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DUMPSEGY V1.0: A Program to Examine the Contents of SEG-Y Disk-Image Seismic Data

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Although this program has been extensively tested, the Geological Survey can not guarantee that it will give accurate results in all applications nor that it will work on all computer systems.

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

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CONTENTS

Abstract 1
Introduction 1
System requirements 2
Program function 3
DUMPSEGY Overview 4
File information display 5
Default display 5
EBCDIC header option 6
Binary header option 7
Trace header option 7
Floating point sample option 8
File and/or header information only option 9
Trace range option 9
File output option 10
Copy as binary option 11
Creating new SEG-Y files 11
Data sample conversion 13
Sample data file 14
Disclaimer 15
Reference 16

TABLES

Table 1. DUMPSEGY command line options 17
2. SEG-Y binary header values definitions 17
3. SEG-Y trace header values definitions 20

FIGURES

Figure 1. Program usage information display 23
2. SEG-Y file information display 23
3. An example of the default DUMPSEGY sample display . 24
4. An example of the EBCDIC header display 24
5. An example of the binary header display 25
6. An example of a data trace header display 27
7. An example of a floating point sample display 28

DUMPSEGY V1.0

ABSTRACT

DUMPSEGY is a character-based interactive program written in C and designed to display the header information and hexadecimal and floating point sample values of digital seismic data stored in industry-standard SEG-Y format. DUMPSEGY is started at the system command line prompt, and requires at a minimum the SEG-Y data file path and name. Up to eight display options may be included on the command line following the data file name. DUMPSEGY, invoked with no options, will display information about the SEG-Y file opened, prompt the user for the sequential trace number of the seismic data trace to be displayed, directly access that trace, and display the hexadecimal values of the samples comprising that trace.

DUMPSEGY options allow: 1) displaying the SEG-Y EBCDIC header, 2) displaying the binary header, 3) displaying the individual data trace header information of the user-selected trace, 4) displaying the individual samples that comprise a trace translated from the SEG-Y format into their floating point values, 5) displaying only the file information and or header information, with no display of the individual samples, for selected data traces, 6) specifying a file to receive the output, 7) specifying a sequential range of traces to display, including an increment between sequential traces, and 8) copying portions and components of the input file in binary format allowing the construction of a new SEG-Y file from the original.

If started without specifying a trace range, DUMPSEGY will prompt the user for other data traces to display until the user enters 0 to exit the program

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. Desktop PC's have increased in processing power to the point that an Intel 80486 processor-based DOS PC running at 25 Mhz was able to execute a computationally intensive seismic data processing algorithm 50% faster than the same source code running on a VAX

11/780 with an attached array processor (Miller, 1992, personal communication). This increase in desktop computing power and disk storage has made the PC-based real-time display of seismic data a practical reality.

DUMPSEGY uses the seismic data stored in industry-standard SEG-Y format. A typical amount of seismic data occupies many megabytes of storage space and thus, for practical purposes, a hard disk or CD-ROM is necessary. PLOTSEGY (Zihlman, 1992) provides a means of real-time display of SEG-Y seismic data in the DOS environment. DUMPSEGY provides a method of examining the SEG-Y header information and sample values of the seismic data and as such may be seen as a companion program to PLOTSEGY. Like PLOTSEGY, DUMPSEGY was written for operating systems which internally store floating point numbers using the IEEE format, such as DOS or UNIX (see **DATA SAMPLE CONVERSION**, below).

DUMPSEGY was written in ANSI C allowing the source code to be compiled and used in any operating system environment, such as DOS or UNIX, having compilers supporting the ANSI standard.

SYSTEM REQUIREMENTS

DUMPSEGY 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.

DOS ENVIRONMENT

DUMPSEGY has the following DOS hardware and software requirements:

* Intel 80286 or higher processor.
* 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 and is strongly recommended.

Please refer to the EBCDIC Header Display section below for source code compilation information concerning that display.

UNIX ENVIRONMENT

DUMPSEGY has the following UNIX software requirement:

* Source code must be compiled using an ANSI compliant compiler.

Please refer to the EBCDIC Header Display section below for source code compilation information concerning that display.

PROGRAM FUNCTION

DUMPSEGY is started at the system command line prompt by typing

DUMPSEGY <input file> -e -b -t -c -v -n -f <output file> -r first:last:increment

A description of each of the options is given in Table 1. The <input file> is required. DUMPSEGY and the <input file> must be separated with at least one space. Options may be entered in any order and in either upper or lower case. The hyphen (-) before each option is required and no blanks are allowed between the hyphen and the option character. All options must be separated from one another and from the any file name with at least one or more spaces. Option "-f" must have at least one space separating it and the following <output file> name, which must be a valid file name for the operating system in use. Option "-r" must have at least one space separating it and the starting and stopping trace range following it. The trace range must be given as starting trace number:ending trace number, where the starting and ending trace number are integer values representing the sequential seismic data trace numbers in the file. The starting and ending trace numbers must be separated with a colon (:). Optionally, a trace increment may be included following the ending trace number and separated from it by a colon (:). No spaces between the starting trace number, the ending trace number and the trace increment are allowed.

