h          ;Change to graphics
        int     10h             ;mode by calling
        pop     bp              ;int 10 service
        ret
graf    endp
;
        public  chkdrv
;
chkdrv  proc    far
        push    bp
        push    es

        mov     ax,03533h       ;Get int 33h by
        int     21h             ;calling int 21
        mov     ax,es           ;Check segment, offset
        or      ax,bx           ;of int 33 vector. If
        jnz     back            ;0 or pointing to IRET,
        mov     bl,es:[bx]      ;driver not installed
        cmp     bl,0cfh
        jne     back            ;Exit

        mov     ax,seg mdata    ;Set up DS to
        mov     ds,ax           ;point to data seg
        mov     dx,offset msg   ;Get message
        mov     ah,09h          ;output to screen
        int     21h
        pop     es
        pop     bp
        mov     ax,04c00h       ;Terminate
        int     21h

   back:
        pop     es
        pop     bp
        ret
chkdrv  endp
;
mcode   ends
        end
```

Making Calls from Microsoft FORTRAN

To make a mouse function call from a program in Microsoft FORTRAN (version 3.30 or later):

1. Include statements in your program that check if the mouse driver is installed. These statements must appear before any calls to mouse functions. (See the FORTRAN program example below.)
2. Call the mouse library procedure "MOUSES" as a regular FORTRAN external subroutine.
3. Link the compiled program with MOUSE.LIB. (For details about using the LINK command, see your documentation on Microsoft FORTRAN.)

Example

FORTRAN program

The following program puts an IBM Color/Graphics Adapter into 640 x 200 graphics mode and displays the default mouse cursor (the standard cursor shape described under "Sample Cursors" later in this chapter). This program calls two assembly-language subroutines, "graf" and "chkdrv". (See the assembly-language program after the Pascal program example earlier in this chapter for the "graf" and "chkdrv" subroutine listings.)

```
        PROGRAM MTEST

C
C       -- Mouse Library calls test in MS FORTRAN V3.31 --
C
        INTEGER*2    M1, M2, M3, M4
        EXTERNAL     GRAF, CHKDRV

C       --  Call driver checking routine  --
        CALL CHKDRV()

C       -- Mouse init call --
        M1 = 0
        CALL MOUSES(M1, M2, M3, M4)
        IF ( M1 .EQ. 0 ) THEN
             WRITE(*,*)' Microsoft Mouse not found'
             STOP
        ENDIF

C       -- Place cursor in the center of the screen --
        M1 = 4
        M3 = 200
        M4 = 100
        CALL MOUSES(M1, M2, M3, M4)

C       -- Set minimum and maximum horizontal position --
        M1 = 7
```

```
        M3 = 150
        M4 = 450
        CALL MOUSES(M1, M2, M3, M4)

C       -- Set minimum and maximum vertical position --
        M1 = 8
        M3 = 50
        M4 = 150
        CALL MOUSES(M1, M2, M3, M4)

        CALL GRAF()

        WRITE(*,*) ' Cursor is limited to the center of the screen.'
        WRITE(*,*) ' Press the left mouse button to EXIT.'

        M1 = 1
        CALL MOUSES(M1, M2, M3, M4)

C       -- Loop for left mouse button pressed  --
        M2 = 9999
 100      M1 = 3
          CALL MOUSES(M1, M2, M3, M4)
        IF ( M2 .NE. 1 ) GOTO 100

        STOP
        END
```

Making Calls from Microsoft C

To make a mouse function call from a program in Microsoft C (version 3.0 or later):

1. Include statements in your program that check if the mouse driver is installed. These statements must appear before any calls to mouse functions. (See the C program example on the next page.)
2. Call one of the following mouse library procedures as a regular C external routine:

Use this procedure	To call from a
CMOUSES	Small-model program
CMOUSEC	Compact-model program
CMOUSEM	Medium-model program
CMOUSEL	Large- or huge-model program

Parameters are declared as signed or unsigned integers. Since MOUSE.LIB requires that all parameters be passed by reference, precede each parameter name with "&" (address of).

3 Link the compiled program with MOUSE.LIB. (For details about using the LINK command, see your documentation on Microsoft C.)

Example

The following program puts an IBM Color/Graphics Adapter into 640 x 200 graphics mode and displays the default mouse cursor (the standard cursor shape described under "Sample Cursors" later in this chapter).

C program

```
#include <stdio.h>
#include <dos.h>

void chkdrv();
void graf();

main()
{
    int m1, m2, m3, m4;

    chkdrv();               /* check for mouse driver    */
    m1 = 0;                 /* initialize mouse          */
    cmouses(&m1, &m2, &m3, &m4);

    if ( m1 = 0 ) {
        printf("Microsoft Mouse not found");
        exit (-1);          /* exit, if mouse not found */
        }

    m1 = 4;                 /* function call 4           */
    m3 = 200;               /* set mouse position at     */
    m4 = 100;               /* center of the screen      */
    cmouses(&m1, &m2, &m3, &m4);

    m1 = 7;                 /* function call 7           */
    m3 = 150;               /* minimum horizontal value */
    m4 = 450;               /* maximum horizontal value */
    cmouses(&m1, &m2, &m3, &m4);

    m1 = 8;                 /* function call 8           */
    m3 = 50;                /* minimum vertical value    */
    m4 = 150;               /* maximum vertical value    */
    cmouses(&m1, &m2, &m3, &m4);

    graf();

    printf("Cursor limited to the center of the screen.\n");
    printf("Press the left mouse button to EXIT.");

    m1 = 1;                  /* Function 1, show cursor */
    cmouses(&m1, &m2, &m3, &m4);

    m2 = 0;                  /* Loop until left mouse    */
```

```
    while ( m2 != 1 ) {    /* button is pressed        */
        m1 = 3;
        cmouses(&m1, &m2, &m3, &m4);
        }

    m1 = 2;
    cmouses(&m1, &m2, &m3, &m4);
}

void chkdrv()
{
    union REGS inregs, outregs;
    struct SREGS segregs;
    long address;
    unsign char first_byte;

    inregs.x.ax = 0x3533;
    intdosx ( &inregs, &outregs, &segregs );
    address=(((long)segregs.es)<<16)+(long)outregs.x.bx;
    first_byte=*(long far *)address;
    If ((address == 0) || (first_byte == 0xcf)){
        printf("Mouse driver not installed");
        exit();
        }

}

void graf()
{
    union REGS cpuregs;

    cpuregs.x.ax = 0x0006;
    int86 ( 0x10, &cpuregs, &cpuregs );
}
```

Piano Program Listing

This section presents the complete source code for the Piano demonstration program that came in your Microsoft Mouse package. The program is written in BASIC for the IBM Personal Computer's BASIC Interpreter. (The Piano source program listing is also in the file PIANO.BAS on the Microsoft Mouse Tools Disk.)

The following is an explanation of the program details:

Line numbers	Comments
1000–1090	Copyright message
1100–1160	Set up music, clear graphics screen to blue.
1170–1250	Read in the frequencies for the various piano keys.

Line numbers	Comments
1260–1380	Link the mouse software and the program.
1390–1430	Function 15 sets the mouse sensitivity. With this setting, a horizontal movement of 1.6 inches moves the cursor across the entire screen. This relatively high sensitivity permits songs to be played rapidly. Accuracy is no problem since the piano keys are large.
1440–1620	The integer array CURSOR contains the screen and cursor masks, which define the shape and color of the cursor. These statements define the screen mask; the mask is set to all ones. The mask is logically ANDed with the screen under the cursor.
1630–1810	Define the cursor mask. The values are XORed with the result of the AND operation to create the cursor shape and color. In this case, the cursor shape is a north-pointing arrowhead. Its color is the inverse of whatever is under it.
1820–1860	Function 9 sets the cursor shape. It also defines the cursor hot spot. In this case, the hot spot is the tip of the arrowhead. The mouse software automatically prevents the cursor hot spot from leaving the screen.
1870–1930	Read in the Microsoft logo from precalculated data and place the data on the screen.
1940–2150	Draw the white and black piano keys.
2160–2200	Draw the QUIT box in the lower-right corner.
2210–2240	Function 4 centers the cursor to just under the piano keys.
2250	Function 1 turns on the cursor. The cursor appears on the screen and can be moved using the mouse.

Line numbers	Comments
2260–2290	Function 3 gives the status of the two mouse buttons and the location of the cursor. This is probably the most common mouse function used in applications.
2300–2370	Some decisions are made. If both mouse buttons are up, or if the cursor is not on the piano keyboard, then any sound that might be playing is turned off.
2380–2430	At this point, the mouse button is down when the cursor is over the QUIT box. The program turns off the cursor, clears the screen, then quits.
2440–2510	The program has determined that a button is down and the cursor is over the piano keyboard. These statements determine which key the mouse cursor is over.
2520–2570	The note is played by the SOUND statement set with the correct frequency. This note is played in the background as the program loops back to line 2090.
2580–2630	This data contains the correct frequencies to play the musical notes.
2640–3050	Data to draw the Microsoft logo using the PUT statement.

