
UNITED STATES DEPARTMENT OF INTERIOR
GEOLOGICAL SURVEY

# GSPOST Version 1.0: A program to plot symbols and post numerical data from ASCII tables on regional scale maps using an IBM PC (or compatible) microcomputer and plotter.

by

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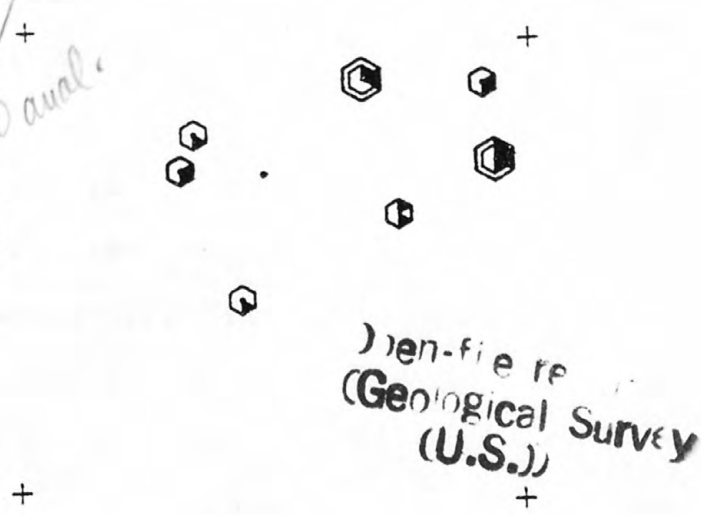



Open File Report
87-127A
Program disk
87-127B



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This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards. Any use of trade names is for descriptive purposes only and does not imply endorsement by the U.S. Geological Survey.

Although program tests have been made, no guarantee (expressed or implied) is made by the authors regarding program correctness, accuracy, or proper execution on all computer systems.

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## INTRODUCTION

GSPOST is a microcomputer program that takes data from a properly formatted ASCII file and drives a plotter, to make maps displaying information associated with geographic points by drawing symbols and/or posting numerical data at latitude-longitude specified sites.

The sites chosen might be sample localities, drill holes, or mine portals -- any site that can be located using latitude-longitude coordinates. Numerical data for sites must be organized into a row and column format. Each row contains information pertaining to a single site. Each column contains a specified kind of numerical attribute.

The GSPOST program draws data from ASCII files in which the locality identifier (numbers and/or letters) and the latitude/longitude location of the site are specified in the first set of columns. The attributes related to the site can occupy up to 50 other columns. Latitude/longitude information in a file can be specified in degrees and decimal degrees, or in degrees, minutes, seconds and decimal seconds (but both formats cannot be used in a single file ).

The GSPOST program allows the user to specify the column from which data will be drawn, 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. The position of posting of numerical data at each site can be varied to reduce over-printing of numbers.

For each map to be drawn, the area is specified using latitude/longitude corners, the desired scale is specified, and maps drawn using Universal Transverse Mercator, Lambert Conformal Conic (one or two parallels), and Albers Equal Area projections.

## HARDWARE ENVIRONMENT

GSPOST is one of a series of computer programs for geologists (see reference list) designed to fit in an office-based environment. The programs use an IBM PC (or compatible microcomputer) using the MS-DOS or PC_DOS operating system. These programs require a hardware configuration as follows:

IBM PC or PC/XT, or fully compatible microcomputer.
AT least 128K Random Access Memory
Two DS/DD Floppy disk drives or Hard disk
At least one serial port
8087 Chip co processor chip
Hewlett-Packard Plotter model numbers HP 7475 and above, or other completely compatible plotters using the HPGL plotting instructions.
Printer

## INSTALLATION

The program disk contains the GSPOST program , both the source code GSPOST.BAS and the executable version, GSPOST.EXE, a configuration file (CONFIG.CAD specifying ports and communication parameters between computer and plotter and a file named GSCAD.SYM that provides a standard set of symbols. The program, GSPOST.EXE, and files CONFIG.CAD and GSCAD.SYM can be stored on a floppy disk or in any sub-directory on a hard disk that is within the computers current search list (see PATH command in DOS manual). Other floppy disks or subdirectories within the current search list might be used for data files, map projection files, and plot files which will be generated by the user to fit specific uses.

## OPERATION

GSPOST requires six files. 1) GSPOST.EXE, 2) GSCAD.SYM, CONFIG.CAD, and three files created by the user. The user must create the file containing data, a projection file specifying the map projection to be used in plotting, and a plot control file which specifies plot requirements. Information on each of these files is contained in succeeding sections of this documentation.

The communication file CONFIG.CAD contains information that lets the computer send data to the plotter. The symbol file GSCAD.SYM contains information about the standard set of symbols used by GSPOST and any symbols defined by the user. The communication file and the symbol file are discussed in more detail in the appendix. All files must be available before running GSPOST.

Before starting GSPOST the communication parameters in the file named CONFIG.CAD should be compared to the settings of the system, including the port on the computer connected to the plotter and the baud setting on the plotter.

The program is started by entering GSPOST while at the DOS prompt. The program will then display a disclaimer screen. Press the space bar, and the program will continue operation. The program enters an interactive mode in which screen prompts will request entry of a series of file names. After each prompt, the user must enter the requested file name. including drive if the file is not in the default area. The first query will request the name of the projection file (DRIVE:FILENAME.EXT). After typing this, tap the enter key to enter the information into the computer. The next query will ask for entry of the name of the plot control file; enter the complete file name (DRIVE:FILENAME.EXT). The GSPOST program will then drive the plotter; after completion of the plot, the computer will be returned to the DOS operating system.

EXAMPLES OF GRAPHICAL OUTPUT FROM GSPOST

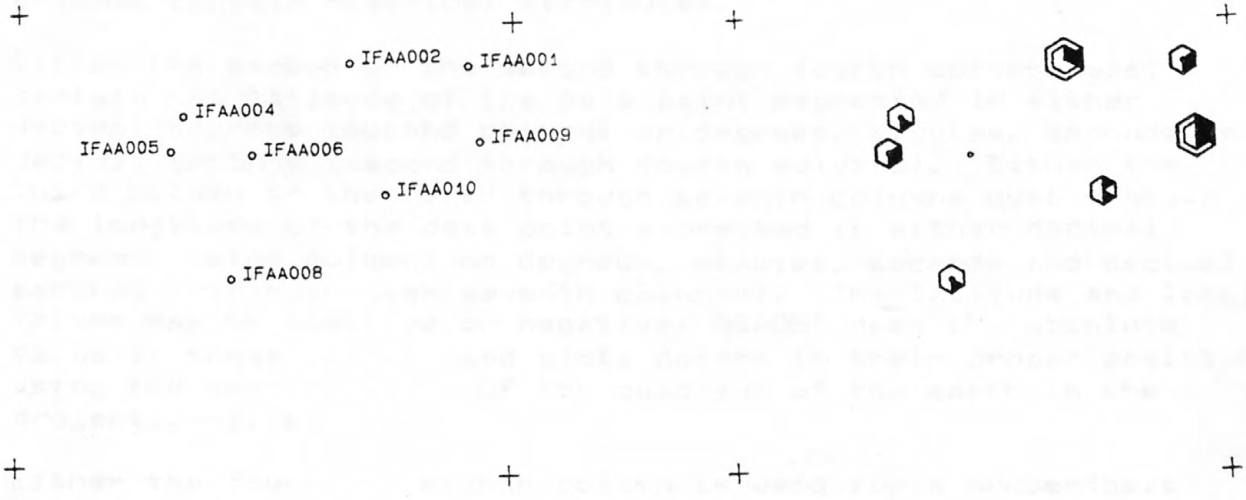



Fig. 1 A

A small circle is drawn at each site site, and sample numbers are posted

Fig 1 B

Symbols are drawn at each site; multiple values are indicated by overlaying symbols of different types.

The + signs on the figures indicate the position of the corners specified in the plot file.

## DATA FILE

The user must create an ASCII data file that contains a series of rows and columns. Each row is a series of attributes that apply to one data point. Each column contains one kind of attribute. The first several columns must contain information about the sample identification, the latitude, the longitude, and the plot angle of the posted information. The user can choose the attributes to be displayed in the remaining columns. Examples of geochemical attributes might include the concentrations of silver, copper, and lead, oil well attributes might include Flow rate, depth to pay zone, and well head pressure. All attributes must be numbers except for column 1 which 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 (which ends the string of characters that constitute the locality identifier). A blank space after the comma is permitted, but isn't required. The delimiter separating columns except for the ending of the first column is a blank "character" or a comma. The next 2 or 6 columns contain the latitude and longitude coordinates of the site; 2 columns if the latitude and longitude are specified in degrees (and decimal degrees), 6 columns if specified in degrees, minutes, and seconds. The remaining columns contain numerical attributes.

Either the second or the second through fourth columns must contain the latitude of the data point expressed in either decimal degrees (second column) or degrees, minutes, seconds and decimal seconds (second through fourth columns). Either the third column or the fifth through seventh columns must contain the longitude of the data point expressed in either decimal degrees (third column) or degrees, minutes, seconds and decimal seconds (fifth through seventh columns). The latitude and longitude values may be positive or negative: GSPOST uses the absolute value of these values, and plots points in their proper positions using the specification of the quadrant of the earth in the projection file.

Either the fourth or eighth column is used for a number(best understood as the "angle") which specifies the position of posting of data relative to the datapoint. We recommend starting with a series of zeroes in that column, then, if necessary, edit the column to move postings to more desirable positions. 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. The angles specified cause rotation of the posting, positive angles are measured counterclockwise from the horizontal. The diagram below illustrates the effects of specifying different angles to post numerical data.


The ASCII data file can have up to 50 columns and any number of rows. The first four to eight columns must be reserved for the specific uses described above.

The ASCII data file can be created in a variety of different ways. If data is available in LOTUS 1,2,3, 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, that other columns are separated by a "blank" and that all columns except the locality identifier column contain numbers only. The user specifies (and must keep track of the data types in each column by number. The data columns are numbered, from the left, with 1, just after the columns containing locality identifier, latitude longitude data, and posting angle.

An example of an ASCII data file is provided below. It is properly formatted; it contains latitude/longitude data in degrees and decimal degrees, has no headers, and no entries below the last record.

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

An example of a properly formatted ASCII file with latitude/longitude in degrees, minutes, and seconds is provided below.

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

## PROJECTION FILES

The projection file must be created by the user to match the map that is desired. It furnishes information to the computer about the map projection to be used for the map that will be drawn by this program. The projection file is identical with the projection file used by the GSMAP program. Each projection file consists of a series of ASCII records.

Record 1

A code number identifying the quadrant of the earth.

1 - North Latitude, West longitude (includes all of U.S.)
2 - North Latitude, East Longitude
3 - South Latitude, East Longitude
4 - South Latitude, West longitude

Example 1 for US

Record 2

A code describing the type of projection.

1 - Lambert Conformal Conic projection (1 standard parallel
2 - Lambert Conformal Conic projection (2 standard parallels
3 - Universal Transverse Mercator

4 - Albers Equal Area

Example 2 for Lambert Conformal Conic (2 standard parallels)

Record 3

The earth's equatorial radius: for the Clarke 1866 Spheroid, use a value of 6378.2064

Record 4

The earth's polar radius: for the Clarke 1866 Spheroid, use a value of 6356.5838.

Record 5

This record is dependent on the type of projection chosen.

Lambert Conformal Conic (1 parallel)
Enter the applicable value for the standard parallel

Lambert Conformal Conic (2 parallels)
In the conterminous US enter 45,33

Universal Transverse Mercator
Enter the standard meridian of the applicable zone

Albers Equal Area (standard parallels)
In the conterminous US enter 45.5,29.5
In Alaska enter 65,55
In Hawaii, enter 18,8

Record 6

This record is dependent on the type of projection selected.

Lambert Conformal Conic (1 parallel), Lambert Conformal Conic (2 parallels) and Albers Equal Area

Enter the central meridian of the map

Universal Transverse Mercator

Enter the scale factor. (0.9996 unless known to be different.

***Annotated examples***

Lambert Conformal Conic - two parallels

| | |
|---|---|
| 1 | Northwest quadrant of Earth |
| 2 | "2" specifies LCC - two standard parallels |
| 6378.2064 | Equatorial radius in KM, Clarke, 1866 |
| 6356.5838 | Polar radius in KM, Clarke, 1866 |
| 45,33 | Standard parallels for map 105,0,0 |
| Central meridian for map | |

Universal Transverse Mercator - UTM

| | |
|---|---|
| 1 | Northwest quadrant of Earth |
| 3 | "3" specifies UTM projection |
| 6378.2064 | Equatorial radius in KM, Clarke, 1866 |
| 6356.5838 | Polar radius in KM, Clarke, 1866 |
| 105,0,0 | Standard meridian for map |
| 0.9996 | Scale factor |

**Albers Equal Area projection**

| | |
|---|---|
| 1 | Quadrant of Earth ("1" specifies NW) |
| 4 | "4" specifies Albers Equal Area projection |
| 6378.2064 | Equatorial radius in KM, Clarke, 1866 |
| 6356.5838 | Polar radius in KM, Clarke, 1866 |
| 45.5,29.5 | Standard parallels for "Lower 48" |
| 100,0,0 | Meridian central to map |

The Albers Equal Area projection is used by the USGS for sectional maps of the 50 States in the National Atlas of 1970, and for other U.S. maps at scales of 1:2,500,000 and smaller.

# PLOT CONTROL FILE

The user must create a plot control file. A plot control file contains a series of ASCII records that specify various parameters that control the area, size, orientation and content of the maps that are to be generated.

Record 1
Latitude Longitude of NW corner of plot area
DD, MM, SS, DDD, MM, SS

Record 2 Latitude Longitude of SW corner of plot area
DD, MM, SS, DDD, MM, SS

Record 3 Latitude Longitude of SE corner of plot area
DD, MM, SS, DDD, MM, SS

Record 4 Latitude Longitude of NE corner of plot area
DD, MM, SS, DDD, MM, SS

Record 5 x scale, y scale - the denominators of the scale fraction, eg. 24000, 24000 (for 1:24,000 scale maps)

Record 6 The offset in inches from the plotter default origin near the corner of the plotter paper for thesouth west corner of the plotted map; see
plotter documentation.
XOFF, YOFF, eg. 1, 3

Record 7, this value specifies that the plot should be rotated on the plotter, or should not be rotated; see plotter documentation.
Y or N

Record 8, Speed and Force These values specify the speed of drawing lines in cm/sec and the pressure on the pen. eg. 25, 1 for fibertip pens on paper. Refer to the Hewlett Packard manuals for recommended values

Record 9 The width and height in centimeters for posted numbers and letters; this does not refer to symbol size.

Record 10 The complete filename for the ASCII file that contains the data to be plotted. (DRIVE:FILENAME.EXT)

Record 11 An option that specifies the format of the data file. If the data file contains latitude-longitude recorded as decimal degrees then enter DD. If the data file contains degrees-minutes-seconds, enter DMS.

Record 12 contains the number of rows and columns in the data table. The number of columns does NOT include the locality identifier column, the latitude and longitude column or the column that contains the angle specifying the posting position. The number of columns specified here is the number of **data** columns.

The succeeding Records contain information specifying the data column which is to be used, the kinds and sizes of symbols that are to be drawn, and the posting that is desired. To post locality identifiers enter 0,0 for record 13.

Record 13 Column and Classes This record specifies that data in the column specified by number is to be used, and that plots/postings will be based on the specified number of classes. For each class add a line to the plot file containing the data specified below.
Column to be plotted, number of classes to be plotted separately
Example 3,4 specifies four classes to be separately plotted from the data in the third data column Each class of data requires a record in the file - the entry of 4 above requires four records (numbers 14,15,16,17 in the plot file); each record specifying classes contains six entries separated by commas; in sequence, (1) the low value for the class, (2) the high value for the class, (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 rasters (one raster is 1/1016" 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).

Example 20,50,3,11,100,N this line specifies that values ranging from 20 to 50 are to be selected, symbol 11 is to be used, and drawn about .1 inch high.
Following the requisite number of lines specifying class intervals, pen, symbol, size, and posting yea/or nay, a series of subsequent records can be used to specify selection of data from other columns, and succeeding records to specify class intervals for these data. All records specifying columns and numbers of class intervals must be followed by the requisite number of records specifying class and plot data.

No record is required to indicate that the end of the plot file has been reached, a carriage return at the end of the last line of the plot file constitutes the end of the plot file.

The following plot file was used to produce figure 1B.

```
44,0,0,113,57,0
43,52,0,113,57,0
43,52,0,113,45,0
44,0,0,113,45,0
250000,250000
0,0
N
25,1
TESTDD1.PRN
DD
8,4
1,3
0,  1000,  1,  1,  25,  N
1000,  1100,  1,  41,  150,  N
1100,  1500,  1,  41,  225,  N
3,2
65,  75,  2,  42,  150,  N
110,  150,  2,  42,  225,  N
4,1
25,  40,  1,  43,  150,  N
```

## References

Selner, Gary I., Taylor, Richard B., and Johnson, Bruce R., 1986 GSDRAW and GSMAP Version 3.0: Prototype Programs for the IBM PC or Compatible Microcomputers to assist Compilation and Publication of Geologic Maps and Illustrations: U.S. Geological Survey Open-File Report 86-447A, Program Disks 86-447B, 53 p., 2 disks.

Selner, Gary I., Taylor, Richard B., and Johnson, Bruce R., 1986 GSSECT Version 1.0: A Prototype Program for the IBM PC or Compatible Microcomputers to assist drawing of cross sections: U.S. Geological Survey Open-File Report 86-446A, Program Disk 86-446B, 8 p., 1 disk.

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

## APPENDIX

## SOFTWARE

Version 1.0 of GSPOST was written and tested using the MicroSoft QuickBASIC Compiler to improve execution speed. The program cannot be tested or executed under BASICA, but must be compiled using Microsoft QUICKBASIC. Because the program supports the 8087 co-processor, a product such as 87BASIC from Microway is needed: this product modifies the standard libraries from Microsoft to call the 8087 chip. The program can be compiled and executed using the standard Microsoft compiler and libraries after removing one line (CALL MICROSOFT), but the execution time is slower. The program has been tested using 128K of RAM memory and using DOS 3.0. It should run on versions of DOS 2.1 and greater. The release disk contains the source code in ASCII format, the executable code generated by the QuickBASIC compiler, the symbol file (GSCAD.SYM), and the configuration file named CONFIG.CAD used to set communication parameters between the computer and the plotter.

The minimum software requirements for utilizing the programs are PC/DOS 2.1 or higher, the release disk, and a word processing program capable of producing ASCII files. A program such as Wordstar in non-document mode is a suitable word processing program; Wordstar in document mode is not suitable.

## CONFIG.CAD

The Config.Cad file used to establish proper communictions is a two line file. The first line applies to a digitizer if one is present in the system. , the second to the plotter. Each line of text specifies the asynchronous transmission port to which the device is attached, the transmission speed (baud rate), and other parameters that apply to communication between hardware device and computer. The user is referred to the OPEN COM .. statement in the IBM Basic manual for explanation of these parameters. The user normally would not change the contents of the file, which looks like the example below:

"COM2:1200,N,8,1"
"COM1:2400,N,8,1,RS,CS65535,DS,CD"

When using GSMAP or GSDRAW on IBM PC/AT computers, or high speed versions of the PC or PC/XT, use transmission speed from computer to plotter of 2400 baud. Higher baud rates (9600) that work between the 4.77 megahertz PC and a plotter seem to fail when used with 6 and 8 megahertz computers.

## GSCAD.SYM

The file named GSCAD.SYM is required for use with GSPOST to provide a standard set of symbols. This symbol set was created during the development of the GSMAP/GSDRAW software and contains many the commonly used symbols. Additional symbols can be coded by the user, The system is simple enough thatthis can be done even by a non programmer. A word processing program such as non-document mode WORDSTAR is needed.

Standard symbols

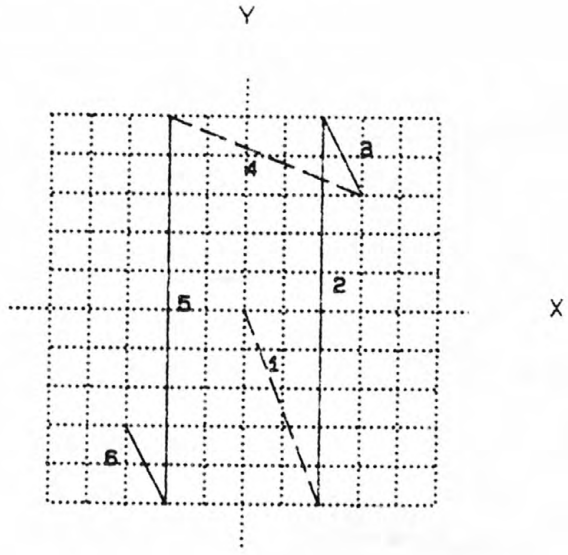
## CODING OF NEW SYMBOLS

New symbols can be coded by the user and included in the GSCAD.SYM file. The coding is easier than might be anticipated. Sketch a square of unit edge, with a point at the center. Begin specifying each symbol assuming that the pen is at the center point. Each line of the code tells the pen to move to a new position in the square; a "PU" specifies that the move is with the PEN UP (no line drawn), a "PD" specifies that the move is made with PEN DOWN (drawing a line). All moves are relative to the last point, not to the center of the square.

- The center of the square is the point that is digitized and the center of the plotted symbol.
- The first line of the symbol specifies the number assigned to the symbol, the number of moves, and if the polygon defined by the symbol is to be filled "Y", or is not to be filled "N".
- Each subsequent line begins with a "PU" or "PD" instruction, and defines the move in the X direction, and the move in the Y direction.
- The pen need not be returned to the center point at the end of drawing the symbol.

## EXAMPLE OF CODING OF A USER DEFINED SYMBOL

```
209,6,"N"
"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
```



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