HONEYWELL

MULTICS MENU CREATION FACILITIES

SOFTWARE

SUBJECT

Description of the Multics Menu Creation Facilities

SPECIAL INSTRUCTIONS

This publication superesedes the previous edition of the manual, Order No. CP51-01, dated July 1982, and its addenda CP51-01A, dated August 1982, CP51-01B, dated February 1983, and CP51-01C, dated December 1983.

Throughout the document change bars are used to indicate technical changes and additions; asterisks denote deletions.

Refer to the Preface for "Significant Changes."

SOFTWARE SUPPORTED

Multics Software Release 11.0

ORDER NUMBER

CP51-02

DATE

February 1985

PREFACE

The publication is intended for application programmers who are building menu interfaces to existing software. The Multics menu system consists of several commands and subroutines which can be used to create and manage menus.

The major topics presented are:

- A description of the terminal-management software that provides a means of dividing the terminal screen into different regions and of performing real-time editing. The terminal-management software is referred to in text as the "video system."
- A description of the Multics commands and subroutines provided for creation and manipulation of video screens and creation and display of menus.
- A description of the Multics I/O modules that support terminal-management functions.

There are some manuals that are prerequisites to this one in that they describe tools that the application writer uses. The writer must be familiar with Multics I/O processing, commands, and subroutines. The manuals describing these are as follows:

Multics Programmer's Reference Manual (Order No. AG91)	Programmer's Reference
Multics Commands and Active Functions (Order No. AG92)	Commands
Multics Subroutines and I/O Modules (Order No. AG93)	Subroutines

File No.: 1L13, 1U13 CP51-02

The Programmer's Reference manual describes I/O processing and contains specific details for the use of screen terminals. The Commands manual contains the descriptions of commands that are referenced in text, such as exec_com. The Subroutines manual contains Multics subroutine descriptions.

In addition, this publication assumes the programmer is familiar with PL/I, FORTRAN, or COBOL, and the Multics exec_com facility. (The exec_com examples in this document use Version 2 of exec_com.) The PL/I language is described in the *PL/I Language Specification,* (Order No. AG94); the FORTRAN Language is described in the *FORTRAN Reference Manual,* Order No. AT58); the COBOL Language is described in the *COBOL Reference Manual,* (Order No. AS44).

Significant Changes in CP51-02

The video system now supports windows which do not extend across the full width of the screen. See Section 2 for details.

The video system editor now accepts either upper or lower case letters when you use default escape sequences. See Section 4 for details.

The "suppress_redisplay" field has been added to the line_editor_info structure. See Section 4 for details.

The "window_call" command now accepts the "-width NC (-wid NC)" control argument which specifies the width of a region for a request. See the "window_call" command in Section 5.

The "change_window" and "create_window" arguments to the "window_call" command now accept the "-column C" and "-width NC" control argument. See Section 5.

A "-line_speed (-ls)" control argument has been added to "window_call invoke". This allows you to specify the speed of your connection to Multics when you use the video system. If no "-line_speed" is specified, the current line_speed is used. See Section 5 for details.

The "window_$edit_line" entry which allows applications to preload the video editor input buffer with a string, has been added to the window_ subroutine. See Section 6 for details.

The "window_$write_raw_text" entry in the window_ subroutine now causes the cursor position to become undefined and sets the screen_invalid window status flag. See Section 6.

Support for the "set_term_type" control order has been added to the tc_io_ I/O module. This control order or the set_tty command allows you to change the terminal type in a video session.

Two new control arguments have been added to window_io_ switch. The "-first_column COL_NO" (control argument) is the column number on the screen where the window is to begin. The "-width N COLS" (control argument) is the number of columns in the window. See Section 7.

The "set_output_conversion" and "get_output_conversion" control orders have been added to the window_io_ I/O module. The "get_output_conversion" control order obtains the current contents of the specified table. The "set_output_conversion" control order provides a table to use in formatting output to identify certain kinds of special characters. See Section 7 for details.

The "get_special" and "set_special" control orders have also been added to window_io_. The "get_special" control order obtains the contents of the special_chars table currently in use. The "set_special" control order provides a table that specifies sequences to be substituted for certain output characters. See Section 7.

A "get_editor_key_bindings" control order, which returns a pointer to the line_editor_key_binding structure describing the key bindings, has been added to window_io_. The "set_editor_key_bindings" control order has been changed. New fields have been added to the line_editor_key_binding structure. The control arguments "-name STR", "-description STR", and "-info_pathname PATH" have been added to the io_call support set_editor_key_bindings control order.

A new mode, "edited, ^edited" suppresses printing of characters for which there is not defined Multics equivalent on the device referenced. See Section 7 for details.

CONTENTS

Illustrations

SECTION 1

INTRODUCTION TO THE MENU SYSTEM

Multics is a large-scale, interactive system with a rich repertoire of commands, subroutines, tools and many interrelated subsystems. There are over 2,000 commands and subroutines alone. Effective use of the power this system has to offer is a specialty not every user masters. In many cases there is no reason to master it. The majority of users have specific tasks to accomplish online and require only a small subset of the available tools. What they do need to know is what tools exist to get their job done most efficiently. The easier it is to figure that out, the better. Since many of these people are not trained in computer use, the system should be made easy to understand, provide flexibility and keep training at a minimum. The Multics menu system provides a means of accomplishing this.

WHAT IS A MENU

A menu is a list of options presented to the user on a video terminal. By typing a single key, designating an option choice, an action is performed. The most important feature the menu system has to offer is permitting the user who knows very little about the system to interact with the computer. No knowledge of commands is required since the system calls the command to do the job once the user indicates an option. All the actions required for a specific task are displayed on the terminal, selections are made, and the user is ushered through a given task by being prompted. You can design menus for all different levels of expertise and for any number of tasks. The easiest way to explain the menu system and to provide application ideas is to give examples of menus. The menu "Games" is shown here.

```
Type a number and the corresponding action will be performed.

                              GAMES
1) Print a maze                              6) Play Star Trek
2) Print a large maze                        7) Play Adventure
3) Play Football                             8) Guess the Animal
4) Play Baseball                             9) Play Backgammon
5) Do a Simulated Parachute Jump
 ============================================================
```

Imagine that the boxes in all the examples in this section are on terminal screens. This entire display is defined by the menu application. The screen is divided into two sections with the top part of the screen for menu display and the bottom part of the screen for user input/output.

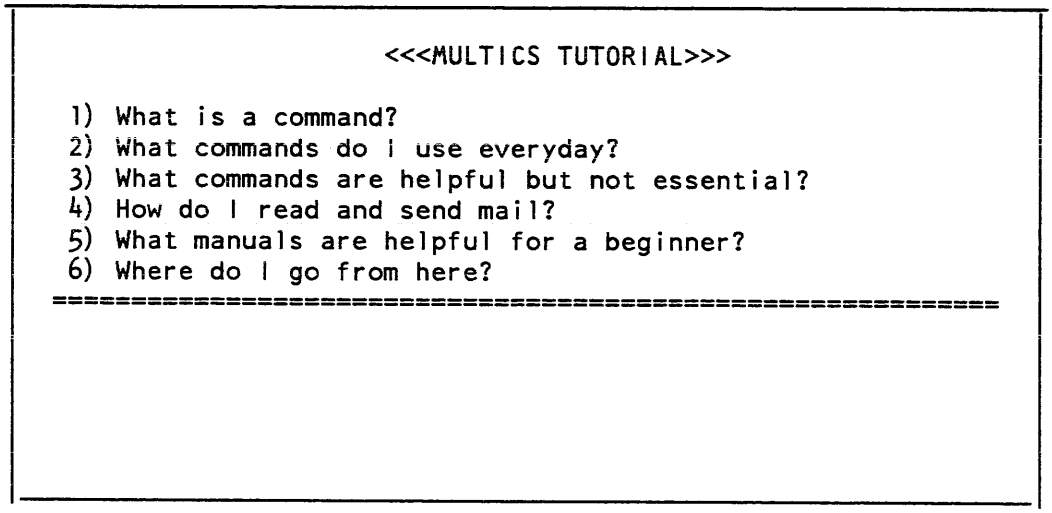
The user of this menu selects one of the options and the screen changes from the list of menu options to the description of a specific game. The screen is no longer divided into two parts and the user input/output section of the screen is expanded to full size. For example, if Option 5 is selected, the transactions appear as follows. In this example, user-typed input is preceded by an exclamation point.

```
Welcome to "splat"--the game that simulates a parachute jump.
Try to open your chute at the last possible moment without
going splat.

Select your own altitude? !yes
What altitude (ft)? !5000
                                        .
                                        .
                                        .
```

When the user is finished playing this game, the screen goes back to the original menu display. Another option is selected or the user exits this particular menu.

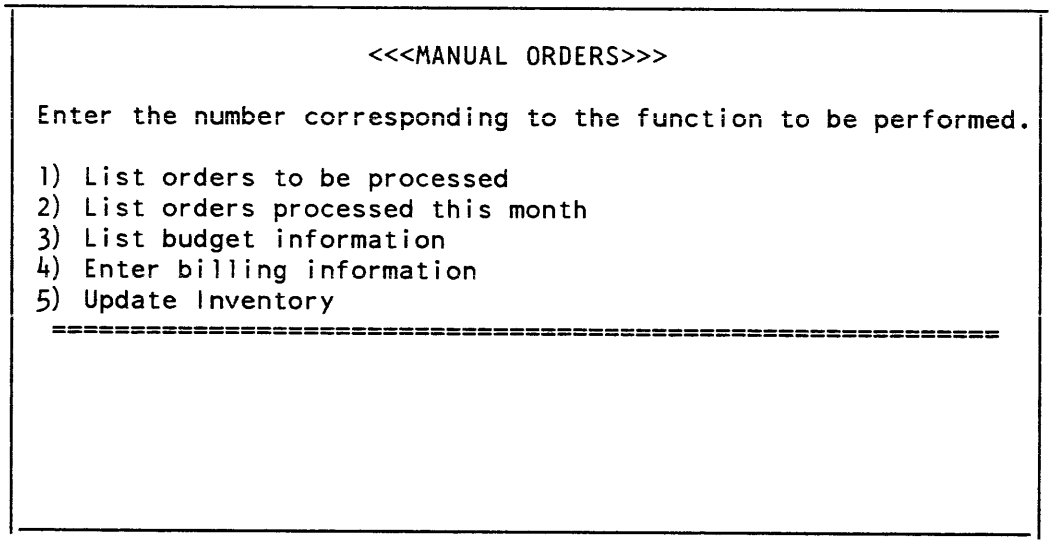
The next example is a menu for Tess True-Heart, a new terminal operator. Other than knowing how to login, Tess is a Multics novice. She needs to learn a little bit about the Multics system, i.e., how a command works, how to read her mail, and what manuals to read for details. Tess is at an advantage because the word processing system she worked on in her previous job also used menus, so she understands the concept. This is an important advantage for the application writer too. Since menus are used widely throughout the industry, people who use your menus will not find the concept a foreign one. As illustrated below, the menu system quite effectively "fences off" the Multics system into an understandable set of tools for personal use. The following example was written for Tess as an introduction to Multics.



As an example of the material in some of these options, Option 2 might discuss the list, help, and dprint commands. All the commands Tess is likely to use in her daily work are candidates for this option.

The commands in Option 3 would be more sophisticated and might include exec_com and the absentee commands.

Another example of a menu user is Percival C. Monday. Percy has no former experience with a computer and it is peripheral to his job. He uses it essentially as a filing system. This application is not unlike one intended for ticket agents at an airline counter, who use a computer strictly for one set of tasks. Percy must be able to read orders received, process orders, file the orders, check the budget allocation/expenditures, charge a department, maintain an inventory and change the inventory as orders are filled and shipments arrive. A menu to accomplish these tasks might look like this:



In the previous examples, the user went from a menu to the game "parachute jump" or to explanations of commands. In this example, Percy is going from the first menu to other menus. If Percy selects Option 5, the screen might look like this:

```
1) List of parts available
2) Additions made to inventory list
3) Deletions made to inventory list
```

Percy selects one of the options in this list and performs the appropriate action.

The first three examples are for inexperienced users and the advantages for such persons are obvious. However, the menu system can be tailored for the experienced user as well. The next example is a manager's application. The manager is Gloria VanDerMint, who has five people working for her in the research and development department. In addition to her development work, she has a number of tasks that must be performed routinely, so you can incorporate them all into one menu. You can set up a number of data bases containing information such as weekly status reports from her unit, and from these she writes the unit status report or performance appraisals, and updates schedules. You may also include the memo command to remind her when performance appraisals and status reports are due. Another convenient command to incorporate is calendar, which reminds her of meetings and trips. Gloria's menu is given below.

```
          <<<The Good, The Bad, and The Boring>>>


1) Read memos                    6) Personal Schedules
2) Send memos                    7) Produce Schedules
3) Calendar                      8) Performance Appraisal Form
4) Modify calendar
5) Unit Status reports
 ============================================================
```

An additional menu for more complex tasks is one that offers a choice of programming procedures. This is helpful for people who have programmed on other systems but not on Multics and discusses the languages and editors available, tells them about formatting programs explain compiling on Multics and discusses debugging tools. It might contain the following:

```
                    <<<Programming Procedures>>>

1) Name Your Language                    4) Format Your Program
2) Enter New Program                     5) Execute Your Program
3) Update Existing Program               6) Debug Your Program
 ============================================================
```

THE CONNECTION BETWEEN THE MENU SYSTEM AND THE VIDEO SYSTEM

In the next section, the video system is introduced. A more detailed discussion is presented in Section 4. Menu application programs use the video system to manage the display on the terminal screen. As noted above, all these examples have the screen divided into portions which have different uses. Since we cannot physically divide the screen, we must do it logically. This is the job of the video system, and this terminal management is required to support the menu software.

SECTION 2

INTRODUCTION TO THE VIDEO SYSTEM

The advent of comparatively low cost video terminals has brought a new dimension to the computing industry. Today's video terminals have many more capabilities than hard copy ones. Real-time editing, and higher speed communication are available and the display can change easily and quickly with varied functions.

The video system is a terminal-independent presentation interface. This means that an application can run on any supported terminal and produce essentially the same display. The video system enables the application writer to divide the terminal screen into "windows" to partition the display. The menu writer must have a thorough understanding of windows; how to invoke the video system (the first step in the process of creating windows), how to revoke the video system, and how to create, destroy, change and clear windows. This section discusses design considerations involved in using windows and covers the video material most important to the menu application writer. For a more detailed description of the features of the video system, see Section 4 of this manual.

WHAT IS A WINDOW

A window is an area of the screen whose contents can be manipulated without affecting the rest of the display. For example, the user may scroll the contents of a segment in one window without moving the contents of the segment displayed on any other part of the screen.

Each window behaves like an individual video terminal. Many possible operations may be performed on a window. These include displaying characters, moving the cursor, erasing lines, inserting lines, and others. Characters are normally sent to a window via the Multics I/O system and the iox_ subroutine (see the *Multics I/O and Subroutines* manual, Order No. AG93). Additional operations specific to the capabilities of video terminals are performed by the window_ subroutine (described in Section 6), which is analogous to iox_.

A window is a rectangular region of the screen. The screen can be divided into several windows that can be viewed simultaneously but the windows may not overlap. The number of line and columns in each window can vary. A window can be one column wide or it can extend across the full width of the screen.

The size of a window is specified at the time the window is created. Character positions are identified by line and column with the origin (or home) located at the upper left hand corner of the window. Each window has its own home, line 1, column 1, and character positions are always with respect to the home of the specific window.

If you want to create a window from command level, use the window_call command with the create_window argument. You can also use the window_create entry to the window_ subroutine to create a window on the terminal screen. (Refer to the description of window_ subroutine later in this manual.)

The command syntax for creating windows from command level is:

```
window_call create_window -io_switch WINDOW
  {-line L -column C -height NL -width NC}
```

window_call, wdc
this command provides a command interface to the video system

create_window, crwd
this argument creates a new window on the screen

-io_switch WINDOW 1 -io_switch
WINDOW 1 specifies the window associated with the given I/O switch.

-line L
specifies the line number on the screen where the window is to begin. To create a window beginning on the third line, use -line 3. If -line is not specified, the default is line 1.

-column C, col C
specifies the column number on the screen where the window is to begin. To create a window beginning in the third column, use -column 3. If -column is not specified, the default is column 1.

height NL, -hgt NL
specifies the height of the window. To create a window 10 lines high, use -height 10. If -height is not specified, the default is the remainder of the screen.

-width NC, -wid NC
specifies the width of the window. To create a window 20 columns wide, use -width 20. If -width is not specified, the default is the remainder of the screen.

Figure 2-1 is an example of three different types of windows that you can create on a screen. You can create a window called WINDOW_1 that is 20 columns wide and 10 lines high. This window begins on the third line and the second column. To create WINDOW_1 (shown in Figure 2-1), type the following command line:

```
wdc crwd -is WINDOW_1 -line 3 -column 2 -height 10 -width 20
```

You can also create a second window on the same screen called WINDOW_2. This window is 3 columns wide and begins in column 25. Since line and height are not specified, the window begins in line one and fills the remainder of the screen. To create WINDOW_2 (shown in Figure 2-1), type:

```
wdc crwd -is WINDOW_2 -column 25 -width 3
```

You can create a third window on the screen called WINDOW_3. This window is 14 columns wide and 7 lines high. This window begins at line 17 and column 32. To create WINDOW_3 (shown in Figure 2-1), type:

```
wdc crwd -is WINDOW_3 -line 17 -column 32 -height 7 -width 14
```

Refer to Section 5 for more information on these commands and other commands used by the menu and video software.

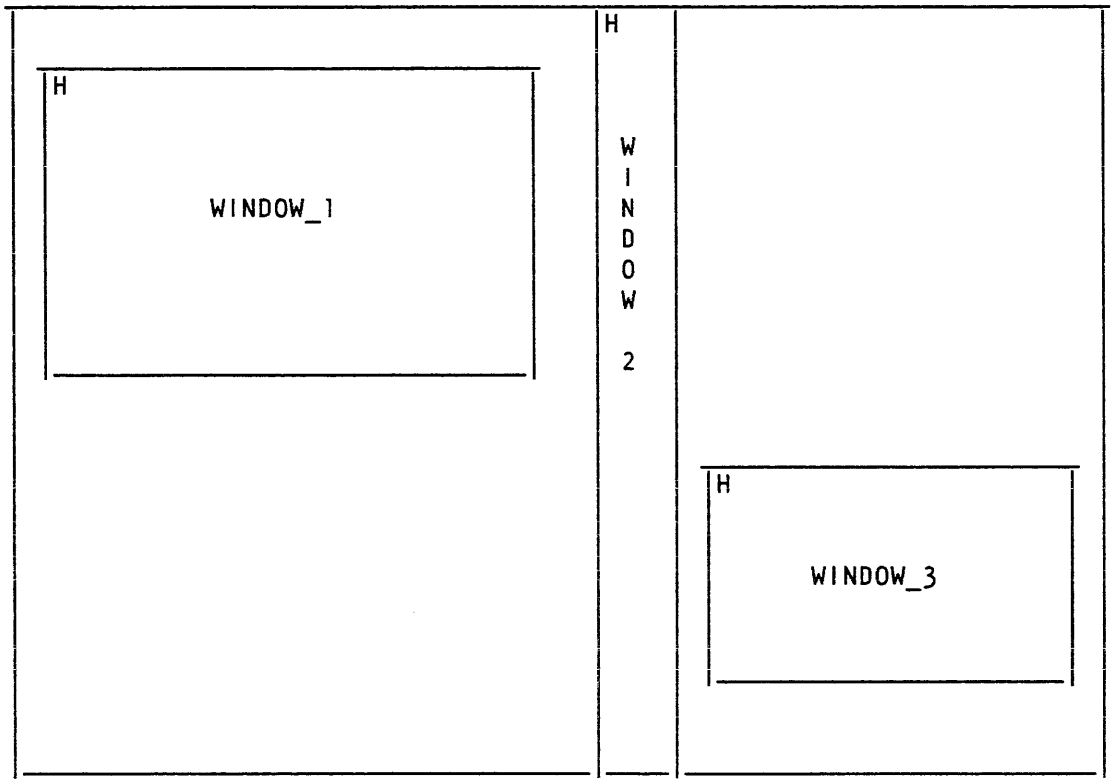


Figure 2-1. Windows on a Screen

Window Capabilities

The capabilities defined for a window are grouped into five categories: positioning the cursor, selective erasure, scrolling, selective alteration, and miscellaneous. Window operations may be performed with the window_call command or by a call to the window_ subroutine. These are described in Sections 5 and 6 respectively.

POSITIONING THE CURSOR

Each window has its own logical cursor. This cursor exists even when the terminal's cursor is performing operations in another window. The position of this cursor may be explicitly changed in a variety of ways. The cursor can be positioned absolutely or relatively. Absolute positioning can be to the home position or to an arbitrary line and column. Relative positioning can be up, down, left, or right any number of positions. The cursor also moves as characters are displayed in the window.

SELECTIVE ERASURE

Selective Erasure (or clearing) means changing some region of the display so that no visible characters appear in that region, without changing any other area of the window. Most video terminals are capable of at least some selective erase operations. Where possible, the video system uses any special terminal features present to clear regions. When the terminal has no useful feature for clearing the specified region, regions are cleared by overwriting them with spaces. This can be a rather slow operation.

A region is a rectangle contained within a window. Like a window, it has an extent (height and width) and a position. All erasure operations pertain to regions. The definition of the region may be explicit (position and extent supplied in the call) or implicit (the region begins at the current cursor location, or at home). The cursor is always left at the origin of the region.

A window may be cleared: entirely, from the home to the end of the window; from the current cursor position to the end of the current line in the window; from the current cursor position to the end of the window. An arbitrary region may also be cleared.

SCROLLING

A window may be scrolled up or down by a given number of lines. Scrolling up means moving lines up from the bottom of the window - deleting lines at the top, and adding new, blank lines at the bottom. Scrolling down means moving lines from the top of the window down, deleting at the bottom and adding at the top. Scrolling is usually done automatically by the video system when output fills the window, but it can also be requested explicitly.

SELECTIVE ALTERATION

Selective alteration means adding or deleting characters or lines in the middle of the window. When characters (or lines) are added, adjoining characters (or lines) move over to make room for the new ones. When characters (or lines) are deleted, characters (or lines) move in to fill up the gap. This differs from selective erasure, which only affects the characters erased.

MISCELLANEOUS

Among other things, entries are provided in the window_ subroutine and the window_call command to sound an audible alarm, to obtain the current cursor position, and to output an arbitrary character sequence.

Window/Video Commands and Subroutines

The command supporting windows is introduced here but is explained in detail in Section 5 of this manual.

window_call
: is the command interface to the video system. This is used in exec_com applications while the window_ subroutine is used in PL/I, ft_window_ is used in FORTRAN, and cb_window_ is used in COBOL applications.

The subroutines supporting windows and the video system are described in detail in Section 6 of this manual and are as follows:

video_utils_
: activates and deactivates the video system.

video_data_
: is a data segment containing information about the video system.

window_
: is the subroutine interface to the video system. It is the corresponding subroutine to the window_call command.

Attaching the Video System

You must check whether or not the users of the proposed menu have the video system turned on. It is not likely that novice users would do this initially but it might be included in a project start_up. If it is on, it is important that you leave it alone. Do not turn it on again or you will get an error message. If you have determined that the video system is turned on, you should then have your application use the space allocated to the user_input/output window instead of the whole screen. Thus, if the user creates a separate window for interactive messages, an application should not use that space. Using the space allocated to the user_io window respects the user's explicit wishes and prevents violation of the restriction against using two overlapping windows at the same time.

When the video system is invoked, the entire screen is covered by a window associated with the user_i/o I/O switch. Determine how much of the screen you have and divide up that amount for use by your application. Since terminals vary in the length of the screen, and some users already may have some lines devoted to their own video display, you are probably dealing with less than 20 lines, so design with that in mind. As long as there are eight or ten lines available for user input/output that should be sufficient.

The first step then is determining whether or not the video system is turned on and, if not, turn it on. This should be included at the beginning of all menu applications. The following is the exec_com example. The lines are numbered only for the purpose of explanation and should not be included in your exec_com.

```
1    &set already_video &[io attached user_terminal_]
2    &if &[not &(already_video)]
3    &then window_call invoke
4    &set first_line &[window_call get_first_line] n_lines
     &[window_call get_window_height]
```

where:

1. determines whether or not the video system is attached to the user's terminal.
2. turns it on if it isn't already on.
3. invokes window_call initiating the window environment.
4. sets the lines for the window. This is part of the first step because when you revoke the video system at the end of the exec_com, you must set the screen to the size it was originally.

The following is the PL/I example that does the same thing. Declare statements are included in the example. Again, the lines are numbered for the purpose of explanation and the numbers should not be included in your program.

```
     dcl  (addr, null) builtin;

     dcl  iox_$control entry (ptr, char (*), ptr, fixed bin (35));
     dcl  com_err_ entry () options (variable);
     dcl  iox_$user_io ptr ext static;
     dcl  video_utils_$turn_on_login_channel entry
            (fixed bin (35), char (*));
     dcl  video_data_$terminal_iocb ext static ptr;
     dcl  ME char (32) init ("test_program") static options (constant);
     dcl  code fixed bin (35);
     dcl  already_video bit (1);
     dcl  reason char (128);

1    %include window_control_info;
2    dcl 1 my_window_info like window_position_info;
3    my_window_info.version = window_position_info_version_1;
4    if video_data_$terminal_iocb = null () then do;
5       call video_utils_$turn_on_login_channel (code, reason);
6       if code ^= 0 then do;
             call com_err_ (code, ME, "^a", reason);
             return;
        end;
7       already_video = "0"b;
     end;
8    else already_video = "1"b;
9    call iox_$control (iox_$user_io, "get_window_info",
        addr (my_window_info), code);
10   if code ^= 0 then do;
         call com_err_ (code, ME, "get_window_info");
         return;
      end;
```

where:

1. includes appropriate structure declarations
2. declares an automatic copy of window info
3. sets the version number of window info
4. determines if the video system is not activated then does 4 through 6
5. turns on the video system and
6. if there is an error, reports it to the caller and quits
7. makes a note to the effect that video was invoked by this program
8. goes to here if the video system is already activated (video was not activated by this program)
9. gets the current size and location (beginning line number) of the user_i/o window
10. prints error message

Detaching the Video System

At the end of the exec_com, you have to turn off video and leave things as you found them. First, is the exec_com example for revoking the video system. The lines are numbered only for the purpose of explanation and these numbers should not be included in your exec_com.

```
1    &if &(already_video)
2    &then window_call change_window -line &(first_line)
       -height &(n_lines)
3    &else window_call revoke
```

where:

1. determines whether or not video was activated by this exec_com.
2. if video was activated by another exec_com, then user_i/o window is returned to previous size and it is cleared.
3. otherwise, the window interface to the video system is deactivated and the user_i/o window goes to full screen.

The PL/I example:

```
1    if already_video  then do;
2    call video_utils_$turn_off_login_channel(code);
       if code ^=0 then do;
          .
          .
          .
       end;
     end;
3    else do; call iox_$control(iox_$user_io, "set_window_info",
       addr(my_window_info), code);
       if code ^=0 then do;
          .
          .
          .
       end;
     end;
```

where:

1. determines whether or not video was activated by this program.
2. if video was previously attached, then the user_i/o window is returned to its previous size.
3. if the video system was activated by this program, it is then deactivated and the user_i/o window goes to full screen.

Design Requirements for Windows

In Section 1, all of the examples used two windows: the top window which displayed the menu itself and the bottom window which was for user input/output. As part of the menu design process, you decide ahead of time how the display will look and from that determine the number of windows that will be advantageous.

As an example, you may have the screen divided into three windows. The top window could display the status of the user with the user name, a description of what he's doing and a clock. The middle window could contain various menus and could grow or shrink depending on the selection made. The bottom window could be for unformatted output and for typing in input.

The number of windows technically permitted is quite large and probably more than you will need. Knowing how many functions are to be performed, you should carefully select the number of windows to be used by an application. It is possible on a 24 line terminal to have 24 windows but rarely, if ever, would that be useful. Each window would be too small and the screen would be too cluttered. Practically, there should not be more than five. In the examples in Section 1, there are lines marking the division between top and bottom * windows. This is a trailer line specified in the exec_com or program. It is not necessary, but does make the delineation obvious and aids readability. Windows may not overlap. Each | window has its own extent (height and width) and location (the position of its home on the screen). Windows can change their extent and location as long as they never overlap. The initial extent and location of a window is determined in the attach description of the window.

Window Operations

The rest of this section discusses the operations of window_call and window_ that are most essential. These include: create, change, destroy, and clear. Specific examples are given for exec_com and PL/I applications.

Now you need to define windows and this is done with arguments to window_call or with the entry points of the window_ subroutine. The first action discussed is create_window. Part of the creation process is the naming of windows. Windows are associated with iox_ I/O switches. The "name of the window" is just the name of the switch, or as it is sometimes called, the iocb name. Since many Multics commands and subroutines make use of the standard switches user_io, user_input, error_output, and user_output, it is usually necessary to have these switches connected to some window. This is done by window_call invoke or video_utils_$turn_on_login_channel. By convention, the bottom window of the screen is used for user_i/o.

Important Window Requests

Before a window can be created you must decide on its starting line number as discussed above in "Attaching Video" and its length (in number of lines). As mentioned earlier, it is customary to get space for a new window from the user_i/o window and to position the new window at the top of the user_i/o window. Therefore, one of the first things to do is find out where the user_i/o window is. Once this is known you must determine just how high, in lines, the new window must be and shrink the user_i/o window by that amount. It is a good idea to always check to make sure there is enough space left in the user_i/o window to allow meaningful communication once it has been shrunk. In our examples we will insist on at least a five line user_i/o window.

To do all that has been discussed so far in an exec_com, we would have the following:

```
&- stored in the default value segment as the_menu.

&set io_start &[window_call get_first_line]
&set io_height &[window_call get_window_height]
&set menu_height &[menu_describe the_menu -height]

&- Now calculate the new positions of both windows.

&set menu_start &(io_start)
&set io_start &[plus &(io_start) &(menu_height)]
&set io_height &[minus &(io_height) &(menu_height)]

&- The label referenced below would, of course, need to be
&- defined and would include an appropriate error message.

&if &[nless &(io_height) 5]
  &then &goto USER_I/O_TOO_SMALL

&- Now shrink user_i/o

window_call change_window -line &(io_start) -height &(io_height)

&- And define the new window, called able

window_call create_window -io_switch able -line &(menu_start) -height
  &(menu_height)
```

The real work of creating the new window above was done by the window_call command with the create_window argument. This command created the necessary iox_ I/O switch attachments to make "able" an I/O switch which describes a video system window that occupies the first "menu_height" lines of what was user_i/o.

THE PL/I EXAMPLE

A window can be created either at command level or from a PL/I subroutine. To do the same thing in PL/I you would use the following code fragment:

```
/* Get the variables initialized.  We assume the menu has */
/* been created and the requirements for the menu are     */
/* stored in the menu_needs structure (see menu_ for dcl) */

%include window_control_info;
dcl 1 io_window_info like (window_position_info);
dcl 1 menu_window_info like (window_position_info);

io_window_info.version = window_position_info_version_1;
call iox_$control (iox_$user_io, "get_window_info", addr
   (io_window_info), code);
   if  code ^= 0 then do;
        .
   process the error
        .
   end;
menu_window_info = io_window_info;

/* Now calculate the new positions of both windows. */

menu_window_info.origin.line = io_window_info.origin.line;
io_window_info.origin.line = io_window_info.origin.line
     +menu_window_info.extent.height;
io_window_info.extent.height = io_window_info.extent.height
     -menu_window_info.extent.height;
if io_window_info.extent.height < 5
then do;
   if  code ^= 0 then  do;
        .
   process the error
        .
   end;
end;

/* Now shrink user_i/o */

call iox_$control (iox_$user_io, "set_window_info", addr
  (io_window_info), code);
   if code ^= 0 then do;
        .
   process the error
        .
   end;

/* And define the new window */

call window_$create (video_data_$terminal_iocb, addr (menu_window_info),
     menu_window_iocbp, code);
```

CHANGE WINDOW OPERATION

In the above examples we have seen that it was necessary to change or shrink the user_i/o window in order to create a new window. When we discuss destroying windows below we will see a need to expand the user_i/o window to recover the space freed by the destruction of a window.