```
1000 '
1010 ' THE VIRTUAL PIANO
1020 '
1030 ' COPYRIGHT (C) 1983 BY MICROSOFT CORPORATION
1040 ' WRITTEN BY CHRIS PETERS
1050 '
1060 '-----------------------------------------
1070 '
1080 ' INITIALIZE
1090 '
1100 DEFINT A-Z
1110 DIM CURSOR(15,1),FREQ(27,2),MICROSOFT(839)
1120 KEY OFF
1130 PLAY"MF"
1140 SCREEN 1
1150 COLOR 1,1
1160 CLS
1170 '
```

```
1180 ' Read in the flat, normal, and sharp note frequencies
1190 '
1200 FOR J=0 TO 2
1210 FOR I=0 TO 6
1220 READ K
1230 FREQ(I,J)=K : FREQ(I+7,J)=K*2 : FREQ(I+14,J)=K*4 :
     FREQ(I+21,J)=K*8
1240 NEXT
1250 NEXT
1260 '
1270 ' Determine mouse driver location; if not found, quit.
1280 '
1290 DEF SEG=0
1300 MSEG=256*PEEK(51*4+3)+PEEK(51*4+2)   'Get mouse segment
1310 MOUSE=256*PEEK(51*4+1)+PEEK(51*4)+2 'Get mouse offset
1320 IF MSEG OR (MOUSE-2) THEN 1370
1330 PRINT"Mouse: Microsoft Mouse driver not found"
1340 PRINT
1350 PRINT"Press any key to return to system"
1360 I$=INKEY$ : IF I$="" THEN 1360 ELSE SYSTEM
1370 DEF SEG=MSEG                          'Set mouse segment
1375 IF PEEK(MOUSE-2)=207 THEN 1330
1380 M1=0 : CALL MOUSE(M1,M2,M3,M4)       'Initialize mouse
1390 '
1400 ' Set Mouse sensitivity
1410 '
1420 M1 = 15 : M3=4 : M4=8
1430 CALL MOUSE(M1,M2,M3,M4)
1440 '
1450 ' Define the "logical and" cursor mask
1460 '
1470 CURSOR( 0,0)=&HFFFF ' Binary 1111111111111111
1480 CURSOR( 1,0)=&HFFFF ' Binary 1111111111111111
1490 CURSOR( 2,0)=&HFFFF ' Binary 1111111111111111
1500 CURSOR( 3,0)=&HFFFF ' Binary 1111111111111111
1510 CURSOR( 4,0)=&HFFFF ' Binary 1111111111111111
1520 CURSOR( 5,0)=&HFFFF ' Binary 1111111111111111
1530 CURSOR( 6,0)=&HFFFF ' Binary 1111111111111111
1540 CURSOR( 7,0)=&HFFFF ' Binary 1111111111111111
1550 CURSOR( 8,0)=&HFFFF ' Binary 1111111111111111
1560 CURSOR( 9,0)=&HFFFF ' Binary 1111111111111111
1570 CURSOR(10,0)=&HFFFF ' Binary 1111111111111111
1580 CURSOR(11,0)=&HFFFF ' Binary 1111111111111111
1590 CURSOR(12,0)=&HFFFF ' Binary 1111111111111111
1600 CURSOR(13,0)=&HFFFF ' Binary 1111111111111111
1610 CURSOR(14,0)=&HFFFF ' Binary 1111111111111111
1620 CURSOR(15,0)=&HFFFF ' Binary 1111111111111111
1630 '
1640 ' Define the "exclusive or" cursor mask
1650 '
1660 CURSOR( 0,1)=&H0300 ' Binary 0000001100000000
1670 CURSOR( 1,1)=&H0300 ' Binary 0000001100000000
1680 CURSOR( 2,1)=&H0FC0 ' Binary 0000111111000000
1690 CURSOR( 3,1)=&H0FC0 ' Binary 0000111111000000
1700 CURSOR( 4,1)=&H3FF0 ' Binary 0011111111110000
1710 CURSOR( 5,1)=&H3FF0 ' Binary 0011111111110000
1720 CURSOR( 6,1)=&HFCFC ' Binary 1111110011111100
1730 CURSOR( 7,1)=&HC00C ' Binary 1100000000001100
1740 CURSOR( 8,1)=&H0000 ' Binary 0000000000000000
```

```
1750 CURSOR( 9,1)=&H0000 ' Binary 0000000000000000
1760 CURSOR(10,1)=&H0000 ' Binary 0000000000000000
1770 CURSOR(11,1)=&H0000 ' Binary 0000000000000000
1780 CURSOR(12,1)=&H0000 ' Binary 0000000000000000
1790 CURSOR(13,1)=&H0000 ' Binary 0000000000000000
1800 CURSOR(14,1)=&H0000 ' Binary 0000000000000000
1810 CURSOR(15,1)=&H0000 ' Binary 0000000000000000
1820 '
1830 ' Set the mouse cursor shape
1840 '
1850 M1 = 9 : M2 = 6 : M3 = 0
1860 CALL MOUSE(M1,M2,M3,CURSOR(0,0))
1870 '
1880 ' Draw the MICROSOFT logo from pre-calculated data
1890 '
1900 FOR I=0 TO 779
1910 READ MICROSOFT(I)
1920 NEXT
1930 PUT(62,0),MICROSOFT,PSET
1940 '
1950 ' Initialize keyboard size parameters
1960 '
1970 YL = 60 : WKL = 80 : BKL = 45 : KW = 15 :
     WKN = 21
1980 XL = 320-KW*WKN : YH = YL + WKL : XH = 319 :
     BKW2=KW3
1990 QX = 272 : QY = 176
2000 '
2010 ' Draw the white keys
2020 '
2030 LINE (XL,YL)-(XH,YH),3,BF
2040 FOR I=XL TO XH STEP KW
2050 LINE (I,YL)-(I,YH),0
2060 NEXT
2070 '
2080 ' Draw the "black" keys
2090 '
2100 C=6
2110 FOR X=XL TO XH STEP KW
2120 C=C+1 : IF C=7 THEN C=0
2130 IF C=0 OR C=3 THEN 2150
2140 LINE(X-BKW2,YL)-(X+BKW2,YL+BKL),2,BF
2150 NEXT
2160 '
2170 ' Draw the quit box
2180 '
2190 LINE(QX,QY)-(319,199),3,B
2200 LOCATE 24,36 : PRINT"Quit";
2210 '
2220 ' Set mouse cursor location, then turn on cursor
2230 '
2240 M1 = 4 : M3 = 320 : M4 = 160 : CALL MOUSE(M1,M2,M3,M4)
2250 M1 = 1 : CALL MOUSE(M1,M2,M3,M4)
2260 '
2270 ' MAIN LOOP
2280 '
2290 M1=3 : CALL MOUSE(M1,BT,MX,MY)   'Get mouse location
                                        and button status
2300 IF (BT AND 2) THEN OTV=7 : GOTO 2340
```

```
                    'If right button down, set high octave
2310 IF (BT AND 1) THEN OTV=0 : GOTO 2340
                    'If left button down, set lower octave
2320 SOUND 442,0    'If both buttons up, turn off sound
2330 GOTO 2290      'Keep looping...
2340 MX = MX2       'Correct for medium resolution screen
2350 IF MX <= XL OR MY < YL THEN 2320   'If above keyboard,
                                         turn off sound
2360 IF MY <= YH THEN 2470              'If on keyboard,
                                         play sound
2370 IF MY < QY OR MX < QX THEN 2320'   'If above quit box,
                                         turn off sound
2380 '
2390 ' Button down inside the quit box
2400 '
2410 M1=2 : CALL MOUSE(M1,M2,M3,M4)  'Turn off mouse cursor
2420 CLS ' Clear screen
2430 END ' Quit
2440 '
2450 ' Button down over keyboard, determine which key
2460 '
2470 WKY = (MX-XL)\KW+OTV : R = 1       'Get which white
                                         key cursor is over
2480 IF MY > YL+BKL THEN 2560           'Is it lower than
                                         the black keys?
2490 MK=(MX-XL) MOD KW  ' No, get which side of key
2500 IF MK <= BKW2 THEN R=0 : GOTO 2560 'Is it the left
                                         black key?
2510 IF MK >= KW-BKW2 THEN R=2  ' Is it the right black key?
2520 '
2530 ' Play the note. For BASIC interpreter duration = 2
2540 ' For BASIC compiler duration = 1
2550 '
2560 SOUND FREQ(WKY,R),2
2570 GOTO 2290  ' Continue looping
2580 '
2590 ' Musical note frequencies
2600 '
2610 DATA 131,139,156,175,185,208,233
2620 DATA 131,147,165,175,196,220,247
2630 DATA 139,156,165,185,208,233,247
2640 '
2650 ' Data to draw the MICROSOFT logo
2660 '
2670 DATA 462,28,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
2680 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
2690 DATA 0,0,0,-193,240,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
2700 DATA 0,0,0,0,0,768,-1,0,0,0,0,3840,-1,-16129,0,
 -253,0,0,-193,240
2710 DATA 0,0,0,0,0,0,0,0,0,0,-193,0,16128,4095,252,
 16128,-1,240, -256,-769,0
2720 DATA 0,0,0,0,-193,240,768,-1,255,768,-1,1023,-1,
 -1,240,0,0,0,-193,192
2730 DATA -256,4095,252,-253,-1,255,-256,-1,240,-253,
 -1,-1,768,-1,255,16128,-1,-3841,768,-1
2740 DATA 1023,-1,-1,240,0,0,0,-193,192,-256,4095,252,
 -193,-1,-3841,-256,-1, 252,-1009,0
2750 DATA -256,4032,-1,-16129,-253,-1,-1,768,-1,1023,
 -1,-1,240,0,0,0,-193,240,-253,4095
```

