OPEN-FILE REPORT (GEOLOGICAL SURVEY (U.S.))

GSPOST Version 3.0: a program to plot symbols and post numerical data from ASCII tables providing Geodetic or Cartesian coordinates using an IBM PC (or compatible) microcomputer and plotter.

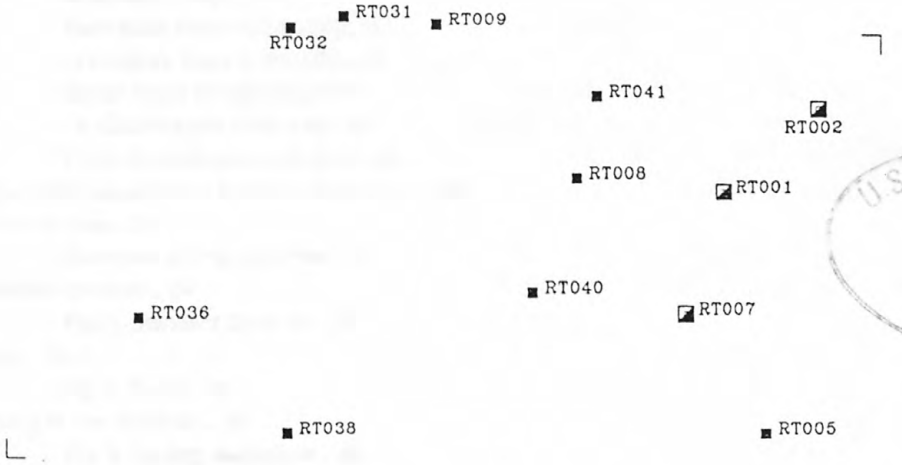
by Gary I. Selner, Cole L. Smith and Richard B. Taylor

UNITED STATES DEPARTMENT OF INTERIOR
GEOLOGICAL SURVEY

GSPOST Version 3.0: A program to plot symbols and post numerical data from ASCII tables providing Geodetic or Cartesian coordinates using an IBM PC (or compatible) microcomputer and plotter.

by

Gary I. Selner, Cole L. Smith and Richard B. Taylor



Open File Report
90-269

Denver, Colorado
April 1990

TABLE OF CONTENTS

INTRODUCTION

GSPOST is a microcomputer program that takes data from a properly formatted ASCII file and plots on the screen, on a plotter, or writes to a disk file in HPGL (Hewlett Packard Graphics Language) to make maps displaying information associated with geographic sites by drawing symbols and/or posting numerical data. GSPOST can use latitude and longitude (geodetic) coordinates or X,Y (Cartesian) coordinates. The sites might be sample localities, drill holes, or mine portals, but characterized by location in latitude, longitude or X,Y coordinates and a site identifier, and usually by numeric values for attributes of the site, such as chemical data from a sample site, or flow rates from a well. A set of standard symbols is supplied on the release disk. Symbol definitions are contained in an ASCII file; additions to the standard set can be made by the user.

The user must supply an ASCII data file that contains a series of rows and columns. Each row contains a series of attributes that apply to one data point. Each column contains one kind of attribute. The first columns of each row are "control" columns providing the site's identifier, the coordinates of the site and the position and angle posting numerical values. Additional columns to a total of 50, are data columns. Latitude/longitude information can be specified either in decimal degrees, or in degrees, minutes, and seconds. Both formats cannot be used in a single file. X,Y coordinates are specified in a system appropriate to the map; these cannot be mixed with latitude,longitude coordinates in a single data file.

ASCII plot control files and files specifying parameters for the selected map projection (latitude,longitude coordinates) also are prepared by the user.

GSPOST allows the user to specify the column from which data will be taken, values or ranges in values (class intervals), and choose different symbols (and/or different symbol sizes for each class, with or without posting of numerical values, or the posting of site identifiers.

The position of posting of numerical data at each site can be adjusted to reduce over-printing of numbers by changing the position and/or the angle of the posting. These adjustments are made by on-screen editing. For any given map the X and Y scales are independent; the area is specified using the coordinates of corner points in the coordinate system chosen for locating data points (latitude,longitude of X,Y).

Maps can be drawn from geodetic data using the following map projections: Mercator, Transverse Mercator, Universal Transverse Mercator, Oblique Mercator, Albers Equal Area, Lambert Conformal Conic, Polyconic, and Equidistant Conic.

GSPOST operates from menu screens, and on-screen prompts calling for responses from the user. Responses are entered by typing appropriate answers to the prompts, and then hitting the ENTER key. Default values are indicated in the documentation. Files are specified by entering the full name of the file with extension at appropriate prompts.

This version of GSPOST is designated as "level 6" as it's operations are consistent with the practice of GSMAP and GSDRAW Version 6.0 (Selner and Taylor, 1989). The same equipment is used, the same configuration files are used to interface the computer with the monitor and plotter, and the same projection files are used to produce maps on the supported map projections from geodetic data.

GSPOST Version 3.0 replaces GSPOST Version 2.0 and GSPXY Version 1.0. It supports plotting using either Geodetic or Cartesian Coordinates, the use of additional fonts, and adds the flexibility created by the use of alternate posting positions to the single position with control of angle offered by the previous programs. Windows within the area of plotting can be excluded from plotting if desired. This offers a way of treating areas with a sample density too high to avoid over-plotting. A line can be drawn around excluded areas to ensure that omission of data is shown on the plot.

Hardware environment

GSPOST requires a microcomputer operating under MS DOS or PC DOS. The computer must be fully compatible with the IBM PC, have at least 512 Kbyte random access memory, two floppy disk drives or a hard disk, one serial port, a math co-processor chip, and an EGA, VGA, or Hercules graphics card and matching monitor. A CGA monitor can be used, but lacks sufficient resolution for successful editing.

The plotter must support HPGL plot commands at a level at or above that of the Hewlett Packard model HP 7475. HPGL at this level is supported by many, but not all kinds of plotters.

Installation

If GSMAP Version 6 or other "level 6" program has already been installed, copy the executable file GSPOST.EXE from the release disk into the default drive of the computer. If level 6 configuration files for the screen and the plotter and one or more font files (extension .FNT) are not available, also copy the configuration files for the plotter CONFIG.PLT, and the screen CONFIG.SCR, CONFIG.EGA, CONFIG.VGA and at least one of the font files (0.FNT is suggested) from the release disk to the working area.

Modifications to the configuration files supplied on the release disk may be necessary to match the configuration specified in these files to system parameters. Instructions for these modifications are provided in Appendix 1.

Operation of GSPOST requires four files supplied on the release disk and three others created by the user (examples are also supplied on the release disk):

1. GSPOST.EXE, the executable program.
2. CONFIG.PLT, the file configuring communication parameters between the computer and the plotter and the definitions of symbols in the standard symbol set.
3. CONFIG.SCR, the file specifying graphics parameters for the graphics adapter and monitor.
4. One or more font files: 0.FNT, and others indicated by the plot control file.

The user must supply:

5. A projection parameter file is required if geodetic data is being used. This file specifies parameters for the map projection to be used. Examples on the release disk have the extension PRJ.
6. The data file in row-column format.
7. The plot control file that contains specifications of the plot. Examples on the release disk have the extension PLT.
8. The exclusion file specifying coordinates of areas inside the area of the plot inside which plotting is not to be done, if such exclusion is wanted. The example on the release disk has the extension .EXC.

These files must be available before operating GSPOST.

Check to see that the files required for your project are available before starting GSPOST.

The program is started by entering GSPOST from the DOS prompt. The screen will briefly display the disclaimer screen, then enter an interactive mode in which screen prompts will request a response, then proceed to other prompts after an appropriate entry.

The first prompt will be:
DOES YOUR FILE CONTAIN GEODETIC OR CARTESIAN COORDINATES?(G/C):

Enter G if the file specifies locations in latitude, longitude coordinates; enter C if X,Y coordinates are used. The default answer is G. The next prompt will be:
DO YOU WANT TO SPECIFY PLOT AREA INTERACTIVELY (Y/N):

If you put the corners of the area to be plotted in the plot file, answer N (No). If you answer N later prompts calling for entry of plot corners will be skipped. The default response is N. The Y (Yes) response allows sequential plots of different areas to be made without the necessity of constructing individual plot control files for each, and later prompts will request entry of the coordinates of the corners of the area to be plotted.

The next prompt will request the entry of the name of the plot control file.
ENTER PLOT CONTROL FILE NAME:

Enter the full name (including extension) of the plot control file. If you are working in geodetic coordinates, after entry of the name of the file a list of files with the extension .PRJ in the default drive will be displayed, and a prompt at the bottom of the screen will call for entry of the name of the desired projection file.
ENTER FILENAME OF PROJECTION PARAMETERS:

This prompt will be not be displayed if Cartesian coordinates are specified. If you are using Geodetic coordinates. Enter the complete name of the file, including extension.

If you answer Y to the prompt: DO YOU WANT TO SPECIFY PLOT AREA INTERACTIVELY prompts will call for entry of the coordinates of the corners for the plot. If geodetic coordinates are being used, options are provided by the next prompt:

TYPES OF MAPS
1- 24,000 7/12 MINUTE
2- 62,500 15 MINUTE
3- 100,000 30 MIN LAT x 1 DEG LONG
4- 250,000 1 DEG LAT X 2 DEG LONG
5- OTHER

Choice of the options 1-4 will bring a prompt for entry of the latitude, longitude coordinates of the NORTHWEST corner of the area. Entry of a 5 will bring prompts for entry of the coordinates of all four corners of the plot area. Enter the coordinate(s) requested. If map types 1-4 are chosen the UTM projection will be chosen without the necessity of entering the name of a projection parameter file.

If Cartesian coordinates are being used four prompts will call for entry of the coordinates of the corners of the plot area:
ENTER UPPER LEFT CORNER(X,Y)
ENTER LOWER LEFT CORNER(X,Y)
ENTER LOWER RIGHT CORNER(X,Y)
ENTER UPPER RIGHT CORNER(X,Y)

Next, a message will be displayed providing information on the size of the map to be plotted and asking if you wish to continue:
DO YOU WANT TO CONTINUE?(Y/N):

If the size of the plot is appropriate, respond **Y**, if not enter **N**. The default answer is **Y**. A prompt will next ask for input about exclusion of areas:
DO YOU WANT TO USE AN AREAL EXCLUSION FILE? (Y/N):

If exclusion is needed enter **Y**, if not enter **N**. The default is **N**.

