

**U.S. Geological Survey Open-File Report 95-516
PLOTSEIS V2.5.3**

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**A DOS Display Program for
SEG-Y Formatted Seismic Data**

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1: ABSTRACT

PLOTSEIS is an interactive program written in C and designed to display digital seismic data, stored in industry-standard SEG-Y format, using an 80286 or higher numbered Intel processor personal computer and the MS-DOS or PC-DOS operating system. PLOTSEIS will prompt the user for the file path and file name of the SEG-Y data file to display and then display a menu of options for the user, including the option of entering a different sample rate, setting the type of trace scaling to use, the time window and timing lines annotation frequency, the display parameters to use, the command to plot the data, and the command to exit the program. PLOTSEIS will automatically recognize and use EGA, VGA, and Hercules video devices. Screen displays may be captured and sent to a printer or PCX graphics file. A screen dump of the seismic data displayed may be sent to an attached printer by issuing the DOS GRAPHICS command before running PLOTSEIS. Screen images are sent to the printer by pressing simultaneously the SHIFT and PRINT SCRN keys. A PCX graphics file is generated by pressing "p" (lowercase p) after a screen of data has been displayed.

2: INTRODUCTION

The combination of low cost, powerful personal computers (PC's) possessing hard disk drives with hundreds of megabytes of storage allows a "mainframe" level of computing on a user's desk. This increase in desktop computing power and disk storage has made the real-time display of industry standard SEG-Y format seismic data a practical reality.

PLOTSEIS was written to operate on DOS-based PC's to read any standard SEG-Y format digital files, either disk-based or on CD-ROM, and display these data in real-time to the user's monitor. The input files are disk images of the SEG-Y format as described by Berry, et. al. (1975).

3: SYSTEM REQUIREMENTS

PLOTSEIS was developed in C using Borland C/C++ 3.0 on an ALR BusinessVEISA with a 33 Mhz Intel 80386 processor, an 80387 math coprocessor, and MS-DOS 4.01.

PLOTSEIS has the following hardware and software requirements:

- ◆ Intel 80286 or higher processor. An 80386 or greater is strongly recommended.
- ◆ Video card capable of EGA, VGA, or Hercules displays.
- ◆ DOS 3.0 or later.
- ◆ A hard disk drive or CD-ROM containing the input file(s).
- ◆ A math coprocessor is NOT required, but will be used if available.

4: PLOTSEIS OVERVIEW

PLOTSEIS consists of three program sections: entry of SEG-Y data file path and name, entry of seismic trace display information, and the data display itself. PLOTSEIS is started at the

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DOS command line prompt by typing PLOTSEIS. At program startup, PLOTSEIS will display an opening banner. After pressing any key, PLOTSEIS will prompt the user for a directory path and file name. Entering "exit" or "EXIT" to any prompt will halt program execution and return the user to the DOS command level. Entering "quit" or "QUIT" to any prompt will halt program execution and return the user to the directory file path and name portion of the program.

After the file directory path has been entered, PLOTSEIS will display a menu of files available. A file is selected by using the up and down arrow keys, the HOME key and END key to move through the menu until the desired file name is highlighted. Once the file name has been highlighted, pressing ENTER selects and opens the file. Upon successful opening of the file PLOTSEIS will display the following information:

- ◆ File name.
- ◆ Data type: SEG-Y
- ◆ Data Format: 16 bit integer, 32 bit integer, or 32 bit floating point
- ◆ Sample rate, milliseconds
- ◆ Number of samples in each trace.
- ◆ Maximum time, milliseconds.
- ◆ Bytes per trace.
- ◆ Bytes in the file.
- ◆ Traces in the file.

This information remains displayed on-screen until the user presses any key.

After pressing a key PLOTSEIS displays two text windows: one on the left displaying a menu of program options, the other on the right displaying information about the program option currently selected in the other window. The current program options are:

- ◆ **Sample Rate:** Allows entry of a new sample rate. The default is to accept the sample rate as read from the binary SEG-Y header record in the selected file.
- ◆ **Scaling:** Allows displaying the data relative to the average non-zero value calculated per trace or relative to that value calculated from a range of traces.
- ◆ **Time Window:** Allows defining the starting time, ending time, and the time axis annotation frequency of the data to be displayed.
- ◆ **Display Parameters:** Allows defining the type of trace to display, any linear gain to apply to the data, the first trace to display, the number of traces per display, the trace annotation frequency, a trace increment, which of 3 header values to display, and the display color.
- ◆ **Plot Data:** Displays the data using the parameters and defaults defined above.

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- ◆ **Exit Program:** Stops PLOTSEIS and returns the user to the DOS prompt.

The user moves through the program options using the up and down arrow keys until the desired option is selected. The selected option is invoked by pressing the ENTER key. Pressing the ESC (ESCAPE) key returns the user back to the directory path entry portion of PLOTSEIS.

5: PLOTSEIS PROGRAM OPTIONS

All information entered by the user in response to a program prompt will be kept as the default value for that prompt. Default values are displayed with each prompt enclosed in square brackets. A default value is selected by pressing the enter key (ENTER) in response to a particular prompt. Entering "quit" or "QUIT" in response to a program prompt will return the user to the directory path/file name portion of the program. Entering "exit" or "EXIT" in response to a program prompt will return the user to the DOS prompt.

NOTE: PLOTSEIS does no extensive error checking on the values entered by the user. Indiscriminate replies to the program's prompts may cause unpredictable results.

5.1: SAMPLE RATE

This option allows the user to change the sample rate used to read the data. For SEG-Y data format files, which have the sample rate defined in the binary header portion of the file, the default value will usually suffice. If the binary header contains the wrong sample rate, it may be overridden by entering a value here. Integer value required.

5.2: SCALING

This option will display a prompt for the user to select the scaling method desired: Trace Normalized or Relative Amplitude. In each case the samples within a trace are scaled against a reference value.

5.2.1: TRACE NORMALIZED

All trace amplitudes within a single trace are scaled relative to the reference value calculated for that individual trace. The reference value used per trace is determined by calculating the average value of all non-zero samples within that trace. The advantage of this normalization technique is that it permits the viewing of data sets having widely varying average amplitudes between traces (such as raw shot records) on the same screen using the same gain factor.

5.2.2: RELATIVE AMPLITUDE

All trace amplitudes of all traces are scaled relative to one reference value. If the Relative Amplitude option is selected, the user will be prompted to enter a value to be used as the reference value, or to specify the starting trace number and how many traces to be used to calculate that value. If the reference value is to be calculated, PLOTSEIS will calculate the average non-zero sample value for all

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traces within the user-specified range. This method allows the display of all samples of all traces relative to a single, constant value.

5.3: TIME WINDOW

The three Time Window parameters determine what vertical portion of the trace will be displayed and how often the time axis will be annotated:

Trace Minimum Time - Starting display time in milliseconds. Integer value required.

Trace Maximum Time - Ending display time in milliseconds. Integer value required.

Timing Lines - How often, in milliseconds, to annotate the time axis. Integer value required.

5.4: DISPLAY PARAMETERS

These parameters define how the data will appear on the user's monitor screen.

5.4.1: TRACE TYPE

Three types of trace displays are available:

- | | |
|-------------------------|--|
| 1. Wiggle: | A single line connecting all samples in a trace. |
| 2. Variable Area: | The area from the zero sample value to the the positive sample value only colored. |
| 3. Wiggle/Variable Area | A combination of the Wiggle and Variable Area display types. |

Integer value of 1, 2, or 3 required.

5.4.2: TRACE GAIN

The user may enter a floating point value which will be applied as a scalar multiplier to every trace sample value. A negative gain factor will reverse the polarity of the traces displayed. Integer or floating point value required.

5.4.3: CLIPPING

This parameter specifies, in trace widths, how far a trace may extend horizontally. Any samples having amplitudes which extend past this limit are "clipped" at that limit set by this parameter. Integer value required.