```
2760 DATA 252,-3841,0,-961,-256,-1,255,0,0,0,3840,-1,
 -16129,-241,0,-253,960,-1,1023,-1
2770 DATA -1,240,0,0,0,-193,240,-253,4095,1020,255,0,
 -253,-256,4032,-16129,-1,-1,-1,4092
2780 DATA 4095,-16129,-4033,0,16128,1008,-1,1023,-1,-1,
 240,0,0,0,-193,252,-241,4095,1020,252
2790 DATA 0,-256,-256,960,-15361,252,0,0,4095,1023,
 -16129,-16321,0,3840,1008,255,0,3840,252,0
2800 DATA 0,0,0,-193,252,-241,4095,4092,240,0,16128,
 -64,192,-16129,0,0,0,3840,255,0
2810 DATA 255,0,768,1020,255,0,3840,252,0,0,0,0,-193,
 255,-193,4095,4092,240,0,16128
2820 DATA -64,192,-12289,-1,192,-241,-12289,-3841,0,
 255,0,768,1020,255,0,3840,252,0,0,0
2830 DATA 0,-193,255,-193,4095,16380,192,0,3840,-16,
 960,-12289,240,0,0,-15553,-1,768,252,0
2840 DATA 0,1023,255,0,3840,252,0,0,0,0,-193,-16129,
 -1,4095,16380,192,0,0,-256,4032
2850 DATA -16129,0,0,0,768,-1,1008,252,0,0,1023,-1,
 255,3840,252,0,0,0,0,-3265
2860 DATA -16129,-3073,4095,16380,192,0,0,-256,-1,4095,
 -1,0,-253,-16129,-1,1020,252,0,0,1023
2870 DATA -1,255,3840,252,0,0,0,0,-3265,-3073,-3073,
 4095,16380,192,0,0,-256,-1,4095,240
2880 DATA 0,0,-16321,-241,1023,252,0,0,1023,-1,255,
 3840,252,0,0,0,0,-4033,-3073,-15361
2890 DATA 4095,16380,192,0,0,-256,-1,252,0,0,0,0,16128,
 -15361,252,0,0,1023,-1,255
2900 DATA 3840,252,0,0,0,0,-4033,-1,-15361,4095,16380,192,
 0,0,-256,-1,4092,240,0,0
2910 DATA -16321,768,-3073,252,0,0,1023,255,0,3840,252,0,
 0,0,0,-4033,-193,1023,4095,4092
2920 DATA 240,0,0,-256,-64,4092,-1,192,-241,-16129,0,
 -3841,255,0,768,1020,255,0,3840,252
2930 DATA 0,0,0,0,-4033,-193,1023,4095,4092,240,0,16128,
 -64,4032,255,0,0,0,16128,252
2940 DATA -3841,255,0,768,1020,255,0,3840,252,0,0,0,0,
 -4033,-241,1020,4095,1020,252,0
2950 DATA -256,-256,960,1023,252,0,0,16383,1023,-3841,
 -16321,0,3840,1008,255,0,3840,252,0,0
2960 DATA 0,0,-4033,-241,1020,4095,1020,255,0,-253,-256,
 960,-16129,-1,-1,-1,16380,-1,-3841,-4033
2970 DATA 0,16128,1008,255,0,3840,252,0,0,0,0,-4033,-253,
 1008,4095,252,-3841,0,-961,-256
2980 DATA 192,-16129,0,0,0,3840,-1,-16129,-241,0,-253,960,
 255,0,3840,252,0,0,0,0
2990 DATA -4033,-253,1008,4095,252,-193,768,-3841,-256,
 192,-16129,-1009,0,-256,4032,-1,255,-253,240,-193
3000 DATA 768,255,0,3840,252,0,0,0,0,-4033,-256,960,4095,
 252,-253,-1,255,-256,192,-16129
3010 DATA -253,-1,-1,768,-1,252,16128,-1,-3841,768,255,0,
 3840,252,0,0,0,0,-4033,-256
3020 DATA 960,4095,252,16128,-1,240,-256,192,-16129,0,0,
 0,0,-193,192,768,-1,255,768,255
3030 DATA 0,3840,252,0,0,0,0,0,0,0,0,768,-1,0,0,0,0,3840,-1
3040 DATA -16129,0,0,0,0,-193,240,0,0,0,0,0,0,0,0,0,0,0,0
3050 DATA 0,0,0,0,0,0,0,0,0,-193,240,0,0,0,0,0,0,0,0,0,0
```

Sample Cursors

This section describes the following sample graphics cursors:

- Standard Cursor Shape
- Up Arrow
- Left Arrow
- Check Mark
- Pointing Hand
- Diagonal Cross
- Rectangular Cross
- Hourglass

These sample cursors illustrate the wide variety of cursor shapes that can be defined for use in application programs.

The sample cursors are designed for high-resolution graphics mode. Each cursor is a white shape with a black outline on a transparent field. The shape typically suggests the type of action you may take with the mouse. For example, an arrow usually means "make a selection by pointing at an item."

To use a sample cursor in an interpretive BASIC program, copy the BASIC statements presented for the cursor directly to your program. Type the statements exactly as shown, using line numbers that are consistent with your program's numbering scheme.

To use a sample cursor in an assembly- or high-level-language program, define an array in your program and assign the values given for each cursor to the array elements. Assign the values in a way that will make their storage order identical to their storage order in a BASIC program.

The statements in this section define only the cursor's shape. It is up to you to define the action associated with a cursor by including the necessary statements in your program.

Standard Cursor Shape

The standard cursor shape is a solid arrow that points up and to the left. The hot spot is just beyond the arrow's tip, so you can point to an item without covering it. The standard cursor is the most convenient shape when using the mouse to choose or select items from the screen.

```
 100 '
 200 ' Define the screen mask
 300 '
 400 CURSOR( 0,0)=&H3FFF 'Binary 0011111111111111
 500 CURSOR( 1,0)=&H1FFF 'Binary 0001111111111111
 600 CURSOR( 2,0)=&H0FFF 'Binary 0000111111111111
 700 CURSOR( 3,0)=&H07FF 'Binary 0000011111111111
 800 CURSOR( 4,0)=&H03FF 'Binary 0000001111111111
 900 CURSOR( 5,0)=&H01FF 'Binary 0000000111111111
1000 CURSOR( 6,0)=&H00FF 'Binary 0000000011111111
1100 CURSOR( 7,0)=&H007F 'Binary 0000000001111111
1200 CURSOR( 8,0)=&H003F 'Binary 0000000000111111
1300 CURSOR( 9,0)=&H001F 'Binary 0000000000011111
1400 CURSOR(10,0)=&H01FF 'Binary 0000000111111111
1500 CURSOR(11,0)=&H10FF 'Binary 0001000011111111
1600 CURSOR(12,0)=&H30FF 'Binary 0011000011111111
1700 CURSOR(13,0)=&HF87F 'Binary 1111100001111111
1800 CURSOR(14,0)=&HF87F 'Binary 1111100001111111
1900 CURSOR(15,0)=&HFC3F 'Binary 1111110000111111
2000 '
2100 ' Define the cursor mask
2200 '
2300 CURSOR( 0,1)=&H0000 'Binary 0000000000000000
2400 CURSOR( 1,1)=&H4000 'Binary 0100000000000000
2500 CURSOR( 2,1)=&H6000 'Binary 0110000000000000
2600 CURSOR( 3,1)=&H7000 'Binary 0111000000000000
2700 CURSOR( 4,1)=&H7800 'Binary 0111100000000000
2800 CURSOR( 5,1)=&H7C00 'Binary 0111110000000000
2900 CURSOR( 6,1)=&H7E00 'Binary 0111111000000000
3000 CURSOR( 7,1)=&H7F00 'Binary 0111111100000000
3100 CURSOR( 8,1)=&H7F80 'Binary 0111111110000000
3200 CURSOR( 9,1)=&H78C0 'Binary 0111111111000000
3300 CURSOR(10,1)=&H7C00 'Binary 0111110000000000
3400 CURSOR(11,1)=&H4600 'Binary 0100011000000000
3500 CURSOR(12,1)=&H0600 'Binary 0000011000000000
3600 CURSOR(13,1)=&H0300 'Binary 0000001100000000
3700 CURSOR(14,1)=&H0300 'Binary 0000001100000000
3800 CURSOR(15,1)=&H0180 'Binary 0000000110000000
3900 '
4000 '  Set the mouse cursor shape, color, and hot
4050 '  spot
4100 '
4200 M1% = 9
4300 M2% = -1   ' Horizontal hot spot
4400 M3% = -1   ' Vertical hot spot
4500 CALL MOUSE(M1%,M2%,M3%,CURSOR(0,0))
```

Up Arrow

The up arrow is a solid, up-directed arrow with the hot spot at the tip. This shape is useful when directing a motion on the screen with the mouse.

```
 100 '
 200 '  Define the screen mask
 300 '
 400 CURSOR( 0,0)=&HF9FF 'Binary 1111100111111111
 500 CURSOR( 1,0)=&HF0FF 'Binary 1111000011111111
 600 CURSOR( 2,0)=&HE07F 'Binary 1110000001111111
 700 CURSOR( 3,0)=&HE07F 'Binary 1110000001111111
 800 CURSOR( 4,0)=&HC03F 'Binary 1100000000111111
 900 CURSOR( 5,0)=&HC03F 'Binary 1100000000111111
1000 CURSOR( 6,0)=&H801F 'Binary 1000000000011111
1100 CURSOR( 7,0)=&H801F 'Binary 1000000000011111
1200 CURSOR( 8,0)=&H000F 'Binary 0000000000001111
1300 CURSOR( 9,0)=&H000F 'Binary 0000000000001111
1400 CURSOR(10,0)=&HF0FF 'Binary 1111000011111111
1500 CURSOR(11,0)=&HF0FF 'Binary 1111000011111111
1600 CURSOR(12,0)=&HF0FF 'Binary 1111000011111111
1700 CURSOR(13,0)=&HF0FF 'Binary 1111000011111111
1800 CURSOR(14,0)=&HF0FF 'Binary 1111000011111111
1900 CURSOR(15,0)=&HF0FF 'Binary 1111000011111111
2000 '
2100 '  Define the cursor mask
2200 '
2300 CURSOR( 0,1)=&H0000 'Binary 0000000000000000
2400 CURSOR( 1,1)=&H0600 'Binary 0000011000000000
2500 CURSOR( 2,1)=&H0F00 'Binary 0000111100000000
2600 CURSOR( 3,1)=&H0F00 'Binary 0000111100000000
2700 CURSOR( 4,1)=&H1F80 'Binary 0001111110000000
2800 CURSOR( 5,1)=&H1F80 'Binary 0001111110000000
2900 CURSOR( 6,1)=&H3FC0 'Binary 0011111111000000
3000 CURSOR( 7,1)=&H3FC0 'Binary 0011111111000000
3100 CURSOR( 8,1)=&H7FE0 'Binary 0111111111100000
3200 CURSOR( 9,1)=&H0600 'Binary 0000011000000000
3300 CURSOR(10,1)=&H0600 'Binary 0000011000000000
3400 CURSOR(11,1)=&H0600 'Binary 0000011000000000
3500 CURSOR(12,1)=&H0600 'Binary 0000011000000000
3600 CURSOR(13,1)=&H0600 'Binary 0000011000000000
3700 CURSOR(14,1)=&H0600 'Binary 0000011000000000
3800 CURSOR(15,1)=&H0000 'Binary 0000000000000000
3900 '
4000 '  Set the mouse cursor shape, color, and hot
4050 '  spot
4100 '
4200 M1 = 9
4300 M2 = 5   ' Horizontal hot spot
4400 M3 = 0   ' Vertical hot spot
4500 CALL MOUSE(M1,M2,M3,CURSOR(0,0))
```

Left Arrow

The left arrow is a solid, left-directed arrow with the hot spot at the tip. This shape is useful when directing a motion on the screen with the mouse. To generate a right arrow, just reverse the binary bit pattern for each array element and move the hot spot to the new tip. For example, the first element, Binary 1111111000011111 (&HFE1F), becomes Binary 1111100001111111 (&HF87F).

