

A Hewlett-Packard Software Summary
for the System 45B Desktop Computer

System 45B Graphics Utilities



Adaptable Routines for 2-D Figure Construction and Manipulation

Engineers, scientists and businessmen are recognizing that computer-generated graphics can communicate ideas and facts much more rapidly and clearly than reams of tabular data and reports. The presentation of computer data in graphical form — called Computer Graphics — helps you quickly assimilate and understand complex relationships, large amounts of data or intricate computational results.

To aid the programmer in writing graphics programs, Hewlett-Packard offers the Graphics Utilities software pack. This pack, when used with the HP System 45B Desktop Computer, helps you create, manipulate, store and display a wide range of 2-dimensional figures for use in your graphics applications. You can incorporate any of the pack's 50 documented routines and subprograms into your own application program thereby reducing software development time and minimizing programming bugs (see Figure 1). The pack includes subprograms for creating and transforming graphics images, along with graphics input routines and output to selected external graphics devices. Both single and multi-object figures can be developed for a variety of 2-D applications.

The Graphics Utilities pack comes with a user's manual that explains each subprogram in detail. Variable lists, references and annotated listings provide the necessary information to easily use and modify any program.

Versatile Graphics Data Base

A valuable feature of this pack is the 2-dimensional, hierarchical data base that contains five interrelated matrices providing an extremely flexible method of handling image data. This series of linked matrices will store 1) status 2) vertex 3) edge 4) object and 5) picture data. The first three of these create single objects while ex-

tended versions plus the last two can handle several objects or figures in memory simultaneously. Matrix operations can then be used for transformations. Non-spatial data can also be associated with the graphic data within the data base.

Two-Dimensional Figure Construction

The HP Graphics Utilities pack provides the following figure creation and handling operations and features:

- Line segments, circles and arcs. Drawing can be accomplished by entering the desired X-Y coordinates manually or by positioning the System 45B's CRT cursor.
- Transformation routines for rotating, scaling and translating your figure.
- Storage and display routines for saving and recalling figures.
- A routine for character generation for figure annotation. Character types are stick, script, Roman and Gothic. Character size is user-programmable.
- "Big Picture Construction" — the ability to combine previously constructed and stored figures to generate a new figure.

Auxiliary Utility Routines

In addition to the 2-D figure construction, the Graphics Utilities pack also provides:

- A binary program that implements a graphics "dump" from the System 45B's CRT to an HP dot matrix printer.
- A subprogram that uses special binary statements to permit alpha-numeric prompts and user input responses while the CRT is in graphics display mode.

- A "comment stripper" routine that removes extraneous program comments thereby compacting the program and using less storage space.

Hardware Configuration

The HP Graphics Utilities software pack is designed to run on the System 45B Desktop Computer with 187K bytes of user available Read/Write memory (Opt. 204) and the Graphics Display Subsystem (Opt. 311, Opt. 700). This is the minimum configuration. To get maximum performance from your system, it is recommended that you add the following options:

- Second tape cartridge drive (Opt. 600)
- Built-in thermal line printer (Opt. 560, 561, 540 or 541)

The following optional peripheral devices may also be added to your system:

- HP 9885M/S Flexible Disk Drive
- HP 2631G Serial Impact Printer (HP-IB)
- HP 9872A 4-Color Plotter (HP-IB)

Ordering Information

Order HP Part No. 09845-10050 to receive the System 45B Graphics Utilities software pack which includes:

- two program tapes
- instruction manual with documentation



```
10 SUB Circle_by_3_pts(SHORT Radius,Xa,Xb,Xc,X_center,Ya,Yb,Yc,Y_center)
20 !
30 ! *** Given three points find the radius and center point of a circle ***
40 !
50 ! Parameters: Radius - Radius that is calculated and passed back
60 !           Xa - X-coordinate of 1st point
70 !           Xb - X-coordinate of 2nd point
80 !           Xc - X-coordinate of 3rd point
90 !           X_center - X-coordinate of center point that is calculated
100 !           and passed back
110 !           Ya - Y-coordinate of 1st point
120 !           Yb - Y-coordinate of 2nd point
130 !           Yc - Y-coordinate of 3rd point
140 !           Y_center - Y-coordinate of center point that is calculated
150 !           and passed back
160 !
170 SHORT Angle_cab,Avg_side,Old_xb,Old_yb,Side_a,Side_b,Side_c,Slope1,Slope2
180 SHORT Xa_prime,Xb_prime,Ya_prime,Yb_prime,Y_intercept1,Y_intercept2
190 !
200 ! Check for horizontal or vertical lines.
210 Old_xb=Xb
220 Old_yb=Yb
230 IF (Xa=Xb) OR (Xb=Xc) THEN Xb=Xb-.25
240 IF (Ya=Yb) OR (Yb=Yc) THEN Yb=Yb-.25
250 Slope1=(Ya-Yb)/(Xa-Xb)
260 Slope2=(Yb-Yc)/(Xb-Xc)
270 IF ABS(Slope1-Slope2).001 THEN 310
280 Xb=Xb-.25
290 GOTO 250
300 ! Calculate the radius
310 Side_a=SQR(ABS(Xb-Xc)^2+ABS(Yb-Yc)^2)
320 Side_b=SQR(ABS(Xc-Xa)^2+ABS(Yc-Ya)^2)
330 Side_c=SQR(ABS(Xa-Xb)^2+ABS(Ya-Yb)^2)
340 Angle_cab=ACS((Side_a^2-Side_b^2-Side_c^2)/(-2*Side_b*Side_c))
350 Avg_side=.5*(Side_a+Side_b+Side_c)
360 Radius=Side_a*Side_b*Side_c/(4*Avg_side*(Avg_side-Side_a)*TAN(Angle_cab/2))
370 ! Calculate the center of the circle
380 Slope1=-1/Slope1
390 Slope2=-1/Slope2
400 Xa_prime=(Xa+Xb)/2
410 Ya_prime=(Ya+Yb)/2
420 Xb_prime=(Xb+Xc)/2
430 Yb_prime=(Yb+Yc)/2
440 Y_intercept1=Ya_prime-Slope1*Xa_prime
450 Y_intercept2=Yb_prime-Slope2*Xb_prime
460 X_center=(Y_intercept1-Y_intercept2)/(Slope2-Slope1)
470 Y_center=(Slope2*Y_intercept1-Slope1*Y_intercept2)/(Slope2-Slope1)
480 Xb=Old_xb
490 Yb=Old_yb
500 SUBEND
```

Parameters passed to and from the subprogram.

Annotations to improve understanding and ease-of-use.

Comprehensive definitions of program parameters.

Compact listing of local variables.

Internal checks to avoid calculation errors.

Calculation of center and radius given three points (digitized or manually entered data).

Figure 1. A typical subprogram listing. The subprogram calculates parameters for a circle from three points on the circumference and prepares data for storage and CRT display.



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Ask for an HP Desktop Computer representative.