If you enter **Y** a prompt will call for entry of the name of the exclusion file:
ENTER AREAL EXCLUSION FILENAME:

Enter the full name of the file, with extension. After this entry the screen will display status information about the current files, as in the example below:

```
CURRENT CONTROL FILE=LL.PLT
AREA EXCLUSION FILE =
CURRENT DATA FILE    = LL.PRN
NUMBER OF ROWS       = 19
NUMBER OF COLUMNS    = 11
CURRENT VARIABLE     = 0
NUMBER OF CLASSES    = 1
```

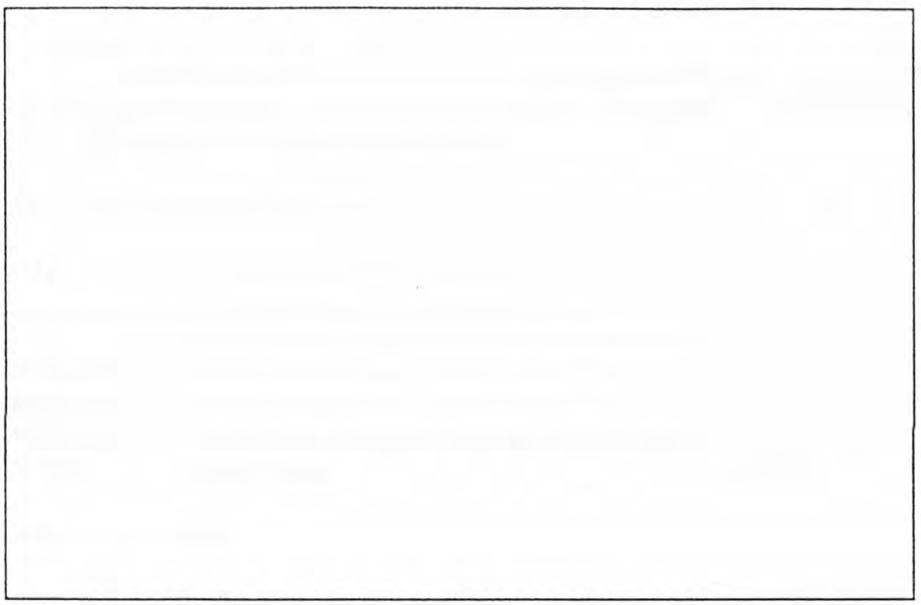
The next prompt will call for selection of the "plot option", ie. to select between plotting to the screen, plotting on hard copy using the plotter, or sending output to an HPGL file on a disk. The prompt will be:

```
ENTER PLOT OPTION
DEVICE-
     S=SCREEN
     P=PLOTTER
     D=DISK
     Q=RETURN TO DOS
ENTER CHOICE (S,P,D,N,Q):
```

Enter **S**, **P**, or **D**, to continue, or **Q** to exit to DOS. The default is **S**.

The screen plot not only allows preview of the plot on the screen, but provides an interactive screen editor so that posting positions can be modified to reduce over-printing.

Screen-edit functions screen #1



A=MODIFY

Entering **A** will bring a cursor to the lower left corner of the screen, and the prompt:

↑↓→←F=FASTMODE,S=SLOWMODE,SPACE=LAST POINT,ESC=EXIT,RETURN TO FIX POINT

Use the arrow keys on the numeric keypad to move the cursor + to the symbol of the entry to be modified, using **F** fast mode for coarse adjustments, the **S** mode for fine adjustments. The editor opens in a mode moving the cursor in 10 pixel increments; in fast mode **F**, the cursor moves in 20pixel increments, in slow mode S the cursor moves in one pixel steps. When the cursor is on the correct place, hit the ENTER key to identify the desired entry. The cursor will stay at this position; the function message and the prompt line will change, and information will be displayed about the point chosen (row in the table, identifier, and posting angle) see below:

Screen-edit functions screen #2

A=CH.ANGLE

Entry of **A** brings the prompt:

ENTER NEW POSTING ANGLE

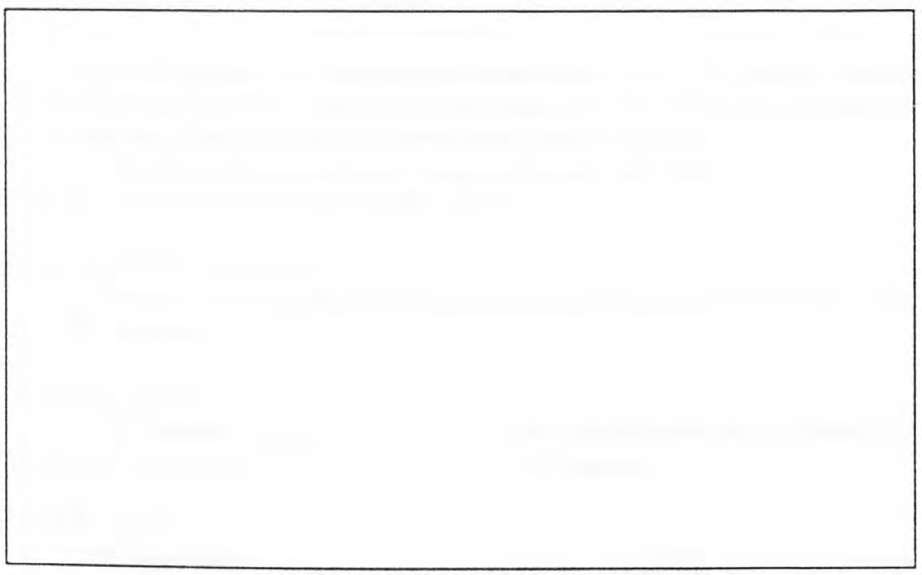
Enter the angle desired; 0 degrees posts to the right of the symbol, 180 degrees to the left, angles between 0^{O} and 180^{O} change the angle of posting in a counterclockwise direction. Negative angles change posting in a clockwise direction. The screen will show the new posting, and if satisfactory, C to exit will return operation to the previous screen.

B=CHG.LOC
Entry of B brings the prompt:
↑↓→←F=FASTMODE,S=SLOWMODE,SPACE=LAST POINT,ESC=EXIT,RETURN TO FIX POINT

Use the arrow keys to move the + cursor to the new posting position desired, then hit the ENTER key to establish the new position. The screen will show the new posting, and if satisfactory, C to exit will return operation to the previous screen. If the position is not satisfactory, use B to try again. Remember that if the angle of posting is 0 the posting position is relative to a point at the lower left corner of the block occupied by the posting, but displaced to the right a distance corresponding to the size of the symbol. But if the posting angle is 180^{O}, posting will be to the left of the point, and relative to the lower right corner of the posting, and displaced to the right a distance corresponding to the size of the symbol. The cursor position will be marked on the screen until it is refreshed to assist accurate location.

C=EXIT
Enter C to return to the previous screen.

More screen plot-edit functions screen #1



-FUNCTIONS-
A=MODIFY
B=WINDOW
C=IDENTIFY
D=REFRESH
E=DRAW CRNS
F=DRW GRD
G=SAVE CHG
H=RESTORE
I=EXIT

ENTER DESIRED FUNCTION ?

B=WINDOW

Entering B will bring a cursor + to the lower left corner of the screen window (box) and a prompt to the bottom of the screen:

↑↓→←F=FASTMODE,S=SLOWMODE,SPACE=LAST POINT,ESC=EXIT,RETURN TO FIX POINT

Use the arrow keys to move the cursor + to the lower left corner of the area to be windowed, using the F fast mode for coarse adjustments, the S mode for fine adjustments. The editor opens in a fast mode with movements in 10 pixel increments; in fast mode F mode movements are in 20 pixel steps; in slow mode S movements of the cursor are in one pixel steps. Hitting the ENTER key establishes the lower left corner of the new window. A second cursor + will appear at the upper right corner of the screen, and the prompt will change:

↑↓→←F=FASTMODE,S=SLOWMODE,SPACE=LAST POINT,ESC=EXIT,RETURN TO FIX POINT

Use the arrow keys to move the second cursor + to the upper right corner of the area to be windowed, then hit the ENTER key to establish the window. The windowed area will be redrawn on the screen at the newly specified scale. Further windowing can be done, or editing can proceed. The cursors can be moved outside the screen plot window, and although they will not be drawn, the windowing process can be used to enlarge the window slightly. If a much larger window is needed, it is better to use the H function to step back to the entire area as shown initially on the screen plot. Only points inside the window will be posted; labels from points inside the window may extend outside the window. Adjust the size of the window carefully.

C=IDENTIFY

Enter C if you wish to identify an entry. The prompt will be:

↑↓→←F=FASTMODE,S=SLOWMODE,SPACE=LAST POINT,ESC=EXIT,RETURN TO FIX POINT

Move the cursor to the symbol to identify the point. The posting is associated with the symbol point (the site location) not with the position of posting. Hit the return key. Information about the point selected (row, identifier, posting angle) will be displayed on the screen.

Then select the appropriate function from the prompt:

ENTER DESIRED FUNCTION? ▒

D=REFRESH

Redraw the screen from the file by entering D to refresh the screen. This gets rid of extra cursor points in an edit sequence.

E=DRAW CRNS

This function, enter E will plot the corners specified in the plot file on the screen. Angled corner braces will be used e.g.(⌞) for the SW (lower left) corner .

F=DRW GRD

To draw reference grid points on the screen, select function F. A prompt will ask for entry of the delta spacing you wish, e.g. in geodetic coordinates the prompt will be:

ENTER DELTA(DD,MM,SS):

In Cartesian coordinates the prompt will be:

ENTER DELTA (INCHES)

The grid spacing entered is in inches at plot scale.

Enter the spacing desired. A grid defined by + symbols will be plotted on the screen. This grid is not preserved if the screen is windowed, but can be redrawn after windowing.

G=SAVE CHG

Changes made during editing can be saved to a new data file by entering G. A prompt will be displayed asking for the name of the new file. Enter the full name of the file, including the extension. Corner braces and grid points from the edit sequence are not stored in the data file.

H=RESTORE

To step back to the initial screen of the edit sequence, use the **H** function, for example, if you need to select a new area for continued editing.

I=EXIT

If plotting from several columns is specified in the plot control file, entry of **I** takes the system back to the plot option prompt:

```
ENTER PLOT OPTION
DEVICE-
     S=SCREEN
     P=PLOTTER
     D=DISK
Other-
     N=NEXT VARIABLE FROM PLOT FILE
     Q=RETURN TO DOS
ENTER CHOICE (S,P,D,N,Q):
```

Enter **S**, **P**, or **D** to continue, Or **N** to continue with another variable from the plot file, or **Q** to exit to DOS.

If plotting of all columns has been completed, and all edit changes have been saved, the system will return to the DOS prompt. If all changes haven't been saved, a reminder will prompt:

```
DO YOU WANT TO EXIT WITHOUT SAVING?(Y/N) (the default is N):
```

If you want to save the changes made to the control columns in a data file, enter **Y** and a prompt will ask for the name of the file. Enter the full name of the file with extension. A final prompt will be:

```
DO YOU WANT TO PROCESS ANOTHER FILE (Y/N):
```

If you want to continue the GSPOST session enter **Y** and proceed (from the prompt asking if you wish to use geodetic or Cartesian coordinates). Entry of **N** will return the system to the DOS prompt.

If you enter **P** at to go to the plotter, a reminder will be shown:
PLOTTER SHOULD BE ON AND PAPER LOADED!!!!!
HIT ANY KEY WHEN READY

Hit a key to start plotting. GSPOST will drive the plotter according to specifications in the plot control file, beginning with the first column specified in the plot control file. After completion of this plot, prompts will ask if you want to draw corner "braces" to identify the plot corners, if you want to draw internal tick marks, and if so what the spacing of the tick marks is to be. The default answer to the draw corners and plot tick marks prompts is **N**. You will also have the opportunity to draw or not draw the outlines of the excluded areas. These outlines will be drawn using pen #1. After these entries, the computer will show a prompt much like one at a previous stage:

```
ENTER PLOT OPTION
DEVICE-
     S=SCREEN
     P=PLOTTER
     D=DISK
OTHER-
     N=NEXT VARIABLE FROM PLOT FILE
     Q=RETURN TO DOS
ENTER CHOICE (S,P,D,N,Q):
```

Enter S, P, or D, if a change is needed, Q to exit to DOS, or **N** to continue plotting if data from another column (another variable) is to be plotted. If only a single variable is used in the plot control file, both Q and N will return the system to the DOS prompt. If several variables are to be plotted, entry of **N** will begin the plot of data from the column specified second in the plot file. The sequence can be continued until the required plots for all data columns have been completed.

Plotting to a file

If **D** is answered, a prompt will request:
ENTER DISK FILENAME:

Enter the name you choose for the output file. The next prompt will ask for entry of the values for the scaling points, P1X, P1Y, P2X, P2Y. See Appendix 1 and plotter documentation for values. After entry of the scaling pointse. g., **80,320,10080,7520** the font and data will be loaded and a prompt will request an entry:

```
ENTER PLOT OPTION
DEVICE-
     S=SCREEN
     P=PLOTTER
     D=DISK
OTHER-
     N=NEXT VARIABLE FROM PLOT FILE
     Q=RETURN TO DOS
ENTER CHOICE (S,P,D,N,Q):
```

Entry of **N** will continue plotting from specified columns until the plot is complete. HPGL output files can be used to generate plots on a plotter, using a program such as QUEIT (Selner and Taylor 1989). Proprietary programs are available that use laser printers or 24 pin dot matrix printers to make plots from HPGL files.

Duplicate plots generally will take less time if made from HPGL files using Queit.

DATA FILES

The user must create an ASCII data file that contains a series of rows and columns before using GSPOST. Each row (record or line) is a series of entries that apply to one data point. Each column contains one kind of attribute.

Header records

Header records (lines) can be used to provide information about the file. If a blank line follows the last line in the file that contains data, annotations can be made to the end of the file.

Control columns

The first several columns in the data file are control columns that contain the site's identifier, the site's coordinates, and the plot angle for posted values, and alternate posting positions. The suceeding columns are data columns; the user can choose the attributes to be displayed. Examples of geochemical attributes might include the concentrations of silver, copper, and lead. All attributes in data columns must be numbers.

Column 1 must be used for the locality identifier (the locality number or alphanumeric label for the data point). This identification label can consist of up to 16 alphanumeric characters or numbers, but must not include a comma. These characters or numbers must be followed by a comma to end the string of characters that constitutes the locality identifier. If the locality identifier is enclosed in quotation marks the comma is not required. A blank space after the comma is permitted, but isn't required.

The next columns contain the coordinates of the site. Two formats are acceptable for geodetic coordinates.

Format: Decimal degrees:
DD.DDDD,DDD.DDDD Latitude, then Longitude

Latitude and longitude values using this format can be positive or negative. Latitude values are positive in the northern hemisphere and negative in the southern hemisphere; longitude values are positive in the eastern hemisphere and negative in the western hemisphere.

Format: Degrees, minutes, and seconds:
DD,MM,SS.SS,C,DDD,MM,SS.SSS,C, Latitude, then Longitude

The character represented by C above may be N,S,E,W as appropriate to provide the required compass direction for North or South latitudes and East or West Longitude.

Format, Cartesian coordinates:
X,Y

X and Y coordinates are specified in decimal units defined for each plot.

Posting angle

The column following the last coordinate column is used for a number, best understood as an "angle", which specifies rotation of posting about the data point. We recommend starting with a series of zeros in this column, then, if necessary, edit the column using the screen-editor to rotate postings to positions that avoid overwriting of values.

Entry of an angle of 0 specifies a posting to the right of the symbol. An angle of 180 degrees specifies posting left of the symbol. Other angles cause rotation of the posting to other positions; positive angles are measured counterclockwise from the horizontal; negative angles can be used.

Alternate posting positions

The fifth and sixth or the eleventh and twelfth columns are used to specify alternate positions for posting data. These columns are modified when the on-screen edit capabilities of GSPOST are used to generate alternate positions. Values of 0 for these alternate positions cause default to the site locations. To begin work with a file, we suggest that posting angles and alternate positions be specified as 0. Entries in the data file would appear as shown in examples that follow.

Data columns

The ASCII data file can have up to 50 data columns and up to 5,000 rows. The "control" columns must be reserved for the specific uses described above. The next fifty columns are data columns that can be used for numerical data (numbers only, no alpha characters).

The ASCII data file can be created in a variety of different ways. If data is available in LOTUS 1,2,3 or similar program, a data file can be created by asking for generation of a PRN file. Regardless of how the ASCII data file is generated the user must make certain that a comma is present after the locality identifier or that it is enclosed by double quote marks (", that any column containing an alpha character ends with a comma, that other columns are separated by a "blank" and that data columns contain numbers only. The user specifies (and must keep track of) the data types in each column by number. The data columns are counted from the left. Data column #1 follows the column that contains the longitude value for the alternate posting position (or the zero that specifies the default position.

The example of a geodetic data file provided below contains latitude, longitude data in decimal degrees, has no header lines, and no entries below the last record.

```
IFAA001,  43.987    -113.768  0 0 0  943     6    65    28
IFAA002,  43.9875   -113.816  0 0 0 1007     7    85    24
IFAA004,  43.9709   -113.883  0 0 0  935    11    58    29
IFAA005,  43.96049  -113.888  0 0 0  884     6    69    32
IFAA006,  43.95979  -113.855  0 0 0  911     6    60    23
IFAA008,  43.92329  -113.863  0 0 0  911    10    49    30
IFAA009,  43.96471  -113.763  0 0 0 1114    11    76    27
IFAA010,  43.94881  -113.801  0 0 0 1082     8    60    25
```

The example of a geodetic data file provided below contains latitude,longitude in degrees, minutes, and seconds is provided below. It has one header record, and no entries below the last record.

```
Identifier                                                Fe   Ti   Mn   P205
    IFAA001,  43  59  13 N,  113  46   5 W, 0 0 0  943    6   65   28
    IFAA002,  43  59  15 N,  113  48  58 W, 0 0 0 1007    7   85   24
    IFAA004,  43  58  15 N,  113  52  59 W, 0 0 0  935   11   58   29
    IFAA005,  43  57  38 N,  113  53  17 W, 0 0 0  884    6   69   32
    IFAA006,  43  57  35 N,  113  51  18 W, 0 0 0  911    6   60   23
    IFAA008,  43  55  24 N,  113  51  47 W, 0 0 0  911   10   49   30
    IFAA009,  43  57  53 N,  113  45  47 W, 0 0 0 1114   11   76   27
    IFAA010,  43  56  56 N,  113  48   4 W, 0 0 0 1082    8   60   25
```

The example of a Cartesian coordinate data file provided below has no header records, and no records following the last data record.

```
TRAA001,  43.98     113.768  0 0 0  943     6    65    28
TRAA002,  43.987    113.81   0 0 0 1007     7    85    24
TRAA005,  43.960    113.88   0 0 0  884     6    69    32
TRAA006,  43.959    113.85   0 0 0  911     6    60    23
TRAA008,  43.923    113.86   0 0 0  911    10    49    30
TRAA009,  43.964    113.76   0 0 0 1114    11    76    27
TRAA010,  43.948    113.80   0 0 0 1082     8    60    25
```

Commas must be used after the identifier and after the characters used to designate the "Compass" directions. Commas or blanks can be used to separate any of the other columns.

Example of an edited geodetic coordinate data file

The example of an edited Geodetic coordinate data file provided below has three header records, and no records following the last data record. Posting angles modified during editing are printed in bold type; the latitude and longitude values for alternate posting positions are underlined. Only a part of the file has been printed so that the print will fit on the page. Alternate posting positions are recorded in decimal degrees. Zeros are introduced when the fixed format of the output data file is imposed.

"Samples analyzed using an A-Z technique on the ICP"

19 11

"SAMPID"	"Lat"	"Long"	"Ang"	ALT LAT	ALT LONG	"SampT"	"Ag"	"As"
"RT002	" 38.85561	-115.76600	0	38.85122	-115.77191	61.00000	0.50600	111.63400
"RT005	" 38.77740	-115.77000	0	0.00000	0.00000	61.00000	0.02400	5.57700
"RT007	" 38.80341	-115.79900	0	0.00000	0.00000	61.00000	3.14900	80.88800
"RT008	" 38.83220	-115.83700	0	0.00000	0.00000	61.00000	0.02400	2.76500
"RT009	" 38.86470	-115.88500	180	0.00000	0.00000	61.00000	0.00800	9.60500
"RT010	" 38.90860	-115.92100	0	0.00000	0.00000	61.00000	0.02100	3.95300
"RT011	" 38.91991	-115.94400	0	0.00000	0.00000	61.00000	0.10400	2.21700
"RT024	" 38.94521	-115.86400	0	0.00000	0.00000	61.00000	0.04000	0.00000
"RT031	" 38.86380	-115.91400	0	0.00000	0.00000	61.00000	0.05700	18.60000
"RT032	" 38.85950	-115.93000	0	38.85448	-115.93464	61.00000	0.06000	4.93000
"RT036	" 38.78680	-115.96500	0	0.00000	0.00000	61.00000	0.15500	8.35600
"RT038	" 38.76379	-115.91600	0	0.00000	0.00000	61.00000	0.07000	9.22200

PLOT CONTROL FILES

The user must create a plot control file before using GSPOST. A plot control file contains a series of ASCII records (lines) that specify parameters that control the area, size, orientation and content of the maps that are to be generated. The list below is for a file where map corners are specified in the plot control file. The first four records are omitted if plot corners are to be entered interactively.

Record 1: Latitude,Longitude of NW corner of plot area, format DD,MM,SS,C,DDD,MM,SS,C OR X,Y coordinates of the upper left corner of the area.

Record 2: Latitude,Longitude of SW corner of plot area, format DD,MM,SS,C,DDD,MM,SS,C, OR X,Y coordinates of the lower left corner of the area.

Record 3: Latitude Longitude of SE corner of plot area, format **DD,MM,SS,C,DDD,MM,SS,C, OR X,Y** coordinates of the lower right corner of the area.

Record 4: Latitude Longitude of NE corner of plot area, format **DD,MM,SS,C,DDD,MM,SS,C, OR X,Y** coordinates of the upper right corner of the area.

Record 5: X scale, Y scale. For Geodetic coordinates, the denominators of the scale fractions.g, 24000,24000 (for 1:24,000 scale maps); for Cartesian coordinates the numerator of the scale multiplier, e.g. **2,2** for maps twice the size plotted at 1,1.

Record 6: The offset in inches from the plotter default origin near the corner of the plotter paper for the SW (lower left) corner of the plotted map; see plotter documentation, e.g, **1,3**, for XOFF=1", YOFF=3".

Record 7: This record specifies rotation on the plot media, see plotter documentation, and appendix 1, e.g. **Y** yes rotate, or N, no, don't rotate.

Record 8: Speed and Force, these values specify the speed of drawing lines in cm/sec and the pressure on the pen, e.g, **25,1**, refer to plotter manuals for recommended values, and see Appendix 1.

Record 9: The font number, width and height in inches for posted numbers and letters, e.g 0,0.04,0.06. This does not refer to symbol size.

Record 10: The complete filename for the ASCII file that contains the data to be plotted, e.g, :FILENAME.EXT.

Record 11: For Geodetic coordinates. If the data file contains latitude,longitude recorded in decimal degrees enter DD. If the data file contains degrees,minutes,seconds, enter DMS.

Record 11 Cartesian coordinates, Record **12** for Geodetic coordinates: The number of rows used for data, the number of data columns, and the number of lines used for header records in the data file. These three numbers are separated by commas. If there are no header records, specify 0 (zero). The number of data columns does NOT include the locality identifier column, the latitude and longitude columns the posting angle column, or the alternate posting position columns. The number of columns specified here is the number of data columns, e.g., **12,3,0.**

Succeeding records contain information specifying the data column(s) which are to be used, the kinds and sizes of symbols that are to be drawn, and the posting that is desired. These records group into two types.

Type 1: A record with two numerical entries specifies the data column selected, and the number of classes (ranges) to be used to plot that data. The data column is specified by number, followed by the number of classes, e. g. 3,4 specifies four classes to be separately plotted from the data in the third data column

Type 2: Each class of data requires a record in the file - the entry of 4 above requires four succeeding records. Each record specifying classes contains six entries separated by commas; in sequence, (1) the low value for the class (values selected will be greater than or equal to the low value), (2) the high value for the class (values selected will be less than the high value), (3) the pen to be used (pen position in the carousel in the plotter by number), (4) the number of the symbol to be used, (5)the size of the symbol in thousandths of an inch, and (6) Y or N which specifies whether posting of the numerical value from the table at this point is desired (Y) or not (N). For example 20,50,3,11,100,N specifies that values ranging from 20 to 50 are to be selected, symbol 11 is to be used, and drawn 100/1000 inch high.

A record of Type 1 must be followed by the requisite number of records (lines) of type 2 specifying class intervals, pen, symbol, size, and posting "Y" or "N". Subsequent records of Type 1 followed by specified numbers of records of Type 2 can be used to plot data from other columns.

To plot a symbol at each locality and post the locality identifiers, insert a record reading 0,1 at any position appropriate for a type 1 record. Follow this record with a type 2 record specifying 0, 0, Pen #, Symbol #, Symbol size. Generally it works best to insert these records after record #12 or #11 that specifies the number of rows and columns in the data file. This facilitates editing of posting positions.

No record is required to mark the end of the plot file, a carriage return at the end of the last line of the plot file marks the end of the plot file.

Examples of GSPOST plot control files

The plot files contain only the information in the left column of the print-out below.

Geodetic coordinate plot control file to plot data

Entries in Plot File	Notes on contents of plot file
44,0,0,N,113,57,0,W	Lat/Lon NW Corner
43,52,0,N,113,57,0,W	Lat/Lon SW Corner
43,52,0,N,113,45,0,W	Lat/Lon SE Corner
44,0,0,N,113,45,0,W	Lat/Lon NE Corner
250000,250000	XSCALE, YSCALE
0,0	XOFF=0, YOFF=0
N	"N", Don't rotate plot
25,1	Speed,Force
0,0.1,0.15	Font#=0,Width=0.1", Height=0.15" for characters to be posted
TESTDD1.PRN	FILENAME.EXT of data file
DD	File format Decimal Degrees.
8,4,0	#Rows,#columns in data file,#lines used for header records
2,3	Use column 2, 3 classes
0, 1000, 1, 1, 25, N	Range 0-1000,Pen 1, Symbol 1,25/1000 inch, "N" don't post
1000, 1100, 1, 41, 150, N	Range 1000-1100, Pen 1, Symbol 41,150/1000 inch, "N" Don't post
1100, 1500, 1, 41, 225, N	Range 1100-1500, Pen 1,Symbol 41,225/1000 inch, "N" Don't post
3,2	Use column #3, 2 classes
65, 75, 2, 42, 150, N	Range 65-75, Pen 2, Symbol 42,150/1000 inch, "N" Don't post
110, 150, 2, 42, 225, N	Range 110-150, Pen 2, Symbol 42,225/1000 inch, "N" Don't post
4,1	Use column #4, 1 class
25, 40, 1, 43, 150, N	Range 25-40, Pen 1, Symbol 43,150/1000 inch, "N" Don't post

Entries in Plot File	Notes on contents of plot file
44,0,0,N,113,57,0,W	Lat/Lon NW Corner
43,52,0,N,113,57,0,W	Lat/Lon SW Corner
43,52,0,N,113,45,0,W	Lat/Lon SE Corner
44,0,0,N,113,45,0,W	Lat/Lon NE Corner
250000,250000	XSCALE, YSCALE
0,0	XOFF, YOFF
N	"N", Don't rotate plot
25,1	Speed,Force
0,0.1,0.15	Font=#0, Width=0.1", Height=0.15" for characters to be posted
TESTDD1.PRN	FILENAME.EXT of data file
DD	File format Decimal Degrees
8,4,0	#Rows,#columns in data file,#lines used for header records
0,1	Use column #0=Locality identifiers, 1 class
0,0,4,5,50,Y	Range 0-0, Pen 4, Symbol 5, 50/1000", "Y" Post identifiers

Plot files for GSPOST when corners of the plot are specified interactively are like those above except that the plot corners are not specified in the file (they would look like the above, if the first four records were deleted).

Cartesian coordinate plot control file to first plot site identifiers, then plot data

Entries in Plot File	Notes on contents of plot file
115.75,39	X,Y coordinates NW Corner
115.75,38.75	X,Y coordinates SW Corner
116,38.75	X,Y coordinates SE Corner
116,38.39	X,Y coordinates NE Corner
20,20	XSCALE=20, YSCALE=20
1,2	XOFF=1", YOFF=2"
Y	"Y" Rotate plot
25,1	Speed=25,Force=1
0,0.07,0.1	Font=#0, Width=.07, Height=.1 of characters to be posted
XY.PRN	FILENAME.EXT of data file=XY.PRN
19,11,3	#Rows=19,#columns=11 in data file,#lines=3 for header records
0,1	Use column #0, 1 class
0,0,3,5,50,Y	Range 0-0, Pen 3,Symbol 5, 50/1000","Y" post identifiers
3,3	Use column 3, 3 classes
0,18,1,30,50,N	Range 0-18, Pen 1, Symbol 30,50/1000 inch, "N" don't post
18,100,1,30,50,N	Range 0-100, Pen 1, Symbol 30,50/1000 inch, "N" Don't post
5,3	Use column 5, 3 classes
0,1,1,30,50	Range 0-1, Pen 1,Symbol 30,50/1000 inch, "N" Don't post
1,2,3,32,100,N	Range 1-2, Pen 3, Symbol 32, 100/1000 inch, "N" Don't post
2,2000,1,32,150,N	Range 2-2000, Pen1, Symbol 32, 150/1000 inch, "N" Don't post
6,3	Use column #6, 3 classes
0,1,1,30,50,N	Range 0-1 Pen 1, Symbol 30, 50/1000 inch, "N" Don't post
0.1,0.2,1,33,250,N	Range 0.1-0.21, Pen 1, Symbol 33,250/1000 inch, "N" Don't post
7,3	Use column #7, 3 classes
0,10,1,9,50,N	Range 0-10, Pen 1, Symbol 9, 50/1000 inch, "N" Don't post
10,25,1,34,100,N	Range 10-25, Pen 1, Symbol 34, 100/1000 inch, "N" don't post
25,1000,3,34,150,Y	Range 25-1000, Pen 3, Symbol 34, 150/1000 inch, "Y" post

EXCLUSION FILES

Exclusion files are used to specify coordinates of areas that are to be excluded from plotting. One to ten areas may be excluded. The coordinates of the four corners of an area or areas are supplied in degree, minute second format, in the sequence NW, SW, SE, and NE for geodetic coordinates as shown in the example below that specifies two areas for exclusion. No head or trailing records are permitted and the file must end with a carriage return.

```
48,37,30,N,93,30,00,W
48,30,00,N,93,30,00,W
48,30,00,N,93,15,00,W
48,37,30,N,93,15,00,W
48,15,00,N,92,22,30,W
48,07,30,N,92,22,30,W
48,07,30,N,92,15,00,W
48,15,00,N,92,15,00,W
```

If using Cartesian coordinates, exclusion files must contain the X and Y coordinates of the four corners of the area to be excluded using the units of the data in the sequence, X,Y for the upper left corner, X,Y for the lower left corner, X,Y for the lower right corner, and X,Y for the upper right corner.

MAP PROJECTIONS

Map projections and USGS practice are described by Snyder, 1982 and 1987, in U.S.Geological Survey Bulletin 1532 and Professional Paper 1395. Information on the map projection is given in marginal notes on USGS maps, but the data on the parallels and meridian used to prepare the map is not provided. The summary below should help, but please read the original by Snyder. This bulletin and the Professional Paper answer questions you should have. Unless otherwise stated on the map margin or in the Snyder reports, use the Clarke 1866 Ellipsoid.

Small Scale Maps

Maps labeled Albers Equal Area projection

When used for maps of the 48 conterminous states, the standard parallels are 29,30,0,N degrees and 45,30,0,N . The central meridian is 96,0,0,W.

For maps of Alaska, the standard parallels are 55,0,0,N degrees and 65,0,0,N degrees. The central meridian is 154,0,0,W.

For maps of Hawaii, the standard parallels are 8,0,0,N and 18,0,0,N. The central meridian is 157,0,0,W.

Maps labeled Lambert Conformal Conic

The Lambert conformal conic is used by the USGS for a map of the US showing all 50 states in true relative position. This map has been issued at scales of 1:6,000,000 and at 1:10,000,000. For this map the standard parallels are 37,0,0,N and 65,0,0 N. The central meridian is the line of longitude at the center of the sheet.

Maps labeled Transverse Mercator

In 1979 a spherical form of the Transverse Mercator was chosen for a base map of North America at a scale of 1:5,000,000 for tectonic and other geologic maps. The scale factor along the central meridian of 100,0,0,W longitude is reduced to 0.926, see projection parameter file Example 8 below.

State Scale Maps (1:500,000)

For the 500,000 scale base maps of the 48 contiguous states, the Lambert Conformal Conic projection was used. The standard meridian is the line of longitude central to the map.

1 x 2 Degree Maps (1:250,000)

Maps labeled Transverse Mercator

Army Map Service (AMS) 1 degree by 2 degree sheets use the Transverse Mercator projection. The principal meridian is the line of longitude central to the map.

Maps labeled Universal Transverse Mercator (UTM)

The UTM projection will be used by the USGS for 1 x 2 degree sheets as it updates the AMS series. The proper central meridian can be determined either by using tables listing the central meridian for the UTM Zone or by locating the nearest line of longitude of whole number of degrees that is divisible by 3 but not by 2.

30' x 60' Maps (1:100,000)

For all new 30 minute by 60 minute quadrangles, the UTM projection is used. The proper central meridian can be determined either by using tables listing the central meridian for the UTM Zone or by locating the nearest line of longitude of whole number of degrees that is divisible by 3 but not by 2.

15' Quadrangles (1:62,500)

Maps labeled Polyconic

Many 15 minute quadrangle maps have been drawn using the Polyconic projection. The central meridian is the line of longitude central to the map.

7 1/2' Quadrangles (1:24,000)

Maps labeled Polyconic

Many 7 1/2 minute quadrangle maps have been drawn using the Polyconic projection. The central meridian is the line of longitude central to the map.

Maps labeled Lambert or Transverse Mercator

Beginning in the late 1950's the USGS began using projections that were based on the parameters that serve as the basis of the State Plane Coordinate system. Depending on the state, the projection will be either Lambert Conformal Conic, Transverse Mercator or Oblique Mercator (panhandle of Alaska only). USGS Bulletin 1532 (Snyder, 1982) presents an excellent description of the basis of the SPCS and the projection that is used for each State. This Bulletin also describes in Table 8 the projection parameters that are used for each zone of each State. Table 8 lists a scale reduction for Transverse Mercator such as 1:2500. The projection file requires a scale factor. The formula to compute scale factor from scale reduction is scale factor = 1.0 - (1/scale reduction) i.e. a 1:2500 scale reduction results in a scale factor of 0.9996 or scale factor = 1.0 -(1.0/2500) = 0.9996. A useful approximation for digitizing and plotting is to use the Polyconic Projection. The maximum difference in the 700-800 mm diagonals of 7 1/2 or 15 minute quadrangles between Transverse Mercator, Lambert, and Polyconic projections is about 0.05 mm. This is a much smaller figure than that expected due to size changes due to changes in humidity for a paper copy. It is only twice the accuracy attributed to a good digitizer.

Projections supported by GSPOST Version 3.0

Cylindrical:

Mercator, Transverse Mercator, Universal Transverse Mercator, Oblique Mercator

Conic:

Polyconic, Lambert Conformal Conic, Albers Equal Area, Equidistant Conic

Examples of Projection Files

Latitude,Longitude values are entered in Degrees, Minutes, Seconds and followed by the appropriate letter designating compass direction: for example, W longitude, N latitude in the conterminous U.S. Equatorial and polar radii are specified in kilometers.

Universal Transverse Mercator

File	Description of Contents
1	"1" designates Universal Transverse Mercator
6378.2064	Equatorial radius, in km, Clarke 1866
6356.5838	Polar radius in km, Clarke 1866
105,0,0,W	Longitude, Principal Meridian of UTM Zone
0.9996	Scale factor

Albers Equal Area

File	Description of contents
2	"2" designates Albers Equal Area
6378.2064	Equatorial radius, in km, Clarke 1866
6356.5838	Polar radius in km, Clarke 1866
45,30,0,N	Latitude, first standard parallel
29,30,0,N	Latitude, second standard parallel
100,0,0,W	Longitude, meridian central to map

Lambert Conformal Conic

File	Description of contents
3	"3" designates Lambert Conformal Conic
6378.2064	Equatorial radius, in km, Clarke 1866
6356.5838	Polar radius in km, Clarke 1866
33,0,0,N	Latitude, first standard parallel
45,0,0,N	Latitude, second standard parallel
105,0,0,W	Longitude, meridian central to map

Mercator

File	Description of contents
4	"4" designates Mercator
6378.2064	Equatorial radius, in km, Clarke 1866
6356.5838	Polar radius in km, Clarke 1866
105,0,0,W	Longitude, Meridian Central to map

Polyconic

File	Description of contents
5	"5" designates Polyconic
6378.2064	Equatorial radius, in km, Clarke 1866
6356.5838	Polar radius in km, Clarke 1866
105,0,0,W	Longitude, meridian central to map

Transverse Mercator

File	Description of contents
6	"6" designates Transverse Mercator
6378.2064	Equatorial radius, in km, Clarke 1866
6356.5838	Polar radius in km, Clarke 1866
105,0,0,W	Longitude, meridian central to map
0.9996	Scale factor

Parameters of special DNAG map for spherical Earth

File	Description of contents
6	"6" designates Transverse Mercator
6371.204	Radius of Earth in km
6371.204	Radius of Earth in Km
100,0,0,W	Longitude, meridian central to map
0.926	Scale factor unique to this map

Oblique Mercator Projection

The sample oblique mercator projection file provides parameters used in generating the Appalachian Map

File	Contents
7	"7" designates Oblique Mercator
6378.2064	Equatorial radius, in km, Clarke 1866
6356.5838	Polar radius in km, Clarke 1866
1.0	Scale factor along central axis
42,0,0,N	Latitude, center point of projection
73,0,0,W	Longitude, center point of projection
51,30,0,N	Latitude, S end of line defining axis
56,0,0,W	Longitude, S end of line defining axis
33,30,0,N	Latitude, N end of line defining axis
84,30,0,W	Longitude, N end of line defining axis

Equidistant Conic

File	Description of contents
8	"8" designates Equidistant Conic
6378.38584	Radius of Earth in km
6356.910	Radius of Earth in Km
9,0,0,N	Latitude, first standard parallel
4,0,0,N	Latitude, second standard parallel
66,0,0,W	Longitude, meridian central to map

Values in this example are for Venezuela maps labeled "Proyeccion Conico Secante Compensada." This projection is also used for certain maps in Alaska labeled "Modified Mercator", see Snyder, 1982.

A standard set of symbols is defined in the CONFIG.PLT file. These symbols were developed for GSMAP and GSDRAW. We recommend use of symbols 1-46 with GSPOST.

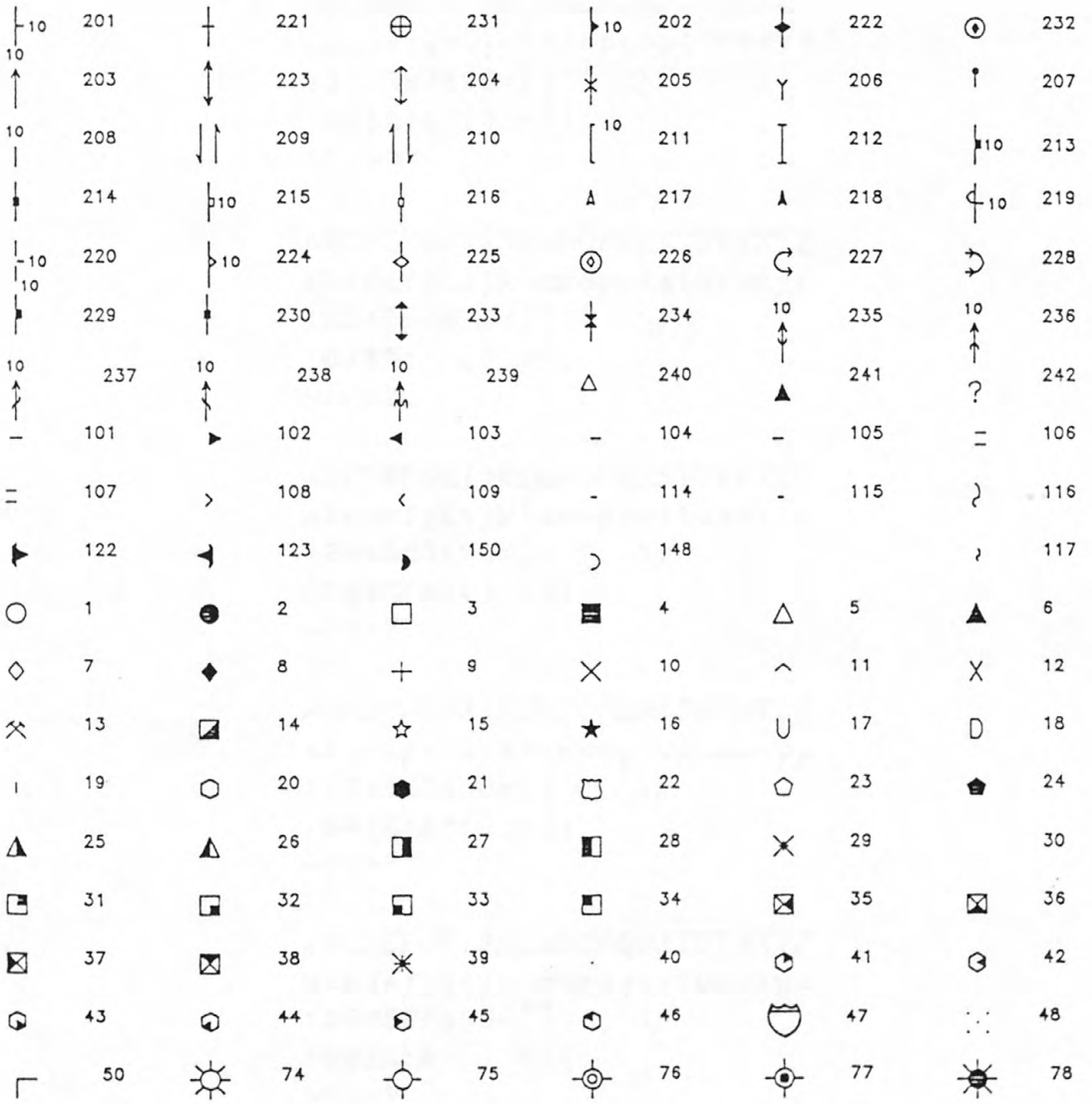


Fig. 1 _ Standard symbols defined in the file CONFIG.PLT

Fonts 0 and 2 are supplied with GSPOST. Font #0 is the default font used if a different font is specified but is not in the working area of the computer. The remaining fonts were released with GSMAP Version 6.0

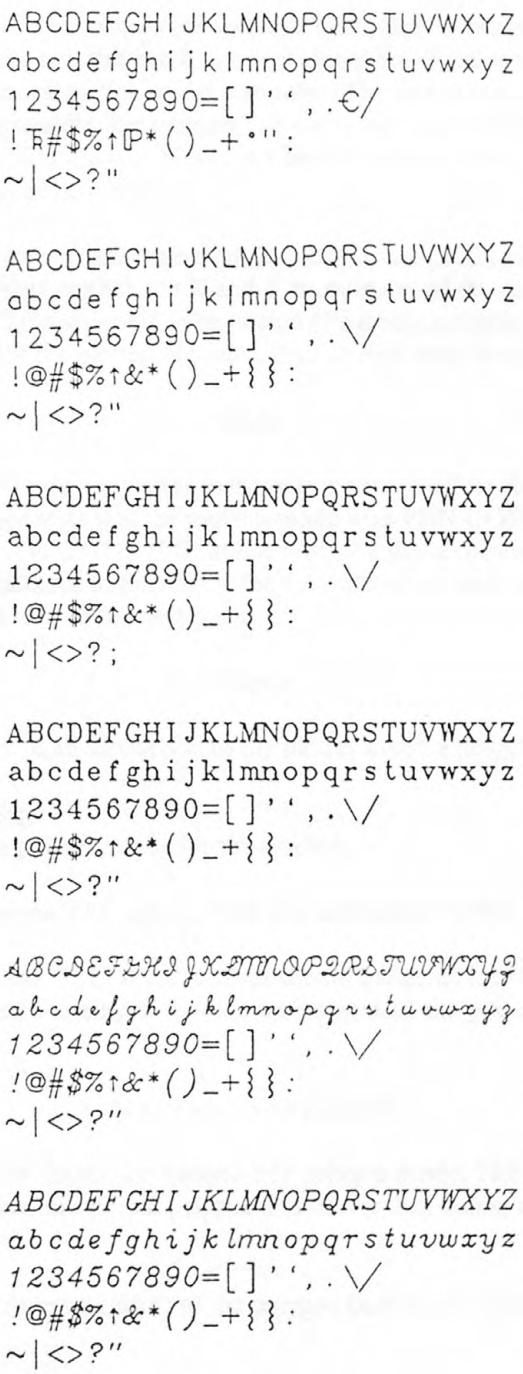


Fig. 2 _ Examples of fonts 0-5, from top to bottom, #0=Roman Simplex augmented with the special geologic characters, #1=Roman Simplex, #2=Roman Duplex, #3=Roman Triplex, #4=Script simplex, #5=Roman Duplex Italic.

Coding of new symbols

New symbols can be encoded by the user and included in the CONFIG.PLT file. Coding is easier than might be anticipated. Symbols are drawn with straight lines and/or with circles. Closed polygons defined by lines or circles may be filled.

Starting

To be consistent with other symbols, sketch a square with sides of unit length and a point at the center. Figure 9 provides examples. Assume that the pen is at the center point of the square. Each line of the code describing the symbol provides one instruction to the computer. The center of the square locates the point digitized. A symbol is drawn using straight line segments (moves) and circles. Moves can be either with pen up (no line drawn) or with pen down (line drawn). Moves can be combined to define polygons which will be filled (solid fill). Circles may either be filled or not filled.

The first line of the code for a symbol specifies the number assigned to the symbol and the number of lines (records) required to define that symbol, the X and Y coordinates of the reference point for posting, and the size (in inches) of the height of the numbers to be posted (0's if no posting is desired). Subsequent lines consist of a series of instructions for the plotter. No more than 25 lines may be used.

Moves

A line starting with a "PU" tells the plotter to move to a new position with the PEN UP (no line drawn), a line starting with "PD" specifies that the move is made with PEN DOWN (drawing a line). All moves are relative to the last point. After the "PU" or "PD" at the start of a line a comma must be used; the number after this comma specifies the X distance to the next point, then a comma must be used; the number after the second comma specifies the Y distance to the next point.

Polygons

A line starting with a "PM" is an instruction to the plotter about a polygon.

"PM",0,0 defines the start of a polygon.
"PM",2,0 ends a polygon and ends polygon mode for the symbol.

The polygon defined between "PM",0,0 and "PM",2,0 instructions will be filled with a solid pattern.

Moves between "PM"0,0 and "PM,2,0 instructions should define a closed polygon; if the polygon is not closed, the "PM"2 instruction forces a closing of the exterior polygon to the point occupied by the pen when the "PM",0 instruction was issued.

Exterior and interior polygons

"PM",1,0 ends a polygon but leaves the computer in polygon mode. This instruction is used, for example, between moves that define an external polygon and moves that define an internal polygon to be left unfilled.

The "PM",1,0 instruction forces a closing of the polygon back to the position at the time the "PM",0,0 instruction was issued.

A line of code starting with a "CI", instruction calls for the drawing of a circle. The "CI" must be followed by a comma. The number following the comma specifies the diameter of the circle to be drawn. This number is followed by a comma, then by a 0 (zero). The diameter is specified in units relative to the unit square as discussed at the start of this section.

The center of the circle is the point occupied by the pen at the time the "CI" instruction is given. A "CI" instruction defines a complete polygon; it is equivalent to a set of moves between "PM"1,0 instructions, but counts as a single line.

Reference position for posting of symbols Code Group 200-299

A reference position for posting of numbers is given in the first line defining the symbol following the symbol number and number of moves and before the number specifying the size of the posted numbers. This reference position is defined in the coordinate space of the unit box used for coding of the symbols. Check symbols with posting in the CONFIG.PLT file for examples, especially study definitions of symbols 201 and 202. 0's are used for positions and height of characters for symbols without posting.

Additional information on coding is given in the Interfacing and Programming Manual supplied with HP plotters. Please note that all HPGL commands ARE NOT SUPPORTED by level 6 programs. Use only the commands provided above.

Examples of the coding of symbols are shown om p. 31.

Symbol 209; Uses PU and PD moves

```
209,6,0,0,0     - symbol number, number of lines of code,0's indicate no posting
"PU",0.2,-0.5
"PD",0.0,1.0
"PD",0.1,-0.2
"PU",-0.5,0.2
"PD",0.0,-1.0
"PD",-0.1,0.2
```

Symbol 14; Uses PU and PD moves, and one filled polygon

```
14,8,0,0,0      -symbol number, number of lines of code, 0's indicate no posting
"PU",0.5,0.5    - move to the upper right corner of symbol; PU
"PD",-1.0,0.0   - move to upper left corner; PD
"PD",0.0,-1.0   - move to lower left corner; PD
"PM",0,0        - starts polygon to be filled
"PD",1.0,0.0    - move draws lower line of filled triangle
"PD",0.0,1.0    - move draws right edge of filled triangle
 "PD",-1.0,-1.0  - move draws hypotenuse of filled triangle
"PM",2,0         Ends definition of filled polygon
```

- Filling of triangular polygon
  Note: the "PM",0,0 instruction starts definition of a polygon to be filled; the PM",2,0 ends the polygon's definition

Symbol 77, uses PU and PD moves, and two circles defined as exterior and interior polygon.

```
77,14,0,0,0
"PU",0,1.0
"PD",0,-0.5
"PU",0,-0.5
"PM",0,0        -starts filled polygon = circle
"CI",.5,0       -specifies circle, diameter 0.5
"PM",2,0        -ends filled polygon = circle
"PU",0,-0.5
"PD",0,-0.5
"PU",-1.0,1.0
"PD",0.5,0.0
"PU",1.0,0.0
"PD",0.5,0
"PU",-1.0,0.0
"CI",1,0        open circle; polygon not specified; circle
                will not be filled
```

- The "units" for the diameter of the circles are specified in the same "units" as the "moves" for the pen, based on the unit square
- Lines for symbol 77 go outside the unit square; this is permissible. The only reason for the unit square is to assist in keeping symbols similar in size.
- Symbol 209 with coding as drawn here was found to be too small.

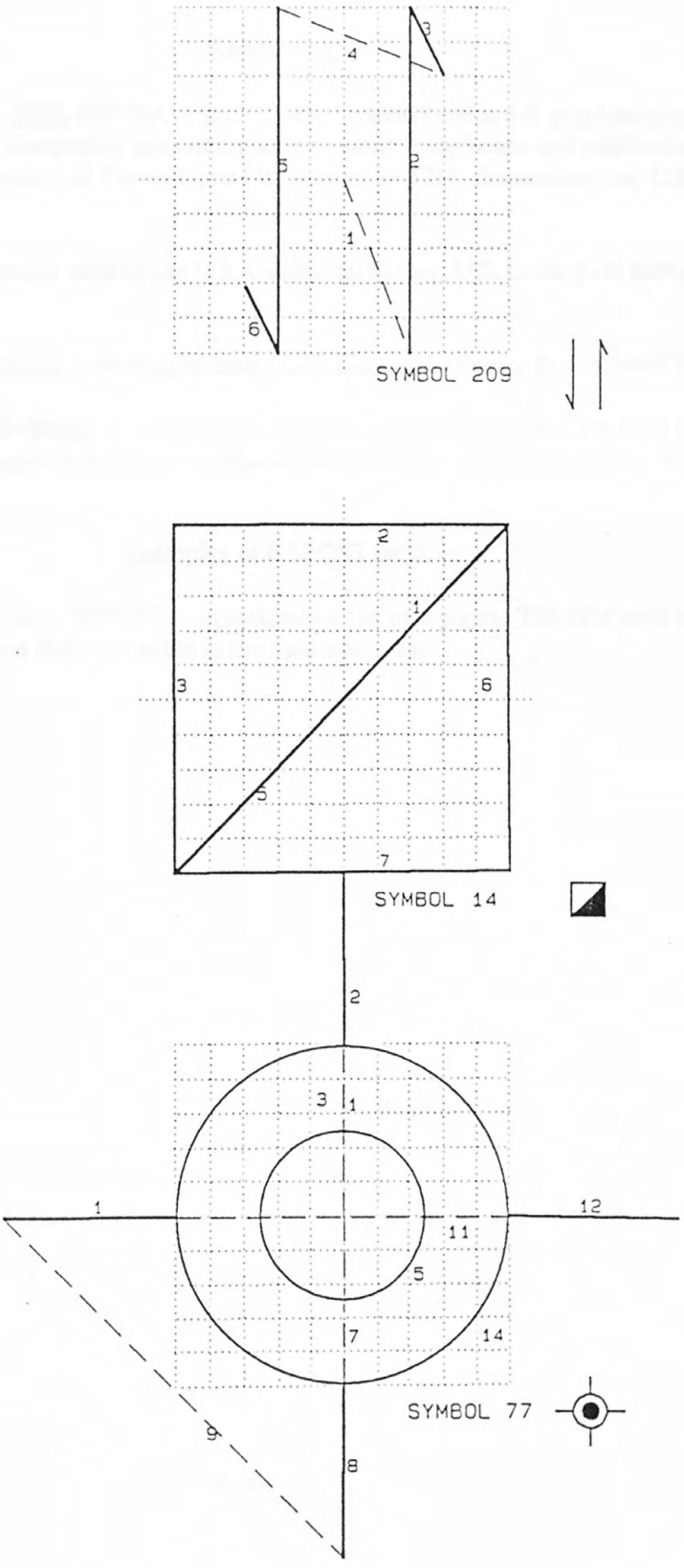


Fig. 3 _ Examples of coding of symbols. Unit square shown by dotted lines, pen up moves by dashed lines, pen down moves by solid lines.

References

Selner, G. I., and Taylor, R. B., 1989, GSDRAW and GSMAP system version 6.0: graphics programs and utility programs for the IBM PC and compatible microcomputers to assist compilation and publication of geologic maps and illustrations: U.S. Geological Survey Open File Report 89-373A, documentation, 158 p., and 89-373B, 5 program diskettes.

Snyder, J. P., 1982, Map Projections used by the U.S. Geological Survey: U.S. Geological Survey Bulletin 1532 313 p.

Snyder, J. P., 1987, Map projections, a working manual: U.S. Geological Survey Professional Paper 1395, 393 p.

U.S. Geological Survey, 1986, Software documentation, General cartographic transformation package: U.S. Geological Survey, National mapping program, Technical Instructions, unpublished report, 68 p.

Examples of GSPOST plots

Four samples of plots from GSPOST are provided on the next pages. The files used to generate the plots are provided on the release disk, and noted in the figure caption.

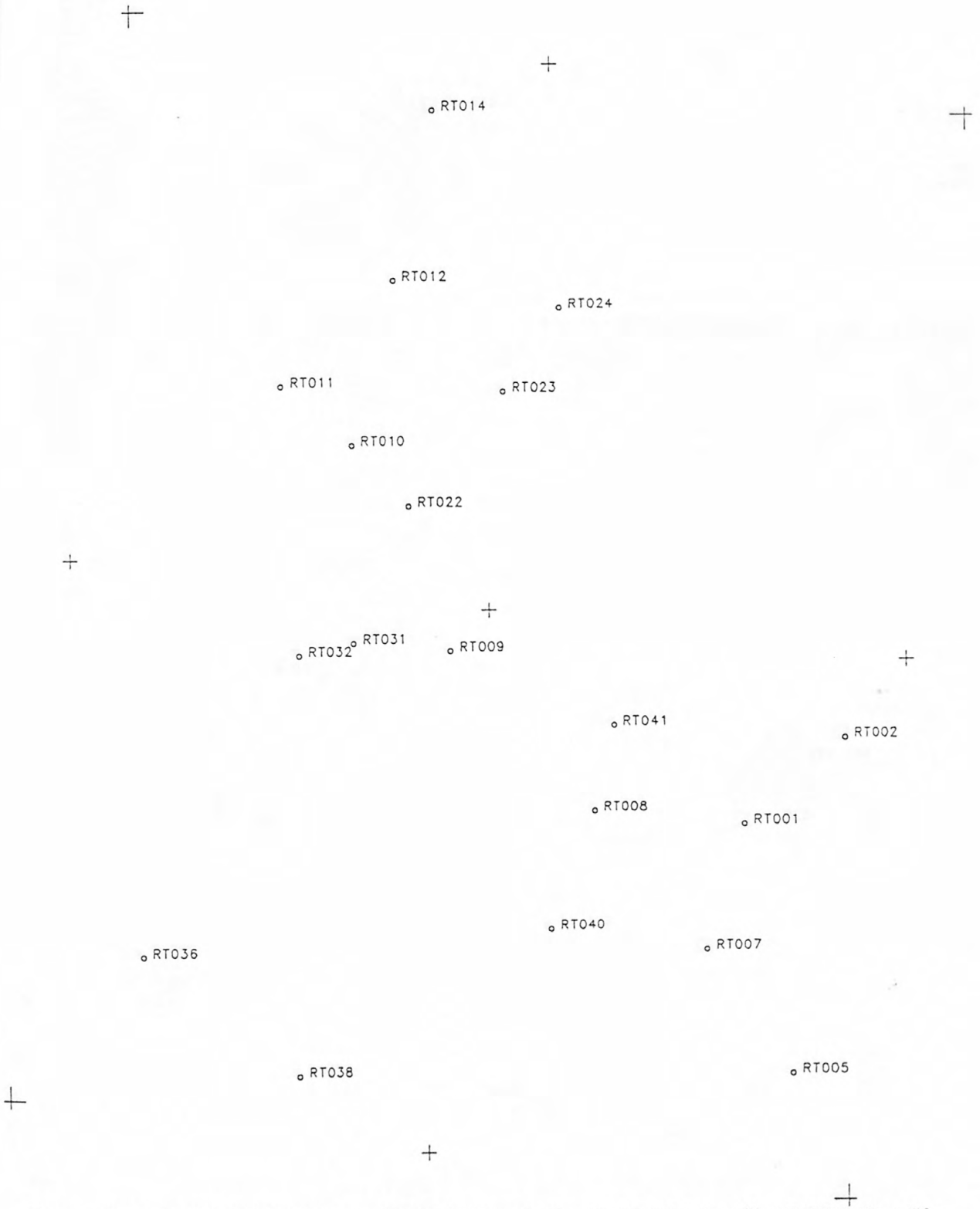


Fig. 4 _ Example of GSPOST plot. Plot file LL.PLT, projection file LL.PRJ, data file LL.PRN, Font #0; corners and internal geodetic ticks at 0,7,30 plotted. This kind of plot file, and data file makes an excellent star for on-screen editing.

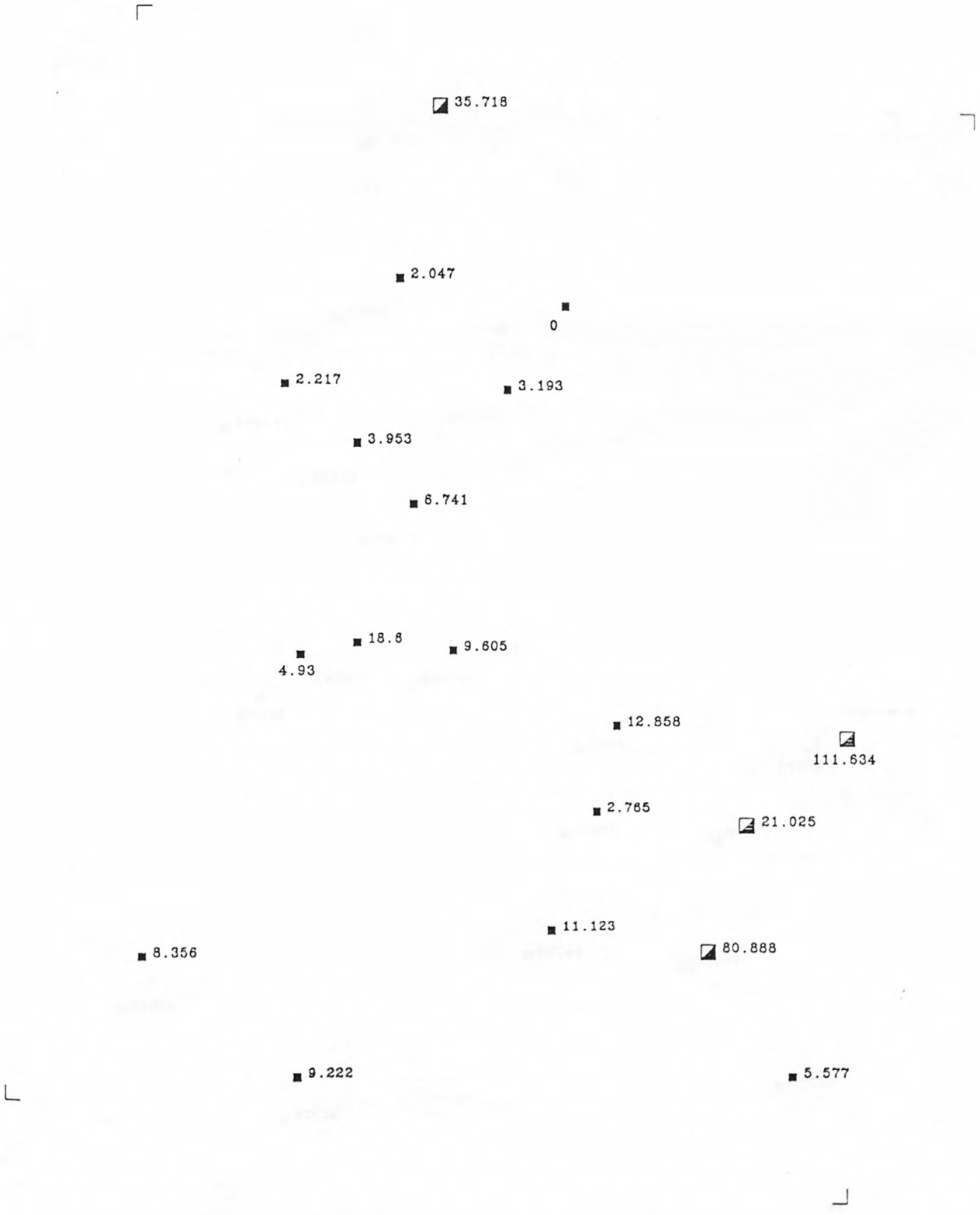


Fig. 5 _ Example of GSPOST plot. Plot file LLTEMP.PLT, projection file LL.PRJ, data file LLTEMP.PRN, font #2, data file LLTEMP.PRN edited from LL.PRN. Corners plotted.

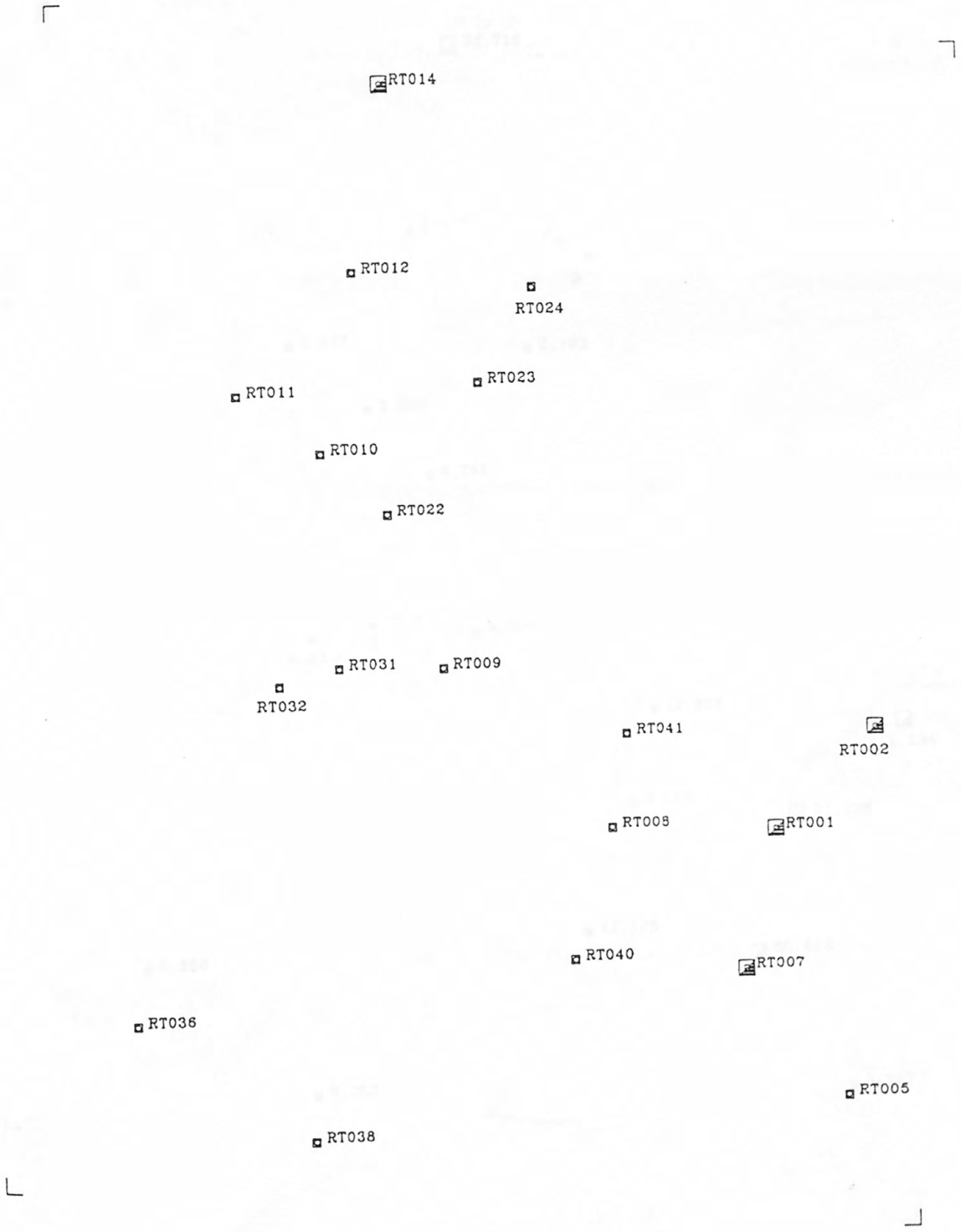


Fig. 6 _ Example of GSPOST plot. Plot file LLTEMP1.PLT, projection file LL.PRJ, data file LLTEMP.PRJ Font #2.

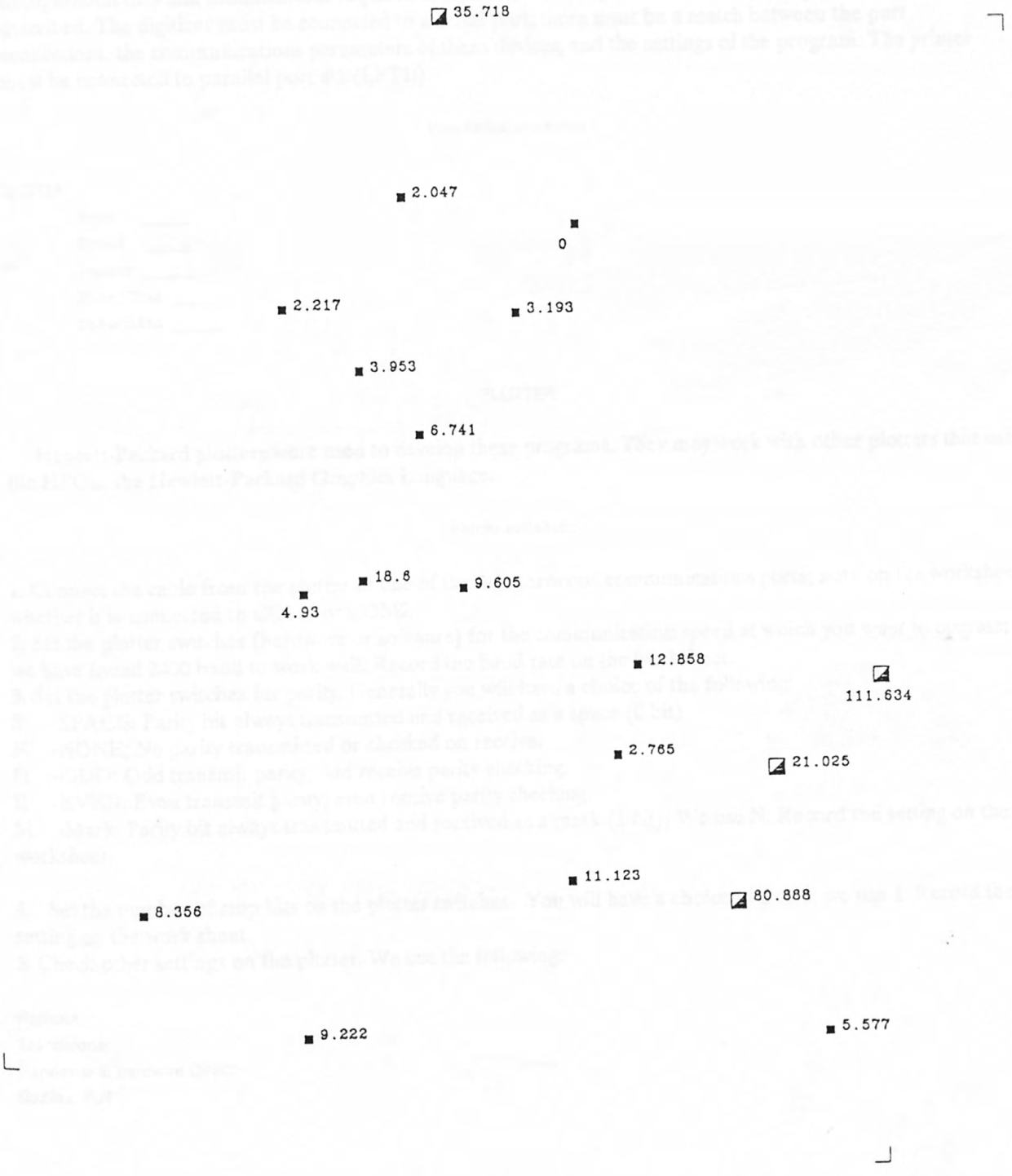


Fig. 7 _ Example of GSPOST plot. Plot file LLTEMP.PLT, projection file LL.PRJ, data file LLTEMP.PRN, Font #2, Exclusion file LL.EXC, outline plotted.

APPENDIX

Hardware installation and configuration files

This section deals with the physical installation of the plotter, and with its connection to the computer, and verification of correct installation. A worksheet is supplied to assist recording of settings. The makeup of configuration files and modifications required to tune the files to specific hardware configurations is also described. The digitizer must be connected to a serial port; there must be a match between the port connections, the communications parameters of these devices, and the settings of the program. The printer must be connected to parallel port #1 (LPT1:).

Installation worksheet

PLOTTER

Port _____
Speed _____
Parity _____
Bits/Char _____
Stop bits _____

PLOTTER

Hewlett-Packard plotters were used to develop these programs. They may work with other plotters that use the HPGL, the Hewlett-Packard Graphics Language.

Plotter Installation

1. Connect the cable from the plotter to one of the asynchronous communications ports; note on the worksheet whether it is connected to COM1 or COM2.
2. Set the plotter switches (hardware or software) for the communication speed at which you want to operate; we have found 2400 baud to work well. Record the baud rate on the worksheet.
3. Set the plotter switches for parity. Generally you will have a choice of the following:

S - SPACE: Parity bit always transmitted and received as a space (0 bit).
N -NONE; No parity transmitted or checked on receive.
O -ODD: Odd transmit parity, odd receive parity checking.
E -EVEN: Even transmit parity, even receive parity checking.
M -Mark: Parity bit always transmitted and received as a mark (1 bit); We use N. Record the setting on the worksheet.

4. Set the number of stop bits on the plotter switches. You will have a choice of 1 or 2; we use 1. Record the setting on the work sheet.
5. Check other settings on the plotter. We use the following:

Remote
Standalone
Handshake: hardwire Direct
Duplex: Full

The following BASIC program (BASICA) can be used to check transmission between the plotter and computer. It may require modification to reflect values set in previous steps. It is set up for the values we normally use. Modifications normally are to line 10. This program came from the Hewlett-Packard operation and Interconnection Manual for the HP 7550A Graphics Plotter; refer to the BASIC manual supplied with your computer for a description of the OPEN COMn: command.

```
10 OPEN "COM1:2400,N,8,1,RS,CS65535,DS,CD" AS #1
20 PRINT #1 "IN;OI;"
30 INPUT #1,ID$
40 PRINT #1,"LB";ID$;" COMMUNICATION OK";CHR$(3)
60 PRINT #1, "PA 0,0;SP0;"
70 END
```

The program will read the model of the plotter and plot the a message like the one following on the plotter using the pen in carousel position one.

```
7550A COMMUNICATIONS OK
(YOUR MODEL #, if not a 7550A)
```

If the above program does not run, check switch settings and/or cable connections and then retry the program. If it still does not work, check the plotter manual and seek assistance.

For the HP 7585B plotter the following switch settings apply: the cable must be connected to the COMPUTER/MODEM port; use the following settings.

```
INTERFACE MODE
RS232C
        NORMAL
        NORMAL
        STANDALONE
        NORMAL
        NORMAL

RS-232-C
Parity      OFF
        ODD
Duplex half-full  FULL
          HARDWIRE
DTR-BYPASS      NORMAL
```

For the HP 7475 plotter, the following switch settings apply:

```
  0  S2
  0  S1
  0  Y
   1 US
  0  B/A3-.A/A4
   1 B4
  0  B3
   1 B2
  0  B1
```

Screen and graphics adapter

GSPOST supports the following kinds of graphics:
CGA color and monochrome
CGA monochrome plasma screen
EGA color
VGA color
Hercules monochrome

Each is configured by appropriate entries in the CONFIG.SCR file. The system must be configured for graphics. Some systems require use of the GRAPHICS mode command. In addition, use of Hercules graphics requires use of the QBHERC.COM program supplied with this release before starting each use of GSPOST to initialize graphics.

When configuring the system record the kind of graphics adapter (CGA, EGA, VGA, Hercules, and the kind of monitor: color or monochrome.

Configuration files on the release disk

Two configuration files are required: they are named CONFIG.PLT and CONFIG.SCR, for the plotter, and screen (monitor) respectively.

If the conditions below are satisfied, the configuration files CONFIG.PLT and CONFIG.SCR supplied on the release disk can be used without modification.

- The plotter is connected to COM1, and set to 2400 baud, and set as recommended below.
- The monitor is in CGA mode.

If these conditions are not satisfied, modifications must be made. Normally only the first line of each file must be changed. Use a word processing program that does not leave embedded characters.

Functions of Configuration files

CONFIG.PLT: plotter configuration and symbol definition. The first line of the file named CONFIG.PLT sets communication parameters between the computer and the plotter. The remaining records (lines) contain the definitions of symbols.

CONFIG.SCR: the first line of the file named CONFIG.SCR sets the screen graphics mode.

The first line of the CONFIG.PLT file sets communication parameters between the computer and the plotter. The rest of the file contains the description for symbols, see p. 36. These parameters are described in the BASIC manual, see OPEN COM statement. The part of the CONFIG.PLT file after symbol 2 is not printed.

```
"COM1: 2400,N, 8, 1,RS,CS65535,DS,CD"
50,4,0,0,0
"PU",1.0,0.0
"PD",-1.0,0.0
"PD",0.0,-1.0
"PU",0.0,1.0
1,2,0,0,0
"PU",0.0,0.0
"CI",1.0,0.0
2,4,0,0,0
"PM",0,0
"PU",0.0,0.0
"CI",1.0,0.0
"PM",2,0
```

The CONFIG.SCR file must be configured to match the adapter and monitor of the system.

For CGA color or monochrome the file consists of one line:
"CGAC"

For CGA resolution on monochrome plasma screens the file consists of one line:
"CIII"

For EGA monochrome the file consists of one line:
"EGAM"

For EGA or VGA color the file may consist of a series of lines as configured for the GSDRAW and GSMAP programs, but for GSPOST only the first line is required to configure for EGA or VGA color. Other records do no harm, but aren't used.

For EGA color the file consists of one line:
"EGAC"

For VGA color the file consists of one line:
"VGAC"

Hercules graphics

For Hercules monochrome the CONFIG.SCR file consists of one line:
"HERM"

If Hercules graphics are to be used, before starting GSPOST the system must be "set up" using the QBHERC.COM file included on the release disk. At the DOS prompt enter QBHERC. Then enter GSPOST to start operation of the program.

Colors on screen-plots with EGA or VGA color monitors are set by pen number: pen numbers correspond to standard DOS color numbers, as below. Yes you can use color numbers 0-15 (16 colors) but you won't see color #0=black, and your plotter won't plot using pen numbers greater than the number of pen positions in the carousel; pen numbers 1-6 for some plotters, pen numbers 1-8 for others.

Color #1=Blue
Color #2=Green
Color #3=Cyan
Color #4=Red
Color #5=Magenta
Color #6=Brown
Color #7=White
Color #8=Gray
Color #9=Light Blue
Color #10=Light Green
Color #11=Light Cyan
Color #12=Light Red
Color #13=Light Magenta
Color #14=Yellow
Color #15=High Intensity White
Color #0=Black

Plotter information

The information below provides a brief summary of information useful with GSPOST. Consult the documentation that came with your plotter.

Rotation

Rotation is a plotter feature enabling rotation of a plot by 90 degrees on the plotter media. Check the plotter manual for rotation instructions. In most cases if the X dimension of the plot exceeds the Y, no "rotation" should be specified.

Speed and Force

Speed and force are plotter parameters. Pen speed is specified in (cm/sec) and force by integers 1 to 8 that set the force. Optimum speed and force depend on pen type and plot media. Default settings provided by Hewlett-Packard are given here in parentheses. The quality of final plots is generally improved by slowing the pen speed.

	Recommended values		
PEN TYPE	SPEED cm/sec	Force	Force values = grams
			1 - 10 g
Fiber	25 (50)	1 (2)	2 = 18 g, 3 = 26 g
Roller	30 (60)	3 (6)	4 = 34 g, 5 = 42 g
Refillable ink pens	12 (30)	2 (2)	6 = 50 g, 7 = 58 g
Disposable ink pens	15 (15)	1 (1)	8 = 60 g

Entry of numeric values for the X and Y values of scaling points P1 and P2 is required if plots are sent to a disk file rather than to the screen or to a plotter. Scaling points P1 and P2 define the size of a plot made by a plotter. The default location of P1 is the lower-left corner of the Plot; that of P2 is the upper-right corner of the plot. If a plot is sent from GSPOST to a plotter, values for scaling points are provided to the computer by the plotter. If a plot is sent from GSPOST to a disk file values for P1 and P2 must be entered by the user. Values for scaling points P1 and P2 are discussed in the documentation for each plotter. These values depend on the kind of plotter and on the size of the plot paper. Values for three plotters are provided below. Paper dimensions are in inches. Scaling points are the coordinates of the lower left and upper right corner of the sheet in plotter units (1/1024"). Examples are provided below for unrotated plots:

For the HP 7475A

	P1x,P1y	P2x,P2y
A size paper 8 1/2 x 11	250,596	10250,7796
B size paper 11 x 17	522,259	15722,10259

For the HP 7550A

	P1x,P1y	P2x,P2y
A size paper 8 1/2 x 11	80,320	10080,7520
B size paper 11 x 17	620,80	15820,10080

For the HP 7585/7586

	P1x,P1y	P2x,P2y
A size paper (8 1/2 x 11	-2790,-4500	2790,4500
B size paper 11 x 17	-7100,-4500	7100,4500
C size paper 17 x 22	-7090,-10075	7090,10075
D size paper 22 x 34	-15710,-15060	15710,15060
E size paper 34 x 44	-20840,-16180	20840,16180

Rotation of plots (using the plot control file) interchanges X and Y. Values for scaling points are therefore interchanged, e.g. for a plot on the HP 7550A with 8 1/2 x 11 inch paper, the values to be entered for an unrotated plot would be 80,320,10080,7520 but the values to be entered for a rotated point would be 320,80,7520,10080.

Files on the release disk

```
GSPOST.EXE    Executable program file, GSPOST
CONFIG.SCR    Screen configuration file for EGA monitors (or VGA in EGA mode)
CONFIG.CGA    Screen configuration file for CGA monitors
CONFIG.PLT    Plotter configuration file for a plotter connected to serial port #1

Examples of   Projection parameter files:
UTM105.PRJ    Universal Transverse Mercator, Longitude, 105 degrees West
POL105.PRJ    Polyconic, West Longitude 105 degrees  West

Font files:
0.FNT         Font #0  Gothic
2.FNT         Font #2  Roman Duplex

Sample files; examples used for creating Figures 4-6
LL.PRJ        Projection parameter file
LL.PLT        Plot file for plotting locality identifiers
LL.PRN        Original data file
LLTEMP.PLT    Plot file, symbols, posting of values from one column
LLTEMP1.PLT   Plot file, posted locality numbers, symbols based on one data column
LLTEMP.PRN    Edited data file derived from LL.PRN
LL.EXC        Area exclusion file for use with LL files

UTM105.PRJ    Sample UTM projection file, central meridian 105 degrees West
POL105.PRJ    Sample Polyconic projection file, central meridian 105 degres West

QBHERC.COM    Initialization file for Hercules monochrome graphics
```

Source code

Version 3.0 of GSPOST was written and tested using the MicroSoft QuickBasic Compiler Version 4.0. The program cannot be tested or executed under BASICA, but must be compiled. The source code for these programs is available on written request from the authors: please send a formatted 360 Kbyte 5 1/4" diskette to Gary I. Selner or Richard B. Taylor, U.S. Geological Survey, Denver Federal Center, M.S. 905, Lakewood CO 80225