```
 100 '
 200 '  Define the screen mask
 300 '
 400 CURSOR( 0,0)=&HFE1F 'Binary 1111111000011111
 500 CURSOR( 1,0)=&HF01F 'Binary 1111000000011111
 600 CURSOR( 2,0)=&H0000 'Binary 0000000000000000
 700 CURSOR( 3,0)=&H0000 'Binary 0000000000000000
 800 CURSOR( 4,0)=&H0000 'Binary 0000000000000000
 900 CURSOR( 5,0)=&HF01F 'Binary 1111000000011111
1000 CURSOR( 6,0)=&HFE1F 'Binary 1111111000011111
1100 CURSOR( 7,0)=&HFFFF 'Binary 1111111111111111
1200 CURSOR( 8,0)=&HFFFF 'Binary 1111111111111111
1300 CURSOR( 9,0)=&HFFFF 'Binary 1111111111111111
1400 CURSOR(10,0)=&HFFFF 'Binary 1111111111111111
1500 CURSOR(11,0)=&HFFFF 'Binary 1111111111111111
1600 CURSOR(12,0)=&HFFFF 'Binary 1111111111111111
1700 CURSOR(13,0)=&HFFFF 'Binary 1111111111111111
1800 CURSOR(14,0)=&HFFFF 'Binary 1111111111111111
1900 CURSOR(15,0)=&HFFFF 'Binary 1111111111111111
2000
2100 '  Define the cursor mask
2200 '
2300 CURSOR( 0,1)=&H0000 'Binary 0000000000000000
2400 CURSOR( 1,1)=&H00C0 'Binary 0000000011000000
2500 CURSOR( 2,1)=&H07C0 'Binary 0000011111000000
2600 CURSOR( 3,1)=&H7FFE 'Binary 0111111111111110
2700 CURSOR( 4,1)=&H07C0 'Binary 0000011111000000
2800 CURSOR( 5,1)=&H07C0 'Binary 0000000011000000
2900 CURSOR( 6,1)=&H0000 'Binary 0000000000000000
3000 CURSOR( 7,1)=&H0000 'Binary 0000000000000000
3100 CURSOR( 8,1)=&H0000 'Binary 0000000000000000
3200 CURSOR( 9,1)=&H0000 'Binary 0000000000000000
3300 CURSOR(10,1)=&H0000 'Binary 0000000000000000
3400 CURSOR(11,1)=&H0000 'Binary 0000000000000000
3500 CURSOR(12,1)=&H0000 'Binary 0000000000000000
3600 CURSOR(13,1)=&H0000 'Binary 0000000000000000
3700 CURSOR(14,1)=&H0000 'Binary 0000000000000000
3800 CURSOR(15,1)=&H0000 'Binary 0000000000000000
3900 '
4000 '  Set the mouse cursor shape, color, and hot
4050 '  spot
4100 '
4200 M1 = 9
4300 M2 = 0    ' Horizontal hot spot
4400 M3 = 3    ' Vertical hot spot
4500 CALL MOUSE(M1,M2,M3,CURSOR(0,0))
```

Check Mark

The check mark is a solid figure with the hot spot in the center of the "V" formed by the check. This shape can be used when checking off items in a list with the mouse or while a program is checking some aspect of its operation.

```
 100 '
 200 '  Define the screen mask
 300 '
 400 CURSOR( 0,0)=&HFFF0 'Binary 1111111111110000
 500 CURSOR( 1,0)=&HFFE0 'Binary 1111111111100000
 600 CURSOR( 2,0)=&HFFC0 'Binary 1111111111000000
 700 CURSOR( 3,0)=&HFF81 'Binary 1111111110000001
 800 CURSOR( 4,0)=&HFF03 'Binary 1111111100000011
 900 CURSOR( 5,0)=&H0607 'Binary 0000011000000111
1000 CURSOR( 6,0)=&H000F 'Binary 0000000000001111
1100 CURSOR( 7,0)=&H001F 'Binary 0000000000011111
1200 CURSOR( 8,0)=&HC03F 'Binary 1100000000111111
1300 CURSOR( 9,0)=&HF07F 'Binary 1111000001111111
1400 CURSOR(10,0)=&HFFFF 'Binary 1111111111111111
1500 CURSOR(11,0)=&HFFFF 'Binary 1111111111111111
1600 CURSOR(12,0)=&HFFFF 'Binary 1111111111111111
1700 CURSOR(13,0)=&HFFFF 'Binary 1111111111111111
1800 CURSOR(14,0)=&HFFFF 'Binary 1111111111111111
1900 CURSOR(15,0)=&HFFFF 'Binary 1111111111111111
2000 '
2100 '  Define the cursor mask
2200 '
2300 CURSOR( 0,1)=&H0000 'Binary 0000000000000000
2400 CURSOR( 1,1)=&H0006 'Binary 0000000000000110
2500 CURSOR( 2,1)=&H000C 'Binary 0000000000001100
2600 CURSOR( 3,1)=&H0018 'Binary 0000000000011000
2700 CURSOR( 4,1)=&H0030 'Binary 0000000000110000
2800 CURSOR( 5,1)=&H0060 'Binary 0000000001100000
2900 CURSOR( 6,1)=&H70C0 'Binary 0111000011000000
3000 CURSOR( 7,1)=&H1D80 'Binary 0001110110000000
3100 CURSOR( 8,1)=&H0700 'Binary 0000011100000000
3200 CURSOR( 9,1)=&H0000 'Binary 0000000000000000
3300 CURSOR(10,1)=&H0000 'Binary 0000000000000000
3400 CURSOR(11,1)=&H0000 'Binary 0000000000000000
3500 CURSOR(12,1)=&H0000 'Binary 0000000000000000
3600 CURSOR(13,1)=&H0000 'Binary 0000000000000000
3700 CURSOR(14,1)=&H0000 'Binary 0000000000000000
3800 CURSOR(15,1)=&H0000 'Binary 0000000000000000
3900 '
4000 '  Set the mouse cursor shape, color, and hot
4050 '  spot
4100 '
4200 M1 = 9
4300 M2 = 6    ' Horizontal hot spot
4400 M3 = 7    ' Vertical hot spot
4500 CALL MOUSE(M1,M2,M3,CURSOR(0,0))
```

Pointing Hand

The pointing hand is a solid figure with the hot spot at the tip of the extended finger. The pointing hand is another convenient shape to use when choosing or selecting items from the screen, especially if the items are represented by icons or symbols such as the keys of a piano keyboard or a calculator.

```
 100 '
 200 '  Define the screen mask
 300 '
 400 CURSOR( 0,0)=&HE1FF 'Binary 1110000111111111
 500 CURSOR( 1,0)=&HE1FF 'Binary 1110000111111111
 600 CURSOR( 2,0)=&HE1FF 'Binary 1110000111111111
 700 CURSOR( 3,0)=&HE1FF 'Binary 1110000111111111
 800 CURSOR( 4,0)=&HE1FF 'Binary 1110000111111111
 900 CURSOR( 5,0)=&HE000 'Binary 1110000000000000
1000 CURSOR( 6,0)=&HE000 'Binary 1110000000000000
1100 CURSOR( 7,0)=&HE000 'Binary 1110000000000000
1200 CURSOR( 8,0)=&H0000 'Binary 0000000000000000
1300 CURSOR( 9,0)=&H0000 'Binary 0000000000000000
1400 CURSOR(10,0)=&H0000 'Binary 0000000000000000
1500 CURSOR(11,0)=&H0000 'Binary 0000000000000000
1600 CURSOR(12,0)=&H0000 'Binary 0000000000000000
1700 CURSOR(13,0)=&H0000 'Binary 0000000000000000
1800 CURSOR(14,0)=&H0000 'Binary 0000000000000000
1900 CURSOR(15,0)=&H0000 'Binary 0000000000000000
2000 '
2100 '  Define the cursor mask
2200 '
2300 CURSOR( 0,1)=&H1E00 'Binary 0001111000000000
2400 CURSOR( 1,1)=&H1200 'Binary 0001001000000000
2500 CURSOR( 2,1)=&H1200 'Binary 0001001000000000
2600 CURSOR( 3,1)=&H1200 'Binary 0001001000000000
2700 CURSOR( 4,1)=&H1200 'Binary 0001001000000000
2800 CURSOR( 5,1)=&H13FF 'Binary 0001001111111111
2900 CURSOR( 6,1)=&H1249 'Binary 0001001001001001
3000 CURSOR( 7,1)=&H1249 'Binary 0001001001001001
3100 CURSOR( 8,1)=&HF249 'Binary 1111001001001001
3200 CURSOR( 9,1)=&H9001 'Binary 1001000000000001
3300 CURSOR(10,1)=&H9001 'Binary 1001000000000001
3400 CURSOR(11,1)=&H9001 'Binary 1001000000000001
3500 CURSOR(12,1)=&H8001 'Binary 1000000000000001
3600 CURSOR(13,1)=&H8001 'Binary 1000000000000001
3700 CURSOR(14,1)=&H8001 'Binary 1000000000000001
3800 CURSOR(15,1)=&HFFFF 'Binary 1111111111111111
3900 '
4000 '  Set the mouse cursor shape, color, and hot
4050 '  spot
4100 '
4200 M1 = 9
4300 M2 = 5    ' Horizontal hot spot
4400 M3 = 0    ' Vertical hot spot
4500 CALL MOUSE(M1,M2,M3,CURSOR(0,0))
```

Diagonal Cross

The diagonal cross is a solid figure with the hot spot at the center of the cross. This shape is useful as a pointer in a game, or when canceling an operation or deleting an item from a list.

