

***Open Watcom FORTRAN 77***

***Graphics Library Reference***



***Version 2.0***

**Open Watcom**

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# ***Preface***

The Open Watcom FORTRAN 77 Optimizing Compiler is an implementation of the American National Standard programming language FORTRAN, ANSI X3.9-1978, commonly referred to as FORTRAN 77. The language level supported by this compiler includes the full language definition as well as significant extensions to the language.

This manual describes the Open Watcom FORTRAN 77 Graphics Library. This library of routines is used to create graphical images such as lines and circles on the screen. Routines are also provided for displaying text.

This book was produced with the Open Watcom GML electronic publishing system, a software tool developed by WATCOM. In this system, writers use an ASCII text editor to create source files containing text annotated with tags. These tags label the structural elements of the document, such as chapters, sections, paragraphs, and lists. The Open Watcom GML software, which runs on a variety of operating systems, interprets the tags to format the text into a form such as you see here. Writers can produce output for a variety of printers, including laser printers, using separately specified layout directives for such things as font selection, column width and height, number of columns, etc. The result is type-set quality copy containing integrated text and graphics.

## ***Acknowledgements***

Many members of Watcom International Corp. have made a significant contribution to the design and implementation of the Open Watcom FORTRAN 77 Graphics Library. The design of this software is based upon ideas evolved and proven over the past decade in other software projects in which these people have been involved.

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# ***1 Graphics Library***

The Open Watcom FORTRAN 77 Graphics Library consists of a large number of routines that provide graphical image support under DOS and QNX. This chapter provides an overview of this support. The following topics are discussed.

- Graphics Routines
- Graphics Adapters
- Classes of Graphics Routines
  - 1. Environment Routines
  - 2. Coordinate System Routines
  - 3. Attribute Routines
  - 4. Drawing Routines
  - 5. Text Routines
  - 6. Graphics Text Routines
  - 7. Image Manipulation Routines
  - 8. Font Manipulation Routines
  - 9. Presentation Graphics Routines
- Display Routines
- Analyze Routines
- Utility Routines
- Include Files

## ***1.1 Graphics Routines***

Graphics routines are used to display graphical images such as lines and circles upon the computer screen. Routines are also provided for displaying text along with the graphics output.

## ***1.2 Graphics Adapters***

Support is provided for both color and monochrome screens which are connected to the computer using any of the following graphics adapters:

- IBM Monochrome Display/Printer Adapter (MDPA)
- IBM Color Graphics Adapter (CGA)
- IBM Enhanced Graphics Adapter (EGA)
- IBM Multi-Color Graphics Array (MCGA)

- IBM Video Graphics Array (VGA)
- Hercules Monochrome Adapter
- SuperVGA adapters (SVGA) supplied by various manufacturers

### 1.3 Classes of Graphics Routines

The routines in the Open Watcom FORTRAN 77 Graphics Library can be organized into a number of classes:

#### *Environment Routines*

These routines deal with the hardware environment.

#### *Coordinate System Routines*

These routines deal with coordinate systems and mapping coordinates from one system to another.

#### *Attribute Routines*

These routines control the display of graphical images.

#### *Drawing Routines*

These routines display graphical images such as lines and ellipses.

#### *Text Routines*

These routines deal with displaying text in both graphics and text modes.

#### *Graphics Text Routines*

These routines deal with displaying graphics text.

#### *Image Manipulation Routines*

These routines store and retrieve screen images.

#### *Font Manipulation Routines*

These routines deal with displaying font based text.

#### *Presentation Graphics Routines*

These routines deal with displaying presentation graphics elements such as bar charts and pie charts.

The following subsections describe these routine classes in more detail. Each routine in the class is noted with a brief description of its purpose.

#### 1.3.1 Environment Routines

These routines deal with the hardware environment. The `_getvideoconfig` routine returns information about the current video mode and the hardware configuration. The `_setvideomode` routine selects a new video mode.

Some video modes support multiple pages of screen memory. The visual page (the one displayed on the screen) may be different than the active page (the one to which objects are being written).

The following routines are defined:

|                                |   |
|--------------------------------|---|
| <code>_getactivepage</code>    | get the number of the current active graphics page                          |
| <code>_getvideoconfig</code>   | get information about the graphics configuration                            |
| <code>_getvisualpage</code>    | get the number of the current visual graphics page                          |
| <code>_grstatus</code>         | get the status of the most recently called graphics library routine         |
| <code>_setactivepage</code>    | set the active graphics page (the page to which graphics objects are drawn) |
| <code>_settextrows</code>      | set the number of rows of text displayed on the screen                      |
| <code>_setvideomode</code>     | select the video mode to be used  |
| <code>_setvideomoderows</code> | select the video mode and the number of text rows to be used                |
| <code>_setvisualpage</code>    | set the visual graphics page (the page displayed on the screen)             |

### 1.3.2 Coordinate System Routines

These routines deal with coordinate systems and mapping coordinates from one system to another. The Open Watcom FORTRAN 77 Graphics Library supports three coordinate systems:

1. Physical coordinates
2. View coordinates
3. Window coordinates

Physical coordinates match the physical dimensions of the screen. The physical origin, denoted (0,0), is located at the top left corner of the screen. A pixel to the right of the origin has a positive x-coordinate and a pixel below the origin will have a positive y-coordinate. The x- and y-coordinates will never be negative values.

The view coordinate system can be defined upon the physical coordinate system by moving the origin from the top left corner of the screen to any physical coordinate (see the `_setvieworg` routine). In the view coordinate system, negative x- and y-coordinates are allowed. The scale of the view and physical coordinate systems is identical (both are in terms of pixels).

The window coordinate system is defined in terms of a range of user-specified values (see the `_setwindow` routine). These values are scaled to map onto the physical coordinates of the screen. This allows for consistent pictures regardless of the resolution (number of pixels) of the screen.

The following routines are defined:

|                                |  |
|--------------------------------|--|
| <code>_getcliprgn</code>       | get the boundary of the current clipping region                                      |
| <code>_getphyscoord</code>     | get the physical coordinates of a point in view coordinates                          |
| <code>_getviewcoord</code>     | get the view coordinates of a point in physical coordinates                          |
| <code>_getviewcoord_w</code>   | get the view coordinates of a point in window coordinates                            |
| <code>_getviewcoord_wxy</code> | get the view coordinates of a point in window coordinates                            |
| <code>_getwindowcoord</code>   | get the window coordinates of a point in view coordinates                            |
| <code>_setcliprgn</code>       | set the boundary of the clipping region  |
| <code>_setvieworg</code>       | set the position to be used as the origin of the view coordinate system              |
| <code>_setviewport</code>      | set the boundary of the clipping region and the origin of the view coordinate system |
| <code>_setwindow</code>        | define the boundary of the window coordinate system                                  |

### 1.3.3 Attribute Routines

These routines control the display of graphical images such as lines and circles. Lines and figures are drawn using the current color (see the `_setcolor` routine), the current line style (see the `_setlinestyle` routine), the current fill mask (see the `_setfillmask` routine), and the current plotting action (see the `_setplotaction` routine).

The following routines are defined:

|                               |  |
|-------------------------------|--|
| <code>_getarcinfo</code>      | get the endpoints of the most recently drawn arc |
| <code>_getbkcolor</code>      | get the background color                         |
| <code>_getcolor</code>        | get the current color                            |
| <code>_getfillmask</code>     | get the current fill mask                        |
| <code>_getlinestyle</code>    | get the current line style                       |
| <code>_getplotaction</code>   | get the current plotting action                  |
| <code>_remapallpalette</code> | assign colors for all pixel values               |
| <code>_remappalette</code>    | assign color for one pixel value                 |
| <code>_selectpalette</code>   | select a palette                                 |
| <code>_setbkcolor</code>      | set the background color                         |
| <code>_setcolor</code>        | set the current color                            |
| <code>_setfillmask</code>     | set the current fill mask                        |
| <code>_setlinestyle</code>    | set the current line style                       |
| <code>_setplotaction</code>   | set the current plotting action                  |

### 1.3.4 Drawing Routines

These routines display graphical images such as lines and ellipses. Routines exist to draw straight lines (see the `_lineto` routines), rectangles (see the `_rectangle` routines), polygons (see the `_polygon` routines), ellipses (see the `_ellipse` routines), elliptical arcs (see the `_arc` routines) and pie-shaped wedges from ellipses (see the `_pie` routines).

These figures are drawn using the attributes described in the previous section. The routines ending with `_w` or `_wxy` use the window coordinate system; the others use the view coordinate system.

The following routines are defined:

|                                    |  |
|------------------------------------|--|
| <code>_arc</code>                  | draw an arc  |
| <code>_arc_w</code>                | draw an arc using window coordinates                                       |
| <code>_arc_wxy</code>              | draw an arc using window coordinates                                       |
| <code>_clearscreen</code>          | clear the screen and fill with the background color                        |
| <code>_ellipse</code>              | draw an ellipse  |
| <code>_ellipse_w</code>            | draw an ellipse using window coordinates                                   |
| <code>_ellipse_wxy</code>          | draw an ellipse using window coordinates                                   |
| <code>_floodfill</code>            | fill an area of the screen with the current color                          |
| <code>_floodfill_w</code>          | fill an area of the screen in window coordinates with the current color    |
| <code>_getcurrentposition</code>   | get the coordinates of the current output position                         |
| <code>_getcurrentposition_w</code> | get the window coordinates of the current output position                  |
| <code>_getpixel</code>             | get the color of the pixel at the specified position                       |
| <code>_getpixel_w</code>           | get the color of the pixel at the specified position in window coordinates |
| <code>_lineto</code>               | draw a line from the current position to a specified position              |

|                             |   |
|-----------------------------|---|
| <code>_lineto_w</code>      | draw a line from the current position to a specified position in window coordinates |
| <code>_moveto</code>        | set the current output position   |
| <code>_moveto_w</code>      | set the current output position using window coordinates                            |
| <code>_pie</code>           | draw a wedge of a "pie"   |
| <code>_pie_w</code>         | draw a wedge of a "pie" using window coordinates                                    |
| <code>_pie_wxy</code>       | draw a wedge of a "pie" using window coordinates                                    |
| <code>_polygon</code>       | draw a polygon  |
| <code>_polygon_w</code>     | draw a polygon using window coordinates   |
| <code>_polygon_wxy</code>   | draw a polygon using window coordinates   |
| <code>_rectangle</code>     | draw a rectangle  |
| <code>_rectangle_w</code>   | draw a rectangle using window coordinates   |
| <code>_rectangle_wxy</code> | draw a rectangle using window coordinates   |
| <code>_setpixel</code>      | set the color of the pixel at the specified position                                |
| <code>_setpixel_w</code>    | set the color of the pixel at the specified position in window coordinates          |

### 1.3.5 Text Routines

These routines deal with displaying text in both graphics and text modes. This type of text output can be displayed in only one size.

This text is displayed using the `_outtext` and `_outmem` routines. The output position for text follows the last text that was displayed or can be reset (see the `_settextposition` routine). Text windows can be created (see the `_settextwindow` routine) in which the text will scroll. Text is displayed with the current text color (see the `_settextcolor` routine).

The following routines are defined:

|                                |  |
|--------------------------------|--|
| <code>_clearscreen</code>      | clear the screen and fill with the background color  |
| <code>_displaycursor</code>    | determine whether the cursor is to be displayed after a graphics routine completes execution |
| <code>_getbkcolor</code>       | get the background color   |
| <code>_gettextcolor</code>     | get the color used to display text   |
| <code>_gettextcursor</code>    | get the shape of the text cursor   |
| <code>_gettextposition</code>  | get the current output position for text   |
| <code>_gettextwindow</code>    | get the boundary of the current text window  |
| <code>_outmem</code>           | display a text string of a specified length  |
| <code>_outtext</code>          | display a text string  |
| <code>_scrolltextwindow</code> | scroll the contents of the text window   |
| <code>_setbkcolor</code>       | set the background color   |
| <code>_settextcolor</code>     | set the color used to display text   |
| <code>_settextcursor</code>    | set the shape of the text cursor   |
| <code>_settextposition</code>  | set the output position for text   |
| <code>_settextwindow</code>    | set the boundary of the region used to display text  |
| <code>_wrapon</code>           | permit or disallow wrap-around of text in a text window                                      |

### 1.3.6 Graphics Text Routines

These routines deal with displaying graphics text. Graphics text is displayed as a sequence of line segments, and can be drawn in different sizes (see the `_setcharsize` routine), with different orientations (see the `_settextorient` routine) and alignments (see the `_settextalign` routine). The routines ending with `_w` use the window coordinate system; the others use the view coordinate system.

The following routines are defined:

|                                |   |
|--------------------------------|---|
| <code>_gettexttext</code>      | get the bounding rectangle for a graphics text string                         |
| <code>_gettextsettings</code>  | get information about the current settings used to display graphics text      |
| <code>_grtext</code>           | display graphics text   |
| <code>_grtext_w</code>         | display graphics text using window coordinates                                |
| <code>_setcharsize</code>      | set the character size used to display graphics text                          |
| <code>_setcharsize_w</code>    | set the character size in window coordinates used to display graphics text    |
| <code>_setcharspacing</code>   | set the character spacing used to display graphics text                       |
| <code>_setcharspacing_w</code> | set the character spacing in window coordinates used to display graphics text |
| <code>_setttextalign</code>    | set the alignment used to display graphics text                               |
| <code>_setttextorient</code>   | set the orientation used to display graphics text                             |
| <code>_setttextpath</code>     | set the path used to display graphics text                                    |

### 1.3.7 Image Manipulation Routines

These routines are used to transfer screen images. The `_ getimage` routine transfers a rectangular image from the screen into memory. The `_ putimage` routine transfers an image from memory back onto the screen. The routines ending with `_ w` or `_ wxy` use the window coordinate system; the others use the view coordinate system.

The following routines are defined:

|                             |   |
|-----------------------------|---|
| <code>_getimage</code>      | store an image of an area of the screen into memory                       |
| <code>_getimage_w</code>    | store an image of an area of the screen in window coordinates into memory |
| <code>_getimage_wxy</code>  | store an image of an area of the screen in window coordinates into memory |
| <code>_imagesize</code>     | get the size of a screen area   |
| <code>_imagesize_w</code>   | get the size of a screen area in window coordinates                       |
| <code>_imagesize_wxy</code> | get the size of a screen area in window coordinates                       |
| <code>_putimage</code>      | display an image from memory on the screen                                |
| <code>_putimage_w</code>    | display an image from memory on the screen using window coordinates       |

### 1.3.8 Font Manipulation Routines

These routines are for the display of fonts compatible with Microsoft Windows. Fonts are contained in files with an extension of `.FON`. Before font based text can be displayed, the fonts must be registered with the `_ registerfonts` routine, and a font must be selected with the `_ setfont` routine.

The following routines are defined:

|                               |   |
|-------------------------------|---|
| <code>_getfontinfo</code>     | get information about the currently selected font         |
| <code>_getgtexttext</code>    | get the length in pixels of a text string                 |
| <code>_getgtextvector</code>  | get the current value of the font text orientation vector |
| <code>_outgtext</code>        | display a string of text in the current font              |
| <code>_registerfonts</code>   | initialize the font graphics system                       |
| <code>_setfont</code>         | select a font from among the registered fonts             |
| <code>_setgtextvector</code>  | set the font text orientation vector                      |
| <code>_unregisterfonts</code> | free memory allocated by the font graphics system         |

### 1.3.9 Presentation Graphics Routines

These routines provide a system for displaying and manipulating presentation graphics elements such as bar charts and pie charts. The presentation graphics routines can be further divided into three classes:

#### *Display Routines*

These routines are for the initialization of the presentation graphics system and the displaying of charts.

#### *Analyze Routines*

These routines calculate default values for chart elements without actually displaying the chart.

#### *Utility Routines*

These routines provide additional support to control the appearance of presentation graphics elements.

The following subsections describe these routine classes in more detail. Each routine in the class is noted with a brief description of its purpose.

#### 1.3.9.1 Display Routines

These routines are for the initialization of the presentation graphics system and the displaying of charts. The `_pg_initchart` routine initializes the system and should be the first presentation graphics routine called. The single-series routines display a single set of data on a chart; the multi-series routines (those ending with `ms`) display several sets of data on the same chart.

The following routines are defined:

|                                 |  |
|---------------------------------|--|
| <code>_pg_chart</code>          | display a bar, column or line chart                        |
| <code>_pg_chartms</code>        | display a multi-series bar, column or line chart           |
| <code>_pg_chartpie</code>       | display a pie chart  |
| <code>_pg_chartscluster</code>  | display a scatter chart                                    |
| <code>_pg_chartsclusterm</code> | display a multi-series scatter chart                       |
| <code>_pg_defaultchart</code>   | initialize the chart environment for a specific chart type |
| <code>_pg_initchart</code>      | initialize the presentation graphics system                |

#### 1.3.9.2 Analyze Routines

These routines calculate default values for chart elements without actually displaying the chart. The routines ending with `ms` analyze multi-series charts; the others analyze single-series charts.

The following routines are defined:

|                                  |  |
|----------------------------------|--|
| <code>_pg_analyzechart</code>    | analyze a bar, column or line chart              |
| <code>_pg_analyzechartms</code>  | analyze a multi-series bar, column or line chart |
| <code>_pg_analyzepie</code>      | analyze a pie chart                              |
| <code>_pg_analyzecluster</code>  | analyze a scatter chart                          |
| <code>_pg_analyzeclusterm</code> | analyze a multi-series scatter chart             |

### 1.3.9.3 Utility Routines

These routines provide additional support to control the appearance of presentation graphics elements.

The following routines are defined:

|                                |  |
|--------------------------------|--|
| <code>_pg_getchardef</code>    | get bit-map definition for a specific character  |
| <code>_pg_getpalette</code>    | get presentation graphics palette (colors, line styles, fill patterns and plot characters) |
| <code>_pg_getstyleset</code>   | get presentation graphics style-set (line styles for window borders and grid lines)        |
| <code>_pg_hlabelchart</code>   | display text horizontally on a chart   |
| <code>_pg_resetpalette</code>  | reset presentation graphics palette to default values                                      |
| <code>_pg_resetstyleset</code> | reset presentation graphics style-set to default values                                    |
| <code>_pg_setchardef</code>    | set bit-map definition for a specific character  |
| <code>_pg_setpalette</code>    | set presentation graphics palette (colors, line styles, fill patterns and plot characters) |
| <code>_pg_setstyleset</code>   | set presentation graphics style-set (line styles for window borders and grid lines)        |
| <code>_pg_vlabelchart</code>   | display text vertically on a chart   |

## 1.4 Include Files

All program modules which use the Graphics Library should include the file `graphapi.fi`. This file contains definitions of all the routines in the library. As well, each routine should include `graph.fi` which contains all the structure and constant definitions.

Modules using the presentation graphics routines should also include the file `pgapi.fi`. As well, each routine should include `pg.fi`.



---

## 2 Graphics Library Routines

This chapter contains, in alphabetical order, descriptions of the routines which comprise the graphics library. Each description consists of a number of subsections:

**Synopsis:**

This subsection gives an example of a declaration for the routine, showing the types of the routine and its arguments.

**Description:**

This subsection is a description of the routine.

**Returns:**

This subsection describes the return value (if any) for the routine.

**See Also:**

This subsection provides a list of related routines.

**Example:**

This subsection consists of an example program demonstrating the use of the routine. In some cases the output from the program is also displayed.

