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HPGLUTIL, A COMPUTER PROGRAM FOR PROCESSING HEWLETT-PACKARD GRAPHICS LANGUAGE (HPGL) FILES AND REGISTERING PLOTS TO BASE MAPS

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INTRODUCTION

This program will read an HPGL plotter command file and transmit the commands to various types of output devices. It will optionally rescale the drawing and transform the coordinates. A drawing may be registered to a basemap mounted in the plotter by using a digitizing sight to identify three registration points marking the upper left, lower left, and lower right corners of the drawing. An HPGL file must be prepared that plots those three points first using exactly the same parameters as the main plot file. The program will also change the size of the plot without registration, for example, a D-size plot may be reproduced on a page-size laser-jet. Pen color, width, and gray tone can be set for output to some raster devices.

SYSTEM REQUIREMENTS

You need an IBM-PC (or compatible) running MS-DOS version 2.1 or later with at least 512K bytes of memory to use the HPGLUTIL program. In addition, you need an output device such as a Hewlett-Packard plotter which supports the Hewlett-Packard Graphics Language. If you intend to register the plot to a preprinted paper or film base, the plotter must have the capability of digitizing locations on the base.

CONTENTS OF THE RELEASE DISK

The release disk contains all of the files necessary to install and execute the program. In addition, it contains an example of an HPGL file for the user to examine and to test the program. A list of the files on the release disk follows:

README.DOC	text file describing how to print documentation.
HPGLUTIL.DOC	contents of this documentation.
HPGLUTIL.EXE	program executable.
GEOL.HPG	HPGL plot file of geologic quadrangle
GEOLREG.HPR	HPGL plot file of registration points for GEOL.HPG file
TOPO.HPG	HPGL plot file of scanned topographic basemap for GEOL.HPG file
TOPOREG.HPR	HPGL plot file of registration points for TOPO.HPG file
RULER.HPG	HPGL plot file of ruler suitable for calibrating laserjet printers

INSTALLATION INSTRUCTIONS

The HPGLUTIL.EXE file on the release disk should be copied to a directory of the user's choice. The directory must be within the current PATH list (or the program must be contained in the working directory). The user should print a copy of this document (HPGLUTIL.DOC) for reference during the execution of the program.

HPGL FILES

The Hewlett-Packard Graphics Language is a set of commands defined by Hewlett-Packard corporation, which, when transmitted to a plotter, will be interpreted by the plotter and then executed. The commands have a defined format which consists of a two-character mnemonic that may be followed by one or more numbers separated by commas. There are various levels of HPGL that have evolved as hardware capability as developed. This program HPGLUTIL supports HPGL and for some output devices, HPGL/2. The polyline encoded (PE) command in HPGL/2 is supported.

Many programs will transmit the HPGL commands directly to a serial (or parallel) port and through an attached cable to a compatible plotter. However, for many reasons, the user will often be offered the option to write the HPGL commands to disk file for processing at a later time or perhaps on a diferent computer in a separate location. The HPGLUTIL program is designed to permit the user to process these HPGL disk files.

The HPGLUTIL program was developed to address several specific needs. The primary function of this program is to facilitate registration of a plot of a thematic map to a pre-printed base, such as a paper topographic map or a greenline base on drafting film. Registered plots on paper can be used for review copies, and registered plots on greenlines can be used to produce negatives for open-file reports or scribing guides. The program is based on the plot register (PR) option in the GSMAP program (Selner and Taylor, 1993), but has been expanded and separated from GSMAP so that plots generated by other CAD and illustration software can also be registered.

This program can reproduce a plot at its original scale and orientation, rescale it from one standard scale to another, custom scale X and Y coordinates independently, or automatically rescale, shift, and rotate a plot so that it is registered to a basemap mounted in a plotter or to another plot file.

Rescaling allows plots designed for any standard paper size to be plotted on any other standard paper size. This saves the effort of regenerating the plot, and enables use of a laserjet printer to make page-size file copies of large drawings. It is also necessary for precise plotting on laserjet printers, because they are generally not true to scale in plotting exactly 1016 plotter units per inch. The errors are generally less than 1 percent, and can be compensated by calibrating the error and setting the scale factors in the program. After selecting to rescale, select an A-size source and an A-size target. The X and Y scales will be shown as 1 and 1, and opportunity will be offered to enter new values reflecting the calibration of the target laserjet printer.

The proportions of the plottable area vary from one standard sheet size to another and between different models of plotters, so that rescaling to a different size sheet may change Y-axis scaling differently than X-axis scaling. If it is important that X-axis and Y-axis scaling be kept identical, manually override the automatic scaling and change the scale for the axis that is too long to be identical to the other axis.

Registration is based on three points, one in the upper left corner, one in the lower left corner, and one in the lower right corner of the plot. Those points must be clearly identifiable on the target sheet. Typically they are the corners of the map. The plotter coordinates of those three points on the sheet is obtained by using the digitizing

function of the plotter. Ideally, a fiber optic sight is mounted in a pen slot on the carousel, driven to a registration point by controls on the plotter, lowered to the paper surface, and centered on a registration point. The exact coordinates are recorded when the digitizing button is pressed. If a sight is not available, a dry pen may be used with some loss of accuracy.

Plotters generally assume paper is mounted in landscape mode, with the X-axis parallel to the long axis of the paper and the paper travel direction (in roller plotters). This causes some confusion and difficulties when working with 7 1/2' and 15' quadrangle maps, which have a portrait format. Different software packages offer different solutions to this problem that affect the registration process. GSMAP allows an instruction in the plot control file to rotate the plot. If this option is chosen, an instruction RO 90 is included in the plotter file that instructs the plotter to rotate its coordinate axes 90 degrees counterclockwise. If this command is to be in effect while plotting is in progress, it must also be in effect when the registration points are digitized. The program has no way of knowing while digitizing if the plotter file will contain an RO 90 command, since the plotter file has not yet been named, so the user is requested to supply the information. For other software packages the user may be uncertain if a RO 90 command is used, but this can be determined by looking at the first few commands in the plotter file. The most likely case is that the RO 90 command is not used, and that is the default assumption of the program.

Some CAD programs offer the option of a rotated plot, but do not use the RO 9O command. Instead they transpose X and Y coordinates in the plotter file. In that case the default assumption of no rotate command should be used when digitizing registration points on the plotter, but the registration points should be in the southwest, southeast, and northeast corners of the map, since they occupy the upper left, lower left, and lower right corners of the plot sheet when viewed in the default landscape mode.

The coordinates of points corresponding to the digitized points are assumed to be the first three different set of coordinates in a registration plotter file. It may be difficult to know or control which points are plotted first by a software package, so it is recommended that a separate registration plotter file be created that plots only the control points, using exactly the same plot parameters used to create the main plotter file. If the software creating the registration file inserts an extra coordinate or reorders the registration points, this program will detect the unusual order and offer an opportunity for the user to manually rearrange the points to their correct order.

In the course of the program, the name of the registration file will be requested before the name of the main plot file. If it is certain that the first three points in the main plot file are the control points, then the main file can be named as the registration file. Plotter files generated by future versions of GSMAP may start with the registration points to eliminate need of preparing a registration plotter file.

For the present, a registration plot file can be prepared in GSMAP by using a reserved line code (99?) to digitize an L-shaped line connecting the three control points in the counterclockwise direction. Then generate a plotter file using a plot control file that plots only line code 99, but is otherwise identical to the plot control file used to generate the main plotter file. The control points must lie within the corners specified in the plot control file, otherwise they will be missing from the registration plotter file. An alternative

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technique is to generate a plotter file where no data is plotted, but tics are requested corresponding to the corners of the map. That file can be edited on an ASCII word processor to eliminate the unneeded coordinates. In a CAD program, create the L-shaped line in its own layer, turn off all the other layers, and generate the registration plotter file. Then turn off the registration layer, turn on the data layers, and generate the main plotter file.

If the output mode selected is printing to a file, the plot registration option is still available. The plotter is not available to digitize points, so those point coordinates must come from a file. This is usually the registration plotter file of another thematic plot of the same area, perhaps prepared by different software. In this way one plotter file becomes registered to another for later combination, or plotting one on top of the other. For example, geologic line work might be combined with a plot of the topographic base, or color polygons generated using the GSMAP system might be combined with line work from a CAD program.

PROGRAM OPERATION

The HPGLUTIL program is started by typing the name of the program followed by a carriage return when the computer is at the DOS command prompt.

Output Device Menu

The first menu offers a selection of devices for eventual or immediate plotting of the data. Devices not specifically mentioned may also work if they are designed to accept Hewlett-Packard Graphics Language instructions (HPGL or HPGL/2). Many manufacturers support this standard.

Pen plotters have a digitizing capability that allow plotter files to be registered to a preprinted paper or film base mounted in the plotter. Implementation of that capability is the primary function of this program. Pen plotters include a range of sizes from A (letter size) to E (34 by 44 inches). A- and B-size plotters generally have the origin of their coordinate system in the lower left hand corner, whereas larger pen plotters generally have their origin in the center of the paper sheet. A- and B-size plots may also be produced on large plotters, but the coordinate origin will commonly be in the center of the sheet. The number of pens available vary from one plotter to another, but this program does not check if the number of pens requested in a plot file actually exist on the selected device. The program will control the speed and force of the pen according to parameters selected by the user, so that default values may be overridden. Slow pen speed may enhance the appearance of a final plot and fast may be best for draft plots.

Film plotters project a beam of light on a sheet of film, commonly to produce 35 mm slides. In the case of the HP-7510 plotter, colors and pen thickness can only be set on the front panel of the machine, so they cannot be changed using this program. Only eight colors can be used in a single plot, but this limitation can be overcome by dividing an illustration into two or more plotter files. If the film is not advanced after the first file, the color palette can be changed to make 8 more colors available before plotting the second file over

the first. White covers any color, but other colors combine to produce intermediate shades where they overlap.

The PSjet is an example of an older laser jet printer that emulates a page-size plotter. The emulation is activated by a switch on the machine. The PSjet recognizes most HPGL commands, but not HPGL/2 commands. This program allows line thickness (in mm) to be set for the 8 logical pens supported by the PSjet and ejects the paper after the plot is complete.

More recent versions of laserjet printers, such as the HP- Laserjet IIIp, commonly have a built-in plotter emulation mode that can only be accessed by software commands. In addition to pen plotter functions, these printers offer software control of pen thickness and gray scale tone, and allow immediate production of multiple copies. This program allows access to those features for plotter command files that were not prepared specifically for a raster device.

Paintjet printers can be equipped with a cartridge that allows HPGL/2 emulation. All the features of the laserjet are available, and this program can map a great variety of colors to 16 pens by specifying components of red, green, and blue ink. Colors are produced by dithering ink dots of 4 pens, so that area fills give truer colors than thin lines. A-size and B-size paper can be accommodated.

DesignJet plotters are also inkjet raster devices, similar to a paintjet, but as large as E-size. Unfortunately they lack a digitizing capability, so the plot cannot be registered to a pre-printed base. If a plotter file of the base exists, however, this program allows the data file to be registered to and combined with the base file before sending the data to the plotter. The coordinate origin for a DesignJet plotter is in the lower left corner of the paper.

Output Mode Menu

The output mode menu sets the parameters necessary for proper communication between the computer and the plotter or printer. These parameters depend on the location and type of physical connection and switch settings on the plotter. If the devices are connected with a parallel cable, the cable is probably connected to a 25-pin line printer port on the computer (LPT1 or LPT2). This type of connection provides the fastest data transmission, but is not suitable for long distances. The second possibility is a serial cable connection through a 9-pin communications port (COM1 or COM2). Communications ports above 2 are not supported by this program.

If the connection is serial, the program will query for the baud rate set on the plotter. Usual settings are 9600, 4800, 2400, 1200, or 300. The program assumes plotter settings of no parity, 8 data bits, and 1 stop bit. If your plotter settings are different, the program may not work.

Another possibility is to plot to a file. Plotting to a file is useful if files are to be registered and combined on a computer that is not connected to the plotter. Sometimes plotter files must be transferred onto a non-DOS machine before they can be directed to the plotter. By capturing the output to a file, all the facilities of this program can be retained in the non-DOS environment.

File Selection

When requesting input of plotter file names, the program presents a directory from which the file can be selected using arrow keys. This directory shows only files having an extension starting with .HP. It is recommended to name the main plotter files with extension .HPG and registration plotter files with extension .HPR. The program directory offers the option of typing in plotter file names if the .HP? extension has not been used.