```
 100 '
 200 '  Define the screen mask
 300 '
 400 CURSOR( 0,0)=&H07E0 'Binary 0000011111100000
 500 CURSOR( 1,0)=&H0180 'Binary 0000000110000000
 600 CURSOR( 2,0)=&H0000 'Binary 0000000000000000
 700 CURSOR( 3,0)=&HC003 'Binary 1100000000000011
 800 CURSOR( 4,0)=&HF00F 'Binary 1111000000001111
 900 CURSOR( 5,0)=&HC003 'Binary 1100000000000011
1000 CURSOR( 6,0)=&H0000 'Binary 0000000000000000
1100 CURSOR( 7,0)=&H0180 'Binary 0000000110000000
1200 CURSOR( 8,0)=&H07E0 'Binary 0000011111000000
1300 CURSOR( 9,0)=&HFFFF 'Binary 1111111111111111
1400 CURSOR(10,0)=&HFFFF 'Binary 1111111111111111
1500 CURSOR(11,0)=&HFFFF 'Binary 1111111111111111
1600 CURSOR(12,0)=&HFFFF 'Binary 1111111111111111
1700 CURSOR(13,0)=&HFFFF 'Binary 1111111111111111
1800 CURSOR(14,0)=&HFFFF 'Binary 1111111111111111
1900 CURSOR(15,0)=&HFFFF 'Binary 1111111111111111
2000 '
2100 '  Define the cursor mask
2200 '
2300 CURSOR( 0,1)=&H0000 'Binary 0000000000000000
2400 CURSOR( 1,1)=&H700E 'Binary 0111000000001110
2500 CURSOR( 2,1)=&H1C38 'Binary 0001110000111000
2600 CURSOR( 3,1)=&H0660 'Binary 0000011001100000
2700 CURSOR( 4,1)=&H03C0 'Binary 0000001111000000
2800 CURSOR( 5,1)=&H0660 'Binary 0000011001100000
2900 CURSOR( 6,1)=&H1C38 'Binary 0001110000111000
3000 CURSOR( 7,1)=&H700E 'Binary 0111000000001110
3100 CURSOR( 8,1)=&H0000 'Binary 0000000000000000
3200 CURSOR( 9,1)=&H0000 'Binary 0000000000000000
3300 CURSOR(10,1)=&H0000 'Binary 0000000000000000
3400 CURSOR(11,1)=&H0000 'Binary 0000000000000000
3500 CURSOR(12,1)=&H0000 'Binary 0000000000000000
3600 CURSOR(13,1)=&H0000 'Binary 0000000000000000
3700 CURSOR(14,1)=&H0000 'Binary 0000000000000000
3800 CURSOR(15,1)=&H0000 'Binary 0000000000000000
3900 '
4000 '  Set the mouse cursor shape, color, and hot
4050 '  spot
4100 '
4200 M1 = 9
4300 M2 = 7    ' Horizontal hot spot
4400 M3 = 4    ' Vertical hot spot
4500 CALL MOUSE(M1,M2,M3,CURSOR(0,0))
```

Rectangular Cross

The rectangular cross is a solid figure with the hot spot at the center of the cross. This shape is useful as a pointer in a game, or when inserting items into a list.

```
 100 '
 200 '  Define the screen mask
 300 '
 400 CURSOR( 0,0)=&HFC3F 'Binary 1111110000111111
 500 CURSOR( 1,0)=&HFC3F 'Binary 1111110000111111
 600 CURSOR( 2,0)=&HFC3F 'Binary 1111110000111111
 700 CURSOR( 3,0)=&H0000 'Binary 0000000000000000
 800 CURSOR( 4,0)=&H0000 'Binary 0000000000000000
 900 CURSOR( 5,0)=&H0000 'Binary 0000000000000000
1000 CURSOR( 6,0)=&HFC3F 'Binary 1111110000111111
1100 CURSOR( 7,0)=&HFC3F 'Binary 1111110000111111
1200 CURSOR( 8,0)=&HFC3F 'Binary 1111110000111111
1300 CURSOR( 9,0)=&HFFFF 'Binary 1111111111111111
1400 CURSOR(10,0)=&HFFFF 'Binary 1111111111111111
1500 CURSOR(11,0)=&HFFFF 'Binary 1111111111111111
1600 CURSOR(12,0)=&HFFFF 'Binary 1111111111111111
1700 CURSOR(13,0)=&HFFFF 'Binary 1111111111111111
1800 CURSOR(14,0)=&HFFFF 'Binary 1111111111111111
1900 CURSOR(15,0)=&HFFFF 'Binary 1111111111111111
2000 '
2100 '  Define the cursor mask
2200 '
2300 CURSOR( 0,1)=&H0000 'Binary 0000000000000000
2400 CURSOR( 1,1)=&H0180 'Binary 0000000110000000
2500 CURSOR( 2,1)=&H0180 'Binary 0000000110000000
2600 CURSOR( 3,1)=&H0180 'Binary 0000000110000000
2700 CURSOR( 4,1)=&H7FFE 'Binary 0111111111111110
2800 CURSOR( 5,1)=&H0180 'Binary 0000000110000000
2900 CURSOR( 6,1)=&H0180 'Binary 0000000110000000
3000 CURSOR( 7,1)=&H0180 'Binary 0000000110000000
3100 CURSOR( 8,1)=&H0000 'Binary 0000000000000000
3200 CURSOR( 9,1)=&H0000 'Binary 0000000000000000
3300 CURSOR(10,1)=&H0000 'Binary 0000000000000000
3400 CURSOR(11,1)=&H0000 'Binary 0000000000000000
3500 CURSOR(12,1)=&H0000 'Binary 0000000000000000
3600 CURSOR(13,1)=&H0000 'Binary 0000000000000000
3700 CURSOR(14,1)=&H0000 'Binary 0000000000000000
3800 CURSOR(15,1)=&H0000 'Binary 0000000000000000
3900 '
4000 '  Set the mouse cursor shape, color, and hot
4050 '  spot
4100 '
4200 M1 = 9
4300 M2 = 7    ' Horizontal hot spot
4400 M3 = 4    ' Vertical hot spot
4500 CALL MOUSE(M1,M2,M3,CURSOR(0,0))
```

Hourglass

The hourglass is a solid figure with the hot spot at the center of the glass. This shape can be used to show that the operation in progress will take some time to complete.

```
 100 '
 200 '  Define the screen mask
 300 '
 500 CURSOR( 1,0)=&H0000 'Binary 0000000000000000
 600 CURSOR( 2,0)=&H0000 'Binary 0000000000000000
 700 CURSOR( 3,0)=&H0000 'Binary 0000000000000000
 800 CURSOR( 4,0)=&H8001 'Binary 1000000000000001
 900 CURSOR( 5,0)=&HC003 'Binary 1100000000000011
1000 CURSOR( 6,0)=&HE007 'Binary 1110000000000111
1100 CURSOR( 7,0)=&HF00F 'Binary 1111000000001111
1200 CURSOR( 8,0)=&HE007 'Binary 1110000000000111
1300 CURSOR( 9,0)=&HC003 'Binary 1100000000000011
1400 CURSOR(10,0)=&H8001 'Binary 1000000000000001
1500 CURSOR(11,0)=&H0000 'Binary 0000000000000000
1600 CURSOR(12,0)=&H0000 'Binary 0000000000000000
1700 CURSOR(13,0)=&H0000 'Binary 0000000000000000
1800 CURSOR(14,0)=&H0000 'Binary 0000000000000000
1900 CURSOR(15,0)=&HFFFF 'Binary 1111111111111111
2000 '
2100 '  Define the cursor mask
2200 '
2300 CURSOR( 0,1)=&H0000 'Binary 0000000000000000
2400 CURSOR( 1,1)=&H7FFE 'Binary 0111111111111110
2500 CURSOR( 2,1)=&H6006 'Binary 0110000000000110
2600 CURSOR( 3,1)=&H300C 'Binary 0011000000001100
2700 CURSOR( 4,1)=&H1818 'Binary 0001100000011000
2800 CURSOR( 5,1)=&H0C30 'Binary 0000110000110000
2900 CURSOR( 6,1)=&H0660 'Binary 0000011001100000
3000 CURSOR( 7,1)=&H03C0 'Binary 0000001111000000
3100 CURSOR( 8,1)=&H0660 'Binary 0000011001100000
3200 CURSOR( 9,1)=&H0C30 'Binary 0000110000110000
3300 CURSOR(10,1)=&H1998 'Binary 0001100110011000
3400 CURSOR(11,1)=&H33CC 'Binary 0011001111001100
3500 CURSOR(12,1)=&H67E6 'Binary 0110011111100110
3600 CURSOR(13,1)=&H7FFE 'Binary 0111111111111110
3700 CURSOR(14,1)=&H0000 'Binary 0000000000000000
3800 CURSOR(15,1)=&H0000 'Binary 0000000000000000
3900 '
4000 '  Set the mouse cursor shape, color, and hot
4050 '  spot
4100 '
4200 M1 = 9
4300 M2 = 7    ' Horizontal hot spot
4400 M3 = 7    ' Vertical hot spot
4500 CALL MOUSE(M1,M2,M3,CURSOR(0,0))
```

8 Writing Mouse Programs for IBM EGA Modes

If your application program includes mouse support for IBM enhanced graphics modes D, E, F, and 10, your program must interact with the IBM Enhanced Graphics Adapter (EGA) through the Microsoft EGA Register Interface Library (EGA.LIB). EGA.LIB is included on the Microsoft Mouse Tools disk. If your program tries to set the EGA registers directly, rather than through this interface, the mouse cursor will not be drawn correctly.

The EGA Register Interface allows your program to write to *and* read from write-only registers on the EGA. You need this capability to use interrupt-driven graphics, such as the cursor update code.

The EGA Register Interface Library

The Microsoft EGA Register Interface Library consists of nine functions that can be called from assembly-language programs or from programs written in high-level languages such as Microsoft QuickBASIC, Pascal, FORTRAN, and C. These functions:

- Read from or write to one or more of the EGA write-only registers
- Define default values for EGA write-only registers or reset the registers to these default values
- Check whether the EGA Register Interface is present and, if so, return its version number

How the Interface Library Works

The mouse driver loads the EGA Register Interface Library if it detects an EGA installed in the system. The interface maintains *shadow maps* (memory images) of the

EGA write-only registers, which allow application programs to read these registers. The shadow maps are updated whenever your program calls one of the interface functions to set a register; therefore, the shadow maps always contain the last values written to the registers. When your program calls one of the interface functions to read a register, the function call returns the value stored in the shadow map.

The code in the interface intercepts mode-change calls to the BIOS ROM (INT 10h with AH = 0) and updates the shadow maps and default register tables accordingly.

How to Call the EGA Register Interface Library

This section shows how to call functions in the EGA Register Interface Library from programs written in assembly language and high-level languages.

Making Calls from Assembly-Language Programs

To call EGA Register Interface functions from an assembly-language program:

1. Load the AX, BX, CX, DX, and ES registers (as required) with the parameter values.
2. Execute software interrupt 16 (10h).

Values returned by the EGA Register Interface functions are placed in the registers.

When called from assembly-language programs, functions F2, F3, F4, F5, and F7 expect ES:BX to be a table pointer.

Example

Use the following instructions to set the palette registers to the values in the array "mytable":