Command level changes are done with the window_call keyword change_window. In PL/I the changes are made by the set_window_info control order. In general this will be preceded by a get_window_info control order and some calculations.

DESTROY WINDOW OPERATION

Once a window is no longer needed it must be destroyed, i.e., the I/O switch must be closed and detached thus freeing up the space on the screen that was occupied by the window. In addition, this space should be returned to some active window so that it can be used. If the freed space is adjacent to the user_i/o window it should be consumed by that window, but it can be added to any adjacent window. In our examples we will add it back to user_i/o.

To reverse the effects of the exec_com window creation example above we would have:

```
&- destroy the able window

&- and let user_i/o have the space back

&set io_start &(menu_start)
&set io_height &[plus &(menu_height) &(io_height)]
&set menu_start 0 menu_height 0

window_call change_window -line &(io_start) -height &(io_height)
```

In PL/I we would have:

```
/* destroy the able window */

call window_$destroy (...);
   if code ^= 0 then do;
        .
   process the error
        .
   end;
```

```
/* and let user_i/o have the space back */

io_window_info.origin.line = menu_window_info.origin.line;
io_window_info.extent.height = menu_window_info.extent.height
     +io_window_info.extent.height;

call iox_$control (iox_$user_io, "set_window_info",
     addr (io_window_info), code);
   if code ^= 0 then do;
        .
   process the error
        .
   end;
```

CLEAR WINDOW OPERATION

Another very useful operation is the clear_window operation. This clears the entire window to all spaces and leaves the cursor positioned at the upper left hand corner of the window. There are other clearing operations, but this one is the simplest and most useful.

From command level we can clear the user_i/o window by:

```
window_call clear_window
```

If we had wanted to clear, say the able window, we would have included the -io_switch control argument specifying able as the window to operate on.

This same effect, clearing the able window of our examples, can be accomplished from PL/I by:

```
call window_$clear_window (menu_window_iocbp, code);
   if code ^= 0 then do;
        .
   process the error
        .
   end;
```

The clear_window operation is useful when an application wants to start with a clean slate in the user_i/o window. For example, before printing out a description of some menu option it might be desirable to clear the user_i/o window.

OTHER USEFUL OPERATIONS

Once window status is set, any operation performed on that window (except for a create or destroy operation) returns the status code video_et_$window_status_pending until the status is reset. To reset the status, perform a get_window_status control order on the window switch. Refer to "Control Operations" for window_io_ later in this manual.

There are many other operations that can be performed on windows using the video system. These are all described in the window_call command in Section 5 or in the window_ subroutine description in Section 6 or the control orders or modes of the window_io_ I/O module in Section 7.

SECTION 3

MENU APPLICATIONS

This section discusses the use of function keys and the building of a menu application. It includes a sample exec_com, and PL/I programs. FORTRAN and COBOL programmers refer to Section 8 and Section 9, respectively.

GUIDELINES FOR FUNCTION KEYS

A set of keys that are integral to the menu system are the function keys. These are used to get information, move from one menu to another, or to exit from a menu and return to Multics command level. The reason that the function keys are used at all is to reserve the numbers for the options and also to eliminate the need to include these functions in every list of options in every menu. Ease of use is enhanced when the function keys are doing the same thing from application to application. The following example shows the definitions of the function keys in the "Games" menu.

```
Press F1 - Gives definitions of the function keys
Press F2 - Returns to the first menu
Press F3 - Goes to the previous menu
Press F4 - Returns to Multics command level
```

If there are no function keys on the terminal, then the user could type specially assigned keys in sequence. In the following example the escape key has been chosen in conjunction with a letter that is related to the action performed. The selection would then be:

```
ESC d - Gives definitions of the function keys
ESC f - Returns to the first menu
ESC p - Goes to the previous menu
ESC r - Returns to Multics command level
```

Since not all terminals have function keys, you must include a call to ttt_info_$function_key_data (described in *Multics Subroutines and I/O Modules*, Order No. AG93) in your program, which will return information about the terminal being used. This information covers whether or not there are function keys and how many there are.

For those terminals without function keys, or which do not have enough, you must designate keys to be used in their place. It is helpful to the end user if the first of these keys is a "special" key such as the escape key. This should be followed by a regular key that is somewhat related to the action to be performed. You can use a single key, but the advantage of two in sequence is that it does not interfere with the option numbers or letters that have been used. The sequence can also be more than two keys, but the longer it is the greater the chance of typing errors.

Summary of function key recommendations:

- Assign the same meaning to specific keys for every menu.
- Include a call to ttt_info_$function_key_data in your program.
- There is no command level interface to ttt_info_$function_key_data so this cannot be done with exec_com.

If function keys are not available, follow the above suggestions plus:

- Use a combination of characters such that the first character is not the same as any menu option character. A suggestion is using a special key (not @ or #) such as <ESC> in conjunction with a character related to the action performed. For example, <ESC> p for previous menu, or <ESC> r for returning to command level.
- Do not use numbers or single letters as they are reserved for options.
- Do not use two digit numbers because only the first digit is "heard" and an option would therefore be selected. In other words, if you have a function numbered 12 only the first digit is processed so option 1 would be selected.

THE EXEC_COM EXAMPLE

There are four ways in which menu applications may be built: one using exec_com and written in the Multics command language; the others using PL/I, FORTRAN or COBOL programs. The exec_coms provide a quick and easy way to implement very simple menu applications whereas PL/I, FORTRAN or COBOL programs provide for more powerful and robust ones. The Multics menu system provides commands and subroutines to facilitate either type of implementation.

Below is an example of an exec_com interface to the menu system. It is a very simple application and it illustrates how you can begin. The example is a document menu for everyday office use. It is called "Document System". The user will be able to enter, edit, display, print, list or delete documents. The last option available is to exit the document system. So, there are seven options in all and they will be displayed in the top window. Since you will probably want them displayed in the fewest number of lines possible, make space in this window for 6 lines allowing for the headers, the trailers, and the list of menu options printed in two columns. The area from line seven to the end of the screen is the user_i/o window. To see how the standard I/O switch attachments change when you use an exec_com to create a menu, refer to Appendix A, especially Figure A-3. Line numbers are used in this example to indicate new lines, e.g., line 18 is all one line in the exec_com and a new line does not occur till the number 19 appears. Line numbers should not be included in your exec_com.

```
1  &version 2
2  &trace off

   &- First we will see if the video system is enabled
   &- in the users process.  This is done by checking
   &- to see if the I/O switch user_terminal_ is
   &- attached.  If it isn't we invoke the video
   &- system.  We need to do this so that we can later
   &- return the user to his/her normal environment.

3  &set already_video &[io attached user_terminal_]
4  &if &[not &(already_video)]
5  &then window_call invoke

   &- Now  we  will create our demonstration menu.  In
   &- real  applications this menu would most likely be
   &- saved  in  some  value  segment  containing other menus.


6 menu_create main -option "enter new document"
  -option "edit old document" -option "print document on
  terminal" -option "print document on printer" -option
  "list documents" -option "delete document" -columns 2
  -header "<<< DOCUMENT SYSTEM >>>" -center_headers
  -trailer "-" -trailer "USE FUNCTION KEY 1 TO EXIT"
  -trailer "-" -center_trailers -pad "-"

   &- Here we determine where the windows will go.
   &- What we will attempt to do is split the user_i/o
   &- window into two windows.  The top window is named
   &- using a unique name to avoid conflict with other
   &- I/O switch names in the process and will contain
   &- the menu.  The bottom window will be user_i/o.
   &- This split of user_i/o is done to allow this
   &- application to run while other video applications
   &- windows exist on the screen.

7  &set menu_start &[window_call get_first_line]
8  &set menu_height &[menu_describe main -height]
9  &set io_start &[plus &(menu_start) &(menu_height)]
10 &set io_height &[minus [window_call get_window_height] &(menu_height)]

   &- We must have at least 5 lines left in user_i/o.
   &- This is an arbitrary limit that this exec_com
   &- will enforce.

11 &if &[nless &(io_height) 5]
12   &then &do
13     &print There is not enough room on the screen to run.
14     &quit
15 &end

   &- Now establish the window to be used to display
   &- the menu.  It takes its space on the screen from
   &- user_i/o, so first shrink user_i/o.  The menu
```

```
    &- window is given a name using the unique active
    &- function to avoid conflicts with I/O switch names
    &- already in existence.

16  window_call change_window -line &(io_start) -height &(io_height)
17  &set menu_switch &[unique].menu
18  window_call create_window -io_switch &(menu_switch) -line
    &(menu_start) -height &(menu_height)

    &- We are now ready to display the menu and get a
    &- choice.  We must display the menu each time
    &- through the loop due to the fact that
    &- menu_get_choice will modify the menu display in
    &- the window.  We will set a local exec_com
    &- variable to the choice made just in case we want
    &- it in the future (in this example we don't, but
    &- its a good idea anyway).

19  &label GET-CHOICE

20  menu_display main -io_switch &(menu_switch)
21  &set choice &[menu_get_choice main -io_switch &(menu_switch)]

    &- Now that we have either (1) a valid menu choice
    &- in the form of a decimal integer, or (2) a
    &- function key selection in the form "F" followed
    &- by the function key number, let's perform the
    &- requested action.

22  &goto CHOICE-&(choice)

    &- This choice is "enter a new document." It will
    &- first create the new document and then enter ted
    &- to allow entry of the text.  Before doing
    &- anything, this action, like all others, will
    &- clear the user_i/o window.  This gives a feeling
    &- of starting some new action that we want at this
    &- point (this is done for all actions).

23  &label CHOICE-1

24  window_call clear_window
25  io control user_i/o reset_more
26  do "create &&1;ted -pn &&1" [response "new document name:"]
27  &goto GET-CHOICE

    &- This choice is "edit an old document." It will
    &- enter ted for editing of the requested document.

28  &label CHOICE-2

29  window_call clear_window
30  io control user_i/o reset_more
31  ted -pn [response "old document name:"]
32  &goto GET-CHOICE
```

```
    &- This choice is "print document on terminal." It
    &- will just print the specified document in the
    &- user_i/o window.

33  &label CHOICE-3

34  window_call clear_window
35  io control user_i/o reset_more
36  print [response "document name:"] 1
37  &goto GET-CHOICE

    &- This action is "print document on printer." It
    &- will simply enter a dprint request of the
    &- specified document.

38  &label CHOICE-4

39  window_call clear_window
40  io control user_i/o reset_more
41  dprint [response "document name:"]
42  &goto GET-CHOICE

    &- This is the "list documents" action.  It will
    &- simply list the names of all of the documents
    &- defined.  Our convention for document naming is
    &- simple - any single component segment name will
    &- do.

43  &label CHOICE-5

44  window_call clear_window
45  io control user_i/o reset_more
46  list * -name -primary
47  &goto GET-CHOICE

    &- This is the "delete document" action.  It deletes
    &- the document specified by the user.

48  &label CHOICE-6

49  window_call clear_window
50  io control user_i/o reset_more
51  delete [response "document name:"]
52  &goto GET-CHOICE

   &- This is the action for function key #1.  This
   &- action exits the document subsystem.  At this
   &- point we will destroy the menu window and either:
   &- (1) return the user_i/o window to its former
   &- state, or (2) revoke the window system entirely.
   &- This choice is based on whether the video system
   &- was in effect when we started this exec_com.

53  &label CHOICE-F1
```

```
54  window_call delete_window -io_switch &(menu_switch)
55  &if &(already_video)
56    &then &do
57      window_call change_window -line &(menu_start) -height
        &[plus &(menu_height) &(io_height)]
58      window_call clear_window
59    &end
60    &else window_call revoke

61  &quit

    &- One last thing to check for are undefined
    &- function keys.  For these we will simply ring the
    &- bell (in the video system tradition that's what
    &- it does for undefined control character input
    &-  sequences).

62  &label CHOICE-&(choice)

63  window_call bell
64  &goto GET-CHOICE
```

THE PL/I EXAMPLE

Below is the PL/I example setting up the same menu, Document System. Your first reaction may be that it is far more complicated and much longer than the exec_com example. If the document system menu were going to stay this simple it probably wouldn't be reasonable to do it in PL/I. But if the menu is going to be enhanced with more capabilities and power, PL/I is the better approach. You can add a great deal of versatility and correct errors with a PL/I application, something that just cannot be done with exec_com.

```
md1:
     proc ();

/* Automatic */

dcl choice fixed bin;
dcl choices (6) char (30) var;
dcl code fixed bin (35);
dcl fkey bit (1) aligned;
dcl headers (1) char (30) var;
dcl key_shift_idx fixed bin;
dcl menu_io ptr init (null);
dcl menu_io_switch_name char (32);
dcl menu_ptr ptr;
dcl my_area area (4095);
dcl 1 my_menu_format like menu_format;
dcl 1 my_menu_requirements like menu_requirements;
dcl 1 new_window_info like window_position_info;
dcl reason char (512);
dcl term_type char (32);
dcl trailers (2) char (30) var;
dcl 1 user_io_window_info like window_position_info;
dcl video_was_already_on bit (1) aligned;
```

```
/* Based */

dcl 1 fkey_data like function_key_data based (function_key_data_ptr);

/* Builtin */

dcl (addr, empty, length, null) builtin;

/* Conditions */

dcl cleanup condition;

/* Entries */

dcl com_err_ entry () options (variable);
dcl ioa_ entry () options (variable);
dcl ttt_info_$function_key_data entry
      (char (*), ptr, ptr, fixed bin (35));
dcl unique_chars_ entry (bit (*)) returns (char (15));
dcl user_info_$terminal_data
          entry (char (*), char (*), char (*), fixed bin, char (*));
dcl video_utils_$turn_off_login_channel entry (fixed bin (35));
dcl video_utils_$turn_on_login_channel entry (char (*), fixed bin (35));

/* External */

dcl video_data_$terminal_iocb pointer external;

/* Static */

dcl ALTERNATE_F1_STRING char (2) static options (constant) init ("q");
                                                        /*  ESC q */
dcl ME char (3) static options (constant) init ("md1");
dcl MIN_USER_IO_HEIGHT fixed bin static options (constant) init (5);
dcl USER_IO char (8) static options (constant) init ("user_i/o");

          video_was_already_on = (video_data_$terminal_iocb ^= null);

          on cleanup call terminate_sys ();

/* Set up the menu. */

/* Invoke the window system if it's not already invoked. */

if ^video_was_already_on then do;
   call video_utils_$turn_on_login_channel (code, reason);
   if code ^= 0 then
       call quit (code, reason);
end;
call window_$clear_window (iox_$user_io, code);
   if code ^= 0 then
       call quit (code, USER_IO);

/* Create the menu. */
```

```
choices (1) = "enter new document";
choices (2) = "edit old document";
choices (3) = "print document on terminal";
choices (4) = "print document on printer";
choices (5) = "list documents";
choices (6) = "delete document";

headers (1) = "<<< DOCUMENT SYSTEM >>>";
trailers (1) = "USE FUNCTION KEY 1 TO EXIT";
trailers (2) = "-";

call user_info_$terminal_data ((""), term_type, (""), (0), (""));
call ttt_info_$function_key_data (term_type, addr (my_area),
    function_key_data_ptr, (code));

if code ^= 0 then
   call quit (code, "Unable to determine terminal type")

/* See if we have to use an escape sequence for F1 */

if fkey_data.highest < 1 then do;
    trailers (1) = "USE ESC-q TO EXIT";
    free fkey_data in (my_area);
    function_key_data_highest = 1;
    allocate fkey_data in (my_area) set (function_key_data_ptr);
    fkey_data.version = function_key_data_version_1;
    fkey_data.seq_ptr = addr (ALTERNATE_F1_STRING);
    fkey_data.seq_len = length (ALTERNATE_F1_STRING);
    do key_shift_idx = 0 to 3;
      fkey_data.home.sequence_length
               (key_shift_idx) = 0;
      fkey_data.left.sequence_length
               (key_shift_idx) = 0;
      fkey_data.up.sequence_length
               (key_shift_idx) = 0;
      fkey_data.right.sequence_length
               (key_shift_idx) = 0;
      fkey_data.down.sequence_length
               (key_shift_idx) = 0;
      fkey_data.function_keys.sequence_length
               (0, key_shift_idx) = 0;
      fkey_data.function_keys.sequence_length
               (1, key_shift_idx) = 0;
    end;
    fkey_data.function_keys.sequence_index (1, KEY_PLAIN) = 1;
    fkey_data.function_keys.sequence_length (1, KEY_PLAIN) =
      length (ALTERNATE_F1_STRING);
end;

    my_menu_format.version = menu_format_version_1;
    my_menu_format.max_width = 80;
    my_menu_format.max_height = 6;
    my_menu_format.n_columns = 2;
    my_menu_format.center_headers = "1"b;
    my_menu_format.center_trailers = "1"b;
```

```
    my_menu_format.pad = "0"b;
    my_menu_format.pad_char = "-";

    my_menu_requirements.version = menu_requirements_version_1;

/* Now we can create the menu. */

call menu_$create (choices, headers, trailers, addr
        (my_menu_format),
    MENU_OPTION_KEYS, addr (my_area), addr (my_menu_requirements),
         menu_ptr, code);
if code ^= 0 then
   call quit (code, "Unable to create menu.");

/* Now carve the menu I/O window out of the user_i/o window.
   This program insists that the user_i/o window must be at
   least 5 lines high after this is done.  The menu I/O window
   is given a unique name so that this program can be invoked
   recursively. */

user_io_window_info.version = window_position_info_version_1;
call iox_$control (iox_$user_io, "get_window_info",
   addr (user_io_window_info), code);
if code ^= 0 then
   call quit (code, USER_IO);

if user_io_window_info.height
   < my_menu_requirements.lines_needed + MIN_USER_IO_HEIGHT then
   call quit (0, "Window ""user_i/o"" is too small.");

new_window_info.version = window_position_info_version_1;
new_window_info.line =
   user_io_window_info.line + my_menu_requirements.lines_needed;
new_window_info.width = user_io_window_info.width;
new_window_info.height =
   user_io_window_info.height - my_menu_requirements.lines_needed;
call iox_$control (iox_$user_io, "set_window_info",
addr (new_window_info), code);
if code ^= 0 then
   call quit (code, "Unable to shrink window ""user_i/o"".");

menu_io_switch_name = "menu_i/o_" || unique_chars_ ("0"b);
call iox_$find_iocb (menu_io_switch_name, menu_io, code);
if code ^= 0 then
   call quit (code, "Unable to get IOCB pointer for menu window.");

new_window_info.line = user_io_window_info.line;
new_window_info.height = my_menu_requirements.lines_needed;

call window_$create (video_data_$terminal_iocb,
   addr (new_window_info), menu_io, code);
if code ^= 0 then
   call quit (code, "Unable to create the menu_i/o window.");
```

```
/* Now that we have the window system all set up we can go ahead and
   display the menu and start processing. */

call menu_$display (menu_io, menu_ptr, code);
if code ^= 0 then
  . call quit (code, "Unable to display menu.");

/* Now start processing input from the user. */

do while ("1"b);

/* Get an option number or function key value from the user. */

call menu_$get_choice (menu_io, menu_ptr, function_key_data_ptr,
   fkey, choice, code);

/* Perform an action depending on the user's selection. */

if code ^= 0 then
   call quit (code, "Unable to get choice.");
if fkey then
   if choice = 1 then do;
      call terminate_sys ();
      if video_was_already_on then
        call window_$clear_window (iox_$user_io, (0));
      goto EXIT;
   end;
   else call window_$bell (menu_io, (0));
  else do;
    if choice = 1 then
        call create_document ();
    else if choice = 2 then
          call edit_document ();
    else if choice = 3 then
          call display_document ();
    else if choice = 4 then
          call print_document ();
    else if choice = 5 then
          call list_documents ();
    else if choice = 6 then
          call delete_document ();
    else call window_$bell (menu_io, (0));

    end;
  end;       /* do while */

  EXIT:
          return;

  /* procedures for options */

  create_document:
       proc ();

          call ioa_ ("To be provided.");
```

```
        end create_document;


   edit_document:
        proc ();

            call ioa_ ("To be provided.");

        end edit_document;


display_document:
        proc ();

            call ioa_ ("To be provided.");

        end display_document;


print_document:
        proc ();

            call ioa_ ("To be provided.");

        end print_document;

list_documents:
        proc ();

            call ioa_ ("To be provided.");

        end list_documents;


delete_document:
        proc ();

            call ioa_ ("To be provided.");

        end delete_document;

/* internal procedures */

/* This procedure is called whenever we must leave the
   subsystem we have set up (if an error occurs or the
   user wants to leave).  It rearranges things back to
   the way they were before. */

terminate_sys:
        proc ();

            if menu_io ^= null () then
                call window_$destroy (menu_io, (0));
            if video_was_already_on then
                call iox_$control (iox_$user_io, "set_window_info",
```

```
                    addr (user_io_window_info), (0));
          else call video_utils_$turn_off_login_channel ((0));

     end terminate_sys;

quit:
     proc (code, explanation);

dcl code fixed bin (35);
dcl explanation char (*);

          call terminate_sys ();
          call com_err_ (code, ME, explanation);
          go to EXIT;

     end quit;

%include iox_dcls;
%page;
%include window_dcls;
%page;
%include function_key_data;
%page;
%include menu_dcls;
%page;
%include window_control_info;

     end mdl;
```

SECTION 4

VIDEO SYSTEM DETAILS

This section describes the Multics Video System. The Multics Video System is an upwards compatible extension to the Multics Communications System. The basic features of * the Multics Video System are:

- Dividing the user's terminal into one or more windows. Windows are described in detail in Section 2 of this manual.
- A powerful real-time editor for input lines. The erase and kill characters take effect as soon as they are typed. Additional characters allow the user to delete words and to retrieve deleted text.
- Flexible control over output. When a window is full of output it can scroll (removing lines from the top of the window, adding new ones to the bottom), or wrap (output begins at the top of the window, optionally clearing the window first).
- MORE Processing. The video system pauses when a window is full of output until the user indicates that the window has been read. This is an extension to End Of Page processing. The user can also choose to discard unseen all pending output.

REAL-TIME EDITING

Real-time editing is markedly different from usual Multics editing. All editing requests take effect immediately. The screen changes to show the effect of the characters or lines deleted. In addition, the set of editing characters expands to include several *control characters.*

Control characters are characters entered using the control key. The control key is a key that acts like the shift key. By itself it generates no characters; it is used to change the meaning of some other key. When the key "A" is typed while the control key is held down, the character sent by the terminal is control A, which is written as ^A. The control characters are the first 32 ASCII characters, 000 through 037 octal.

Alphabetic characters are given in capitals, but either an upper or lower case letter (as for N or n) can be used with default escape sequences. If an upper case letter is used with a user-defined sequence, both the upper and lower case keys must be bound in order for both keys to work. The letters ESC represent the escape key. For ESC F, you would press the escape key, release it and type an f or F.

Although most Multics users keep the system default erase (#) and kill (@) symbols, the video system recognizes and then assumes the values of any erase and kill characters that may have been set via the set_tty command.

The Erase Character

The erase character removes the character to the left of the cursor. The cursor moves to the left, and exactly one character is deleted. This is different from usual Multics editing where an erase character typed after white space deletes *all* whitespace, and otherwise deletes all characters from a column position. The erase character is settable for each window. In addition, the DEL character (\177) and the backspace character (\010) are always erase characters.

The Kill Character

The kill character deletes the entire line to the left of the cursor. The cursor then goes back to the beginning of the line. Again, this happens immediately. The deleted line is saved, and can be recovered. See "Retrieving Deleted Text" below. The kill character is settable per-window.

The Line Editor

Additional editing is possible using sequences of one and two characters. The two-character sequences all begin with the ASCII ESC character, (^[, octal 033), which is not the same as the Multics input escape character ("\").

MOVING THE CURSOR

The line editor can move the cursor forward or backward within the current line while repositioning the cursor either a character at a time or a word at a time. A word is an unbroken string of uppercase and lowercase alphabetics, numerals, underscores, backspace characters, and hyphens. (This is the default definition of a word, which can be changed with the set_token_delimiters order, described in the window_io_ writeup.) The cursor can also move explicitly to the beginning or the end of the current line. The requests that perform these actions are listed under "Other Editor Requests" below.

DELETING CHARACTERS AND WORDS

The line editor can delete a single character or an entire word at a time. Various editing requests described below can delete the character or word immediately to either the left or the right of the cursor. The deleted text (only words, not characters) is saved and can be retrieved. For example, typing ESC DEL (or ESC followed by the current erase character) deletes the word to the left of the cursor. The word is saved on the kill ring (see below).

RETRIEVING DELETED TEXT

Text deleted by the word and line kill characters is saved, and can be restored. The text is saved on a kill ring. A kill ring is a set of kill slots. Each slot holds deleted text. Successive word kills share one kill slot, so if several words are deleted one after another, all of them will be retrieved by a single retrieve command.

Deleted text is saved with previously deleted text if two delete characters are typed in succession. If intervening characters are typed, the kill ring is rotated: a new slot is selected to hold saved text.

Text is entered when the user types text followed by a carriage return. Each input line is added to the kill ring. This provides editing of the previous input line.

The following control characters are used to retrieve deleted text:

^Y	(or yank) retrieves deleted text from the kill ring. This is the only way to recover from an erroneous kill character.
ESC Y	can be typed only after either ^Y or ESC Y. It deletes the text just retrieved, without saving it on the kill ring, rotates the ring (to the next most recently killed text) and retrieves the text from the new top slot.

The following example is given in triplets. The first line shows what the user types, the second line shows what one line of the display looks like afterwards, and the third line (or lines) shows the kill ring. The top item on the kill ring is at the top of the column.

```
User Types: This is a sentence
Display is: This is a sentence
Kill Ring:   <empty>
```

NOTE: The kill ring is empty because the user has just invoked the video system.

```
User Types: ESC DEL
Display is: This is a
Kill Ring:  sentence
```

One word is deleted, and it begins the kill ring.

```
User Types: ESC DEL
Display is: This is
Kill Ring:  a sentence
```

Another word is deleted; it is merged into the same kill slot.

```
User Types: an example sofa

Display is: This is an example sofa
Kill Ring:  a sentence

User Types: ESC DEL
Display is: This is an example
Kill Ring:  sofa
            a sentence
```

This deleted word is not merged, because there has been typing since the last kill command. There are now two slots on the kill ring.

```
User Types: of ^Y
Display is: This is an example of sofa
Kill Ring:  sofa
            a sentence
```

The top kill slot is yanked back.

```
User Types: ESC Y
Display is: This is an example of a sentence
Kill Ring:  a sentence
            sofa
```

The kill ring is rotated, the previously yanked contents are deleted from the line, and the new top item from the ring is yanked to replace it.

If a carriage return were typed at the end of "This is an example of a sentence", the kill ring would then contain a new slot containing the entire input line.

Other Editor Requests

Alphabetic characters are given in capitals, but either an upper or lower case letter (ESC F or ESC f) can be used. The following control characters are also recognized by the line editor:

^L	Clears the window and redisplays the input line.
^Q	"quotes" the next character, causing it to have no special meaning. This is useful for entering control characters. It serves some of the same purposes as the input escape character (\).
^F	moves the cursor forward one character.
^B	moves the cursor backward one character.
ESC F	moves the cursor forward one word.
ESC B	moves the cursor backward one word.

^A	moves the cursor to the beginning of the current line.
^E	moves the cursor to the end of the current line.
^D	deletes the current character (deletes forward).
DEL, #	deletes the character to the left of the cursor (deletes backward).
ESC D	deletes the current word (deletes forward).
ESC DEL, ESC #	deletes the word to the left of the cursor (deletes backward).
ESC C	capitalize initial word.
ESC U	capitalize word.
ESC L	lower case word.
ESC T	twiddle word.

By default, no other control characters have meaning. If any are typed, the only action they cause is an audible alarm. You can create additional editor requests by writing PL/1 programs that conform to a standard calling sequence (see "Writing Editor Extensions").

The set of characters used to define a word for control characters such as ESC F can be changed via the set_token_characters control order. See the description in the window_io_ I/O module later in this manual.

Writing Editor Extensions

The video system provides a full input line editor, including the ability to edit in the middle of the line. Of course, there are many potential editor functions that people might like to use (see the *Emacs Text Editor User's Guide* Order No. CH27), and not all of these are provided. Rather than attempt to anticipate every possible editor request, the video system allows users who are familiar with PL/1 to write their own editor requests and associate sequences of keystrokes (key bindings) with these requests.

The key binding mechanism can be used for a wide variety of applications. Since editor requests are executed immediately by single or multiple keystroke sequences, highly interactive facilities can be built into the input line editor.

LINE EDITOR ROUTINES

Editor request routines are PL/I programs that conform to a standard calling sequence. The request procedure is given complete control of the input buffer and can add or delete characters or modify the current contents of the buffer. The video system editor's redisplay facility manages all display updates; the individual editor routines need no knowledge of the video enviroment or the screen contents.

A library of editor utility routines is provided (see "Editor Utilities"). These can be called by user-written editor routines to perform such actions as insertion and deletion of text from the buffer, manipulation of the kill ring, and manipulation of words within the input buffer.

A line editor routine is declared as follows:

USAGE

```
dcl twiddle_words entry (pointer, fixed bin(35));

call twiddle_words (line_editor_info_ptr, code);
```

ARGUMENTS

line_editor_info_ptr
is a pointer to the line_editor_info data structure (described below).

code
is a standard status code. (Output) If the status code returned by the editor routine is error_table_$action_not_performed, the editor will ring the terminal bell to indicate that the editor routine was used improperly. Any other code will reported in a more drastic manner, via the sub_err_ mechanism.