5.4.4: FIRST TRACE

This parameter defines the first trace of the file to display. This is the physical trace number of the data in the data file, where traces are numbered

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starting with the number 1 and increase by one to the end of the file. PLOTSEIS will directly access the first trace specified, and sequentially access every trace after that. Integer value required.

5.4.5: TRACES PER PANEL

This parameter specifies how many traces to display per screen, or "panel", and may range from 1 to 500. Integer value required

5.4.6: TRACE ANNOTATION

This parameter specifies the frequency with which traces are annotated along the top horizontal axis. Integer value required.

5.4.7: TRACE INCREMENT

This parameter specifies how many traces forward PLOTSEIS will move through the SEG-Y file after displaying the current trace. This allows "fitting" more than 500 traces per screen. A trace increment of 2 and 500 traces per panel will display a 1,000 trace data set, every other trace. A negative trace increment and the proper STARTING TRACE NUMBER value will produce a reverse-sorted display of the data. Integer value required.

5.4.8: TRACE HEADER

This parameter specifies whether the trace header's Common Depth Point (CDP), CDP ensemble trace, or Field File Identification (FFID) is displayed across the top of the display at the user-specified annotation frequency. Integer value of 1, 2, or 3 required.

5.4.9: TRACE COLOR

This parameter specifies whether to use the default color scheme, display the data as black traces on a white background, or color the traces according to the trace sample amplitudes. Integer value of 1, 2, or 3 required.

5.5: PLOT DATA

This program option instructs PLOTSEIS to display data from the selected file using the specified display parameters. PLOTSEIS will directly access the physical trace number specified in the FIRST TRACE display parameter. All traces after that are accessed sequentially. The sample rate and number of samples per trace are determined from each trace header. All samples for each trace are read, regardless of the time window entered. Currently a maximum of 10,000 samples are allowed per trace. Data sets having more than 10,000 samples per trace will cause PLOTSEIS to fail and should be resampled to have 10,000 samples per trace or less.

PLOTSEIS will display the data in the SEG-Y file one "panel", or screen, at a time. The number of traces displayed per panel is set by the TRACES PER PANEL display parameter. At the end of each panel the user may return to the program options

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screen (by pressing the ESC key), or display the next panel of data, if it exists. If all the data has been displayed the user is returned to the program options screen. Pressing the escape key (ESC) at any time during the display of data will stop the data display and return the user to the program options screen.

Screen displays may be captured and sent to a printer or PCX graphics file. A screen dump of the seismic data displayed may be sent to an attached printer by issuing the DOS GRAPHICS command before running PLOTSEIS. Screen images are sent to the printer by pressing simultaneously the SHIFT and PRINT SCRN keys. A PCX graphics file is generated by pressing "p" (lowercase p) after a screen of data has been displayed. When the user presses "p", PLOTSEIS will beep once and start writing a PCX format graphics file of the screen to the directory from which the program was invoked. PLOTSEIS will beep 3 times at the completion of that file. The PCX files created will be written to the directory from which PLOTSEIS was started and will be named SEIS001.PCX for the first, SEIS002.PCX for the second, and so on until the user exits from the program. *Each time PLOTSEIS is run the naming of any PCX files generated will restart at SEIS001.PCX and will overwrite any previously generated files of the same name.*

5.6: EXIT PROGRAM

Taking this program option will halt the program and return the user to the DOS prompt.

6.0: DISCLAIMER

This software publication was prepared by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, make any warranty, expressed or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of the information, apparatus, product, or process disclosed in this report, or represents that its use would not infringe on privately owned rights. Reference therein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof.

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7.0: REFERENCE

Barry, K.M., Cavers, D.A., and Kneale, C.W., 1975, Recommended standards for digital tape formats, in Digital Tape Standards; Society of Exploration Geophysicists ["Recommended standards for digital tape formats" reprinted from Geophysics, v. 32, p. 1073 - 1084; v. 37, p. 36-44; v. 40, p. 344 - 352.] p. 22 - 30.