```
mytable  db 00h,01h,02h,03h,04h,05h,14h,07h
         db 38h,39h,3ah,3bh,3ch,3dh,3eh,3fh
           .
           .
           .
  mov ax, ds
  mov es, ax                ;set es to the data segment
  mov bx, offset mytable    ;now es:bx --> mytable
  mov cx, 0010h             ;starting at reg 0 for 16
  mov dx, 18h               ;18h = attribute chip
  mov ah, 0f3h              ;f3h = write register range
  int 10h                   ;go!
           .
           .
           .
```

Making Calls from High-Level-Language Programs

You can include EGA Register Interface function calls in QuickBASIC, Pascal, FORTRAN, and C programs as ordinary procedure calls.

To make an EGA function call from a high-level-language program:

1. Declare the appropriate procedure as an external procedure:

   For compiled BASIC and Pascal programs, use the procedure "EGA" if the argument addresses are in the program's data segment (short addresses), or the procedure "EGAS" if the arguments are in another segment (long addresses).

   For FORTRAN programs, use the procedure "EGAS".

   For C programs, use the procedure "cegas" for small-model programs, the procedure "cegam" for medium-model programs, or the procedure "cegal" for large-model programs.

   Your program must pass the addresses (not the values) of five integer arguments to these procedures, so be sure to include an appropriate parameter list in the declarations.

2. Use the normal calling conventions to make the calls.
3. Link the compiled program with EGA.LIB.

All functions require five parameters: E1, E2, E3, E4, and E5. The following table shows how these parameters correspond to the registers listed in the function descriptions:

Parameter	Register
E1	AH
E2	BX
E3	CX
E4	DX
E5	ES

E5 is a dummy parameter for all functions except function FA (Interrogate Driver). For function FA, the value returned for ES is placed in E5.

Use the following conventions when calling functions F2, F3, F4, F5, and F7 from a high-level-language program:

- Procedures that use short argument addresses ("EGA", "cegas", and "cegam") set register ES to the value in register DS when they are called.

  Procedures that use long argument addresses ("EGAS" and "cegal") set register ES to the value of the segment passed as part of parameter E2.
- In BASIC, FORTRAN, and Pascal programs, fill an integer array (packed 2 bytes per integer) with the table values required by the function. Pass the first element of the array as parameter E2.

  In C programs, fill a character array with the table values required by the function. Pass either the name of the array or a pointer to the array as parameter E2.

Examples

In a Pascal program with long argument addresses, use the following statement to declare "EGAS" as an external procedure:

```
PROCEDURE EGAS
(VARS E1, E2, E3, E4, E5:INTEGER);
EXTRN;
```

Once the procedure has been declared, use the following statements to restore the default settings for the EGA registers:

```
E1  :=  246  (*Function number is 246 = F6 (hexadecimal)*)
EGAS(E1, E2, E3, E4, E5)
```

In a small-model C program (version 3.0 or later), the following example restores the default settings for the EGA registers:

```
int ah, bx, cx, dx, es;

ah = 0xF6;              /* restore default settings */
cegas(&ah, &bx, &cx, &dx, &es);
```

In a QuickBASIC program, the following example prints the version number of the EGA Register Interface:

```
' Interrogate driver, get version number.
'

        e1% = &h00FA
        e2% = 0

        call ega(e1%, e2%, e3%, e4%, e5%)

        if (e2% <> 0) then 100
        print "EGA Register Interface not found"
        end

 100    print "EGA Register Interface found, version "
        def seg = e5%
        majver = peek(e2%)
        minver = peek(e2% + 1)
        def seg
        print " = ";
        print majver;
        print ".";
        print minver
        def seg
```

Restrictions on Use of the EGA Register Interface Library

This section describes restrictions on the ways that application programs can use the EGA Register Interface Library.

Calls to BIOS ROM Video Routines

The EGA Register Interface Library only intercepts calls to the BIOS ROM video routines (INT 10h, AH = 13h or less) that change the screen mode (AH = 0). It does not intercept any other BIOS ROM video routine calls. However, any other BIOS ROM video routine calls should restore all registers, so there is no problem in using them.

A call to interrupt 10h to set the color palette (AH = Bh) is an exception to this rule. Use EGA Register Interface function F5 to set the color palette. (For more information about function F5, see "EGA Register Interface Functions" later in this chapter.)

Attribute Controller Registers

Before your application program uses the Attribute Controller registers (I/O address 3C0h) in an extended interrupt 10h call, the program must set the Address or Data register flip-flop to the Address register (by doing an input from I/O port 3BAh or 3DAh). The flip-flop is always reset to this state when the program returns from the interrupt 10h call.

An interrupt routine that accesses the attribute chip always leaves the flip-flop set to the Address register when the program returns from the interrupt call. Therefore, if your application program sets the flip-flop to the Data register and expects the flip-flop to remain in this state, the program must disable interrupts between the time it sets the flip-flop to the Data register state and the last time the flip-flop is assumed to be in this state.

Sequencer Memory Mode Register

When the Sequencer Memory Mode register (I/O address 3C5h, data register 4) is accessed, the sequencer produces a glitch on the CAS lines that may cause problems with video random-access memory (VRAM). As a result, your application program cannot use the EGA Register Interface to read from or write to this register. Instead, use

the following procedure to safely alter this register:

1. Disable interrupts.
2. Set Synchronous Reset (bit 1) in the Sequencer Reset register to 0.
3. Read/modify/write the Sequencer Memory Mode register.
4. Set Synchronous Reset (bit 1) in the Sequencer Reset register to 1.
5. Enable interrupts.

Input Status Registers

Your application program cannot use the EGA Register Interface to read Input Status registers 0 (I/O address 3C2h) and 1 (I/O address 3BAh or 3DAh). If the program must read these registers, it should do so directly.

Graphics Controller Miscellaneous Register

When the Graphics Controller Miscellaneous register (I/O address 3CFh, data register 6) is accessed, a glitch on the CAS lines occurs that may cause problems with video random-access memory (VRAM). As a result, your application program should not use the EGA Register Interface to read from or write to this register.

EGA Register Interface function F6 does not alter the state of the Graphics Controller Miscellaneous register. Use the following procedure to safely alter this register:

1. Disable interrupts.
2. Set Synchronous Reset (bit 1) in the Sequencer Reset register to 0.
3. Read/modify/write the Graphics Controller Miscellaneous register.
4. Set Synchronous Reset (bit 1) in the Sequencer Reset register to 1.
5. Enable interrupts.

EGA Register Interface Functions

This section describes each EGA Register Interface function in detail. The following list shows these functions by function number:

Number (Hex)	Function
F0	Read one register
F1	Write one register
F2	Read register range
F3	Write register range
F4	Read register set
F5	Write register set
F6	Revert to default registers
F7	Define default register table
FA	Interrogate driver

Note Calls F8h, F9h, and FBh through FFh are reserved.

Each function description includes:

- The parameters required to make the call (input) and the expected return values (output)
- Any special considerations regarding the function

If the function description does not specify an input for a parameter, you don't need to supply a value for that parameter before making the call. If the function description does not specify an output value for a parameter, the parameter's value is the same before and after the call.

Caution The EGA Register Interface does not check input values, so be sure that the values you load into the registers are correct before making a call.

Function F0: Read One Register

Function F0 reads data from a specified register on the EGA.

Input:

AH = F0h

BX = Pointer for pointer/data chips:

BH = 0
BL = pointer

Ignored for single registers

DX = Port number:

Pointer/data chips

0h: CRT Controller (3?4h)
8h: Sequencer (3C4h)
10h: Graphics Controller (3CEh)
18h: Attribute Controller (3C0h)

Single registers

20h: Miscellaneous Output register (3C2h)
28h: Feature Control register (3?Ah)
30h: Graphics 1 Position register (3CCh)
38h: Graphics 2 Position register (3CAh)

? = B for monochrome modes or D for color modes

Output:

AX: Restored

BH: Restored
BL: Data

DX: Restored

All other registers restored

Examples

The following example saves the contents of the Sequencer Map Mask register in "myvalue":

```
myvalue db  ?

  mov ah, 0f0h          ;f0 = read one register
  mov bx, 0002h         ;bh = 0 / bl = map mask
                        ;index
  mov dx, 0008h         ;dx = sequencer
  int 10h               ;get it!
  mov myvalue, bl       ;save it!
```

The following example saves the contents of the Miscellaneous Output register in "myvalue":

```
myvalue db  ?

  mov ah, 0f0h          ;f0 = read one register
  mov dx, 0020h         ;dx = miscellaneous output
                        ; register
  int 10h               ;get it!
  mov myvalue, bl       ;save it!
```

Function F1: Write One Register

Function F1 writes data to a specified register on the EGA.

When your application program returns from a call to function F1, the contents of registers BH and DX are not restored. Your program must save and restore these registers itself if this is desired.

Input:

AH = F1h

BL = Pointer for pointer/data chips

or

Data for single registers

BH = Data for pointer/data chips (ignored for single registers)

DX = Port number:

Pointer/data chips

0h: CRT Controller (3?4h)
8h: Sequencer (3C4h)
10h: Graphics Controller (3CEh)
18h: Attribute Controller (3C0h)

Single registers

20h: Miscellaneous Output register (3C2h)
28h: Feature Control register (3?Ah)
30h: Graphics 1 Position register (3CCh)
38h: Graphics 2 Position register (3CAh)

? = B for monochrome modes or D for color modes

Output:

AX: Restored

BL: Restored
BH: Not restored

DX: Not restored

All other registers restored

Examples

The following example writes the contents of "myvalue" into the CRT Controller Cursor Start register:

```
myvalue db  3h

  mov ah, 0f1h     ; f1 = write one register
  mov bh, myvalue  ; bh = data from myvalue
  mov bl, 000ah    ; bl = cursor start index
  mov dx, 0000h    ; dx = crt controller
  int 10h          ; write it!
```

The following example writes the contents of "myvalue" into the Feature Control register:

```
myvalue db  2h

  mov ah, 0f1h      ; f1 = write one register
  mov bl, myvalue   ; bl = data from myvalue
  mov dx, 0028h     ; dx = feature control
                    ; register
  int 10h           ; write it!
```

Function F2: Read Register Range

Function F2 reads data from a specified range of registers on the EGA. A range of registers is defined to be several registers on a single chip that have consecutive indexes. This call makes sense only for the pointer/data chips.

Input:

AH = F2h

CH = Starting pointer value
CL = Number of registers (must be > 1)

DX = Port number:

0h: CRT Controller (3?4h)
8h: Sequencer (3C4h)
10h: Graphics Controller (3CEh)
18h: Attribute Controller (3C0h)

? = B for monochrome modes or D for color modes

ES:BX = Points to table of one-byte entries (length = value in CL). On return, each entry is set to the contents of the corresponding register.

Output:

AX: Restored

BX: Restored

CX: Not restored

DX: Restored

ES: Restored

All other registers restored

Example

The following example saves the contents of the Attribute Controller Palette registers in "paltable":

```
paltable db  16 dup (?)

   mov ax, ds                ; assume paltable in
                             ;  data segment
   mov es, ax                ; es = data segment
   mov bx, offset paltable   ; es:bx = paltable
                             ; address
   mov ah, 0f2h              ; f2 = read register
                             ; range
   mov cx, 0010h             ; ch = start index of 0
                             ; cl = 16 registers
                             ; to read
   mov dx, 0018h             ; dx = attribute
                             ; controller
   int 10h                   ; read them!
```

Function F3: Write Register Range

Function F3 writes data to a specified range of registers on the EGA. A range of registers is defined to be several registers on a single chip that have consecutive indexes. This call only makes sense for the pointer/data chips.

Input:

AH = F3h

CH = Starting pointer value
CL = Number of registers (must be > 1)

DX = Port number

0h: CRT Controller (3?4h)
8h: Sequencer (3C4h)
10h: Graphics Controller (3CEh)
18h: Attribute Controller (3C0h)

? = B for monochrome modes or D for color modes

ES:BX = Points to table of one-byte entries (length = value in CL). Each entry contains the value to be written to the corresponding register.

Output:

AX: Restored

BX: Not restored

CX: Not restored

DX: Not restored

ES: Restored

All other registers restored

Example

The following example writes the contents of "cursloc" into the CRT Controller Cursor Location High and Cursor Location Low registers.