After the plotter file is selected, plotting begins and a gauge indicating percent completion is displayed. The program periodically predicts the time necessary to complete the plot based on rate of progress. After the plot is complete, the program offers an opportunity to plot another file using the same parameters and registration. This is useful if data from different sources are being combined or if it is necessary to re-ink parts of the plot because of pen skips. It may be advantageous to plot initially only the registration file to check if the registration is perfect, then to plot the data file at the second opportunity. After all files compatible with the active parameters and registration have been plotted, opportunity is given either to quit the program or start again at the beginning so that new parameters can be set.

EXAMPLE OF REGISTERED PLOT

This example will show the menu choices necessary to register a plot of a geologic map to a topographic map mounted in a large pen plotter. After the program is started, a title and disclaimer screen appears followed by a brief explanation of program functions. The explanation indicates that default choices are always marked by an asterisk. After reading the explanation, the user can quit the program by pressing <Q> or continue by pressing any other key. If the program continues, the menu shown below appears and the user must pick an output device by pressing a number.

```
        DEVICE
1 = *PEN PLOTTER:
2 = FILM PLOTTER (HP 7510)
3 = PSJET LASERJET
4 = HP-PAINTJET (WITH HPGL/2 MODULE)
5 = HP-LASERJET IIIp
6 = HP-DESIGNJET
```

DEVICE FOR OUTPUT?

Plot registration is only possible on a pen plotter, so the user must select the first choice, either by pressing <1> <RETURN> or just by pressing <RETURN>, since pen plotter is the default choice, as indicated by the asterisk. Next the menu below appears offering options for the output of the plotter commands to be generated.

OUTPUT THROUGH? 1*=COM1 2=COM2 3=LPT1 4=LPT2 5=FILE 6=NUL

If the plotter is connected to serial port 2, the user must enter <2> <RETURN>. Since a serial port was selected, the menu below appears, and the user must indicate the baud rate set on the plotter.

PLOTTER BAUD SETTING? (DEFAULT IS 9600)

If the plotter is set to 2400 baud, the user must type <2400> <RETURN>. The menu below then appears to allow the user to control the speed of pen movements depending on the type of pens loaded in the plotter.

10 = TRANSPARENCY   30* = DRAFTING PEN
50 = FIBER-TIP   60 = ROLLER BALL

PEN SPEED? (INCREMENT 5)

Although drafting pens are loaded in the plotter carousel, the user may type <20> <RETURN> to select a speed of 20 cm/sec to decrease the possibility of pen skips. The menu below then appears to allow the user to control the force with which the pen is pressed against the map in the plotter.

2 = TRANSPARENCY   3* = DRAFTING PEN
2 = FIBER-TIP   6 = ROLLER BALL

PEN FORCE? (1 TO 8)

The user may press <RETURN> to select the default force of 3. The menu below then appears so that the user can specify whether the plot is to be at the original scale, rescaled from one standard size to another, or rescaled, shifted and rotated to register to a basemap mounted in the plotter.

PLOT SCALE 1* = ORIGINAL 2 = RESIZE 3 = REGISTERED TO BASE

The user presses <3> <RETURN> in order to register the plot. The next input is the drive and directory to search for HPGL files of registration points and of data.

DRIVE AND DIRECTORY FOR PLOTTER FILES?

If the plotter files are in the default directory then the user can just press <RETURN>, otherwise type the appropriate information such as <c:\gsmap9> <RETURN>.

The next step is to digitize the registration points on the plotter, which should be turned on and properly connected before reaching this point in the program. The program first asks:

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IS THE PLOT FILE IN ROTATED COORDINATES (CONTAIN A <RO 90> COMMAND)? y/N*

    The default answer is no, so the user presses <RETURN> to indicate no rotation. Then the program gives the following instructions about digitizing the registration points.

PLACE DIGITIZING SIGHT IN PEN CAROUSEL
HIT ENTER KEY ON KEYBOARD WHEN READY
SELECT PEN NUMBER AND HIT PEN UP KEY ON PLOTTER TO LOAD DIGITIZING SIGHT.
MOVE SIGHT TO APPROXIMATE LOCATION OF UPPER LEFT CORNER USING PLOTTER CONTROLS.
HIT PEN DOWN, MOVE TO EXACT POSITION OF UPPER LEFT CORNER.
DIGITIZE BY HITTING ENTER KEY ON PLOTTER

    The coordinates will be printed on the screen and the process is then repeated for the lower left and lower right registration points. Then the following message appears.

REMOVE DIGITIZING SIGHT AND REPLACE WITH PEN
HIT ANY KEY TO CONTINUE

    The screen clears, and a list of all files in the designated directory with extensions starting with HP is displayed. The user is requested to indicate the file containing registration points. Generally the user will use arrow keys to point at the file and <RETURN> to select it. If the desired file is not listed, the user has the option to change to another directory, or to type in the name of the file.

    Four coordinate pairs will then be read from the indicated file and listed on the screen as upper left, lower left, lower right, and extra. Four are read because some programs move the pen to 0,0 before they start plotting the registration points.

PLOTTER COORDINATES OF REGISTRATION POINTS

	X	Y
1. UPPER LEFT	-18520	10580
2. LOWER LEFT	-18460	-10600
3. LOWER RIGHT	15345	-10600
4. EXTRA	0	0

    The example above is in the proper order, but if the pairs are out of the usual order, as in the example below, the following query appears.

PLOTTER COORDINATES OF REGISTRATION POINTS

	X	Y
1. UPPER LEFT	0	0
2. LOWER LEFT	-18520	-10580

3. LOWER RIGHT   -18460 -10600
4. EXTRA   15345 -10600

DO YOU WISH TO REARRANGE THE ORDER OF REGISTRATION POINTS? y/N*

If the user agrees that the points are out of order, then <Y> <RETURN> must be pressed, and the program will query:

WHAT LINE NUMBER SHOULD BE IN THE UPPER LEFT?

The coordinate pair on the first line will then be switched with the pair on the line entered by the user, and the list will be printed in the new order. This process is repeated for the lower left and lower right registration points. The user must then confirm that the new order is correct, or the reordering process is repeated. After the coordinates of the target registration points are digitized from the plotter and the coordinates of the source registration points are read from the file, the transformation necessary to register is calculated and the results printed on the screen as follows (the numbers vary from one plot to another). If the results are different than expected, the user can abort the program at this point rather than continue with a flawed plot.

X OFFSET=-564 PLOTTER UNITS
Y OFFSET= 334 PLOTTER UNITS
ROTATION=.0025 DEGREES
X SCALE CHANGE= .9999999987
Y SCALE CHANGE= .9999999979

CONTINUE PROGRAM? Y*/n

If the program is continued, the screen will clear and a list of plotter files will appear in the same way as when the registration file was selected, but in this case the data in the file selected will be drawn on the map. When the file is selected, plotting will begin and a gauge will appear on the screen indicating progress along with estimates of remaining time needed to complete the plot. When the plot is complete the following query appears.

WOULD YOU LIKE TO PLOT ANOTHER FILE OVER THE FIRST FILE, USING THE SAME PARAMETERS AND REGISTRATION? y/N*

If <Y> <RETURN> is selected then the list of plotter files appears again for another selection. Otherwise the following query offers the opportunity either to reset all parameters and continue the program or to exit.

EXIT PROGRAM? Y*/n

EXAMPLE OF PLOT TO RASTER DEVICE

This example will show the menu choices necessary when plotting on a color raster device. After the program is started, a title and disclaimer screen appears followed by a brief explanation of program functions. After reading the explanation, the user can quit the program by pressing <Q> or continue by pressing any other key. If the program continues, the menu shown below appears and the user must pick an output device by pressing a number.

```
        DEVICE
1 = *PEN PLOTTER:
2 = FILM PLOTTER (HP 7510)
3 = PSJET LASERJET
4 = HP-PAINTJET (WITH HPGL/2 MODULE)
5 = HP-LASERJET IIIp
6 = HP-DESIGNJET
```

DEVICE FOR OUTPUT?

For this example assume the user wants to plot on an HP-DesignJet, so <6> <RETURN> must be typed. Next the menu below appears offering options for the output of the plotter commands to be generated.

OUTPUT THROUGH? 1*=COM1 2=COM2 3=LPT1 4=LPT2 5=FILE 6=NUL

For this example assume the plotter is not connected to the DOS computer but is connected to a unix machine, so the plotter instructions to be generated must be stored on a file temporarily and later moved to the unix machine via FTP. The user must enter <5> <RETURN> to select plotting to a file. The following query appears.

NAME OF NEW FILE TO HOLD HPGL COMMANDS?

The user must type in a legitimate DOS file name and <RETURN>.
The next options offered control the line thickness, line density, and pen colors of raster devices. The first query is shown below.

DO YOU WANT TO CHANGE THE DEFAULT PEN THICKNESS, COLOR, OR DENSITY? y/N*

If the default <N> option is selected, all such controls will be bypassed. Otherwise the user may specify the name of a file containing all the information necessary to configure the raster device conceptual pens.

THE FILE STRUCTURE FOR A CUSTOM PALETTE IS:
5 |(PEN NUMBER)
0,200,150,0,100 |(RED, GREEN, BLUE, PEN WIDTH IN MM, DENSITY %)

DO YOU WANT TO LOAD CUSTOM PEN PARAMETERS FROM A FILE? y/N* ,

If no file is loaded, then the program queries for the number of virtual pens to define.

MAXIMUM NUMBER OF PENS? (15* TO 255)

Next it queries whether pen thicknesses are to be changed.

DO YOU WANT TO SET THICKNESS FOR SOME PENS? y/N*

If thicknesses are to be changed, a list of thicknesses is displayed.

FOR THINNEST POSSIBLE LINE ENTER 0 THICKNESS

PEN 1 = 0 MM THICK
PEN 2 = 0 MM THICK
PEN 3 = 0 MM THICK
PEN 4 = 0.1 MM THICK
PEN 5 = 0 MM THICK
PEN 6 = 0 MM THICK
PEN 7 = 0 MM THICK
PEN 8 = 0 MM THICK

PEN NUMBER TO CHANGE? (RETURN TO QUIT, -1 FOR ALL)

If a pen number is selected the thickness for that pen must be entered.

THICKNESS IN MM?

The same process is repeated for percent density of pens (shading), and for colors. Colors are specified by values of red, green, and blue between 0 and 255.

DO YOU WANT TO SET DENSITY % FOR SOME PENS? y/N*

DO YOU WANT TO CHANGE PEN COLORS? y/N*

ENTER VALUES 0 TO 255 FOR RED, GREEN, AND BLUE
255, 0, 0 = RED | 255, 255, 255 = BLACK | 0, 0, 0 = WHITE OR DEFAULT COLOR

PEN NUMBER TO CHANGE? (RETURN TO QUIT)

The menu below then appears so that the user can specify whether the plot is to be at the original scale, rescaled from one standard size to another, or rescaled, shifted and rotated to register to a basemap mounted in the plotter.

PLOT SCALE 1*=ORIGINAL 2=RESIZE 3=REGISTERED TO BASE

For this example, assume the user presses <2> <RETURN> in order to enlarge a plot from D-size to E-size. The next input is the drive and directory to search for HPGL files of registration points and of data.

DRIVE AND DIRECTORY FOR PLOTTER FILES?

If the plotter files are in the default directory then the user can just press <RETURN>, otherwise type the appropriate information such as <c:\gsmap9> <RETURN>.
Next are the following queries to determine the original plot size of the source, the desired output size, and any additional X or Y offset.

ORIGINAL PLOT SIZE? 1=A 2=B 3=C 4*=D 5=E 6=DESIGNJET (E)
NEW PLOT SIZE? 1*=A 2=B 3=C 4=D 5=E 6=DESIGNJET (E)
INPUT X OFFSET IN INCHES?
INPUT Y OFFSET IN INCHES?

Based on the source and target plot sizes, a transformation is calculated and listed on the screen as follows

X OFFSET=-564 PLOTTER UNITS
Y OFFSET= 334 PLOTTER UNITS
ROTATION= 0 DEGREES
X SCALE CHANGE= 1.374
Y SCALE CHANGE= 1.243

DO YOU WANT TO CHANGE THE SCALE FACTORS? y/N*

The X and Y scale changes will usually not be equal. In order to maintain the same proportions as in the original drawing, the user must enter <Y> <RETURN>, then enter new scale factors that will fit on the sheet but are equal for X and Y.

X SCALE FACTOR?
Y SCALE FACTOR?

For this example the user would enter 1.243 for both X and Y scale to obtain the

largest possible undistorted plot. Then there is a last opportunity to abort the program before plotting begins.

CONTINUE PROGRAM? Y*/n

If the program is continued, the screen will clear and a list of all files in the designated directory with extensions starting with HP is displayed. The user is requested to indicate the file containing data to be plotted. Generally the user will use arrow keys to point at the file and <RETURN> to select it. If the desired file is not listed, the user has the option to change to another directory, or to type in the name of the file. When the file is selected, plotting will begin and a gauge will appear on the screen indicating progress along with estimates of remaining time needed to complete the plot. When the plot is complete the following query appears.

