



**HP 2623A/2627A
Reference Manual Supplement
Part No. 02627-90020**

The contents of this supplement are to be added to the *Reference Manual (HP 2623A or HP 2627A)* as the last appendix. This supplement provides installation and programming information for the optional HP 17623A Graphics Tablet. Additional information is given in the *HP 17623A Operator's Manual*, part no. 17623-90001.



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INTRODUCTION

The terminal uses the optional graphics tablet as an input device. The graphics tablet controls cursor positioning and outputs X, Y coordinates to the host computer. This appendix provides procedures for installing, operating, and using the graphics tablet with the terminal.

The *HP 17623A Operator's Manual*, part no. 17623-90001, contains confidence test information and procedures for cleaning the graphics tablet.

INSTALLING THE GRAPHICS TABLET

Figure 1 shows the graphics tablet connected to the terminal. The tablet consists of a flat surface (platen) and a stylus (pen) connected to the tablet by a cable. The terminal provides power for the tablet via an interconnecting cable.

To install the graphics tablet with the terminal, perform the following steps:

1. Turn off terminal power.
2. Disconnect the keyboard cable from the terminal.
3. Mount the interface module onto the rear of the terminal.
4. Connect the interface module's cable into the terminal's connector from which the keyboard was removed.
5. Connect the keyboard cable to the interface module.
6. Connect the tablet to the interface module.
7. Turn terminal power on. Installation of the graphics tablet to the terminal is now complete.
8. Automatically, the tablet performs an internal confidence test. The indicator lights will flash momentarily.

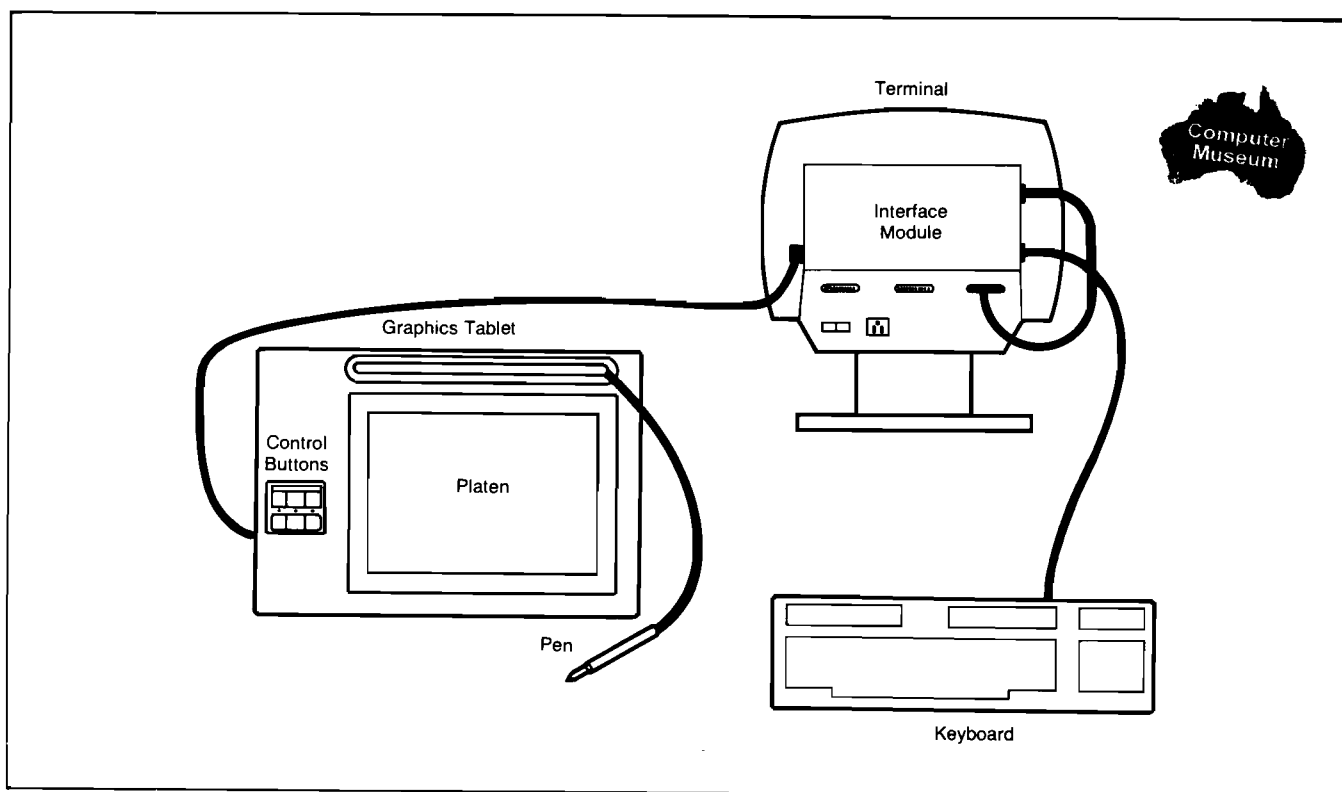





Figure 1. Graphics Tablet Connected to the Terminal

OPERATION

The pen or stylus connected to the tablet is designed to move the graphics cursor on the terminal's screen. The pen tip contains a switch which is used to turn the pen on or off for drawing. This feature allows drawing a line, moving to another point, and starting a new line. In addition, a control button ("ENTER POINT") can be used to enter points. When the tablet is operational, its surface is sensitive to the nearness of the pen tip. When the pen tip is brought very close to the tablet surface, the graphics cursor is moved to a corresponding point on the terminal's display screen.

CONTROL BUTTONS

The graphics tablet has three control buttons (figure 2) which are used to select the tablet's operating conditions. Each button has a yellow indicator light above it that indicates whether the controlled condition is in effect.

-  — Leftmost control button selects on-line or off-line operation.
-  — Center control button initiates transfer of coordinate data to the host.
-  — Rightmost control button rotates coordinate system for left-handed use.

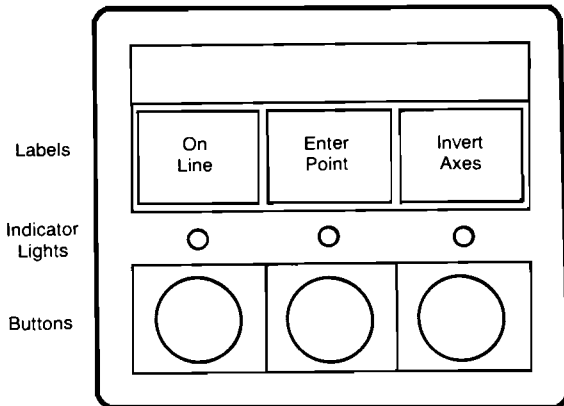


Figure 2. Graphics Tablet Controls

On-Line Operation

On-line or off-line tablet operation is controlled by pressing the control button, "ON LINE". When the tablet is on-line (the indicator light is on), the pen can be used to control the terminal's graphics cursor. When the tablet is off-line (the light is off), the tablet has no effect on the terminal's operation.

Enter Point

The center control button, "ENTER POINT", can be used instead of depressing the pen to enter points. You can hold the button down when tracing fine detail. The indicator light comes on when either the button or pen is pressed. The indicator light will blink when in continuous digitized mode.

Left and Right-Hand Operation

If desired, the tablet can be rotated (180 degrees) upside down to accommodate the left-handed user. The tablet's coordinate system must also be reoriented by pressing the control button, "INVERT AXES". The associated indicator light will go on. The labels for the buttons can be inverted and the controls can now be used with left-handed ease.

USING THE GRAPHICS TABLET

The tablet can be used to control the graphics cursor for menu selection, for selection and placement of objects and for sketching on the screen.

The tablet can also be used for menu selection and digitization of existing pictures on the tablet. Table 1 lists the escape code sequences sent from the terminal to control the graphics tablet.

Table 1. Graphics Tablet Escape Sequences

Operation	
$\text{Esc}^* j 0A$	Turns the tablet off-line
$\text{Esc}^* j 1A$ (default)	Turns the tablet on-line and resets tablet modes to their default values
$\text{Esc}^* j 0B$ (default)	Selects low resolution
$\text{Esc}^* j 1B$	Selects high resolution coordinates
$\text{Esc}^* j 0C$ (default)	Selects synchronous coordinate transfer mode
$\text{Esc}^* j 1C$	Selects asynchronous coordinate transfer mode
$\text{Esc}^* j 0D$ (default)	Selects point pen mode
$\text{Esc}^* j 1D$	Selects pen-down mode
$\text{Esc}^* j 2D$	Selects pen-toggle mode
$\text{Esc}^* j 0E$ (default)	Selects ASCII data format
$\text{Esc}^* j 1E$	Selects binary data format
Status Requests	
$\text{Esc}^* s 3^{\wedge}$ (type 3)	Reads current cursor position immediately
$\text{Esc}^* s 4^{\wedge}$ (type 4)	Reads current cursor position if either the tablet originates transfer or a keyboard press occurs
$\text{Esc}^* s 32^{\wedge}$ (type 32)	Requests tablet identification
$\text{Esc}^* s 33^{\wedge}$ (type 33)	Reads current cursor position only if tablet originates transfer
Tablet Initialization	
$\text{Esc}^* E$	Terminal hard reset
$\text{Esc}^* m r$	Sets graphics defaults
$\text{Esc}^* m 1 r$	Sets graphics defaults (a subset operation of $\text{Esc}^* m r$)
$\text{Esc}^* w r$	Graphics hard reset
$\text{Esc}^* j 1A$ (default)	Turns the tablet on-line and resets tablet modes to their default values

PROGRAMMATIC CONTROL

Tablet On-Line/Off-Line

You can programmatically turn the graphics tablet on-line or off-line.

Turns graphics tablet on-line	Ctrl-J1a (default)
Turns graphics tablet off-line	Ctrl-J0a

You can also turn the tablet on-line or off-line by pressing the on-line/off-line control button on the tablet. When it is on-line, the associated light above the button is on. If the light is off, the tablet is off-line.

NOTE: Turning the tablet to on-line with the control button does not reset the tablet to its default conditions.

Tablet Resolution

Selects low resolution coordinates	Ctrl-J0B (default)
Selects high resolution coordinates	Ctrl-J1B

The resolution for the tablet is four times that of the terminal. In low resolution, data from the tablet is scaled down to the terminal's resolution before sending it to the host. This reduces data communications flow during continuous coordinate transfers.

In high resolution, coordinate input for the host computer is sent at the tablet's resolution. At high resolution, all coordinate transfers, including type 3 and type 4 status requests (Ctrl-S3 and Ctrl-S4) are affected.

Cursor tracking on the screen is unaffected by the selected resolution, as the entire active platen surface is mapped to the entire displayable screen.

Coordinate Transfer Modes

Selects synchronous coordinate transfer mode	Ctrl-J0C (default)
Selects asynchronous coordinate transfer mode	Ctrl-J1C

There are two basic modes of sending coordinate data to the host computer when the tablet's pen switch is used: (1) synchronous and (2) asynchronous.

The synchronous mode involves sending one and only one point (coordinate pair) to the host when the tablet pen triggers the coordinate input. The terminal will not send any more coordinates until requested to do so by the host

computer. This mode is useful for menu selection and placement functions. Synchronous tablet input is requested by the host with the type 4 and type 33 graphics status requests (Ctrl-S4 and Ctrl-S33).

When using the asynchronous mode, however, the terminal returns coordinates whenever the tablet pen triggers the input. This mode is especially useful for freehand drawing and tracing applications. After the terminal receives an "end asynchronous mode" command (Ctrl-J0C), a three byte ASCII string, "EOT" (End of Transfer) is sent to the host after the last asynchronous point is transferred. This signals to the host that no more coordinate transfers are forthcoming.

Pen Modes

There are three host selectable modes of tablet pen operation: (1) point pen, (2) pen-down, and (3) pen-toggle.

Point pen	Ctrl-J0D (default)
Pen-down	Ctrl-J1D
Pen-toggle	Ctrl-J2D

Point pen mode is used for menu picking and placement functions. In point pen mode, the tablet only recognizes the X,Y coordinates when the up-to-down pen transition occurs and no additional coordinates are sent.

Both the pen-down and pen-toggle modes are continuous methods of tablet operation. When using either mode, the tablet can generate a stream of coordinate data at a rate of up to 30 points per second. In the pen-down mode, points are treated as input for the host whenever the pen switch is in the down position. To produce continuous input data, the pen is held down as it is moved on the tablet's platen.

In pen-toggle mode, single pen presses activate and deactivate continuous coordinate transfers. That is, the down-to-up transition of the first pen press initiates digitization. Thereafter, the pen is logically down, and coordinate input is continuously generated as the pen moves on the platen in the up position. The next up-to-down pen transition stops the input stream and cursor tracking until the next pen press.

When operating in either of the continuous methods, coordinate data returned to the host includes a prefix character. The prefix indicates to the host where the pen is lifted and where the stream of coordinate data starts. The same prefix character is used for each cursor position during a single stream of transfers. When the stream of coordinate data is stopped (physically lifting the pen in the pen-down mode or depressing the pen once in the pen-toggle mode), a new prefix is used when the tablet input resumes. There are four prefix characters, which are used in sequence: }, {,], [. This sequence is repeated every four moves.

Data Formats

Selects ASCII cursor data format $\text{ESC} \cdot \text{J} 0 \text{E}$ (default)

Selects binary cursor data format $\text{ESC} \cdot \text{J} 1 \text{E}$

ASCII is the default format for transmitting cursor data. Each transferred coordinate consists of a plus sign (+) followed by five numeric characters. The X and Y coordinates are separated by a comma (,). For example, an asynchronous transfer, while in point pen mode, looks as follows (assuming a cursor position of X=105 and Y=40):

+ 0 0 1 0 5, + 0 0 0 4 0 <terminator>

where <terminator> is either ESC , $\text{ESC} \cdot \text{F}$, or $\text{ESC} \cdot \text{B}$, depending on the terminal configuration (as defined for any status block transfer).

Binary cursor data format reduces the data communications flow by packing the data in the following manner:

BYTE	BIT							MEANING
	7	6	5	4	3	2	1	
1	Prefix (ASCII)
2	0	1	0	0	0	0	X10	HI X
3	0	1	X9	X8	X7	X6	X5	MID X
4	0	1	X4	X3	X2	X1	X0	LO X
5	0	1	0	0	0	0	Y10	HI Y
6	0	1	Y9	Y8	Y7	Y6	Y5	MID Y
7	0	1	Y4	Y3	Y2	Y1	Y0	LO Y
8	0	1	0	0	K7	K6	K5	HI Key Code
9	0	1	K4	K3	K2	K1	K0	LO Key Code

The prefix character and key code bytes are only sent when they apply to the particular transfer in effect, such as a transfer in ASCII format. When the binary cursor format is selected, all coordinate transfers, regardless of the coordinate transfer tablet modes, use this format. Even a type 3 ($\text{ESC} \cdot \text{s} 3 \text{^}$) status transfer is sent in binary format.

Tablet Defaults

When the terminal is powered on, the following tablet defaults are in effect:

- The tablet is on-line
- Low Resolution Coordinates
- Synchronous Coordinate Transfer Mode
- Point Pen Mode
- ASCII Data Format

The following actions reset the tablet to its default values:

1. Terminal power-on
2. Terminal hard reset ($\text{ESC} \text{E}$)
3. Programmatically sets tablet on-line ($\text{ESC} \cdot \text{J} 1 \text{A}$)
4. Graphics hard reset ($\text{ESC} \cdot \text{w} \text{r}$)

5. Set graphics defaults ($\text{ESC} \cdot \text{m} \text{r}$)

6. Set graphics defaults (subset operation of $\text{ESC} \cdot \text{m} \text{r}$) ($\text{ESC} \cdot \text{m} 1 \text{r}$)

GRAPHICS TABLET STATUS

There are four graphics tablet status requests: (1) read cursor position immediately, (2) read cursor position if the tablet originates transfer or a keyboard press occurs, (3) request tablet identification, and (4) read cursor position only if tablet originates transfer.

Read Cursor

Reads Current Cursor Position Immediately $\text{ESC} \cdot \text{s} 3 \text{^}$

When the current graphics cursor position is requested, it returns a string of ASCII characters indicating the coordinate position. The format for transfer complies with the rules of high resolution and binary modes.

Read Cursor and Wait

Read Cursor Position if Either Tablet Originates Transfer or a Keyboard Press Occurs $\text{ESC} \cdot \text{s} 4 \text{^}$

When used in conjunction with the tablet, the format for transfer complies with the rules of high resolution and binary modes. When the cursor is in position, the user then strikes a key or presses the pen to trigger the transfer. The three digit keycode, which is included in the transfer, will be "128" to indicate a tablet pen press.

For example, assume that the cursor is positioned at coordinates X=105, Y=40 in low resolution and ASCII transfer mode, a pen press would cause the following response to a type 4 status request:

+ 0 0 1 0 5, + 0 0 0 4 0, 1 2 8 <terminator>

where <terminator> is either ESC , $\text{ESC} \cdot \text{F}$, or $\text{ESC} \cdot \text{B}$, depending on the terminal configuration (as defined for any status block transfer).

Tablet Identification

Requests Tablet Identification $\text{ESC} \cdot \text{s} 2 \text{^}$

When the terminal receives this status request, a "1" is returned if the tablet is attached to the terminal, or a "0" if the tablet is not attached. When the tablet is connected to the terminal, it is recognized as being present regardless of whether it is on-line or off-line.

Await Tablet

Read Cursor Position Only if
Tablet Originates Transfer

␣*s33^

Type 33 status request is similar to type 4 status request, except that type 33 may only be triggered by the tablet. After receiving this request, the terminal turns on the graphics cursor, if it hasn't already been turned on. The next time the pen is logically depressed, the terminal will return the cursor's X and Y coordinates. For example, if the cursor is at location X=105, Y=40 and the tablet is operating in low resolution and transfer modes, the following message is returned to the host:

* 0 0 1 0 5, * 0 0 0 4 0 <terminator>

If any escape sequence is received by the terminal after it has received the type 33 status request and before the tablet is triggered, the request will be aborted. The new

sequence will be executed instead. Otherwise, keyboard and datacomm activity may proceed as normal while the type 33 status request is pending.

NOTE: Care should be taken when using graphics text with the tablet. The graphics cursor indicates the position of the next graphics character. Therefore, if the cursor is moved while graphics text is being received by the terminal, the text will appear wherever the cursor rests. To prevent this, take the tablet off-line (␣*j0A) just before sending graphics text and put the tablet on-line after all text has been sent to the terminal.

DRAWING EXAMPLES

To become familiar with the tablet's drawing capabilities, try the program examples in figures 3 and 4. These programs are written in BASIC.

DRAWDEMO

```

10 REM *****
20 REM   This program demonstrates the graphics tablet in a simple
30 REM   freehand drawing application. Asynchronous coordinate
40 REM   transfer mode and pen-toggle pen mode are used to accomplish
50 REM   rapid continuous digitizing. Coordinates received from the
60 REM   terminal are transmitted by the host back to the terminal,
70 REM   embedded in an Esc*p escape sequence. Lines are thus plotted
80 REM   on the screen, tracking the movement of the tablet pen.
90 REM
100 REM  The program detects the pen being picked up and a new line
110 REM  started by monitoring the continuous mode prefix of each
120 REM  asynchronous coordinate transfer. Whenever the bracket
130 REM  character changes, indicating a logical lift of the pen, a
140 REM  move instruction is inserted in the plotting sequence sent
150 REM  to the terminal.
160 REM *****
165 REM
170 DIM A$(20)
180 REM
190 REM ** Use tablet I.D. status request to see if tablet is present.
200 REM ** If not, jump to end:
210 REM
220 PRINT '27"*s32^";
230 LINPUT A$
240 IF A$="0" THEN GOTO 570
250 REM
260 REM ** Initialize graphics and select desired tablet modes:
270 REM
280 PRINT '27"*mR";
290 PRINT '27"*dK";
300 PRINT '27"*pA";
310 PRINT '27"*j 1a 1c 2D";
320 REM
330 REM ** Initialize B$ (saves previous bracket character).
340 REM
350 B$=" "
360 REM
370 REM ** Print instructions for user on screen:
380 REM
390 PRINT '27"H" '27"J";&
    "BEGIN FREEHAND DRAWING...TYPE 'E <cr>' TO END."
400 REM
410 REM  The main loop reads asynchronous coordinate data from
420 REM  the terminal and sends it back with an Esc*p sequence
430 REM  to plot the continuous line.
440 REM
450 LINPUT A$
460 IF A$[1,1]="E" OR A$[1,1]="e" THEN GOTO 530
470 IF A$[1,1]<>B$ THEN PRINT '27"*pa";
480 ELSE PRINT '27"*p";
490 PRINT A$[2,14];"Z";
500 B$=A$[1,1]
510 GOTO 450
520 REM
530 REM ** Turn off asynchronous mode and wait for "E O T"
540 PRINT '27"*jOC";
550 LINPUT A$
560 IF A$<>"EOT" THEN GOTO 550
570 END

```

Figure 3. DRAWDEMO Program

PLOTDEMO

```

10 REM *****
20 REM This program is similar to DRAWDEMO, but digitizing is done
30 REM synchronously using the type 4 status request. Rubberband
40 REM line is used to preview the line before it is entered. Point
50 REM pen mode is used so that the user transfers points one at a
60 REM time.
70 REM
80 REM Since the type 4 status request is used, coordinates may be
90 REM sent by pressing either the pen switch or a key on the
100 REM keyboard. This program works with or without the tablet.
110 REM *****
120 REM
130 REM
140 DIM A$[20]
150 REM
160 REM ** Initialize graphics, and select desired tablet
170 REM ** modes. (All tablet modes needed are defaults;
180 REM ** only the TABLET ON LINE command is necessary.)
190 REM ** Wait until first point is entered to turn on
200 REM ** rubberband line.
210 REM
220 PRINT '27"*mR";
230 PRINT '27"*pA";
240 PRINT '27"*j 1a";
250 REM
260 REM ** Print instructions for user on screen:
270 REM
280 PRINT '27"h"27"J";"BEGIN ENTERING POINTS...TYPE 'E' TO END."
290 REM
300 REM *****
310 REM The main loop polls the terminal with type 4 status request
320 REM (Esc * s 4 ^). The transferred coordinates are sent back
330 REM to the terminal embedded in an Esc*p escape sequence to plot
340 REM a line to the point entered.
350 REM *****
360 PRINT '27"*s4^";
370 LINPUT A$
380 REM ** Check for "E" or "e"
390 IF A$[15,17]="069" OR A$[15,17]="101" THEN GOTO 430
400 PRINT '27"*p";A$[1,13];"Z";
410 PRINT '27"*dM";
420 GOTO 360
430 END

```

Figure 4. PLOTDEMO Program

