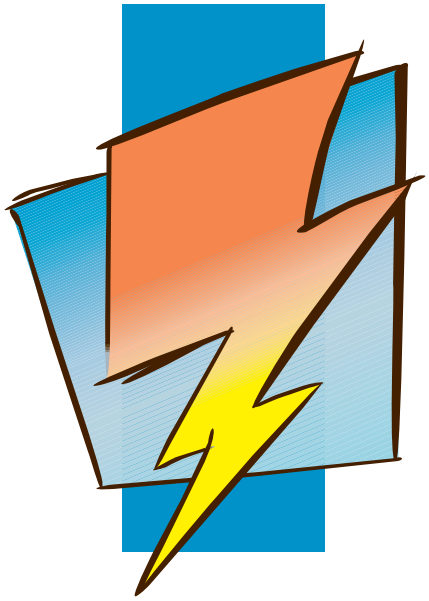
Open Watcom FORTRAN 77

Graphics Library Reference



Version 2.0

Open Watcom

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For more information please visit https://github.com/open-watcom/open-watcom-v2 .

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.

July, 1997.

Trademarks Used in this Manual

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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.

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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:

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

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

_getarcinfo	get the endpoints of the most recently drawn arc
_getbkcolor	get the background color
_getcolor	get the current color
_getfillmask	get the current fill mask
_getlinestyle	get the current line style
_getplotaction	get the current plotting action
_remapallpalette	assign colors for all pixel values
_remappalette	assign color for one pixel value
_selectpalette	select a palette
_setbkcolor	set the background color
_setcolor	set the current color
_setfillmask	set the current fill mask
_setlinestyle	set the current line style
_setplotaction	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` routine), rectangles (see the `_rectangle` routine), polygons (see the `_polygon` routine), ellipses (see the `_ellipse` routine), elliptical arcs (see the `_arc` routine) and pie-shaped wedges from ellipses (see the `_pie` routine).

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:

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

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

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

_gettextextent	get the bounding rectangle for a graphics text string
_gettextsettings	get information about the current settings used to display graphics text
_grtext	display graphics text
_grtext_w	display graphics text using window coordinates
_setcharsize	set the character size used to display graphics text
_setcharsize_w	set the character size in window coordinates used to display graphics text
_setcharspacing	set the character spacing used to display graphics text
_setcharspacing_w	set the character spacing in window coordinates used to display graphics text
_settextalign	set the alignment used to display graphics text
_settextorient	set the orientation used to display graphics text
_settextpath	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:

_getimage	store an image of an area of the screen into memory
_getimage_w	store an image of an area of the screen in window coordinates into memory
_getimage_wxy	store an image of an area of the screen in window coordinates into memory
_imagesize	get the size of a screen area
_imagesize_w	get the size of a screen area in window coordinates
_imagesize_wxy	get the size of a screen area in window coordinates
_putimage	display an image from memory on the screen
_putimage_w	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:

_getfontinfo	get information about the currently selected font
_getgtextextent	get the length in pixels of a text string
_getgtextvector	get the current value of the font text orientation vector
_outgtext	display a string of text in the current font
_registerfonts	initialize the font graphics system
_setfont	select a font from among the registered fonts
_setgtextvector	set the font text orientation vector
_unregisterfonts	frees 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:

_pg_chart	display a bar, column or line chart
_pg_chartms	display a multi-series bar, column or line chart
_pg_chartpie	display a pie chart
_pg_chartscatter	display a scatter chart
_pg_chartscatterms	display a multi-series scatter chart
_pg_defaultchart	initialize the chart environment for a specific chart type
_pg_initchart	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:

_pg_analyzechart	analyze a bar, column or line chart
_pg_analyzechartms	analyze a multi-series bar, column or line chart
_pg_analyzepie	analyze a pie chart
_pg_analyzescatter	analyze a scatter chart
_pg_analyzescatterms	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:

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

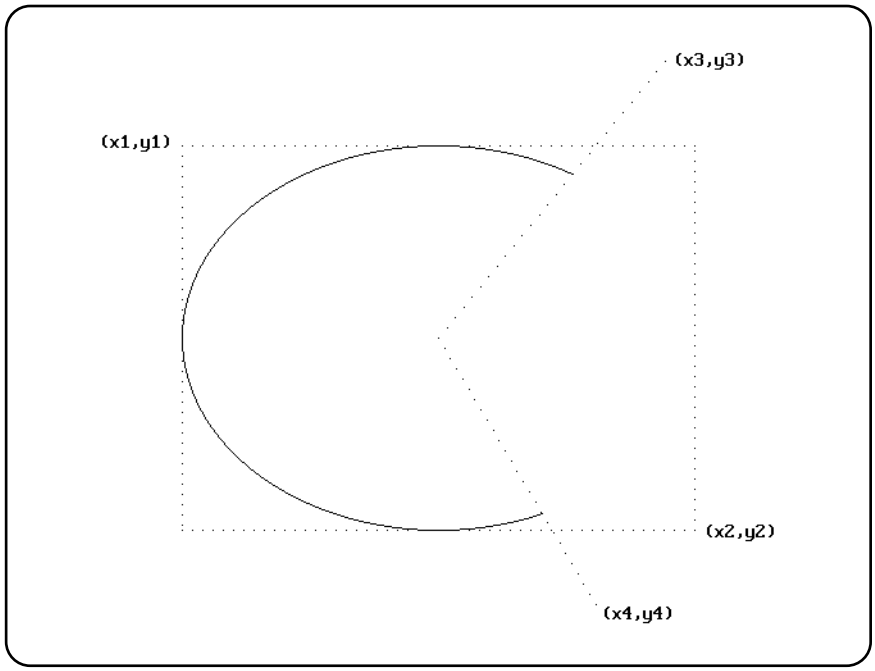
Synopsis:

```
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.

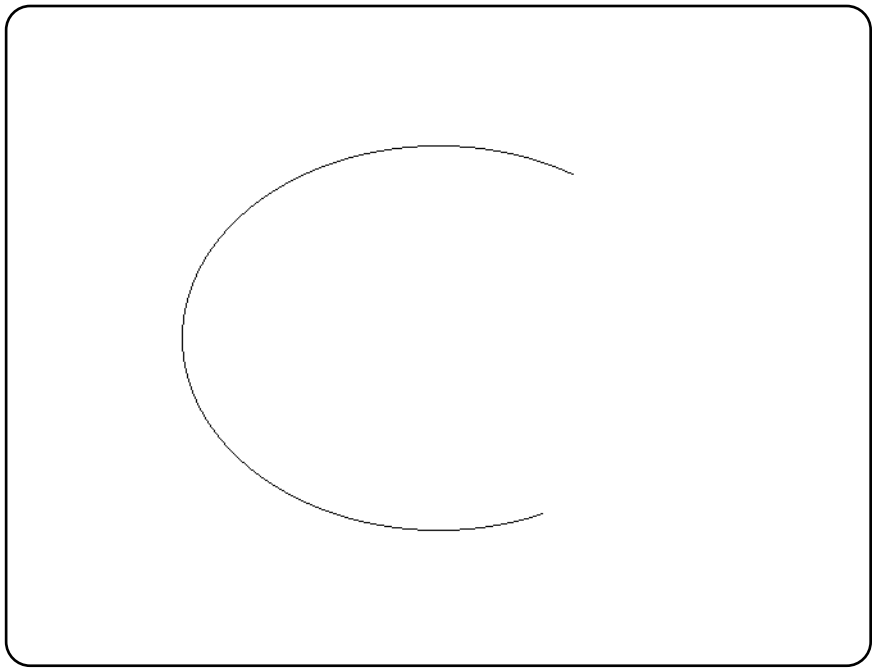
Returns: The _arc routines return a non-zero value when the arc was successfully drawn; otherwise, zero is returned.

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

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`, `_setcliprgn`, `_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`, `_settextcursor`

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

      character*30 name

      call _setvideomode( _TEXTC80 )
      call _settextposition( 2, 1 )
      call _displaycursor( _GCURSORON )
      call _outtext( 'Cursor ON'//char(10)//char(10)
     +               //'Enter your name >'c )
      read( *, '(a30)' ) name
      call _displaycursor( _GCURSOROFF )
      call _settextposition( 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.

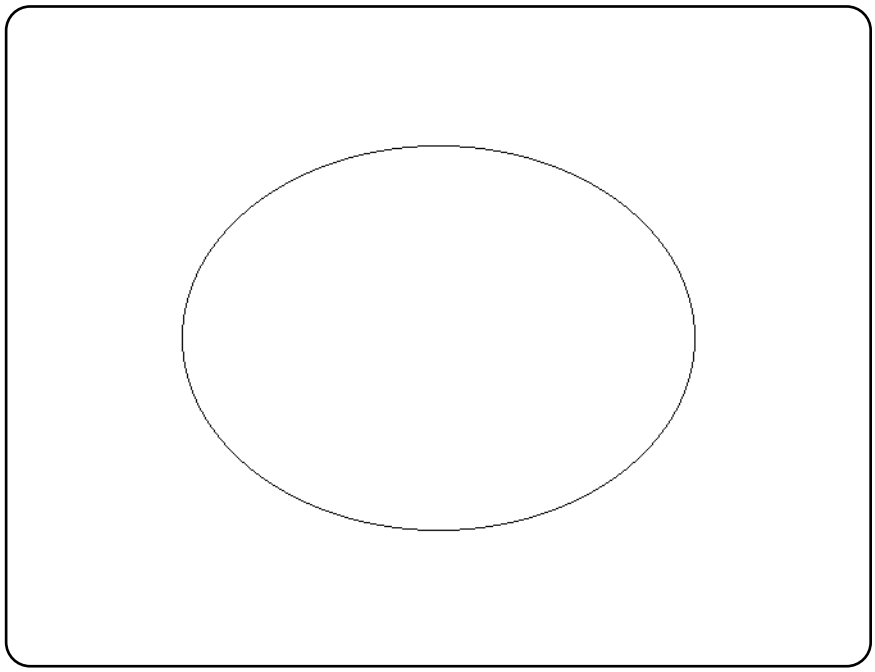
Returns: The `_ellipse` routines return a non-zero value when the ellipse was successfully drawn; otherwise, zero is returned.

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: `_setcliprgn`, `_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

Synopsis:

```
integer*2 function _getarcinfo( start_pt, end_pt,
                                inside_pt )
record /xycoord/ start_pt
record /xycoord/ end_pt
record /xycoord/ inside_pt
```

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.

The endpoints of the arc can be used to connect other lines to the arc. The interior point can be used to fill the pie.

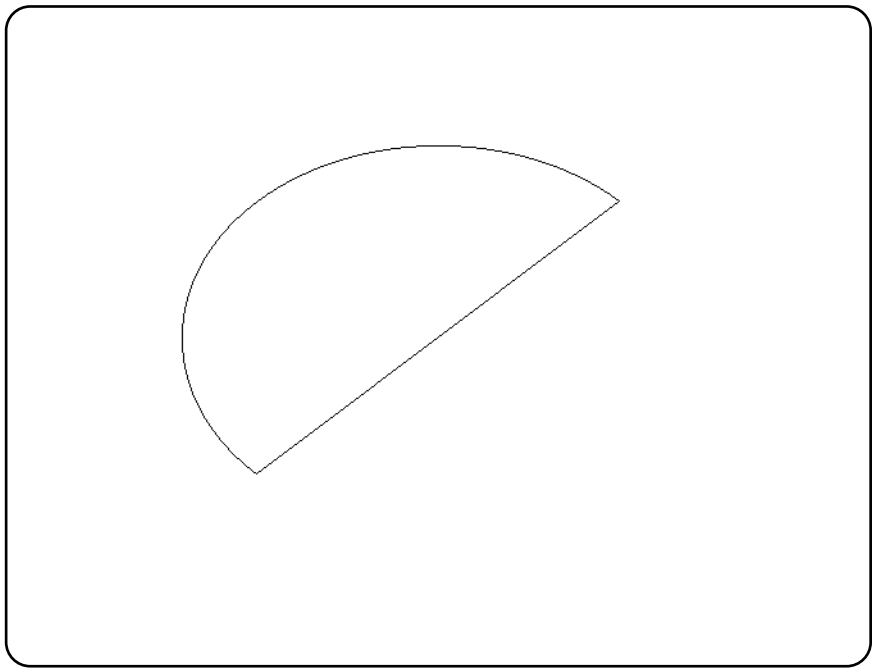
Returns: The `_getarcinfo` routine returns a non-zero value when successful. If the previous arc or pie was not successfully drawn, zero is returned.

See Also: `_arc`, `_pie`

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
```

produces the following:



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:

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

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 an `xycoord` 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

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:

_GPSET	replace the original screen pixel value with the supplied pixel value
_GAND	replace the original screen pixel value with the *bitwise and* of the original pixel value and the supplied pixel value
_GOR	replace the original screen pixel value with the *bitwise or* of the original pixel value and the supplied pixel value
_GXOR	replace the original screen pixel value with the *bitwise exclusive-or* 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*.

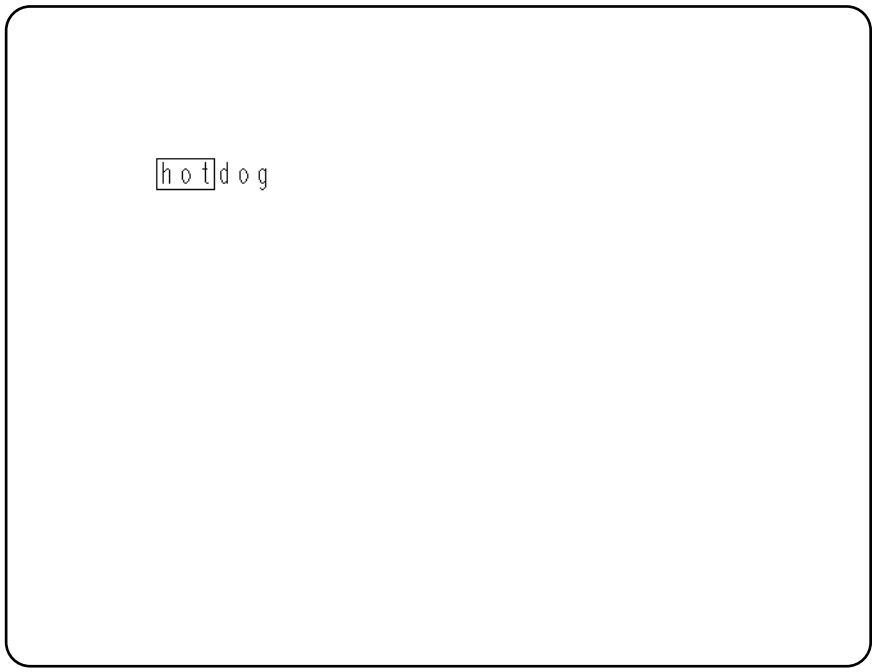
The concatenation point is the position to use to output text after the given string. The text extent parallelogram outlines the area where the text string would be displayed. The four points are returned in counter-clockwise order, starting at the upper-left corner.

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`, `_settextposition` and `_settextwindow` 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`, `_settextposition`, `_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:
```
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):

basevectorx	x-component of the current base vector
basevectory	y-component of the current base vector
path	current text path
height	current text height (in pixels)
width	current text width (in pixels)
spacing	current text spacing (in pixels)
horizalign	horizontal component of the current text alignment
vertalign	vertical component of the current text alignment

See Also: `_grtext`, `_setcharsize`, `_setcharspacing`, `_settextalign`, `_settextpath`, `_settextorient`

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):

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

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

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

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

_MONO	regular monochrome
_COLOR	regular color
_ENHANCED	enhanced color
_ANALOGMONO	analog monochrome
_ANALOGCOLOR	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:

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.

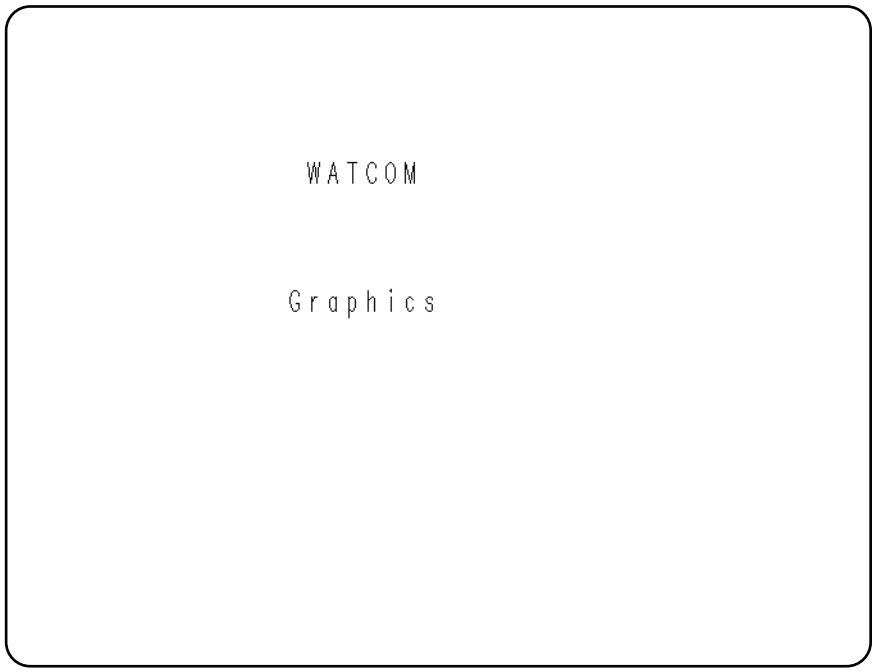
Returns: The _grtext routines return a non-zero value when the text was successfully drawn; otherwise, zero is returned.

See Also: _outtext, _outmem, _outgtext, _setcharsize, _settextalign, _settextpath, _settextorient, _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.

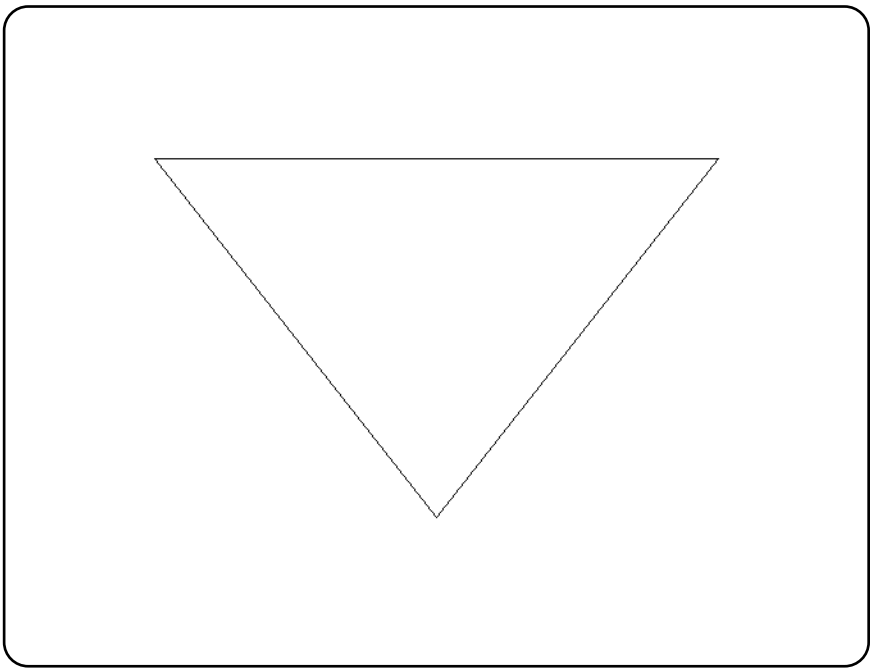
Returns: The `_lineto` routines return a non-zero value when the line was successfully drawn; otherwise, zero is returned.

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`

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

Synopsis:

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

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

The chart environment structure *env* is filled with default values based on the values of the *cat*, *values* and *explode* arguments. The arguments are the same as for the `_pg_chartpie` routine.

Returns: The `_pg_analyzepie` 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_analyzechart`, `_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
      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_analyzescatterms( 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_analyzescatterms` 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_chartscatterms` 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_analyzescatterms( 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_chartscatterms( env, x, y, NUM_SERIES,
     +                NUM_VALUES, NUM_VALUES, labels )
      pause
      call _setvideomode( _DEFAULTMODE )
      end
```

Classification: PC Graphics

Systems: _pg_analyzescatter - DOS
_pg_analyzescatterms - 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.

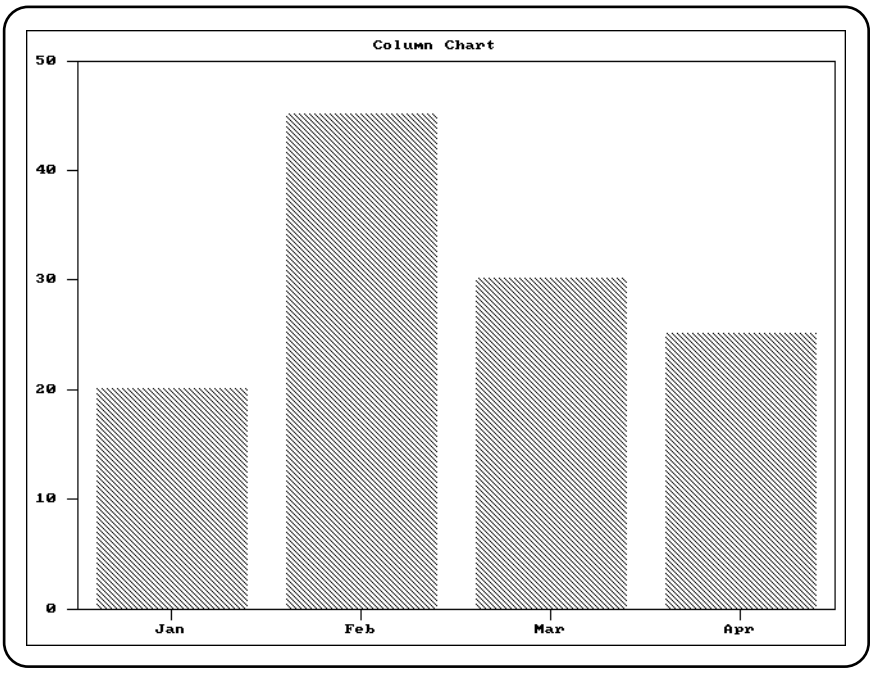
Returns: The _pg_chart routines return zero if successful; otherwise, a non-zero value is returned.

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

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.

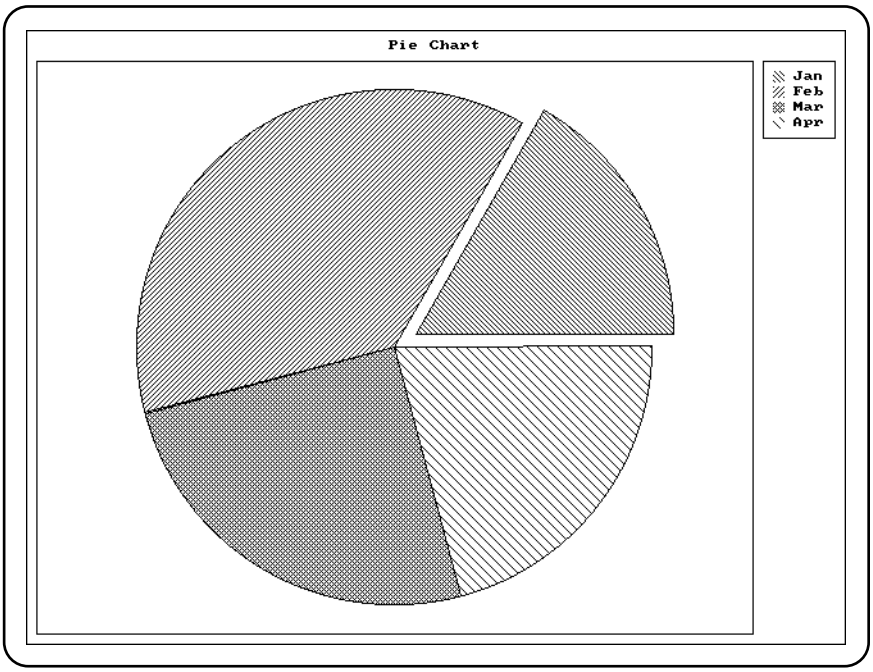
Returns: The _pg_chartpie routine returns zero if successful; otherwise, a non-zero value is returned.

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_chartscatterms( 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_chartscatterms` 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.

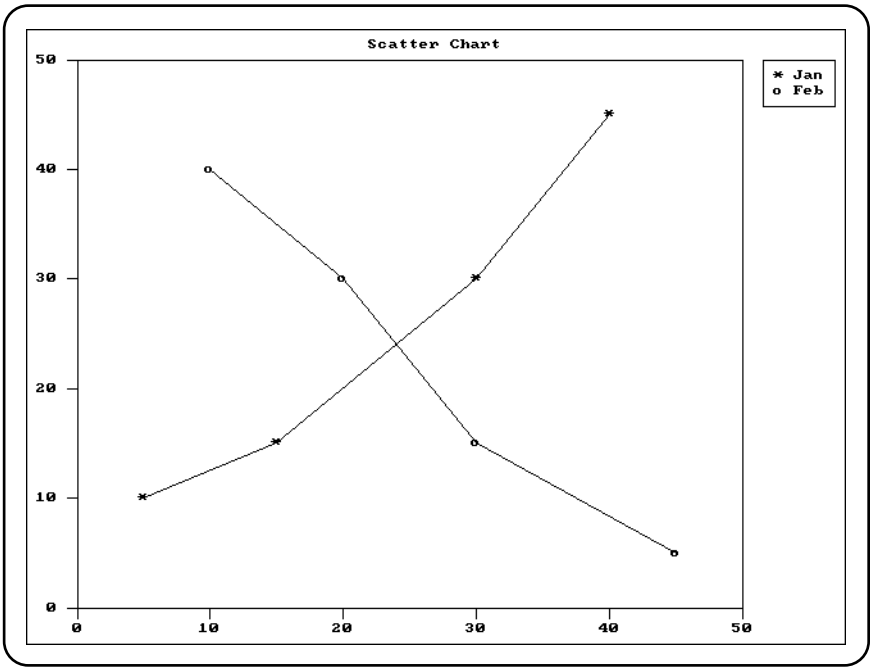
Returns: The `_pg_chartscatter` routines return zero if successful; otherwise, a non-zero value is returned.

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_chartscatterms( 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:

_PG_BARCHART	Bar chart (horizontal bars)
_PG_COLUMNCHART	Column chart (vertical bars)
_PG_LINECHART	Line chart
_PG_SCATTERCHART	Scatter chart
_PG_PIECHART	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:

Type	Style 1	Style 2
Bar	_PG_PLAINBARS	_PG_STACKEDBARS
Column	_PG_PLAINBARS	_PG_STACKEDBARS
Line	_PG_POINTANDLINE	_PG_POINTONLY
Scatter	_PG_POINTANDLINE	_PG_POINTONLY
Pie	_PG_PERCENT	_PG_NOPERCENT

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:

color	color used to display series
style	line style used for line and scatter charts
fill	fill pattern used to fill interior of bar and pie sections
plotchar	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

Synopsis:
```
integer*2 function _pg_hlabelchart( env, x, y,
                                    color, label )
record /chartenv/ env
integer*2 x, y, color
character*(*) label
```

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.

Returns: The _pg_hlabelchart 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_vlabelchart

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 )
      call _pg_hlabelchart( env, 64, 32, 1,
     +                 'Horizontal label'c )
      call _pg_vlabelchart( env, 48, 32, 1,
     +                 'Vertical label'c )
      pause
      call _setvideomode( _DEFAULTMODE )
      end
```

Classification: PC Graphics

Systems: DOS

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

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

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:

color	color used to display series
style	line style used for line and scatter charts
fill	fill pattern used to fill interior of bar and pie sections
plotchar	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 _pg_vlabelchart( env, x, y,
                                    color, label )
record /chartenv/ env
integer*2 x, y, color
character*(*) label
```

Description: The _pg_vlabelchart routine displays the text string *label* on the chart described by the *env* chart structure. The string is displayed vertically 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.

Returns: The _pg_vlabelchart 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_hlabelchart

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 )
      call _pg_hlabelchart( env, 64, 32, 1,
     +                 'Horizontal label'c )
      call _pg_vlabelchart( env, 48, 32, 1,
     +                 'Vertical label'c )
      pause
      call _setvideomode( _DEFAULTMODE )
      end
```

Classification: PC Graphics

Systems: DOS

Synopsis:

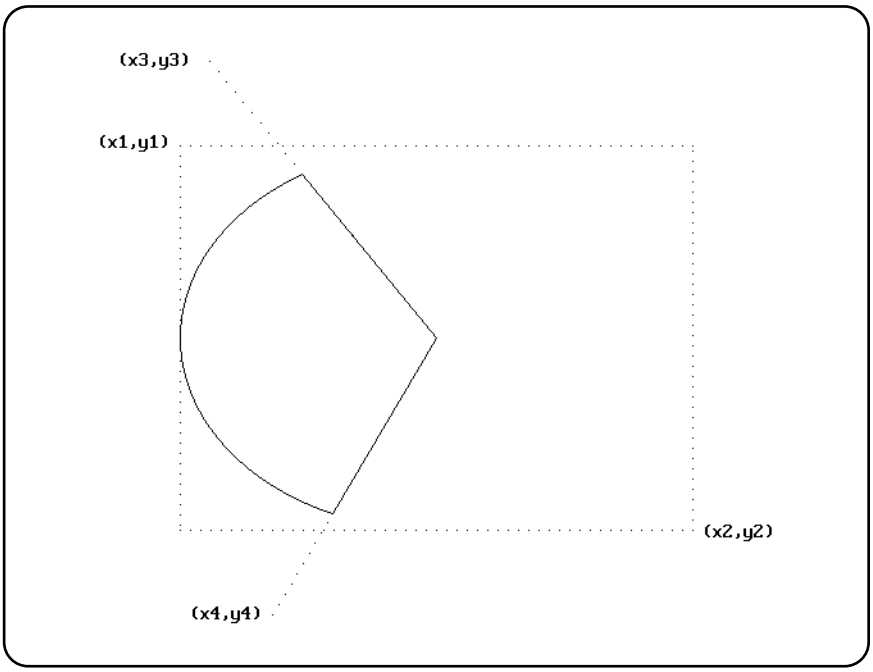
```
integer*2 function _pie( fill, x1, y1, x2, y2,
                                  x3, y3, x4, y4 )
integer*2 fill
integer*2 x1, y1
integer*2 x2, y2
integer*2 x3, y3
integer*2 x4, y4

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

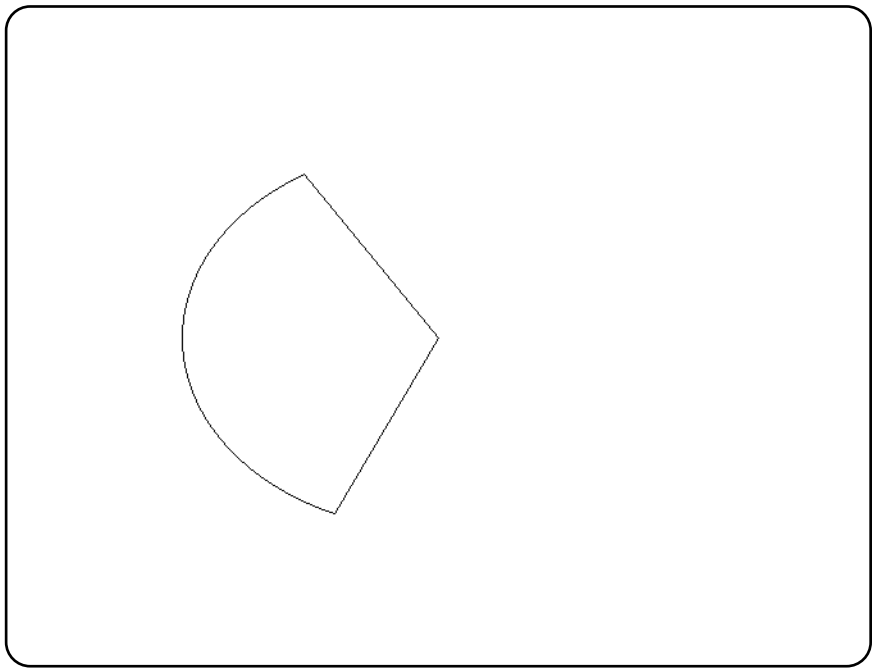
Returns: The `_pie` routines return a non-zero value when the figure was successfully drawn; otherwise, zero is returned.

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:

_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

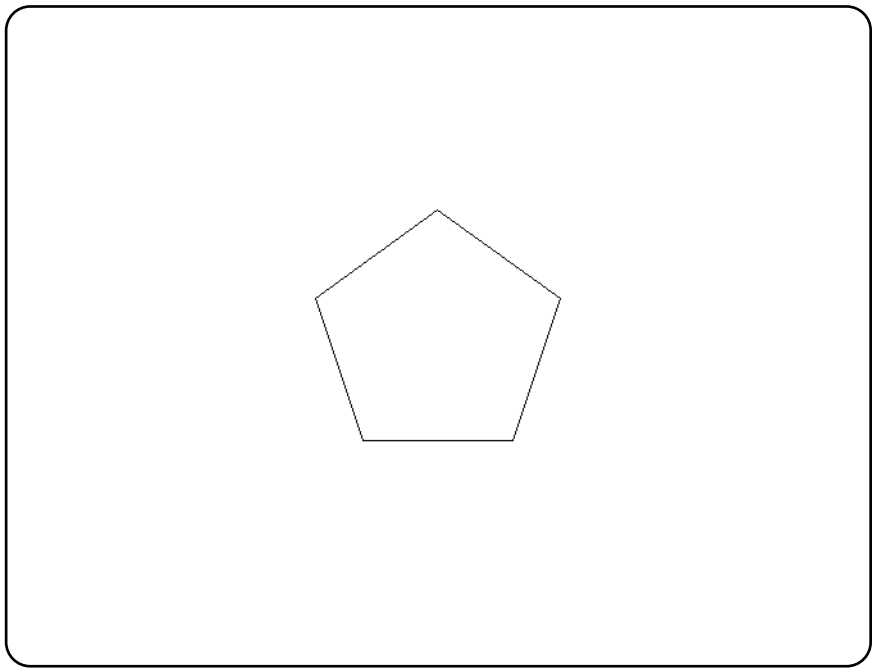
Returns: The `_polygon` routines return a non-zero value when the polygon was successfully drawn; otherwise, zero is returned.

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:

_GPSET	replace the rectangle on the screen by the saved image
_GPRESET	replace the rectangle on the screen with the pixel values of the saved image inverted; this produces a negative image
_GAND	produce a new image on the screen by ANDing together the pixel values from the screen with those from the saved image
_GOR	produce a new image on the screen by ORing together the pixel values from the screen with those from the saved image
_GXOR	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 _putimage 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

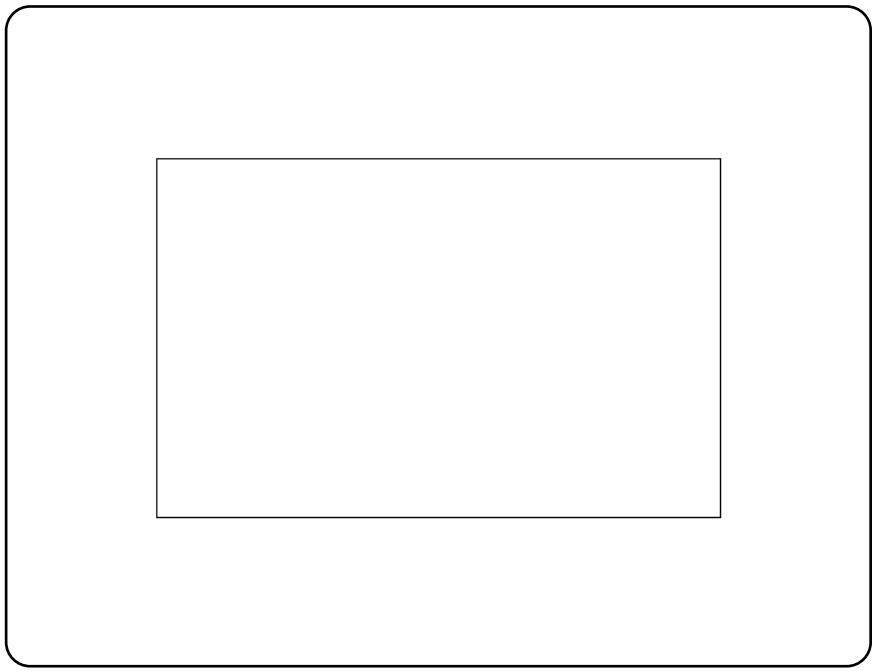
Returns: The `_rectangle` routines return a non-zero value when the rectangle was successfully drawn; otherwise, zero is returned.

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`, `_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 _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

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
_GSCROLLDOWN	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( _GSCROLLDOWN )
        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 Number	Pixel Values 1	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

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.

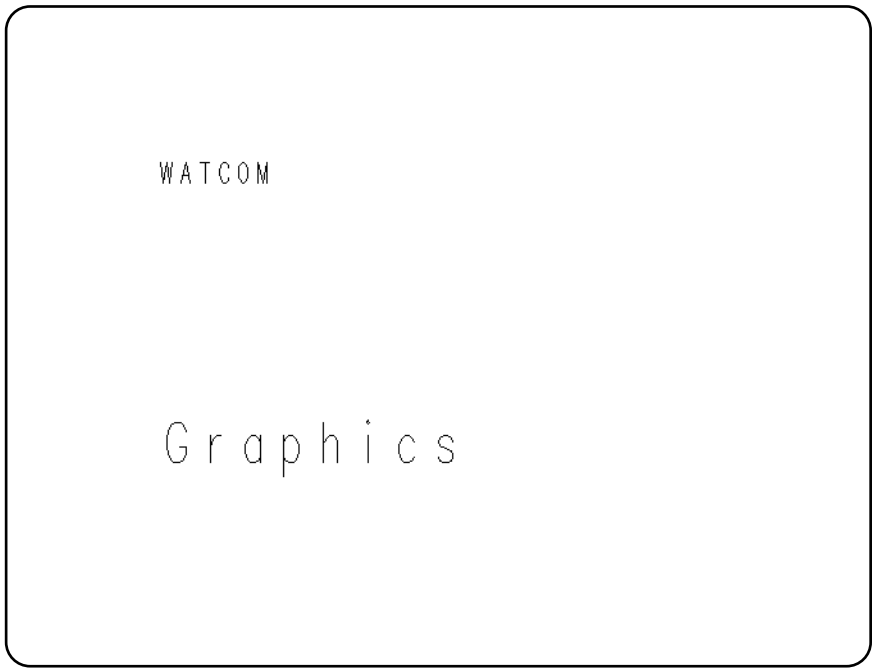
These sizes are used when displaying text with the `_grtext` routine. The default character sizes are dependent on the graphics mode selected, and can be determined by the `_gettextsettings` routine.

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

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

subroutine _setcharspacing_w( space )
double precision space
```

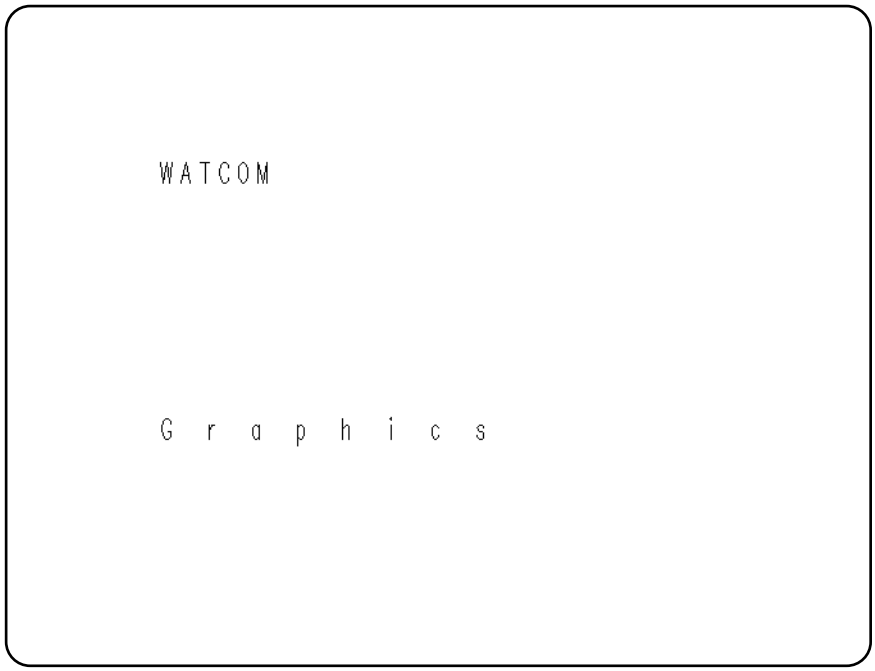
Description: The _setcharspacing routines set the current character spacing to have the value of the argument *space*. For the _setcharspacing routine, *space* represents a number of pixels. For the _setcharspacing_w routine, *space* represents a length along the x-axis in the window coordinate system.

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

Synopsis:
```
subroutine _setcliprgn( x1, y1, x2, y2 )
integer*2 x1, y1
integer*2 x2, y2
```

Description: The _setcliprgn 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 _setcliprgn 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 _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 _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*.

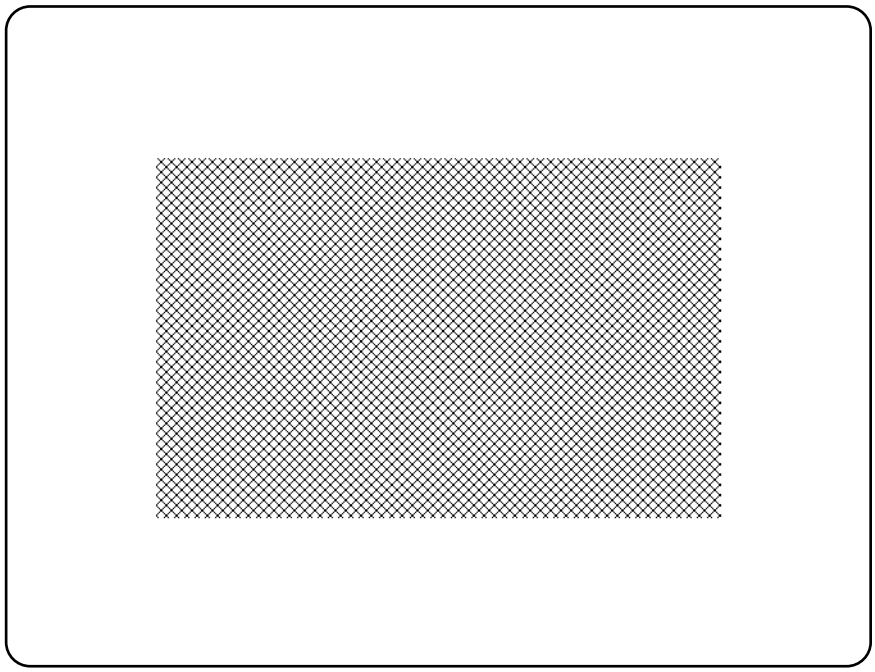
The fill mask is an eight-byte array which is interpreted as a square pattern (8 by 8) of 64 bits. Each bit in the mask corresponds to a pixel. When a region is filled, each point in the region is mapped onto the fill mask. When a bit from the mask is one, the pixel value of the corresponding point is 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:

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

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

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 an xycoord 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`.

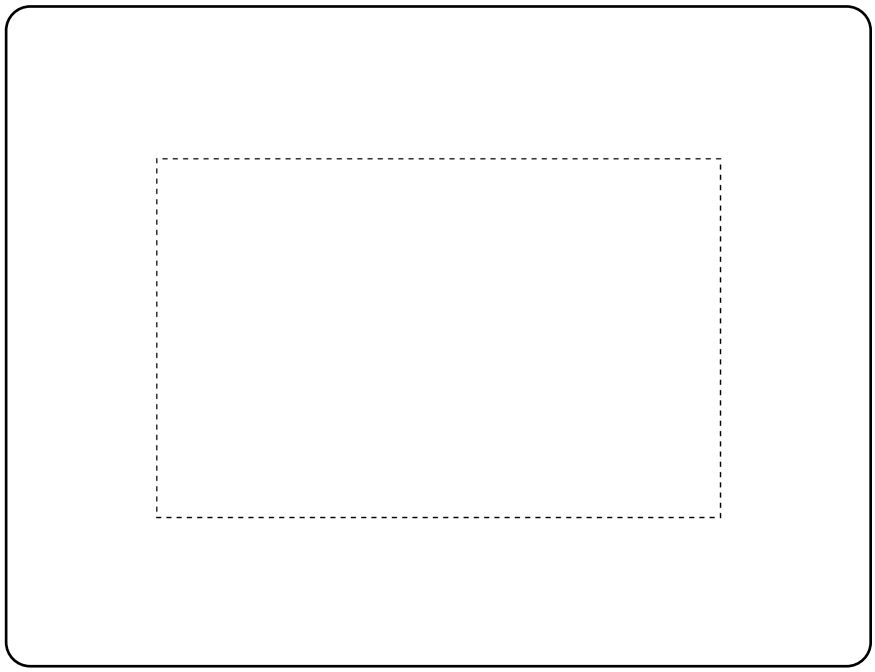
The default line style mask is `'FFFF'x`.

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
```

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:

_GPSET	replace the original screen pixel value with the supplied pixel value
_GAND	replace the original screen pixel value with the *bitwise and* of the original pixel value and the supplied pixel value
_GOR	replace the original screen pixel value with the *bitwise or* of the original pixel value and the supplied pixel value
_GXOR	replace the original screen pixel value with the *bitwise exclusive-or* 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:

_NORMAL	use the default horizontal alignment for the current setting of the text path
_LEFT	the text string is left justified at the given point
_CENTER	the text string is centred horizontally about the given point
_RIGHT	the text string is right justified at the given point

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

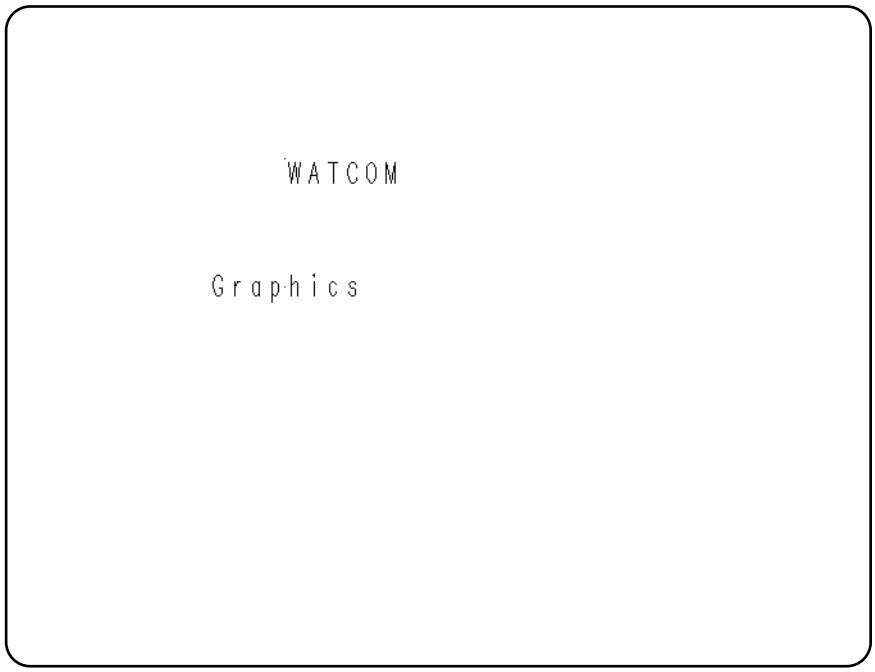
_NORMAL	use the default vertical alignment for the current setting of the text path
_TOP	the top of the text string is aligned at the given point
_CAP	the cap line of the text string is aligned at the given point
_HALF	the text string is centred vertically about the given point
_BASE	the base line of the text string is aligned at the given point
_BOTTOM	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 value	Color	Pixel 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

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

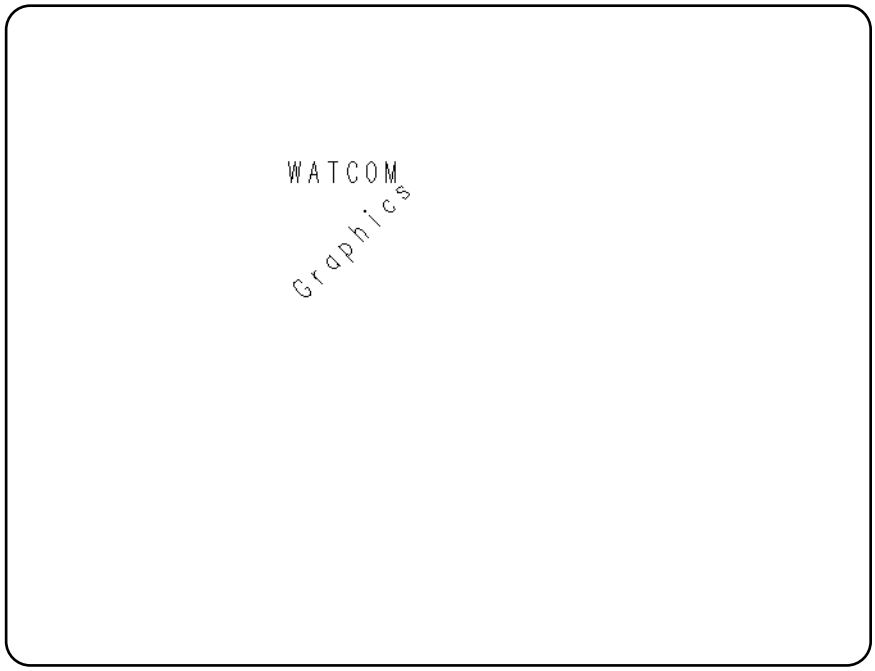
Synopsis:
```
subroutine _settextorient( vecx, vecy )
integer*2 vecx, vecy
```

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

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:

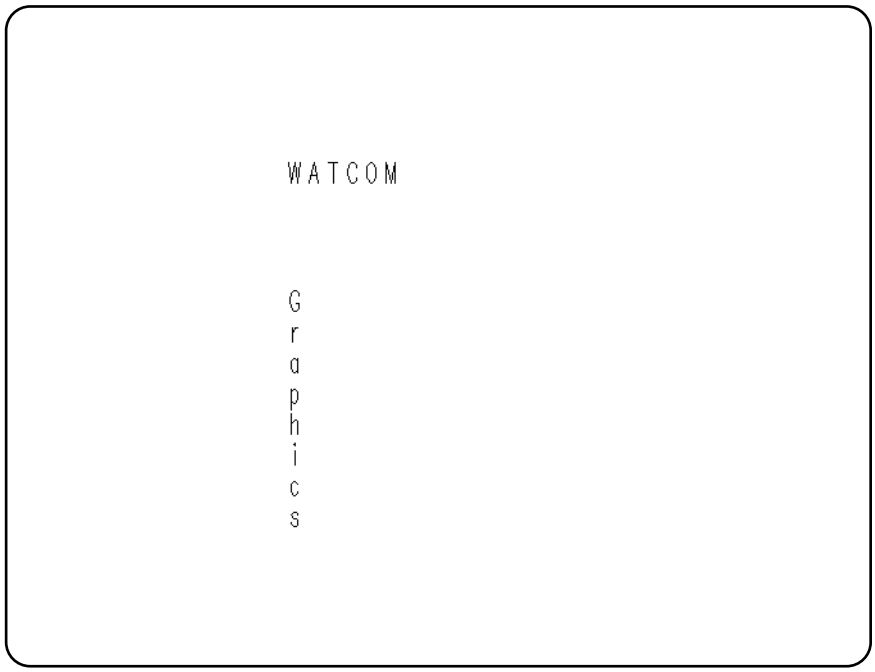
_PATH_RIGHT	subsequent characters are drawn to the right of the previous character
_PATH_LEFT	subsequent characters are drawn to the left of the previous character
_PATH_UP	subsequent characters are drawn above the previous character
_PATH_DOWN	subsequent characters are drawn below the previous character

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

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

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

Synopsis:
```
integer*2 function _setvideomode( mode )
integer*2 mode
```

Description: The `_setvideomode` routine sets the video mode according to the value of the *mode* argument. The value of *mode* can be one of the following:

```
Mode            Type    Size     Colors    Adapter

_MAXRESMODE   (graphics mode with highest resolution)
_MAXCOLORMODE (graphics mode with most colors)
_DEFAULTMODE  (restores screen to original mode)
_TEXTBW40       M,T     40 x 25     16    MDPA,HGC,VGA,SVGA
_TEXTC40        C,T     40 x 25     16    CGA,EGA,MCGA,VGA,SVGA
_TEXTBW80       M,T     80 x 25     16    MDPA,HGC,VGA,SVGA
_TEXTC80        C,T     80 x 25     16    CGA,EGA,MCGA,VGA,SVGA
_MRES4COLOR     C,G    320 x 200     4    CGA,EGA,MCGA,VGA,SVGA
_MRESNOCOLOR    C,G    320 x 200     4    CGA,EGA,MCGA,VGA,SVGA
_HRESBW         C,G    640 x 200     2    CGA,EGA,MCGA,VGA,SVGA
_TEXTMONO       M,T     80 x 25     16    MDPA,HGC,VGA,SVGA
_HERCMONO       M,G    720 x 350     2    HGC
_MRES16COLOR    C,G    320 x 200    16    EGA,VGA,SVGA
_HRES16COLOR    C,G    640 x 200    16    EGA,VGA,SVGA
_ERESNOCOLOR    M,G    640 x 350     4    EGA,VGA,SVGA
_ERESCOLOR      C,G    640 x 350  4/16    EGA,VGA,SVGA
_VRES2COLOR     C,G    640 x 480     2    MCGA,VGA,SVGA
_VRES16COLOR    C,G    640 x 480    16    VGA,SVGA
_MRES256COLOR   C,G    320 x 200   256    MCGA,VGA,SVGA
_URES256COLOR   C,G    640 x 400   256    SVGA
_VRES256COLOR   C,G    640 x 480   256    SVGA
_SVRES16COLOR   C,G    800 x 600    16    SVGA
_SVRES256COLOR  C,G    800 x 600   256    SVGA
_XRES16COLOR    C,G   1024 x 768    16    SVGA
_XRES256COLOR   C,G   1024 x 768   256    SVGA
```

In the preceding table, the Type column contains the following letters:

M	indicates monochrome; multiple colors are shades of grey
C	indicates color
G	indicates graphics mode; size is in pixels
T	indicates text mode; size is in columns and rows of characters

The Adapter column contains the following codes:

MDPA	IBM Monochrome Display/Printer Adapter
CGA	IBM Color Graphics Adapter
EGA	IBM Enhanced Graphics Adapter
VGA	IBM Video Graphics Array
MCGA	IBM Multi-Color Graphics Array
HGC	Hercules Graphics Adapter
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( _TEXTC80, _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

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 an `xycoord` 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( _TEXTC80 )
        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

A

B

C

D

E

F

G

H

I

L

M

N

O

P

R

S

T

U

V

W

X