WOULD YOU LIKE TO PLOT ANOTHER FILE OVER THE FIRST FILE, USING THE SAME PARAMETERS AND REGISTRATION? y/N*

If <Y> <RETURN> is selected then the list of plotter files appears again for another selection. Otherwise the following query offers the opportunity either to reset all parameters and continue the program or to exit.
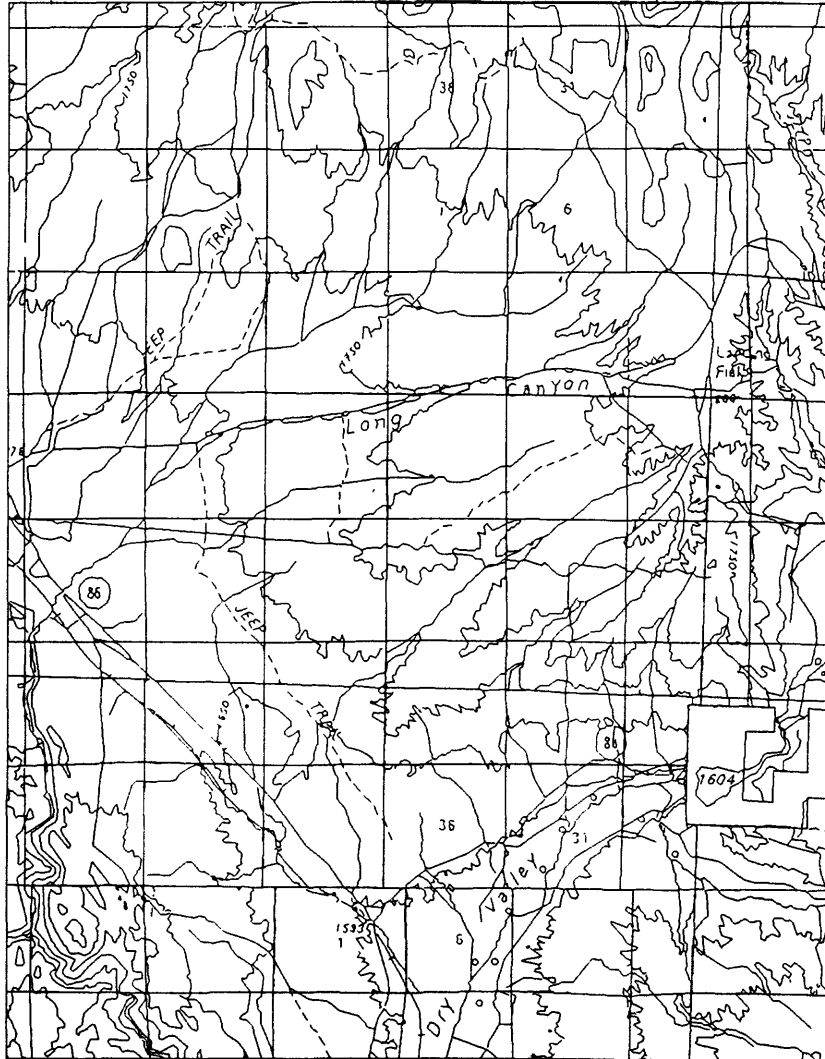
EXIT PROGRAM? Y*/n

REFERENCES

Selner, Gary I. and Taylor, Richard B., 1993, SYSTEM 9 GSMAP and Other Programs for the IBM PC (and Compatible) Microcomputers, to Assist Workers in the Earth Sciences, U.S. Geological Survey Open-File Report 93-511, 363 p., 2 disks.

Plot of HPGL file GEOL.HPG (geology of the Rose Valley quadrangle, Lincoln County, Nevada)

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Plot of HPGL file TOPO.HPG (topography of the Rose Valley quadrangle, Lincoln County, Nevada, 1;100,000 scale)

Use this ruler to calibrate a laser printer.

This box should be 20 cm X 10 cm

Each fine tic on the 20 cm axis represents
a 0.002 scale adjustment.

Each fine tic on the 10 cm axis represents
a 0.004 scale adjustment.

SCALE FACTOR 0.9

1.1

Plot of HPGL file RULER.HPG