**Classification:**

This subsection provides an indication of where the routine is commonly found. The following notation is used:

**PC Graphics**      These &routines are part of the PC graphics library.

**Systems:**

This subsection provides an indication of where the routine is supported. The following notation is used:

**DOS**      This routine is available on both 16-bit DOS and 32-bit extended DOS.

**QNX**      This routine is available on QNX Software Systems' 16 or 32-bit operating systems.

**Synopsis:**

```
integer*2 function _arc( x1, y1, x2, y2,
                        x3, y3, x4, y4 )

integer*2 x1, y1
integer*2 x2, y2
integer*2 x3, y3
integer*2 x4, y4

integer*2 function _arc_w( x1, y1, x2, y2,
                          x3, y3, x4, y4 )

double precision x1, y1
double precision x2, y2
double precision x3, y3
double precision x4, y4

integer*2 function _arc_wxy( p1, p2, p3, p4 )
record /_ wxycoord/ p1
record /_ wxycoord/ p2
record /_ wxycoord/ p3
record /_ wxycoord/ p4
```

**Description:** The `_arc` routines draw elliptical arcs. The `_arc` routine uses the view coordinate system. The `_arc_w` and `_arc_wxy` routines use the window coordinate system.

The center of the arc is the center of the rectangle established by the points  $(x1, y1)$  and  $(x2, y2)$ . The arc is a segment of the ellipse drawn within this bounding rectangle. The arc starts at the point on this ellipse that intersects the vector from the centre of the ellipse to the point  $(x3, y3)$ . The arc ends at the point on this ellipse that intersects the vector from the centre of the ellipse to the point  $(x4, y4)$ . The arc is drawn in a counter-clockwise direction with the current plot action using the current color and the current line style.

The following picture illustrates the way in which the bounding rectangle and the vectors specifying the start and end points are defined.



When the coordinates (x1,y1) and (x2,y2) establish a line or a point (this happens when one or more of the x-coordinates or y-coordinates are equal), nothing is drawn.

The current output position for graphics output is set to be the point at the end of the arc that was drawn.

**Returns:** The `_arc` routines return a non-zero value when the arc was successfully drawn; otherwise, zero is returned.

**See Also:** `_ellipse`, `_pie`, `_rectangle`, `_getarcinfo`, `_setcolor`, `_setlinestyle`, `_setplotaction`

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

call _setvideomode( _VRES16COLOR )
call _arc( 120, 90, 520, 390, 500, 20, 450, 460 )
pause
call _setvideomode( _DEFAULTMODE )
end
```

produces the following:



**Classification:** PC Graphics

**Systems:** `_arc` - DOS  
`_arc_w` - DOS  
`_arc_wxy` - DOS

## ***\_clearscreen***

---

**Synopsis:**     subroutine \_clearscreen( area )  
                 integer\*2 area

**Description:** The \_clearscreen routine clears the indicated *area* and fills it with the background color. The *area* argument must be one of the following values:

***\_GCLEARSCREEN***     area is entire screen

***\_GVIEWPORT***       area is current viewport or clip region

***\_GWINDOW***         area is current text window

**See Also:**     \_ setbkcolor, \_ setviewport, \_ setcliprpn, \_ settextwindow

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

call _setvideomode( _VRES16COLOR )
call _rectangle( _GFILLINTERIOR,
+               100, 100, 540, 380 )
pause
call _setviewport( 200, 200, 440, 280 )
call _clearscreen( _GVIEWPORT )
pause
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**     DOS

**Synopsis:**     integer\*2 function \_displaycursor( mode )  
              integer\*2 mode

**Description:** The \_displaycursor routine is used to establish whether the text cursor is to be displayed when graphics routines complete. On entry to a graphics routine, the text cursor is turned off. When the routine completes, the *mode* setting determines whether the cursor is turned back on. The *mode* argument can have one of the following values:

***\_GCURSORON***             the cursor will be displayed

***\_GCURSOROFF***          the cursor will not be displayed

**Returns:**     The \_displaycursor routine returns the previous setting for *mode*.

**See Also:**     \_ gettextcursor, \_ setttextcursor

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

character*30 name

call _setvideomode( _ TEXTC80 )
call _setttextposition( 2, 1 )
call _displaycursor( _ GCURSORON )
call _outtext( 'Cursor ON'//char(10)//char(10)
+             //'Enter your name >'c )
read( *, '(a30)' ) name
call _displaycursor( _ GCURSOROFF )
call _setttextposition( 6, 1 )
call _outtext( 'Cursor OFF'//char(10)//char(10)
+             //'Enter your name >'c )
read( *, '(a30)' ) name
call _setvideomode( _ DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**     DOS

**Synopsis:**

```
integer*2 function _ellipse( fill, x1, y1, x2, y2 )
integer*2 fill
integer*2 x1, y1
integer*2 x2, y2

integer*2 function _ellipse_w( fill, x1, y1, x2, y2 )
integer*2 fill,
double precision x1, y1
double precision x2, y2

integer*2 function _ellipse_wxy( fill, p1, p2 )
integer*2 fill,
record /_ wxycoord/ p1, p2
```

**Description:** The `_ellipse` routines draw ellipses. The `_ellipse` routine uses the view coordinate system. The `_ellipse_w` and `_ellipse_wxy` routines use the window coordinate system.

The center of the ellipse is the center of the rectangle established by the points  $(x1, y1)$  and  $(x2, y2)$ .

The argument *fill* determines whether the ellipse is filled in or has only its outline drawn. The argument can have one of two values:

**`_GFILLINTERIOR`**      fill the interior by writing pixels with the current plot action using the current color and the current fill mask

**`_GBORDER`**            leave the interior unchanged; draw the outline of the figure with the current plot action using the current color and line style

When the coordinates  $(x1, y1)$  and  $(x2, y2)$  establish a line or a point (this happens when one or more of the x-coordinates or y-coordinates are equal), nothing is drawn.

**Returns:** The `_ellipse` routines return a non-zero value when the ellipse was successfully drawn; otherwise, zero is returned.

**See Also:** `_arc`, `_rectangle`, `_setcolor`, `_setfillmask`, `_setlinestyle`, `_setplotaction`

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

call _setvideomode( _VRES16COLOR )
call _ellipse( _GBORDER, 120, 90, 520, 390 )
pause
call _setvideomode( _DEFAULTMODE )
end
```

produces the following:



**Classification:** PC Graphics

**Systems:**     `_ellipse` - DOS  
                 `_ellipse_w` - DOS  
                 `_ellipse_wxy` - DOS

**Synopsis:**     integer\*2 function \_floodfill( x, y, stop\_color )  
                 integer\*2 x, y  
                 integer\*2 stop\_color  
  
                 integer\*2 function \_floodfill\_w( x, y, stop\_color )  
                 double precision x, y  
                 integer\*2 stop\_color

**Description:**   The \_floodfill routines fill an area of the screen. The \_floodfill routine uses the view coordinate system. The \_floodfill\_w routine uses the window coordinate system.

The filling starts at the point (x, y) and continues in all directions: when a pixel is filled, the neighbouring pixels (horizontally and vertically) are then considered for filling. Filling is done using the current color and fill mask. No filling will occur if the point (x, y) lies outside the clipping region.

If the argument *stop\_color* is a valid pixel value, filling will occur in each direction until a pixel is encountered with a pixel value of *stop\_color*. The filled area will be the area around (x, y), bordered by *stop\_color*. No filling will occur if the point (x, y) has the pixel value *stop\_color*.

If *stop\_color* has the value (-1), filling occurs until a pixel is encountered with a pixel value different from the pixel value of the starting point (x, y). No filling will occur if the pixel value of the point (x, y) is the current color.

**Returns:**       The \_floodfill routines return zero when no filling takes place; a non-zero value is returned to indicate that filling has occurred.

**See Also:**       \_ setcliprpn, \_ setcolor, \_ setfillmask, \_ setplotaction

**Example:**       include 'graphapi.fi'  
                 include 'graph.fi'  
  
                 call \_setvideomode( \_VRES16COLOR )  
                 call \_setcolor( 1 )  
                 call \_ellipse( \_GBORDER, 120, 90, 520, 390 )  
                 call \_setcolor( 2 )  
                 call \_floodfill( 320, 240, 1 )  
                 pause  
                 call \_setvideomode( \_DEFAULTMODE )  
                 end

**Classification:** PC Graphics

**Systems:**       \_ floodfill - DOS  
                 \_ floodfill\_w - DOS



**Synopsis:** integer\*2 function \_getactivepage()

**Description:** The \_getactivepage routine returns the number of the currently selected active graphics page.

Only some combinations of video modes and hardware allow multiple pages of graphics to exist. When multiple pages are supported, the active page may differ from the visual page. The graphics information in the visual page determines what is displayed upon the screen. Animation may be accomplished by alternating the visual page. A graphics page can be constructed without affecting the screen by setting the active page to be different than the visual page.

The number of available video pages can be determined by using the \_getvideoconfig routine. The default video page is 0.

**Returns:** The \_getactivepage routine returns the number of the currently selected active graphics page.

**See Also:** \_setactivepage, \_setvisualpage, \_getvisualpage, \_getvideoconfig

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer old_ apage, old_ vpage

call _setvideomode( _ HRES16COLOR )
old_ apage = _getactivepage()
old_ vpage = _getvisualpage()
! draw an ellipse on page 0
call _setactivepage( 0 )
call _setvisualpage( 0 )
call _ellipse( _ GFILLINTERIOR, 100, 50,
+              540, 150 )
! draw a rectangle on page 1
call _setactivepage( 1 )
call _rectangle( _ GFILLINTERIOR, 100, 50,
+              540, 150 )
pause
! display page 1
call _setvisualpage( 1 )
pause
call _setactivepage( old_ apage )
call _setvisualpage( old_ vpage )
call _setvideomode( _ DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:** DOS

**Description:** The `_getarcinfo` routine returns information about the arc most recently drawn by the `_arc` or `_pie` routines. The arguments `start_pt` and `end_pt` are set to contain the endpoints of the arc. The argument `inside_pt` will contain the coordinates of a point within the pie. The points are all specified in the view coordinate system.

**Returns:** The `_getarcinfo` routine returns a non-zero value when successful. If the previous arc or pie was not successfully drawn, zero is returned.

```
Example:
include 'graphapi.fi'
include 'graph.fi'

record /xycoord/ start_pt, end_pt, inside_pt

call _setvideomode( _VRES16COLOR )
call _arc( 120, 90, 520, 390, 520, 90, 120, 390 )
call _getarcinfo( start_pt, end_pt, inside_pt )
call _moveto( start_pt.xcoord, start_pt.ycoord )
call _lineto( end_pt.xcoord, end_pt.ycoord )
pause
call _setvideomode( _DEFAULTMODE )
end
```

## 18 Graphics Library Routines



**Classification:** PC Graphics

**Systems:** DOS

**Synopsis:** integer\*4 function \_getbkcolor()

**Description:** The \_getbkcolor routine returns the current background color. In text modes, the background color controls the area behind each individual character. In graphics modes, the background refers to the entire screen. The default background color is 0.

**Returns:** The \_getbkcolor routine returns the current background color.

**See Also:** \_setbkcolor, \_remappalette

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer bk, old_bk
integer colors(16)/
+   _BLACK, _BLUE, _GREEN,
+   _CYAN, _RED, _MAGENTA,
+   _BROWN, _WHITE, _GRAY, _LIGHTBLUE,
+   _LIGHTGREEN, _LIGHTCYAN, _LIGHTRED,
+   _LIGHTMAGENTA, _YELLOW, _BRIGHTWHITE/

call _setvideomode( _VRES16COLOR )
old_bk = _getbkcolor()
do bk = 1, 16
    call _setbkcolor( colors( bk ) )
    pause
enddo
call _setbkcolor( old_bk )
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:** DOS

**Synopsis:**     subroutine \_getcliprgn( x1, y1, x2, y2 )  
                 integer\*2 x1, y1  
                 integer\*2 x2, y2

**Description:** The \_getcliprgn routine returns the location of the current clipping region. A clipping region is defined with the \_setcliprgn or \_setviewport routines. By default, the clipping region is the entire screen.

The current clipping region is a rectangular area of the screen to which graphics output is restricted. The top left corner of the clipping region is placed in the arguments (x1,y1) . The bottom right corner of the clipping region is placed in (x2,y2) .

**See Also:**     \_ setcliprgn, \_ setviewport

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer*2 x1, y1, x2, y2

call _setvideomode( _VRES16COLOR )
call _getcliprgn( x1, y1, x2, y2 )
call _setcliprgn( 130, 100, 510, 380 )
call _ellipse( _GBORDER, 120, 90, 520, 390 )
pause
call _setcliprgn( x1, y1, x2, y2 )
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**     DOS

**Synopsis:**     integer\*2 function \_getcolor()

**Description:** The \_getcolor routine returns the pixel value for the current color. This is the color used for displaying graphics output. The default color value is one less than the maximum number of colors in the current video mode.

**Returns:**     The \_getcolor routine returns the pixel value for the current color.

**See Also:**     \_ setcolor

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer col, old_col

call _setvideomode( _ VRES16COLOR )
old_col = _getcolor()
do col = 0, 15
    call _setcolor( col )
    call _rectangle( _ GFillInterior,
+                  100, 100, 540, 380 )
    pause
enddo
call _setcolor( old_col )
call _setvideomode( _ DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**     DOS

**Synopsis:**     record /xycoord/ function \_getcurrentposition()  
                  record /\_wxycoord/ function \_getcurrentposition\_w()

**Description:** The \_getcurrentposition routines return the current output position for graphics. The \_getcurrentposition routine returns the point in view coordinates. The \_getcurrentposition\_w routine returns the point in window coordinates.

The current position defaults to the origin, (0,0), when a new video mode is selected. It is changed by successful calls to the \_arc, \_moveto and \_lineto routines as well as the \_setviewport routine.

Note that the output position for graphics output differs from that for text output. The output position for text output can be set by use of the \_settextposition routine.

**Returns:**     The \_getcurrentposition routines return the current output position for graphics.

**See Also:**     \_ moveto, \_ settextposition

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

record /xycoord/ old_pos

call _setvideomode( _VRES16COLOR )
old_pos = _getcurrentposition()
call _moveto( 100, 100 )
call _lineto( 540, 100 )
call _lineto( 320, 380 )
call _lineto( 100, 100 )
call _moveto( old_pos.xcoord, old_pos.ycoord )
pause
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**     \_getcurrentposition - DOS  
                  \_getcurrentposition\_w - DOS

**Synopsis:**      subroutine \_getfillmask( mask )  
                 integer\*1 mask(8)

**Description:**    The \_getfillmask routine copies the current fill mask into the area located by the argument *mask*. The fill mask is used by the \_ellipse, \_floodfill, \_pie, \_polygon and \_rectangle routines that fill an area of the screen.

The fill mask is an eight-byte array which is interpreted as a square pattern (8 by 8) of 64 bits. Each bit in the mask corresponds to a pixel. When a region is filled, each point in the region is mapped onto the fill mask. When a bit from the mask is one, the pixel value of the corresponding point is set using the current plotting action with the current color; when the bit is zero, the pixel value of that point is not affected.

When the fill mask is not set, a fill operation will set all points in the fill region to have a pixel value of the current color.

**See Also:**      \_floodfill, \_setfillmask, \_setplotaction

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer*1 old_mask(8)
integer*1 new_mask(8)/
+           '81'x, '42'x, '24'x, '18'x,
+           '18'x, '24'x, '42'x, '81'x/

call _setvideomode( _VRES16COLOR )
call _getfillmask( old_mask )
call _setfillmask( new_mask )
call _rectangle( _GFILLINTERIOR,
+               100, 100, 540, 380 )
call _setfillmask( old_mask )
pause
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**      DOS



**Synopsis:**     integer\*2 function \_getfontinfo( info )  
                  record /\_fontinfo/ info

**Description:** The \_getfontinfo routine returns information about the currently selected font. Fonts are selected with the \_setfont routine. The font information is returned in the \_fontinfo structure indicated by the argument *info*. The structure contains the following fields:

|                  |   |
|------------------|---|
| <i>type</i>      | 1 for a vector font, 0 for a bit-mapped font          |
| <i>ascent</i>    | distance from top of character to baseline in pixels  |
| <i>pixwidth</i>  | character width in pixels (0 for a proportional font) |
| <i>pixheight</i> | character height in pixels                            |
| <i>avgwidth</i>  | average character width in pixels                     |
| <i>filename</i>  | name of the file containing the current font          |
| <i>facename</i>  | name of the current font                              |

**Returns:**     The \_getfontinfo routine returns zero if the font information is returned successfully; otherwise a negative value is returned.

**See Also:**     \_ registerfonts, \_ unregisterfonts, \_ setfont, \_ outgtext, \_ getgtextextent,  
                  \_ setgtextvector, \_ getgtextvector

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

record /_fontinfo/ info

integer width

call _setvideomode( _VRES16COLOR )
call _getfontinfo( info )
call _moveto( 100, 100 )
call _outgtext( 'WATCOM Graphics'c )
width = _getgtextextent( 'WATCOM Graphics'c )
call _rectangle( _GBORDER, 100, 100,
+               100 + width, 100 + info.pixheight )
pause
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**     DOS

## **\_getgtextextent**

---

**Synopsis:**     integer\*2 function \_getgtextextent( text )  
                  character\*(\*) text

**Description:** The \_getgtextextent routine returns the length in pixels of the argument *text* as it would be displayed in the current font by the routine \_outgtext. Note that the text is not displayed on the screen, only its length is determined.

**Returns:**     The \_getgtextextent routine returns the length in pixels of a string.

**See Also:**     \_ registerfonts, \_ unregisterfonts, \_ setfont, \_ getfontinfo, \_ outgtext,  
                  \_ setgtextvector, \_ getgtextvector

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

record /_ fontinfo/ info

integer width

call _setvideomode( _ VRES16COLOR )
call _getfontinfo( info )
call _moveto( 100, 100 )
call _outgtext( 'WATCOM Graphics'c )
width = _getgtextextent( 'WATCOM Graphics'c )
call _rectangle( _ GBORDER, 100, 100,
+               100 + width, 100 + info.pixheight )
pause
call _setvideomode( _ DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**     DOS

**Synopsis:**      record /xycoord/ function \_getgtextvector()

**Description:**    The \_getgtextvector routine returns the current value of the text orientation vector. This is the direction used when text is displayed by the \_outgtext routine.

**Returns:**        The \_getgtextvector routine returns, as anxycoord structure, the current value of the text orientation vector.

**See Also:**        \_registerfonts,\_unregisterfonts,\_setfont,\_getfontinfo,\_outgtext,  
\_getgtextextent,\_setgtextvector

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

record /xycoord/ old_vec

call _setvideomode( _VRES16COLOR )
old_vec = _getgtextvector()
call _setgtextvector( 0, -1 )
call _moveto( 100, 100 )
call _outgtext( 'WATCOM Graphics'c )
call _setgtextvector( old_vec.xcoord, old_vec.ycoord )
pause
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**        DOS

**Synopsis:**

```
subroutine _getimage( x1, y1, x2, y2, image )
integer*2 x1, y1
integer*2 x2, y2
integer*1 image(*)

subroutine _getimage_w( x1, y1, x2, y2, image )
double precision x1, y1
double precision x2, y2
integer*1 image(*)

subroutine _getimage_wxy( p1, p2, image )
record /_ wxycoord/ p1, p2
integer*1 image(*)
```

**Description:** The `_getimage` routines store a copy of an area of the screen into the buffer indicated by the *image* argument. The `_getimage` routine uses the view coordinate system. The `_getimage_w` and `_getimage_wxy` routines use the window coordinate system.

The screen image is the rectangular area defined by the points  $(x1, y1)$  and  $(x2, y2)$ . The buffer *image* must be large enough to contain the image (the size of the image can be determined by using the `_imagesize` routine). The image may be displayed upon the screen at some later time by using the `_putimage` routines.

**See Also:** `_imagesize`, `_putimage`

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer*1 image(:)
integer y, image_size, istat

call _setvideomode( _VRES16COLOR )
call _ellipse( _GFILLINTERIOR,
+             100, 100, 200, 200 )
image_size = _imagesize( 100, 100, 201, 201 )
allocate( image(image_size), stat = istat )
if( istat .eq. 0 )then
    call _getimage( 100, 100, 201, 201, image )
    call _putimage( 260, 200, image, _GPSET )
    call _putimage( 420, 100, image, _GPSET )
    do y = 100, 280, 20
        call _putimage( 420, y, image, _GXOR )
        call _putimage( 420, y+20, image, _GXOR )
    enddo
    deallocate( image )
endif
pause
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**

- `_getimage` - DOS
- `_getimage_w` - DOS
- `_getimage_wxy` - DOS

**Synopsis:** integer\*2 function \_getlinestyle()

**Description:** The \_getlinestyle routine returns the current line-style mask.

The line-style mask determines the style by which lines and arcs are drawn. The mask is treated as an array of 16 bits. As a line is drawn, a pixel at a time, the bits in this array are cyclically tested. When a bit in the array is 1, the pixel value for the current point is set using the current color according to the current plotting action; otherwise, the pixel value for the point is left unchanged. A solid line would result from a value of 'FFFF'x and a dashed line would result from a value of 'F0F0'x.

The default line style mask is 'FFFF'x.

**Returns:** The \_getlinestyle routine returns the current line-style mask.

**See Also:** \_lineto, \_pie, \_rectangle, \_polygon, \_setlinestyle

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer DASHED
parameter (DASHED='f0f0'x)

integer old_style

call _setvideomode( _VRES16COLOR )
old_style = _getlinestyle()
call _setlinestyle( DASHED )
call _rectangle( _GBORDER, 100, 100, 540, 380 )
call _setlinestyle( old_style )
pause
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:** DOS

## **\_getphyscoord**

---

**Synopsis:**     record /xycoord/ function \_getphyscoord( x, y )  
                 integer\*2 x, y

**Description:** The \_getphyscoord routine returns the physical coordinates of the position with view coordinates (x,y) . View coordinates are defined by the \_setvieworg and \_setviewport routines.

**Returns:**     The \_getphyscoord routine returns the physical coordinates, as an xycoord structure, of the given point.

**See Also:**     \_ getviewcoord, \_ setvieworg, \_ setviewport

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

record /xycoord/ pos

real urand
integer seed

seed = 75347
call _setvideomode( _ VRES16COLOR )
call _setvieworg(
+      mod( int( urand( seed )*32767 ), 640 ),
+      mod( int( urand( seed )*32767 ), 480 ) )
pos = _getphyscoord( 0, 0 )
call _rectangle( _ GBORDER,
+      - pos.xcoord, - pos.ycoord,
+      639 - pos.xcoord, 479 - pos.ycoord )
pause
call _setvideomode( _ DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**     DOS

**Synopsis:**     integer\*2 function \_getpixel( x, y )  
                 integer\*2 x, y

                 integer\*2 function \_getpixel\_w( x, y )  
                 double precision x, y

**Description:**   The \_getpixel routines return the pixel value for the point with coordinates (x,y) . The \_getpixel routine uses the view coordinate system. The \_getpixel\_w routine uses the window coordinate system.

**Returns:**        The \_getpixel routines return the pixel value for the given point when the point lies within the clipping region; otherwise, (-1) is returned.

**See Also:**        \_ setpixel

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer x, y, i
real urand
integer seed

seed = 75347
call _setvideomode( _ VRES16COLOR )
call _rectangle( _ GBORDER, 100, 100, 540, 380 )
do i = 0, 60000
  x = 101 + mod( int( urand( seed )*32767 ),
+               439 )
  y = 101 + mod( int( urand( seed )*32767 ),
+               279 )
  call _setcolor( _ getpixel( x, y ) + 1 )
  call _setpixel( x, y )
enddo
pause
call _setvideomode( _ DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**        \_ getpixel - DOS  
                  \_ getpixel\_w - DOS

**Synopsis:** integer\*2 function \_getplotaction()

**Description:** The \_getplotaction routine returns the current plotting action.

The drawing routines cause pixels to be set with a pixel value. By default, the value to be set is obtained by replacing the original pixel value with the supplied pixel value. Alternatively, the replaced value may be computed as a function of the original and the supplied pixel values.

The plotting action can have one of the following values:

|               |  |
|---------------|--|
| <b>_GPSET</b> | replace the original screen pixel value with the supplied pixel value  |
| <b>_GAND</b>  | replace the original screen pixel value with the <i>bitwise and</i> of the original pixel value and the supplied pixel value   |
| <b>_GOR</b>   | replace the original screen pixel value with the <i>bitwise or</i> of the original pixel value and the supplied pixel value  |
| <b>_GXOR</b>  | replace the original screen pixel value with the <i>bitwise exclusive-or</i> of the original pixel value and the supplied pixel value. Performing this operation twice will restore the original screen contents, providing an efficient method to produce animated effects. |

**Returns:** The \_getplotaction routine returns the current plotting action.

**See Also:** \_setplotaction

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer old_act

call _setvideomode( _VRES16COLOR )
old_act = _getplotaction()
call _setplotaction( _GPSET )
call _rectangle( _GFillInterior, 100, 100,
+               540, 380 )
pause
call _setplotaction( _GXOR )
call _rectangle( _GFillInterior, 100, 100,
+               540, 380 )
pause
call _setplotaction( old_act )
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:** DOS



**Synopsis:** integer\*2 function \_gettextcolor()

**Description:** The \_gettextcolor routine returns the pixel value of the current text color. This is the color used for displaying text with the \_outtext and \_outmem routines. The default text color value is set to 7 whenever a new video mode is selected.

**Returns:** The \_gettextcolor routine returns the pixel value of the current text color.

**See Also:** \_settextcolor, \_setcolor, \_outtext, \_outmem

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer old_col
integer old_bk

call _setvideomode( _ TEXTC80 )
old_col = _gettextcolor()
old_bk = _getbkcolor()
call _settextcolor( 7 )
call _setbkcolor( _ BLUE )
call _outtext( ' WATCOM '//char(10)//
+           'Graphics'c )
call _settextcolor( old_col )
call _setbkcolor( old_bk )
pause
call _setvideomode( _ DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:** DOS

**Synopsis:**     integer\*2 function \_gettextcursor()

**Description:** The \_gettextcursor routine returns the current cursor attribute, or shape. The cursor shape is set with the \_settextcursor routine. See the \_settextcursor routine for a description of the value returned by the \_gettextcursor routine.

**Returns:**     The \_gettextcursor routine returns the current cursor shape when successful; otherwise, (-1) is returned.

**See Also:**     \_settextcursor, \_displaycursor

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer*2 old_ shape

old_ shape = _ gettextcursor()
call _ settextcursor( '0007'x )
call _ outtext(
+      char(10)//'Block cursor'c )
pause
call _ settextcursor( '0407'x )
call _ outtext(
+      char(10)//'Half height cursor'c )
pause
call _ settextcursor( '2000'x )
call _ outtext(
+      char(10)//'No cursor'c )
pause
end
```

**Classification:** PC Graphics

**Systems:**     DOS

**Synopsis:**      subroutine \_gettextextent( x, y, text, concat, extent )  
                 integer\*2 x, y  
                 character\*(\*) text  
                 record /xycoord/ concat  
                 record /xycoord/ extent(4)

**Description:**    The \_gettextextent routine simulates the effect of using the \_grtext routine to display the text string *text* at the position (x,y), using the current text settings. The concatenation point is returned in the argument *concat*. The text extent parallelogram is returned in the array *extent*.

The concatenation point is the position to use to output text after the given string. The text extent parallelogram outlines the area where the text string would be displayed. The four points are returned in counter-clockwise order, starting at the upper-left corner.

**See Also:**      \_grtext, \_gettextsettings

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

record /xycoord/ concat, extent(4)

call _setvideomode( _VRES16COLOR )
call _grtext( 100, 100, 'hot'c )
call _gettextextent( 100, 100, 'hot'c,
+                   concat, extent )
call _polygon( _GBORDER, 4, extent )
call _grtext( concat.xcoord, concat.ycoord,
+            'dog'c )
pause
call _setvideomode( _DEFAULTMODE )
end
```

produces the following:



**Classification:** PC Graphics

**Systems:** DOS

**Synopsis:**      record /rccoord/ function \_gettextposition()

**Description:**    The \_gettextposition routine returns the current output position for text. This position is in terms of characters, not pixels.

The current position defaults to the top left corner of the screen, (1,1), when a new video mode is selected. It is changed by successful calls to the \_outtext, \_outmem, \_setttextposition and \_setttextwindow routines.

Note that the output position for graphics output differs from that for text output. The output position for graphics output can be set by use of the \_moveto routine.

**Returns:**        The \_gettextposition routine returns, as an rccoord structure, the current output position for text.

**See Also:**        \_outtext, \_outmem, \_setttextposition, \_setttextwindow, \_moveto

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

record /rccoord/ old_pos

call _setvideomode( _ TEXTC80 )
old_pos = _gettextposition()
call _setttextposition( 10, 40 )
call _outtext( 'WATCOM Graphics'c )
call _setttextposition( old_pos.row, old_pos.col )
pause
call _setvideomode( _ DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**        DOS

## **\_gettextsettings**

---

**Synopsis:**      subroutine \_gettextsettings( settings )  
                 record /textsettings/ settings

**Description:** The \_gettextsettings routine returns information about the current text settings used when text is displayed by the \_grtext routine. The information is stored in the textsettings structure indicated by the argument *settings*. The structure contains the following fields (all are integer\*2 fields):

|                    |  |
|--------------------|--|
| <i>basevectorx</i> | x-component of the current base vector             |
| <i>basevectory</i> | y-component of the current base vector             |
| <i>path</i>        | current text path                                  |
| <i>height</i>      | current text height (in pixels)                    |
| <i>width</i>       | current text width (in pixels)                     |
| <i>spacing</i>     | current text spacing (in pixels)                   |
| <i>horizontaln</i> | horizontal component of the current text alignment |
| <i>verticaln</i>   | vertical component of the current text alignment   |

**See Also:**    \_grtext, \_setcharsize, \_setcharspacing, \_setttextalign, \_setttextpath,  
                 \_setttextorient

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

record /textsettings/ ts

call _setvideomode( _VRES16COLOR )
call _gettextsettings( ts )
call _grtext( 100, 100, 'WATCOM'c )
call _setcharsize( 2 * ts.height, 2 * ts.width )
call _grtext( 100, 300, 'Graphics'c )
call _setcharsize( ts.height, ts.width )
pause
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**     DOS

**Synopsis:**     subroutine \_gettextwindow( row1, col1, row2, col2 )  
                 integer\*2 row1, col1  
                 integer\*2 row2, col2

**Description:** The \_gettextwindow routine returns the location of the current text window. A text window is defined with the \_settextwindow routine. By default, the text window is the entire screen.

The current text window is a rectangular area of the screen. Text display is restricted to be within this window. The top left corner of the text window is placed in the arguments (row1,col1). The bottom right corner of the text window is placed in (row2,col2).

**See Also:**     \_ settextwindow, \_ outtext, \_ outmem, \_ settextposition, \_ scrolltextwindow

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer i
integer*2 r1, c1, r2, c2
character*80 buff

call _setvideomode( _TEXTC80 )
call _gettextwindow( r1, c1, r2, c2 )
call _settextwindow( 5, 20, 20, 40 )
do i = 1, 20
    write( buff, '(Line ', i2, ', ', a1, a1 )' )
+      i, char(10), char(0)
    call _outtext( buff )
enddo
pause
call _settextwindow( r1, c1, r2, c2 )
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**     DOS

**Synopsis:**      subroutine `_getvideoconfig( config )`  
                 record `/videoconfig/ config`

**Description:** The `_getvideoconfig` routine returns information about the current video mode and the hardware configuration. The information is returned in the `videoconfig` structure indicated by the argument `config`. The structure contains the following fields (all are `integer*2` fields):

|                      |   |
|----------------------|---|
| <i>numxpixels</i>    | number of pixels in x-axis                            |
| <i>numypixels</i>    | number of pixels in y-axis                            |
| <i>numtextcols</i>   | number of text columns                                |
| <i>numtextrows</i>   | number of text rows                                   |
| <i>numcolors</i>     | number of actual colors                               |
| <i>bitsperpixel</i>  | number of bits in a pixel value                       |
| <i>numvideopages</i> | number of video pages                                 |
| <i>mode</i>          | current video mode                                    |
| <i>adapter</i>       | adapter type  |
| <i>monitor</i>       | monitor type  |
| <i>memory</i>        | number of kilobytes (1024 characters) of video memory |

The `adapter` field will contain one of the following values:

|                          |                                    |
|--------------------------|------------------------------------|
| <i><b>_NODISPLAY</b></i> | no display adapter attached        |
| <i><b>_UNKNOWN</b></i>   | unknown adapter/monitor type       |
| <i><b>_MDPA</b></i>      | Monochrome Display/Printer Adapter |
| <i><b>_CGA</b></i>       | Color Graphics Adapter             |
| <i><b>_HERCULES</b></i>  | Hercules Monochrome Adapter        |
| <i><b>_MCGA</b></i>      | Multi-Color Graphics Array         |
| <i><b>_EGA</b></i>       | Enhanced Graphics Adapter          |
| <i><b>_VGA</b></i>       | Video Graphics Array               |
| <i><b>_SVGA</b></i>      | SuperVGA Adapter                   |



The `monitor` field will contain one of the following values:

|                            |                    |
|----------------------------|--------------------|
| <b><i>_MONO</i></b>        | regular monochrome |
| <b><i>_COLOR</i></b>       | regular color      |
| <b><i>_ENHANCED</i></b>    | enhanced color     |
| <b><i>_ANALOGMONO</i></b>  | analog monochrome  |
| <b><i>_ANALOGCOLOR</i></b> | analog color       |

The amount of memory reported by `_getvideoconfig` will not always be correct for SuperVGA adapters. Since it is not always possible to determine the amount of memory, `_getvideoconfig` will always report 256K, the minimum amount.

**See Also:** `_setvideomode`, `_setvideomoderows`

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer mode
record /videoconfig/ vc
character*80 buff

call _getvideoconfig( vc )
select( vc.adapter )
case( _VGA, _SVGA )
    mode = _VRES16COLOR
case( _MCGA )
    mode = _MRES256COLOR
case( _EGA )
    if( vc.monitor .eq. _MONO )then
        mode = _ERESNOCOLOR
    else
        mode = _ERESCOLOR
    endif
case( _CGA )
    mode = _MRES4COLOR
case( _HERCULES )
    mode = _HERCMONO
case default
    stop 'No graphics adapter'
endselect
if( _setvideomode( mode ) .ne. 0 )then
    call _getvideoconfig( vc )
    write( buff,
+         '( i3, '' x '', i3, '' x '', i3, a1 )' )
+         vc.numxpixels, vc.numypixels,
+         vc.numcolors, char(0)
    call _outtext( buff )
    pause
    call _setvideomode( _DEFAULTMODE )
endif
end
```

**Classification:** PC Graphics

**Systems:** DOS

**Synopsis:**

```
record /xycoord/ function _getviewcoord( x, y )
integer*2 x, y

record /xycoord/ function _getviewcoord_w( x, y )
double precision x, y

record /xycoord/ function _getviewcoord_wxy( p )
record /_wxycoord/ p
```

**Description:** The `_getviewcoord` routines translate a point from one coordinate system to viewport coordinates. The `_getviewcoord` routine translates the point (x, y) from physical coordinates. The `_getviewcoord_w` and `_getviewcoord_wxy` routines translate the point from the window coordinate system.

Viewport coordinates are defined by the `_setvieworg` and `_setviewport` routines. Window coordinates are defined by the `_setwindow` routine.

**Returns:** The `_getviewcoord` routines return the viewport coordinates, as an `xycoord` structure, of the given point.

**See Also:** `_getphyscoord`, `_setvieworg`, `_setviewport`, `_setwindow`

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

record /xycoord/ pos1, pos2

integer seed
real urand

seed = 75347
call _setvideomode( _VRES16COLOR )
call _setvieworg(
+      mod( int( urand( seed )*32767 ), 640 ),
+      mod( int( urand( seed )*32767 ), 480 ) )
pos1 = _getviewcoord( 0, 0 )
pos2 = _getviewcoord( 639, 479 )
call _rectangle( _GBORDER,
+              pos1.xcoord, pos1.ycoord,
+              pos2.xcoord, pos2.ycoord )
pause
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:** `_getviewcoord` - DOS  
          `_getviewcoord_w` - DOS  
          `_getviewcoord_wxy` - DOS

**Synopsis:** integer\*2 function \_getvisualpage()

**Description:** The \_getvisualpage routine returns the number of the currently selected visual graphics page.

Only some combinations of video modes and hardware allow multiple pages of graphics to exist. When multiple pages are supported, the active page may differ from the visual page. The graphics information in the visual page determines what is displayed upon the screen. Animation may be accomplished by alternating the visual page. A graphics page can be constructed without affecting the screen by setting the active page to be different than the visual page.

The number of available video pages can be determined by using the \_getvideoconfig routine. The default video page is 0.

**Returns:** The \_getvisualpage routine returns the number of the currently selected visual graphics page.

**See Also:** \_setvisualpage, \_setactivepage, \_getactivepage, \_getvideoconfig

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer old_ apage, old_ vpage

call _setvideomode( _ HRES16COLOR )
old_ apage = _getactivepage()
old_ vpage = _getvisualpage()
! draw an ellipse on page 0
call _setactivepage( 0 )
call _setvisualpage( 0 )
call _ellipse( _ GFILLINTERIOR, 100, 50,
+              540, 150 )
! draw a rectangle on page 1
call _setactivepage( 1 )
call _rectangle( _ GFILLINTERIOR, 100, 50,
+               540, 150 )
pause
! display page 1
call _setvisualpage( 1 )
pause
call _setactivepage( old_ apage )
call _setvisualpage( old_ vpage )
call _setvideomode( _ DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:** DOS

**Synopsis:**     record /\_ wxycoord/ function \_ getwindowcoord( x, y )  
                 integer\*2 x, y

**Description:** The \_ getwindowcoord routine returns the window coordinates of the position with view coordinates (x,y) . Window coordinates are defined by the \_ setwindow routine.

**Returns:**     The \_ getwindowcoord routine returns the window coordinates, as a \_ wxycoord structure, of the given point.

**See Also:**     \_ setwindow, \_ getviewcoord

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

record /xycoord/ centre
record /_ wxycoord/ pos1, pos2

call _ setvideomode( _ MAXRESMODE )
! draw a box 50 pixels square
! in the middle of the screen
centre = _ getviewcoord_w( 0.5, 0.5 )
pos1 = _ getwindowcoord( centre.xcoord - 25,
+                         centre.ycoord - 25 )
pos2 = _ getwindowcoord( centre.xcoord + 25,
+                         centre.ycoord + 25 )
call _ rectangle_wxy( _ GBORDER, pos1, pos2 )
pause
call _ setvideomode( _ DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**     DOS

**Synopsis:** integer\*2 function \_grstatus()

**Description:** The \_grstatus routine returns the status of the most recently called graphics library routine. The routine can be called after any graphics routine to determine if any errors or warnings occurred. The routine returns 0 if the previous routine was successful. Values less than 0 indicate an error occurred; values greater than 0 indicate a warning condition.

The following values can be returned: uindex=2 uindex=2 uindex=2 uindex=2 uindex=2 uindex=2  
uindex=2 uindex=2 uindex=2 uindex=2

| Constant              | Value | Explanation                  |
|-----------------------|-------|------------------------------|
| _GROK                 | 0     | no error                     |
| _GRERROR              | -1    | graphics error               |
| _GRMODENOTSUPPORTED   | -2    | video mode not supported     |
| _GRNOTINPROPERMODE    | -3    | routine n/a in this mode     |
| _GRINVALIDPARAMETER   | -4    | invalid parameter(s)         |
| _GRINSUFFICIENTMEMORY | -5    | out of memory                |
| _GRFONTFILENOTFOUND   | -6    | can't open font file         |
| _GRINVALIDFONTFILE    | -7    | font file has invalid format |
| _GRNOOUTPUT           | 1     | nothing was done             |
| _GRCLIPPED            | 2     | output clipped               |

**Returns:** The \_grstatus routine returns the status of the most recently called graphics library routine.

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer x, y
real urand
integer seed

seed = 75347
call _setvideomode( _VRES16COLOR )
while( _grstatus() .eq. _GROK )do
    x = mod( int( urand( seed )*32767 ), 700 )
    y = mod( int( urand( seed )*32767 ), 500 )
    call _setpixel( x, y )
endwhile
pause
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:** DOS

**Synopsis:**

```
integer*2 function __grtext( x, y, text )
integer*2 x, y
character*(*) text

integer*2 function __grtext_w( x, y, text )
double precision x, y
character*(*) text
```

**Description:** The `__grtext` routines display a character string. The `__grtext` routine uses the view coordinate system. The `__grtext_w` routine uses the window coordinate system.

The character string *text* is displayed at the point (x,y) . The string must be terminated by a null character (char(0)). The text is displayed in the current color using the current text settings.

The graphics library can display text in three different ways.

1. The `__outtext` and `__outmem` routines can be used in any video mode. However, this variety of text can be displayed in only one size.
2. The `__grtext` routine displays text as a sequence of line segments, and can be drawn in different sizes, with different orientations and alignments.
3. The `__outgtext` routine displays text in the currently selected font. Both bit-mapped and vector fonts are supported; the size and type of text depends on the fonts that are available.

**Returns:** The `__grtext` routines return a non-zero value when the text was successfully drawn; otherwise, zero is returned.

**See Also:** `__outtext`, `__outmem`, `__outgtext`, `__setcharsize`, `__setttextalign`, `__setttextpath`, `__setttextorient`, `__setcharspacing`

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

call __setvideomode( __VRES16COLOR )
call __grtext( 200, 100, ' WATCOM'c )
call __grtext( 200, 200, 'Graphics'c )
pause
call __setvideomode( __DEFAULTMODE )
end
```

produces the following:



**Classification:** PC Graphics

**Systems:**     \_`grtext` - DOS  
              \_`grtext_w` - DOS



**Synopsis:**

```
integer*4 function _imagesize( x1, y1, x2, y2 )
integer*2 x1, y1
integer*2 x2, y2

integer*4 function _imagesize_w( x1, y1, x2, y2 )
double precision x1, y1
double precision x2, y2

integer*4 function _imagesize_wxy( p1, p2 )
record /_wxycoord/ p1, p2
```

**Description:** The `_imagesize` routines compute the number of bytes required to store a screen image. The `_imagesize` routine uses the view coordinate system. The `_imagesize_w` and `_imagesize_wxy` routines use the window coordinate system.

The screen image is the rectangular area defined by the points `(x1,y1)` and `(x2,y2)`. The storage area used by the `_getimage` routines must be at least this large (in bytes).

**Returns:** The `_imagesize` routines return the size of a screen image.

**See Also:** `_getimage`, `_putimage`

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer*1 image(:)
integer y, image_size, istat

call _setvideomode( _VRES16COLOR )
call _ellipse( _GFILLINTERIOR,
+             100, 100, 200, 200 )
image_size = _imagesize( 100, 100, 201, 201 )
allocate( image(image_size), stat = istat )
if( istat .eq. 0 )then
    call _getimage( 100, 100, 201, 201, image )
    call _putimage( 260, 200, image, _GPSET )
    call _putimage( 420, 100, image, _GPSET )
    do y = 100, 280, 20
        call _putimage( 420, y, image, _GXOR )
        call _putimage( 420, y+20, image, _GXOR )
    enddo
    deallocate( image )
endif
pause
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:** `_imagesize` - DOS  
          `_imagesize_w` - DOS  
          `_imagesize_wxy` - DOS

**Synopsis:**     integer\*2 function \_lineto( x, y )  
              integer\*2 x, y

integer\*2 function \_lineto\_w( x, y )  
double precision x, y

**Description:**   The \_lineto routines draw straight lines. The \_lineto routine uses the view coordinate system. The \_lineto\_w routine uses the window coordinate system.

The line is drawn from the current position to the point at the coordinates (x, y) . The point (x, y) becomes the new current position. The line is drawn with the current plotting action using the current line style and the current color.

**Returns:**       The \_lineto routines return a non-zero value when the line was successfully drawn; otherwise, zero is returned.

**See Also:**        \_moveto, \_setcolor, \_setlinestyle, \_setplotaction

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

call _setvideomode( _VRES16COLOR )
call _moveto( 100, 100 )
call _lineto( 540, 100 )
call _lineto( 320, 380 )
call _lineto( 100, 100 )
pause
call _setvideomode( _DEFAULTMODE )
end
```

produces the following:



**Classification:** PC Graphics

**Systems:**     \_ lineto - DOS  
                 \_ lineto\_w - DOS

## ***\_moveto Routines***

---

**Synopsis:**     `record /xycoord/ function _moveto( x, y )`  
                  `integer*2 x, y`

`record /_wxycoord/ function _moveto_w( x, y )`  
                  `double precision x, y`

**Description:**   The `_moveto` routines set the current output position for graphics. The `_moveto` routine uses the view coordinate system. The `_moveto_w` routine uses the window coordinate system.

The current output position is set to be the point at the coordinates  $(x, y)$ . Nothing is drawn by the routine. The `_lineto` routine uses the current output position as the starting point when a line is drawn.

Note that the output position for graphics output differs from that for text output. The output position for text output can be set by use of the `_settextposition` routine.

**Returns:**       The `_moveto` routines return the previous value of the output position for graphics.

**See Also:**       `_getcurrentposition`, `_lineto`, `_settextposition`

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

call _setvideomode( _VRES16COLOR )
call _moveto( 100, 100 )
call _lineto( 540, 100 )
call _lineto( 320, 380 )
call _lineto( 100, 100 )
pause
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**       `_moveto` - DOS  
                  `_moveto_w` - DOS

**Synopsis:**      subroutine \_outgtext( text )  
                 character\*(\*) text

**Description:**    The \_outgtext routine displays the character string indicated by the argument *text*. The string must be terminated by a null character (char(0)).

The string is displayed starting at the current position (see the \_moveto routine) in the current color and in the currently selected font (see the \_setfont routine). The current position is updated to follow the displayed text.

When no font has been previously selected with \_setfont, a default font will be used. The default font is an 8-by-8 bit-mapped font.

The graphics library can display text in three different ways.

1.    The \_outtext and \_outmem routines can be used in any video mode. However, this variety of text can be displayed in only one size.
2.    The \_grtext routine displays text as a sequence of line segments, and can be drawn in different sizes, with different orientations and alignments.
3.    The \_outgtext routine displays text in the currently selected font. Both bit-mapped and vector fonts are supported; the size and type of text depends on the fonts that are available.

**See Also:**        \_registerfonts, \_unregisterfonts, \_setfont, \_getfontinfo, \_getgtextextent,  
                 \_setgtextvector, \_getgtextvector, \_outtext, \_outmem, \_grtext

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer i, n
character*10 buff

call _setvideomode( _VRES16COLOR )
n = _registerfonts( '*.fon'c )
do i = 0, n - 1
    write( buff, '( "n", i2.2, a1 )' ) i, char(0)
    call _setfont( buff )
    call _moveto( 100, 100 )
    call _outgtext( 'WATCOM Graphics'c )
    pause
    call _clearscreen( _GCLEARSCREEN )
enddo
call _unregisterfonts()
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**        DOS

**Synopsis:**      subroutine \_outmem( text, length )  
                 character\*(\*) text  
                 integer\*2 length

**Description:**    The \_outmem routine displays the character string indicated by the argument *text*. The argument *length* specifies the number of characters to be displayed. Unlike the \_outtext routine, \_outmem will display the graphical representation of characters such as ASCII 10 and 0, instead of interpreting them as control characters.

The text is displayed using the current text color (see the \_settextcolor routine), starting at the current text position (see the \_settextposition routine). The text position is updated to follow the end of the displayed text.

The graphics library can display text in three different ways.

1.    The \_outtext and \_outmem routines can be used in any video mode. However, this variety of text can be displayed in only one size.
2.    The \_grtext routine displays text as a sequence of line segments, and can be drawn in different sizes, with different orientations and alignments.
3.    The \_outgtext routine displays text in the currently selected font. Both bit-mapped and vector fonts are supported; the size and type of text depends on the fonts that are available.

**See Also:**      \_settextcolor, \_settextposition, \_settextwindow, \_grtext, \_outtext,  
                 \_outgtext

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer i
character*20 buf

call _clearscreen( _GCLEARSCREEN )
do i = 0, 255
    call _settextposition( 1 + mod( i, 16 ),
+                          1 + 5 * ( i / 16 ) )
    buf( 1:1 ) = char( i )
    call _outmem( buf, 1 )
enddo
pause
end
```

**Classification:** PC Graphics

**Systems:**      DOS

**Synopsis:**      subroutine \_outtext( text )  
                 character\*(\*) text

**Description:**    The \_outtext routine displays the character string indicated by the argument *text*. The string must be terminated by a null character (char(0)). When a line-feed character (char(10)) is encountered in the string, the characters following will be displayed on the next row of the screen.

The text is displayed using the current text color (see the \_settextcolor routine), starting at the current text position (see the \_settextposition routine). The text position is updated to follow the end of the displayed text.

The graphics library can display text in three different ways.

1.    The \_outtext and \_outmem routines can be used in any video mode. However, this variety of text can be displayed in only one size.
2.    The \_grtext routine displays text as a sequence of line segments, and can be drawn in different sizes, with different orientations and alignments.
3.    The \_outgtext routine displays text in the currently selected font. Both bit-mapped and vector fonts are supported; the size and type of text depends on the fonts that are available.

**See Also:**      \_settextcolor, \_settextposition, \_settextwindow, \_grtext, \_outmem,  
                 \_outgtext

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

call _setvideomode( _TEXTC80 )
call _settextposition( 10, 30 )
call _outtext( 'WATCOM Graphics'c )
pause
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**      DOS

**Synopsis:**

```
integer*2 function _pg_analyzechart( env, cat, values, n )
record /chartenv/ env
integer*4 cat(*)
real values(*)
integer*2 n

integer*2 function _pg_analyzechartms( env, cat, values,
                                     nseries, n,
                                     dim, labels )

record /chartenv/ env
integer*4 cat(*)
real values(*)
integer*2 nseries, n, dim
integer*4 labels(*)
```

**Description:** The `_pg_analyzechart` routines analyze either a single-series or a multi-series bar, column or line chart. These routines calculate default values for chart elements without actually displaying the chart.

The `_pg_analyzechart` routine analyzes a single-series bar, column or line chart. The chart environment structure `env` is filled with default values based on the type of chart and the values of the `cat` and `values` arguments. The arguments are the same as for the `_pg_chart` routine.

The `_pg_analyzechartms` routine analyzes a multi-series bar, column or line chart. The chart environment structure `env` is filled with default values based on the type of chart and the values of the `cat`, `values` and `labels` arguments. The arguments are the same as for the `_pg_chartms` routine.

**Returns:** The `_pg_analyzechart` routines return zero if successful; otherwise, a non-zero value is returned.

**See Also:** `_pg_defaultchart`, `_pg_initchart`, `_pg_chart`, `_pg_chartpie`,  
`_pg_chartscatter`, `_pg_analyzepie`, `_pg_analyzescatter`



**Example:**

```
include 'graphapi.fi'
include 'graph.fi'
include 'pgapi.fi'
include 'pg.fi'

integer NUM_ VALUES
parameter (NUM_ VALUES=4)

integer*4 categories( NUM_ VALUES )
real values( NUM_ VALUES )
+           / 20, 45, 30, 25 /

record /chartenv/ env

categories( 1 ) = loc( 'Jan'c )
categories( 2 ) = loc( 'Feb'c )
categories( 3 ) = loc( 'Mar'c )
categories( 4 ) = loc( 'Apr'c )

call _ setvideomode( _ VRES16COLOR )
call _ pg_ initchart()
call _ pg_ defaultchart( env,
+           _ PG_ COLUMNCHART, _ PG_ PLAINBARS )
env.maintitle.title = 'Column Chart'c
call _ pg_ analyzechart( env, categories,
+           values, NUM_ VALUES )
! use manual scaling
env.yaxis.autoscale = 0
env.yaxis.scalemin = 0.0
env.yaxis.scalemax = 100.0
env.yaxis.ticinterval = 25.0
call _ pg_ chart( env, categories,
+           values, NUM_ VALUES )
pause
call _ setvideomode( _ DEFAULTMODE )
end
```

**Classification:** PC Graphics**Systems:**    \_pg\_ analyzechart - DOS  
             \_pg\_ analyzechartms - DOS

**Description:** The `_pg_analyzepie` routine analyzes a pie chart. This routine calculates default values for chart elements without actually displaying the chart.

**Returns:** The `_pg_analyzepie` routine returns zero if successful; otherwise, a non-zero value is returned.

## 58 Graphics Library Routines

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'
include 'pgapi.fi'
include 'pg.fi'

integer NUM_VALUES
parameter (NUM_VALUES=4)

integer*4 categories( NUM_VALUES )
real values( NUM_VALUES )
+       / 20, 45, 30, 25 /
integer*2 explode( NUM_VALUES )
+       / 1, 0, 0, 0 /

record /chartenv/ env

categories( 1 ) = loc( 'Jan'c )
categories( 2 ) = loc( 'Feb'c )
categories( 3 ) = loc( 'Mar'c )
categories( 4 ) = loc( 'Apr'c )

call _setvideomode( _VRES16COLOR )
call _pg_initchart()
call _pg_defaultchart( env,
+       _PG_PIECHART, _PG_NOPERCENT )
env.maintitle.title = 'Pie Chart'c
env.legend.place = _PG_BOTTOM
call _pg_analyzepie( env, categories,
+       values, explode, NUM_VALUES )
! make legend window same width as data window
env.legend.autosize = 0
env.legend.legendwindow.x1 = env.datawindow.x1
env.legend.legendwindow.x2 = env.datawindow.x2
call _pg_chartpie( env, categories,
+       values, explode, NUM_VALUES )
pause
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:** DOS

**Synopsis:**

```
integer*2 function _pg_analyzescatter( env, x, y, n )
record /chartenv/ env
real x(*), y(*)
integer*2 n

integer*2 function _pg_analyzescatterterms( env, x, y,
                                             nseries, n,
                                             dim, labels )

record /chartenv/ env
real x(*), y(*)
integer*2 nseries, n, dim
integer*4 labels(*)
```

**Description:** The `_pg_analyzescatter` routines analyze either a single-series or a multi-series scatter chart. These routines calculate default values for chart elements without actually displaying the chart.

The `_pg_analyzescatter` routine analyzes a single-series scatter chart. The chart environment structure `env` is filled with default values based on the values of the `x` and `y` arguments. The arguments are the same as for the `_pg_chartscatter` routine.

The `_pg_analyzescatterterms` routine analyzes a multi-series scatter chart. The chart environment structure `env` is filled with default values based on the values of the `x`, `y` and `labels` arguments. The arguments are the same as for the `_pg_chartscatterterms` routine.

**Returns:** The `_pg_analyzescatter` routines return zero if successful; otherwise, a non-zero value is returned.

**See Also:** `_pg_defaultchart`, `_pg_initchart`, `_pg_chart`, `_pg_chartpie`,  
`_pg_chartscatter`, `_pg_analyzechart`, `_pg_analyzepie`

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'
include 'pgapi.fi'
include 'pg.fi'

integer NUM_VALUES
parameter (NUM_VALUES=4)
integer NUM_SERIES
parameter (NUM_SERIES=2)

integer*4 labels( NUM_SERIES )
real x( NUM_SERIES, NUM_VALUES )
+      / 5, 15, 30, 40, 10, 20, 30, 45 /
real y( NUM_SERIES, NUM_VALUES )
+      / 10, 15, 30, 45, 40, 30, 15, 5 /

record /chartenv/ env

labels( 1 ) = loc( 'Jan'c )
labels( 2 ) = loc( 'Feb'c )

call _setvideomode( _VRES16COLOR )
call _pg_initchart()
call _pg_defaultchart( env,
+      _PG_SCATTERCHART, _PG_POINTANDLINE )
env.maintitle.title = 'Scatter Chart'c
call _pg_analyzescatterterms( env, x, y, NUM_SERIES,
+      NUM_VALUES, NUM_VALUES, labels )
! display x-axis labels with 2 decimal places
env.xaxis.autoscale = 0
env.xaxis.ticdecimals = 2
call _pg_chartscatterterms( env, x, y, NUM_SERIES,
+      NUM_VALUES, NUM_VALUES, labels )
pause
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**     \_pg\_analyzescatter - DOS  
             \_pg\_analyzescatterterms - DOS

**Synopsis:**

```
integer*2 function _pg_chart( env, cat, values, n )
record /chartenv/ env
integer*4 cat(*)
real values(*)
integer*2 n

integer*2 function _pg_chartms( env, cat, values, nseries,
                                n, dim, labels )

record /chartenv/ env
integer*4 cat(*)
real values(*)
integer*2 nseries, n, dim
integer*4 labels(*)
```

**Description:** The `_pg_chart` routines display either a single-series or a multi-series bar, column or line chart. The type of chart displayed and other chart options are contained in the *env* argument. The argument *cat* is an array of addresses of strings. These strings describe the categories against which the data in the *values* array is charted.

The `_pg_chart` routine displays a bar, column or line chart from the single series of data contained in the *values* array. The argument *n* specifies the number of values to chart.

The `_pg_chartms` routine displays a multi-series bar, column or line chart. The argument *nseries* specifies the number of series of data to chart. The argument *values* is assumed to be a two-dimensional array defined as follows:

```
real values( nseries, dim )
```

The number of values used from each series is given by the argument *n*, where *n* is less than or equal to *dim*. The argument *labels* is an array of addresses of strings. These strings describe each of the series and are used in the chart legend.

**Returns:** The `_pg_chart` routines return zero if successful; otherwise, a non-zero value is returned.

**See Also:** `_pg_defaultchart`, `_pg_initchart`, `_pg_chartpie`, `_pg_chartscatter`,  
`_pg_analyzechart`, `_pg_analyzepie`, `_pg_analyzescatter`

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'
include 'pgapi.fi'
include 'pg.fi'

integer NUM_VALUES
parameter (NUM_VALUES=4)

integer*4 categories( NUM_VALUES )
real values( NUM_VALUES )
+           / 20, 45, 30, 25 /

record /chartenv/ env

categories( 1 ) = loc( 'Jan'c )
categories( 2 ) = loc( 'Feb'c )
categories( 3 ) = loc( 'Mar'c )
categories( 4 ) = loc( 'Apr'c )

call _setvideomode( _VRES16COLOR )
call _pg_initchart()
call _pg_defaultchart( env,
+                       _PG_COLUMNCHART, _PG_PLAINBARS )
env.maintitle.title = 'Column Chart'c
call _pg_chart( env, categories,
+               values, NUM_VALUES )
pause
call _setvideomode( _DEFAULTMODE )
end
```

produces the following:



**Classification:** PC Graphics

## ***\_pg\_chart Routines***

---

**Systems:**     \_pg\_chart - DOS  
              \_pg\_chartms - DOS



**Synopsis:**     integer\*2 function \_pg\_chartpie( env, cat, values, explode, n )  
                record /chartenv/ env  
                integer\*4 cat(\*)  
                real values(\*)  
                integer\*2 explode(\*), n

**Description:**   The `_pg_chartpie` routine displays a pie chart. The chart is displayed using the options specified in the `env` argument.

The pie chart is created from the data contained in the `values` array. The argument `n` specifies the number of values to chart.

The argument `cat` is an array of addresses of strings. These strings describe each of the pie slices and are used in the chart legend. The argument `explode` is an array of values corresponding to each of the pie slices. For each non-zero element in the array, the corresponding pie slice is drawn "exploded", or slightly offset from the rest of the pie.

**Returns:**       The `_pg_chartpie` routine returns zero if successful; otherwise, a non-zero value is returned.

**See Also:**       `_pg_defaultchart`, `_pg_initchart`, `_pg_chart`, `_pg_chartscatter`,  
                  `_pg_analyzechart`, `_pg_analyzepie`, `_pg_analyzescatter`

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'
include 'pgapi.fi'
include 'pg.fi'

integer NUM_VALUES
parameter (NUM_VALUES=4)

integer*4 categories( NUM_VALUES )
real values( NUM_VALUES )
+           / 20, 45, 30, 25 /
integer*2 explode( NUM_VALUES )
+           / 1, 0, 0, 0 /

record /chartenv/ env

categories( 1 ) = loc( 'Jan'c )
categories( 2 ) = loc( 'Feb'c )
categories( 3 ) = loc( 'Mar'c )
categories( 4 ) = loc( 'Apr'c )

call _setvideomode( _VRES16COLOR )
call _pg_initchart()
call _pg_defaultchart( env,
+                     _PG_PIECHART, _PG_NOPERCENT )
env.maintitle.title = 'Pie Chart'c
call _pg_chartpie( env, categories,
+                 values, explode, NUM_VALUES )
pause
call _setvideomode( _DEFAULTMODE )
end
```

produces the following:



**Classification:** PC Graphics

**Systems:** DOS

**Synopsis:**

```
integer*2 function _pg_chartscatter( env, x, y, n )
record /chartenv/ env
float x(*), y(*)
integer*2 n

integer*2 function _pg_chartscatterterms( env, x, y, nseries,
                                          n, dim, labels )

record /chartenv/ env
real x(*), y(*)
integer*2 nseries, n, dim
integer*4 labels(*)
```

**Description:** The `_pg_chartscatter` routines display either a single-series or a multi-series scatter chart. The chart is displayed using the options specified in the *env* argument.

The `_pg_chartscatter` routine displays a scatter chart from the single series of data contained in the arrays *x* and *y*. The argument *n* specifies the number of values to chart.

The `_pg_chartscatterterms` routine displays a multi-series scatter chart. The argument *nseries* specifies the number of series of data to chart. The arguments *x* and *y* are assumed to be two-dimensional arrays defined as follows:

```
real x( nseries, dim )
```

The number of values used from each series is given by the argument *n*, where *n* is less than or equal to *dim*. The argument *labels* is an array of addresses of strings. These strings describe each of the series and are used in the chart legend.

**Returns:** The `_pg_chartscatter` routines return zero if successful; otherwise, a non-zero value is returned.

**See Also:** `_pg_defaultchart`, `_pg_initchart`, `_pg_chart`, `_pg_chartpie`,  
`_pg_analyzechart`, `_pg_analyzepie`, `_pg_analyzescatter`

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'
include 'pgapi.fi'
include 'pg.fi'

integer NUM_VALUES
parameter (NUM_VALUES=4)
integer NUM_SERIES
parameter (NUM_SERIES=2)

integer*4 labels( NUM_SERIES )
real x( NUM_SERIES, NUM_VALUES )
+      / 5, 15, 30, 40, 10, 20, 30, 45 /
real y( NUM_SERIES, NUM_VALUES )
+      / 10, 15, 30, 45, 40, 30, 15, 5 /

record /chartenv/ env

labels( 1 ) = loc( 'Jan'c )
labels( 2 ) = loc( 'Feb'c )

call _setvideomode( _VRES16COLOR )
call _pg_initchart()
call _pg_defaultchart( env,
+      _PG_SCATTERCHART, _PG_POINTANDLINE )
env.maintitle.title = 'Scatter Chart'c
call _pg_chartscatterterms( env, x, y, NUM_SERIES,
+      NUM_VALUES, NUM_VALUES, labels )
pause
call _setvideomode( _DEFAULTMODE )
end
```

produces the following:



**Classification:** PC Graphics

**Systems:**     \_pg\_chartscatter - DOS  
                 \_pg\_chartscatterms - DOS

**Synopsis:**     integer\*2 function `_pg_defaultchart( env, type, style )`  
                  record /chartenv/ env  
                  integer\*2 type, style

**Description:**   The `_pg_defaultchart` routine initializes the chart structure *env* to contain default values before a chart is drawn. All values in the chart structure are initialized, including blanking of all titles. The chart type in the structure is initialized to the value *type*, and the chart style is initialized to *style*.

The argument *type* can have one of the following values:

|                                |                              |
|--------------------------------|------------------------------|
| <b><i>_PG_BARCHART</i></b>     | Bar chart (horizontal bars)  |
| <b><i>_PG_COLUMNCHART</i></b>  | Column chart (vertical bars) |
| <b><i>_PG_LINECHART</i></b>    | Line chart                   |
| <b><i>_PG_SCATTERCHART</i></b> | Scatter chart                |
| <b><i>_PG_PIECHART</i></b>     | Pie chart                    |

Each type of chart can be drawn in one of two styles. For each chart type the argument *style* can have one of the following values: `uindex=2 uindex=2 uindex=2 uindex=2 uindex=2 uindex=2`

| Type    | Style 1                         | Style 2                        |
|---------|---------------------------------|--------------------------------|
| Bar     | <code>_ PG_ PLAINBARS</code>    | <code>_ PG_ STACKEDBARS</code> |
| Column  | <code>_ PG_ PLAINBARS</code>    | <code>_ PG_ STACKEDBARS</code> |
| Line    | <code>_ PG_ POINTANDLINE</code> | <code>_ PG_ POINTONLY</code>   |
| Scatter | <code>_ PG_ POINTANDLINE</code> | <code>_ PG_ POINTONLY</code>   |
| Pie     | <code>_ PG_ PERCENT</code>      | <code>_ PG_ NOPERCENT</code>   |

For single-series bar and column charts, the chart style is ignored. The "plain" (clustered) and "stacked" styles only apply when there is more than one series of data. The "percent" style for pie charts causes percentages to be displayed beside each of the pie slices.

**Returns:**     The `_pg_defaultchart` routine returns zero if successful; otherwise, a non-zero value is returned.

**See Also:**     `_pg_initchart`, `_pg_chart`, `_pg_chartpie`, `_pg_chartscatter`

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'
include 'pgapi.fi'
include 'pg.fi'

integer NUM_VALUES
parameter (NUM_VALUES=4)

integer*4 categories( NUM_VALUES )
real values( NUM_VALUES )
+           / 20, 45, 30, 25 /

record /chartenv/ env

categories( 1 ) = loc( 'Jan'c )
categories( 2 ) = loc( 'Feb'c )
categories( 3 ) = loc( 'Mar'c )
categories( 4 ) = loc( 'Apr'c )

call _setvideomode( _VRES16COLOR )
call _pg_initchart()
call _pg_defaultchart( env,
+                       _PG_COLUMNCHART, _PG_PLAINBARS )
env.maintitle.title = 'Column Chart'c
call _pg_chart( env, categories,
+               values, NUM_VALUES )
pause
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:** DOS

**Synopsis:**     integer\*2 function \_pg\_getchardef( ch, def )  
              integer\*2 ch  
              integer\*1 def(8)

**Description:** The \_pg\_getchardef routine retrieves the current bit-map definition for the character *ch*. The bit-map is placed in the array *def*. The current font must be an 8-by-8 bit-mapped font.

**Returns:**     The \_pg\_getchardef routine returns zero if successful; otherwise, a non-zero value is returned.

**See Also:**     \_pg\_defaultchart, \_pg\_initchart, \_pg\_chart, \_pg\_chartpie,  
              \_pg\_chartscatter, \_pg\_setchardef

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'
include 'pgapi.fi'
include 'pg.fi'

integer NUM_VALUES
parameter (NUM_VALUES=4)

real x( NUM_VALUES )
+      / 5, 25, 45, 65 /
real y( NUM_VALUES )
+      / 5, 45, 25, 65 /
integer*1 diamond( 8 )
+      / '10'x, '28'x, '44'x, '82'x,
+      '44'x, '28'x, '10'x, '00'x /

record /chartenv/ env
integer*1 old_def( 8 )

call _setvideomode( _VRES16COLOR )
call _pg_initchart()
call _pg_defaultchart( env,
+      _PG_SCATTERCHART, _PG_POINTANDLINE )
env.maintitle.title = 'Scatter Chart'c
! change asterisk character to diamond
call _pg_getchardef( ichar( '*' ), old_def )
call _pg_setchardef( ichar( '*' ), diamond )
call _pg_chartscatter( env, x, y, NUM_VALUES )
call _pg_setchardef( ichar( '*' ), old_def )
pause
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**     DOS



**Synopsis:**     integer\*2 function \_pg\_getpalette( pal )  
                  record /paletteentry/ pal(\*)

**Description:** The \_pg\_getpalette routine retrieves the internal palette of the presentation graphics system. The palette controls the colors, line styles, fill patterns and plot characters used to display each series of data in a chart.

The argument *pal* is an array of palette structures that will contain the palette. Each element of the palette is a structure containing the following fields:

|                 |  |
|-----------------|--|
| <i>color</i>    | color used to display series                               |
| <i>style</i>    | line style used for line and scatter charts                |
| <i>fill</i>     | fill pattern used to fill interior of bar and pie sections |
| <i>plotchar</i> | character plotted on line and scatter charts               |

**Returns:**     The \_pg\_getpalette routine returns zero if successful; otherwise, a non-zero value is returned.

**See Also:**     \_pg\_defaultchart, \_pg\_initchart, \_pg\_chart, \_pg\_chartpie,  
                  \_pg\_chartscatter, \_pg\_setpalette, \_pg\_resetpalette

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'
include 'pgapi.fi'
include 'pg.fi'

integer NUM_VALUES
parameter (NUM_VALUES=4)

integer*4 categories( NUM_VALUES )
real values( NUM_VALUES )
+           / 20, 45, 30, 25 /
integer*1 bricks( 8 )
+           / 'ff'x, '80'x, '80'x, '80'x,
+           'ff'x, '08'x, '08'x, '08'x /

record /chartenv/ env
record /paletteentry/ pal( _PG_PALETTELEN )
integer i

categories( 1 ) = loc( 'Jan'c )
categories( 2 ) = loc( 'Feb'c )
categories( 3 ) = loc( 'Mar'c )
categories( 4 ) = loc( 'Apr'c )

call _setvideomode( _VRES16COLOR )
call _pg_initchart()
call _pg_defaultchart( env,
+           _PG_COLUMNCHART, _PG_PLAINBARS )
env.maintitle.title = 'Column Chart'c
! get default palette and change 1st entry
call _pg_getpalette( pal )
pal( 2 ).color = 12
do i = 1, 8
    pal( 2 ).fill( i ) = bricks( i )
enddo
! use new palette
call _pg_setpalette( pal )
call _pg_chart( env, categories,
+           values, NUM_VALUES )
! reset palette to default
call _pg_resetpalette()
pause
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:** DOS

**Synopsis:**     subroutine \_pg\_getstyleset( style )  
                 integer\*2 style(\*)

**Description:**   The \_pg\_getstyleset routine retrieves the internal style-set of the presentation graphics system. The style-set is a set of line styles used for drawing window borders and grid-lines. The argument *style* is an array that will contain the style-set.

**See Also:**     \_pg\_defaultchart, \_pg\_initchart, \_pg\_chart, \_pg\_chartpie,  
                 \_pg\_chartscatter, \_pg\_setstyleset, \_pg\_resetstyleset

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'
include 'pgapi.fi'
include 'pg.fi'

integer NUM_VALUES
parameter (NUM_VALUES=4)

integer*4 categories( NUM_VALUES )
real values( NUM_VALUES )
+           / 20, 45, 30, 25 /

record /chartenv/ env
integer*2 style( _PG_PALETTELEN )

categories( 1 ) = loc( 'Jan'c )
categories( 2 ) = loc( 'Feb'c )
categories( 3 ) = loc( 'Mar'c )
categories( 4 ) = loc( 'Apr'c )

call _setvideomode( _VRES16COLOR )
call _pg_initchart()
call _pg_defaultchart( env,
+           _PG_COLUMNCHART, _PG_PLAINBARS )
env.maintitle.title = 'Column Chart'c
! turn on yaxis grid, and use style 2
env.yaxis.grid = 1
env.yaxis.gridstyle = 2
! get default style-set and change entry 2
call _pg_getstyleset( style )
style( 3 ) = '8888'x
! use new style-set
call _pg_setstyleset( style )
call _pg_chart( env, categories,
+           values, NUM_VALUES )
! reset style-set to default
call _pg_resetstyleset()
pause
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**     DOS

**Description:** The `_pg_hlabelchart` routine displays the text string *label* on the chart described by the *env* chart structure. The string is displayed horizontally starting at the point  $(x, y)$ , relative to the upper left corner of the chart. The *color* specifies the palette color used to display the string.

**See Also:** `_pg_defaultchart`, `_pg_initchart`, `_pg_chart`, `_pg_chartpie`,  
`_pg_chartscatter`, `_pg_vlabelchart`

**Classification:** PC Graphics

**Synopsis:** integer\*2 function \_pg\_initchart()

**Description:** The \_pg\_initchart routine initializes the presentation graphics system. This includes initializing the internal palette and style-set used when drawing charts. This routine must be called before any of the other presentation graphics routines.

The initialization of the presentation graphics system requires that a valid graphics mode has been selected. For this reason the \_setvideomode routine must be called before \_pg\_initchart is called. If a font has been selected (with the \_setfont routine), that font will be used when text is displayed in a chart. Font selection should also be done before initializing the presentation graphics system.

**Returns:** The \_pg\_initchart routine returns zero if successful; otherwise, a non-zero value is returned.

**See Also:** \_pg\_defaultchart, \_pg\_chart, \_pg\_chartpie, \_pg\_chartscatter,  
\_setvideomode, \_setfont, \_registerfonts

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'
include 'pgapi.fi'
include 'pg.fi'

integer NUM_VALUES
parameter (NUM_VALUES=4)

integer*4 categories( NUM_VALUES )
real values( NUM_VALUES )
+           / 20, 45, 30, 25 /

record /chartenv/ env

categories( 1 ) = loc( 'Jan'c )
categories( 2 ) = loc( 'Feb'c )
categories( 3 ) = loc( 'Mar'c )
categories( 4 ) = loc( 'Apr'c )

call _setvideomode( _VRES16COLOR )
call _pg_initchart()
call _pg_defaultchart( env,
+                       _PG_COLUMNCHART, _PG_PLAINBARS )
env.maintitle.title = 'Column Chart'c
call _pg_chart( env, categories,
+               values, NUM_VALUES )
pause
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:** DOS

## ***\_pg\_resetpalette***

---

**Synopsis:**     integer\*2 function \_pg\_resetpalette()

**Description:** The \_pg\_resetpalette routine resets the internal palette of the presentation graphics system to default values. The palette controls the colors, line styles, fill patterns and plot characters used to display each series of data in a chart. The default palette chosen is dependent on the current video mode.

**Returns:**     The \_pg\_resetpalette routine returns zero if successful; otherwise, a non-zero value is returned.

**See Also:**     \_pg\_defaultchart, \_pg\_initchart, \_pg\_chart, \_pg\_chartpie,  
                 \_pg\_chartscatter, \_pg\_getpalette, \_pg\_setpalette

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'
include 'pgapi.fi'
include 'pg.fi'

integer NUM_ VALUES
parameter (NUM_ VALUES=4)

integer*4 categories( NUM_ VALUES )
real values( NUM_ VALUES )
+           / 20, 45, 30, 25 /
integer*1 bricks( 8 )
+           / 'ff'x, '80'x, '80'x, '80'x,
+           'ff'x, '08'x, '08'x, '08'x /

record /chartenv/ env
record /paletteentry/ pal( _ PG_ PALETTELEN )
integer i

categories( 1 ) = loc( 'Jan'c )
categories( 2 ) = loc( 'Feb'c )
categories( 3 ) = loc( 'Mar'c )
categories( 4 ) = loc( 'Apr'c )

call _ setvideomode( _ VRES16COLOR )
call _ pg_ initchart()
call _ pg_ defaultchart( env,
+           _ PG_ COLUMNCHART, _ PG_ PLAINBARS )
env.maintitle.title = 'Column Chart'c
! get default palette and change 1st entry
call _ pg_ getpalette( pal )
pal( 2 ).color = 12
do i = 1, 8
    pal( 2 ).fill( i ) = bricks( i )
enddo
! use new palette
call _ pg_ setpalette( pal )
call _ pg_ chart( env, categories,
+           values, NUM_ VALUES )
! reset palette to default
call _ pg_ resetpalette()
pause
call _ setvideomode( _ DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:** DOS

**Synopsis:**        subroutine \_pg\_resetstyleset()

**Description:**   The \_pg\_resetstyleset routine resets the internal style-set of the presentation graphics system to default values. The style-set is a set of line styles used for drawing window borders and grid-lines.

**See Also:**        \_pg\_defaultchart, \_pg\_initchart, \_pg\_chart, \_pg\_chartpie,  
                  \_pg\_chartscatter, \_pg\_getstyleset, \_pg\_setstyleset

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'
include 'pgapi.fi'
include 'pg.fi'

integer NUM_VALUES
parameter (NUM_VALUES=4)

integer*4 categories( NUM_VALUES )
real values( NUM_VALUES )
+           / 20, 45, 30, 25 /

record /chartenv/ env
integer*2 style( _PG_PALETTELEN )

categories( 1 ) = loc( 'Jan'c )
categories( 2 ) = loc( 'Feb'c )
categories( 3 ) = loc( 'Mar'c )
categories( 4 ) = loc( 'Apr'c )

call _setvideomode( _VRES16COLOR )
call _pg_initchart()
call _pg_defaultchart( env,
+           _PG_COLUMNCHART, _PG_PLAINBARS )
env.maintitle.title = 'Column Chart'c
! turn on yaxis grid, and use style 2
env.yaxis.grid = 1
env.yaxis.gridstyle = 2
! get default style-set and change entry 2
call _pg_getstyleset( style )
style( 3 ) = '8888'x
! use new style-set
call _pg_setstyleset( style )
call _pg_chart( env, categories,
+           values, NUM_VALUES )
! reset style-set to default
call _pg_resetstyleset()
pause
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**        DOS



**Synopsis:**     integer\*2 function \_pg\_setchardef( ch, def )  
              integer\*2 ch  
              integer\*1 def(8)

**Description:**   The \_pg\_setchardef routine sets the current bit-map definition for the character *ch*. The bit-map is contained in the array *def*. The current font must be an 8-by-8 bit-mapped font.

**Returns:**       The \_pg\_setchardef routine returns zero if successful; otherwise, a non-zero value is returned.

**See Also:**       \_pg\_defaultchart, \_pg\_initchart, \_pg\_chart, \_pg\_chartpie,  
                 \_pg\_chartscatter, \_pg\_getchardef

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'
include 'pgapi.fi'
include 'pg.fi'

integer NUM_VALUES
parameter (NUM_VALUES=4)

real x( NUM_VALUES )
+      / 5, 25, 45, 65 /
real y( NUM_VALUES )
+      / 5, 45, 25, 65 /
integer*1 diamond( 8 )
+      / '10'x, '28'x, '44'x, '82'x,
+      '44'x, '28'x, '10'x, '00'x /

record /chartenv/ env
integer*1 old_def( 8 )

call _setvideomode( _VRES16COLOR )
call _pg_initchart()
call _pg_defaultchart( env,
+      _PG_SCATTERCHART, _PG_POINTANDLINE )
env.maintitle.title = 'Scatter Chart'c
! change asterisk character to diamond
call _pg_getchardef( ichar( '*' ), old_def )
call _pg_setchardef( ichar( '*' ), diamond )
call _pg_chartscatter( env, x, y, NUM_VALUES )
call _pg_setchardef( ichar( '*' ), old_def )
pause
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**       DOS

## ***\_pg\_setpalette***

---

**Synopsis:**     integer\*2 function `_pg_setpalette( pal )`  
                  record /paletteentry/ `pal(*)`

**Description:**   The `_pg_setpalette` routine sets the internal palette of the presentation graphics system. The palette controls the colors, line styles, fill patterns and plot characters used to display each series of data in a chart.

The argument *pal* is an array of palette structures containing the new palette. Each element of the palette is a structure containing the following fields:

|                 |  |
|-----------------|--|
| <i>color</i>    | color used to display series                               |
| <i>style</i>    | line style used for line and scatter charts                |
| <i>fill</i>     | fill pattern used to fill interior of bar and pie sections |
| <i>plotchar</i> | character plotted on line and scatter charts               |

**Returns:**       The `_pg_setpalette` routine returns zero if successful; otherwise, a non-zero value is returned.

**See Also:**       `_pg_defaultchart`, `_pg_initchart`, `_pg_chart`, `_pg_chartpie`,  
                  `_pg_chartscatter`, `_pg_getpalette`, `_pg_resetpalette`

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'
include 'pgapi.fi'
include 'pg.fi'

integer NUM_VALUES
parameter (NUM_VALUES=4)

integer*4 categories( NUM_VALUES )
real values( NUM_VALUES )
+       / 20, 45, 30, 25 /
integer*1 bricks( 8 )
+       / 'ff'x, '80'x, '80'x, '80'x,
+       'ff'x, '08'x, '08'x, '08'x /

record /chartenv/ env
record /paletteentry/ pal( _PG_PALETTELEN )
integer i

categories( 1 ) = loc( 'Jan'c )
categories( 2 ) = loc( 'Feb'c )
categories( 3 ) = loc( 'Mar'c )
categories( 4 ) = loc( 'Apr'c )

call _setvideomode( _VRES16COLOR )
call _pg_initchart()
call _pg_defaultchart( env,
+       _PG_COLUMNCHART, _PG_PLAINBARS )
env.maintitle.title = 'Column Chart'c
! get default palette and change 1st entry
call _pg_getpalette( pal )
pal( 2 ).color = 12
do i = 1, 8
    pal( 2 ).fill( i ) = bricks( i )
enddo
! use new palette
call _pg_setpalette( pal )
call _pg_chart( env, categories,
+       values, NUM_VALUES )
! reset palette to default
call _pg_resetpalette()
pause
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:** DOS

**Synopsis:**      subroutine \_pg\_setstyleset( style )  
                 integer\*2 style(\*)

**Description:**    The \_pg\_setstyleset routine retrieves the internal style-set of the presentation graphics system. The style-set is a set of line styles used for drawing window borders and grid-lines. The argument *style* is an array containing the new style-set.

**See Also:**      \_pg\_defaultchart, \_pg\_initchart, \_pg\_chart, \_pg\_chartpie,  
                 \_pg\_chartscatter, \_pg\_getstyleset, \_pg\_resetstyleset

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'
include 'pgapi.fi'
include 'pg.fi'

integer NUM_VALUES
parameter (NUM_VALUES=4)

integer*4 categories( NUM_VALUES )
real values( NUM_VALUES )
+           / 20, 45, 30, 25 /

record /chartenv/ env
integer*2 style( _PG_PALETTELEN )

categories( 1 ) = loc( 'Jan'c )
categories( 2 ) = loc( 'Feb'c )
categories( 3 ) = loc( 'Mar'c )
categories( 4 ) = loc( 'Apr'c )

call _setvideomode( _VRES16COLOR )
call _pg_initchart()
call _pg_defaultchart( env,
+                     _PG_COLUMNCHART, _PG_PLAINBARS )
env.maintitle.title = 'Column Chart'c
! turn on yaxis grid, and use style 2
env.yaxis.grid = 1
env.yaxis.gridstyle = 2
! get default style-set and change entry 2
call _pg_getstyleset( style )
style( 3 ) = '8888'x
! use new style-set
call _pg_setstyleset( style )
call _pg_chart( env, categories,
+              values, NUM_VALUES )
! reset style-set to default
call _pg_resetstyleset()
pause
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**      DOS



**Synopsis:**

```
integer*2 function _pie( fill, x1, y1, x2, y2,
                        x3, y3, x4, y4 )

integer*2 fill
integer*2 x1, y1
integer*2 x2, y2
integer*2 x3, y3
integer*2 x4, y4

integer*2 function _pie_w( fill, x1, y1, x2, y2,
                          x3, y3, x4, y4 )

integer*2 fill
double precision x1, y1
double precision x2, y2
double precision x3, y3
double precision x4, y4

integer*2 function _pie_wxy( fill, p1, p2, p3, p4 )
integer*2 fill,
record /_ wxycoord/ p1, p2
record /_ wxycoord/ p3, p4
```

**Description:** The `_pie` routines draw pie-shaped wedges. The `_pie` routine uses the view coordinate system. The `_pie_w` and `_pie_wxy` routines use the window coordinate system.

The pie wedges are drawn by drawing an elliptical arc (in the way described for the `_arc` routines) and then joining the center of the rectangle that contains the ellipse to the two endpoints of the arc.

The elliptical arc is drawn with its center at the center of the rectangle established by the points  $(x1, y1)$  and  $(x2, y2)$ . The arc is a segment of the ellipse drawn within this bounding rectangle. The arc starts at the point on this ellipse that intersects the vector from the centre of the ellipse to the point  $(x3, y3)$ . The arc ends at the point on this ellipse that intersects the vector from the centre of the ellipse to the point  $(x4, y4)$ . The arc is drawn in a counter-clockwise direction with the current plot action using the current color and the current line style.

The following picture illustrates the way in which the bounding rectangle and the vectors specifying the start and end points are defined.



When the coordinates  $(x1, y1)$  and  $(x2, y2)$  establish a line or a point (this happens when one or more of the x-coordinates or y-coordinates are equal), nothing is drawn.

The argument *fill* determines whether the figure is filled in or has only its outline drawn. The argument can have one of two values:

***\_GFILLINTERIOR***      fill the interior by writing pixels with the current plot action using the current color and the current fill mask

***\_GBORDER***            leave the interior unchanged; draw the outline of the figure with the current plot action using the current color and line style

**Returns:**            The `_pie` routines return a non-zero value when the figure was successfully drawn; otherwise, zero is returned.

**See Also:**           `_arc`, `_ellipse`, `_setcolor`, `_setfillmask`, `_setlinestyle`, `_setplotaction`

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

call _setvideomode( _VRES16COLOR )
call _pie( _GBORDER, 120, 90, 520, 390,
+          140, 20, 190, 460 )
pause
call _setvideomode( _DEFAULTMODE )
end
```

produces the following:



**Classification:** PC Graphics

**Systems:**     `_pie` - DOS  
                 `_pie_w` - DOS  
                 `_pie_wxy` - DOS



**Synopsis:**

```
integer*2 function _polygon( fill, numpts, points )
integer*2 fill
integer*2 numpts
record /xycoord/ points(*)

integer*2 function _polygon_w( fill, numpts, points )
integer*2 fill
integer*2 numpts
double precision points(*)

integer*2 function _polygon_wxy( fill, numpts, points )
integer*2 fill
integer*2 numpts
record /_wxycoord/ points(*)
```

**Description:** The `_polygon` routines draw polygons. The `_polygon` routine uses the view coordinate system. The `_polygon_w` and `_polygon_wxy` routines use the window coordinate system.

The polygon is defined as containing *numpts* points whose coordinates are given in the array *points*.

The argument *fill* determines whether the polygon is filled in or has only its outline drawn. The argument can have one of two values:

|                                    |  |
|------------------------------------|--|
| <b><code>_GFILLINTERIOR</code></b> | fill the interior by writing pixels with the current plot action using the current color and the current fill mask               |
| <b><code>_GBORDER</code></b>       | leave the interior unchanged; draw the outline of the figure with the current plot action using the current color and line style |

**Returns:** The `_polygon` routines return a non-zero value when the polygon was successfully drawn; otherwise, zero is returned.

**See Also:** `_setcolor`, `_setfillmask`, `_setlinestyle`, `_setplotaction`

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

record /xycoord/ points(5)/
+      319, 140, 224, 209, 261, 320,
+      378, 320, 415, 209/

call _setvideomode( _VRES16COLOR )
call _polygon( _GBORDER, 5, points )
pause
call _setvideomode( _DEFAULTMODE )
end
```

produces the following:



**Classification:** PC Graphics

**Systems:**     `_polygon` - DOS  
                  `_polygon_w` - DOS  
                  `_polygon_wxy` - DOS

**Synopsis:**

```
subroutine _putimage( x, y, image, mode )
integer*2 x, y
integer*1 image(*)
integer*2 mode

subroutine _putimage_w( x, y, image, mode )
double precision x, y
integer*1 image(*)
integer*2 mode
```

**Description:** The `_putimage` routines display the screen image indicated by the argument *image*. The `_putimage` routine uses the view coordinate system. The `_putimage_w` routine uses the window coordinate system.

The image is displayed upon the screen with its top left corner located at the point with coordinates  $(x, y)$ . The image was previously saved using the `_getimage` routines. The image is displayed in a rectangle whose size is the size of the rectangular image saved by the `_getimage` routines.

The image can be displayed in a number of ways, depending upon the value of the *mode* argument. This argument can have the following values:

|                        |  |
|------------------------|--|
| <b><i>_GPSET</i></b>   | replace the rectangle on the screen by the saved image   |
| <b><i>_GPRESET</i></b> | replace the rectangle on the screen with the pixel values of the saved image inverted; this produces a negative image  |
| <b><i>_GAND</i></b>    | produce a new image on the screen by ANDing together the pixel values from the screen with those from the saved image  |
| <b><i>_GOR</i></b>     | produce a new image on the screen by ORing together the pixel values from the screen with those from the saved image   |
| <b><i>_GXOR</i></b>    | produce a new image on the screen by exclusive ORing together the pixel values from the screen with those from the saved image; the original screen is restored by two successive calls to the <code>_putimage</code> routine with this value, providing an efficient method to produce animated effects |

**See Also:** `_getimage`, `_imagesize`

**Example:**

```

include 'graphapi.fi'
include 'graph.fi'

integer*1 image(:)
integer y, image_size, istat

call _setvideomode( _VRES16COLOR )
call _ellipse( _GFillInterior,
+             100, 100, 200, 200 )
image_size = _imagesize( 100, 100, 201, 201 )
allocate( image(image_size), stat = istat )
if( istat .eq. 0 )then
    call _getimage( 100, 100, 201, 201, image )
    call _putimage( 260, 200, image, _GPSET )
    call _putimage( 420, 100, image, _GPSET )
    do y = 100, 280, 20
        call _putimage( 420, y, image, _GXOR )
        call _putimage( 420, y+20, image, _GXOR )
    enddo
    deallocate( image )
endif
pause
call _setvideomode( _DEFAULTMODE )
end

```

**Classification:** PC Graphics

**Systems:**      \_putimage - DOS  
                   \_putimage\_w - DOS

**Synopsis:**

```
integer*2 function _rectangle( fill, x1, y1, x2, y2 )
integer*2 fill
integer*2 x1, y1
integer*2 x2, y2

integer*2 function _rectangle_w( fill, x1, y1, x2, y2 )
integer*2 fill
double precision x1, y1
double precision x2, y2

integer*2 function _rectangle_wxy( fill, p1, p2 )
integer*2 fill
record /_wxycoord/ p1, p2
```

**Description:** The `_rectangle` routines draw rectangles. The `_rectangle` routine uses the view coordinate system. The `_rectangle_w` and `_rectangle_wxy` routines use the window coordinate system.

The rectangle is defined with opposite corners established by the points `(x1,y1)` and `(x2,y2)`.

The argument *fill* determines whether the rectangle is filled in or has only its outline drawn. The argument can have one of two values:

***\_GFILLINTERIOR***      fill the interior by writing pixels with the current plot action using the current color and the current fill mask

***\_GBORDER***            leave the interior unchanged; draw the outline of the figure with the current plot action using the current color and line style

**Returns:** The `_rectangle` routines return a non-zero value when the rectangle was successfully drawn; otherwise, zero is returned.

**See Also:** `_setcolor`, `_setfillmask`, `_setlinestyle`, `_setplotaction`

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

call _setvideomode( _VRES16COLOR )
call _rectangle( _GBORDER, 100, 100, 540, 380 )
pause
call _setvideomode( _DEFAULTMODE )
end
```

produces the following:



**Classification:** PC Graphics

**Systems:**     `_rectangle` - DOS  
                 `_rectangle_w` - DOS  
                 `_rectangle_wxy` - DOS

**Synopsis:**     integer\*2 function \_registerfonts( path )  
                  character\*(\*) path

**Description:**   The \_registerfonts routine initializes the font graphics system. Fonts must be registered, and a font selected, before text can be displayed with the \_outgtext routine.

The argument *path* specifies the location of the font files. This argument is a file specification, and can contain drive and directory components and may contain wildcard characters. The \_registerfonts routine opens each of the font files specified and reads the font information. Memory is allocated to store the characteristics of the font. These font characteristics are used by the \_setfont routine when selecting a font.

**Returns:**       The \_registerfonts routine returns the number of fonts that were registered if the routine is successful; otherwise, a negative number is returned.

**See Also:**        \_unregisterfonts,\_setfont,\_getfontinfo,\_outgtext,\_getgtexttextent,  
                  \_setgtextvector,\_getgtextvector

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer i, n
character*10 buff

call _setvideomode( _VRES16COLOR )
n = _registerfonts( '*.fon'c )
do i = 0, n - 1
    write( buff, '( "n", i2.2, a1 )' ) i, char(0)
    call _setfont( buff )
    call _moveto( 100, 100 )
    call _outgtext( 'WATCOM Graphics'c )
    pause
    call _clearscreen( _GCLEARSCREEN )
enddo
call _unregisterfonts()
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**        DOS

## ***\_remapallpalette***

---

**Synopsis:**     integer\*2 function \_remapallpalette( colors )  
              integer\*4 colors(\*)

**Description:** The \_remapallpalette routine sets (or remaps) all of the colors in the palette. The color values in the palette are replaced by the array of color values given by the argument *colors*. This routine is supported in all video modes, but only works with EGA, MCGA and VGA adapters.

The array *colors* must contain at least as many elements as there are supported colors. The newly mapped palette will cause the complete screen to change color wherever there is a pixel value of a changed color in the palette.

The representation of colors depends upon the hardware being used. The number of colors in the palette can be determined by using the \_getvideoconfig routine.

**Returns:**     The \_remapallpalette routine returns (-1) if the palette is remapped successfully and zero otherwise.

**See Also:**     \_ remappalette, \_ getvideoconfig

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer colors(16)/
+   _ BRIGHTWHITE, _ YELLOW, _ LIGHTMAGENTA,
+   _ LIGHTRED, _ LIGHTCYAN, _ LIGHTGREEN,
+   _ LIGHTBLUE, _ GRAY, _ WHITE, _ BROWN,
+   _ MAGENTA, _ RED, _ CYAN,
+   _ GREEN, _ BLUE, _ BLACK/
integer x, y

call _setvideomode( _ VRES16COLOR )
do y = 0, 3
  do x = 0, 3
    call _setcolor( x + 4 * y )
    call _rectangle( _ GFILLINTERIOR,
+                   x * 160, y * 120,
+                   ( x + 1 ) * 160, ( y + 1 ) * 120 )
  enddo
enddo
pause
call _remapallpalette( colors )
pause
call _setvideomode( _ DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**     DOS



**Synopsis:**     integer\*4 function \_remappalette( pixval, color )  
                 integer\*2 pixval  
                 integer\*4 color

**Description:**   The \_remappalette routine sets (or remaps) the palette color *pixval* to be the color *color*. This routine is supported in all video modes, but only works with EGA, MCGA and VGA adapters.

The argument *pixval* is an index in the color palette of the current video mode. The argument *color* specifies the actual color displayed on the screen by pixels with pixel value *pixval*. Color values are selected by specifying the red, green and blue intensities that make up the color. Each intensity can be in the range from 0 to 63, resulting in 262144 possible different colors. A given color value can be conveniently specified as a value of type integer\*4. The color value is of the form '00bbggrr'x, where bb is the blue intensity, gg is the green intensity and rr is the red intensity of the selected color. The file graph.fi defines constants containing the color intensities of each of the 16 default colors.

The \_remappalette routine takes effect immediately. All pixels on the complete screen which have a pixel value equal to the value of *pixval* will now have the color indicated by the argument *color*.

**Returns:**       The \_remappalette routine returns the previous color for the pixel value if the palette is remapped successfully; otherwise, (-1) is returned.

**See Also:**       \_ remapallpalette, \_ setvideomode

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer col
integer colors(16)/
+      _ BLACK, _ BLUE, _ GREEN,
+      _ CYAN, _ RED, _ MAGENTA,
+      _ BROWN, _ WHITE, _ GRAY, _ LIGHTBLUE,
+      _ LIGHTGREEN, _ LIGHTCYAN, _ LIGHTRED,
+      _ LIGHTMAGENTA, _ YELLOW, _ BRIGHTWHITE/

call _setvideomode( _ VRES16COLOR )
do col = 1, 16
    call _remappalette( 0, colors(col) )
    pause
enddo
call _setvideomode( _ DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**       DOS

## **\_scrolltextwindow**

---

**Synopsis:**      subroutine \_scrolltextwindow( rows )  
                 integer\*2 rows

**Description:** The \_scrolltextwindow routine scrolls the lines in the current text window. A text window is defined with the \_settextwindow routine. By default, the text window is the entire screen.

The argument *rows* specifies the number of rows to scroll. A positive value means to scroll the text window up or towards the top of the screen. A negative value means to scroll the text window down or towards the bottom of the screen. Specifying a number of rows greater than the height of the text window is equivalent to clearing the text window with the \_clearscreen routine.

Two constants are defined that can be used with the \_scrolltextwindow routine:

**\_GSCROLLUP**            the contents of the text window are scrolled up (towards the top of the screen) by one row

**\_GSCROLLEDOWN**        the contents of the text window are scrolled down (towards the bottom of the screen) by one row

**See Also:**      \_settextwindow, \_clearscreen, \_outtext, \_outmem, \_settextposition

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer i
character*80 buff

call _setvideomode( _TEXTC80 )
call _settextwindow( 5, 20, 20, 40 )
do i = 1, 10
    write( buff, '( "Line ", i2, a1, a1 )' )
+      i, char(10), char(0)
    call _outtext( buff )
enddo
pause
call _scrolltextwindow( _GSCROLLEDOWN )
pause
call _scrolltextwindow( _GSCROLLUP )
pause
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**      DOS

**Synopsis:**     integer\*2 function \_selectpalette( palnum )  
                 integer\*2 palnum

**Description:** The \_selectpalette routine selects the palette indicated by the argument *palnum* from the color palettes available. This routine is only supported by the video modes \_MRES4COLOR and \_MRESNOCOLOR.

Mode \_MRES4COLOR supports four palettes of four colors. In each palette, color 0, the background color, can be any of the 16 possible colors. The color values associated with the other three pixel values, (1, 2 and 3), are determined by the selected palette.

The following table outlines the available color palettes:

| Palette<br>Number | 1           | Pixel Values<br>2 | 3            |
|-------------------|-------------|-------------------|--------------|
| 0                 | green       | red               | brown        |
| 1                 | cyan        | magenta           | white        |
| 2                 | light green | light red         | yellow       |
| 3                 | light cyan  | light magenta     | bright white |

**Returns:**     The \_selectpalette routine returns the number of the previously selected palette.

**See Also:**     \_setvideomode, \_getvideoconfig

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer x, y, pal

call _setvideomode( _MRES4COLOR )
do y = 0, 1
  do x = 0, 1
    call _setcolor( x + 2 * y )
    call _rectangle( _GFillInterior,
+                   x * 160, y * 100,
+                   ( x + 1 ) * 160, ( y + 1 ) * 100 )
  enddo
enddo
do pal = 0, 3
  call _selectpalette( pal )
  pause
enddo
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**     DOS

**Synopsis:**     integer\*2 function \_setactivepage( pagenum )  
              integer\*2 pagenum

**Description:** The \_setactivepage routine selects the page (in memory) to which graphics output is written. The page to be selected is given by the *pagenum* argument.

Only some combinations of video modes and hardware allow multiple pages of graphics to exist. When multiple pages are supported, the active page may differ from the visual page. The graphics information in the visual page determines what is displayed upon the screen. Animation may be accomplished by alternating the visual page. A graphics page can be constructed without affecting the screen by setting the active page to be different than the visual page.

The number of available video pages can be determined by using the \_getvideoconfig routine. The default video page is 0.

**Returns:**     The \_setactivepage routine returns the number of the previous page when the active page is set successfully; otherwise, a negative number is returned.

**See Also:**     \_getactivepage, \_setvisualpage, \_getvisualpage, \_getvideoconfig

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer old_ apage, old_ vpage

call _setvideomode( _HRES16COLOR )
old_ apage = _getactivepage()
old_ vpage = _getvisualpage()
! draw an ellipse on page 0
call _setactivepage( 0 )
call _setvisualpage( 0 )
call _ellipse( _GFillInterior, 100, 50,
+              540, 150 )
! draw a rectangle on page 1
call _setactivepage( 1 )
call _rectangle( _GFillInterior, 100, 50,
+               540, 150 )
pause
! display page 1
call _setvisualpage( 1 )
pause
call _setactivepage( old_ apage )
call _setvisualpage( old_ vpage )
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**     DOS

**Synopsis:**     integer\*4 function \_setbkcolor( color )  
                integer\*4 color

**Description:** The \_setbkcolor routine sets the current background color to be that of the *color* argument. In text modes, the background color controls the area behind each individual character. In graphics modes, the background refers to the entire screen. The default background color is 0.

When the current video mode is a graphics mode, any pixels with a zero pixel value will change to the color of the *color* argument. When the current video mode is a text mode, nothing will immediately change; only subsequent output is affected.

**Returns:**     The \_setbkcolor routine returns the previous background color.

**See Also:**     \_ getbkcolor

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer bk, old_bk
integer colors(16)/
+      _BLACK, _BLUE, _GREEN,
+      _CYAN, _RED, _MAGENTA,
+      _BROWN, _WHITE, _GRAY, _LIGHTBLUE,
+      _LIGHTGREEN, _LIGHTCYAN, _LIGHTRED,
+      _LIGHTMAGENTA, _YELLOW, _BRIGHTWHITE/

call _setvideomode( _VRES16COLOR )
old_bk = _getbkcolor()
do bk = 1, 16
    call _setbkcolor( colors( bk ) )
    pause
enddo
call _setbkcolor( old_bk )
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**     DOS

## ***\_setcharsize Routines***

---

**Synopsis:**      subroutine \_setcharsize( height, width )  
                 integer\*2 height, width

                 subroutine \_setcharsize\_w( height, width )  
                 double precision height, width

**Description:**    The \_setcharsize routines set the character height and width to the values specified by the arguments *height* and *width*. For the \_setcharsize routine, the arguments *height* and *width* represent a number of pixels. For the \_setcharsize\_w routine, the arguments *height* and *width* represent lengths along the y-axis and x-axis in the window coordinate system.

These sizes are used when displaying text with the \_grtext routine. The default character sizes are dependent on the graphics mode selected, and can be determined by the \_gettextsettings routine.

**See Also:**      \_grtext, \_gettextsettings

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

record /textsettings/ ts

call _setvideomode( _VRES16COLOR )
call _gettextsettings( ts )
call _grtext( 100, 100, 'WATCOM'c )
call _setcharsize( 2 * ts.height, 2 * ts.width )
call _grtext( 100, 300, 'Graphics'c )
call _setcharsize( ts.height, ts.width )
pause
call _setvideomode( _DEFAULTMODE )
end
```

produces the following:



**Classification:** PC Graphics

**Systems:**     `_setcharsize` - DOS  
                 `_setcharsize_w` - DOS

## ***\_setcharspacing Routines***

---

**Synopsis:**     subroutine \_setcharspacing( space )  
                 integer\*2 space

                 subroutine \_setcharspacing\_w( space )  
                 double precision space

**Description:**     The \_setcharspacing routines set the current character spacing to have the value of the argument *space*. For the \_setcharspacing routine, *space* represents a number of pixels. For the \_setcharspacing\_w routine, *space* represents a length along the x-axis in the window coordinate system.

The character spacing specifies the additional space to leave between characters when a text string is displayed with the \_grtext routine. A negative value can be specified to cause the characters to be drawn closer together. The default value of the character spacing is 0.

**See Also:**     \_grtext, \_gettextsettings

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

call _setvideomode( _VRES16COLOR )
call _grtext( 100, 100, 'WATCOM'c )
call _setcharspacing( 20 )
call _grtext( 100, 300, 'Graphics'c )
pause
call _setvideomode( _DEFAULTMODE )
end
```

produces the following:



**Classification:** PC Graphics



**Systems:**     `_setcharspacing` - DOS  
              `_setcharspacing_w` - DOS

## ***\_setcliprpn***

---

**Synopsis:**      subroutine \_setcliprpn( x1, y1, x2, y2 )  
                 integer\*2 x1, y1  
                 integer\*2 x2, y2

**Description:**    The \_setcliprpn routine restricts the display of graphics output to the clipping region. This region is a rectangle whose opposite corners are established by the physical points (x1,y1) and (x2,y2) .

The \_setcliprpn routine does not affect text output using the \_outtext and \_outmem routines. To control the location of text output, see the \_settextwindow routine.

**See Also:**      \_settextwindow, \_setvieworg, \_setviewport

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer*2 x1, y1, x2, y2

call _setvideomode( _VRES16COLOR )
call _getcliprpn( x1, y1, x2, y2 )
call _setcliprpn( 130, 100, 510, 380 )
call _ellipse( _GBORDER, 120, 90, 520, 390 )
pause
call _setcliprpn( x1, y1, x2, y2 )
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**      DOS

**Synopsis:**     integer\*2 function \_setcolor( pixval )  
                 integer\*2 pixval

**Description:** The \_setcolor routine sets the pixel value for the current color to be that indicated by the *pixval* argument. The current color is only used by the routines that produce graphics output; text output with \_outtext uses the current text color (see the \_settextcolor routine). The default color value is one less than the maximum number of colors in the current video mode.

**Returns:**     The \_setcolor routine returns the previous value of the current color.

**See Also:**     \_getcolor, \_settextcolor

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer col, old_col

call _setvideomode( _VRES16COLOR )
old_col = _getcolor()
do col = 0, 15
    call _setcolor( col )
    call _rectangle( _GFILLINTERIOR,
+                  100, 100, 540, 380 )
    pause
enddo
call _setcolor( old_col )
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**     DOS

**Synopsis:**     subroutine \_setfillmask( mask )  
                 integer\*1 mask(8)

**Description:**   The \_setfillmask routine sets the current fill mask to the value of the argument *mask*.

The fill mask is an eight-byte array which is interpreted as a square pattern (8 by 8) of 64 bits. Each bit in the mask corresponds to a pixel. When a region is filled, each point in the region is mapped onto the fill mask. When a bit from the mask is one, the pixel value of the corresponding point is set using the current plotting action with the current color; when the bit is zero, the pixel value of that point is not affected.

When the fill mask is not set, a fill operation will set all points in the fill region to have a pixel value of the current color. By default, no fill mask is set.

**See Also:**     \_getfillmask, \_ellipse, \_floodfill, \_rectangle, \_polygon, \_pie, \_setcolor,  
                 \_setplotaction

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer*1 old_mask(8)
integer*1 new_mask(8)/
+           '81'x, '42'x, '24'x, '18'x,
+           '18'x, '24'x, '42'x, '81'x/

call _setvideomode( _VRES16COLOR )
call _getfillmask( old_mask )
call _setfillmask( new_mask )
call _rectangle( _GFILLINTERIOR,
+               100, 100, 540, 380 )
call _setfillmask( old_mask )
pause
call _setvideomode( _DEFAULTMODE )
end
```

produces the following:



**Classification:** PC Graphics

**Systems:** DOS

**Synopsis:**     integer\*2 function `_setfont`( `opt` )  
                  character\*(\*) `opt`

**Description:** The `_setfont` routine selects a font from the list of registered fonts (see the `_registerfonts` routine). The font selected becomes the current font and is used whenever text is displayed with the `_outgtext` routine. The routine will fail if no fonts have been registered, or if a font cannot be found that matches the given characteristics.

The argument *opt* is a string of characters specifying the characteristics of the desired font. These characteristics determine which font is selected. The options may be separated by blanks and are not case-sensitive. Any number of options may be specified and in any order. The available options are:

|                    |   |
|--------------------|---|
| <i>hX</i>          | character height X (in pixels)  |
| <i>wX</i>          | character width X (in pixels)   |
| <i>f</i>           | choose a fixed-width font   |
| <i>p</i>           | choose a proportional-width font  |
| <i>r</i>           | choose a raster (bit-mapped) font   |
| <i>v</i>           | choose a vector font  |
| <i>b</i>           | choose the font that best matches the options   |
| <i>nX</i>          | choose font number X (the number of fonts is returned by the <code>_registerfonts</code> routine) |
| <i>t'facename'</i> | choose a font with specified facename   |

The facename option is specified as a "t" followed by a facename enclosed in single quotes. The available facenames are:

|                |   |
|----------------|---|
| <i>Courier</i> | fixed-width raster font with serifs                                 |
| <i>Helv</i>    | proportional-width raster font without serifs                       |
| <i>Tms Rmn</i> | proportional-width raster font with serifs                          |
| <i>Script</i>  | proportional-width vector font that appears similar to hand-writing |
| <i>Modern</i>  | proportional-width vector font without serifs                       |
| <i>Roman</i>   | proportional-width vector font with serifs                          |

When "nX" is specified to select a particular font, the other options are ignored.

If the best fit option ("b") is specified, `_setfont` will always be able to select a font. The font chosen will be the one that best matches the options specified. The following precedence is given to the options when selecting a font:

1. Pixel height (higher precedence is given to heights less than the specified height)

2. Facename
3. Pixel width
4. Font type (fixed or proportional)

When a pixel height or width does not match exactly and a vector font has been selected, the font will be stretched appropriately to match the given size.

**Returns:** The `_setfont` routine returns zero if successful; otherwise, (-1) is returned.

**See Also:** `_registerfonts`, `_unregisterfonts`, `_getfontinfo`, `_outgtext`,  
`_getgtextextent`, `_setgtextvector`, `_getgtextvector`

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer i, n
character*10 buff

call _setvideomode( _VRES16COLOR )
n = _registerfonts( '*.fon'c )
do i = 0, n - 1
    write( buff, '( 'n', i2.2, a1 )' ) i, char(0)
    call _setfont( buff )
    call _moveto( 100, 100 )
    call _outgtext( 'WATCOM Graphics'c )
    pause
    call _clearscreen( _GCLEARSCREEN )
enddo
call _unregisterfonts()
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:** DOS

## ***\_setgtextvector***

---

**Synopsis:**      record /xycoord/ function \_setgtextvector( x, y )  
                 integer\*2 x, y

**Description:** The \_setgtextvector routine sets the orientation for text output used by the \_outgtext routine to the vector specified by the arguments (x,y) . Each of the arguments can have a value of -1, 0 or 1, allowing for text to be displayed at any multiple of a 45-degree angle. The default text orientation, for normal left-to-right text, is the vector (1,0) .

**Returns:**      The \_setgtextvector routine returns, as anxycoord structure, the previous value of the text orientation vector.

**See Also:**      \_registerfonts,\_unregisterfonts,\_setfont,\_getfontinfo,\_outgtext,  
                 \_getgtextextent,\_getgtextvector

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

record /xycoord/ old_vec

call _setvideomode( _VRES16COLOR )
old_vec = _getgtextvector()
call _setgtextvector( 0, -1 )
call _moveto( 100, 100 )
call _outgtext( 'WATCOM Graphics'c )
call _setgtextvector( old_vec.xcoord, old_vec.ycoord )
pause
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**      DOS



**Synopsis:**     subroutine `_setlinestyle( style )`  
                  integer\*2 `style`

**Description:**   The `_setlinestyle` routine sets the current line-style mask to the value of the *style* argument.

The line-style mask determines the style by which lines and arcs are drawn. The mask is treated as an array of 16 bits. As a line is drawn, a pixel at a time, the bits in this array are cyclically tested. When a bit in the array is 1, the pixel value for the current point is set using the current color according to the current plotting action; otherwise, the pixel value for the point is left unchanged. A solid line would result from a value of 'FFFF'x and a dashed line would result from a value of 'F0F0'x.

The default line style mask is 'FFFF'x.

**See Also:**     `_getlinestyle`, `_lineto`, `_rectangle`, `_polygon`, `_setplotaction`

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer DASHED
parameter (DASHED='f0f0'x)

integer old_style

call _setvideomode( _VRES16COLOR )
old_style = _getlinestyle()
call _setlinestyle( DASHED )
call _rectangle( _GBORDER, 100, 100, 540, 380 )
call _setlinestyle( old_style )
pause
call _setvideomode( _DEFAULTMODE )
end
```

produces the following:



**Classification:** PC Graphics

**Systems:** DOS

**Synopsis:**     integer\*2 function \_ setpixel( x, y )  
                 integer\*2 x, y

                 integer\*2 function \_ setpixel\_ w( x, y )  
                 double precision x, y

**Description:**   The \_ setpixel routine sets the pixel value of the point (x,y) using the current plotting action with the current color. The \_ setpixel routine uses the view coordinate system. The \_ setpixel\_ w routine uses the window coordinate system.

A pixel value is associated with each point. The values range from 0 to the number of colors (less one) that can be represented in the palette for the current video mode. The color displayed at the point is the color in the palette corresponding to the pixel number. For example, a pixel value of 3 causes the fourth color in the palette to be displayed at the point in question.

**Returns:**       The \_ setpixel routines return the previous value of the indicated pixel if the pixel value can be set; otherwise, (-1) is returned.

**See Also:**       \_ getpixel, \_ setcolor, \_ setplotaction

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer x, y, i
real urand
integer seed

seed = 75347
call _ setvideomode( _ VRES16COLOR )
call _ rectangle( _ GBORDER, 100, 100, 540, 380 )
do i = 0, 60000
  x = 101 + mod( int( urand( seed )*32767 ),
+               439 )
  y = 101 + mod( int( urand( seed )*32767 ),
+               279 )
  call _ setcolor( _ getpixel( x, y ) + 1 )
  call _ setpixel( x, y )
enddo
pause
call _ setvideomode( _ DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**       \_ setpixel - DOS  
                  \_ setpixel\_ w - DOS

## **\_setplotaction**

---

**Synopsis:**     integer\*2 function \_setplotaction( action )  
              integer\*2 action

**Description:** The \_setplotaction routine sets the current plotting action to the value of the *action* argument.

The drawing routines cause pixels to be set with a pixel value. By default, the value to be set is obtained by replacing the original pixel value with the supplied pixel value. Alternatively, the replaced value may be computed as a function of the original and the supplied pixel values.

The plotting action can have one of the following values:

|                      |  |
|----------------------|--|
| <b><u>_GPSET</u></b> | replace the original screen pixel value with the supplied pixel value  |
| <b><u>_GAND</u></b>  | replace the original screen pixel value with the <i>bitwise and</i> of the original pixel value and the supplied pixel value   |
| <b><u>_GOR</u></b>   | replace the original screen pixel value with the <i>bitwise or</i> of the original pixel value and the supplied pixel value  |
| <b><u>_GXOR</u></b>  | replace the original screen pixel value with the <i>bitwise exclusive-or</i> of the original pixel value and the supplied pixel value. Performing this operation twice will restore the original screen contents, providing an efficient method to produce animated effects. |

**Returns:**     The previous value of the plotting action is returned.

**See Also:**     \_ getplotaction

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer old_act

call _setvideomode( _VRES16COLOR )
old_act = _getplotaction()
call _setplotaction( _GPSET )
call _rectangle( _GFILLINTERIOR, 100, 100,
+               540, 380 )
pause
call _setplotaction( _GXOR )
call _rectangle( _GFILLINTERIOR, 100, 100,
+               540, 380 )
pause
call _setplotaction( old_act )
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**     DOS

**Synopsis:**     subroutine `_settextalign( horiz, vert )`  
                  integer\*2 horiz, vert

**Description:** The `_settextalign` routine sets the current text alignment to the values specified by the arguments *horiz* and *vert*. When text is displayed with the `_grtext` routine, it is aligned (justified) horizontally and vertically about the given point according to the current text alignment settings.

The horizontal component of the alignment can have one of the following values:

|                      |   |
|----------------------|---|
| <b><u>NORMAL</u></b> | use the default horizontal alignment for the current setting of the text path |
| <b><u>LEFT</u></b>   | the text string is left justified at the given point                          |
| <b><u>CENTER</u></b> | the text string is centred horizontally about the given point                 |
| <b><u>RIGHT</u></b>  | the text string is right justified at the given point                         |

The vertical component of the alignment can have one of the following values:

|                      |   |
|----------------------|---|
| <b><u>NORMAL</u></b> | use the default vertical alignment for the current setting of the text path |
| <b><u>TOP</u></b>    | the top of the text string is aligned at the given point                    |
| <b><u>CAP</u></b>    | the cap line of the text string is aligned at the given point               |
| <b><u>HALF</u></b>   | the text string is centred vertically about the given point                 |
| <b><u>BASE</u></b>   | the base line of the text string is aligned at the given point              |
| <b><u>BOTTOM</u></b> | the bottom of the text string is aligned at the given point                 |

The default is to use `_LEFT` alignment for the horizontal component unless the text path is `_PATH_LEFT`, in which case `_RIGHT` alignment is used. The default value for the vertical component is `_TOP` unless the text path is `_PATH_UP`, in which case `_BOTTOM` alignment is used.

**See Also:**     `_grtext`, `_gettextsettings`

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

call _setvideomode( _VRES16COLOR )
call _grtext( 200, 100, 'WATCOM'c )
call _setpixel( 200, 100 )
call _settextalign( _CENTER, _HALF )
call _grtext( 200, 200, 'Graphics'c )
call _setpixel( 200, 200 )
pause
call _setvideomode( _DEFAULTMODE )
end
```

produces the following:



**Classification:** PC Graphics

**Systems:** DOS

**Synopsis:**     `integer*2 function _settextcolor( pixval )`  
                  `integer*2 pixval`

**Description:**   The `_settextcolor` routine sets the current text color to be the color indicated by the pixel value of the *pixval* argument. This is the color value used for displaying text with the `_outtext` and `_outmem` routines. Use the `_setcolor` routine to change the color of graphics output. The default text color value is set to 7 whenever a new video mode is selected.

The pixel value *pixval* is a number in the range 0-31. Colors in the range 0-15 are displayed normally. In text modes, blinking colors are specified by adding 16 to the normal color values. The following table specifies the default colors in color text modes.

| Pixel<br>value | Color   | Pixel<br>value | Color         |
|----------------|---------|----------------|---------------|
| 0              | Black   | 8              | Gray          |
| 1              | Blue    | 9              | Light Blue    |
| 2              | Green   | 10             | Light Green   |
| 3              | Cyan    | 11             | Light Cyan    |
| 4              | Red     | 12             | Light Red     |
| 5              | Magenta | 13             | Light Magenta |
| 6              | Brown   | 14             | Yellow        |
| 7              | White   | 15             | Bright White  |

**Returns:**       The `_settextcolor` routine returns the pixel value of the previous text color.

**See Also:**       `_gettextcolor`, `_outtext`, `_outmem`, `_setcolor`

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer old_col
integer old_bk

call _setvideomode( _TEXTC80 )
old_col = _gettextcolor()
old_bk = _getbkcolor()
call _settextcolor( 7 )
call _setbkcolor( _BLUE )
call _outtext( ' WATCOM ' //char(10)//
+           'Graphics'c )
call _settextcolor( old_col )
call _setbkcolor( old_bk )
pause
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**       DOS

## **\_settextcursor**

---

**Synopsis:**     integer\*2 function \_ settextcursor( cursor )  
                 integer\*2 cursor

**Description:** The \_ settextcursor routine sets the attribute, or shape, of the cursor in text modes. The argument *cursor* specifies the new cursor shape. The cursor shape is selected by specifying the top and bottom rows in the character matrix. The high byte of *cursor* specifies the top row of the cursor; the low byte specifies the bottom row.

Some typical values for *cursor* are:

| Cursor  | Shape                    |
|---------|--------------------------|
| '0607'x | normal underline cursor  |
| '0007'x | full block cursor        |
| '0407'x | half-height block cursor |
| '2000'x | no cursor                |

**Returns:**     The \_ settextcursor routine returns the previous cursor shape when the shape is set successfully; otherwise, (-1) is returned.

**See Also:**     \_ gettextcursor, \_ displaycursor

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer*2 old_shape

old_shape = _ gettextcursor()
call _ settextcursor( '0007'x )
call _ outtext(
+   char(10)//'Block cursor'c )
pause
call _ settextcursor( '0407'x )
call _ outtext(
+   char(10)//'Half height cursor'c )
pause
call _ settextcursor( '2000'x )
call _ outtext(
+   char(10)//'No cursor'c )
pause
end
```

**Classification:** PC Graphics

**Systems:**     DOS



**Synopsis:**      subroutine \_settextorient( vecx, vecy )  
                 integer\*2 vecx, vecy

**Description:**    The \_settextorient routine sets the current text orientation to the vector specified by the arguments (vecx,vecy) . The text orientation specifies the direction of the base-line vector when a text string is displayed with the \_grtext routine. The default text orientation, for normal left-to-right text, is the vector (1,0) .

**See Also:**      \_grtext, \_gettextsettings

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

call _setvideomode( _VRES16COLOR )
call _grtext( 200, 100, 'WATCOM'c )
call _settextorient( 1, 1 )
call _grtext( 200, 200, 'Graphics'c )
pause
call _setvideomode( _DEFAULTMODE )
end
```

produces the following:



**Classification:** PC Graphics

**Systems:**      DOS

## ***\_settextpath***

---

**Synopsis:**      subroutine \_ settextpath( path )  
                 integer\*2 path

**Description:**    The \_ settextpath routine sets the current text path to have the value of the *path* argument. The text path specifies the writing direction of the text displayed by the \_ grtext routine. The argument can have one of the following values:

***\_PATH\_RIGHT***              subsequent characters are drawn to the right of the previous character

***\_PATH\_LEFT***                subsequent characters are drawn to the left of the previous character

***\_PATH\_UP***                  subsequent characters are drawn above the previous character

***\_PATH\_DOWN***                subsequent characters are drawn below the previous character

The default value of the text path is `_ PATH_ RIGHT`.

**See Also:**        `_ grtext`, `_ gettextsettings`

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

call _ setvideomode( _ VRES16COLOR )
call _ grtext( 200, 100, 'WATCOM'c )
call _ settextpath( _ PATH_ DOWN )
call _ grtext( 200, 200, 'Graphics'c )
pause
call _ setvideomode( _ DEFAULTMODE )
end
```

produces the following:



**Classification:** PC Graphics

**Systems:** DOS

## ***\_settextposition***

---

**Synopsis:**      record /rccoord/ function \_ settextposition( row, col )  
                 integer\*2 row, col

**Description:**    The \_ settextposition routine sets the current output position for text to be (row,col) where this position is in terms of characters, not pixels.

The text position is relative to the current text window. It defaults to the top left corner of the screen, (1,1), when a new video mode is selected, or when a new text window is set. The position is updated as text is drawn with the \_ outtext and \_ outmem routines.

Note that the output position for graphics output differs from that for text output. The output position for graphics output can be set by use of the \_ moveto routine.

**Returns:**        The \_ settextposition routine returns, as an rccoord structure, the previous output position for text.

**See Also:**        \_ gettextposition, \_ outtext, \_ outmem, \_ settextwindow, \_ moveto

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

record /rccoord/ old_pos

call _ setvideomode( _ TEXTC80 )
old_pos = _ gettextposition()
call _ settextposition( 10, 40 )
call _ outtext( 'WATCOM Graphics'c )
call _ settextposition( old_pos.row, old_pos.col )
pause
call _ setvideomode( _ DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**        DOS

**Synopsis:**     integer\*2 function \_ settextrows( rows )  
                integer\*2 rows

**Description:** The \_ settextrows routine selects the number of rows of text displayed on the screen. The number of rows is specified by the argument *rows*. Computers equipped with EGA, MCGA and VGA adapters can support different numbers of text rows. The number of rows that can be selected depends on the current video mode and the type of monitor attached.

If the argument *rows* has the value *\_MAXTEXTROWS*, the maximum number of text rows will be selected for the current video mode and hardware configuration. In text modes the maximum number of rows is 43 for EGA adapters, and 50 for MCGA and VGA adapters. Some graphics modes will support 43 rows for EGA adapters and 60 rows for MCGA and VGA adapters.

**Returns:**     The \_ settextrows routine returns the number of screen rows when the number of rows is set successfully; otherwise, zero is returned.

**See Also:**     \_ getvideoconfig, \_ setvideomode, \_ setvideomoderows

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer valid_rows(8)/
+      14, 25, 28, 30,
+      34, 43, 50, 60/

integer i, j, rows
character*80 buff

do i = 0, 7
  rows = valid_rows( i )
  if( _ settextrows( rows ) .eq. rows )then
    do j = 1, rows
      write( buff, '( "Line ", i2, a1 )' )
+      j, char(0)
      call _ settextposition( j, 1 )
      call _ outtext( buff )
    enddo
    pause
  endif
enddo
call _ setvideomode( _ DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**     DOS

## ***\_settextwindow***

---

**Synopsis:**      subroutine \_settextwindow( row1, col1, row2, col2 )  
                 integer\*2 row1, col1  
                 integer\*2 row2, col2

**Description:**    The \_settextwindow routine sets the text window to be the rectangle with a top left corner at (row1,col1) and a bottom right corner at (row2,col2) . These coordinates are in terms of characters not pixels.

The initial text output position is (1,1) . Subsequent text positions are reported (by the \_gettextposition routine) and set (by the \_outtext,\_outmem and \_settextposition routines) relative to this rectangle.

Text is displayed from the current output position for text proceeding along the current row and then downwards. When the window is full, the lines scroll upwards one line and then text is displayed on the last line of the window.

**See Also:**      \_gettextposition,\_outtext,\_outmem,\_settextposition

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer i
integer*2 r1, c1, r2, c2
character*80 buff

call _setvideomode( _TEXTC80 )
call _gettextwindow( r1, c1, r2, c2 )
call _settextwindow( 5, 20, 20, 40 )
do i = 1, 20
    write( buff, '( "Line "', i2, a1, a1 )' )
+      i, char(10), char(0)
    call _outtext( buff )
enddo
pause
call _settextwindow( r1, c1, r2, c2 )
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**      DOS



### SVGA

SuperVGA adapters

The modes `_MAXRESMODE` and `_MAXCOLORMODE` will select from among the video modes supported by the current graphics adapter the one that has the highest resolution or the greatest number of colors. The video mode will be selected from the standard modes, not including the SuperVGA modes.

Selecting a new video mode resets the current output positions for graphics and text to be the top left corner of the screen. The background color is reset to black and the default color value is set to be one less than the number of colors in the selected mode.

**Returns:** The `_setvideomode` routine returns the number of text rows when the new mode is successfully selected; otherwise, zero is returned.

**See Also:** `_getvideoconfig`, `_settextrows`, `_setvideomoderows`

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer mode
record /videoconfig/ vc
character*80 buff

call _getvideoconfig( vc )
select( vc.adapter )
case( _VGA, _SVGA )
    mode = _VRES16COLOR
case( _MCGA )
    mode = _MRES256COLOR
case( _EGA )
    if( vc.monitor .eq. _MONO )then
        mode = _ERESNOCOLOR
    else
        mode = _ERESCOLOR
    endif
case( _CGA )
    mode = _MRES4COLOR
case( _HERCULES )
    mode = _HERCMONO
case default
    stop 'No graphics adapter'
endselect
if( _setvideomode( mode ) .ne. 0 )then
    call _getvideoconfig( vc )
    write( buff,
+         '( i3, '' x '', i3, '' x '', i3, a1 )' )
+         vc.numxpixels, vc.numypixels,
+         vc.numcolors, char(0)
    call _outtext( buff )
    pause
    call _setvideomode( _DEFAULTMODE )
endif
end
```

**Classification:** PC Graphics

**Systems:** DOS



**Synopsis:**     integer\*2 function \_setvideomoderows( mode, rows )  
              integer\*2 mode  
              integer\*2 rows

**Description:** The \_setvideomoderows routine selects a video mode and the number of rows of text displayed on the screen. The video mode is specified by the argument *mode* and is selected with the \_setvideomode routine. The number of rows is specified by the argument *rows* and is selected with the \_settextrows routine.

Computers equipped with EGA, MCGA and VGA adapters can support different numbers of text rows. The number of rows that can be selected depends on the video mode and the type of monitor attached.

**Returns:**     The \_setvideomoderows routine returns the number of screen rows when the mode and number of rows are set successfully; otherwise, zero is returned.

**See Also:**     \_getvideoconfig, \_setvideomode, \_settextrows

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer rows
character*80 buff

rows = _setvideomoderows( _TEXT80, _MAXTEXTROWS )
if( rows .ne. 0 )then
    write( buff,
+         ' (''Number of rows is '', i2, a1 )' )
+         rows, char(0)
    call _outtext( buff )
    pause
    call _setvideomode( _DEFAULTMODE )
endif
end
```

**Classification:** PC Graphics

**Systems:**     DOS

## ***\_setvieworg***

---

**Synopsis:**     record /xycoord/ function \_setvieworg( x, y )  
                 integer\*2 x, y

**Description:** The \_setvieworg routine sets the origin of the view coordinate system, (0,0), to be located at the physical point (x,y). This causes subsequently drawn images to be translated by the amount (x,y).

**Returns:**     The \_setvieworg routine returns, as anxycoord structure, the physical coordinates of the previous origin.

**See Also:**     \_getviewcoord, \_getphyscoord, \_setcliprgn, \_setviewport

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

call _setvideomode( _VRES16COLOR )
call _setvieworg( 320, 240 )
call _ellipse( _GBORDER, -200, -150, 200, 150 )
pause
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**     DOS

**Synopsis:**     subroutine \_setviewport( x1, y1, x2, y2 )  
                 integer\*2 x1, y1  
                 integer\*2 x2, y2

**Description:**   The \_setviewport routine restricts the display of graphics output to the clipping region and then sets the origin of the view coordinate system to be the top left corner of the region. This region is a rectangle whose opposite corners are established by the physical points (x1,y1) and (x2,y2) .

The \_setviewport routine does not affect text output using the \_outtext and \_outmem routines. To control the location of text output, see the \_settextwindow routine.

**See Also:**     \_setcliprgn, \_setvieworg, \_settextwindow, \_setwindow

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer XSIZE, YSIZE
parameter (XSIZE=380)
parameter (YSIZE=280)

call _setvideomode( _VRES16COLOR )
call _setviewport( 130, 100,
+               130 + XSIZE, 100 + YSIZE )
call _ellipse( _GBORDER, 0, 0, XSIZE, YSIZE )
pause
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**     DOS

**Synopsis:**     integer\*2 function \_ setvisualpage( pagenum )  
                 integer\*2 pagenum

**Description:** The \_ setvisualpage routine selects the page (in memory) from which graphics output is displayed. The page to be selected is given by the *pagenum* argument.

Only some combinations of video modes and hardware allow multiple pages of graphics to exist. When multiple pages are supported, the active page may differ from the visual page. The graphics information in the visual page determines what is displayed upon the screen. Animation may be accomplished by alternating the visual page. A graphics page can be constructed without affecting the screen by setting the active page to be different than the visual page.

The number of available video pages can be determined by using the \_ getvideoconfig routine. The default video page is 0.

**Returns:**     The \_ setvisualpage routine returns the number of the previous page when the visual page is set successfully; otherwise, a negative number is returned.

**See Also:**     \_ getvisualpage, \_ setactivepage, \_ getactivepage, \_ getvideoconfig

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer old_ apage, old_ vpage

call _ setvideomode( _ HRES16COLOR )
old_ apage = _ getactivepage()
old_ vpage = _ getvisualpage()
! draw an ellipse on page 0
call _ setactivepage( 0 )
call _ setvisualpage( 0 )
call _ ellipse( _ GFillInterior, 100, 50,
+              540, 150 )
! draw a rectangle on page 1
call _ setactivepage( 1 )
call _ rectangle( _ GFillInterior, 100, 50,
+               540, 150 )
pause
! display page 1
call _ setvisualpage( 1 )
pause
call _ setactivepage( old_ apage )
call _ setvisualpage( old_ vpage )
call _ setvideomode( _ DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**     DOS

**Synopsis:**     integer\*2 function \_setwindow( invert, x1, y1, x2, y2 )  
                 logical invert  
                 double precision x1, y1  
                 double precision x2, y2

**Description:**     The \_setwindow routine defines a window for the window coordinate system. Window coordinates are specified as a user-defined range of values. This allows for consistent pictures regardless of the video mode.

The window is defined as the region with opposite corners established by the points (x1,y1) and (x2,y2) . The argument *invert* specifies the direction of the y-axis. If the value is .TRUE., the y values increase from the bottom of the screen to the top, otherwise, the y values increase as you move down the screen.

The window defined by the \_setwindow routine is displayed in the current viewport. A viewport is defined by the \_setviewport routine.

By default, the window coordinate system is defined with the point (0.0,0.0) located at the lower left corner of the screen, and the point (1.0,1.0) at the upper right corner.

**Returns:**         The \_setwindow routine returns a non-zero value when the window is set successfully; otherwise, zero is returned.

**See Also:**        \_setviewport

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

call _setvideomode( _MAXRESMODE )
call draw_house( 'Default window'c )
call _setwindow( .TRUE., -0.5, -0.5, 1.5, 1.5 )
call draw_house( 'Larger window'c )
call _setwindow( .TRUE., 0.0, 0.0, 0.5, 1.0 )
call draw_house( 'Left side'c )
call _setvideomode( _DEFAULTMODE )
end

subroutine draw_house( msg )

include 'graph.fi'
character*80 msg

call _clearscreen( _GCLEARSCREEN )
call _outtext( msg )
call _rectangle_w( _GBORDER, 0.2, 0.1, 0.8, 0.6 )
call _moveto_w( 0.1, 0.5 )
call _lineto_w( 0.5, 0.9 )
call _lineto_w( 0.9, 0.5 )
call _arc_w( 0.4, 0.5, 0.6, 0.3,
+           0.6, 0.4, 0.4, 0.4 )
call _rectangle_w( _GBORDER, 0.4, 0.1, 0.6, 0.4 )
pause
end
```

**Classification:** PC Graphics

**Systems:**      DOS

**Synopsis:**      subroutine \_unregisterfonts()

**Description:**    The \_unregisterfonts routine frees the memory previously allocated by the \_registerfonts routine. The currently selected font is also unloaded.

Attempting to use the \_setfont routine after calling \_unregisterfonts will result in an error.

**See Also:**      \_registerfonts, \_setfont, \_getfontinfo, \_outgtext, \_getgtextextent,  
                 \_setgtextvector, \_getgtextvector

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer i, n
character*10 buff

call _setvideomode( _VRES16COLOR )
n = _registerfonts( '*.fon'c )
do i = 0, n - 1
    write( buff, '( ''n'', i2.2, a1 )' ) i, char(0)
    call _setfont( buff )
    call _moveto( 100, 100 )
    call _outgtext( 'WATCOM Graphics'c )
    pause
    call _clearscreen( _GCLEARSCREEN )
enddo
call _unregisterfonts()
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**      DOS

**Synopsis:**     integer\*2 function \_wrapon( wrap )  
              integer\*2 wrap

**Description:** The \_wrapon routine is used to control the display of text when the text output reaches the right side of the text window. This is text displayed with the \_outtext and \_outmem routines. The *wrap* argument can take one of the following values:

***\_GWRAPON***               causes lines to wrap at the window border

***\_GWRAPOFF***           causes lines to be truncated at the window border

**Returns:**     The \_wrapon routine returns the previous setting for wrapping.

**See Also:**    \_ outtext, \_ outmem, \_ settextwindow

**Example:**

```
include 'graphapi.fi'
include 'graph.fi'

integer i
character buff*80

call _setvideomode( _TEXT80 )
call _settextwindow( 5, 20, 20, 30 )
call _wrapon( _GWRAPOFF )
do i = 1, 3
    call _settextposition( 2 * i, 1 )
    write( buff,
+         ' (''Very very long line '', i2, a1)' )
+         i, char(0)
    call _outtext( buff )
enddo
call _wrapon( _GWRAPON )
do i = 4, 6
    call _settextposition( 2 * i, 1 )
    write( buff,
+         ' (''Very very long line '', i2, a1)' )
+         i, char(0)
    call _outtext( buff )
enddo
pause
call _setvideomode( _DEFAULTMODE )
end
```

**Classification:** PC Graphics

**Systems:**     DOS



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