```
cursloc db  01h, 00h            ; cursor at page
                                ; offset 0100h

        mov ax, ds              ; assume cursloc in
                                ;  data segment
        mov es, ax              ; es=data segment
        mov bx, offset cursloc  ; es:bx=cursloc address
        mov ah, 0f3h            ; f3=write register
                                ;  range
        mov cx, 0e02h           ; ch=start index of 14
                                ; cl=2 registers to
                                ;  write
        mov dx, 0000h           ; dx=crt controller
        int 10h                 ; write them!
```

Function F4: Read Register Set

Function F4 reads data from a set of registers on the EGA. A set of registers is defined to be several registers that may or may not have consecutive indexes, and that may or may not be on the same chip.

Input:

AH = F4h

CX = Number of registers (must be > 1)

ES:BX = Points to table of records with each entry in this format:

Bytes 1-2: Port number

Pointer/data chips

0h: CRT Controller (3?4h)
8h: Sequencer (3C4h)
10h: Graphics Controller (3CEh)
18h: Attribute Controller (3C0h)

Single registers

20h: Miscellaneous Output register (3C2h)
28h: Feature Control register (3?Ah)
30h: Graphics 1 Position register (3CCh)
38h: Graphics 2 Position register (3CAh)

? = B for monochrome modes or D for color modes

Byte 3: Pointer value (0 for single registers)

Byte 4: EGA Register Interface fills in data read from register specified in bytes 1-3.

Output:

AX: Restored

BX: Restored

CX: Not restored

ES: Restored

All other registers restored

Example

The following example saves the contents of the Miscellaneous Output register, Sequencer Memory Mode register, and CRT Controller Mode Control register in "results":

```
outvals dw  0020h ; miscellaneous output register
        db  0     ; 0 for single registers
        db  ?     ; returned value

        dw  0008h ; sequencer
        db  04h   ; memory mode register index
        db  ?     ; returned value

        dw  0000h ; crt controller
        db  17h   ; mode control register index
        db  ?     ; returned value

results db  3 dup (?)

        mov ax, ds              ; assume outvals in
                                ;  data segment
        mov es, ax              ; es=data segment
        mov bx, offset outvals ; es:bx=outvals address
        mov ah, 0f4h            ; f4=read register set
        mov cx, 3               ; number of entries in
                                ;  outvals
        int 10h                 ; get values into
                                ;  outvals!
        mov si, 3               ; move the returned
                                ;  values from
        add si, offset outvals ;  outvals
        mov di, offset results ;  to results
        mov cx, 3               ; 3 values to move

movloop: mov ax, [si]   ; move one value from outvals
        mov [di], ax    ;  to results
        add si, 4       ; skip to next source byte
        inc di          ; point to next destination
        loop movloop    ;  byte
```

Function F5: Write Register Set

Function F5 writes data to a set of registers on the EGA. A set of registers is defined to be several registers that may or may not have consecutive indexes, and that may or may not be on the same chip.

Input:

AH = F5h

CX = Number of registers (must be > 1)

ES:BX = Points to table of values with each entry in this format:

Bytes 1-2: Port number

Pointer/data chips

0h: CRT Controller (3?4h)
8h: Sequencer (3C4h)
10h: Graphics Controller (3CEh)
18h: Attribute Controller (3C0h)

Single registers

20h: Miscellaneous Output register (3C2h)
28h: Feature Control register (3?Ah)
30h: Graphics 1 Position register (3CCh)
38h: Graphics 2 Position register (3CAh)

? = B for monochrome modes or D for color modes

Byte 3: Pointer value (0 for single registers)

Byte 4: Data to be written to register specified in bytes 1-3

Output

AX: Restored

BX: Restored

CX: Not restored

ES: Restored

All other registers restored

Example

The following example writes the contents of "outvals" to the Miscellaneous Output register, Sequencer Memory Mode register, and CRT Controller Mode Control register:

```
outvals dw  0020h ; miscellaneous output register
        db  0     ; 0 for single registers
        db  0a7h  ; output value

        dw  0008h ; sequencer
        db  04h   ; memory mode register index
        db  03h   ; output value

        dw  0000h ; crt controller
        db  17h   ; mode control register index
        db  0a3h  ; output value

        mov ax, ds              ; assume outvals in
                                ;  data segment
        mov es, ax              ; es=data segment
        mov bx, offset outvals  ; es:bx=outvals address
        mov ah, 0f5h            ; f5=write register set
        mov cx, 3               ; number of entries in
                                ;  outvals
        int 10h                 ; write the registers!
```

Function F6: Revert to Default Registers

Function F6 restores the default settings of any registers that your application program has changed through the EGA Register Interface. The default settings are defined in a call to function F7.

Input:

AH = F6h

Output:

All registers restored

Note If your program makes an interrupt 10h (video display adapter) call to function 0 to set the display mode, the default register values will change to the BIOS values for the selected mode.

Example

The following example restores the default settings of the EGA registers:

```
mov ah, 0f6h   ; f6 = revert to default
               ;  registers
int 10h        ; do it now!
```

Function F7: Define Default Register Table

Function F7 defines a table containing default values for any pointer/data chip or single register. If you define default values for a pointer/data chip, you must define them for *all* registers within that chip.

Input:

AH = F7h

DX = Port number:

Pointer/data chips

0h: CRT Controller (3?4h)
8h: Sequencer (3C4h)
10h: Graphics Controller (3CEh)
18h: Attribute Controller (3C0h)

Single registers

20h: Miscellaneous Output register (3C2h)
28h: Feature Control register (3?Ah)
30h: Graphics 1 Position register (3CCh)
38h: Graphics 2 Position register (3CAh)

? = B for monochrome modes or D for color modes

ES:BX = Points to table of one-byte entries. Each entry contains the default value for the corresponding register. The table must contain entries for all registers.

Output:

AX: Restored

BX: Not restored

DX: Not restored

ES: Restored

All other registers restored

Examples

The following example defines default values for the Attribute Controller:

```
attrdflt db  00h, 01h, 02h, 03h, 04h, 05h, 06h, 07h
         db  10h, 11h, 12h, 13h, 14h, 15h, 16h, 17h
         db  08h, 00h, 0fh, 00h

         mov ax, ds                ; assume attrdflt in
                                   ;  data segment
         mov es, ax                ; es = data segment
         mov bx, offset attrdflt   ; es:bx = attrdflt
                                   ;  address
         mov ah, 0f7h              ; f7 = define default
                                   ;  register table
         mov dx, 0018h             ; dx = attribute
                                   ;  controller
         int 10h                   ; do it!
```

The following example defines a default value for the Feature Control register:

```
featdflt db  00h

         mov ax, ds                ; assume featdflt in
                                   ;  data segment
         mov es, ax                ; es = data segment
         mov bx, offset featdflt   ; es:bx = featdflt
                                   ;  address
         mov ah, 0f7h              ; f7 = define default
                                   ;  register table
         mov dx, 0028h             ; dx = feature control
                                   ;  register
         int 10h                   ; do it!
```

Function FA: Interrogate Driver

Function FA interrogates the mouse driver and returns a value specifying whether or not the mouse driver is present.

Input:

AH = FAh

BX = 0

Output:

AX: Restored

BX = 0 if mouse driver is not present

ES:BX: Pointer to EGA Register Interface version number, if present:

Byte 1: Major release number
Byte 2: Minor release number (in 1/100ths)

Example

The following example interrogates the mouse driver and displays the results:

```
gotmsg db  "mouse driver found", 0dh, 0ah, 24h
nopmsg db  "mouse driver not found", 0dh, 0ah, 24h
revmsg db  "revision $"
crlf   db  0dh, 0ah, 24h

ten    db  10

       mov bx, 0              ; must be 0 for this call
       mov ah, 0fah           ; fa = interrogate driver
       int 10h                ; interrogate!
       or  bx, bx             ; bx = 0 ?
       jnz found              ; branch if driver present
       mov dx, offset nopmsg  ; assume nopmsg in data
                              ;  segment
       mov ah, 09h            ; 9 = print string
       int 21h                ; output not found message
       jmp continue           ; that all for now