The line_editor_info structure (declared in window_line_editor.incl.pl1) is declared as follows:

```
dcl  1 line_editor_info          aligned based (line_editor_info_ptr),
       2 version                 char(8),
       2 iocb_ptr                pointer, /* to current window */
       2 repetition_count        fixed bin,
       2 flags,
         3 return_from_editor    bit(1) unaligned,
         3 merge_next_kill       bit(1) unaligned,
         3 old_merge_next_kill   bit(1) unaligned,
         3 last_kill_direction   bit(1) unaligned,
         3 numarg_given          bit(1) unaligned,
         3 suppress_redisplay    bit(1) unaligned
         3 pad                   bit(30) unaligned,
       2 user_data_ptr           pointer, /* for user state info */
       2 cursor_index            fixed bin(21),
       2 line_length             fixed bin(21),
       2 input_buffer            character(1024) unaligned;
       2 key_sequence            character(128);

dcl line_editor_input_line char(line_editor_info.line_length) based (addr
      (line_editor_info.input_buffer));

dcl line_editor_info_version_2 char(8) static options (constant) init
      ("lei00002");
```

STRUCTURE ELEMENTS

version
is string for this structure. (Input) The current version string, "lei00002", is the value of the variable line_editor_info_version_2, declared in the same include file.

iocb_ptr
is the pointer to the current window. (Input)

repetition_count
is the value of the numeric argument specified by the user, and is undefined if no numeric argument was specified (i. e., numarg_given flag = "0"b). (Input)

return_from_editor
is a flag which is set by the editor routine if the editor invocation is to be terminated and the input line returned to the caller. The input buffer is redisplayed before the buffer is returned to the caller, unless overriden by the line_editor_info.suppress_redisplay flag.

merge_next_kill
is a flag which should be set when text is deleted and added to the kill ring if subsequent deletions are to be added to the same kill ring element. (Input/Output) This flag is managed by the editor utility routines. If the editor utility routines are used for all input buffer modifications, the user-written editor routine need never set this flag.

old_merge_next_kill
is an internal editor state flag and should not be modified. (not used)

last_kill_direction
direction of last kill (forward or backward).

numarg_given
is "1"b (i.e. true) if a numeric argument was supplied by the user via ESC-NNN or ^U.

suppress_redisplay
is a flag that stops the redisplay of the input buffer when line_editor_info.return_from_editor is set.

pad
reserved for future use.

user_data_ptr
points to a user data structure which the video system ignores, other than passing this pointer to requests that follow.

cursor_index
is the index of the character in the input buffer on which the cursor is currently located. (Input/Output) This index must be updated if characters are added or deleted before the cursor, or the cursor is moved by the editor routine. The cursor index must be no larger than one greater than the input_line_length. If the editor utility routines are used for all input buffer manipulations, the cursor_index will be updated appropriately.

line_length
is a count of the number of characters in the current input line. (Input/Output) This variable must be updated if any characters are inserted or deleted from the input buffer. The value of the line_length variable must always be non-negative, and must never be larger than the length of the input buffer. If the line editor utility routines are used for all input buffer manipulations, the line_length variable will be updated automatically.

input_buffer
is a character string containing the current input line. (Input/Output) Any manipulations may be performed on this string by the editor routine. It is recommended that the editor utility routines be used for all insertions and deletions to ensure that the various state variables and flags remain consistent. The line_editor_input_line variable can be used to address the valid part of the input buffer as astring.

key_sequence
A character string that contains the sequence of key strokes that invoked this editor routine.

Window Editor Utilities

As was mentioned above, a library of editor utility routines is provided for the benefit of user-written editor routines. Some operations can be performed simply by a user-written editor routine. For example, to position the cursor to the end of the line, simply set the cursor_index variable to one greater than the value of the line_length variable. However, most actions are more complex than this and it is recommended that the editor utility routines be used to perform most operations. The following is a description of these routines. In all cases, line_editor_info_ptr is the pointer to the editor data structure that is supplied as an argument to user-written editor routines.

```
dcl window_editor_utils_$insert_text entry (ptr, char(*), code);
call window_editor_utils_$insert_text (line_editor_info_ptr, "text",
     code);
```

Inserts the supplied character string into the input buffer at the current cursor location. If the string is too large to fit in the remaining buffer space, the code error_table_$action_not_performed is returned. This routine updates the line_length field of the line_editor_info structure, and the cursor_index if necessary.

```
dcl window_editor_utils_$delete_text entry (ptr, fixed bin, code);
call window_editor_utils_$delete_text (line_editor_info_ptr, count,
     code);
```

Deletes a specified number of characters (supplied by the variable count) from the input buffer at the current cursor location. If there are not enough characters remaining between the cursor and the end of the line, error_table_$action_not_performed is returned and no characters are deleted. The line_length component of the line_editor_info_structure is updated, and the cursor_index if necessary.

```
dcl window_editor_utils_$delete_text_save entry
     (ptr, fixed bin, bit(1), code);
call window_editor_utils_$delete_text_save
    (line_editor_info_ptr, count, kill_direction, code);
```

This entrypoint is idenentical to delete_text, but the deleted text is added tc the kill ring. The kill_direction flag is used during kill mergng to decide whether the killed text will be concatenated onto the beginning or end of the current kill ring element. "1"b is used to specify a forward kill (e.g. FORWARD_DELETE_WORD), "0" a backward kill.

```
dcl window_editor_utils_$move_forward entry (ptr, fixed bin, code);
call window_editor_utils_$move_forward (line_editor_info_ptr, count, code);
```

Advances the cursor forward a specified number of characters (supplied by the variable "count") in the input line. If there are not enough characters between the cursor and the end of the line, error_table_$action_not_performed is returned.

```
dcl window_editor_utils_$move_backward entry (ptr, fixed bin, code);
call window_editor_utils_$move_backward
    (line_editor_info_ptr, count, code);
```

Moves the cursor backward a specified number of characters (supplied by the variable "count") in the input line. If there are not enough characters between the cursor and the end of the line, error_table_$action_not_performed is returned.

```
dcl window_editor_utils_$move_forward_word entry (ptr, code);
call window_editor_utils_$move_forward_word (line_editor_info_ptr, code);
```

Updates the cursor_index to a position after the next word (or token) in the input line. A word is defined via the editor's set of token delimiters, set via the set_token_delimiters control order.

```
dcl window_editor_utils_$move_backward_word entry (ptr, code);
call window_editor_utils_$move_backward_word
    (line_editor_info_ptr, code);
```

Updates the cursor_index to a position before the preceeding word (or token) in the input line. A word is defined via the editor's set of token delimiters, set via the set_token_delimiters control order.

```
dcl window_editor_utils_$get_top_kill_ring_element entry
    (ptr, char(*), fixed bin 35))
call window_editor_utils_$get_top_kill_ring_element
    (line_editor_info_ptr, text code),
```

Returns the top kill ring element.

```
dcl window_editor_utils_$rotate_kill_ring entry (ptr, fixed bin (35))
call window_editor_utils_$rotate_kill_ring
     (line_editor_info_ptr, code)
```

Rotates the kill ring.

End-Of-Window Processing

When output has filled a window, old lines must be removed to make way for new ones. This is usually done by scrolling old lines off the top of the window. But for windows that cannot be scrolled (usually because the terminal cannot scroll) it is possible to move the cursor back to home, and output new lines overwriting the old ones. This is known as wrapped output. A variation on wrapped output is to clear the window after moving the cursor home. The action taken when a window is full is controlled on a per-window basis by any one or the following more_mode modes:

- clear the window is cleared, and output starts at the home position.
- fold output begins at the first line and moves down the screen a line at a time replacing exisitng text with new text. Prompts for a MORE response when it is about to overwrite the first line written since the last read or MORE break.
- scroll lines are scrolled off the top of the window, and new lines are printed in the space that is cleared at the bottom of the screen. This is the default for all terminals capable of scrolling (i.e., those terminals that have the capability to insert and delete lines).
- wrap output begins at the first line and moves down the screen a line at a time replacing existing text with new text. Prompts for a MORE response at the bottom of every window of output. This is the default for terminals incapable of scrolling.

For more information, refer to window_io_ in Section 7.

MORE PROCESSING

As lines are displayed in the window, old lines are scrolled off the top of the window or otherwise removed. When output would cause a line to be removed that has been displayed since the most recent input, it is assumed that the user may not have had a chance to read it, and MORE processing occurs. The question "MORE?" appears on the screen, and no further output occurs until the user indicates that pending output is to be either displayed or discarded. MORE processing is controlled by the "more" mode, which is enabled by default.

Output resumes if the user strikes CR, and is discarded if the user strikes DEL. The characters used can be set by a control order. Type ahead characters are not seen by MORE processing. The response to MORE must be typed after the prompt appears. All other characters are buffered to be returned later.

When output is discarded, the video system simply ignores output until a get_line or get_chars call is made, a "reset_more" control order call is made, or the window is cleared, or the cursor is moved to home. WARNING: a prompt sent just before a get_line call will not be printed if output is discarded, unless the prompting program first issues a "reset_more" control order (or otherwise resets more processing).

OUTPUT BUFFERING

The video system sometimes buffers output internally, sending it to the terminal when certain internal conditions are satisfied. All buffered output is sent to the terminal whenever an input call is made (e.g., window_$get_echoed_chars). This ensures that all output, including prompts, is seen by the user before input is read. An application program that calls window_ entrypoints directly should take this buffering into account to perform correctly. If it is necessary to send output to the terminal when no read request is to be done (e.g., displaying an incremental message during a long computation), the application should call window_$sync on the I/O switch after the output has been requested (e.g., via a call to window_$overwrite_text). See the description of window_$sync in the window_ subroutine description later in this manual.

SUBROUTINE INTERFACE

The video system provides a standard set of operations for windows available through the window_ subroutine. Some terminals are not capable of supporting all of these operations. In addition, the standard iox_ operations of get_line, get_chars, and put_chars are provided. Some manipulations on windows are made via iox_ control orders (the window_io_ description in Section 7). Some of these are compatible with existing tty_ control orders. The iox_ and tty_ subroutines are both described in the *Multics Subroutines and I/O Modules* manual, Order No. AG93. Other manipulations control features that are specific to the window environment.

The iox_ operations are defined in terms of the more primitive window_ operations. For example, the window_ primitive, window_$overwrite_text, can only display a string of characters that fit on a terminal line. The iox_$put_chars wraps long strings onto multiple lines, and displays control characters with the conventional octal representation. For this reason special care must be taken when using window_ applications on a window when iox_ operations are in use as well. For more details see the description of the reset_more control order in the window_io description in Section 7.

COMMAND LINE INTERFACE

The command level interface to the video system is the window_call command. This command can perform most of the operations on a window supported by window_ directly from command level. The window_call command is described in Section 5.

SECTION 5

COMMANDS

This section contains descriptions of the commands used by the menu and video software, presented in alphabetical order.

Name: menu_create

SYNTAX AS A COMMAND

```
menu_create menu_name {-control_args}
```

FUNCTION

The menu_create command creates a menu description, assigns it a specified name, and stores the description in a segment. The menu description may be used with other menu commands, active functions, and subroutines.

ARGUMENTS

menu_name
is the name assigned to the menu when it is stored.

CONTROL ARGUMENTS

-pathname PATH, -pn PATH
is the pathname of the segment in which the menu is stored. Menus are stored in value segments. If the specified segment does not exist, the user is asked argument). The value suffix is assumed. If this control argument is omitted, the user's default value segment (>udd>Project_id>Person_id>Person_id.value) is used to store the menu.

-brief, -bf
means that if the segment specified by the -pathname control argument does not exist, it is to be created without querying the user.

-option STR, -opt STR
specifies a menu option. The options appear in the menu in the order given. At least one option must be supplied. If STR contains blanks or special characters, it must be quoted.

-header STR, -he STR
specifies a line of header. All header lines specified appear in the menu in the order given. If STR contains blanks or special characters, it must be quoted.

-trailer STR, -tr STR
specifies a trailer line. All trailers appear in the menu in the order given. If STR contains blanks or special characters, it must be quoted.

The remaining control arguments control the format of the menu. All are optional.

-columns N, -col N
where N is a positive decimal integer, sets the number of columns in the menu to N. The default is one column.

-center_headers, -ceh
causes all header lines to be centered.

-no_center_headers, -nceh
causes header lines to be flush left. This is the default.

-center_trailers, -cet
causes all trailer lines to be centered.

-no_center_trailers, -ncet
causes trailer lines to be flush left. This is the default.

-option_keys STR, -okeys STR
specifies the keystrokes to be associated with each option. Each character in STR is associated with the corresponding option, so that if it is typed, the corresponding option is selected. There must be at least as many characters in STR as there are options. If this control argument is not given, the string "123456789ABCDEFGHIJKLMNOPQRSTUVWXYZ" is used.

-pad C
where C is one character, specifies the padding character for centering. The default is the space character.

-line_length N, -ll N
where N is a positive decimal integer, specifies the line length for the menu. If not supplied, the line length will be the line length of the user's terminal at the time the command is invoked.

ACCESS REQUIRED

The user must have r and w access on the value segment.

EXAMPLES

The following example sets up a small menu named compile.

```
menu_create compile -pn [pd]>temp -pad = -he "SAMPLE MENU" -tr = -ceh -cet
  -columns 2 -ll 78 -opt "Compile with No Options"
  -opt "Symbol Table" -opt "Profile Info"
```

Creates a menu that looks like this:

```
================================SAMPLE MENU================================
 (1) Compile with No Options          (3) Profile Info
 (2) Symbol Table
===========================================================================
```

Name: menu_delete

SYNTAX AS A COMMAND

```
menu_delete menu_name {-control_arg}
```

FUNCTION

The menu_delete command deletes a menu description from a specified value segment.

ARGUMENTS

menu_name
is the name that was assigned to the menu when it was stored.

CONTROL ARGUMENTS

-pathname PATH, -pn PATH
is the pathname of the value segment in which the menu is stored. If this control argument is not given, the user's default value segment is searched for the menu. The value suffix is assumed.

Name: menu_describe

SYNTAX AS A COMMAND

```
menu_describe menu_name {-control_args}
```

SYNTAX AS AN ACTIVE FUNCTION

```
[menu_describe menu_name -control_args]
```

FUNCTION

The menu_describe command prints or returns information about a menu.

ARGUMENTS

menu_name
is the name that was assigned to the menu when it was stored.

CONTROL ARGUMENTS

-count, -ct
returns the number of options defined in the menu.

-height
returns the height of the menu.

-pathname PATH, -pn PATH
is the name of the value segment in which the menu has been stored. The value suffix is assumed. If this control argument is omitted, the user's default value segment is searched for the menu.

-width
returns the width of the menu.

NOTES

When used as an active function, exactly one of -count, -height, or -width must be given.

As a command, any number are allowed. If none are given, all attributes are displayed.

Name: menu_display

SYNTAX AS A COMMAND

```
menu_display menu_name {-control_args}
```

FUNCTION

The menu_display command displays a menu in a window.

ARGUMENTS

menu_name
is the name that was assigned to the menu when it was stored.

CONTROL ARGUMENTS

-io_switch STR, -is STR
specifies the name of an I/O switch for a window. The default is user_output.

-pathname PATH, -pn PATH
is the name of the value segment in which the menu has been stored. The value suffix is assumed. If this control argument is omitted, the user's default value segment is searched for the menu.

menu_get_choice

Name: menu_get_choice

SYNTAX AS A COMMAND

```
menu_get_choice menu_name {-control_args}
```

SYNTAX AS AN ACTIVE FUNCTION

```
[menu_get_choice menu_name {-control_args}]
```

FUNCTION

The menu_get_choice command, given the menu called menu_name on display in a window, gets a menu choice from the user and prints or returns it.

ARGUMENTS

menu_name
is the name that was assigned to the menu when it was stored.

CONTROL ARGUMENTS

-pathname PATH, -pn PATH
is the name of the value segment in which the menu has been stored. The value suffix is assumed. If this control argument is omitted, the user's default value segment is searched for the menu.

-io_switch STR, -is STR
where STR is the name of an I/O switch for a window. The default is user_i/o.

-default_fkeys STR, -fkeys STR
specifies the keys to be used if the terminal does not have function keys or if the terminal does not have the proper set of function keys. See "Notes on Function Keys" below.

-function_keys STR, -fkeys STR
specifies the keys to be used to simulate function keys. This control overrides any function key definitions already established for the terminal. See "Notes on Function Keys" below.

menu_get_choice

NOTES ON FUNCTION KEYS

Many terminals have function keys. On many of these terminals (such as the Honeywell VIP7801) they are labelled "F1", "F2", etc. If you type one of these function keys, menu_get_choice returns the string "F*", where * is a one or two digit number signifying which function key was pressed. It is possible to specify your own set of keystrokes to be used in lieu of the terminal's function keys, or to specify a set of keystrokes to be used if the terminal does not have enough function keys. These are done by using the -fkeys and -dfkeys control arguments. Each of these control arguments is followed by a string. Each character in this string is used to simulate a function key. The first character is used to simulate function key 0, the next to simulate function key 1, etc. To simulate a given function key, type esc-C, where C is the character corresponding to the function key. Thus if the string is "0123456789", typing esc-2 will return F2.

The -fkeys control argument is used to specify keystrokes to be used instead of any which might be defined for the terminal. If this control argument is given, then the simulation of function keys always takes place.

The -dfkeys control argument is used if you want to use the terminal defined function keys if possible, but wish to specify key sequences to be used to simulate function keys if necessary. Each character in the string following -dfkeys corresponds to one function key. If the character is a space, it means it makes no difference if the terminal has a function key corresponding to that position. If the character is not a space, that character will be used to simulate a function key if necessary. If the terminal does not have a function key for every non-space character in the string, then the -dfkeys string is used to simulate function keys. Thus, the string "^ ?p q" means that you do not care whether the terminal has a function key 0 or a function key 3, but you wish to use function keys 1,2, and 4. If any of these 3 function keys is not present on the terminal, then esc-? will substitute for F1, esc-p will substitute for F2, and esc-q will substitute for F4.

Name: menu_list

SYNTAX AS A COMMAND

```
menu_list {menu_starname} {-control_arg}
```

SYNTAX AS AN ACTIVE FUNCTION

```
[menu_list {menu_starname} {-control_arg}]
```

FUNCTION

The menu_list command lists the names of the menu descriptions stored in a value segment.

ARGUMENTS

menu_starname
is a starname that is used to search for menu descriptions. If it is omitted, the default is **.

CONTROL ARGUMENTS

-pathname PATH, -pn PATH
is the pathname of the value segment in which the menu has been stored. The value suffix is assumed. If this control argument is not given, the user's default value segment (udd>Project_id>Person_id>Person_id.value) is searched for the menu.

Name: window_call

SYNTAX AS A COMMAND

```
window_call arguments {-control_args}
```

SYNTAX AS AN ACTIVE FUNCTION

```
[window_call arguments {-control_args}]
```

FUNCTION

The window_call command provides a command interface to the video system.

ARGUMENTS

are listed below. A detailed description follows the control arguments section.

```
bell
change_window, chgwd
clear_region, clrgn
clear_to_end_of_line, cleol
clear_to_end_of_window, cleowd
clear_window, clwd
create_window, crwd
delete_chars, dlch
delete_window, dlwd
get_echoed_chars, gech
get_first_line, gfl
get_one_unechoed_char, gouch
get_position, gpos
get_terminal_height, gtmhgt
get_terminal_width, gtmwid
get_unechoed_chars, guch
get_window_height, gwdhgt
insert_text, itx
invoke
overwrite_text, otx
revoke
scroll_region, scrgn
set_position, spos
set_position_rel, sposrel
supported_terminal
sync
video_invoked
write_sync_read, wsr
```

CONTROL ARGUMENTS

-column C, -col C
specifies a column on the screen. The leftmost column is 1. If -column is not specified, the default is the remainder of the screen.

-count N, -ct N
specifies a count. See the specific requests for details.

-height NL, -hgt NL
specifies the height of a region or a window for a request. If -height is not specified, the default is the remainder of the screen.

-io_switch WINDOW, -is WINDOW
where WINDOW is an I/O switch. The operation is performed on the window associated with the named I/O switch.

-line L
specifies a line on the screen. The top line is line 1.

-line_speed N, -ls N
specifies the speed of the terminal's connection to Multics. N is in characters per second.

-terminal_type STR, -ttp STR
where STR is a terminal type. Information on accepted terminal types can be obtained with the print_terminal_types (ptt) command.

-string TEXT, -str TEXT
specifies a text string for display. If TEXT contains blanks or other special command processor characters it must be enclosed in quotes.

-width NC, -wid NC
specifies the width of a region for a request. If -width is not specified, the default is the remainder of the screen.

Argument Descriptions

bell

SYNTAX AS A COMMAND

```
wdc bell {-io_switch WINDOW}
```

FUNCTION

activates the terminal bell. On some terminals, this may produce a visual indication instead of an audible tone. The cursor position must be defined. The cursor is positioned to the current position of the specified window, if it is elsewhere on the screen. If -io_switch is not specified, user_i/o is assumed.

change_window, chgwd

SYNTAX AS A COMMAND

```
wdc chgwd {-line L} {-column C} {-height NL} {-width NC}
      {-io_switch WINDOW}
```

FUNCTION

changes the origin or size of the specified window. At least one of -line, -column, -height, or -width is required. -line L specifies the line number or the screen where the window is to begin. If -line is not supplied, the default is column 1. If only the -line control argument is given (changing the top line of the window), the window length is automatically adjusted. That is, if the -line control argument increases the value of the top line number (moving the window down), the window length shrinks accordingly. However, if the -line control argument decreases the top line number (moving the window up), the length remains the same. -column C specifies the column number on the screen where the window is to begin. If -column is not supplied, the default is column 1. If only the -column control argument is given (changing the first column on the left), the window width is automatically adjusted. -height NL specifies the height of the window. If height is not specified, the default is the remainder of the screen. If only the -height control argument is given (changing the window length), the origin line remains the same. -width NC specifies the width of the window. If width is not specified, the default is the remainder of the screen. If only the -width control argument is given (changing the window width), the origin column remains the same. If -io_switch is not specified, user_i/o is assumed. See Section 2 for more information on the use of this command.

clear_region, clrgn

SYNTAX AS A COMMAND

```
wdc clrgn -line N -column N -height N -width N {-io_switch WINDOW}
```

FUNCTION

clears the specified rectangular region of the window to blanks. The region may be part or all of the window. If -io_switch is not specified, user_i/o is assumed. See Section 2 for more information on the use of this command.

clear_to_end_of_line, cleol

SYNTAX AS A COMMAND

```
wdc cleol {-io_switch WINDOW}
```

FUNCTION

clears the line from the current cursor position to the end of the line to blanks. The current cursor position must be defined. If -io_switch is not specified, user_i/o is assumed.

clear_to_end_of_window, cleowd

SYNTAX AS A COMMAND

```
wdc cleowd {-io_switch WINDOW}
```

FUNCTION

clears the window from the current cursor position to the end of the window to blanks. The current cursor position must be defined. If -io_switch is not specified, user_i/o is assumed.

clear_window, clwd

SYNTAX AS A COMMAND

```
wdc clwd {-io_switch WINDOW}
```

FUNCTION

clears the specified window so that its content becomes entirely blank. The current cursor position is defined to be at Line 1, Column 1 of the specified window. If -io_switch is not specified, user_i/o is assumed. See Section 2 for more information on the use of this command.

create_window, crwd

SYNTAX AS A COMMAND

```
wdc crwd -io_switch WINDOW {-line L -column C -height NL -width NC}
```

FUNCTION

creates a new window on the screen with name (and I/O switch) WINDOW. -line L specifies the line number on the screen where the window is to begin. If -line is not supplied, the default is line 1. -column C specifies the column number on the screen where the window is to begin. If -column is not supplied, the default is column 1 -height NL specifies the height of the window. If -height is not specified, the default is the remainder of the screen. -width NC specifies the width of the window. If -width is not specified, the default is the remainder of the screen. The window is blank when created, and the cursor position is Line 1, Column 1 of the new window. See Section 2 for more information on the use of this command.

delete_chars, dlch

SYNTAX AS A COMMAND

```
wdc dlch -count N {-io_switch WINDOW}
```

FUNCTION

deletes N characters to the right of the current cursor position on the current line. The cursor remains stationary; characters to the right of the deleted characters move to the left to fill the vacated space. The current cursor position must be defined. If -io_switch is not specified, user_i/o is assumed.

delete_window, dlwd

SYNTAX AS A COMMAND

```
wdc dlwd -io_switch WINDOW
```

FUNCTION

destroys the specified window. The I/O switch is closed and detached. See Section 2 for more information on the use of this command.

get_echoed_chars, gech

SYNTAX AS A COMMAND

```
wdc gech -count N {-io_switch WINDOW}
```

FUNCTION

reads characters from the terminal until either N characters or a break character is read. All characters except the break are echoed on the screen in the current window. For information on break characters, see the break_table control order in the description of window_io_ in Section 7. The current cursor position must be defined. If -io_switch is not specified, user_i/o is assumed.

ACTIVE FUNCTION USAGE

two strings are returned. The first contains any nonbreak characters read, and the second contains the break character, if any.

get_first_line, gfl

SYNTAX AS A COMMAND

```
wdc gfl {-io_switch WINDOW}
```

FUNCTION

prints the line on the screen where the specified window begins. If -io_switch is not specified, user_i/o is assumed.

ACTIVE FUNCTION USAGE

returns the line on the screen where the specified window begins. If -io_switch is not specified, user_i/o is assumed.

get_one_unechoed_char, gouch

SYNTAX AS A COMMAND

```
wdc gouch {-io_switch WINDOW}
```

FUNCTION

reads a single unechoed character from the terminal. If -io_switch is not specified, user_i/o is assumed.

ACTIVE FUNCTION USAGE

returns a single unechoed character from the terminal.

get_position, gpos

SYNTAX AS A COMMAND

```
wdc gpos {-io_switch WINDOW}
```

FUNCTION

prints the current line and column position of the cursor.

ACTIVE FUNCTION USAGE

returns the line and column position as a pair of integers separated by a space. If -io_switch is not specified, user_i/o is assumed.

get_terminal_height, gtmhgt

SYNTAX AS A COMMAND

```
wdc gtmhgt
```

FUNCTION

prints the total number of lines on the user's terminal.

ACTIVE FUNCTION USAGE

returns the total number of lines on the user's terminal.

get_terminal_width, gtmwid

SYNTAX AS A COMMAND

```
wdc gtmwid
```

FUNCTION

prints the total number of columns on the user's terminal.

ACTIVE FUNCTION USAGE

returns the total number of columns on the user's terminal.

get_unechoed_chars, guch

SYNTAX AS A COMMAND

```
wdc guch -count N {-io_switch WINDOW}
```

FUNCTION

reads characters from the terminal until either N characters or a break character are read. The current cursor position must be defined. If -io_switch is not specified, user_i/o is assumed.

ACTIVE FUNCTION USAGE

returns two strings. The first contains any nonbreak characters read, and the second contains the break character, if any.

get_window_height, gwdhgt

SYNTAX AS A COMMAND

```
wdc gwdhgt {-io_switch WINDOW}
```

FUNCTION

prints the height of the specified window.

insert_text, itx

SYNTAX AS A COMMAND

```
wdc itx -string window {-io_switch WINDOW}
```

FUNCTION

displays the text string window at the current cursor position. If there are any characters to the right of the current position on the current line, they are moved to the right to accommodate the new string. There is no wraparound feature; if text goes off the screen it is dropped. The text string window may contain only printable ASCII characters. Use the io_call put_chars command to display nonprintable characters in a readable form. If -io_switch is not specified, user_i/o is assumed.

invoke

SYNTAX AS A COMMAND

```
wdc invoke {-line_speed N, -ls N}
```

FUNCTION

activates the video system on the user's terminal. If no line speed is specified, the current line speed is used. The user's terminal must be attached with the tty_ I/O module. If graphics or auditing are in use they must be removed before this command is given. The settings of the following tty_ modes are copied when the video system is invoked: vertsp, can, erkl, esc, red, and ctl_char. In addition, if ^pl is set on video system invocation, ^more will be set in the video system. (For more details on modes, see the window_io_ I/O module in Section 7.) Similarly, the settings of the current erase and kill characters are copied when the video system invoked. (See "Real-Time Editing" in Section 4 for details.) See Section 2 for more information on the use of this command.

window_call

overwrite_text, otx

SYNTAX AS A COMMAND

```
wdc otx -string STR {-io_switch STR}
```

FUNCTION

displays the text string STR at the current cursor position in the window. If there is any text to the right of the current position in the window, it is overwritten with the supplied string. The text string STR may contain only printable ASCII characters. Use the io_call put_chars command to display nonprintable characters in a readable form. If -io_switch is not specified, user_i/o is assumed.

revoke

SYNTAX AS A COMMAND

```
wdc revoke
```

FUNCTION

removes the video system from the user's terminal. The standard tty_ attachment is restored. The settings of the following modes are copied when the video system is revoked: vertsp, can, erkl, esc, red, and ctl_char. If ^more is set while in the video system, ^pl mode will be set after revoking the video system. (For more details on modes, see the window_io_ I/O module in Section 7.) Similarly, the settings of the current erase and kill characters are copied when the video system is revoked. (See "Real-Time Editing" in Section 4 for details.) See Section 2 for more information on the use of this command.

scroll_region, scrgn

SYNTAX AS A COMMAND

```
wdc scrgn -count N {-line L -height C -io_switch WINDOW}
```

FUNCTION

scrolls the specified region N lines as specified by -count. The specified region is the whole width of the screen. It can be a whole window or part of a window. If -count N is negative the window is scrolled down, and if it is positive the window is scrolled up. If lines are scrolled off the screen they are dropped. If -line is not supplied, the default is 1. If -height is not supplied, the remainder of the window is scrolled. If -io_switch is not specified, user_i/o is assumed.

set_position, spos

SYNTAX AS A COMMAND

```
wdc spos -line L -column C {-io_switch WINDOW}
```

FUNCTION

positions the cursor to the specified line and column of the specific window. If -io_switch is not specified, user_i/o is assumed.

set_position_rel, sposrel

SYNTAX AS A COMMAND

```
wdc sposrel -line L -column C {-io_switch WINDOW}
```

FUNCTION

changes the cursor position by N lines and N columns. If -io_switch is not specified, user_i/o is assumed. The current cursor position must be defined. One of the control_args must be specified and both may be specified. Whichever control_arg is not specified defaults to zero.

supported_terminal

SYNTAX AS A COMMAND

```
wdc supported_terminal {-ttp terminal_type}
```

FUNCTION

returns "true" if the video system can be invoked on the specified terminal type. If no terminal type is specified, the current terminal type is used.

sync

SYNTAX AS A COMMAND

```
wdc sync {-io_switch WINDOW}
```

FUNCTION

waits for the last operation performed on the window to be completed. Over certain networks it may not be possible to actually wait for delivery of the characters to the terminals. If -io_switch is not specified, user_i/o is assumed.

video_invoked

SYNTAX AS A COMMAND

```
wdc video_invoked
```

FUNCTION

returns "true" if the video system is in use in the user's process.

write_sync_read, wsr

SYNTAX AS A COMMAND

```
wdc wsr -string STR -count N {-io_switch WINDOW}
```

FUNCTION

displays a prompting string STR at the current cursor position in the window, and then reads input typed in response to the prompt. Characters are read unechoed, until either N characters or a break character is read. If -io_switch is not specified, user_i/o is assumed.

ACTIVE FUNCTION USAGE

prints a prompting string and returns the characters read.

SECTION 6

PL/I SUBROUTINE INTERFACE

This section contains descriptions of the PL/I subroutines used by the menu and video software, presented in alphabetical order.

Name: menu_

The menu_ subroutine provides menu display and selection services. It can display a menu in a window and get a selection from the user. The entries work with menu objects. A menu object is a pointer to an internal description of a menu. The caller is expected to preserve the pointer, and to perform no operation on it other than comparison with the null pointer or with another menu object, except through the menu_ subroutine. Declarations for the entries and the associated structures are in the include file menu_dcls.incl.pl1 described below in "Data Structures".

Entry: menu_$create

This entry creates a menu object given its description. The menu data structure is allocated in a caller supplied area, and may be saved across processes by calling menu_$store. A pointer to the new menu is returned, also with the minimum size of a window to hold the menu.

USAGE

```
declare menu_$create entry ((*) char (*) varying, (*) char (*) varying,
      (*) char (*) varying, ptr, (*) char (1) unal, ptr, ptr, ptr,
      fixed bin (35));

call menu_$create (choices, headers, trailers, format_ptr, keys, area_ptr,
      needs_ptr, menu, code);
```

ARGUMENTS

choices
: is an array of the names of the options. (Input) If the maximum number of choices is exceeded, the code menu_et_$too_many_options is returned. The current maximum is 61.

headers
: is an array of headers. (Input) If the length of the first header is zero, then no headers are used. This allows the caller to specify no headers, without resorting to a zero-extent array, which is invalid PL/I.

trailers
: is an array of trailers. (Input) As for headers, a zero-length first trailer means that no trailers are displayed.

format_ptr
: points to a structure, menu_format, that controls formatting of the menu. (Input) This structure is described below in "Data Structures".

keys
is an array specifying the keystroke for each option. (Input) The array must have at least as many elements as the array of option names. If not, the error code menu_et_$too_few_keys is returned. It may have more keys than choices. Each item of the array must be unique, or menu_et_$keys_not_unique is returned. If the valid keys (the keys for which there are choices) are either all upper case or all lower case, menu_$get_choice will treat upper and lower case letters identically.

area_ptr
is a pointer to an area where the menu description is allocated. (Input) If the area is not large enough, the area condition is signalled. If this pointer is null, the system free area is used.

needs_ptr
points to the menu_requirements structure giving requirements to display the menu. (Input) The structure is described below in "Data Structures". The caller supplies this structure and fills in the version number menu_requirements_version_1, the remaining members are output from this entry.

menu
is a newly created menu object. (Output)

code
is a standard system error code, or an error code from menu_et_. (Output)

Entry: menu_$delete

This entry deletes a menu object from a specified value segment.

USAGE

```
declare menu_$delete entry (char (*), char (*), char (*), fixed bin (35));

call menu_$delete (dirname, entryname, menu_name, code);
```

ARGUMENTS

dirname
is the pathname of the containing directory. (Input)

entryname
is the entryname of the segment. (Input) It must have the value suffix.

menu_name
is the name that was assigned to the menu when it was stored (see the description of menu_$store). (Input)

code
is a standard system error code. (Output)

Entry: menu_$describe

This entry fills in a caller-supplied data structure describing some of the aspects of a menu object. The caller can use this to ensure a window is sufficiently large to hold a menu.

USAGE

```
declare menu_$describe entry (ptr, ptr, fixed bin (35));

call menu_$describe (menu, needs_ptr, code);
```

ARGUMENTS

menu
is the menu object to describe. (Input)

needs_ptr
points to a structure declared like menu_requirements described in "Data Structures" below. (Input) The caller fills in the version to be menu_requirements_version_1, and the remaining members are filled in by this entry.

code
is a standard system error code. (Output)

Entry: menu_$destroy

This entry is used to delete a menu object. The caller uses this to free storage of a menu, since the representation of a menu is not known outside the menu_ subroutine. This entry has no effect on screen contents or on stored menus.

USAGE

```
declare menu_$destroy entry (ptr, fixed bin (35));

call menu_$destroy (menu, code);
```

ARGUMENTS

menu
is the menu object to destroy. (Input)

code
is a standard system error code. (Output)

Entry: menu_$display

This entry displays a menu object on a supplied window.

USAGE

```
declare menu_$display entry (ptr, ptr, fixed bin (35));

call menu_$display (window, menu, code);
```

ARGUMENTS

window
is a pointer to an IOCB for an I/O switch attached through window_io_. (Input) This window must be large enough to hold the menu. A menu window should be used ONLY for menu I/O, if redisplay optimizations are desired.

menu
is the menu object to be displayed. (Input)

code
is a standard system error code. (Output)

Entry: menu_$get_choice

This entry returns a choice from a menu. The menu is assumed to be already displayed in the window.

USAGE

```
declare menu_$get_choice entry (ptr, ptr, ptr, bit (1) aligned, fixed bin,
      fixed bin (35));

call menu_$get_choice (window, menu, function_key_info, fkey, selection,
      code);
```

ARGUMENTS

window
is a pointer to the IOCB for the I/O switch used to display the menu. (Input)

menu
is the menu object on display in the window. (Input)

function_key_info
is a pointer to a data structure describing the function keys available on the terminal. (Input) This data structure is obtained by the caller from the ttt_info_$function_key_data subroutine. If this pointer is null, no function keys are used.

fkey
returns a value of "1"b if a function key was hit instead of a menu selection. (Output)

selection
gives the option number or function key number chosen by the user. For an option, it is a number between 1 and the highest defined option, inclusive. For a function key, it is the number of the function key.

code
is a standard system error code. (Output)

NOTES

If a terminal has no function keys, the caller can define input escape sequences for function keys. These may be chosen to have mnemonic value to the end user. For example, if Function Key 1 is used to print a help file, the input sequence ESC h could replace it. In some applications, this will be easier for the end user to remember than an unlabelled function key. The caller can define these keys by allocating and filling in the same function key structure normally returned by the ttt_info_ subroutine.

If a key is hit that is not one of the option keys and is not a function key, then the terminal bell is rung.

Entry: menu_$list

This entry lists the menu objects stored in a specified value segment.

USAGE

```
declare menu_$list entry (char (*), char (*), char (*), ptr, fixed bin, ptr,
      fixed bin (35));

call menu_$list (dirname, entryname, menu_starname, area_ptr,
      menu_list_info_version, menu_list_info_ptr, code);
```

ARGUMENTS

dirname
is the pathname of the containing directory. (Input)

entryname
is the entryname of the segment. (Input) It must have the value suffix.

menu_starname
is matched against the names of the menus stored in the segment. (Input) Only names that match menu_starname are returned. (see the description of menu_$store).

area_ptr
is a pointer to an area in which to allocate the structure containing the menu names. (Input) If it is null, the system free area is used.

menu_list_info_version
is the version of the menu_list_info structure that the caller expects. (Input) It must be a supported menu_list_info structure version. The only supported version is menu_list_info_version_1.

menu_list_info_ptr
is a pointer to the menu_list_info structure, described below under "Data Structures". (Output)

code
is a standard system error code. (Output)

Entry: menu_$retrieve

This entry retrieves a menu from a specified segment. The segment must be a value segment. The menu data structure is allocated in a caller-supplied area. The menu information is copied from the menu object stored in the segment into the newly allocated structure.

USAGE

```
declare menu_$retrieve entry (char (*), char (*), char (*), ptr, ptr,
      fixed bin (35));

call menu_$retrieve (dirname, entryname, menu_name, area_ptr, menu_ptr, code);
```

ARGUMENTS

dirname
is the pathname of the containing directory. (Input)

entryname
is the entryname of the segment. (Input) It must have the value suffix.

menu_name
is the name that was assigned to the menu when it was stored (see the description of menu_$store). (Input)

area_ptr
is a pointer to an area where the menu object is allocated. (Input) If this argument is null, the system free area is used. If the area is not large enough, the area condition is signalled.

menu_ptr
is a pointer to the menu object that is retrieved from the segment. (Output)

code
is a standard system error code. (Output)

Entry: menu_$store

This entry stores a menu object in a specified segment. The specified segment must be a value segment.

USAGE

```
declare menu_$store entry (char (*), char (*), char (*), bit(1) aligned, ptr,
      fixed bin (35));

call menu_$store (dirname, entryname, menu_name, create_sw, menu_ptr, code);
```

ARGUMENTS

dirname
    is the pathname of the containing directory. (Input)

entryname
    is the entryname of the segment. (Input) It must have the value suffix.

menu_name
    is a name to be assigned to the menu. (Input)

create_sw
    determines whether or not the segment is created if it does not already exist. If the segment does not exist, a value of "1"b will cause it to be created. (Input)

menu_ptr
    is a pointer to the menu object that is to be stored in the segment. (Input)

code
    is a standard system error code. (Output)

DATA STRUCTURES

A menu is described by the "menu_format" structure. It is declared in menu_dcls.incl.pl1.

```
dcl 1 menu_format          aligned based (menu_format_ptr),
      2 version            fixed bin,
      2 constraints,
        3 max_width        fixed bin,
        3 max_height       fixed bin,
      2 n_columns          fixed bin,
      2 flags,
        3 center_headers   bit (1) unal,
        3 center_trailers  bit (1) unal,
        3 pad              bit (34) unal,
      2 pad_char           char (1);
```

STRUCTURE ELEMENTS

menu_format
specifies the format for menu display. (Input) It gives limits for number of lines and characters per line, specifies the number of columns (of options), and controls centering of headers and trailers.

version
must be menu_format_version_1. (Input)

max_width
is the width of the window the menu will be displayed on. (Input) This value is used for centering headers and aligning columns.

max_height
is the maximum height of the window, in lines. (Input)

n_columns
is the number of columns to use in displaying options. (Input)

center_headers
if set, header lines will be centered using the window width supplied above. (Input) If not set, they are flush with the left edge of the window.

center_trailers
same as center_headers, but for trailers. (Input)

pad
must be "0"b. (Input)

pad_char
is the character used for centering headers and/or trailers. (Input)

THE MENU_LIST_INFO STRUCTURE

This entry returns information in the menu_list_info structure, found in the include file menu_list_info.incl.pl1, shown below:

```
dcl 1 menu_list_info          aligned based (menu_list_info_ptr),
      2 version               fixed bin,
      2 n_names               fixed bin,
      2 name_string_length    fixed bin (21),
      2 names                 (menu_list_n_names refer
                                (menu_list_info.n_names)) aligned,
        3 position            fixed bin (21),
        3 length              fixed bin (21),
      2 name_string character (menu_list_name_string_length
                              refer (menu_list_info.name_string_length))
                              unaligned;
```

STRUCTURE ELEMENTS

version
is the version of this structure, menu_list_info_version_1. (Output)

n_names
is the number of menu object names that matched the supplied starname. (Output)

name_string_length
is the total length of all the names that matched the supplied starname, concatenated together. (Output)

names
is an array of information with one entry for each name that matched the specified starname. (Output)

position
is the position in the string menu_list_info.name_string of this menu name. (Output)

length
is the length of this menu name in the string menu_list_info.name_string. (Output)

name_string
contains all the returned names, concatenated together. (Output) The PL/I "defined" attribute can be used to advantage to refer to individual names. For example, we wish to print the menu name indexed by name_index.

```
begin;
 declare this_name character (menu_list_info.length (name_index))
                  defined (menu_list_info.name_string)
                  position (menu_list_info.position (name_index));

     call ioa_ ("The ^d'th menu name is: ^a", name_index, this_name);
 end;
```

THE MENU_REQUIREMENTS STRUCTURE

The requirements for a menu are specified by the menu_requirements structure. It is declared in menu_dcls.incl.pl1.

```
dcl 1 menu_requirements     aligned based (menu_requirements_ptr),
      2 version             fixed bin,
      2 lines_needed        fixed bin,
      2 width_needed        fixed bin,
      2 n_options           fixed bin;
```

STRUCTURE ELEMENTS

version
is set by the caller, and must be menu_requirements_version_1. (Input)

lines_needed
is the number of lines required. (Output) If the window does not have this number of lines, menu display will fail.

width_needed
is the number of columns needed. (Output)

n_options
is the number of options defined. (Output)

The include file, menu_dcls.incl.pl1, also provides an array of key characters that may be used in the menu to select options. This array can be used by the caller as input to the menu_$create entry. Its name is MENU_OPTION_KEYS.

Name: video_data_

The video_data_ subroutine is a data segment containing information about the video system.

Entry: video_data_$terminal_iocb

This is the terminal control switch IOCB pointer. If the video system is activated for the user's terminal, this pointer is nonnull, and points to the IOCB for the switch user_terminal_.

USAGE

fnt typ declare video_data_$terminal_iocb pointer external static;

NOTES

User programs may use this pointer for two purposes:

1. Inquiring as to whether the video system is activated, by checking to see if the pointer is null.

2. Determining the physical characteristics and capabilities of the terminal. This may be accomplished with the get_capabilities control order, described under the window_io_ I/O module. The height and width returned will be that of the physical terminal screen.

   No other manipulations of this switch are permitted.

Name: video_utils_

This subroutine provides interfaces for activating and de-activating the video system.

Entry: video_utils_$turn_on_login_channel

This entry removes the existing attachment of the user's terminal, replacing it with the video system. When this entry returns successfully, the switch user_terminal_ is attached through tc_io_ to the user's terminal. The switch user_ i/o is attached through window_io_ to a window covering the entire screen. invoked: vertsp, can, erkl, esc, red, and ctl_char. In addition, if ^pl is set on video system invocation, ^more will be set in the video system. (For more details on modes, see the window_io_ I/O module.) Similarly, the settings of the current erase and kill characters are copied when the video system is invoked. (See "Real-Time Editing" for details.) To see how the standard I/O switch attachments change when you activate the video system on your terminal, refer to Figure A-2 in Appendix A.

USAGE

```
declare video_utils_$turn_on_login_channel entry (fixed bin (35), char (*));

call video_utils_$turn_on_login_channel (code, reason);
```

ARGUMENTS

code
: is a standard system error code. (Output)

reason
: contains information about the error, if there is one. (Output) (128 characters are enough to hold any message that may be returned in reason.)

NOTES

If the video system is already in service on the user's terminal, the status code video_et_$wsys_invoked is returned, and the value of reason is not defined.

If the activation of the video system fails, the original attachment of the terminal (through tty_) is restored, and information is returned in reason and code.

In particular, if the switch user_i/o is not currently attached through tty_, the code video_et_$switch_not_attached_with_tty_ is returned. This may indicate that the user has auditing or the graphic system in place. The message returned in reason advises the user to remove graphics or auditing and try again.

Entry: video_utils_$turn_off_login_channel

This entry reverses the actions of video_utils_$turn_on_login_channel. That is, it removes the window attachment of user_i/o, detaches terminal control from the user's terminal, and attaches user_i/o to the user's terminal via tty_. The settings of the following modes are copied when when the video system is revoked: vertsp, can, erkl, esc, red, and ctl_char. If ^more is set while in the video system, ^pl mode will be set after revoking the video system. (For more details on modes, see the window_io_ I/O module.) Similarly, the settings of the current erase and kill characters are copied when the video system is revoked. (See "Real-Time Editing" for details.) It is the user's responsibility to detach any windows other than user_io before calling this entry point

USAGE

```
declare video_utils_$turn_off_login_channel entry (fixed bin (35));

call video_utils_$turn_off_login_channel (code);
```

ARGUMENTS

code
: is a standard system error code. (Output) It is nonzero if and only if the video system can not be removed from the user's terminal.

Name: window_

The window_ subroutine provides a terminal independent interface to video terminal operations. More specifically, it controls and performs I/O to a window.

The window_ subroutine is used in conjunction with the iox_ subroutine call entry points in the window_io_ I/O module. The window_ and video_utils_ subroutines together perform the same functions as the window_call command.

The virtual terminal implemented by window_ corresponds closely to common video terminals. The features of the terminal are defined implicitly by the entries below. Not all entries can be supported on all terminals. The result of calling an unsupported feature is the error code video_et_$capability_lacking. Programs can determine whether the device in question supports a given operation by using a get_capabilities control order, described under the window_io_ I/O module.

Additional terminals may be supported by defining their video attributes in the Terminal Type File (TTF). The TTF is described in the *Multics Programmer's Reference Manual*, Order No. AG91.

Some entry points require that the current cursor position be defined when they are called. The current position is defined unless a call is made to the write_raw_text entry point, or an asynchronous event changes the window contents. If the current position is not defined, these entry points will return the status code video_et_$cursor_position_undefined.

If an asynchronous event changes the state of the window, status will be set for the window. Once window status is set, all calls to window_ on that window will return the status code video_et_$window_status_pending until a get_window_status control order is used to pick up the status.

The calling sequences for all the entry points are in the include file window_dcls.incl.pl1.

Entry: window_$bell

This entry activates the terminal alarm. For most terminals, this will be the audible bell. For some it will be a visible signal.

USAGE

```
declare window_$bell entry (ptr, fixed bin (35));

call window_$bell (iocb_ptr, code);
```

ARGUMENTS

iocb_ptr
is a pointer to an IOCB for a switch attached with window_io_. (Input)

code
is a standard system error code. (Output)

NOTES

The current cursor position must be dfined for this call. If the cursor is in some other window on the screen when this call is made, it is moved to the current position in this window.

Entry: window_$change_column

This entry moves the cursor to a different column on the current line, without changing the line.

USAGE

```
declare window_$change_column entry (ptr, fixed bin, fixed bin (35));

call window_$change_column (iocb_ptr, new_column, code);
```

ARGUMENTS

iocb_ptr
is a pointer to an IOCB for a switch attached with window_io_. (Input)

new_column
is the new column. (Input)

code
is a standard system error code. (Output)

NOTES

The current cursor position must be defined.

Entry: window_$change_line

This entry moves the cursor to a new line without changing the column.

USAGE

```
declare window_$change_line entry (ptr, fixed bin, fixed bin (35));

call window_$change_line (iocb_ptr, new_line, code);
```

ARGUMENTS

iocb_ptr
is a pointer to an IOCB for a switch attached with window_io_. (Input)

new_line
is the new line. (Input)

code
is a standard system error code. (Output)

Entry: window_$clear_region

This entry replaces the contents of the region specified with spaces, and leaves the cursor at the upper left-hand corner of the region. The region is defined by giving the upper left-hand corner (line and column), and the width and height of the region.

USAGE

```
declare window_$clear_region entry (ptr, fixed bin, fixed bin, fixed bin,
      fixed bin, fixed bin (35));

call window_$clear_region (iocb_ptr, start_line, start_col, n_lines, n_cols,
      code);
```

ARGUMENTS

iocb_ptr
is a pointer to an IOCB for a switch attached with window_io_. (Input)

start_line
is the number of the line where clearing will begin. (Input)

start_col
is the number of the column where clearing will begin. (Input)

n_lines
is the number of lines which will be cleared. (Input)

n_cols
is the number of columns which will be cleared. (Input)

code
is a standard system error code. (Output)

NOTES

The rectangular region described in cleared. The cursor position defined at (start_line, start_col).

Entry: window_$clear_to_end_of_line

This entry clears everything to the right of the cursor on the current line to spaces. Positions to the left of the cursor are not affected. The cursor is not moved.

USAGE

```
declare window_$clear_to_end_of_line entry (ptr, fixed bin (35));

call window_$clear_to_end_of_line (iocb_ptr, code);
```

ARGUMENTS

iocb_ptr
is a pointer to an IOCB for a switch attached with window_io_. (Input)

code
is a standard system error code. (Output)

NOTES

The cursor position must be defined.

Entry: window_$clear_to_end_of_window

This entry clears all of the window between the cursor and the end of the window. This includes everything to the right of the cursor on the current line, and all lines below the cursor. The cursor is not moved.

USAGE

```
declare window_$clear_to_end_of_window entry (ptr, fixed bin (35));

call window_$clear_to_end_of_window (iocb_ptr, code);
```

ARGUMENTS

iocb_ptr
is a pointer to an IOCB for a switch attached with window_io_. (Input)

code
is a standard system error code. (Output)

NOTES

The current cursor position must be defined.

Entry: window_$clear_window

This entry clears the entire window to spaces, and leaves the cursor at home.

USAGE

```
declare window_$clear_window entry (ptr, fixed bin (35));

call window_$clear_window (iocb_ptr, code);
```

ARGUMENTS

iocb_ptr
is a pointer to an IOCB for a switch attached with window_io_. (Input)

code
is a standard system error code. (Output)

NOTES

The cursor position is defined to be at line 1, column 1 after the screen is cleared.

Entry: window_$create

This entry creates a new window on the terminal screen.

USAGE

```
declare window_$create entry (ptr, ptr, ptr, fixed bin (35));

call window_$create (terminal_iocb_ptr, window_info_ptr, window_iocb_ptr,
     code);
```

ARGUMENTS

terminal_iocb_ptr
is a pointer to an IOCB for the terminal control switch. (Input) Normally this should be video_data_$terminal_iocb.

window_info_ptr
is a pointer to a standard window_position_info structure, as declared in window_control_info.incl.pl1. (Input)

window_iocb_ptr
is a pointer to a detached IOCB pointer. (Input) It may be obtained with iox_$find_iocb which must be done before the call to window_$create. For example:

```
call iox_$find_iocb ("top_window", window_iocb_ptr, code);
```

where the value returned for window_iocb_ptr is used in the call to window_$create.

code
is a standard system error code. (Output)

NOTES

The window_info_ptr must point to a window_position_info structure, as declared in window_control_info.incl.pl1. If window_position_info.width is set to zero, the window will occupy the full width of the screen. Currently windows must occupy the full width of the screen. If tc_io_.*.*in window_position_info.height is set to zero, the remainder of the screen is used. The iocb_ptr is an input argument, iox_$find_iocb may be used to obtain an iocb_ptr for a new switch.

Entry: window_$delete_chars

This entry deletes characters on the current line. Characters to the right of the cursor are moved to the left. Character positions opened up on the right margin are filled with spaces. It is an error to call this entry point if the terminal does not support the delete chars operation.

USAGE

```
declare window_$delete_chars entry (ptr, fixed bin, fixed bin (35));

call window_$delete_chars (iocb_ptr, n_chars, code);
```

ARGUMENTS

iocb_ptr
is a pointer to an IOCB for a switch attached with window_io_. (Input)

n_chars
is the number of characters (starting at the current cursor position) that will be removed from the screen. (Input) If n_chars is zero, no action is taken.

code
is a standard system error code. (Output)

NOTES

The current cursor position must be defined. The number of characters specified by n_chars are deleted, and the remaining characters on the line, if any, move leftward to occupy the space.

Entry: window_$destroy

This entry destroys an existing window, leaving its IOCB in a detached state.

USAGE

```
declare window_$destroy entry (ptr, fixed bin (35));

call window_$destroy (window_iocb_ptr, code);
```

ARGUMENTS

window_iocb_ptr
is a pointer to an IOCB attached with window_$create. (Input)

code
is a standard system error code. (Output)

Entry: window_$edit_line

This entry allows applications to preload the video editor input buffer with a string.

USAGE

```
declare window_$edit_line entry (pointer, pointer, pointer, fixed bin (21),
      fixed bin (21), fixed bin (35));

call window_$edit_line (iocb_ptr, window_edit_line_info_ptr, buffer_ptr,
      buffer_len, n_returned, code);
```

ARGUMENTS

window_iocb_ptr
is a pointer to an IOCB for a switch attached with window_io. (Input)

window_edit_line_info_ptr
is a pointer to a window_edit_line_info structure, as declared in window_control_info.incl.pl1 (described below). (Input)

version
is the version number of the structure. (Input) This is currently window_edit_line_version_1.

line_ptr
is a pointer to the initial text string to be loaded into the input buffer before editing begins. (Input)

line_length
is the length of the string pointed to by line_ptr. (Input)

buffer_ptr
is a pointer to a buffer where the users input will be put. (Input)

buffer_len
is the size of the input buffer. (Input)

n_returned
is the number of characters in the final output line. (Output)

code
is a standard system error code. (Output)

Entry: window_$get_cursor_position

This entry is used to return the current position of the cursor. If the last operation done to the terminal was in some other window, this will not be the actual position of the cursor on the screen.

USAGE

```
declare window_ $get_cursor_position entry (ptr, fixed bin, fixed bin, fixed
      bin (35));

call window_$get_cursor_position (iocb_ptr, line, col, code);
```

ARGUMENTS

iocb_ptr
is a pointer to an IOCB for a switch attached with window_io_. (Input)

line
is the line number. (Output)

col
is the column position. (Output)

code
is a standard system error code. (Output)

NOTES

The current cursor position must be defined.

Entry: window_$get_echoed_chars

This entry accepts input from the typist, echoing the characters as typed, until either a specified number of characters are read, or a break character is encountered. By default, the break characters are the control characters plus DEL (177 octal).

USAGE

```
declare window_$get_echoed_chars entry (ptr, fixed bin (21), char (*), fixed
      bin (21), char (1) varying, fixed bin (35));

call window_$get_echoed_chars (iocb_ptr, n_to_get, buffer, n_got, break,
      code);
```

ARGUMENTS

iocb_ptr
: is a pointer to an IOCB for a switch attached with window_io_. (Input)

n_to_get
: is the number of columns (N) between the cursor and the end of the line. (Input) At most N characters will be returned.

buffer
: is the caller-supplied buffer that holds characters returned. (Input)

n_got
: is the number of characters returned. (Output) Each character is echoed.

break
: is the character that causes the echoing to stop. (Output) This character is not echoed.

code
: is a standard system error code. (Output)

NOTES

This entry point returns no more than n_to_get characters in buffer. It reads and echoes characters until either (1) it has read n_to_get characters, or (2) it has read a break character. If it stops due to a break character, the break character is returned in break, otherwise break is equal to "".

Entry: window_$get_one_unechoed_char

This entry reads a single character, unechoed, from the terminal. Optionally, it can return instead of waiting if there are no characters available.

USAGE

```
declare window_$get_one_unechoed_char entry (ptr, char (1) varying, bit (1)
      aligned, fixed bin (35));

call window_$get_one_unechoed_char (iocb_ptr, char_read, block_flag, code);
```

ARGUMENTS

iocb_ptr
is a pointer to an IOCB for a switch attached with window_io_. (Input)

char_read
is the read character. (Output) If block_flag is "0"b, and no input is typed ahead, then this will be a zero length character string.

block_flag
if this flag is "1"b, input from the terminal is awaited if none is available. (Input) If it is "0"b, and no input is available, then this entry returns immediately, and sets char_read to "".

code
is a standard system error code. (Output)

NOTES

Beware of the PL/I language definition of character string comparisons when using this entry with a block flag of "0"b. In PL/I, both of the following comparisons are true:

```
(" " = " ")
("" = " ")
```

That is, a zero length varying string compares equally to a single space. To test if char_read is nonempty, use an expression like:

```
(length (char_read) > 0)
```

Entry: window_$get_unechoed_chars

This entry accepts input from the typist, leaving it unechoed, until either a specified number of characters are read, or a break character is encountered.

USAGE

```
declare window_$get_unechoed_chars entry (ptr, fixed bin (21), char (*), fixed
      bin (21), char (1) varying, fixed bin (35));

call window_$get_unechoed_chars (iocb_ptr, n_to_get, buffer, n_got, break,
      code);
```

ARGUMENTS

iocb_ptr
is a pointer to an IOCB for a switch attached with window_io_. (Input)

n_to_get
is the number of columns (N) between the cursor and the end of the line. (Input) At most N characters will be returned.

buffer
is the caller-supplied buffer that holds characters returned. (Input)

n_got
is the number of characters returned. (Output) Each character is echoed.

break
is the character that causes the echoing to stop. (Output) This character is not echoed.

code
is a standard system error code. (Output)

NOTES

This entry point will read no more than n_to_get characters from the terminal, without echoing them to the typist. The characters are returned in the buffer. Characters are read until either (1) n_to_get characters are read, or (2) a break character is read. If reading stops due to a break character, then the break character is returned in break. Otherwise break is "".

Entry: window_$insert_text

This entry inserts text at the current cursor position. Text at the cursor or to the right of the cursor is shifted to the right, to accommodate the new text. It is an error to call this entry if the terminal does not support the insertion of text.

USAGE

```
declare window_$insert_text entry (ptr, char (*), fixed bin (35));

call window_$insert_text (iocb_ptr, text, code);
```

ARGUMENTS

iocb_ptr
is a pointer to an IOCB for a switch attached with window_io_. (Input)

text
is the character string to be written. (Input) When converted to output, each character in this string must occupy exactly one print position. The length of this string must be such that characters moved to the right will remain on the current line in the window. If these conditions are not met, the result is undefined. The cursor is left after the last character inserted.

code
is a standard system error code. (Output)

NOTES

The current cursor position must be defined. The string "text" must contain only printable ASCII graphics. If it contains any other characters, the status code video_et_$string_not_printable is returned.

Entry: window_$overwrite_text

This entry writes text on the window in the current cursor location. If there is any text at or to the right of the current cursor position in the window, it is overwritten with the supplied string.

USAGE

```
declare window_$overwrite_text entry (ptr, char (*), fixed bin (35));

call window_$overwrite_text (iocb_ptr, text, code);
```

ARGUMENTS

iocb_ptr
is a pointer to an IOCB for a switch attached with window_io_. (Input)

text
is the character string to be written. (Input) This string should consist of only printable ASCII graphics (octal codes 040 through 176 inclusive), and may not be longer than the space remaining on the current line.

code
is a standard system error code. (Output)

NOTES

The cursor position must be defined. The string "text" may contain only printable ASCII graphics. If it contains anything else the status code video_et_$string_not_printable is returned.

Entry: window_$position_cursor

This entry moves the cursor to any requested position in the window. It defines the current cursor position if it is undefined.

USAGE

```
declare window_$position_cursor entry (ptr, fixed bin, fixed bin,
      fixed bin (35));

call window_$position_cursor (iocb_ptr, line, col, code);
```

ARGUMENTS

iocb_ptr
is a pointer to an IOCB for a switch attached with window_io_. (Input) line is the line number. (Input)

col
is the column position. (Input)

code
is a standard system error code. (Output)

Entry: window_$position_cursor_rel

The entry moves the cursor relative to the current location.

USAGE

```
declare window_$position_cursor_rel entry (ptr, fixed bin, fixed bin,
      fixed bin (35));

call window_$position_cursor_rel (iocb_ptr, line_inc, col_inc, code);
```

ARGUMENTS

iocb_ptr
is a pointer to an IOCB for a switch attached with window_io_. (Input)

line_inc
is the change in line number. (Input) If line_inc is a positive number, the cursor is moved down. If it is a negative number, the cursor is moved up. If it is zero, the cursor's line number is not changed.

col_inc
is the change in column position. (Input) If col_inc is a positive number, the cursor is moved to the right. If it is a negative number, the cursor is moved to the left. If it is zero, the cursor's column position is not changed.

code
is a standard system error code. (Output)

Entry: window_$scroll_region

This entry scrolls a region up or down a given number of lines. A positive scroll count scrolls the window up, deleting lines from the top of the window and adding new blank lines to the bottom. The cursor's new position is at the beginning of the first new blank line. A negative count scrolls the window down, deleting lines from the bottom and adding lines to the top. The cursor is left at home. If this entry is called and the terminal does not support either scrolling or insert and delete lines, the result is an error status, video_et_$capabilities_lacking.

USAGE

```
declare window_$scroll_region entry (ptr, fixed bin, fixed bin, fixed bin,
      fixed bin (35));

call window_$scroll_region (iocb_ptr, start_line, n_lines, scroll_distance,
      code);
```

ARGUMENTS

iocb_ptr
is a pointer to an IOCB for a switch attached with window_io_. (Input)

start_line
is the number of the first line of the region. (Input)

n_lines
is the number of lines that compose the region. (Input)

scroll_distance
is the distance in lines by which the region will be scrolled. (Input)

code
is a standard system error code. (Output)

NOTES

The cursor position is defined to be column one on first_line. The region from first_line for n_lines is scrolled scroll_distance lines, which may be negative.

Entry: window_$sync

This entry synchronizes the process with the typist by writing any pending output to the terminal.

USAGE

```
declare window_$sync entry (ptr, fixed bin (35));

call window_$sync (iocb_ptr, code);
```

ARGUMENTS

iocb_ptr
is a pointer to an IOCB for a switch attached with window_io_. (Input)

code
is a standard system error code. (Output)

NOTES

The calling process is made to wait until the typist types something after the last text output has been transmitted to the terminal.

Entry: window_$write_raw_text

This entry is used to output a terminal dependent sequence. The current cursor position becomes undefined after this call is made. This entry should not be used to output sequences that put graphics onto the terminal screen, as the video system's internal screen image will become inconsistent. This entry is used for terminal-specific features that cannot be accessed via the video system.

USAGE

```
declare window_$write_raw_text entry (ptr, char (*), fixed bin (35));

call window_$write_raw_text (iocb_ptr, text, code);
```

ARGUMENTS

iocb_ptr
is a pointer to an IOCB for a switch attached with window_io_. (Input)

text
is any string of printable ASCII characters to be transmitted to the terminal. (Input)

code
is a standard system error code. (Output)

NOTES

Any call to window_$write_raw_text causes the cursor position to become undefined and sets the screen_invalid window status flag. Subsequent calls to write_raw_text will ignore this flag, but all other window_ entrypoints will return the status code video_et_$window_status_pending until the status flag is cleared. It is the responsibility of the application performing the raw output call to perform a get_window_status control order to clear the status flag.

Entry: window_$write_sync_read

This entry writes a prompt, synchronizes input to the output of the prompt, and reads a response. This entry is useful for queries where it is important to avoid interpreting type-ahead as a response to a question.

USAGE

```
declare window_$write_sync_read entry (ptr, char (*), fixed bin (21),
      char (*), fixed bin (21), char (1) varying, fixed bin (35));

call window_$write_sync_read (iocb_ptr, prompt, n_to_get, buffer, n_got,
      break, code);
```

ARGUMENTS

iocb_ptr
is a pointer to an IOCB for a switch attached with window_io_. (Input)

prompt
is a string of printable ASCII characters which must fit on the current line. (Input)

n_to_get
is the number of columns (N) between the cursor and the end of the line. (Input) At most N characters will be returned.

buffer
is the caller-supplied buffer that holds characters returned. (Input)

n_got
is the number of characters returned. (Output) Each character is echoed.

break
is the character that causes the echoing to stop. (Output) This character is not echoed.

code
is a standard system error code. (Output)

NOTES

The current cursor position must be defined. This entry overwrites the text string "prompt" at the current cursor position. It then reads characters typed after the prompt has been transmitted to the terminal. The characters are read in the same fashion as the get_unechoed_chars entry point. Any characters read before the prompt is transmitted, are buffered and returned to get_echoed_chars or subsequent get_unechoed_chars calls.

SECTION 7

I/O MODULES

This section contains descriptions of the I/O modules used by the menu and video software, presented in alphabetical order. For details on I/O processing, see the *Multics Programmer's Reference Manual*, Order No. AG91.

Name: tc_io_

The tc_io_ I/O module supports terminal independent I/O to the screen of a video terminal.

Entry points in this module are not called directly by users; rather, the module is accessed through the I/O system interfaces iox_.

ATTACH DESCRIPTION

```
tc_io_ {device} {-control_args}
```

ARGUMENTS

device
* is the channel name of the device to be attached If a device is not given, the -login_channel control argument must be given.

CONTROL ARGUMENTS

-login_channel
specifies attachment to the user's primary login channel. If a device is not specified, then the user's login channel is used. This control argument flags this switch for reconnection by the process disconnection facility. If the user's login device should hang up, this switch will be automatically closed, detached, attached, and opened on the user's new login channel when the user reconnects, if permission to use this facility is specified in the SAT and PDT for the user.

-destination DESTINATION
specifies that the attached device is to be called using the address DESTINATION. In the case of telephone auto_call lines, DESTINATION is the telephone number to be dialed. See the dial_manager_ subroutine in the *Multics Subroutines and I/O Modules* manual, Order No. AG93, for more details.

-no_block
specifies that the device is to be managed asynchronously. The tty_ subroutine will not
* block to wait for input to be available or output space to be available. This control argument should not be used on the login channel, because it will cause the command listener to loop calling get_chars.

-no_hangup_on_detach
prevents the detach entry point from hanging up the device. This is not meaningful for the login channel.

-hangup_on_detach
causes the detach entry point to hang up the device automatically. This is not meaningful for the login channel.

OPEN OPERATION

Opens the module for stream_input_output.

GET LINE OPERATION

The get_line operation is not supported.

CONTROL OPERATION

The following control orders are supported:

clear_screen
clears the entire terminal screen. The info_ptr is null. It is intended for use when the screen image may have been damaged due to communications problems, for example.

get_capabilities
returns information about the capabilities of the terminal. The info structure is described in the description of the "get_capabilities" control order in the window_io_ module.

get_break_table
returns the current break table. The info pointer should point to a break table, declared as follows (window_control_info.incl.pl1):

```
dcl 1 break_table_info  aligned based (break_table_ptr),
      2 version         fixed bin,
      2 breaks          (0:127) bit (1) unaligned;
```

STRUCTURE ELEMENTS

version
must be set by the caller to break_table_infc_version_1. (Input)

breaks
has a "1"b for each character that is a break character. (Output)

set_break_table
sets the break table. The info pointer should point to a break table as defined by the get_break_table order, above. By default, the break table has "1"b for all nonprintable characters, and "0"b elsewhere. Applications that set the break table must be careful to reset it afterwards, and establish an appropriate cleanup handler.

set_line_speed
sets the speed of the terminal's connection to Multics. The info_ptr should point to a fixed binary number representing the line speed in characters per second. Negative line speeds are not allowed.

set_term_type
changes the terminal type. The info pointer should point to a set_term_type_info structure, described below. This sets window_status_pending for all windows and sets the ttp_change field in the window_status structure along with the screen_invalid. This operation re-initializes all the terminal specific video system information such as the video sequences, length and width of the screen, and capabilities. It is equivalent to doing "window_call revoke; stty -ttp new_terminal_type; window_call invoke", except no windows are destroyed. The set_term_type_info structure is declared in set_term_type_info.incl.pl1:

```
dcl 1 set_term_type_info          aligned based (sttip)
      2 version                   fixed bin
      2 name char                 (32) unaligned
      2 flags                     unaligned
        3 send_initial_string     bit (1)
        3 set_modes               bit (1)
        3 ignore_line_type        bit (1)
        3 mbz                     bit (33);
```

STRUCTURE ELEMENTS

version
is the version of this structure. (Input) It must be stti_version_1.

name
is the name of the new terminal type. (Input)

NOTES

The send_initial_string, set_modes and ignore_line_type flags are all ignored by the video system. The initial string will always be sent.

reconnection
determines the new terminal type (which may or may not be the same as before the disconnection). Performs a set_term_type control order to inform the rest of the system of the change in terminal type. If the set_term_type fails then the video_utils_$turn_off_login_channel is invoked in an attempt to re-attach tty_. Reconnection (a field in window_status) is set to indicate to an application doing get_window_status that a reconnection has occurred.

The window_status_info structure is declared in window_status.incl.pl1.

Name: window_io_

The window_io_ I/O module supports I/O to a window. In addition to the usual iox_ entries, the module provides terminal independent access to special video terminal features, such as a moveable cursor, selective erasure, and scrolling of regions. The module provides a real-time input line editor and performs output conversion and "MORE" processing.

Entry points in this module are not called directly by users; rather, this module is accessed through the I/O system interfaces iox_ and window_.

ATTACH DESCRIPTION

```
window_io_ switch {-control_args}
```

ARGUMENTS

switch
is the name of an I/O switch attached to a terminal via the tc_io_ I/O module. The window created by this attach operation will be mapped onto the screen of that terminal. Use window_$create to attach and open, and use window_$destroy to detach and close windows on the login terminal.

CONTROL ARGUMENTS

-first_line LINE_NO
LINE_NO is the line number on the screen where the window is to begin. If omitted, the window starts on the topmost line of the screen (line 1).

-height N_LINES, -n_lines N_LINES
N_LINES is the number of lines in the window. The default is to use all lines to the end of the screen.

-first_column COL_NO
COL_NO is the column number on the screen where the window is to begin. If omitted, the window starts on the leftmost column of the screen (column 1).

-width N_COLS, -n_columns N_COLS
N_COLS is the number of the columns in the window. The default is all columns to the end of the screen.

NOTES

The attach description control arguments must specify a region which lies within the terminal screen. If not, the attachment is not made, and the error code video_et_$out_of_terminal_bounds is returned.

When the window is attached, it is cleared and the cursor is left at home.

OPEN OPERATION

The following opening mode is supported: stream_input_output.

PUR CHARS OPERATION

This operation is used to output a character string to the window. If rawo mode (see below) is disabled, the characters are processed according to the output conversions defined for the terminal. If necessary, the string is continued on subsequent lines of the window. If output passes the last line of the window, the placement of additional lines is controlled by the setting of the more_mode mode (see below). If an output line must be erased from the window to make room for this new output, and there has been no intervening input in this window, and more_mode (see below) is enabled, the user is queried for the disposition of this new output. (See MORE processing in Section 4.)

In rawo mode, the characters are written directly to the terminal, without any of the above processing.

GET CHARS OPERATION

This operation returns exactly one character, unechoed, regardless of the size of the caller's buffer. The line editor is not invoked by this call.

GET LINE OPERATION

The get_line operation invokes the real-time input line editor, and returns a complete line typed by the user. A description of the typing conventions is given in Section 4. The put_chars and get_line operations retrieve and reset any statuses that they encounter, so that applications that make these calls need not be changed to check for video_et_$window_status_pending.

CONTROL OPERATION

The control operations below are supported. Note that many of the control operations can be issued at command level via io_call commands; these include any control orders that do not require an info structure, and those described below. The following relations must hold when changing windows (set_window_info). These relations are always true when obtaining information about a window (get_window_info):

```
0 < column + width <= screen width
0 < line + height <= scrren height
```

get_window_info
returns information about the position and extent of the window. The info ptr points to the following structure (declared in window_control_info.incl.pl1):

```
dcl 1 window_position_info  based (window_position_info_ptr),
      2 version             fixed bin,
      2 origin,
        3 column            fixed bin,
        3 line              fixed bin,
      2 extent,
        3 width             fixed bin,
        3 height            fixed bin;
```

STRUCTURE ELEMENTS

version
is the version number of this structure. (Input) It must be window_position_info_version_2.

column
is the column of the upper left-hand corner of the window. (Output) If the column of the upper left-hand corner is zero, then the first column will be used, to allow old programs written when this was a mbz field to run without modification.

line
is the line of the upper left-hand corner of the window. (Output)

width
is the width of the window (columns). (Output)

height
is the height of the window (lines). (Output)

set_window_info
causes the window to be relocated or to change size (or both). The info ptr points to the same structure used in the "get_window_info" control order. The values have the same meaning, but are the new values for the window when setting (Input), and are returned by get_window_info (Output).

get_window_status, set_window_status
window status is used to inform the application that some asynchronous event has disturbed the contents of the window. When window status is set for a window, all calls to window_ will return video_et_$window_status_pending until the status is reset. To reset the status, make a get_window_status control order on the switch. The info pointer should point to the following structure (declared in window_control_info.incl.pl1):

```
dcl  1 window_status_info  aligned based (window_status_info_ptr),
       2 version           fixed bin,
       2 status_string     bit (36) aligned;
```

STRUCTURE ELEMENTS

version
is the version of this structure. (Input) It must be window_status_version_1.

status_string
is the window status information. (Input) To interpret the actual status_string, use the include file window_status.incl.pl1:

```
dcl 1 window_status_info   aligned based (window_status_info_ptr),
     2 screen_invalid      bit (1) unaligned,
     2 async_change        bit (1) unaligned,
     2 ttp_change          bit (1) unaligned,
     2 reconnection        bit (1) unaligned,
     2 pad                 bit (32) unaligned;
```

STRUCTURE ELEMENTS

screen_invalid
indicates that the contents of the window have become undefined. (Input for set, Output for get) This will happen, for example, in the event of a disconnection/reconnection of the terminal.

async_change
indicates that a timer or event call procedure has made a modification to the window. (Input for set, Output for get)

ttp_change
indicates that the terminal type has changed. (Input for set, Output for get) This re-initializes all the terminal specific video system information such as the video sequences, length and width of the screen, and capabilities.

reconnection
determines the new terminal type (which may or may not be the same as before the disconnection). (Input for set, Output for get) Performs a set_term_type control order to inform the rest of the system of the change in terminal type.

pad
reserved for future expansion and must be "0"b.

NOTES

The get_window_status and get_window_status control orders are available from command level and as active functions with the following io_call commands:

```
io_call control window_switch get_window_status status_key_1
   {status_key_2} N
io_call control window_switch set_window_status status_key_1
   {status_key_N}
```

where status_key_N is either screen_invalid, asynchronous_change, ttp_change, or reconnection.

get_capabilities
returns information about the generic capabilities of the terminal. These are the "raw" physical characteristics of the terminal. The video system may simulate those that are lacking. For example, the system simulates insert and delete characters, but does not simulate insert and delete lines. The info ptr should point to the following structure (declared in terminal_capabilities.incl.pl1):

```
dcl 1 capabilities_info    aligned based(capabilities_info_ptr),
      2 version            fixed bin,
      2 screensize,
        3 columns          fixed bin,
        3 rows             fixed bin,
      2 flags,
        3 scroll_region    bit (1) unal,
        3 insert_chars     bit (1) unal,
        3 insert_mode      bit (1) unal,
        3 delete_chars     bit (1) unal,
        3 overprint        bit (1) unal,
        3 pad              bit (28) unal,
      2 line_speed         fixed bin,
```

STRUCTURE ELEMENTS

version
is the version number of this structure. (Input) It must be capabilities_info_version_1, also declared in the include file.

columns
is the number of columns on the terminal. (Output)

rows
is the number of rows (lines) on the terminal. (Output)

scroll_region
is true if the terminal is capable of scrolling, with insert and delete lines. (Output)

insert_chars
is true if the insert_chars function is supported. (Output)

insert_mode
is true if the terminal is capable of going into and out of insert mode. (Output)

delete_chars
is true if the delete chars function is supported. (Output)

overprint
is true if the terminal is capable of printing overstrike characters. (Output) It is currently always set to "0"b (false).

pad
reserved for future expansion and must be "0"b.

line_speed
is the speed of the communications channel to the terminal, in characters per second. (Output)

reset_more
causes MORE Processing to be reset. All lines on the window may be freely discarded without querying the user.

get_editing_chars
is identical to the operation supported by the tty_ I/O module.

set_editing_chars
is identical to the operation supported by the tty_ I/O module.

NOTES

The get_editing_chars and set_editing_chars control orders are available from command level and as active functions with the following io_call commands:

```
io_call window_switch get_editing_chars
io_call control window_switch set_editing_chars erase_kill_characters
```

get_more_responses
returns information about the acceptable responses to MORE processing. The info pointer should point to the following structure (declared in window_control_info.incl.pl1):

```
dcl 1 more_responses_info  aligned based (more_responses_info_ptr),
      2 version            fixed bin,
      2 n_yeses            fixed bin,
      2 n_noes             fixed bin,
      2 yeses              char (32) unaligned,
      2 noes               char (32) unaligned;
```

STRUCTURE ELEMENTS

version
is the version number of this structure and must be set to more_responses_info_version_1, also declared in the include file. (Input)

n_yeses
is the number of different affirmative responses, from zero to 32. (Output)

n_noes
is the number of different negative responses. (Output)

yeses
is the concatenation of all the affirmative responses. (Output) Each response is one character. Only the first "n_yeses" are valid.

noes
is the concatenation of all negative responses. (Output) Each response is one character. Only the first "n_noes" are valid.

set_more_responses
sets the responses. The data structure is the same as the one used for the "get_more_responses" order except that all fields are Input. At most, 32 yeses and 32 noes may be supplied. It is highly recommended that there be at least one yes, so that output may continue. The "yes" and "no" characters must be distinct. If they are not, the error code video_et_$overlapping_more_responses is returned, and the responses are not changed.

NOTES

The get_more_response and set_more_response control orders are available from command level and as active functions with the following io_call command:

```
io_call control window_switch get_more_responses
io_call control window_switch set_more_responses yes_responses
   no_responses
```

where the yes_responses and no_responses will be used as arguments to the get_more_responses control order. If either of the response strings contains blanks or special characters, it must be quoted.

get_more_prompt set_more_prompt
sets the prompt displayed when a more break occurs. The current more responses can be displayed as part of the more prompt, by including the proper ioa_ control codes as part of the prompt string. For example the default video system more prompt string is "More? (^a for more; ^a to discard output.)". With the default more responses of carriage return for more and the delete for discard, the final string displayed is "More (RETURN for more; DEL to discard output.)." The info pointer should point to the following structure (declared in window_control_info.incl.pl1):

```
dcl 1 more_prompt_info     aligned based (more_prompt_info_ptr),
      2 version            char (8),
      2 more_prompt        char (80);
```

STRUCTURE ELEMENTS

version
is the version number of this structure (currently more_prompt_info_version_1). (Input)

more_prompt
is the ioa_ control string to serve as the more prompt. (Input for set, Output for get)

The get_more_prompt and set_more_prompt control orders are available from command level and as active functions with the following io_call command:

```
io_call control window_switch get_more_prompt
io_call control window_switch set_more_prompt prompt_string
```

where window_switch is a valid window_io_ switch and prompt_string is the ioa_ control string described above.

get_more_handler set_more_handler
Sets the handler for video system more breaks to the specified routine. The info pointer should point to the following structure (declared in window_control_io.incl.pl1):

```
dcl 1 more_handler_info      aligned based (more_handler_info_ptr),
      2 version              fixed bin,
      2 flags                unaligned,
        3 old_handler_valid  bit(1),
        3 pad                bit(35),
      2 more_handler         entry (pointer, bit(1) aligned),
      2 old_more_handler     entry (pointer, bit(1) aligned);

dcl (more_handler_info_version_3)
    fixed bin internal static options (constant) init (3);
```

STRUCTURE ELEMENTS

version
is the version number of this structure, and must be set to more_handler_info_version_3 (also declared in the include file). (Input)

more_handler
is the entry to be called at a more break. (Input for set) (Output for get) It will be passed two arguments, described below.

old_handler_valid
is a flag specifying whether some other user-supplied more handler was in effect when the order call was made. (Output) (This can only be used with get.)

old_more_handler
is the user supplied entry that was acting as more handler before the order call was made. (Output) Its value is only defined if the old_handler_valid flag is on. (This can only be used with get.)

The more handler routine is called with two arguments. The first is a pointer to a structure containing information of interest to a more handler (see below), and the second is a flag which the more handler sets to indicate whether or not output should be flushed ("1"b to continue output, "0"b to flush output).

The structure can be found in the include file window_more_handler.incl.pl1, and is declared as follows:

```
dcl 1 more_info            aligned base (more_info_ptr),
      2 version            fixed bin,
      2 more_mode          fixed bin,       /* which flavor */
      2 window_iocb_prt    pointer,         /* for window that MORE'd */
      2 more_prompt        character (80), /* MORE? */
      2 more_responses,
        3 n_yeses          fixed bin,
        3 n_noes           fixed bin,
        3 more_yeses       character (32) unaligned,
                                          /* at most 32 yeses */
        3 more_noes        character (32) unaligned;
```

STRUCTURE ELEMENTS

version
is the version number of the structure (declared as more_handler_info_version_2 in the include file). (Input)

window_iocb_ptr
is a pointer to the iocb for the window in which the more break occurred. (Input) Prompt output should be written to this switch, and responses should be read from it.

more_mode
is the current more mode. (Input) Constants for the different more modes are declared in the include file window_io_attach_data.incl.pl1.

more_prompt
is the current more prompt. (Input) This is the string "More? (^a for more; ^a to discard output)" and is user-settable.

more_responses
is the current set of more responses, and is declared similarly to the more_responses_info structure in the get_more_responses order description above. (Input)

NOTES

The get_more_handler and set_more_handler control orders are available from command level and as active functions with the following io_call command:

```
io_call window_switch get_more_handler
io_call window_switch set_more_handler more_handler
```

where more_handler is the entryname of the routine to be used as the more handler routine. The name is converted to an entry using the user's search rules and is then used as described in the set_more_handler control order.

get_break_table set_break_table
break table determines action of the get_echoed_chars, get_unechoed_chars, and write_sync_read entry points of the window_ subroutine. The array "breaks" has a 1 for each character that is to be considered a break. By default, the break table has "1"b for all the nonprintable characters, and "0"b elsewhere. Applications that set the break table must be careful to reset it afterwards, and establish an appropriate cleanup handler.

```
dcl 1 break_table_info   aligned based (break_table_ptr),
      2 versions         fixed bin,
      2 breaks           (0:127) bit (1) unaligned;
```

STRUCTURE ELEMENTS

versions
must be set by the caller to break_table_info_version_1. (Input)

breaks
has a "1"b for each character that is a break character. (Input/Output)

reset_more_handler
cancels the last user-defined more_handler. The reset_more_handler control order is available from command level with the following io_call command:

```
io_call control window_switch reset_more_handler
```

get_output_conversion
this order is used to obtain the current contents of the specified table. The info_ptr points to a structure like the one described for the corresponding "set" order below, which is filled in as a result of the call (except for the version number, which must be supplied by the caller). If the specified table does not exist (no translation or conversion is required), the status code error_table_$no_table is returned.

set_output_conversion
provides a table to be used in formatting output to identify certain kinds of special characters. The info_ptr points to the following structure (declared in tty_convert.incl.pl1). If the info_ptr is null, no transaction is to be done.

```
dcl 1 cv_trans_struc            aligned
      2 version                 fixed bin,
      2 default                 fixed bin,
      2 cv_trans                aligned
        3 value                 (0:255) fixed bin (8) unaligned
```

STRUCTURE ELEMENTS

version
is the version number of the structure. It must be 2 and declared in tty_convert.incl.pl1.

default
indicates, if nonzero, that the table is the one that was in effect before video was invoked.

values
are the elements of the table. This table is indexed by the value of a typed input character, and the corresponding entry contains the ASCII character resulting from the translation.

get_special
is used to obtain the contents of the special_chars table currently in use. The info_ptr points to the following structure (defined in tty_convert.incl.pl1):

```
dcl 1 get_special_info_struc    aligned
      2 area_ptr                ptr,
      2 table_ptr               ptr;
```

STRUCTURE ELEMENTS

area_ptr
points to an area in which a copy of the current special_chars table is returned. (Input)

table_ptr
is set to the address of the returned copy of the table. (Output)

set_special
provides a table that specifies sequences to be substituted for certain output characters, and characters that are to be interpreted as parts of escape sequences on input. Output sequences are of the following form (defined in tty_convert.incl.pl1):

```
dcl 1 c_chars          based aligned,
      2 count          fixed bin (8) unaligned,
      2 chars (3)      char (1) unaligned;
```

STRUCTURE ELEMENTS

count
is the actual length of the sequence in characters (0<= count <=3). If count is zero, there is no sequence.

chars
are the characters that make up the sequence. The info_ptr points to a structure of the following form (defined in tty_convert.incl.pl1):

```
dcl 1 special_chars_struc      aligned based,
      2 version                fixed bin,
      2 default                fixed bin,
      2 special_chars
        3 nl_seq               aligned like c_chars,
        3 cr_seq               aligned like c_chars,
        3 bs_seq               aligned like c_chars,
        3 tab_seq              aligned like c_chars,
        3 vt_seq               aligned like c_chars,
        3 ff_seq               aligned like c_chars,
        3 printer_on           aligned like c_chars,
        3 printer_off          aligned like c_chars,
        3 red_ribbon_shift     aligned like c_chars,
        3 black_ribbon_shift   aligned like c_chars,
        3 end_of_page          aligned like c_chars,
        3 escape_length        fixed bin,
        3 not_edited_escapes   (sc_escape_len refer
                               (special_chars.escape_length))
                                 like c_chars,
        3 edited_escapes       (sc_escape_len refer
                               (special_chars.escape_length))
                                 like c_chars,
        3 input_escapes        aligned,
          4 len                fixed bin(8) unaligned,
          4 str                char (sc_input_escape_len refer
                               (special_chars.input_escapes.len))
                                 unaligned,
        3 input_results        aligned,
          4 pad                bit(9) unaligned,
          4 str                char (sc_input_escape_len refer
                               (special_chars.input_escapes.len))
                                 unaligned;
```

NOTES

Video ignores cr_seg, bs_seg, tab_seg, vt_seg, ff_seg, printer_on, printer_off, end_of_page, input_escapes, and input results.

STRUCTURE ELEMENTS

version
is the version number of this structure. It must be 1.

default
indicates, if nonzero, that the default values for the current terminal type and baud rate are to be used and that the remainder of the structure is to be ignored.

nl_seq
is the output character sequence to be substituted for a newline character. The nl_seq.count generally should be nonzero.

cr_seq
is the output character sequence to be substituted for a carriage-return character. If count is zero, the appropriate number of backspaces is substituted. However, either cr_seq.count or bs_seq.count should be nonzero (i.e., both should not be zero).

bs_seq
is the output character sequence to be substituted for a backspace character. If count is zero, a carriage return and the appropriate number of spaces are substituted. However, either bs_seq.count or cr_seq.count, should be nonzero (i.e., both should not be zero).

tab_seq
is the output character sequence to be substituted for a horizontal tab. If count is zero, the appropriate number of spaces is substituted.

vt_seq
is the output character sequence to be substituted for a vertical tab. If count is zero, no characters are substituted.

ff_seq
is the output character sequence to be substituted for a formfeed. If count is zero, no characters are substituted.

printer_on
is the character sequence to be used to implement the printer_on control operation. If count is zero, the function is not performed.

printer_off
is the character sequence to be used to implement the printer_off control operation. If count is zero, the function is not performed.

red_ribbon_shift
is the character sequence to be substituted for a red-ribbon-shift character. If count is zero, no characters are substituted.

black_ribbon_shift
is the character sequence to be substituted for a black_ribbon_shift character. If count is zero, no characters are substituted.

end_of_page
is the character sequence to be printed to indicate that a page of output is full. If count is zero, no additional characters are printed, and the cursor is left at the end of the last line.

escape_length
is the number of output escape sequences in each of the two escape arrays.

not_edited_escapes
is an array of escape sequences to be substituted for particular characters if the terminal is in "^edited" mode. This array is indexed according to the indicator found in the corresponding output conversion table (see the description of the set_output_conversion order above).

edited_escapes
is an array of escape sequences to be used in edited mode. It is indexed in the same fashion as not_edited_escapes.

input_escapes
is a string of characters each of which forms an escape sequence when preceded by an escape character.

input_results
is a string of characters each of which is to replace the escape sequence consisting of an escape character and the character occupying the corresponding position in input_escapes.

get_token_characters, set_token_characters
changes the set of characters that are used by the video system input line editor to define a word for such requests as ESC DEL. The set of characters supplied in the structure replace the existing set of characters. The info_ptr points to the following structure (declared in window_control_info.incl.pl1):

```
dcl 1 token_characters_info     aligned based
                                     (token_characters_info_ptr),
      2 version                 char(8),
      2 token_characters_count  fixed bin,
      2 token_characters        char (128) unaligned;
```

STRUCTURE ELEMENTS

version
is the version string for this structure. (Input) Its current value is token_characters_info_version_1, also declared in the include file.

token_characters_count
is the number of characters in the token_characters string. (Input)

token_characters
is a character string containing the new set of token characters. (Input)

NOTES

The set_token_characters and get_token_characters control orders are available from command_level and as active functions with the following io_call commands:

```
io_call control window_switch get_token_characters
io_call control window_switch set_token_characters token_char_string
```

where token_char_string is a character string containing the new set of token characters. get_token_character returns its result as a string if it was invoked as an active function, otherwise it prints out the token characters.

get_editor_key_bindings
returns a pointer to the line_editor_key_binding structure describing the key bindings. io_call support points out the pathname of each editor routine, listing only the names of builtin requests in capital letters, with the word "builtin" in parentheses. The control order prints or returns current information about the key bindings. Use the set_editor_key_bindings control order to change the bindings. This control order prints or returns current information about the key_bindings. Use the set_editor_key_bindings control order to change the bindings.

The info_ptr points to the following structure (declared in window_control_info.incl.pl1):

```
dcl 1 get_editor_key_bindings_info  aligned based
                                    (get_editor_key_binding_info_ptr),
      2 version                     char(8),
      2 flags,
        3 entire_state              bit (1) unaligned,
        3 mbx                       bit (35) unaligned,
      2 key_binding_info_ptr        ptr,
      2 entire_state_ptr            ptr;
```

STRUCTURE ELEMENTS

version
is get_editor_key_binding_info_version_1. (Input)

entire_state
is "1"b if the entire state is desired, "0"b if only information about certain keybindings is desired. (Input)

key_binding_info_ptr
if entire_state = "0"b, then this points to a line_editor_key_binding_structure. (Input) The bindings component of this structure is then filled in based upon the value of each key_sequence supplied.

entire_state_ptr
is set to point to the "state" of the key bindings, if entire_state = "1"b. (Output) This is suitable input to the set_editor_key_bindings control order.

NOTES

The get_editor_key_bindings control order is available from command level and as an active function with following io_call command:

```
io_call control window_switch get_editor_key_bindings
```

The get_editor_key_bindings control order prints or returns information about a key binding. When you use it as an active function the information is returned in a form suitable as arguments to the set_editor_key_bindings control order.

set_editor_key_bindings
A line editor routine is bound to a sequence of keystrokes via the set_editor_key bindings control order. The sequence of characters that triggers an editor request may be of any length, with multiple-key sequences working like the Emacs prefix characters. This allows the use of terminal function keys (which often send three or more character sequences) to invoke line editor requests. More than one binding can be set in one invocation of this control order.

The info_ptr points to the following structure (declared in window_control_info.incl.pl1):

```
dcl 1 set_editor_key_bindings_info aligned based
                                  (set_editor_key_bindings_info_ptr),
    2 version                      char (8),
    2 flags,
      3 replace                    bit (1) unaligned,
      3 update                     bit (1) unaligned,
      3 pad                        bit (34) unaligned.
    2 key_binding_info_ptr;
```

STRUCTURE ELEMENTS

version
is the version of the structure. (Input) It must be set_editor_key_bindings_info_version_1.

replace
if "1"b then key_binding_info is considered to be returned by a previous get_editor_key_bindings operation with entire_state = "1"b and will be used to replace the keybinding state of the editor. (Input)

update
if "1"b then key_binding_info_ptr is considered a pointer to a line_editor_key_binding_info structure, which will be used to update the keybinding state of the editor. (Input)

Note: only one of replace and update may be true, but at least one of them must be true.

key_binding_info_ptr
is a pointer received from get_editor_key bindings operation or a pointer to a line_editor_key_binding_info structure, depending on the value of the replace and update flags. (Input)

Notes on freeing: The video system's internal data structures are freed at the following times: video system revocation and when a set_editor_key_bindings control order with replace = "1"b is done.

NOTES

The set_editor_key_bindings control order is available from command level and as an active function with the following io_call command:

```
io_call control window_switch set_editor_key_bindings key_sequence1
  {user_routine1} {control_args1} ... key_sequenceN
    {user_routineN} {control_args1} {control_argsN}
```

where user_routine is the name of a user-written editor request.

control args are:

```
-external user_routine
-builtin builtin_request_name
-numarg_action numarg_action_name
```

The line_editor_key_bindings_info structure is described in Section 7.

At least one user_routine or one of -external/-builtin must be specified for each key sequence, with the rightmost editor request specifier taking precedence (for example, io control window_switch set_editor_key_binings foo -builtin FORWARD_word,) will bind control -a to the forward word builtin, not the user routine foo.

numarg_action_name
the type of automatic numeric argument to be taken when the editor routine is invoked, must be one of the following and can only be given for external editor routines

REPEAT
(the default is PASS). This can be entered in upper or lower case. Call the user routine n times, where n is the numeric argument supplied by the user.

REJECT
ring the terminal bell and don't call the user routine if a numeric argument is given.

PASS
pass any numeric argument to the user routine, without any other action.

IGNORE
same as PASS but implies the user routine will not make use of the numeric argument.

-name STR
specifies the name of the editor command being assigned to the key. If this is the null string, then a default name is used (for builtins this is the name of the builtin, otherwise it is segname$entrypoint). STR must be quoted if it contains whitespace.

-description STR
specifies a description string to be associated with the key binding. If this is the null string, a default description is used. The defaults can be found in the include file window_editor_values.incl.pl1. STR must be quoted if it contains whitespace.

-info_pathname PATH
specifies an info segment pathname to be associated with this key binding. This info segment is expected to have more information about the editor_routine. If this is not specified, it defaults to >doc>info>video_editing.gi.info if -builtin, otherwise no info segment is associated with the key. The info suffix is assumed on PATH.

MODES OPERATION

The modes operation is supported by window_io_. The recognized modes are listed below. Some modes have a complement indicated by the circumflex character (^) that turns the mode off (e.g. ^more). For these modes, the complement is displayed with that mode. Some modes specify a parameter that can take on a value (e.g. more_mode). These modes are specified as MODE=VALUE, where MODE is the name of the mode and VALUE is the value it is to be set to. Parameterized modes are indicated by the notation (P) in the following description:

more, ^more
Turns MORE processing on. Default is on. If ^pl is set before you invoke the video system, ^more will be set when you invoke the video system.

more_mode = STR
controls behavior when the window is filled. The value for STR may be one of the following:

clear
the window is cleared, and output starts at the home position.

fold
output begins at the first line and moves down the screen a line at a time replacing existing text with new text. Prompts for a MORE response when it is about to overwrite the first line written since the last read or MORE break.

scroll
lines are scrolled off the top of the window, and new lines are printed in the space that is cleared at the bottom of the screen. This is the default for full width windows on all terminals capable of scrolling.

wrap
output begins at the first line and moves down the screen a line at a time replacing existing text with new text. Prompts for a MORE response at the bottom of every window of output. This is the default for all terminals that are incapable of scrolling or when using partial width windows.

vertsp, ^vertsp
is only effective when more mode is on. When vertsp mode is on, output of a FF or VT will cause an immediate MORE query. When you invoke the video system, it copies the current setting of this mode before attaching the window_io_ module. The default is ^vertsp.

rawo, ^rawo
causes characters to be output with no processing whatsoever. The result of output in this mode is undefined.

can, ^can
causes input lines to be canonicalized before they are returned. When you invoke the video system, it copies the current setting of this mode before attaching the window_io_ module. The default is on.

ctl_char, ^ctl_char
specifies that ASCII control characters that do not cause newline or linefeed motion are to be accepted as input except for the NUL character. If the mode is off all such characters are discarded. When you invoke the video system, it copies the current setting of this mode before attaching the window_io_ module. The default is off.

edited, ^edited
suppresses printing of characters for which there is no defined Multics equivalent on the device referenced. If edited mode is off, the 9-bit octal representation of the character is printed. When you invoke the video system, it copies the current setting of this mode before attaching the window_io_ module. The default is off.

erkl, ^erkl
controls the editing functions of get_line. When you invoke the video system, it copies the current setting of this mode before attaching the window_io_ module. The default is on, which allows erase and kill processing and the additional line editor functions.

esc, ^esc
controls input escape processing. When you invoke the video system, it copies the current setting of this mode before attaching the window_io_ module. The default is on.

rawi, ^rawi
acts as a master control for can, erkl, and esc. If this mode is on, none of the input conventions are provided. The default is on.

ll = STR
is the width of the window, in characters, and it can only be changed with the set_window_info control operation.

pl = STR
is the height of the window (i.e., number of lines), and it can only be changed with the set_window_info control operation.

red, ^red
controls interpretation of red shift and black shift characters on output. When you invoke the video system, it copies the current setting of this mode before attaching the window_io_ module. The default is ^red, which ignores them. In red mode, the character sequence given in the TTF is output. The effect is undefined and terminal-specific. In some cases, "red shifted" output appears in inverse video, but this is not guaranteed.

CONTROL OPERATIONS FROM COMMAND LEVEL

Those control operations which require no info_ptr and those additional orders described above may be performed from command level using the io_call command, as follows:

```
io_call control switch_name control_order
```

ARGUMENTS

switch_name
is the name of the I/O switch.

control_order
can be any control order described above under "Control Operation" that can accept a null info_ptr.

SECTION 8

FORTRAN INTERFACE

This section contains descriptions of the FORTRAN subroutine interface to the menu and video software. Two sample FORTRAN programs are provided that illustrate menu creation using automatic window management, and the FORTRAN video interface capabilities.

In the FORTRAN environment, window management can be performed automatically. By using arguments to the FORTRAN window management functions ft_menu_$init1, ft_menu_$init2, and ft_menu_$terminate, applications that do not require sophisticated window management can employ automatic window management. When using automatic window management, your application works in two-window mode: the window in which the menu is displayed and the user i/o window.

If your application requires greater window management capabilities, the menu interface capability lets you build menu applications using the ft_window_$create, ft_window_$destroy, ft_window_$clear, and ft_window_$change capabilities.

Of course, FORTRAN applications, can still use command or PL/1 video management capabilities.

Note that it is not possible to call the ft_menu_ routines with both ANSI77 and ANSI66 character strings. Currently, only ANSI77 character strings are allowed.

Name: ft_menu_

The ft_menu_ subroutine allows a FORTRAN program to use the Multics menu facility (menu_). Through ft_menu_ a FORTRAN program may create a menu object, display the menu, and get a user-entered selection from a menu. Once a menu object has been created, the FORTRAN program can use this menu object by referencing it via a menu-id returned to the caller when the menu object was created or when a stored menu object was retrieved.

The functionality available is provided through the various entry points defined below. Also refer to the FORTRAN include file at the end of this section.

Entry: ft_menu_$create

Utilized to create a menu object. It returns a menu identifier (menu_id) which is subsequently used to reference the menu object.

USAGE

```
declarations:

      character*n1  choices(m1)
      character*n2  headers(m2)
      character*n3  trailers(m3)
      character*1   keys(m4)
      character*1   pad_char
      integer       menu_format(6)
      integer       menu_needs(3)
      integer       menu_id
      integer       code

      call ft_menu_$create (choices, headers, trailers, pad_char, menu_format,
           key, menu_needs, menu_id, code)
```

STRUCTURE ELEMENTS

choices
: is an array of character variables which are the text of the options that the user wishes to display in the menu. (Input) n1 is the length, in characters, of the longest character string comprising the text of an option. m1 is the extent of the array, i.e., the number of options in the menu being described. This array must be at least of extent 1.

headers
is an array of character variables to be displayed at the top of the menu. (Input) n2 is the length, in characters, of the longest header specified. m2 is the extent of the array, i.e., the number of headers (lines) desired. At least one header must be specified (if the first variable is set to blanks, no headers will be used).

trailers
is an array of trailers (displayed immediately below the menu). (Input) n3, m3, are analogous to n2, m2 respectively.

menu_format
is an array, which specifies the format of the menu being created. (Input) Prior to calling this entry point, the FORTRAN programmer is responsible for setting the following variables:

```
menu_format(menu_version) = version number of menu_
        (currently, only version 1 is defined).
menu_format(max_width) = maximum width of the window
         on which the menu will be displayed.
menu_format(max_heigth) = maximum height of window
          on which menu is to be displayed.
menu_format(no_of_columns) = number of columns to be used
          by the menu manager to display the options.
menu_format(center_headers) = 0 or 1;  0 = no, 1 = yes.
menu_format(center_trailers) = 0 or 1;  0 = no, 1 = yes.
```

pad_char
is the character that the menu facility will display at the right and left of a centered header or trailer to fill out the line. (Input)

keys
is an array (maximum value of m4 is 61) that identifies the keystroke to be associated with each choice. (Input) This array must be at least as long as the number of choices in the menu. Each element in the array must be unique.

menu_needs
an array that contains menu related information on successful execution of call. (Output)

```
Returned information:

menu_needs(lines_needed)   the number of lines required
                           to display the menu.
menu_needs(width_needed)   the number of columns required
                           to display the menu.
menu_needs(no_of_options)  the number of options defined
                           in the menu.
```

menu_id
the menu identifier (i.e., the menu object "identifier"). (Output) It must not be altered in any way by the application program.

code
return code. (Output) (See Appendix B.)

Entry: ft_menu_$delete

Deletes a menu object from a given value segment. (See ft_menu_$store.)

USAGE

```
declarations:

      character*168  dir_name
      character*32   entry_name
      character*32   menu_name
      integer        code


      call ft_menu_$delete (dir_name, entry_name, menu_name, code)
```

STRUCTURE ELEMENTS

dir_name
pathname of the directory containing the menu object. (Input)

entry_name
entry name of value segment containing the menu object. (Input) The suffix "value" need not be specified.

menu_name
name used to identify the menu object when the menu object was stored. (Input)

code
return code. (Output) (See Appendix B.)

Entry: ft_menu_$describe

Returns information about a menu object. It returns the number of options in the menu, the number of lines and number of columns required to display the menu. It is primarily used to determine if the menu can be displayed in a given window.

USAGE

```
declarations:

      integer  menu_id
      integer  menu_needs(3)
      integer  code

      call ft_menu_$describe (menu_id, menu_needs, code)
```

STRUCTURE ELEMENTS

menu_id
the menu identifier returned by ft_menu_$create or ft_menu_$retrieve. (Input)

menu_needs
an array into which menu related information is returned. (Output)

```
Returned information:
menu_needs(lines_needed)        the number of lines required
                                to display the menu.

menu_needs(width_needed)        the number of columns needed
                                to display the menu.

menu_needs(no_of_options)       the number of options defined
                                in the menu.
```

code
return code. (Output) (See Appendix B.)

Entry: ft_menu_$destroy

Invoked to delete a menu object from storage. (Not to be confused with ft_menu_$delete, which deletes the menu object from a value segment.) Deleting the menu object has no effect on the screen contents.

USAGE

```
declarations:

      integer  menu_id
      integer  code

      call ft_menu_$destroy (menu_id, code);
```

STRUCTURE ELEMENTS

menu_id
menu identifier returned by ft_menu_$create or ft_menu_$retrieve. (Input/Output) Set to an invalid value on return to prevent the old menu_id from being accidentally used.

code
return code. (Output) (See Appendix B.)

Entry: ft_menu_$display

Invoked to display a menu in a given window.

USAGE

```
declarations:

      integer  window_id
      integer  menu_id
      integer  code

      call ft_menu_$display (window_id, menu_id, code)
```

STRUCTURE ELEMENTS

window_id
a window identifier returned by ft_window_$create. (Input) If usage_mode = 0 this argument will be ignored (see ft_menu_$init2).

menu_id
menu identifier returned when the menu object was created or retrieved. (Input)

code
return code. (Output) (See Appendix B.)

Entry: ft_menu_$get_choice

Returns the choice made by the user, i.e., an integer representing either the menu item chosen or the function key (or its equivalent escape sequence) entered.

USAGE

declarations:

```
character*n1  function_key_info
integer       window_id
integer       menu_id
integer       fkeys
integer       selection
integer       code

call ft_menu_$get_choice (window_id, menu_id, function_key_info, fkeys,
     selection, code)
```

STRUCTURE ELEMENTS

window_id
a window identifier returned by ft_window_$create. (Input) If usage_mode = 0 this argument will be ignored. (see ft_menu_$init2)

menu_id
menu identifier returned by ft_menu_$create or ft_menu_$retrieve. (Input)

function_key_info
a character variable (n1 as required) used to specify the role of function keys (if they exist for the terminal being used) or an equivalent set of escape sequences if the terminal does not have function keys or not the function keys required by the application. (Input) The objective is to let the application use the terminal's function keys if possible, else specify key sequences to be used to simulate function keys. Each character in the string corresponds to one function key. If the character is a space, then it is not relevant if the corresponding function key exists or not. If the character is not a space, that character will be used to simulate a function key if the terminal does not have function keys. If the terminal does not have a function key for every non-space character in the string, then function keys will be simulated. Thus, the string " ?p q" means that the caller does not care whether the terminal has function key 0 or 3, but the caller does wish to use function keys 1,2, and 4. If any of these 3 function keys is not present on the terminal, then esc-? will substitute for F1, esc-p will substitute for F2, and esc-q will substitute for F4.

fkeys
if fkeys = 1 user entered a function key or escape sequence if fkeys = 0 user selected an option (Output)

selection
is an integer representing the choice made by the user. (Output) If the user has chosen an option, it is a number between 1 and the highest defined option. If the user has entered a function key, or escape sequence simulating a function key, it is the number associated with the function key.

code
return code. (Output) (See Appendix B.)

Entries: ft__menu__$init1, ft__menu__$init2

These must be the first calls made to the menu manager. They set up the necessary environment for the menu application and return information concerning the user i/o window.

USAGE

```
declarations:
      integer   code
      integer   usage_mode

      call ft_menu_$init1 ()

      call ft_menu_$init2 (usage_mode,user_window_lines,user_window_columns,
           user_window_id,code)
```

STRUCTURE ELEMENTS

usage_mode
usage_mode = 0 means that the caller does not wish to do any window management at all. (Input) When he/she wishes to display a menu, the window required will be automatically created. This means that the application will operate in a two window mode, the window containing the menu, and the user_io window. Both windows will be managed automatically for the user. If the user specifies this mode, all calls to the ft_window_ subroutine will be ignored and will return an appropriate error code. See Error Code Handling (Appendix B), below. All calls to the ft_menu_ subroutine that require a window identifier will ignore the user provided window_id.

usage_mode = 1 means that the user wishes to define the number and characteristics of the windows to be used in the application. Thus, calls to ft_window_ will be supported and, for the entry points of ft_menu_ that require a window identifier, the caller must use a legal window_id (returned by ft_window_$create).

user_window_lines
the number of lines (rows) in the user i/o window at the time the user invokes ft_menu_$init (which must be the first call to the menu manager in the application). (Output) Undefined if usage_mode = 0.

user_window_columns
the number of columns of the user i/o window when ft_menu_$init invoked. (Output) Undefined if usage_mode = 0.

user_window_id
window identifier of the user i/o window. (Output) Undefined if usage_mode = 0.

code
return code (See Appendix B.) (Output)

Entry: ft_menu_$list

Used to list the menu object(s) stored in value segment. The names selected are those that match a user provided string.

USAGE

```
declarations:
      character*168  dir_name
      character*32   names_array(m1)
      character*32   entry_name
      character*32   match_string
      integer        no_of_matches
      integer        code

      call ft_menu_$list (dir_name, entry_name, match_string, no_of_matches,
           names_array, code)
```

STRUCTURE ELEMENTS

dir_name
pathname of directory containing the menu object. (Input)

entry_name
entry name of value segment containing the menu object. (Input) The suffix "value" need not be specified.

match_string
a character variable that is to be used as the selection criteria to determine what menu object, if any, is contained in the specified value segment that match (or contain) this string. (Input) If set to space(s), all names returned.

no_of_matches
the number of matches found. (Output) If none, then is is 0.

names_array
an array, of extent m1. (Output) The user should insure that m1 is sufficiently large to contain all matches that may be found. Contains the names of all menu objects, in the specified value segment, that match the character string match_string.

code
return code. (Output) (See Appendix B.)

Entry: ft_menu_$retrieve

Used to retrieve a menu object previously stored via the ft_menu_$store. Once retrieved, the user can reference the menu object via the menu identifier (menu_id).

USAGE

```
declarations:
      character*168  dir_name
      character*32   entry_name
      character*32   menu_name
      integer        menu_id
      integer        code

      call ft_menu_$retrieve (dir_name, entry_name, menu_name, menu_id, code)
```

STRUCTURE ELEMENTS

dir_name
    pathname of the directory containing the menu object. (Input)

entry_name
    entry name of value segment containing menu object. (Input) The suffix "value" need not be specified.

menu_name
    name of the menu object used when the object was stored. (Input)

menu_id
    is the menu id returned by the call. (Output) It is used as the menu object identifier.

code
    return code. (Output) (See Appendix B.)

Entry: ft_menu_$store

Used to store a menu object in a specified value segment.

USAGE

```
declarations:

      character*168  dir_name
      character*32   entry_name
      character*32   menu_name
      integer        create_seg
      integer        menu_id
      integer        code
```

```
call ft_menu_$store (dir_name,entry_name, menu_name, create_seg,
      menu_id, code)
```

STRUCTURE ELEMENTS

dir_name
pathname of directory into which the menu object is to be placed. (Input)

entry_name
entry name of value segment into which the menu object is to be placed. (Input) The suffix "value" need not be specified.

menu_name
it is the name to be assigned to the stored menu object. (Input)

create_seg
create_seg = 0 means do not store if value segment identified by entry_name does not already exist. (Input)

create_seg = 1 means create value segment, if it does not already exist, and store menu object in it.

menu_id
it is the menu object identifier returned when ft_menu_$create or ft_menu_$retrieve was called. (Input)

code
return code. (Output) (See Appendix B.)

Entry: ft_menu_$terminate

Must be the last call to the menu manager in the menu application. It will remove the special environment created by ft_menu_$init1 and ft_menu_$init2.

USAGE

```
declarations: none

      call ft_menu_$terminate ()
```

FORTRAN INCLUDE FILE

This include file contains the following declarations:

```
      external ft_menu_$create (descriptors)
      external ft_menu_$delete (descriptors)
      external ft_menu_$describe (descriptors)
      external ft_menu_$destroy (descriptors)
      external ft_menu_$display (descriptors)
      external ft_menu_$get_choice (descriptors)
      external ft_menu_$init1 (descriptors)
      external ft_menu_$init2 (descriptors)
      external ft_menu_$list (descriptors)
      external ft_menu_$retrieve (descriptors)
      external ft_menu_$store (descriptors)
      external ft_window_$change (descriptors)
      external ft_window_$create (descriptors)
      external ft_window_$destroy (descriptors)

      integer  menu_version
      integer  max_width
      integer  max_height
      integer  no_of_columns
      integer  lines_needed
      integer  width_needed
      integer  no_of_options
      integer  center_headers
      integer  center_trailers
      integer  user_window_id
      integer  user_window_lines
      integer  user_window_columns

      parameter (menu_version = 1)
      parameter (max_width = 2)
      parameter (max_height = 3)
      parameter (no_of_columns = 4)
      parameter (center_headers = 5)
      parameter (center_trailers = 6)
      parameter (lines_needed = 1)
      parameter (width_needed = 2)
      parameter (no_of_options = 3)
```

Name: ft_window_

This is the basic video interface subroutine to be used by FORTRAN to create/destroy/change windows. (This subroutine should not be called if usage_mode = 0 (see ft_menu_$init2)).

Its facilities are available through the following entry points.

Entry: ft_window_$change

This entry point is used to change the size of an existing window. The size of a window can always be "shrunk", however it can be increased only it does not overlap with another defined window. (This entry point should not be called if usage_mode = 0 (see ft_menu_$init2).)

USAGE

```
declarations:
      integer  window_id
      integer  first_line
      integer  height
      integer  code

      call ft_window_$change (window_id, first_line, heigth, code)
```

STRUCTURE ELEMENTS

window_id
    window identifier returned by ft_window_$create (or by ft_menu_$init in the case of the user i/o window). (Input)

first_line
    new first line number for the window being changed. (Input) Positive integer.

height
    new height for the window being changed. (Input) Positive integer.

code
    return code. (Output) (See Appendix B.)

Entry: ft_window_$clear_window

Used to clear a specified window.

USAGE

```
declarations:
      integer        window_id
      integer        code

      call ft_window_$clear_window (window_id, code)
```

STRUCTURE ELEMENTS

window_id
    The window identifier (returned by ft_window_$create) of the window to be cleared. (Input)

code
    return code. (Output) (See Appendix B.)

Entry: ft_window_$create

Used to create a new window on the terminal screen. (This entry point should not be called if usage_mode = 0.) (see ft_menu_$init2)

USAGE

```
declarations:

      character*32  switch_name
      integer       window_id
      integer       first_line
      integer       height
      integer       code

      call ft_window_$create (first_line, height, switch_name, window_id,
           code)
```

STRUCTURE ELEMENTS

first_line
    is the line number where the window is to start. (Input)

height
    the number of lines used by the window, i.e., its height. (Input)

switch_name
the name that the caller wishes to associate with the switch. (Input) (The caller may use the switch name, for example, in the FORTRAN "open" statement.)

window_id
the returned id of the window just created. (Output) It must not be altered in any way by the application program.

code
return code. (Output) (See Appendix B.)

Entry: ft_window_$destroy

Used to destroy a previously created window. (This entry point should not be called if usage_mode = 0 (see ft_menu_$init2).)

USAGE

```
declarations:
      integer  window_id
      integer  code

      call ft_window_$destroy (window_id, code)
```

STRUCTURE ELEMENTS

window_id
window identifier (returned by the ft_window_$create). (Input/Output) It is reset to an illegal value by this call.

code
return code. (Output) (See Appendix B.)

FORTRAN MENU APPLICATION EXAMPLES

In the following two FORTRAN examples, a "Message" menu application is created that allows you to display, print, discard, or forward messages. Example 1 is a simple FORTRAN program that interfaces with the Multics menu manager via the ft_menu_ routine. Note in Example 1 that window management functions are called automatically through arguments in the ft_menu_$init2 subroutine.

Example 2 is a FORTRAN program that interfaces with the Multics menu manager through ft_menu_routine; in example 2, however, window management functions are performed by the ft_window_ routine.

ft_window_

EXAMPLE 1:

In this example, all window management is done automatically.

```
subroutine testcase1 ()

    %include ft_menu_dcls

    external ft_menu_$init1 (descriptors)
    external ft_menu_$init2 (descriptors)
    character*15   choices(6)
    character*12   headers(1)
    character*27   trailers(1)
    character*1    keys(6)
    character*168  dir_name
    character*32   entry_name
    character*32   menu_name
    character*12   function_key_info
    character*32   switch_name
    character*9    ME
    integer        create_seg
    integer        no_of_matches
    integer        window_id
    integer        fkeys
    integer        selection
    integer        usage_mode
    integer        menu_format(6)
    integer        menu_needs(3)
    integer        menu_id
    integer        code
    integer        zero

    external com_err_(descriptors)

    integer        too_few_keys
    integer        bad_arg
    integer        keys_not_unique

    ME = "testcase1"
    zero = 0

    choices(1) = "Display Message"
    choices(2) = "Print Message"
    choices(3) = "Discard Message"
    choices(4) = "Forward Message"
    choices(5) = "Reply Message"
    choices(6) = "List Messages"
    headers(1) = "READ MAIL"
    trailers(1) = "Press F1 (or esc-q) to quit"
    keys(1) = "1"
    keys(2) = "2"
```

```
    keys(3) = "3"
    keys(4) = "4"
    keys(5) = "5"
    keys(6) = "6"
    pad_char = "-"
    menu_format(menu_version) = 1
    menu_format(max_width) = 79
    menu_format(max_height) = 10
    menu_format(no_of_columns) = 2
    menu_format(center_headers) = 1
    menu_format(center_trailers) = 1


    code = 0
    usage_mode = 0  !  Window management will be done automatically
                    !  by the system, i.e., usage_mode is set to 0.
                    !  by the system, i.e., usage_mode is set to 0.
    call ft_menu_$init1 ()
    call ft_menu_$init2 (usage_mode,user_window_lines,user_window_columns,
                         user_window_id,code)
                     !  Calling ft_menu_$init MUST
                     !  be the first call to ft_menu_ in the program.

    if (code .eq. zero) go to 5
    call com_err_ (code, ME, " (calling ft_menu_$init2)")
    print, "Unable to set up the appropriate environment for the application."
    go to 999

c   The following calls to cv_error_$name are used retrieve and store
c   the error codes associated with certain errors of interest returned
c   by calls to the menu manager or the system.

5     call cv_error_$name ("error_table_$bad_arg", bad_arg, code)
    if (code .eq. zero) go to 10
    call com_err_ (code, ME, "error_table_$bad_arg")
    go to 999
10    call cv_error_$name ("menu_et_$too_few_keys",too_few_keys,code)
    if (code .eq. zero) go to 20
    call com_err_ (code, ME, "menu_et_$too_few_keys")
    go to 999
20    call cv_error_$name ("menu_et_$keys_not_unique", keys_not_unique, code)
    if (code .eq. zero) go to 40
    call  com_err_ (code, ME, "menu_et_$keys_not_unique")
    go to 999

40    call ft_menu_$create (choices,headers,trailers,pad_char,menu_format,
&                           keys,menu_needs,menu_id,code)

c  This call creates the menu object and returns the menu object identifier,
c  "menu_id".
```

ft_window_

```
    if (code .eq. zero) go to 45
    call com_err_ (code, ME, " (calling ft_menu_$create)")
    print, "The menu could not be created."
    go to 999

c   The created menu is now stored for future use.

45    dir_name = ">udd>m>ri"              ! pathname of directory
    entry_name = "menus_seg"            ! entry name of "value" segment
    menu_name = "ft_read_mail_menu"     ! name of menu
    create_seg = 1          ! create "value" seg if it does not already exist.

    call ft_menu_$store (dir_name, entry_name, menu_name,
                         create_seg, menu_id, code)
    if (code .eq. zero) go to 50

    call com_err_ (code, ME, " (calling ft_menu_$store)")
    print, "The menu could not be stored."
    go to 999
50    window_id = 0
    call ft_menu_$display(window_id,menu_id,code)  !  This call displays
          ! the menu in its own window at top of screen. Since the usage_mode
          ! was set to 0, the program does not have to create the window
          ! before calling ft_menu_$display. The window_id argument is ignored.

    if (code .eq. zero) go to 60
    call com_err_ (code, ME, " (calling ft_menu_$display)")
    print, "The menu could not be displayed."
    go to 999

60    function_key_info = "q"  ! Defines the function key requirements, i.e,
          !   if the terminal has function key 1 (F1) then F1 will be used
        !   to "quit", otherwise "esc_q" will be used to "quit".

61    call ft_menu_$get_choice(window_id,menu_id,function_key_info,fkeys,
&                              selection,code)

c   This call accepts the user input from the menu. On return, the variable
c   "selection" will contain a number (1, 2, 3 , or 4) representing the option
c   chosen by user.
c   Note: if the user entered anything other than 1 or 2 or 3 or 4
c   the terminal "beeped", and the user input was ignored.
c   Since usage_mode is 0, the window_id argument is ignored.

    if (code .eq. zero) go to 90
    if (code .ne. too_few_keys)  go to 70
    call com_err_ (0, ME, "Number of keys less than number of options.")
    go to 999
70    if (code .ne. keys_not_unique) go to 80
    call com_err_ (0, ME, "Option keys not unique.")
    go to 999
```

```
80     call com_err_ (code, ME, " (calling ft_menu_$get_choice).
                  An internal programming error has occurred.")
     go to 999
90     if (fkeys .eq. zero) go to 110
     if (fkeys .eq. 1) go to 100
     print, "An internal program error has occurred. Quitting."
     go to 999
100    if (selection .ne. 1) go to 61
     print, "You entered ""F1"" or ""esc q"". Quitting."
     go to 999
110    print 103,selection
103    format ("You selected option "i1)
     go to 50

999  call ft_menu_$terminate()
    return
    end
```

EXAMPLE 2:

In this example, FORTRAN interfaces with the Multics menu manager and the Multics window manager via the ft_menu_ and ft_window_ subroutines.

```
subroutine testcase2 ()

    %include ft_menu_dcls

    external ft_menu_$init1(descriptors)
    external ft_menu_$init2(descriptors)
    external ft_window_$clear_window (descriptors)
    character*9    choices_one(2)
    character*21   choices_three(4)
    character*21   headers(1)
    character*49   trailers(1)
    character*1    keys(6)
    character*168  dir_name
    character*32   entry_name
    character*32   menu_name
    character*12   function_key_info
    character*32   match_string
    character*32   names_array(10)
    character*32   switch_name
    character*9    ME
    integer        create_seg
    integer        no_of_matches
    integer        window_id1
    integer        window_id2
    integer        fkeys
    integer        selection
    integer        usage_mode
```

```
      integer         menu_format(6)
      integer         menu_needs_one(3)
      integer         menu_needs_two(3)
      integer         menu_needs_three(3)
      integer         curr_window_id
      integer         menu_id1
      integer         menu_id2
      integer         menu_id3
      integer         code
      integer         zero

      external com_err_(descriptors)

      integer         bad_window_id
      integer         nonexistent_window
      integer         insuff_room_for_window

      ME = "testcase2"
      zero = 0

      choices_one(1) = "Read Mail"
      choices_one(2) = "Send Mail"
      choices_three(1) = "Send New Messsage"
      choices_three(2) = "Send Deferred Message"
      choices_three(3) = "Print Sent Message"
      choices_three(4) = "Save Sent Message"
      trailers(1)= "F1 (or esc-q) = quit ; F2 (or esc-f) = first menu"
      keys(1) = "1"
      keys(2) = "2"
      keys(3) = "3"
      keys(4) = "4"
      keys(5) = "5"
      keys(6) = "6"
      pad_char = "-"
      menu_format(menu_version) = 1
      menu_format(max_width) = 79
      menu_format(max_height) = 8
      menu_format(no_of_columns) = 2
      menu_format(center_headers) = 1
      menu_format(center_trailers) = 1

      code = 0
      call ft_menu_$init1 ()
      usage_mode = 1     Window management will be done by user
      call ft_menu_$init2 (usage_mode,user_window_lines,user_window_columns,
     &   user_window_id,code)     Calling ft_menu_$init MUST be the
                                first call to ft_menu_ in the program.
```

```
    if (code .eq. 0) go to 5
    call com_err_ (code, ME, " (calling ft_menu_$init)")
    print, "Unable to set up the appropriate environment for the
&           application."
    go to 999

c       The following calls to cv_error_$name are used retrieve and store
c   the error codes associated with certain errors of interest returned
c   by calls to the menu manager or the system.

5     call cv_error_$name ("video_et_$bad_window_id", bad_window_id, code)
    if (code .eq. zero) go to 10
    call com_err_ (code, ME, "video_et_$bad_window_id")
    go to 999
10    call cv_error_$name ("video_et_$nonexistent_window",
                           nonexistent_window,code)
    if (code .eq. zero) go to 20
    call com_err_ (code, ME, "video_et_$nonexistent_window")
    go to 999
20    call cv_error_$name ("video_et_$insuff_room_for_window",
&                            insuff_room_for_window, code)
    if (code .eq. zero) go to 40
    call  com_err_ (code, ME, "video_et_$insuff_room_for_window")
    go to 999

c   Create first menu

40    headers(1) = "MULTICS MAIL"
    call ft_menu_$create (choices_one,headers,trailers,pad_char,menu_format,
&                         keys,menu_needs_one,menu_id1,code)

c  This call creates the menu object and returns the menu object identifier.
c  This menu is referenced by menu_id1.

    if (code .eq. 0) go to 41
    call com_err_ (code, ME, " (calling ft_menu_$create)")
    print, "The first menu could not be created."
    go to 999

c  For the second menu use a menu object which was stored in a "value" seg.
c  First determine if menu object exists.

41    dir_name = ">udd>m>ri"
    entry_name = "menus_seg"
    match_string = "ft_read_mail_menu"
    call ft_menu_$list (dir_name,entry_name,match_string,no_of_matches,
&                       names_array,code)
    if (code .eq. zero) go to 42
    call com_err_ (code, ME, " (calling ft_menu_$list)")
    go to 999
42    if (no_of_matches .eq. zero) then
```

```
    print, "Stored menu not found."
    go to 999
    else
    if (no_of_matches .eq. 1) go to 43
    print, "Internal error. Quitting."
    go to 999
    end if

c   Retrieve stored menu.

43    menu_name = "ft_read_mail_menu"
    call ft_menu_$retrieve (dir_name,entry_name,menu_name,menu_id2,code)
    if (code .eq. zero) go to 44
    call com_err_ (code, ME, " (calling ft_menu_$retrieve)")
    go to 999

c   Get attributes of retrieved menu.

44    call ft_menu_$describe (menu_id2,menu_needs_two,code)
    if (code .eq. zero) go to 45
    call com_err_ (code, ME, " (calling ft_menu_$describe)")
    go to 999

c   Create third menu

45    headers(1) = "SEND MAIL"
    call ft_menu_$create (choices_three,headers,trailers,pad_char,
&                         menu_format,keys,menu_needs_three,menu_id3,code)

    if (code .eq. 0) go to 50
    call com_err_ (code, ME, " (calling ft_menu_$create)")
    print, "The third menu could not be created."
    go to 999

50    curr_window_id = -1     "-1" indicates that there is no current menu
                              being displayed; otherwise, curr_window_id
                              contains the menu window id

52    call change_menu (user_window_id,curr_window_id,menu_id1,menu_needs_one,
&                       user_window_lines,window_id1,code)
    if (code) 51,53,51
51    call com_err_ (code,"change_menu","Internal error while changing menus.")
    go to 999
53    call ft_window_$clear_window (user_window_id, code)

60    call get_choice (menu_id1,window_id1,fkeys,selection,code)

c   This call accepts the user input from the menu. On return, the variable
c   "selection" will contain a number (0, 1, 2) representing the option or
c   the function key (or its equivalent escape sequence) entered by the user.
c   If fkeys = 1 then the user entered F1 or F2 (or esc-q or esc-f):
```

```
c       if F1 (or esc-q) was entered, then selection = 0
c       if F2 (or esc-f) was entered, then selection = 1
c  If fkeys = 0 then the user selected option:
c       if first option was chosen, then selection = 1
c       if second option was chosen, then selection = 2
c  Note: if the user entered anything other than F1 or F2 or 1 or 2
c  the terminal "beeped", and the user input was ignored.

     if (code .eq. zero) go to 70
     call com_err_ (0, "get_choice", "Internal program error
                                     while getting user choice")
     go to 999
70     if (fkeys .eq. zero) go to 90    user selected an option
     if (fkeys .eq. 1) then
     go to 80    user entered function key
     else      Something is wrong
     print, "An internal program error has occurred. Quitting."
     go to 999
     end if
80     go to (81,82), selection
     call com_err_ (code, ME, "An internal program has occurred. Quitting.")
     go to 999
81     print, "Exiting"      (user has entered F1 or esc-q. Wants to exit)
     go to 999
82     print, "You already are in the first menu."    User want to go to
                                                      first menu
     go to 60
90     go to (100,170), selection   Display either "Read Mail" or "Send Mail"
                                    menu
     call com_err_ (code, ME, "Internal program error. Quitting.")
     go to 999
100    call change_menu (user_window_id,window_id1,menu_id2,menu_needs_two,
&                        user_window_lines, window_id2, code)
     if (code .eq. zero) go to 110
     call com_err_ (code, "change_menu", "Internal error occurred
                                          while switching menus")
     go to 999
110    call get_choice (menu_id2, window_id2, fkeys, selection, code)
     if (code .ne. zero) then
     call com_err_ (code, "get_choice", "Internal error
                                        while getting user choice").
     go to 999
     end if
     go to (160,150), fkeys + 1
     call com_err_ (code,ME, "Internal program error. Quitting.")
     go to 999
150    go to (151,152), selection     user entered function key
     go to 110
151    print, "Exiting at your request"
     go to 999
152    curr_window_id = window_id2
```

```
    go to 52
160   print 300, selection
300   format ("You selected option "i1)
    go to 110

c     User chose "Send Mail" option

170  call change_menu (user_window_id, window_id1,menu_id3,menu_needs_three,
&                      user_window_lines,window_id2,code)
    if (code) 171,180,171
171   call com_err_ (code, "change_menu", "Internal error
                          while changing menus")
    go to 999
180   call get_choice (menu_id3,window_id2,fkeys,selection,code)
    if (code) 181,190,181
181   call com_err_ (code, "get_choice", "Internal error
                          while getting user choice")
    go to 999
190   go to (210,200), fkeys + 1
    print, "Internal error. Quitting"
    go to 999
200   go to (201,202), selection
    go to 180
201   print, "Exiting at your request."
    go to 888
202   curr_window_id = window_id2
    go to 52
210   print 301, selection
301   format ("You selected option "i1)
    go to 180
c  Delete second menu from the value seg.

888   call ft_menu_$delete (dir_name,entry_name,menu_name,code)
    if (code .eq. zero) go to 999
    print, "Menu could not be deleted from value segment."
999   call ft_menu_$terminate()
    return
    end
```

```
subroutine get_choice (menu_id,window_id,fkeys,selection,code)

    external ft_menu_$get_choice (descriptors)

    character*2    function_key_info
    integer        fkeys
    integer        selection
    integer        menu_id
    integer        window_id
    integer        code

    code = 0

    function_key_info = "qf"    Defines the function key requirements, i.e,
          if the terminal has function keys 1 and 2 (F1 and F2) then F1
          will be used  to "quit" and F2 to switch to the first menu,
          otherwise "esc_q" will be used to "quit" and "esc-f" to switch
          to the first menu

    call ft_menu_$get_choice(window_id,menu_id,function_key_info,fkeys,
&                            selection,code)
    return
    end

subroutine change_menu (user_window_id,curr_window_id,menu_id,menu_needs,
                        user_window_lines,window_id,code)

    external ft_window_$change (descriptors)
    external ft_window_$create (descriptors)
    external ft_window_$destroy (descriptors)
    external ft_menu_$display (descriptors)
    external com_err_ (descriptors)

    character*32  switch_name

    integer  menu_needs(3)
    integer  user_window_id
    integer  user_window_columns
    integer  user_window_lines
    integer  curr_window_id
    integer  menu_id
    integer  window_id
    integer  code
    integer  first_line
    integer  height

    parameter (lines_needed = 1)
```

ft_window_

```
c  Destroy the current menu-window

     if (curr_window_id + 1) 90,100,90
90     call ft_window_$destroy (curr_window_id,code)
     if (code) 999,100,999

c  Change the size of the user i/o window to accomodate the new menu-window

100    first_line = 1 + menu_needs(lines_needed)
     height = user_window_lines - menu_needs(lines_needed)
     call ft_window_$change (user_window_id,first_line,height,code)
     if (code) 999,110,999

c    Create window for new menu

110    switch_name = "menu_window"
     call ft_window_$create (1,menu_needs(lines_needed),switch_name,window_id,
&                            code)
     if (code) 999,120,999

c    Display the menu in the menu-window

120    call ft_menu_$display (window_id,menu_id,code)

999    return
     end
```

SECTION 9

COBOL INTERFACE

This section contains descriptions of the COBOL interface to the menu and video software. Two sample COBOL programs are provided that illustrate menu creation using automatic window management, and the COBOL video interface capabilities.

In the COBOL environment, window management can be performed automatically. By using the COBOL window management functions cb_menu_$init1, cb_menu_$init2, and cb_menu_$terminate, applications that do not require sophisticated window management can employ automatic window management activity. When using automatic window management, your application works in two-window mode: the window in which the menu is displayed and the user_i/o window.

If your application requires greater window management capabilities, the menu interface capability lets you build viable menu applications using the cb_window_$create, cb_window_$destroy, and cb_window_$change capabilities.

Of course, COBOL applications can still use command or PL/1 video management capabilities.

Name: cb_menu_

The cb_menu_ subroutine allows a COBOL program to use the Multics menu facility (menu_). Through cb_menu_ a COBOL program may create a menu object, display the menu, and get a user-entered selection from a menu. Once a menu object has been created, the COBOL program can use this menu object by referencing it via a menu-id returned to the caller when the menu object was created or when a stored menu object was retrieved.

The functionality available is provided through the various entry points described below.

Entry: cb_menu_$create

Utilized to create a menu-object. Returns a menu-id which may be subsequently used by other entry points.

USAGE

declarations:

```
01  choices-table.
    02 choices      PIC X(n1) OCCURS (m1) TIMES.
01  headers-table.
    02 headers      PIC X(n2) OCCURS (m2) TIMES.
01  trailers-table.
    02 trailers     PIC X(n3) OCCURS (m3) TIMES.
01  keys-table.
    02 keys         PIC X(1)  OCCURS (m4) TIMES.

01  menu-format.
    02 menu_version USAGE IS COMP-6
    02 constraints USAGE IS COMP-6
       03  max-width.
       03  max-height.
    02  no-of-columns USAGE IS COMP-6.
    02  flags.
       03  center-headers  PIC 9(1).
       03  center-trailers PIC 9(1).
    02  pad-char  PIC X(1).

01  menu-needs  USAGE IS COMP-6.
    02  lines-needed.
    02  width-needed.
    02  no-of-options.

77  menu-id   USAGE IS COMP-6.
77  ret-code  USAGE IS COMP-6.
```

```
call "cb_menu_$create" USING choices-table, headers-table,
      trailers-table, menu-format, keys-table, menu-needs, menu-id,
      ret-code.
```

STRUCTURE ELEMENTS

choices-table
: is a table of elementary data items which are the text of the options that the user wishes to display in the menu. n1 is the length, in characters, of the longest character string comprising the text of an option. m1 is the extent of the table, i.e., the number of options in the menu being described. This table must be at least of extent 1.

headers-table
: is a table of elementary data items to be displayed at the top of the menu. (Input) n2 is the length, in characters, of the longest header specified. m2 is the extent of the table, i.e., the number of headers (lines) desired. At least one header must be specified (if the first header is set to space(s), no headers will be used).

trailers-table
: is an table of trailers (displayed immediately below the menu). (Input) n3, m3, are analogous to n2, m2 respectively.

menu-format
: is a group item defining the format of the menu being created. (Input)

cb_menu_

In the COBOL program the caller is responsible for setting the following elementary data items:

menu-version	the version number of the menu facility. (only version 1 is currently defined)
max-width	maximum width of the window on which the menu is to be displayed.
max-height	maximum height of window on which the menu is to be displayed.
no-of-columns	number of columns to be used to display the options.
center-headers	0 or 1; 0 = no, 1 = yes.
center-trailers	0 or 1 (same as center-headers)

keys-table
is a table (maximum value of m4 is 61) that identifies the keystroke to be associated with each choice. (Input) This table must be at least as long as the number of choices in the menu. Each element in the table must be unique.

menu-needs
a group item that contains menu related information on successful execution of call. (Output)

Returned information:

lines-needed	the number of lines required to display the menu.
width-needed	the number of columns needed to display the menu.
no-of-options	the number of options defined in the menu.

menu-id
the menu-object identifier (i.e., it is the menu object "pointer".) (Output) It must not be altered in any way by the application program.

ret-code
return code. (Output) (See Appendix B.)

Entry: cb_menu_$delete

Deletes a menu object from a given value segment.

USAGE

```
declarations:

      77   dir-name       PIC X(168).
      77   entry-name     PIC X(32).
      77   name-of-menu   PIC X(32).
      77   ret-code       USAGE IS COMP-6.


      call "cb_menu_$delete" USING dir-name, entry-name, name-of-menu,
            ret-code.
```

STRUCTURE ELEMENTS

dir-name
pathname of the directory containing the menu object. (Input)

entry-name
entry name of value segment containing the menu object. (Input) The suffix "value" need not be specified.

name-of-menu
name used to identify the menu object when the menu object was stored. (Input)

ret-code
return code. (Output) (See Appendix B.)

Entry: cb_menu_$describe

Returns information about a menu object. It returns the number of options in the menu, the number of lines and number of columns required to display the menu. It is primarily used to determine if the menu can be displayed in a given window.

USAGE

```
declarations:

      01  menu-needs  USAGE IS COMP-6.
          02  lines-needed.
          02  width-needed.
          02  no-of-options.

      77  menu-id     USAGE IS COMP-6.
      77  ret-code    USAGE IS COMP-6.

      call "cb_menu_$describe" USING menu-id, menu-needs, ret-code.
```

STRUCTURE ELEMENTS

menu-id
the menu identifier returned by cb_menu_$create (or cb_menu_$retrieve in cases where the menu object has been stored). (Input)

menu-needs
a group item that contains menu related information on successful execution of call. (Output)

```
Returned information:

lines-needed        the number of lines needed to
                    display the menu.
width-needed        the number of columns needed
                    to display the menu.
no-of-option        the number of options defined
                    in the menu.
```

ret-code
return code. (Output) (See Appendix B.)

Entry: cb_menu_$destroy

Used to free storage of a menu (not to be confused with cb_menu_$delete, which is used to delete the menu object from a value segment). Destroying the menu has no effect on the screen contents.

USAGE

```
declarations:

      77  menu-id    USAGE IS COMP-6.
      77  ret-code   USAGE IS COMP-6.

      call "cb_menu_$destroy" USING  menu-id, ret-code.
```

STRUCTURE ELEMENTS

menu-id
: menu identifier returned by cb_menu_$create or cb_menu_$retrieve. (Input/Output) (If usage-mode is 0 (see cb_menu_$init2) this operand will be ignored.) Set to an invalid value on return to prevent the old menu-id from being accidentally used.

ret-code
: return code. (Output) (See Appendix B.)

Entry: cb_menu_$display

Invoked to display a menu in a given window.

USAGE

```
declarations:

      77  window-id     USAGE IS COMP-6.
      77  menu-id       USAGE IS COMP-6.
      77  ret-code      USAGE IS COMP-6.

      call "cb_menu_$display" USING  window-id, menu-id, ret-code.
```

STRUCTURE ELEMENTS

window-id
: a window identifier returned by cb_window_$create entry point. (Input) If usage-mode = 0 this operand will be ignored (see cb_menu_$init2).

menu-id
: menu identifier returned when the menu object was created or retrieved. (Input)

ret-code
: return code. (Output) (See Appendix B.)

Entry: cb_menu_$get_choice

Returns the choice made by the user, i.e., a number representing either the menu item chosen or the function key (or its equivalent escape sequence) entered.

USAGE

```
declarations:

      77    function-key-info  PIC X(n1).
      77    window-id          USAGE IS COMP-6.
      77    menu-id            USAGE IS COMP-6.
      77    fkeys              USAGE IS COMP-6.
      77    selection          USAGE IS COMP-6.
      77    ret-code           USAGE IS COMP-6.


      call "cb_menu_$get_choice" USING window-id, menu-id, function-key-info,
           fkeys, selection, ret-code.
```

STRUCTURE ELEMENTS

window-id
a window identifier returned by the cb_window_$create entry point. (Input) If usage-mode = 0 this operand will be ignored (see cb_menu_$init2).

menu-id
menu identifier returned by cb_menu_$create or cb_menu_$retrive. (Input)

function-key-info
a character elementary data item (n1 as required) used to specify the role of function keys (if they exist for the terminal being used) or an equivalent set of escape sequences if the terminal does not have function keys or not the function keys required by the application. (Input) The objective is to let the application use the terminal's function keys if possible, else specify key sequences to be used to simulate function keys. Each character in the string corresponds to one function key. If the character is a space, then it is not relevant if the corresponding function key exists or not. If the character is not a space, that character will be used to simulate a function key if the terminal does not have function keys. If the terminal does not have a function key for every non-space character in the string, then function keys will be simulated. Thus, the string " ?p q" means that the caller does not care whether the terminal has function key 0 or 3, but the caller does wish to use function keys 1,2, and 4. If any of these 3 function keys is not present on the terminal, then esc-? will substitute for F1, esc-p will substitute for F2, and esc-q will substitute for F4.

fkeys
fkeys = 1 user entered a function key or escape sequence fkeys = 0 user selected an option (Output)

selection
is a number representing the choice made by the user. (Output) If the user has chosen an option, it is a number between 1 and the highest defined option. If the user has entered a function key, or escape sequence simulating a function key, it is the number associated with the function key.

ret-code
return code. (Output) (See Appendix B.)

Entries: cb_menu_$init1, cb_menu_$init2

These must be the first calls made to the menu manager. They set up the necessary environment for the menu application and return information concerning the user I/O window.

USAGE

```
declarations:

      inter    code
      integer  usage-mode

      call cb_menu_$init1

      call cb_menu_$init2 (usage-mode, user-window-lines, user-window-columns,
           user-window-id, ret-code)
```

STRUCTURE ELEMENTS

usage-mode
usage-mode = 0 means that the caller does not wish to do any explicit window management. (Input) When he/she wishes to display a menu, the window required will be automatically created. This means that the application will operate in a two window mode, the window containing the menu, and the user_io window. Both windows will be managed automatically for the user. If the user specifies this mode, all calls to the cb_window_ subroutine will be ignored and will return an appropriate error code. See Error Code Handling, below. All calls to the cb_menu_ subroutine that require a window identifier will ignore the user provided window-id.

usage-mode = 1 means that the user wishes to define the number and characteristics of the windows to be used in the application. Thus, calls to cb_window_ will be supported and, for the entry points of cb_menu_ that require a window identifier, the caller must use a legal window-id (returned by cb_window_$create).

user-window-lines
the number of physical lines (rows) of the user i/o window when cb_menu_$init is called (which must be the first cb_menu_ call in the application.) Undefined if usage-mode = 0. (Output)

user-window-columns
the number of columns of the user i/o window at time that cb_menu_$init is called (see immediately above). (Output) Undefined if usage-mode = 0.

user-window-id
window identifier of the user i/o window. (Output) Undefined if usage-mode = 0.

ret-code
return code. (Output) (See Appendix B.)

Entry: cb_menu_$list

Used to list the menu object(s), stored in value segment. The menu objects selected are those that match the string input by the caller.

USAGE

declarations:

```
01  matched-names.
    02  no-of-matches   USAGE IS COMP-6.
    02  menu-names      PIC X(32)  OCCURS (m1) TIMES.

77  dir-name        PIC X(168).
77  entry-name      PIC X(32).
77  match-string    PIC X(32).
77  ret-code        USAGE IS COMP-6.

call "cb_menu_$list" USING dir-name, entry-name, match-string,
     matched-names, ret-code.
```

STRUCTURE ELEMENTS

dir-name
pathname of directory containing the menu object. (Input)

entry-name
entry name of value segment containing the menu object. (Input) The suffix "value" need not be specified.

match-string
a character elementary data item that is to be used as the selection criteria for determining what menu object, if any, is contained in the specified value segment that match (or contain) this string. (Input)

no-of-matches
the number of matches found. (Output) If none, then it is 0.

menu-names
On return, contains the names of all menu objects, in the specified value segment, that match the character string match-string. (Output) Note, if m1 is not large enough to contain all the names, only m1 names will be returned.

ret-code
return code. (Output) (See Appendix B.)

Entry: cb_menu_$retrieve

Used to retrieve a menu object previously stored via the cb_menu_$store subroutine.

USAGE

```
declarations:

      77  dir-name        PIC X(168).
      77  entry-name      PIC X(32).
      77  name-of-menu.   PIC X(32).
      77  menu-id         USAGE IS COMP-6.
      77  ret-code        USAGE IS COMP-6.

      call "cb_menu_$retrieve" USING dir-name, entry-name, name-of-menu,
           menu-id, ret-code.
```

STRUCTURE ELEMENTS

dir-name
pathname of the directory containing the menu object. (Input)

entry-name
entry name of value segment containing menu object. (Input) The suffix "value" need not be specified.

name-of-menu
name of the menu object used when the object was stored. (Input)

menu-id
is the menu id returned by the call. (Output)

ret-code
return code. (Output) (See Appendix B.)

Entry: cb_menu_$store

Used to store a menu object in a specified value segment.

USAGE

```
declarations:

      77  dir-name      PIC X(168).
      77  entry-name    PIC X(32).
      77  name-of-menu  PIC X(32).
      77  create-seg    USAGE IS COMP-6.
      77  menu-id       USAGE IS COMP-6.
      77  ret-code      USAGE IS COMP-6.


      call "cb_menu_$store" USING dir-name, entry-name, name-of-menu,
           create-seg, menu-id, ret-code.
```

STRUCTURE ELEMENTS

dir-name
pathname of directory into which the menu object is to be placed. (Input)

entry-name
entry name of value segment into which menu object is to be placed. (Input) The suffix "value" need not be specified.

name-of-menu
is the name to be assigned to the stored menu object. (Input)

create-seg
create-seg = 0 means do not store if value segment identified by entry-name does not already exist. (Input) create-seg = 1 means create value segment, if it does not already exist, and store menu object in it.

menu-id
is the menu object identifier returned by cb_menu_$create or cb_menu_$retrieve. (Input)

ret-code
return code. (Output) (See Appendix B.)

Entry: cb_menu_$terminate

Must be the last call to the menu manager in the menu application.

USAGE

declarations: none

```
call "cb_menu_$terminate".
```

STRUCTURE ELEMENTS

There are no arguments.

Name: cb_window_

This is the basic video interface subroutine to be used by COBOL to create/destroy/change windows. (If usage-mode = 0 (see cb_menu_$init2) this subroutine should not be called.)

Its facilities are available through the following entry points.

Entry: cb_window_$change

This entry points provides a facility for changing the size of an existing window. The size of a window can always be "shrunk", however it can be increased only it does not overlap with another defined window. (If usage-mode = 0 (see cb_menu_$init2) this entry point should not be called.)

USAGE

```
declarations:

      77  window-id    USAGE IS COMP-6.
      77  first-line   USAGE IS COMP-6.
      77  height       USAGE IS COMP-6.
      77  ret-code     USAGE IS COMP-6.

      call "cb_window_$change" USING window-id, first-line, height,
           ret-code.
```

STRUCTURE ELEMENTS

window-id
    window identifier returned by cb_window_$create. (Input)

first-line
    new first line number for the window being changed. (Input) A positive value.

height
    new height for the window being changed. (Input) A positive value.

ret-code
    return code. (Output) (See Appendix B.)

Entry: cb_window_$clear_window

Used to clear a specified window.

USAGE

```
declarations:

      77  window-id       USAGE IS COMP-6.
      77  ret-code        USAGE IS COMP-6.

      call "cb_window_$clear_window" USING  window-id, ret-code.
```

STRUCTURE ELEMENTS

window-id
    the window identifier (returned by cb_window_$create) of the window to be cleared. (Input)

ret-code
    return code. (Output) (See Appendix B.)

Entry: cb_window_$create

This entry is used to create a new window on the terminal screen. (If usage-mode = 0 (see cb_menu_$init2) this entry point should not be called.)

USAGE

```
declarations:

      77  switch-name     PIC X(32).
      77  first-line      USAGE IS COMP-6.
      77  height          USAGE IS COMP-6.
      77  window-id       USAGE IS COMP-6.
      77  ret-code        USAGE IS COMP-6.

      call "cb_window_$create" USING first-line, height, switch-name,
           window-id, ret-code.
```

STRUCTURE ELEMENTS

first-line
    is the line number where the window is to start. (Input)

height
    the number of lines used by the window, i.e., its height. (Input)

switch-name
the name that the caller wishes to associate with the switch. (Input)

window-id
the returned id of the window just created. (Output) It must not be altered in any way by the application program.

ret-code
return code. (Output) (See Appendix B.)

Entry: cb_window_$destroy

Used to destroy a previously created window. (If usage-mode = 0 (see cb_menu_$init2) this entry point should not be called.)

USAGE

declarations:

```
77  window-id   USAGE IS COMP-6.
77  ret-code    USAGE IS COMP-6.

call "cb_window_$destroy"  USING  window-id, ret-code.
```

STRUCTURE ELEMENTS

window-id
window identifier (returned by the cb_window_$create). (Input/Output) It is reset to an illegal value by this call.

ret-code
return code. (Output) (See Appendix B.)

COBOL MENU APPLICATION EXAMPLES

In the following two COBOL examples, a "Message" menu application is created that allows you to display, print, discard, or forward messages. Example 1 is a simple COBOL program that interfaces with the Multics menu manager via the cb_menu_ routine. Note in example 1 that window management functions are called automatically through arguments in the ft_menu_$init2 subroutine.

Example 2 is a COBOL program that interfaces with the Multics menu manager through the cb_menu_routine; in example 2, however, window management functions are performed by the cb_window_ routine.

EXAMPLE 1:

In this example, all window management is done automatically.

```
    /*****************************************************************
    *        A simple COBOL program interfacing with the Multics     *
    *        menu manager via the cb_menu_ routine.                  *
    *****************************************************************

     CONTROL DIVISION.
     DEFAULT GENERATE AGGREGATE DESCRIPTORS.
     IDENTIFICATION DIVISION.

     PROGRAM-ID.
 cbtest1.

     AUTHOR.
R. I.

     ENVIRONMENT DIVISION.
     CONFIGURATION SECTION.
     SOURCE-COMPUTER.
 Multics.

     OBJECT-COMPUTER.
 Multics.

    /*****************************************************************

     DATA DIVISION.

     WORKING-STORAGE SECTION.

     01 choices-table.
        02 choices  PIC X(15) OCCURS 6 TIMES.
     01 headers-table.
        02 headers  PIC X(14) OCCURS 1 TIMES.
     01 trailers-table.
02 trailers PIC X(32) OCCURS 1 TIMES.
     01 keys-table.
02 keys     PIC X(1)  OCCURS 6 TIMES.

     01 menu-format.
02 menu-version  USAGE IS COMP-6 VALUE 1.
02 constraints   USAGE IS COMP-6.
   03 max-width  VALUE 79.
   03 max-height VALUE 10.
02 no-of-columns USAGE IS COMP-6 VALUE 2.
02 flags.
   03 center-headers    PIC 9(1) VALUE 1.
   03 center-trailer    PIC 9(1) VALUE 1.
```

```
        02 padder   PIC X(1) VALUE "-".

     01 menu-needs     USAGE IS COMP-6.
02 lines-needed.
02 width-needed.
02 no-of-options.

     77 dir-name              PIC X(168).
     77 entry-name            PIC X(32).
     77 menu-name             PIC X(32).
     77 function-key-info     PIC X(1) VALUE "q".
     77 me                    PIC X(7) VALUE "cbtest1".

     77 menu-id
            USAGE IS COMP-6.
     77 ret-code              USAGE IS COMP-6.
     77 window-id             USAGE IS COMP-6.
     77 fkeys                 USAGE IS COMP-6.
     77 option                USAGE IS COMP-6.
     77 easy-mode             USAGE IS COMP-6 VALUE zero.
     77 user-window-lines     USAGE IS COMP-6.
     77 user-window-columns   USAGE IS COMP-6.
     77 user-window-id        USAGE IS COMP-6.
     77 create-seg            USAGE IS COMP-6.

     77 keys-not-unique       USAGE IS COMP-6.
     77 too-few-keys          USAGE IS COMP-6.
     77 bad-arg               USAGE IS COMP-6.

    /*****************************************************************
     PROCEDURE DIVISION.
    *  The call to the cv_error_$name are used to collect the code for
    *  certain error messages that are of interest this application.
    *  Once these codes are retrieved the occurrence of that error can
    *  be easily tested for.

     START-IT.
          CALL "cb_menu_$init1".
CALL "cb_menu_$init2" USING easy-mode, user-window-lines,
   -    user-window-columns, user-window-id, ret-code.

    *  The calls to cb_menu_$init1 & 2 MUST be the first calls to cb_menu_.
    *  They set up the appropriate environment for the menu application.

        IF ret-code EQUAL TO zero GO TO NEXT-ERR-CODE.
CALL "com_err_" USING ret-code, me, "Internal error.
            Could not set up appropriate environment.".
GO TO STOP-IT.

CALL "cv_error_$name" USING "menu_et_$keys_not_unique",
   -    keys-not-unique, ret-code.
```

```
call "ioa_" USING "Error code for keys-not-unique = ^d", keys-not-unique.
IF ret-code EQUAL TO zero GO TO NEXT-ERR-CODE.
CALL "com_err_" USING ret-code, me, " (calling cv_error_$name)".
GO TO STOP-IT.
    NEXT-ERR-CODE.
CALL "cv_error_$name" USING "error_table_$bad_arg", bad-arg, ret-code.
IF ret-code EQUAL TO zero GO TO LAST-ERR-CODE.
CALL "com_err_" USING ret-code, me , " (calling cv_error_$name)".
GO TO STOP-IT.
    LAST-ERR-CODE.
CALL "cv_error_$name" USING "menu_et_$too_few_keys", too-few-keys,
   -    ret-code.
IF ret-code EQUAL TO zero GO TO SET-UP.
CALL "com_err_" USING ret-code, me, " (calling cv_error_$name)".
GO TO STOP-IT.
    SET-UP.
        MOVE 1 TO menu-version.
MOVE "Display Message" TO choices(1).
MOVE "Print Message" TO choices(2).
MOVE "Discard Message" TO choices(3).
        MOVE "Forward Message" TO choices(4).
MOVE "Reply Message" TO choices(5).

MOVE "List Messages" TO choices(6).
MOVE " MULTICS MAIL " TO headers(1).
MOVE "Press F1 or enter esc-q to quit" TO trailers(1).
MOVE "1" TO keys(1).
        MOVE "2" TO keys(2).
MOVE "3" TO keys(3).
        MOVE "4" TO keys(4).
MOVE "5" TO keys(5).
MOVE "6" TO keys(6).


    MENU-CREATE.
        DISPLAY  choices-table.
DISPLAY menu-version.
CALL "cb_menu_$create" USING choices-table, headers-table,
   -    trailers-table, menu-format, keys-table, menu-needs,
   -    menu-id, ret-code.

   *  This call creates a menu object and return the menu object
   *  identifier. This menu object is referenced as "menu-id".
IF ret-code EQUAL TO zero GO TO STORE-MENU.
CALL "com_err_" USING ret-code, me, " (calling cb_menu_$create)".
GO TO STOP-IT.
   STORE-MENU.
MOVE ">udd>m>ri" TO dir-name.
MOVE "menus_seg" TO entry-name.
MOVE "cb_read_mail_menu" TO menu-name.
        MOVE 1 TO create-seg.
```

```
CALL "cb_menu_$store" USING dir-name, entry-name, menu-name,
   -    create-seg, menu-id, ret-code.
IF ret-code EQUAL TO zero GO TO DISPLAY-MENU.
CALL "com_err_" USING ret-code, me, "(calling cb_menu_$store)".
GO TO STOP-IT.
    DISPLAY-MENU.
CALL "cb_menu_$display" USING window-id, menu-id, ret-code.

   *   This call displays the menu in its own window at top of screen.
   *   Since the usage-mode was set to 0, the program does not have to
   *   create the window before calling cb_menu_$display.
   *   The window-id argument is ignored.

IF ret-code EQUAL TO zero GO TO GET-CHOICE.
CALL "com_err_" USING ret-code, me, "Internal error.
         Menu could not be displayed."
GO TO STOP-IT.
    GET-CHOICE.

   *    Defines the function key requirements, i.e.,
   *      if the terminal has function key 1 (F1) then F1 will be used
   *    to "quit", otherwise "esc q" will be used to "quit".

CALL "cb_menu_$get_choice" USING window-id, menu-id,
   -    function-key-info, fkeys, option, ret-code.
IF ret-code EQUAL TO zero GO TO TEST-FKEY.
CALL "com_err_" USING ret-code, me, "Internal error. While getting
         user's choice.".
GO TO STOP-IT.
    TEST-FKEY.
IF fkeys EQUAL TO 1
   CALL "ioa_" USING "Exiting at your request."
   GO TO STOP-IT
ELSE
   CALL "ioa_" USING "You chose option ^d.", option
   GO TO GET-CHOICE.

    STOP-IT.
CALL "cb_menu_$terminate".
   *   cb_menu_$terminate MUST be the last call to cb_menu_ in the
   *   application. It terminates the environment set up cb_menu_$init.

        EXIT PROGRAM.
```

EXAMPLE 2:

In this example, COBOL interfaces with the Multics menu manager and the Multics window manager via the cb_menu_ and cb_window_ subroutines.

```
    /*************************************************************
    *        A simple COBOL program interfacing with the Multics    *
    *        menu manager and window manager via the cb_menu_ and   *
    *        cb_window_ routines, respectively.                     *
    *************************************************************

     CONTROL DIVISION.
     DEFAULT GENERATE AGGREGATE DESCRIPTORS.
     IDENTIFICATION DIVISION.

     PROGRAM-ID.
 cbtest2.

     AUTHOR.
 R. I.

     ENVIRONMENT DIVISION.
     CONFIGURATION SECTION.
     SOURCE-COMPUTER.
 Multics.
     OBJECT-COMPUTER.
 Multics.

    /*************************************************************

     DATA DIVISION.

     WORKING-STORAGE SECTION.

     01 choices-table1.
        02 choices1  PIC X(9)    OCCURS 2 TIMES.
     01 choices-table2.
        02 choices2  PIC X(15)   OCCURS 6 TIMES.
     01 choices-table3.
        02 choices3  PIC X(21)   OCCURS 4 TIMES.
     01 headers-table.
        02 headers  PIC X(23)    OCCURS 1 TIMES.
     01 trailers-table.
02 trailers PIC X(52)    OCCURS 1 TIMES.
     01 keys-table.
02 keys     PIC X(1)     OCCURS 6 TIMES.

     01 menu-format.
02 menu-version  USAGE IS COMP-6 VALUE 1.
02 constraints   USAGE IS COMP-6.
   03 max-width  VALUE 80.
```

cb_window_

```
   03 max-height VALUE 10.
02 no-of-columns USAGE IS COMP-6 VALUE 2.
02 flags.
   03 center-headers    PIC 9(1) VALUE 1.
   03 center-trailer    PIC 9(1) VALUE 1.
        02 padder   PIC X(1) VALUE "-".

     01 menu-needs1     USAGE IS COMP-6.
02 lines-needed1.
02 width-needed1.
02 no-of-options1.

     01 menu-needs2     USAGE IS COMP-6.
02 lines-needed2.
02 width-needed2.
02 no-of-options2.

     01 menu-needs3     USAGE IS COMP-6.
02 lines-needed3.
02 width-needed3.
02 no-of-options3.

      77 dir-name              PIC X(168).
      77 entry-name            PIC X(32).
      77 menu-name             PIC X(32).
      77 function-key-info     PIC X(2) VALUE "qf".
      77 me                    PIC X(7) VALUE "cbtest2".
      77 switch-name           PIC X(32).

      77 lines-needed          USAGE IS COMP-6.
      77 first-line            USAGE IS COMP-6.

      77 height                USAGE IS COMP-6.
      77 menu-id               USAGE IS COMP-6.
      77 menu-id1              USAGE IS COMP-6.
      77 menu-id2              USAGE IS COMP-6.
      77 menu-id3              USAGE IS COMP-6.
      77 ret-code              USAGE IS COMP-6.
      77 curr-window-id        USAGE IS COMP-6.
      77 window-id             USAGE IS COMP-6.
      77 window-id1            USAGE IS COMP-6.
      77 window-id2            USAGE IS COMP-6.
      77 fkeys                 USAGE IS COMP-6.
      77 option                USAGE IS COMP-6.
      77 do-it-yourself        USAGE IS COMP-6 VALUE 1.
      77 user-window-lines     USAGE IS COMP-6.
      77 user-window-columns   USAGE IS COMP-6.
      77 user-window-id        USAGE IS COMP-6.
      77 create-seg            USAGE IS COMP-6.

      77 bad-window-id         USAGE IS COMP-6.
```

```
     77 nonexistent-window      USAGE IS COMP-6.
     77 insuff-room-for-window  USAGE IS COMP-6.

    /*****************************************************************

     PROCEDURE DIVISION.

    *  The call to the cv_error_$name are used to collect the code for
    *  certain error messages that are of interest this application.
    *  Once these codes are retrieved the occurrence of that error can
    *  be easily tested for.

     START-IT.
CALL "cv_error_$name" USING "video_et_$bad_window_id",
   -    bad-window-id, ret-code.
IF ret-code EQUAL TO zero GO TO NEXT-ERR-CODE.
CALL "com_err_" USING ret-code, me, " (calling cv_error_$name)".
GO TO STOP-IT.
     NEXT-ERR-CODE.
CALL "cv_error_$name" USING "video_et_$nonexistent_window",
   -    nonexistent-window, ret-code.
IF ret-code EQUAL TO zero GO TO LAST-ERR-CODE.
CALL "com_err_" USING ret-code, me , " (calling cv_error_$name)".
GO TO STOP-IT.
     LAST-ERR-CODE.
CALL "cv_error_$name" USING "video_et_$insuff_room_for_window",
   -    insuff-room-for-window, ret-code.
IF ret-code EQUAL TO zero GO TO SET-UP.
CALL "com_err_" USING ret-code, me, " (calling cv_error_$name)".
GO TO STOP-IT.
     SET-UP.
MOVE "Read Mail" TO choices1(1).
MOVE "Send Mail" TO choices1(2).

MOVE "Display Message" TO choices2(1).
        MOVE "Print Message" TO choices2(2).
MOVE "Discard Message" TO choices2(3).
MOVE "Forward Message" TO choices2(4).
        MOVE "Reply Message" TO choices2(5).
        MOVE "List Messages" TO choices2(6).

MOVE "Send New Message" TO choices3(1).
MOVE "Send Deferred Message" TO choices3(2).
        MOVE "Print Sent Message" TO choices3(3).
        MOVE "Save Sent Message" TO choices3(4).


MOVE "1" TO keys(1).
        MOVE "2" TO keys(2).
MOVE "3" TO keys(3).
        MOVE "4" TO keys(4).
```

```
MOVE "5" TO keys(5).
MOVE "6" TO keys(6).


CALL "cb_menu_$init1".
CALL "cb_menu_$init2" USING do-it-yourself, user-window-lines,
   -    user-window-columns, user-window-id, ret-code.

   *  The call to cb_menu_$init1 & 2 MUST be the first call to cb_menu_.
   *  It sets up the appropriate environment for the menu application.
   *  The application must do the window management, since
   *  "do-it-youself" is set to 1.

        IF ret-code EQUAL TO zero GO TO CREATE-FIRST-MENU.
CALL "com_err_" USING ret-code, me, "Internal error. Could not set up
        appropriate environment.".
GO TO STOP-IT.

    CREATE-FIRST-MENU.

   *  Create first menu object.

MOVE  "F1 (or esc-q) = quit" TO trailers(1).
MOVE "MULTICS MAIL" TO headers(1).
CALL "cb_menu_$create" USING choices-table1, headers-table,
   -    trailers-table, menu-format, keys-table, menu-needs1,
   -    menu-id1, ret-code.

IF ret-code EQUAL TO zero GO TO CREATE-SECOND-MENU.
CALL "com_err_" USING ret-code, me, " (calling cb_menu_$create)".
GO TO STOP-IT.
    CREATE-SECOND-MENU.

   *  Create second menu object.

MOVE  "F1 (or esc-q) = quit; F2 (or esc-f) = first menu" TO trailers(1).
MOVE "READ MAIL" TO headers(1).
CALL "cb_menu_$create" USING choices-table2, headers-table,
   -    trailers-table, menu-format, keys-table, menu-needs2,
   -    menu-id2, ret-code.
IF ret-code EQUAL TO zero GO TO CREATE-THIRD-MENU.
CALL "com_err_" USING ret-code, me, " (calling cb_menu_$create)".
GO TO STOP-IT.
    CREATE-THIRD-MENU.

   *  Create third menu object.

MOVE "SEND MAIL" TO headers(1).
CALL "cb_menu_$create" USING choices-table3, headers-table,
   -    trailers-table, menu-format, keys-table, menu-needs3,
   -    menu-id3, ret-code.
```

```
IF ret-code EQUAL TO zero GO TO STORE-MENU.
CALL "com_err_" USING ret-code, me, " (calling cb_menu_$create)".
GO TO STOP-IT.

   STORE-MENU.
MOVE ">udd>m>ri" TO dir-name.
MOVE "menu_seg" TO entry-name.
MOVE "cb_test_menu_" TO menu-name.
        MOVE 1 TO create-seg.
CALL "cb_menu_$store" USING dir-name, entry-name, menu-name,
   -    create-seg, menu-id1, ret-code.
IF ret-code EQUAL TO zero GO TO DISPLAY-IT.
CALL "com_err_" USING ret-code, me, "(calling cb_menu_$store)".
GO TO STOP-IT.
    DISPLAY-IT.
MOVE -1 TO curr-window-id.
   *  Setting curr-wind-id to "-1" means that there is no current window
   *  defined.
MOVE menu-id1 TO menu-id.
MOVE lines-needed1 TO lines-needed.

    DISPLAY-FIRST-MENU.

PERFORM CHANGE-MENU THRU GOBACK.
   *  The user i/o window has been "shrunk", the window for the first menu
   *  has been created, and the first menu has been displayed.
        MOVE window-id TO window-id1.
IF ret-code EQUAL TO zero GO TO GET-IT.
CALL "com_err_" USING ret-code, me, "Internal error.
      Menu could not be displayed."
GO TO STOP-IT.
    GET-IT.
PERFORM GET-CHOICE.
   * Get the user input. Two values are returned. (1) fkey. If fkey = 1,
   * then the user entered a function key (or its equivalent escape
   * sequence). If fkey = 0 then the user has selected an option. (2) option.
   * If fkey = 1 then option is the function key number entered. (F1 = 1,
   * F2 = 2, etc.). If fkey = 0, then option is the option number selected,
   * option = 1 means option 1 selected, etc.

IF ret-code EQUAL TO zero GO TO TEST-FKEY.
CALL "com_err_" USING ret-code, me, "Internal error.
      While getting user's choice.".
GO TO STOP-IT.
    TEST-FKEY.
IF fkeys EQUAL TO 1
   IF option EQUAL TO 1
     CALL "ioa_" USING "Exiting at your request."
     GO TO STOP-IT
   ELSE
            GO TO GET-IT
```

```
ELSE
   IF option EQUAL TO 1
     MOVE menu-id2 TO menu-id
             MOVE lines-needed2 TO lines-needed
     PERFORM CHANGE-MENU THRU GOBACK
   ELSE
     MOVE menu-id3 TO menu-id
     MOVE lines-needed3 TO lines-needed
     PERFORM CHANGE-MENU THRU GOBACK.
IF ret-code NOT EQUAL TO zero
  CALL "com_err_" USING ret-code, me, "Internal error.
       While trying to display menu."
  GO TO STOP-IT
ELSE
            MOVE window-id TO window-id2.
    NEXT-GET-IT.
PERFORM GET-CHOICE.
IF fkeys EQUAL TO zero GO TO CHOSE-OPTION.
IF option EQUAL TO 1
  CALL "ioa_" USING "Exiting at your request."
  GO TO STOP-IT
ELSE
  IF option GREATER 2
            GO TO NEXT-GET-IT
  ELSE
    MOVE menu-id1 TO menu-id
    MOVE lines-needed1 TO lines-needed
    GO TO DISPLAY-FIRST-MENU.
    CHOSE-OPTION.
CALL "ioa_" USING "You chose option ^d.", option.
GO TO NEXT-GET-IT.
    GET-CHOICE.
CALL "cb_menu_$get_choice" USING window-id, menu-id,
   -    function-key-info, fkeys, option, ret-code.

    CHANGE-MENU.

   * Destroy the current menu window.
IF (curr-window-id ) EQUAL TO -1 GO TO CHANGE-USER-WIND.
CALL "cb_window_$destroy" USING curr-window-id, ret-code.
          IF ret-code EQUAL TO zero GO TO CHANGE-USER-WIND.
GO TO GOBACK.
    CHANGE-USER-WIND.
COMPUTE first-line = lines-needed + 1.
COMPUTE height = user-window-lines - lines-needed.
CALL "cb_window_$change" USING user-window-id, first-line, height,
   -    ret-code.
IF ret-code EQUAL TO zero GO TO CREATE-NEW-WIND
        ELSE GO TO GOBACK.
    CREATE-NEW-WIND.
MOVE "menu-window" TO switch-name.
```

```
        MOVE 1 TO first-line.
CALL "cb_window_$create" USING first-line, lines-needed,
   -    switch-name, window-id, ret-code.
IF ret-code EQUAL TO zero GO TO DISPLAY-MENU
ELSE GO TO GOBACK.
    DISPLAY-MENU.
        MOVE window-id TO curr-window-id.
CALL "cb_menu_$display" USING window-id, menu-id, ret-code.
        CALL "cb_window_$clear_window" USING user-window-id, ret-code.

    GOBACK.
EXIT.

    STOP-IT.
CALL "cb_menu_$terminate".
   *   cb_menu_$terminate MUST be the last call to cb_menu_ in the
   *   application. It terminates the environment set up cb_menu_$init.

        EXIT PROGRAM.
```

APPENDIX A

I/O SWITCH ATTACHMENTS

This appendix reviews the standard I/O switch attachments, then describes how these attachments change when you activate the video system on your terminal and create a menu.

There are four standard switches which are attached when your process is created. These switches are as follows:

(1) user_i/o: this switch acts as a common collecting point for all terminal I/O. It's attached to your terminal through the I/O module tty_, and is opened for stream input and output.

(2) user_input: this switch controls command and data input at your terminal. It's attached to user_i/o through the I/O module syn_, and through that to your terminal. It's opened for stream input.

(3) user_output: this switch controls command and data output at your terminal. It's attached to user_i/o through the I/O module syn_, and through that to your terminal. It's opened for stream output.

(4) error_output: this switch controls output of error messages at your terminal. It's attached to user_i/o through the I/O module syn_, and through that to your terminal. It's opened for stream output.

To get information about I/O switch attachments, you can use the print_attach_table (pat) command. If you type "pat" on your terminal right after you log in, the system will print the following:

```
error_output        syn_ user_i/o -inh close get_line get_chars
user_input          syn_ user_i/o -inh close put_chars
user_i/o            tty_ -login_channel
          stream_input_output
user_output         syn_ user_i/o -inh close get_line get_chars
```

You can see from this that user_input, user_output, and error_output are all attached via syn_ to user_i/o, which in turn is attached via tty_ to your terminal. Figure A-1 illustrates these standard I/O switch attachments.

When you activate the video system, by issuing a call to video_utils_$turn_on_login_channel or by executing the window_call invoke command, the existing tty_ attachment of your terminal is removed and replaced with video system attachments. The I/O switch user_i/o is now attached through the I/O module window_io_ to a new I/O switch, user_terminal_. User_terminal_ is attached through the I/O module tc_io_ to your terminal.

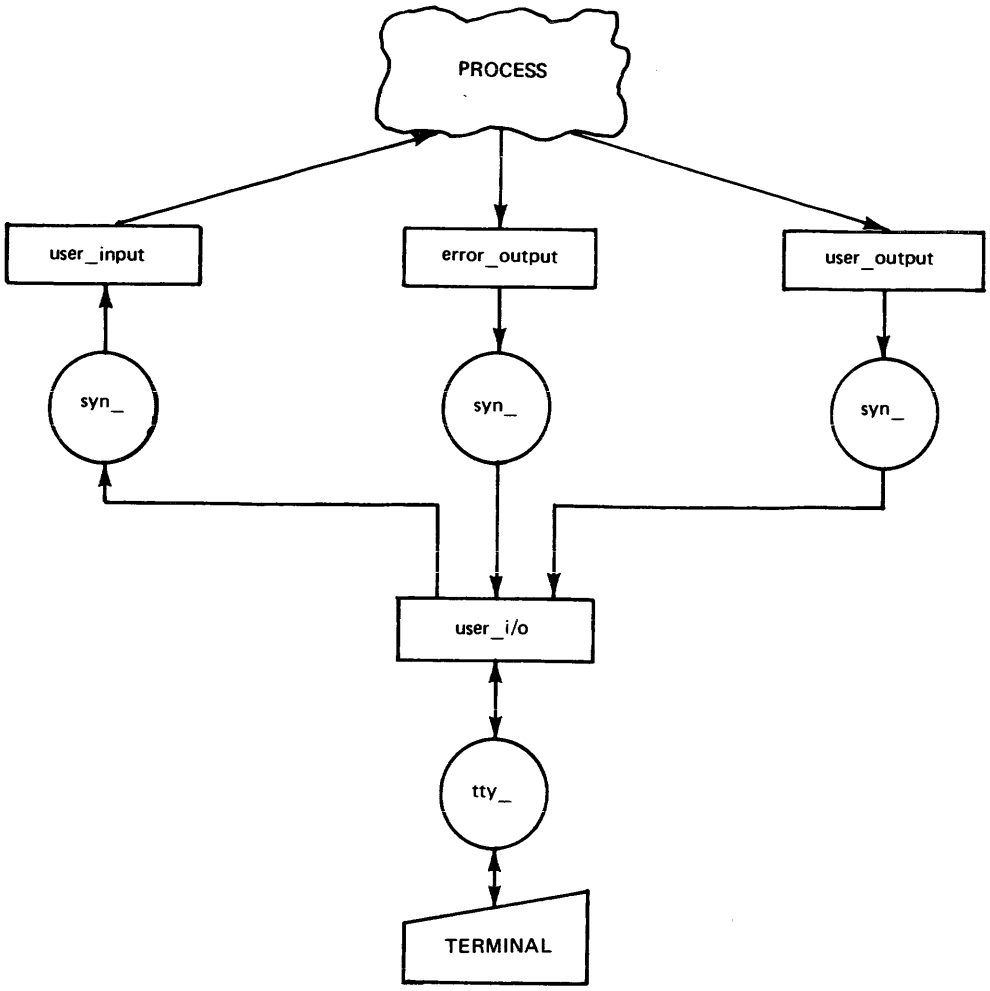


Figure A-1. Standard Attachments

If you type "pat" on your terminal after invoking video, the system will print the following:

```
user_terminal_       tc_io_ -login_channel
          stream_input_output
error_output         syn_ user_i/o -inh close get_line get_chars
user_input           syn_ user_i/o -inh close put_chars
user_i/o             window_io_ user_terminal_ -first_line 1 -n_lines 24
          stream_input_output Video
user_output          syn_ user_i/o -inh close get_line get_chars
```

You can see from this that user_input, user_output, and error_output are still attached via syn_ to user_i/o, but that user_i/o is now attached via window_io_ to user_terminal_, which is in turn attached via tc_io_ to your terminal. User_i/o is now a window as well as a switch. It begins on line 1 of your screen and is 24 lines long. On a VIP7801 terminal, this means that the window covers the entire screen. Figure A-2 illustrates these changes to the standard I/O switch attachments.

When you execute an exec_com to create a menu, the necessary attachments for your menu are built on top of those already set up by your activation of the video system. If you run the exec_com discussed in Section 3 (doc_sys.ec), then type "pat" on your terminal, the system will print the following:

```
user_terminal_       tc_io_ -login_channel
          stream_input_output
error_output         syn_ user_i/o -inh close get_line get_chars
user_input           syn_ user_i/o -inh close put_chars
user_i/o             window_io_ user_terminal_ -first_line 8 -n_lines 17
          stream_input_output Video
user_output          syn_ user_i/o -inh close get_line get_chars
!BBBJLXDqDbMNnn.menu
     window_io_ user_terminal_ -first_line 1 -n_lines 7
          stream_input_output Video
811007144650.613707.exec_com
     ec_input_ ">udd>Project>Person>doc_sys.ec" stream_input
```

You can see from this that user_input, user_output, and error_output are still attached via syn_ to user_i/o, that user_i/o is still attached via window_io_ to user_terminal_, and that user_terminal_ is still attached via tc_ic_ to your terminal. But in addition, the !BBBJLXDqDbMNnn.menu is now attached through window_io_ to user_terminal_ also. (The unique character string "!BBBJLXDqDbMNnn" is generated by using the unique active function, as in the construction [unique].menu, used in doc_sys.ec.) The user_i/o window still begins on line 1, but now it is only 7 lines long. The !BBBJLXDqDbMNnn.menu, which, like user_i/o, is a window as well as a switch, begins on line 8, and is 17 lines long.

The last two lines printed above provide information about attachments made to support the execution of the exec_com. They are of no concern to you in this discussion. Figure A-3 illustrates I/O switch attachments after the video system has been activated and an exec_com creating a menu has been run.

For more information on the print_attach_table command and the unique active function, refer to the *Multics Commands and Active Functions* manual, Order No. AG92.

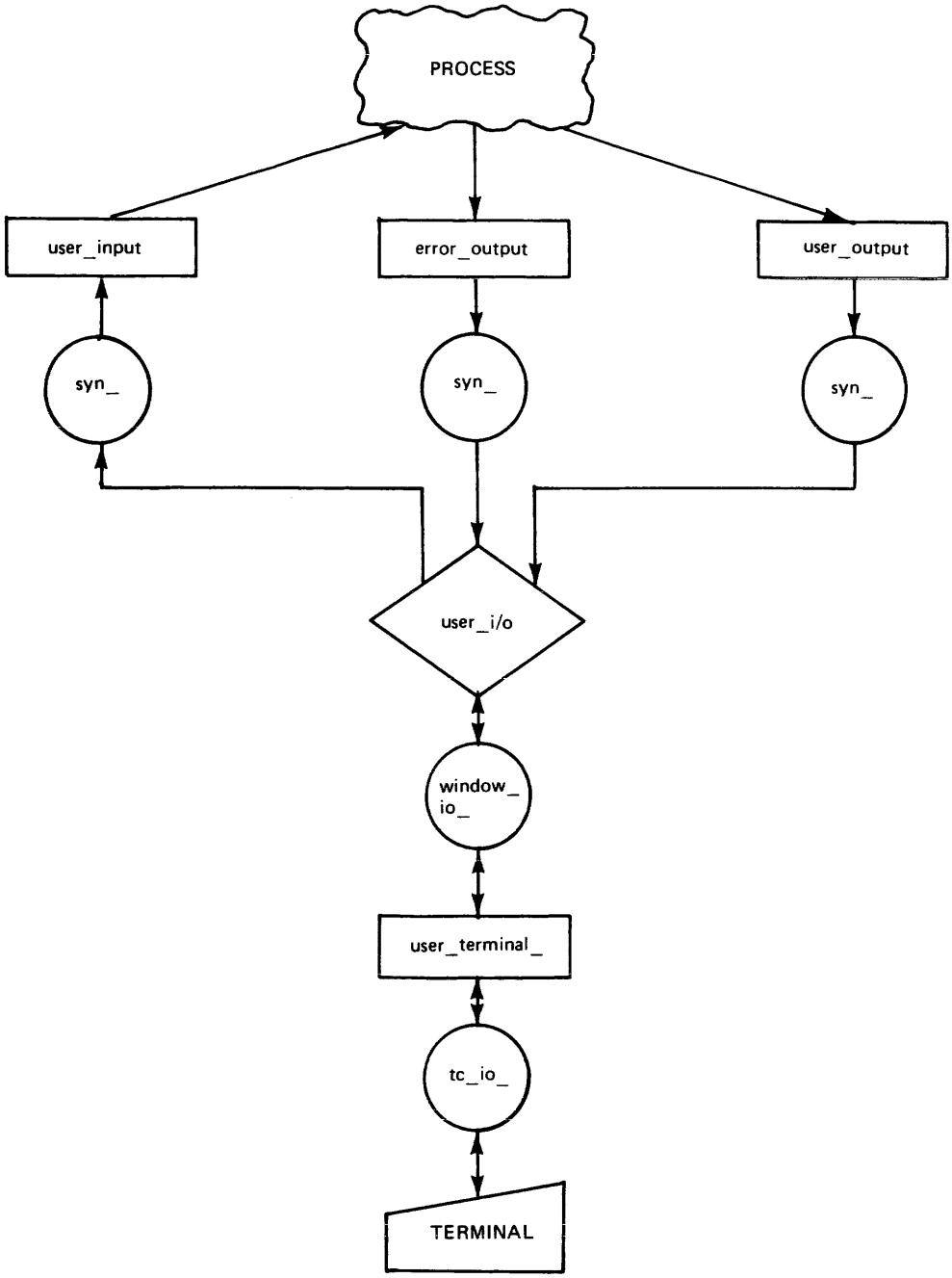


Figure A-2. Attachments After the Invocation of Video

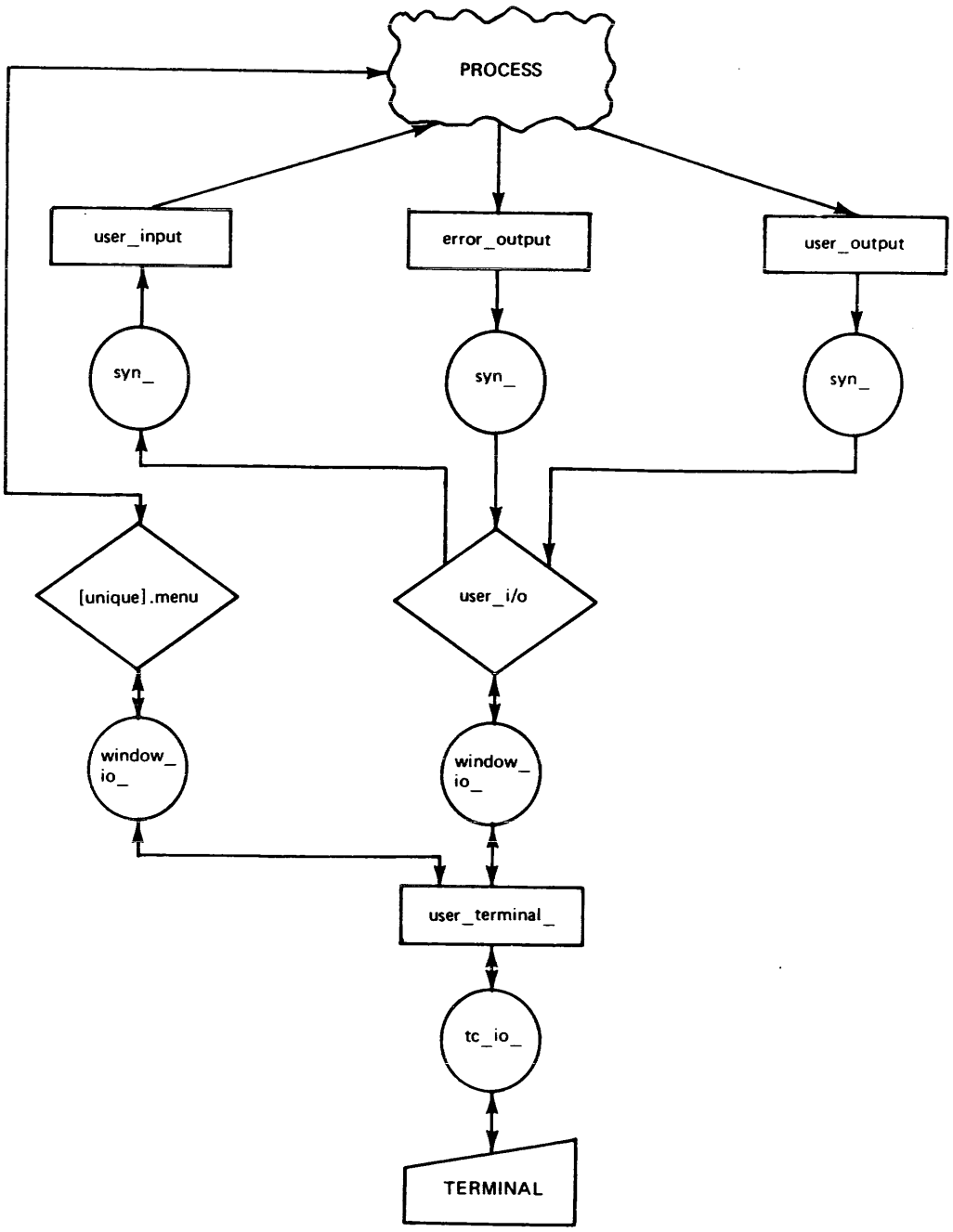


Figure A-3. Attachments After Execution of doc_sys.ec exec_com

APPENDIX B

ERROR CODE HANDLING

The subroutine cv_error_$name is provided in order to allow the FORTRAN and COBOL programmer to test return codes in a way similar to that provided by PL/I.

It provides a means to associate an error "name", e.g., "menu_et_$too_few_keys" with the numeric value of the returned code. Once this is done the programmer can test for a given error code by using the name associated with it.

SYNTAX IN FORTRAN

call cv_error_$name (error_name, converted_code, code)

SYNTAX IN COBOL

CALL "cv_error_$name" USING error-name, converted-code, ret-code.

ARGUMENTS

error_name (error-name)
a quoted string, e.g., "menu_et_$too_many_options", which is name of the error. (Input)

converted_string (converted-string)
an integer (USAGE IS COMP-6 in COBOL) variable where the returned numeric value of the code is to be stored. (Output)

code (FORTRAN)
0 if call was successful, nonzero otherwise. (integer) (Output)

ret-code (COBOL)
0 if call was successful, nonzero otherwise. (USAGE IS COMP-6) (Output)

NOTES

"code" must be declared as "integer" in a FORTRAN program and "ret-code" as USAGE IS COMP-6 in a COBOL program. In every call, to any entry point defined in this document, a return code of zero always means that the call was executed successfully.)

Error codes of particular interest are:

menu_et_$too_many_options
(A menu can contain at most 61 choices.)

menu_et_$too_few_keys
(There are fewer keys than choices.)

menu_et_$keys_not_unique
(Each key must be unique.)

menu_et_$higher_than_max
(The menu will not fit within the specified maximum height.)

video_et_$bad_window_id
(The supplied window id was not valid.)

video_et_$overlapping_windows
(Two windows may not overlap on the screen.)

video_et_$window_too_big (The screen is too small to accommodate a window of the requested size.)

video_et_$insuff_room_for_window
(Insufficient room to create window.)

video_et_$window_too_small
(Tried to adjust window past minimum size.)

video_et_$negative_screen_size
(Negative screen size specified.)

video_et_$negative_window_size
(Negative window size specified.)

video_et_$nonexistent_window
(Specified window does not exist.)

video_et_$overlaps_other_window
(Specified window overlaps other windows.)

video_et_$unable_to_create_window
(Unable to create window.)

video_et_$unable_to_dest_window
(Unable to destroy window.)

video_et_$switch_not_window
(The specified switch is not attached as a window.)

error_table_$no_operation
(Cannot call this entry point in your current mode. Requested operation could not be performed.)

INDEX

MISCELLANEOUS

A

I

K

L

M

W

CUT ALONG LINE

HONEYWELL INFORMATION SYSTEMS
Technical Publications Remarks Form

TITLE: MULTICS MENU CREATION FACILITIES

ORDER NO. CP51-02

DATED FEBRUARY 1985

ERRORS IN PUBLICATION

SUGGESTIONS FOR IMPROVEMENT TO PUBLICATION

Your comments will be investigated by appropriate technical personnel and action will be taken as required. Receipt of all forms will be acknowledged; however, if you require a detailed reply, check here. ☐

FROM: NAME _____ DATE _____

TITLE _____

COMPANY _____

ADDRESS _____

_____

PLEASE FOLD AND TAPE–
NOTE: U. S. Postal Service will not deliver stapled forms

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL
FIRST CLASS PERMIT NO. 39531 WALTHAM, MA02154

POSTAGE WILL BE PAID BY ADDRESSEE

HONEYWELL INFORMATION SYSTEMS
200 SMITH STREET
WALTHAM, MA 02154

ATTN: PUBLICATIONS, MS486

Honeywell

FOLD ALONG LINE

FOLD ALONG LINE

CUT ALONG LI

Together, we can find the answers.

Honeywell

Honeywell Information Systems
U.S.A.: 200 Smith St., MS 486, Waltham, MA 02154
Canada: 155 Gordon Baker Rd., Willowdale, ON M2H 3N7
U.K.: Great West Rd., Brentford, Middlesex TW8 9DH **Italy**: 32 Via Pirelli, 20124 Milano
Mexico: Avenida Nuevo Leon 250, Mexico 11, D.F. **Japan**: 2-2 Kanda Jimbo-cho, Chiyoda-ku, Tokyo
Australia: 124 Walker St., North Sydney, N.S.W. 2060 **S.E. Asia**: Mandarin Plaza, Tsimshatsui East, H.K.

42356, 7.5C385, Printed in U.S.A.

CP51-02