Entering DUMPSEGY without an <input file> will display information on how to use the program as shown in Figure 1.

DUMPSEGY OVERVIEW

A SEG-Y file, whether on tape or disk, is composed of a 3200 byte EBCDIC-format header, followed by a 400 byte binary header, which in turn is followed by individual data traces. Each data trace is composed of a 240 byte trace header followed by the 4 byte SEG-Y samples comprising the actual data for that trace.

DUMPSEGY uses a library of C routines, SEGYLIB.C, designed to read SEG-Y files and originally written for the DOS SEG-Y display program PLOTSEGY (Zihlman, 1992). Currently, the routines in that library allow a maximum of 6000 samples per trace. Data sets having more than 6000 samples per trace may cause DUMPSEGY to fail and should be resampled to have 6000 samples per trace or less.

Starting DUMPSEGY with no command line options will produce the default display as described below. The "-e" and/or "-b" options will display the EBCDIC header and/or the binary header following the File Information display, the "-v" option will translate the SEG-Y data samples into their actual floating point values, the "-n" option will display file and header information only, the "-f" option will direct output to a disk file, and the "-r" option will display a user-defined range of traces, the "-c" option will output the data in binary form.

If the "-f" option is used without the "-c" option, the output file is opened as an ASCII text file and DUMPSEGY will decode the binary information of the input file into ASCII text before writing it to the output file. If the "-f" option is used with the "-c" option, the output file is opened as a binary file and the information requested using the command line options will be written to the output file in binary form.

The "-v" and "-c" options are mutually exclusive and starting DUMPSEGY specifying both on the command line will cause DUMPSEGY to display the program usage information and exit.

FILE INFORMATION DISPLAY

After successfully opening the file specified on the command line, DUMPSEGY will determine and return the following file information:

* File name.
* Sample interval, in microseconds.
* Number of samples per seismic trace.
* Maximum time value per seismic trace, in milliseconds.
* Bytes per seismic trace.
* Bytes in the file.
* Number of seismic traces in the file.

If the "-c" or "-f" options have not been used, this information will remain on the screen until the user presses <CR> or X<CR>. If the "-f" option has been included on the command line, DUMPSEGY will direct the output to the specified file. If the "-c" option has been included on the command line no file information is output by DUMPSEGY. Figure 2 is an example of the File Information Display.

DEFAULT DISPLAY

Starting DUMPSEGY with no options will produce a default display composed of the SEG-Y file information, as discussed above, followed by a prompt for a sequential trace number to display. Enter 0 (zero) to exit the program. Enter a value between 1 and the sequential number of the last trace in the SEG-Y file to display the hexadecimal value of each sample within that trace. The hexadecimal values displayed are the untranslated SEG-Y samples, not their actual floating point values (see Floating Point Sample Display, below). Four samples (16 bytes) are displayed per line as a series of eight, 2 byte (four digit) hexadecimal numbers, separated from each other by a blank. The byte number of the first byte displayed and the byte number of the last byte displayed, relative to the first byte of the SEG-Y FILE, are displayed within square brackets on the left at the start of each line. All samples comprising the data trace are displayed without pause to the end of that trace. After the last sample has

been displayed, the user is prompted for another trace number. Figure 3 is an example of the default sample display.

EBCDIC HEADER OPTION: -e or -E

The "-e" or "-E" option directs DUMPSEGY to process the SEG-Y file EBCDIC header. If the "-c" and "-f" options have not been included on the command line this option will display the 3200 byte EBCDIC header, translated to ASCII, as a series of 40 lines of text 80 characters in length. DUMPSEGY will stop at the end of 20 lines of text and prompt the user to continue the display by pressing <CR>, or to exit the program by pressing X<CR>. Figure 4 is an example of an ASCII translation of the EBCDIC header.

The "-c" option directs DUMPSEGY to copy the EBCDIC header in binary form.

The "-f <output file>" option directs DUMPSEGY to output the EBCDIC header information to that file.

The ASCII translation of the EBCDIC header is displayed differently on DOS and UNIX systems, depending on how the DUMPSEGY source code is compiled. On DOS systems, the EBCDIC header information is displayed as 40 text strings of 80 characters each, with no "new line" character at the end. As the default DOS display is 80 characters per line, the display will "wrap" around to the following line at the end of each 80 character string.

UNIX systems will display the EBCDIC header as a series of 40 text strings, 80 characters each, with a "new line" character at the end.

The source code must be compiled for the desired operating system with the appropriate "define" value ("DOS_SYSTEM" or "UNIX_SYSTEM") defined and the other commented out. If the wrong one is "defined" the EBCDIC header information will be displayed inappropriately. If both "DOS_SYSTEM" and "UNIX_SYSTEM" are defined each line of the EBCDIC header will be displayed twice. If neither are defined no EBCDIC header information will be displayed. Please refer to the source code file DSGYMAIN.C for more information.

BINARY HEADER OPTION: -b or -B

The "-b" or "-B" option directs DUMPSEGY to process the 400 byte SEG-Y file binary header. Only the first 60 bytes of the binary header are defined by the Society of Exploration Geophysics (SEG) (Barry, et al., 1975), and if the "-c" option is not used only those 60 bytes are processed. If the "-c" and "-f" options have not been included on the command line, each SEG-defined header value is displayed, one header value per display line, and is composed of four items: the header value's starting and ending location, in bytes, relative to the first byte of the file, the header value's name, the header value's decimal value, and the header value's actual hexadecimal value. The header value's starting and ending byte locations are enclosed in square brackets. DUMPSEGY will stop after 22 lines of text and prompt the user to continue the display by pressing <CR>, or to exit the program by pressing X<CR>. Pressing <CR> will display the remaining SEG-defined header values, and again prompt the user to continue the display by pressing <CR>, or to exit the program by pressing X<CR>. Table 2 is a list of SEG-defined binary header values, the byte location in the header where they may be found, and how many bytes comprise those header values. Figure 5 is an example of the binary header display.

The "-c" option directs DUMPSEGY to copy the full 400 byte binary header in binary form.

The "-f <output file>" option directs DUMPSEGY to output the binary header information to that file.

TRACE HEADER OPTION: -t ot -T

The "-t" or "-T" option directs DUMPSEGY to process each data trace header. Only the first 180 bytes of the 240 byte data trace header are defined by the Society of Exploration Geophysics (Barry, et al., 1975), and if the "-c" option has not been used, only those 180 bytes are processed. If the "-c" and "-f" options have not been used, each SEG-defined header value is displayed, with one header value per display line and is composed of four

items: the header value's location within the file, the header value's name, the header value's decimal value, and the header value's actual hexadecimal value. The header value's starting and ending byte locations, relative to the first byte in the file, are enclosed in square brackets. DUMPSEGY will stop after 22 lines of text and prompt the user to continue the display by pressing <CR>, or to exit the program by pressing X<CR>. Pressing <CR> will display another 22 line set of SEG-defined header values, and again prompt the user, until all SEG-defined trace header values have been displayed or the user exits the program. Table 3 describes the starting and ending byte locations and the definition of each SEG-defined trace header value. Figure 6 is an example of the trace header display.

The "-c" option directs DUMPSEGY to copy the full 240 bytes of each trace header in binary form.

The "-f <output file>" option directs DUMPSEGY to output the data trace header information to that file.

FLOATING POINT SAMPLE OPTION: -v or -V

The "-v" or "-V" option directs DUMPSEGY to process the individual SEG-Y samples into their floating point values. If the "-f" option is not used, DUMPSEGY will display four samples (16 bytes) per line, separated from each other by a blank. Actual calculation of the floating point number of each sample is given below (see **DATA SAMPLE CONVERSION**, below). The byte range, relative to the first byte of the SEG-Y FILE, of the four samples displayed is shown within square brackets on the left at the start of each line. All samples comprising the data trace are displayed without pause to the end of that trace. After the last sample has been displayed, the user is prompted to enter another trace number. Figure 7 is an example of the floating point sample display.

The "-c" and "-v" options are mutually exclusive and including both on the command line will cause DUMPSEGY to display the program usage information and exit.

The "-f <output file>" option directs DUMPSEGY to output the SEG-Y samples floating point values to that file.

FILE AND/OR HEADER INFORMATION ONLY OPTION: -n or -N

The "-n" or "-N" option directs DUMPSEGY to process only the header information requested using the "-e", "-b", and "-t" options. No data samples are processed. This option was provided to allow the output of header information to a file without including the individual samples for the selected data traces.

If no header options are specified and the "-c" and "-f" options are not used, DUMPSEGY will display only information about the file specified (see **FILE INFORMATION DISPLAY**, above). Using the "-e" (see **EBCDIC HEADER OPTION**, above), "-b" (see **BINARY HEADER OPTION**, above), and "-t" (see **TRACE HEADER OPTION**, above) command line options will display the specified information as discussed above.

If the "-n" and "-v" options (see **FLOATING POINT SAMPLE OPTION**, above) are issued together, the "-n" option will disable the floating point sample option.

The "-c" option directs DUMPSEGY to copy any header information requested in binary form.

The "-f <output file>" option directs DUMPSEGY to output the information to that file.

TRACE RANGE OPTION: -r or -R

The "-r first:last:increment" or "-R first:last:increment" option directs DUMPSEGY tp process only those data traces within the range specified by "first:last". The value "first" is an integer number representing the sequential data trace number of the first trace to display, and the value "last" is an integer number representing the sequential data trace number of the last trace to display, relative to the first data trace in the SEG-Y file as trace number 1. The trace increment is an integer number

which DUMPSEGY will use to step through the data. If no increment is included in the range option an increment of 1 is used.

If the value of "first" is less than "last" and the trace increment is a positive integer, DUMPSEGY will maintain the trace "direction", or order, of the input file. If the value of "first" is greater than "last" and the increment is a negative integer, DUMPSEGY will output the data in reverse order relative to the input file. This allows DUMPSEGY to "reverse sort" the input data. If the value of "first" equals the value of "last", DUMPSEGY will process only that one data trace. Entering range information in a form other than described above will cause DUMPSEGY to behave unpredictably.

DUMPSEGY will exit to the system command line after processing the range of data specified. The output from DUMPSEGY for that trace range specified will be displayed on the user's terminal unless it has been directed to an output file (see **FILE OUTPUT OPTION**, below). If the output is displayed on the terminal, the user will have to respond to all the interactive prompts during the processing of traces within the specified range. If the output has been directed to a disk file, DUMPSEGY will not process any interactive prompts.

FILE OUTPUT OPTION: -f or -F

The "-f <output file>" or "-F <output file>" option directs DUMPSEGY to send the any output to the file specified by "file name". If DUMPSEGY can not open the file specified it will display a message to the user's terminal that it could not open "file name" and that output from the program will be redirected to the user's terminal. With the display of this message, the user may press <CR> to continue, or X<CR> to exit the program.

If this option is used without the "-r" option, DUMPSEGY will prompt the user for a data trace number, process that trace, and output all information to the specified file, and again prompt the user until a 0 (zero) is entered to exit the program. If the "-r" option is used, DUMPSEGY will process all the data traces in the specified range, output all information to the specified file, and exit the program.

The "-c" option directs DUMPSEGY to open the specified output file in binary mode. If no "-c" option is present, the output file is opened in text mode.

COPYING THE DATA IN BINARY FORM OPTION: -c or -C

The "-c" or "-C" option issued on the command line will "copy", or read, the specified input data in binary form. The "-c" and "-v" options are mutually exclusive and including both on the command line will cause DUMPSEGY to display the program usage information and exit. The user is recommended to specify an output file using the "-f" option. This option allows new SEG-Y files to be created from portions of the original SEG-Y input file. See **CREATING NEW SEG-Y FILES**, below.

CREATING NEW SEG-Y FILES

New SEG-Y files may be created from the original SEG-Y input file using the appropriate command line options, as shown in a series of examples below.

Example 1: General form of creating a SEG-Y file.

```
DUMPSEGY <inputfile> -c -e -b -t -f <output file> {-r first:last:increment}
```

The "-c", "-e", "-b", "-t" options are necessary to copy the EBCDIC header, the binary header, all data trace headers, and the data trace samples to output a fully functional SEG-Y file. Optionally, a trace range and increment could be included.

Example 2: Creating a SEG-Y file which is a subset of the input file.

DUMPSEGY <inputfile> -c -e -b -t -f <output file> -r 1:500

A range may be specified to create a subset of the original SEG-Y file, creating a SEG-Y <output file> containing the first 500 traces of the <input file>.

Example 3: Creating a single channel SEG-Y file from a multichannel input file.

DUMPSEGY <inputfile> -c -e -b -t -f <output file> -r 30:480:30

DUMPSEGY may be used to create a single fold ("100 percent") SEG-Y file from multichannel SEG-Y data. If the <input file> consists of 30 channel (30 traces per "shot") demultiplexed seismic data having 6 auxilary traces followed by 24 data traces, where the 30th trace in each "shot" is the trace nearest to the energy source (the "near trace"), the above DUMPSEGY command would produce an <output file> consisting of 16 traces representing the near trace from the 451 traces processed: traces 30, 60, 90, ..., 480 from the <input file>.

Example 4: Creating a SEG-Y file having the reverse sort order of the input file.

DUMPSEGY <input file> -c -e -b -t -f <output file> -r 500:1:-1

This will create a SEG-Y <output file> containing the first 500 traces from the <input file> "reverse sorted" into the <output file>. Where the <input file> has a trace order starting with trace "1" and increasing, the <output file> will start with trace "500" of the <input file> and end with trace "1" of the <input file>.

Example 5: Creating a SEG-Y file from multiple input files.

```
DUMPSEGY <inputfile> -c -e -b -t -f <output file 1> -r 1:50
DUMPSEGY <inputfile> -c -t -f <output file 2> -r 101:150
DUMPSEGY <inputfile> -c -t -f <output file 3> -r 201:250
```

New SEG-Y files may be created from portions of the same or different SEG-Y files in a manner similar to shown above. The first call to DUMPSEGY will create a full SEG-Y <output file> consisting of the data from the <input file> for the trace range specified. The next two calls to DUMPSEGY will create <output files> having only the trace headers and sample values for the data trace range specified. These three files may be concatenated together using the appropriate operating system command(s) to produce a SEG-Y file consisting of traces 1 - 50, 101 - 150, and 201 - 250 from the same or different <input file>. An example of the DOS method of contatenation is shown below:

```
copy <file 1> /B + <file 2> /B + <file 3>    <new output file>
```

The /B option is necessary to process binary format files and ignore the control-Z end of file marker in all but the last of the files to be concatenated.

DATA SAMPLE CONVERSION

Each SEG-Y sample is stored as four consecutive bytes in IBM-compatible format as defined in IBM Form GA 22-6821 (Barry, et al, 1975). These four bytes form a 32 bit word as defined by the SEG Committee on Technical Standards for the SEG-Y format (Barry, et al., 1975). Since DOS and UNIX-based systems internally represent numbers using the IEEE format, reading the IBM-format sample will result in the byte order being changed. For example, a 32 bit sample value may have the hexadecimal value 459AEAEB in IBM-format representation. Reading this value and assigning it to a long integer variable will convert it into the IEEE-format resulting in a hexadecimal value of EBEA9A45. In order to maintain the proper byte order, each byte of the four byte (32 bit) word must be read as an unsigned character and the sample built by "left-shifting" each byte into it's proper position.

Each 32 bit sample is then decomposed into a sign bit (Qs), a 7 bit characteristic (Qc) and a 24 bit fraction (Qf). The corresponding sample value may be calculated by the following:

sample value = Qs * 16^(Qc-64) * Qf

where 16^(Qc-64) is 16 raised to the (Qc-64) power.

SAMPLE DATA FILE

Included with this software publication is SAMPLE.SGY, a DOS copy of the first 125 traces of the SEG-Y final stacked section for the seismic line 624-79, located in the Point Barrow region in the National Petroleum Reserve in Alaska. SAMPLE.SGY, requiring 783600 bytes of disk space, may be used as an input file name for DUMPSEGY.

DISCLAIMER

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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.

Zihlman, F.N., 1992, PLOTSEGY V1.0: A DOS graphics program to display SEG-Y disk-image seismic data; U.S. Geological Survey Open File 92-349A and 92-349B.

TABLES

Table 1: DUMPSEGY command line options.

-e	Display the 40 line EBCDIC header.
-b	Display the 60 SEG-defined bytes of the binary header.
-t	Display the 180 SEG-defined bytes of each data trace header.
-v	Display the floating point value for each sample.
-n	Display file and header information only, no trace samples.
-f <output file>	Send the output to a file. If the "-c" option is included, open the file as a binary file, else open it as a text file.
-r first:last:increment	Process a range of traces.
-c	copy any requested information in binary format. If the "-f" option is included, open that file as a binary file.

Table 2: SEG-defined binary header values (Barry, et al., 1975). An example of the default display format for data trace number 1 from the example data set. Byte 3841 is the first sample in the data trace. Byte 9840 is the last byte of the last sample of the data trace. There are 6000 bytes in this data trace, with 4 bytes per sample, for a total of 1500 samples per trace.

Byte Numbers	Header Value Description
3201 - 3204	Job identification number.
3205 - 3208	Line number.
3209 - 3212	Reel number.
3213 - 3214	Number of data traces per record.
3215 - 3216	Number of auxiliary traces per record.
3217 - 3218	Sample interval, microseconds, this file (reel).
3219 - 3220	Sample interval, microseconds, original field recording.
3221 - 3222	Number of samples per data trace, this file (reel).

3223 - 3224	Number of samples per data trace, original field recording.	
3225 - 3226	Data sample format code:	1 = floating point (4 bytes)
		2 = fixed point (4 bytes)
		3 = fixed point (2 bytes)
		4 = fixed point with gain code (4 bytes).
	NOTE: DUMPSEGY only works with data sample format code 1 data.	
3227 - 3228	CDP fold.	
3229 - 3230	Trace sorting code:	1 = as recorded (no sorting)
		2 = CDP ensemble
		3 = single fold continuous profile
		4 = horizontally stacked
3231 - 3232	Vertical sum code:	1 = no sum
		2 = two sum
		...
		N = N sum (N = 32,767)
3233 - 3234	Sweep frequency at start.	
3235 - 3236	Sweep frequency at end.	
3237 - 3238	Sweep length, ms.	
3239 - 3240	Sweep type code:	1 = linear
		2 = parabolic
		3 = exponential
		4 = other
3241 - 3242	Trace number of sweep channel.	
3243 - 3244	Sweep trace taper length, ms, at start if tapered.	
3245 - 3246	Sweep trace taper length, ms, at end.	
3247 - 3248	Taper type:	1 = linear
		2 = cos
		3 = other
3249 - 3250	Correlated data traces:	1 = no
		2 = yes
3251 - 3252	Binary gain recovered:	1 = yes
		2 = no
3253 - 3254	Amplitude recovery method:	1 = none
		2 = spherical divergence
		3 = AGC
		4 = other
3255 - 3256	Measurement system:	1 = meters
		2 = feet
3257 - 3258	Impulse signal:	1 = Upward = negative number.
		2 = Upward = positive number.
3259 - 3260	Vibratory polarity code - seismic signal lags pilot signal by:	

1 = 337.5 - 22.5 degrees
2 = 22.5 - 67.5 degrees
3 = 67.5 - 112.5 degrees
4 = 112.5 - 157.5 degrees
5 = 157.5 - 202.5 degrees
6 = 202.5 - 247.5 degrees
7 = 247.5 - 292.5 degrees
8 = 292.5 - 337.5 degrees

3261 - 3600	Unassigned - for optional information.

Table 3: SEG-defined data trace header values (Barry, et al., 1975).

Byte Numbers	Header Value Description
1 - 4	Trace sequence number within line.
5 - 8	Trace sequence number within file (reel).
9 - 12	original field record number.
13 - 16	Trace number within original field record.
17 - 20	Energy source point number.
21 - 24	CDP ensemble number.
25 - 28	Trace number within the CDP ensemble.
29 - 30	Trace identification code: 1 = seismic data 2 = dead 3 = dummy 4 = time break 5 = uphole 6 = sweep 7 = timing 8 = water break 9 = N, optional use, N = 32,767
31 - 32	Number of vertically summed traces yielding this trace.
33 - 34	Number of horizontally stacked traces yielding this trace.
35 - 36	Data use: 1 = production 2 = test
37 - 40	Distance from source point to receiver group.
41 - 44	Receiver group elevation - above sea level are positive, below sea level are negative.
45 - 48	Surface elevation at source.
49 - 52	Source depth below surface (positive number).
53 - 56	Datum elevation at receiver group.
57 - 60	Datum elevation at source.
61 - 64	Water depth at source.
65 - 68	Water depth at group.
69 - 70	Scalar to be applied to all elevations & depths, specified in bytes 41 - 68 to give the real value. Scalar = 1, +/-10, +/-100, +/-1000, or +/-10,000. If positive, scalar is used as a multiplier; if negative, scalar is used as a divisor.
71 - 72	Scalar to be applied to all coordinate specified in bytes 73 - 88 to give the real value. Scalar = 1, +/-10, +/-100, +/-1000, or +/-10,000. If positive, scalar is used as a multiplier; if negative, scalar is used as a divisor.
73 - 76	Source coordinate - X.
77 - 80	Source coordinate - Y.

81 - 84	Group coordinate - X.	
85 - 88	Group coordinate - Y.	
	If the coordinate units are in seconds of arc, the X values represent longitude and the Y values represent latitude. A positive value designates the number of seconds east of Greenwich Meridian or north of the equator and a negative value designates the number of seconds south or west.	
89 - 90	Coordinate units:	1 = length (meters or feet)
		2 = seconds of arc
91 - 92	weathering velocity.	
93 - 94	Subweathering velocity.	
95 - 96	Uphole time at source.	
97 - 98	Uphole time at group.	
99 - 100	Source static correction.	
101 - 102	Group static correction.	
103 - 104	Total static applied.	
105 - 106	Lag time A. Time in ms between end of 240-byte trace identification header and time break. positive if time break occurs after end of header, negative if time break occurs before end of header. Time break is defined as the initiation pulse which may be recorded on an auxiliary trace or as otherwise specified by the recording system.	
107 - 108	Lag time B. Time in ms between the time break and the initiation time of the energy source. May be positive or negative.	
109 - 110	Delay recording time. Time in ms between initiation time of energy source and time when recording of data samples begins.	
111 - 112	Mute time - start.	
113 - 114	Mute time - end.	
115 - 116	Number of samples in this trace.	
117 - 118	Sample interval, in microseconds, for this trace.	
119 - 120	Gain type of field instruments:	1 = fixed
		2 = binary
		3 = floating point
		4 = --- N = optional use
121 - 122	Instrument gain constant.	
123 - 124	Instrument early or initial gain (db).	
125 - 126	Correlated:	1 = no
		2 = yes
127 - 128	Sweep frequency at start.	
129 - 130	Sweep frequency at end.	
131 - 132	Sweep length, ms.	
133 - 134	Sweep type:	1 = linear
		2 = parabolic
		3 = exponential

		4 = other
135 - 136	Sweep trace taper length at start, ms.	
137 - 138	Sweep trace taper length at end, ms.	
139 - 140	Taper type:	1 = linear
		2 = cos
		3 = other
141 - 142	Alias filter frequency.	
143 - 144	Alias filter slope.	
145 - 146	Notch filter frequency.	
147 - 148	Notch filter slope.	
149 - 150	Low cut frequency.	
151 - 152	High cut frequency.	
153 - 154	Low cut slope.	
155 - 156	High cut slope.	
157 - 158	Year data recorded.	
159 - 160	Day of year.	
161 - 162	Hour of day (24 hour clock).	
163 - 164	Minute of hour.	
165 - 166	Second of minute.	
167 - 168	Time basis code:	1 = local
		2 = GMT
		3 = other
169 - 170	Trace weighting factor - defined as 2^{-N} volts for the least significant bit. (N=0, 1,...,32,767)	
171 - 172	Geophone group number of roll switch position one.	
173 - 174	Geophone group number of trace number one within original field record.	
175 - 176	Geophone group number of last trace within original field record.	
177 - 178	Gape size (total number of groups dropped).	
179 - 180	Overtravel associated with taper at beginning or end of line:	1 = down (or behind)
		2 = up (or ahead)
181 - 240	Unassigned - for optional information.	
181 - 240		

FIGURES

```
USAGE:  dumpsegy {file name} {-e} {-b} {-t} {-n} {-v} {-c} {-f file} {-r}

{file name} MUST be provided, all other parameters are optional.

-e:                          - display EBCDIC header record.
-b:                          - display BINARY header record.
-t:                          - display individual trace header per trace
                               selected.
-v:                          - display actual SEG-Y sample value in decimal.
-n:                          - display all information EXCEPT trace samples.
-c:                          - copy data to an output file in binary format.
                               This option may be used to create a SEG-Y
                               file containing a subset of the original SEG-Y
                               file.
-f {file name}:              - redirect output to a file.
-r {start:stop:increment}: - sequential range of traces to display,
                               with an optional increment.

The -v and -c options are mutually exclusive and will cause DUMPSEGY to exit.

Optional parameters may be entered in any order.
```

Figure 1: Program usage information displayed to the user's terminal when DUMPSEGY is invoked with no parameters.

```
========== FILE INFORMATION =========
            file: SAMPLE.SGY

      sample rate: 4000.0 microsec
samples per trace:   1500
      data length:   6000 msec
  bytes per trace:   6240
    bytes in file: 3079920
   traces in file:    125
```

Figure 2: File information retrieved and displayed upon opening the specified SEG-Y input file.

```
[ 3841 -  3856] 0000 0000 0000 0000 0000 0000 0000 0000
[ 3857 -  3872] 0000 0000 0000 0000 0000 0000 0000 0000
[ 3873 -  3888] 0000 0000 0000 0000 0000 0000 0000 0000
.
.
.
[ 9793 -  9808] 4788 e33a 474b c1b4 46cf 8a0f 4774 8e1f
[ 9809 -  9824] c632 662e c814 6b52 c7fb f665 47b8 af5f
[ 9825 -  9840] 4813 7b8b 474b c30c c72c e92d c612 dba9
```

Figure 3: An example of the default display format for data trace number 1 from the example data set. Byte 3841 is the first sample in the data trace. Byte 9840 is the last byte of the last sample of the data trace. There are 6000 bytes in this data trace, with 4 bytes per sample, for a total of 1500 samples per trace.

```
C1  NPRA LINE 624-79..CREATED 6/91..TAPE LIBRARY SLOT 12133
C2  GSI PARTY 1182..9.5 LINE MILES
C3  SPTS 1-57..DATA LENGTH 6000 MS..SAMPLE RATE 4 MS..6 FOLD...AGC 1000 MS
C4  SHOT POINT IN HEADER ESPNUM AT BYTE 17, 4 BYTES, INTEGER
C5  ------------------------------------------------------------------
C6  NO WARRANTY EXPRESSED OR IMPLIED IS MADE BY THE U.S. GEOLOGICAL SURVEY,
C7  DEPT OF THE INTERIOR, AS TO THE ACCURACY OF THE DATA & RELATED MATERIALS
C8  PRESENTED HEREIN.  THE ACT OF DISTRIBUTION SHALL NOT CONSTITUTE ANY SUCH
C9  WARRANTY, AND NO RESPONSIBILITY IS ASSUMED BY THE U.S. GEOLOGICAL SURVEY
C10 IN THE USE OF THESE DATA AND RELATED MATERIALS.
C11 ------------------------------------------------------------------
C
C
C
.
.
.
C
```

Figure 4: An example of the EBCDIC header display initiated by command line option "-e".

[3201 - 3204]	jobID	241	000000f1
[3205 - 3208]	lineNumber	623779	000984a3
[3209 - 3212]	reelNumber	1	00000001
[3213 - 3214]	tracesPerRecord	48	0030
[3215 - 3216]	auxTracesPerRecord	0	0000
[3217 - 3218]	sampleRateReel	4000	0fa0
[3219 - 3220]	sampleRateOrig	0	0000
[3221 - 3222]	samplesPerTraceReel	1500	05dc
[3223 - 3224]	samplesPerTraceOrig	1501	05dd
[3225 - 3226]	dataFormatCode	1	0001
[3227 - 3228]	CDPfold	48	0030
[3229 - 3230]	traceSortCode	4	0004
[3231 - 3232]	verticalSumCode	1	0001
[3233 - 3234]	sweepFreqStart	0	0000
[3235 - 3236]	sweepFreqEnd	0	0000
[3237 - 3238]	sweepLength	0	0000
[3239 - 3240]	sweepTypeCode	0	0000
[3241 - 3242]	sweepChannelTraceNumber	0	0000
[3243 - 3244]	sweepTraceTaperLengthStart	0	0000
[3245 - 3246]	sweepTraceTaperLengthEnd	0	0000
[3247 - 3248]	taperType	0	0000
[3249 - 3250]	correlatedData	0	0000
[3251 - 3252]	binaryGainRecovered	0	0000
[3253 - 3254]	amplitudeRecovery	0	0000
[3255 - 3256]	measurementSystem	1	0001
[3257 - 3258]	impulseSignalPolarity	0	0000
[3259 - 3260]	vibratoryPolarityCode	0	0000

Figure 5: An example of the binary header display initiated by the command line option "-b".

[3601 -	3604]	traceSequenceNumberLine	1	00000001
[3605 -	3608]	traceSequenceNumberReel	1	00000001
[3609 -	3612]	origFieldRecordNumber	149	00000095
[3613 -	3616]	fieldRecordTraceNumber	0	00000000
[3617 -	3620]	energySourcePt	0	00000000
[3621 -	3624]	cdpNumber	101	00000065
[3625 -	3628]	traceCdpNumber	1	00000001
[3629 -	3630]	traceIdNumber	1	0001
[3631 -	3632]	verticallySummedTraces	1	0001
[3633 -	3634]	horizontallyStackedTraces	1	0001
[3635 -	3636]	dataUse	1	0001
[3637 -	3640]	sourceToReceiver	0	00000000
[3641 -	3644]	receiverElevation	0	00000000
[3645 -	3648]	sourceSurfaceElevation	0	00000000
[3649 -	3652]	sourceDepth	0	00000000
[3653 -	3656]	receiverDatumElevation	0	00000000
[3657 -	3660]	sourceDatumElevation	0	00000000
[3661 -	3664]	sourceWaterDepth	0	00000000
[3665 -	3668]	groupWaterDepth	0	00000000
[3669 -	3670]	elevationScalar	1	0001
[3671 -	3672]	coordinateScalar	1	0001
[3673 -	3676]	sourceXCoordinate	0	00000000
[3677 -	3680]	sourceYCoordinate	0	00000000
[3681 -	3684]	groupXCoordinate	0	00000000
[3685 -	3688]	groupYCoordinate	0	00000000
[3689 -	3690]	coordinateUnits	1	0001
[3691 -	3692]	weatheringVelocity	0	0000
[3693 -	3694]	subWeatheringVelocity	0	0000
[3695 -	3696]	sourceUpholeTime	0	0000
[3697 -	3698]	groupUpholeTime	0	0000
[3699 -	3700]	sourceStaticCorrection	0	0000
[3701 -	3702]	groupStaticCorrection	0	0000
[3703 -	3704]	totalStaticApplied	0	0000
[3705 -	3706]	lagTimeA	0	0000
[3707 -	3708]	lagTimeB	0	0000
[3709 -	3710]	delayRecordingTime	0	0000
[3711 -	3712]	muteTimeStart	0	0000
[3713 -	3714]	muteTimeEnd	6000	1770
[3715 -	3716]	numberOfSamples	1500	05dc
[3717 -	3718]	sampleInterval	4000	0fa0
[3719 -	3720]	gainType	0	0000
[3721 -	3722]	gainConstant	0	0000

```
[  3723 -   3724] initialGain                    0          0000
[  3725 -   3726] correlated                     0          0000
[  3727 -   3728] sweepFrequencyStart            0          0000
[  3729 -   3730] sweepFrequencyEnd              0          0000
[  3731 -   3732] sweepLength                    0          0000
[  3733 -   3734] sweepType                      0          0000
[  3735 -   3736] sweepTraceTaperStart           0          0000
[  3737 -   3738] sweepTraceTaperEnd             0          0000
[  3739 -   3740] taperType                      0          0000
[  3741 -   3742] aliasFilterFrequency           0          0000
[  3743 -   3744] aliasFilterSlope               0          0000
[  3745 -   3746] notchFilterFrequency           0          0000
[  3747 -   3748] notchFilterSlope               0          0000
[  3749 -   3750] lowCutFrequency                0          0000
[  3751 -   3752] highCutFrequency               0          0000
[  3753 -   3754] lowCutSlope                    0          0000
[  3755 -   3756] highCutSlope                   0          0000
[  3757 -   3758] yearRecorded                   0          0000
[  3759 -   3760] dayOfYear                      0          0000
[  3761 -   3762] hourOfDay                      0          0000
[  3763 -   3764] minuteOfHour                   0          0000
[  3765 -   3766] secondOfMinute                 0          0000
[  3767 -   3768] timeBasisCode                  1          0001
[  3769 -   3770] traceWeightingFactor          10          000a
[  3771 -   3772] geophoneNumberRollSwitch1      0          0000
[  3773 -   3774] geophoneNumberTrace1           0          0000
[  3775 -   3776] geophoneNumberLastTrace        0          0000
[  3777 -   3778] gapSize                        0          0000
[  3779 -   3780] overTravel                     0          0000
```

Figure 6: An example of the data trace header display initiated by command line option "-t".

```
[ 3841 -  3856] +0.000000e+00 +0.000000e+00 +0.000000e+00 +0.000000e+00
[ 3857 -  3872] +0.000000e+00 +0.000000e+00 +0.000000e+00 +0.000000e+00
[ 3873 -  3888] +0.000000e+00 +0.000000e+00 +0.000000e+00 +0.000000e+00
.
.
.
[ 9777 -  9792] +2.087452e+08 +2.421491e+08 -6.184693e+07 -4.641995e+07
[ 9793 -  9808] +1.435371e+08 +7.943661e+07 +1.360130e+07 +1.222169e+08
[ 9809 -  9824] -3.302958e+06 -3.425777e+08 -2.642018e+08 +1.936563e+08
[ 9825 -  9840] +3.268636e+08 +7.944211e+07 -4.709243e+07 -1.235881e+06
```

Figure 7: An example of the floating point display format for data trace number 1 from the example data set. Byte 3841 is the first sample in the data trace. Byte 9840 is the last byte of the last sample of the data trace. There are 6000 bytes in this data trace, with 4 bytes per sample, for a total of 1500 samples per trace.