found: mov dx, offset gotmsg  ; assume gotmsg in data
                              ;  segment
       mov ah, 09h            ; 9 = print string
       int 21h                ; output found message
       mov dx, offset revmsg  ; assume revmsg in data
                              ;  segment
       mov ah, 09h            ; 9 = print string
       int 21h                ; output "revision "
       mov dl, es:[bx]        ; dl = major release number
       add dl, "0"            ; convert to ascii
       mov ah, 2              ; 2 = display character
       int 21h                ; output major release
                              ;  number
       mov dl, "."            ; dl = "."
       mov ah, 2              ; 2 = display character
       int 21h                ; output a period
       mov al, es:[bx+1]      ; al = minor release number
       xor ah, ah             ; ah = 0
       idiv ten               ; al = 10ths, ah = 100ths
       mov bx, ax             ; save ax in bx
       mov dl, al             ; dl = 10ths
       add dl, "0"            ; convert to ascii
       mov ah, 2              ; 2 = display character
       int 21h                ; output minor release 10ths
       mov dl, bh             ; dl = 100ths
       add dl, "0"            ; convert to ascii
       mov ah, 2              ; 2 = display character
       int 21h                ; output minor release
                              ;  100ths
       mov dx, offset crlf    ; assume crlf in data
                              ;  segment
       mov ah, 09h            ; 9 = print string
       int 21h                ; output end of line
continue:                     ; the end
```

Appendices

Appendix A
Mouse Command Line Switches

This appendix describes the mouse command line switches you can use to customize the operation of the Control Panel and the mouse driver.

Control Panel Switches

The Control Panel (CPANEL.EXE) is a memory-resident program that allows you to adjust the mouse sensitivity level—the ratio of cursor movement to actual mouse movement. (For information on using the Control Panel, see Chapter 4, "Moving the Mouse," in your *Microsoft Mouse User's Guide.*)

Whenever you invoke the Control Panel, the program reserves memory for the area of the screen the Control Panel overlays. The amount of memory needed depends on the type of display adapter used and the complexity of the image the Control Panel overlays. The Control Panel has a default size for the overlay buffer, but you can use a command line switch to change the amount of memory reserved by the Control Panel. If your system beeps when you activate the Control Panel, the screen buffer is not large enough.

Use one of the following command line switches to change the size of the buffer, depending on the type of display adapter installed in your system:

Use this switch	For this display adapter
/C<n>	IBM Color/Graphics Adapter
/E<n>	IBM Enhanced Graphics Adapter
/H<n>	Hercules display adapter
/M<n>	IBM Monochrome Adapter
/A<n>	AT&T 6300 display adapter

where <n> is a number in the range 0 to 9. The larger the number, the larger the screen overlay buffer. If no switch is specified, the default value is /E7.

The size of the buffer required depends on the mode of the screen the Control Panel overlays. For example, screens displayed in the enhanced graphics modes require a larger Control Panel overlay buffer than screens displayed in text modes.

In general, use a value in the range 0 to 4 if the Control Panel will overlay only text screens; use a value in the range 5 to 9 if the Control Panel will overlay graphics screens.

The following table shows how many bytes of memory are occupied by the Control Panel and buffer for each possible switch setting:

Setting	Switch				
	/M	/H	/A	/C	/E
0	9712	14240	14992	9360	9360
1	9760	14288	15040	9456	9456
2	9808	14336	15088	9552	9552
3	9856	14384	15136	9744	9744
4	9904	14432	15184	10128	10128
5	9952	14480	15232	11872	19088
6	10000	14528	15280	12128	19344
7	10048	14576	15328	14768	29168
8	10096	14624	15376	15024	29424
9	10144	14672	15424	15280	29680

Using a Control Panel switch

Use a Control Panel switch to specify the size of the overlay buffer when you load the Control Panel into memory. If the Control Panel is already in memory, you must first to remove the Control Panel from memory.

To remove the Control Panel from memory:

- Type *cpanel off*

To specify a screen buffer size when you load the Control Panel:

- Type *cpanel* followed by the appropriate switch.

  For example, to specify the largest possible screen buffer for the area the Control Panel overlays on a CGA system, you would type *cpanel /C9*

Mouse Driver Switches

Use mouse driver command line switches to:

- Specify the sensitivity of the mouse
- Set the interrupt rate (for the InPort® Mouse only)
- Tell the mouse driver the type and location of the Microsoft mouse installed in your system so the driver can bypass its usual procedure for determining mouse hardware configuration
- Disable the mouse driver or remove it from memory

Using a mouse driver switch

You can add mouse driver command line switches to the mouse command lines in the AUTOEXEC.BAT or CONFIG.SYS file, or you can type *mouse* and the command line switches at the DOS prompt. If you type one or more switches at the DOS prompt, there must be a space between *mouse* and each switch.

The following sections describe how to use the mouse driver command line switches.

Specifying Mouse Sensitivity

Use the following command line switches to set mouse sensitivity levels:

Use this switch	To set
/S<nnn>	Horizontal and vertical sensitivity
/H<nnn>	Horizontal sensitivity only
/V<nnn>	Vertical sensitivity only
/D<nnn>	Double-speed threshold

where <nnn> is a number in the range 0 to 100.

The switches for the horizontal and vertical sensitivity are interpreted in the same manner as a Control Panel setting. The double-speed-threshold switch determines the threshold speed for doubling the cursor's motion on the screen. Setting a double-speed threshold makes it easier to move the cursor to widely-separated images on the screen. (You can also use mouse function 19 to build this feature into an application program. For more information, see the description of function 19 in Chapter 6, "Mouse Function Descriptions.")

Setting the Interrupt Rate for the InPort Mouse

If you are using an InPort Mouse, you can use one of the following command line switch settings to specify the interrupt rate for the mouse:

Switch Setting	Interrupt Rate
/R0	disabled
/R1	30Hz (default)
/R2	50Hz
/R3	100Hz
/R4	200Hz

Specifying the Type and Location of the Mouse

The command line switches described in this section direct the mouse driver to bypass its usual search to determine the mouse hardware configuration and to look for a particular type of Microsoft Mouse at a particular I/O port.

This feature is useful if:

- The mouse driver has trouble determining which port the mouse is connected to, given your system's configuration
- More than one InPort device is connected to your computer
- You want to decrease the time required to load the mouse driver

The following table lists each switch you can use to tell the mouse driver to look for a particular mouse hardware configuration:

Use this switch	To look for
/B	Bus or InPort Mouse at primary InPort address
/I1	InPort Mouse at primary InPort address
/I2	InPort Mouse at secondary InPort address
/C1	Serial mouse on COM1
/C2	Serial Mouse on COM2

Disabling or Removing the Mouse Driver

If necessary, you can disable the mouse driver or remove it from memory. Before you disable or remove the mouse driver, you need to remove the Control Panel from memory and end any Mouse Menu program you are using.

To remove the Control Panel from memory:

▣ Type *cpanel off*

To end a Microsoft Expert Mouse Menu program:

▣ Type <filename> *off*

where <filename> is the name of the Expert Mouse Menu program.

To end a Mouse Menu program that you wrote yourself:

- Type *menu off*

To disable or remove the mouse driver from memory:

- Type *mouse off*

If the mouse driver is MOUSE.SYS, it is disabled; if the mouse driver is MOUSE.COM, it is removed from memory.

Appendix B
Linking Existing Mouse Programs with MOUSE.LIB (Version 6.0)

If you have a high-level language program that links with an earlier version of the Microsoft Mouse Library, you may have to modify the program to link it with the new MOUSE.LIB (version 6.0) on the Microsoft Mouse Tools disk.

Version 6.0 of MOUSE.LIB functions the same as the previous mouse library (version 5.03), except that version 6.0 has the following new features:

- New mouse functions 20, 21, 22, 23, 29, and 30
- The fourth parameter (M4%) of mouse function 9 must be passed by reference (instead of by value).
- Mouse function 16 requires four parameters (instead of five).

If your program doesn't call function 9 or 16, you can link it with MOUSE.LIB (version 6.0) without modification.

If your program calls function 9 or 16, you must modify the program so that it conforms with the new interface definitions before you can link it with MOUSE.LIB (version 6.0). If you do not plan to call any of the new mouse functions in your program, you may want to link the program with a previous version of the mouse library.

Note Version 5.03 of the Microsoft Mouse Library is included on the Microsoft Mouse Tools disk in the file OLDMOUSE.LIB.

Appendix C
Making Calls from Borland Turbo Pascal Programs

To call mouse functions from a program in Borland Turbo Pascal, use the procedure shown below to pass the correct parameters to the mouse driver. Include this procedure in your code, then call the mouse functions by passing values into this procedure.

```
Procedure Mouse ( Var m1, m2, m3, m4, m5 : integer );

Var
   CpuReg: record of
              AX, BX, CX, DX, BP,
              SI, DI, DS, ES, FLAGS: integer;
           end;

begin {mouse}

  if m1 >= 0 then
      begin
        CpuReg.AX := m1;           {Load parameters  }
        CpuReg.BX := m2;           { into appropriate}
        CpuReg.CX := m3;           { registers       }

        if (m1 = 9) or (m1 = 12) or (m1 = 20)
           or (m1 = 22) or (m1 = 23) then
           begin
              CpuReg.DX := ofs (m4); {m4 = pointer of }
              CpuReg.ES := seg (m4); { the address of }
           end;                      { the user array }
                                     { or subroutine  }

        else if m1 = 16
           begin
              CpuReg.CX := m2; {Left  x coordinate}
              CpuReg.DX := m3; {Upper y coordinate}
              CpuReg.SI := m4; {Right x coordinate}
              CpuReg.DI := m5; {Lower y coordinate}
           end;
        else
              CpuReg.DX := m4;

        intr ($33, CpuReg);     {Call mouse driver }
                                { at interrupt 33h }
```

```
            if (m1 = 20) then       {Special returns   }
               m2:= CpuReg.ES;

            m1 := CpuReg.AX;        {Return values back}
            m2 := CpuReg.BX;        { to parameters    }
            m3 := CpuReg.CX;
            m4 := CpuReg.DX;

         end;

end; {mouse}
```

Appendix D
Using the Hercules Graphics Card with Mouse Programs

Before you use the Hercules Monochrome Graphics Card with a program that has built-in mouse support, you must do the following:

1. Put the Hercules card into graphics mode (if necessary, see the documentation that came with your Hercules card).
2. Store a 6 in memory location 40h:49h if the Hercules card is using CRT page 0. Store a 5 in memory location 40h:49h if the Hercules card is using CRT page 1.
3. Call mouse function 0 to set the mouse cursor boundaries and CRT page number to the appropriate values.

Index

Index

MICROSOFT®

16011 NE 36th Way, Box 97017, Redmond, WA 98073

Problem Report

Name _____

Street _____

City _____ State _____ Zip _____

Phone _____ Date _____

Instructions

Use this form to report problems with Microsoft hardware or software, documentation errors, or suggested enhancements. Mail the form to Microsoft.

Category

_____ Software Problem

_____ Hardware Problem

_____ Software Enhancement

_____ Hardware Enhancement

_____ Documentation Problem (Document # _____)

_____ Other

Product Description

Microsoft Product _____

Rev. _____ Registration # _____

Operating System _____

Rev. _____ Supplier _____

Other Software Used _____

Rev. _____ Supplier _____

Hardware Description

Manufacturer _____ CPU _____ Memory _____ KB

Disk Size _____" Density: Sides:

Single _____ Single _____

Double _____ Double _____

Peripherals _____

Problem Description

Describe the problem. (Also describe how to reproduce it, and your diagnosis and suggested correction.) Attach a listing if available.

Microsoft Use Only

Tech Support _____ Date Received _____

Routing Code _____ Date Resolved _____

Report Number _____

Action Taken: