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SEG-D, REVISION 1¹

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SEG-D CHANGES

A number of additions are being made to the SEG-D field tape format to make the format more useful in the current seismic data acquisition environment. These changes *are* intended to address the majority of short term needs in the industry today. A more extensive revision to the field tape format will be required within the next few years in order to address long term needs.

The new format will be called "SEG-D, Revision 1", indicating that it is a revised version of the original format. If the expanded features provided in Revision 1 are not used, then the format is compatible with the original SEG-D format.

SPECIFIC CHANGES:

1. To allow for additional defined fields in SEG-D headers, additional blocks are allowed for the General Header and Demux Trace Header.
2. Adding provision for an optional set of General Trailer blocks. This type header allows provisions for recording auxiliary seismic system and real-time navigation related data in the trailer. The trailer is optional and typically follows all other recorded data. The addition of the trailer will allow the accumulation of system faults, data QC information, real-time navigation position, and timing information on the same tape, and contiguous with, the shotpoint that it relates to. By recording this data after all of the other data, additional time is provided for collecting the data and transferring it to the recording system. The Trailer blocks take the same general form as the Channel Set Descriptor. Byte 11 uses the "Channel Type Identification" set to 1100 to indicate a Trailer block. Bytes 1 and 2 indicate the number of the General Trailer block, with the first block numbered as 1. All other information in the trailer is optional and may be formatted as desired by the manufacturer/user. The number of General Trailer blocks is indicated in bytes 13 and 14 of General Header Block #2.
3. Providing provision to include the revision of SEG-D format. Added to Bytes 11 and 12 of General Header Block #2 contain the SEG-D Revision Number. The revision number is a 16 bit unsigned binary number. The Revision number is 1 for the proposed version. In addition, in the General Header Block #1, nibble 1 of byte 12 contains the number of additional blocks in the general header. Nibble 1, byte 12 is an unsigned binary number. This number will be 1 or greater for SEG D Rev 1.
4. Adding provision to include the source and receiver locations for each source and receiver location. Source locations are included in the General Header Blocks. Block #3 contains the position for Source Set #1. Additional General Header Blocks may be included to allow for additional Source Sets. Source

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positions are defined by a Source Line Number (three bytes integer and two bytes fraction), a Source Point Number (three bytes integer and two bytes fraction), and a Source Point Index (one byte). This index allows several locations for the source in the grid, the original value is 1 and that value is incremented by 1 every time the source is moved, even when it is moved back to a previous location). Receiver locations are included in Trace Header Extensions to be used with Demux Trace Headers. Receiver positions are defined by a Receiver Line Number (three integer bytes and two fraction bytes), a Receiver Point Number (three bytes integer and two bytes fraction), and a Receiver Point Index (one byte). This index allows for defining the receiver group in the grid, the original value is 1 and that value is incremented by 1 every time the receiver is moved, even when it is moved back to the previous location).

5. Providing for the use of File Numbers greater than 9999. Bytes 1,2, and 3 in General Header Block #2 allow for a three byte, binary file number. When the file number is greater than 9999, bytes 1 and 2 in the General Header Block #1 must be set to FFFF.
6. Providing for Extended Channel Sets/Scan Types. General Header Block #2 allows for a two byte, binary number of Channel Sets/Scan Types in bytes 4 and 5. When using the Extended Channel Sets/Scan Types, byte 29 of General Header #1 must be set to FF.
7. Providing for additional Extended and External Header blocks. General Header Block #2 bytes 6 and 7 (for Extended Header blocks) and Bytes 8 and 9 (for External Header blocks) allow the use of a two byte, binary number to allow more than 99 blocks. When using these capabilities, General Header Block #1 byte 31 (for extended) and byte 32 (for external) must be set to FF.
8. Providing a mechanism for recording additional information about vibratory sources. Byte 15 of the General Header Block #N indicates the signal used to control vibrator phase. Byte 16 indicates the type of vibrator (P, Shear, Marine). Bytes 28 and 29 contain the phase angle between the pilot and the phase feedback signal. The additional vibrator information may be recorded for multiple sets of sources by using additional General Header blocks.
9. Providing for larger number of samples per trace. Using bytes 8, 9, and 10 of the Trace Header Extension.
10. Providing provisions for using 1/2" square tape cartridges. (ANSI X3.180 1989).
11. Allowing recording data in IEEE and other new formats.
Additional Valid Format Codes for bytes 3 & 4 of the General Header are:
0036 24 bit 2's compliment integer multiplexed
0038 32 bit 2's compliment integer multiplexed
0058 32 bit IEEE multiplexed
8036 24 bit 2's compliment integer demultiplexed
8038 32 bit 2's compliment integer demultiplexed
8058 32 bit IEEE demultiplexed

The IEEE format is fully documented in the IEEE standard, "ANSI/IEEE Std 754 - 1985", available from the IEEE. The IEEE format is summarized as follows:

bit	0	1	2	3	4	5	6	7
Byte 1	S	C ₇	C ₆	C ₅	C ₄	C ₃	C ₂	C ₁
Byte 2	C ₀	Q ₋₁	Q ₋₂	Q ₋₃	Q ₋₄	Q ₋₅	Q ₋₆	Q ₋₇
Byte 3	Q ₋₈	Q ₋₉	Q ₋₁₀	Q ₋₁₁	Q ₋₁₂	Q ₋₁₃	Q ₋₁₄	Q ₋₁₅
Byte 4	Q ₋₁₆	Q ₋₁₇	Q ₋₁₈	Q ₋₁₉	Q ₋₂₀	Q ₋₂₁	Q ₋₂₂	Q ₋₂₃

(see Note 1)

The value (v) of a floating-point number represented in this format is determined as follows:

if $e = 255$ & $f \neq 0$. . v = NaN	Not-a-Number (see Note 2)
if $e = 255$ & $f = 0$. . v = $(-1)^8 * \infty$	Overflow
if $0 < e < 255$ v = $(-1)^8 * 2^{-127} * (1.f)$	Normalized
if $e = 0$ & $f \neq 0$...v = $(-1)^8 * 2^{-126} * (0.f)$	Denormalized
if $e = 0$ & $f = 0$...v = $(-1)^8 * 0$	±zero

where e = binary value of all C's (exponent) and f = binary value of all Q's (fraction)

- NOTES: 1. Bit 7 of byte 4 must be zero to guarantee uniqueness of the start of scan in the Multiplexed format (0058). It may be non zero in the demultiplexed format (8058).
2. A Not-a-Number (NaN) is interpreted as an invalid number. All other numbers are valid and interpreted as described above.
12. Allowing for the use of blocked records. Allow blocked demultiplexed data (integral number of traces in a block). Headers will not be blocked. All records in a block will be the same size. Not all blocks will be the same size. Byte 20 in the general header (B1 = 1) will indicate blocked data. Blocks will be limited to 128 kilobytes. All traces in a block are in the same Channel Set.
 13. Adding the acceptance of ANSI standard X3.27 as the SEG standard for tape labels - as an option. This will be to cover only the label on the magnetic media, it does not cover an external label.
 14. Adding the effective stack order (unsigned binary), in byte 30 in the Channel Set descriptor. Set to 0 if the trace data was intentionally set to real 0. Set to 1 if no stack. Set to the effective stack order if the data is the result of stacked data (with or without processing).
 15. Improving definition of undefined fields. All undefined fields will be specified as: "This field is undefined by this format".
 16. Adding provisions for a Trace Edit byte (byte 10 of Demux Trace Header) to indicate traces zeroed for roll-on or roll-off and to indicate deliberately zeroed traces.

TR=0	No edit of this trace,
TR=1	Trace part of dead channels for roll-on or roll-off spread; trace intentionally zeroed.
TR=2	Trace intentionally zeroed.
 17. Increasing precision of MP factor, using byte 7 of the Channel Set descriptor.
 18. Since modern seismic vessels record more than one streamer at a time, a standard convention is required to identify which streamer recorded each channel of data. The Channel Set Descriptors are updated to handle this task. The definition of a channel set is expanded to include the following rules. A channel set is a group of channels that:

- (a) Use identical recording parameters. This includes the same record length and sample interval.
- (b) Use identical processing parameters, including the same filter selection and array forming parameters. A field has been added to Channel Set Descriptor byte 32 to describe any array forming applied to data in that channel set.
- (c) Originates from the same streamer cable for manne data. The streamer cable number for each channel set has been added to Channel Set Descriptor byte 31.
- (d) Consists of channels with the same group spacing. For example, if one steamer has short group spacing close to the boat and longer groups spacing at long offsets, the data from that steamer would be recorded as two channel sets.

In addition, the first channel in each channel set will start with Trace number one.

19. Correcting the MP factor calculation (refer to Appendix E7 in the SEG-D recording format description).

MP CALCULATION

The calculation of MP for a data recording method is given by one of the following equations:

- (a) $MP = FS - PA - C_{max}$; for binary exponents,
- (b) $MP = FS - PA - 2 \times C_{max}$; for quaternary exponents,
- (c) $MP = FS - PA - 4 \times C_{max}$; for hexadecimal exponents (except the 4 byte excess 64 method),
- (d) $MP = FS - PA - 4 (C_{max} - 64)$; for excess 64 hexadecimal exponents and for 4 byte IEEE exponents, where:

2^{FS} = Converter full scale (millivolts),

2^{PA} = Minimum system gain, and

C_{max} = maximum value of the data exponent,

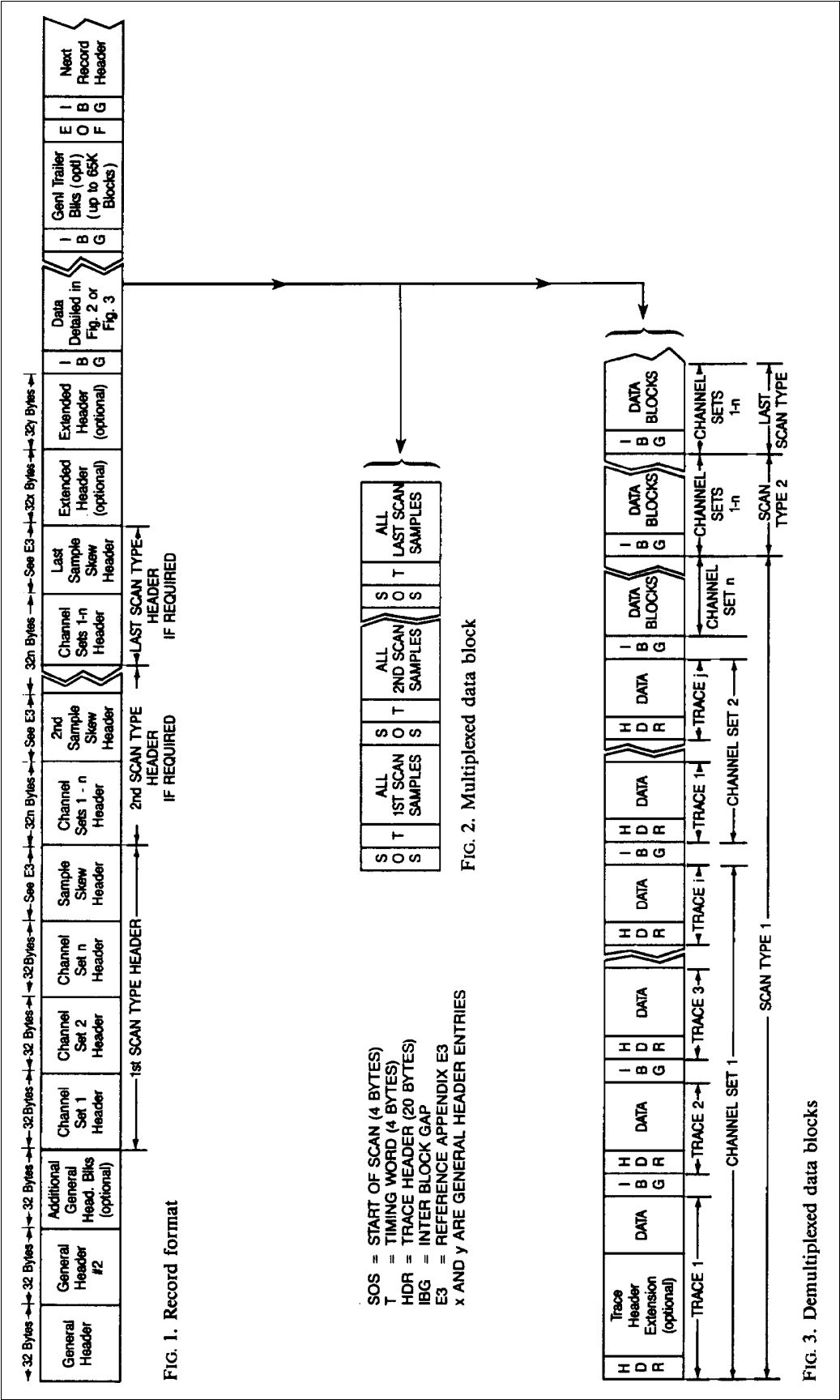
$C_{max} = 15$ for binary exponents,

7 for quaternary exponents,

3 for hexadecimal exponents except excess 64; and

64 for excess 64 exponents and for 4 byte IEEE exponents.

20. Adding the option for using record lengths in millisecond increments (rather than the previous 0.5 second increments). The Extended Record Length is the record ~length, in unsigned binary milliseconds, and is recorded in bytes 15-17 in General Header Block #2. If this option is used, Record Length (R), in the General Header Block #1, bytes 26, 27 must be set to FFF.



GENERAL HEADER #1									
BCD VALUE MSD	8	4	2	1	8	4	2	1	LSD
BINARY VALUE MSB	128	64	32	16	8	4	2	1	LSB
FILE NUMBER	F ₁	F ₁	F ₁	F ₁	F ₂	F ₂	F ₂	F ₂	1
	F ₃	F ₃	F ₃	F ₃	F ₄	F ₄	F ₄	F ₄	2
FORMAT CODE	Y ₁	Y ₁	Y ₁	Y ₁	Y ₂	Y ₂	Y ₂	Y ₂	3
	Y ₃	Y ₃	Y ₃	Y ₃	Y ₄	Y ₄	Y ₄	Y ₄	4
GENERAL CONSTANTS	K ₁	K ₁	K ₁	K ₁	K ₂	K ₂	K ₂	K ₂	5
	K ₃	K ₃	K ₃	K ₃	K ₄	K ₄	K ₄	K ₄	6
	K ₅	K ₅	K ₅	K ₅	K ₆	K ₆	K ₆	K ₆	7
	K ₇	K ₇	K ₇	K ₇	K ₈	K ₈	K ₈	K ₈	8
	K ₉	K ₉	K ₉	K ₉	K ₁₀	K ₁₀	K ₁₀	K ₁₀	9
	K ₁₁	K ₁₁	K ₁₁	K ₁₁	K ₁₂	K ₁₂	K ₁₂	K ₁₂	10
YEAR	YR ₁	YR ₁	YR ₁	YR ₁	YR ₂	YR ₂	YR ₂	YR ₂	11
# BLKS IN GEN HDR	GH ₃	GH ₂	GH ₁	GH ₀	DY ₁	DY ₁	DY ₁	DY ₁	12
DAY (DY)	DY ₂	DY ₂	DY ₂	DY ₂	DY ₃	DY ₃	DY ₃	DY ₃	13
HOURL	H ₁	H ₁	H ₁	H ₁	H ₂	H ₂	H ₂	H ₂	14
MINUTE	MI ₁	MI ₁	MI ₁	MI ₁	MI ₂	MI ₂	MI ₂	MI ₂	15
SECOND	SE ₁	SE ₁	SE ₁	SE ₁	SE ₂	SE ₂	SE ₂	SE ₂	16
MANUFACTURERS CODE	M ₁	M ₁	M ₁	M ₁	M ₂	M ₂	M ₂	M ₂	17
	M ₃	M ₃	M ₃	M ₃	M ₄	M ₄	M ₄	M ₄	18
	M ₅	M ₅	M ₅	M ₅	M ₆	M ₆	M ₆	M ₆	19
BYTES PER SCAN	B ₁	B ₁	B ₁	B ₁	B ₂	B ₂	B ₂	B ₂	20
	B ₃	B ₃	B ₃	B ₃	B ₄	B ₄	B ₄	B ₄	21
	B ₅	B ₅	B ₅	B ₅	B ₆	B ₆	B ₆	B ₆	22
BASE SCAN INTERVAL	I3	I2	I1	I0	I-1	I-2	I-3	I-4	23
POLARITY (P) S/B	P	P	P	P	S/BX ₃	S/BX ₂	S/BX ₁	S/BX ₀	24
SCANS/BLK EXPONENT	S/B ₇	S/B ₆	S/B ₅	S/B ₄	S/B ₃	S/B ₂	S/B ₁	S/B ₀	25
RECORD TYPE (Z)	Z	Z	Z	Z	R ₁	R ₁	R ₁	R ₁	26
RECORD LENGTH (R)	R ₂	R ₂	R ₂	R ₂	R ₃	R ₃	R ₃	R ₃	27
SCAN TYPES/RECORD	ST/R ₁	ST/R ₁	ST/R ₁	ST/R ₁	ST/R ₂	ST/R ₂	ST/R ₂	ST/R ₂	28
CHAN SETS/SCAN TYPE	CS ₁	CS ₁	CS ₁	CS ₁	CS ₂	CS ₂	CS ₂	CS ₂	29

SKEW BLOCKS	SK ₁	SK ₁	SK ₁	SK ₁	SK ₂	SK ₂	SK ₂	SK ₂	30
EXTENDED HEADER BLK	EC ₁	EC ₁	EC ₁	EC ₁	EC ₂	EC ₂	EC ₂	EC ₂	31
EXTERNAL HEADER BLK	EX ₁	EX ₁	EX ₁	EX ₁	EX ₂	EX ₂	EX ₂	EX ₂	32

HEADER BLOCK PARAMETERS

General Header, Block #1 All values are in packed BCD unless otherwise specified.		
Index Byte	Abbreviation	Description
1	F ₁ , F ₂	File number of four digits (0 - 9999), set to FFFF when the file number is greater than 9999. The expanded file number is contained in Bytes 1, 2, & 3 of General Header, Block #2.
2	F ₃ , F ₄	
3	Y ₁ , Y ₂	Format code: 0015 20 bit binary multiplexed 0022 8 bit quaternary multiplexed 0024 16 bit quaternary multiplexed 0036 24 bit 2's compliment integer multiplexed 0038 32 bit 2's compliment integer multiplexed 0042 8 bit hexadecimal multiplexed 0044 16 bit hexadecimal multiplexed 0048 32 bit hexadecimal multiplexed 0058 32 bit IEEE multiplexed 8015 20 bit binary demultiplexed 8022 8 bit quaternary demultiplexed 8024 16 bit quaternary demultiplexed 8036 24 bit 2's compliment integer demultiplexed 8038 32 bit 2's compliment integer demultiplexed 8042 8 bit hexadecimal demultiplexed 8044 16 bit hexadecimal demultiplexed 8048 32 bit hexadecimal demultiplexed 8058 32 bit IEEE demultiplexed 0200 Illegal, do not use 0000 Illegal, do not use
4	Y ₃ , Y ₄	
5	K ₁ , K ₂	General constants, 12 digits
6	K ₃ , K ₄	
7	K ₅ , K ₆	
8	K ₇ , K ₈	
9	K ₉ , K ₁₀	
10	K ₁₁ , K ₁₂	
11	YR ₁ , YR ₂	Last two digits of year (0-99)
12	GH ₁	Number of additional Blocks in General Header (unsigned binary). This number will be 1 or greater for SEG-D Rev 1.
	DY ₁	Julian day 3 digits (1-366)
13	DY ₂ , DY ₃	
14	H ₁ , H ₂	Hour of day 2 digits (0-23) (Greenwich Mean Time)
15	MI ₁ , MI ₂	Minute of hour 2 digits (0-59)

General Header, Block #1**All values are in packed BCD unless otherwise specified.**

Index Byte	Abbreviation	Description
16	SE ₁ , SE ₂	Second of minute 2 digits (0-59)
17	M ₁ , M ₂	Manufacturer's code 2 digits Note: See Appendix B for the current assignments
18	M ₃ , M ₄	Manufacturer's serial number, 4 digits
19	M ₅ , M ₆	
20	B ₁ , B ₂	Bytes per scan 6 digits (1 - 999,999) are utilized in the multiplexed formats to identify the number of bytes (including data, auxiliary, sync, and timing bytes, etc.) required to make up a complete scan. In a demultiplexed record, this field is not used and is recorded as zeros. (See Appendix E2 of the SEG-D Standard).
21	B ₃ , B ₄	
22	B ₅ , B ₆	
23	I ₃ thru I ₄	Base scan interval,--This is coded as a binary number with the LSB equal to 1/16 msec. This will allow sampling intervals from 1/16 through 8 msec in binary steps. Thus, the allowable base scan intervals are 1/16, 1/8, 1/4, 1/2, 1, 2, 4, and 8 msec. The base scan interval is always the difference between successive timing words. Each channel used will be sampled one or more times per base scan interval.
24	P	Polarity, --These 4 binary bits are measured on the sensors, cables, instrument, and source combination and are set into the system manually. The codes are: 0000 Untested 0001 Zero 0010 45 degrees 0011 90 degrees 0100 135 degrees 0101 180 degrees 0110 225 degrees 0111 270 degrees 1000 315 degrees 1001 1010 1011 1100 unassigned 1101 1110 1111
	S/BX ₃ thru S/BX ₀	This binary number (range 0 to 15) is an exponent of 2 and is used in conjunction with S/B (Byte 25).

General Header, Block #1**All values are in packed BCD unless otherwise specified.**

Index Byte	Abbreviation	Description
25	S/B ₇ thru S/B ₀	This binary number (range 0 to 255) is used in Conjunction with S/BX (see Byte 24) to indicate the Number of scans in a block. If it is 0, the data body is one continuous block. Otherwise, the data body is composed of multiple blocks, each block containing S/B x 2 ^{S/BX} scans. It is valid only for multiplexed data.
26	Z,	Record Type Bits 0123 0010 Test record 0100 Parallel channel test 0110 Direct channel test 1001 Normal record 0001 Other
	R ₁	Record length from time zero (in increments of 0.5 Times 1.024 sec). This value can be set from 00.5 to 99.5 representing times from 0.512 sec. to 101.888 sec. A setting of 00.0 indicates the record length is Indeterminate. These three nibbles must be set to FFF when using the Extended Record Length (record length in milliseconds), bytes 15-17, in General Header Block #2.
27	R ₂ , R ₃	
28	ST/R ₁ , ST/R ₂	Scan types per record. This 2 digit code is the number of scan types per record (1-99). (Zero is invalid.)
29	CS ₁ , CS ₂	Number of channel sets per scan type (1-99). (Zero is invalid; set to FF when using Extended channel sets/scan types.) This 2 digit code is the number of channel sets per scan. If multiple scan types are used (such as in a switching sampling interval environment), this number is equal to the number of channel sets contained in the scan type with the largest number of channel sets. If scan types also exist with less than this maximum number of channel sets per scan type, dummy channel set descriptors will have to be recorded in the scan type header. This can be done by setting the number of channels in the dummy channel set descriptor to zero (reference Bytes 9 and 10 of the scan type header description). Example 6 illustrates this requirement.
30	SK ₁ , SK ₂	Number of 32 byte fields added to the end of each scan type header in order to record the sample skew of all channels (0-99). (See Appendix E3 of the SEG-D Standard). Zero indicates that skew is not recorded.
31	EC ₁ , EC ₂	Extended header length. The extended header is used to record additional equipment parameters. The two digits (0-99) in this field specify the number of 32 byte extensions. If more than 99 extensions, then these bytes are set to FF. Bytes 6 and 7 of General Header Block #2 contain the number of 32 byte extensions.

General Header, Block #1

All values are in packed BCD unless otherwise specified.

Index Byte	Abbreviation	Description
32	EX ₁ , EX ₂	External header length. The external header is used to record additional user supplied information in the header. The two digits (0-99) in this field specify the number of 32 byte extensions. If more than 99 extensions, then these bytes are set to FF. Bytes 8 and 9 of General Header Block #2 contain the number of 32 byte extensions.

GENERAL HEADER, BLOCK #2

BCD VALUE MSD	8	4	2	1	8	4	2	1	LSD
BINARY VALUE MSB	128	64	32	16	8	4	2	1	LSB
EXPANDED FILE NUMBER	EF ₂₃	EF ₂₂	EF ₂₁	EF ₂₀	EF ₁₉	EF ₁₈	EF ₁₇	EF ₁₆	1
	EF ₁₅	EF ₁₄	EF ₁₃	EF ₁₂	EF ₁₁	EF ₁₀	EF ₉	EF ₈	2
	EF ₇	EF ₆	EF ₅	EF ₄	EF ₃	EF ₂	EF ₁	EF ₀	3
EXTENDED CHANNEL SETS/SCAN TYPE	EN ₁₅	EN ₁₄	EN ₁₃	EN ₁₂	EN ₁₁	EN ₁₀	EN ₉	EN ₈	4
	EN ₇	EN ₆	EN ₅	EN ₄	EN ₃	EN ₂	EN ₁	EN ₀	5
EXTENDED HEADER BLOCKS	ECX ₁₅	ECX ₁₄	ECX ₁₃	ECX ₁₂	ECX ₁₁	ECX ₁₀	ECX ₉	ECX ₈	6
	ECX ₇	ECX ₆	ECX ₅	EGX ₄	ECX ₃	ECX ₂	ECX ₁	ECX ₀	7
EXTERNAL HEADER BLOCKS	EH ₁₅	EH ₁₄	EH ₁₃	EH ₁₂	EH ₁₁	EH ₁₀	EH ₉	EH ₈	8
	EH ₇	EH ₆	EH ₅	EH ₄	EH ₃	EH ₂	EH ₁	EH ₀	9
	X	X	X	X	X	X	X	X	10
SEG-D REVISION NUMBER	REV ₇	REV ₆	REV ₅	REV ₄	REV ₃	REV ₂	REV ₁	REV ₀	11
	REV ₋₁	REV ₋₂	REV ₋₃	REV ₋₄	REV ₋₅	REV ₋₆	REV ₋₇	REV ₋₈	12
GENERAL TRAILER, NUMBER OF BLOCKS	GT ₁₅	GT ₁₄	GT ₁₃	GT ₁₂	GT ₁₁	GT ₁₀	GT ₉	GT ₈	13
	GT ₇	GT ₆	GT ₅	GT ₄	GT ₃	GT ₂	GT ₁	GT ₀	14
EXTENDED RECORD LENGTH	ERL ₂₃	ERL ₂₂	ERL ₂₁	ERL ₂₀	ERL ₁₉	ERL ₁₈	ERL ₁₇	ERL ₁₆	15
	ERL ₁₅	ERL ₁₄	ERL ₁₃	ERL ₁₂	ERL ₁₁	ERL ₁₀	ERL ₉	ERL ₈	16
	ERL ₇	ERL ₆	ERL ₅	ERL ₄	ERL ₃	ERL ₂	ERL ₁	ERL ₀	17
GEN. HEADER BLOCK #	X	X	X	X	X	X	X	X	18
	0	0	0	0	0	0	1	0	19
	X	X	X	X	X	X	X	X	20
	X	X	X	X	X	X	X	X'	21
	X	X	X	X	X	X	X	X	22

GENERAL HEADER, BLOCK #2									
BCD VALUE MSD	8	4	2	1	8	4	2	1	LSD
BINARY VALUE MSB	128	64	32	16	8	4	2	1	LSB
	X	X	X	X	X	X	X	X	23
	X	X	X	X	X	X	X	X	24
	X	X	X	X	X	X	X	X	25
	X	X	X	X	X	X	X	X	26
	X	X	X	X	X	X	X	X	27
	X	X	X	X	X	X	X	X	28
	X	X	X	X	X	X	X	X	29
	X	X	X	X	X	X	X	X	30
	X	X	X	X	X	X	X	X	31
	X	X	X	X	X	X	X	X	32

GENERAL HEADER BLOCK #2		
Index Byte	Abbreviation	Description
1,2,3	EF ₂₃ – EF ₀	Expanded File Number (three bytes, unsigned binary). For file numbers greater than the 9999, bytes 1 and 2 of the General Header Block #1 must be set to FFFF.
4,5	EN ₁₅ – EN ₀	Extended Channel Sets/Scan Types (two bytes, unsigned binary). Allows the number of Channel Sets/Scan Types to be greater than the 99 allowed in the standard General Header (byte 29). When using the Extended Channel Sets/Scan Types, byte 29 of General Header Block #1 must be set to FF.
6,7	ECX ₁₅ – ECX ₀	Extended Header Blocks (two bytes, unsigned binary). Allows the number of Extended Header Blocks (of 32 bytes each) to be greater than the 99 allowed by the standard General Header (byte 31). To use more than 99 Extended Header Blocks, set byte 31 of General Header Block #1 to FF, and use these two bytes.
8,9	EH ₁₅ – EH ₀	External Header Blocks (two byte, unsigned binary). Allows the number of 32 byte External Header Blocks to be greater than the 99 allowed by the General Header (byte 32). To use more than 99 External Header Blocks, set byte 32 of General Header Block #1 to FF, and use these two bytes.
10	X	These fields are undefined by the format and may have any value.
11,	REV ₇ – REV ₀	SEG-D Revision Number (One byte unsigned binary with one byte binary fraction. Revisions 0 to 0.N are not valid.). This version is Rev 1.00. Number of Blocks of General Trailer (two bytes, unsigned binary). The number of 32 byte blocks to be used to General Trailers.
12	REV ₋₁ – REV ₋₈	
13,14	GT ₁₅ – GT ₀	
15,16,17	ERL ₂₃ – ERL ₀	Extended Record Length (three bytes, unsigned binary) indicates the record length in milliseconds. When using Extended Record Length, the Record Length in the General Header Block #1 (bytes 26,27) must be set to FFF.
18	X	These fields are undefined by format and may have any value.
19	BN ₇ – BN ₀	General Header Block Number (one byte unsigned binary), set to 2 for this block. Zero is not valid.
20 – 32	X	These fields are undefined by format and may have any value.

NOTES:

- Where the range of allowable numbers is not indicated, the follow ranges apply.
 One byte unsigned binary, range is 0 - FF,
 Two byte unsigned binary, range is 0 - FFFF,
 Three byte, two's complement, signed binary; range is - 7FFFFFFF to +7FFFFFFF

GENERAL HEADER, BLOCK N									
BCD VALUE MSD	8	4	2	1	8	4	2	1	LSD
BINARY VALUE MSB	128	64	32	16	8	4	2	1	LSB
	X	X	X	X	X	X	X	X	1
	X	X	X	X	X	X	X	X	2
	X	X	X	X	X	X	X	X	3
SOURCE LINE NUMBER (INTEGER)	SLN ₅	SLN ₂₂	SLN ₂₁	SLN ₂₀	SLN ₁₉	SLN ₁₈	SLN ₁₇	SLN ₁₆	4
	SLN ₁₅	SLN ₁₄	SLN ₁₃	SLN ₁₂	SLN ₁₁	SLN ₁₀	SLN ₉	SLN ₈	5
	SLN ₇	SLN ₆	SLN ₅	SLN ₄	SLN ₃	SLN ₂	SLN ₁	SLN ₀	6
SOURCE LINE NUMBER (FRACTION)	SLN ₋₁	SLN ₋₂	SLN ₋₃	SLN ₋₄	SLN ₋₅	SLN ₋₆	SLN ₋₇	SLN ₋₈	7
	SLN ₋₉	SLN ₋₁₀	SLN ₋₁₁	SLN ₋₁₂	SLN ₋₁₃	SLN ₋₁₄	SLN ₋₁₅	SLN ₋₁₆	8
SOURCE POINT NUMBER (INTEGER)	SPN ₅	SPN ₂₂	SPN ₂₁	SPN ₂₀	SPN ₁₉	SPN ₁₈	SPN ₁₇	SPN ₁₆	9
	SPN ₁₅	SPN ₁₄	SPN ₁₃	SPN ₁₂	SPN ₁₀	SPN ₁₀	SPN ₉	SPN ₈	10
	SPN ₇	SPN ₆	SPN ₅	SPN ₄	SPN ₃	SPN ₂	SPN ₁	SPN ₀	11
SOURCE POINT NUMBER (FRACTION)	SPN ₋₁	SPN ₋₂	SPN ₋₃	SPN ₋₄	SPN ₋₅	SPN ₋₆	SPN ₋₇	SPN ₋₈	12
	SPN ₋₉	SPN ₋₁₀	SPN ₋₁₁	SPN ₋₁₂	SPN ₋₁₃	SPN ₋₁₄	SPN ₋₁₅	SPN ₋₁₆	13
SOURCE POINT INDEX	SPI ₇	SPI ₆	SPI ₅	SPI ₄	SPI ₃	SPI ₂	SPI ₁	SPI ₀	14
PHASE CONTROL	PC ₇	PC ₆	PC ₅	PC ₄	PC ₃	PC ₂	PC ₁	PC ₀	15
TYPE VIBRATOR	V ₇	V ₆	V ₅	V ₄	V ₃	V ₂	V ₁	V ₀	16
PHASE ANGLE	PA ₅	PA ₁₄	PA ₁₃	PA ₁₂	PA ₁₁	PA ₁₀	PA ₉	PA ₈	17
	PA ₇	PA ₆	PA ₅	PA ₄	PA ₃	PA ₂	PA ₁	PA ₀	18
GEN.HEADER BLOCK #	BN ₇	BN ₆	BN ₅	BN ₄	BN ₃	BN ₂	BN ₁	BN ₀	19
SOURCE SET NUMBER	SS ₇	SS ₆	SS ₅	SS ₄	SS ₃	SS ₂	SS ₁	SS ₀	20
	X	X	X	X	X	X	X	X	21
	X	X	X	X	X	X	X	X	22
	X	X	X	X	X	X	X	X	23
	X	X	X	X	X	X	X	X	24
	X	X	X	X	X	X	X	X	25
	X	X	X	X	X	X	X	X	26
	X	X	X	X	X	X	X	X	27
	X	X	X	X	X	X	X	X	28
	X	X	X	X	X	X	X	X	29

GENERAL HEADER, BLOCK N									
BCD VALUE MSD	8	4	2	1	8	4	2	1	LSD
BINARY VALUE MSB	128	64	32	16	8	4	2	1	LSB
	X	X	X	X	X	X	X	X	30
	X	X	X	X	X	X	X	X	31
	X	X	X	X	X	X	X	X	32

GENERAL HEADER BLOCK #N (N Greater than 2)		
Index Byte	Abbreviation	Description
1,2,3	X	These fields are undefined by format and may have any value.
4,5,6	SLN _S , SLN ₂₂ – SLN ₀	Source Line Number, Integer (three bytes, two's complement, signed binary). General Header Block #2 contains the source location for one Source Set. Additional General Header Blocks may be used to provide position information for additional source sets.
7,8	SLN ₋₁ – SLN ₋₁₆	Source Line Number, Fraction
9,10,11	SPN _S , SPN ₂₂ – SPN ₀	Source Point Number, Integer (three bytes, two's complement, signed binary).
12,13	SPN ₋₁ – SPN ₋₁₆	Source Point Number, Fraction.
14	SPI ₇ – SPI ₀	Source Point Index (one byte, unsigned binary). This index allows several locations for the source in the grid, the original value is one and that value is incremented by one every time the source is moved, even when it is moved back to a previous location. Zero value means that the Source Point Index is not recorded.
16	V ₇ – V ₀	Type Vibrator (unsigned binary). Type not recorded 00 P wave vibrator 01 Shear wave vibrator 02 Marine vibrator 03 Other types may be added later.
17,18	PA _S , PA ₁₄ – PA ₀	Phase Angle (two bytes, two's complement, signed binary). The Phase angle of the intercept of the pilot signal with respect to the phase feedback signal, measured in degrees. Phase Angle is set to zero when Phase Control (Byte 15) is zero (Phase Control not recorded).
19	BN ₇ – BN ₀	General Header Block Number (one byte unsigned binary). Set to N for this block. Zero is not valid.
20	SS ₇ – SS ₀	Source Set Number (unsigned binary). Used to allow multiple sets of sources. Zero is not valid.

GENERAL HEADER BLOCK #N (N Greater than 2)		
Index Byte	Abbreviation	Description
21-32	X	These fields are undefined by format and may have any value.

Scan type header (channel set descriptor)

The scan type header is determined by the system configuration and consists of one or more channel set descriptors each of 32 bytes followed by a series of 32 byte sample skew fields. A channel set is defined as a group of channels operating with the same set of parameters and being sampled as part of a scan of data. A scan type header can be composed of from 1 to 99 channel set descriptors. If dynamic parameter changes are required during the recording, additional scan type headers must be added, each containing the channel set descriptors necessary to define the new parameters. Each scan type header must have the same number of channel set descriptors (see Appendix E4 of the SEG-D standard for header length calculation).

CHANNEL SET DESCRIPTOR		
Index Byte	Abbreviation	Description
1	ST ₁ , ST ₂	These two digits (1-99) identify the number of the scan type header to be described by the subsequent bytes. The first scan type header is 1 and the last scan type header number is the same value as Byte 28 (ST/R) of the General Header Block #1. If a scan type header contains more than one channel set descriptor, the scan type header number will be repeated in each of its channel set descriptors. If the system does not have dynamic parameter changes during the record, such as switched sampling intervals, there will only be one scan type header required.
2	CN ₁ , CN ₂	These two digits (1-99) identify the channel set to be described in the next 30 bytes within this scan type header. The first channel set is "1" and the last channel set number is the same number as Byte 29 (CS) of the General Header Block #1. If the scan actually contains fewer channel sets than CS, then dummy channel set descriptors are included as specified in Byte 29 of General Header Block #1. Set to FF when using Channel Sets beyond 99.
3	TF ₁₆ thru TF ₉	Channel set starting time. This is a binary number where TF ₁ = 2 ¹ msec (2-msec increments). This number identifies the timing word of the first scan of data in this channel set. In a single scan type record, this would typically be recorded as a zero (an exception might be deep water recording). In multiple scan type records, this number represents the starting time, in milliseconds, of the channel set. Start times from 0 to 131,070 msec (in 2-msec increments) can be recorded.
4	TF ₈ thru TF ₁	
5	TE ₁₆ thru TE ₉	Channel set end time. This is a binary number where TE ₁ = 2 ¹ milliseconds (2 millisecond increments). These two bytes represent the record end time of the channel set in milliseconds. In a multiplexed record, all channels of a channel set must be of the same length. TE may be used in a demultiplexed record to allow the termination of a particular channel set shorter than other channel sets within its scan type. In a single scan type record, bytes 5 and 6 would be the length of the record. End times up to 131,070 msec (in 2-msec increments) can be recorded.
6	TE ₈ thru TE ₁	
7	MP ₋₃ , MP ₋₁₀	Optional byte which extends the resolution available for MP factor.

CHANNEL SET DESCRIPTOR		
Index Byte	Abbreviation	Description
8	MP _S , MP ₄ thru MP ₋₂	This sign magnitude binary number is the exponent of the base 2 multiplier to be used to descale the data on tape to obtain input voltage in millivolts. The radix point is between MP ₀ and MP ₋₁ . This multiplier has a range of $2^{31.75}$ to $2^{-31.75}$. (See Appendix E7 of the SEG-D Standard.)
9	C/S ₁ , C/S ₂	This is the number of channels in this channel set. It can assume a number from 0-9999.
10	C/S ₃ , C/S ₄	
11	C ₁ , 0	Channel type identification: 0123 Bits 0111 Other 0110 External Data 0101 Time counter ² 0100 Water break 0011 Up hole 0010 Time break 0001 Seis 0000 Unused 1000 Signature/unfiltered 1001 Signature/filtered 1100 Auxiliary Data Trailer
12	S/C	This packed BCD number is an exponent of 2. The number ($2^{S/C}$) represents the number of subscans of this channel set in the base scan. Possible values for this parameter ($2^{S/C}$) are 1 to 512 (20 to 29). Reference Byte 23 of the General Header Block #1.
12	J	Channel gain control method.
13	AF ₁ , AF ₂	Alias filter frequency. It can be coded for any frequency from 0 to 9999 Hz.
14	AF ₃ , AF ₄	
15	0, AS ₁	Alias filter slope in dB per octave. It can be coded from 0 to 999 dB in 1-dB steps. A zero indicates the filter is out (see Appendix E5 for definition).
16	AS ₂ , AS ₃	
17	LC ₁ , LC ₂	Low-cut filter setting. It can be coded for any frequency from 0 to 9999 Hz.
18	LC ₃ , LC ₄	
19	0, LS ₁	Low-cut filter slope. It can be coded for any slope from 0 to 999 dB per octave. A zero slope indicates the filter is out. (See Appendix E5 for definition.)
20	LS ₂ , LS ₃	

² Illegal code for this format because the timing counter is part of the start of scan and cannot be identified as part of a channel.

CHANNEL SET DESCRIPTOR		
Index Byte	Abbreviation	Description
21	NT ₁ , NT ₂	Notch frequency setting. It can be coded for any frequency from 0 to 999.9 Hz. The out filter is written as 000.0 Hz.
22	NT ₃ , NT ₄	
The following notch filters are coded in a similar manner:		
23	NT ₁ , NT ₂	Second notch frequency
24	NT ₃ , NT ₄	
25	NT ₁ , NT ₂	Third notch frequency
26	NT ₃ , NT ₄	
27,28	ECS ₁₅ – ECS ₀	Extended Channel Set Number (two byte unsigned binary). Contains the complete value that is (or should have been) contained in byte two (CN ₁ , CN ₂). Allows additional Channel Sets, beyond the 99 which can be described in byte two. When using Channel sets beyond 99, or when using binary numbers for the Channel Set Number, set byte 2 (CN ₁ , CN ₂) to FF.
29	EFH ₃ – EFH ₀	Extended Header flag (one nibble, four bits, unsigned binary). Set to 1 to indicate that the extended header contains additional information on the channel set.
30	VS ₇ – VS ₀	Vertical Stack (one byte, unsigned binary). Effective stack order. Set to zero if the trace data was intentionally set to real zero. Set to one if no stack. Set to the effective stack order if the data is the result of stacked data (with or without processing).
31	CAB ₇ – CAB ₀	Streamer Cable number (8 bit unsigned binary). Required for streamer data only. Identifies the number of the streamer cable that will be identified in this block. The starboard-most cable is identified as cable 1 while the Port most cable is N. Zero means that the Streamer Cable number has not been recorded.
32	ARY ₇ – ARY ₀	Array Forming (8 bit binary). Identifies whether the data in this channel set is the result of array forming. 01 Hex No array forming. 02 Hex 2 groups summed, no weighting. 03 Hex 3 groups summed, no weighting. 04 Hex 4 groups summed, no weighting. 0N Hex N groups summed, no weighting. 1N Hex N groups weighted, overlapping, summation.

Scan Type Header (Channel Set Descriptor)									
Bit	0	1	2	3	4	5	6	7	
BCD VALUE MSD	8	4	2	1	8	4	2	1	
BINARY VALUE MSB	128	64	32	16	8	4	2	1	
SCAN TYPE NUMBER	ST ₁	ST ₁	ST ₁	ST ₁	ST ₂	ST ₂	ST ₂	ST ₂	1
CHANNEL SET NUMBER	CN ₁	CN ₁	CN ₁	CN ₁	CN ₂	CN ₂	CN ₂	CN ₂	2
CHANNEL SET START TIME	TF ₁₆	TF ₁₅	TF ₁₄	TF ₁₃	TF ₁₂	TF ₁₁	TF ₁₀	TF ₉	3
	TF ₈	TF ₇	TF ₆	TF ₅	TF ₄	TF ₃	TF ₂	TF ₁	4
CHANNEL SET END TIME	TE ₁₆	TE ₁₅	TE ₁₄	TE ₁₃	TE ₁₂	TE ₁₁	TE ₁₀	TE ₉	5
	TE ₈	TE ₇	TE ₆	TE ₅	TE ₄	TE ₃	TE ₂	TE ₁	6
DESCALE MULTIPLIER	MP ₋₃	MP ₋₄	MP ₋₅	MP ₋₆	MP ₋₇	MP ₋₈	MP ₋₉	MP ₋₁₀	7
	MP ₅	MP ₄	MP ₃	MP ₂	MP ₁	MP ₀	MP ₋₁	MP ₋₂	8
NUMBER OF CHANNELS	C/S ₁	C/S ₁	C/S ₁	C/S ₁	C/S ₂	C/S ₂	C/S ₂	C/S ₂	9
	C/S ₃	C/S ₃	C/S ₃	C/S ₃	C/S ₄	C/S ₄	C/S ₄	C/S ₄	10
CHANNEL TYPE	C ₁	C ₁	C ₁	C ₁	0	0	0	0	11
SAMPLE/CHANNEL CHANNEL GAIN	S/C	S/C	S/C	S/C	J	J	J	J	12
ALIAS FILTER FREQUENCY	AF ₁	AF ₁	AF ₁	AF ₁	AF ₂	AF ₂	AF ₂	AF ₂	13
	AF ₃	AF ₃	AF ₃	AF ₃	AF ₄	AF ₄	AF ₄	AF ₄	14
ALIAS FILTER SLOPE	0	0	0	0	AS ₁	AS ₁	AS ₁	AS ₁	15
	AS ₂	AS ₂	AS ₂	AS ₂	AS ₃	AS ₃	AS ₃	AS ₃	16
LOW CUT FILTER	LC ₁	LC ₁	LC ₁	LC ₁	LC ₂	LC ₂	LC ₂	LC ₂	17
	LC ₃	LC ₃	LC ₃	LC ₃	LC ₄	LC ₄	LC ₄	LC ₄	18
LOW CUT FILTER SLOPE	0	0	0	0	LS ₁	LS ₁	LS ₁	LS ₁	19
	LS ₂	LS ₂	LS ₂	LS ₂	LS ₃	LS ₃	LS ₃	LS ₃	20
FIRST NOTCH FILTER	NT ₁	NT ₁	NT ₁	NT ₁	NT ₂	NT ₂	NT ₂	NT ₂	21
	NT ₃	NT ₃	NT ₃	NT ₃	NT ₄	NT ₄	NT ₄	NT ₄	22
SECOND NOTCH FILTER	NT ₁	NT ₁	NT ₁	NT ₁	NT ₂	NT ₂	NT ₂	NT ₂	23
	NT ₃	NT ₃	NT ₃	NT ₃	NT ₄	NT ₄	NT ₄	NT ₄	24
THIRD NOTCH FILTER	NT ₁	NT ₁	NT ₁	NT ₁	NT ₂	NT ₂	NT ₂	NT ₂	25
	NT ₃	NT ₃	NT ₃	NT ₃	NT ₄	NT ₄	NT ₄	NT ₄	26

Scan Type Header (Channel Set Descriptor)									
Bit	0	1	2	3	4	5	6	7	
BCD VALUE MSD	8	4	2	1	8	4	2	1	
BINARY VALUE MSB	128	64	32	16	8	4	2	1	
EXTENDED CHANNEL SET NUMBER	EC ₁₅	EC ₁₄	EC ₁₃	EC ₁₂	EC ₁₁	EC ₁₀	EC ₉	EC ₈	27
	EC ₇	EC ₆	EC ₅	EC ₄	EC ₃	EC ₂	EC ₁	EC ₀	28
EXTEND. HEADER FLAG	EFH ₃	EFH ₂	EFH ₁	EFH ₀	X	X	X	X	29
VERTICAL STACK	VS ₇	VS ₆	VS ₅	VS ₄	VS ₃	VS ₂	VS ₁	VS ₀	30
STREAMER NO.	CAB ₇	CAB ₆	CAB ₅	CAB ₄	CAB ₃	CAB ₂	CAB ₁	CAB ₀	31
ARRAY FORMING	ARY ₇	ARY ₆	ARY ₅	ARY ₄	ARY ₃	ARY ₂	ARY ₁	ARY ₀	32

Demux Trace Header									
Bit	0	1	2	3	4	5	6	7	
BCD VALUE MSD	8	4	2	1	8	4	2	1	
BINARY VALUE MSB	128	64	32	16	8	4	2	1	
CHANNEL SET NUMBER	CN ₁	CN ₁	CN ₁	CN ₁	CN ₂	CN ₂	CN ₂	CN ₂	4
TRACE NUMBER	TN ₁	TN ₁	TN ₁	TN ₁	TN ₂	TN ₂	TN ₂	TN ₂	5
	TN ₃	TN ₃	TN ₃	TN ₃	TN ₄	TN ₄	TN ₄	TN ₄	6
FIRST TIMING WORD	T ₁₅	T ₁₄	T ₁₃	T ₁₂	T ₁₁	T ₁₀	T ₉	T ₈	7
	T ₇	T ₆	T ₅	T ₄	T ₃	T ₂	T ₁	T ₀	8
	T ₋₁	T ₋₂	T ₋₃	T ₋₄	T ₋₅	T ₋₆	T ₋₇	T ₋₈	9
TRACE HEADER EXTEN.	THE ₇	THE ₆	THE ₅	THE ₄	THE ₃	THE ₂	THE ₁	THE ₀	10
SAMPLE SKEW	SSK ₋₁	SSK ₋₂	SSK ₋₃	SSK ₋₄	SSK ₋₅	SSK ₋₆	SSK ₋₇	SSK ₋₈	11
TRACE EDIT	TR ₇	TR ₆	TR ₅	TR ₄	TR ₃	TR ₂	TR ₁	TR ₀	12
TIME BREAK WINDOW	TW ₁₅	TW ₁₄	TW ₁₃	TW ₁₂	TW ₁₁	TW ₁₀	TW ₉	TW ₈	13
	TW ₇	TW ₆	TW ₅	TW ₄	TW ₃	TW ₂	TW ₁	TW ₀	14
	TW ₋₁	TW ₋₂	TW ₋₃	TW ₋₄	TW ₋₅	TW ₋₆	TW ₋₇	TW ₋₈	15
EXTENDED CHANNEL SET NUMBER	EN ₁₅	EN ₁₄	EN ₁₃	EN ₁₂	EN ₁₁	EN ₁₀	EN ₉	EN ₈	16
	EN ₇	EN ₆	EN ₅	EN ₄	EN ₃	EN ₂	EN ₁	EN ₀	17
EXTENDED FILE NUMBER	EFN ₂₃	EFN ₂₂	EFN ₂₁	EFN ₂₀	EFN ₁₉	EFN ₁₈	EFN ₁₇	EFN ₁₆	18
	EFN ₁₅	EFN ₁₄	EFN ₁₃	EFN ₁₂	EFN ₁₁	EFN ₁₀	EFN ₉	EFN ₈	19
	EFN ₇	EFN ₆	EFN ₅	EFN ₄	EFN ₃	EFN ₂	EFN ₁	EFN ₀	20

DEMUX TRACE HEADER		
Index Byte	Abbreviation	Description
1,2	$F_1 - F_4$	File Number (two byte, four digit, BCD). These bytes must be set to FFFF when the Extended File Number (bytes 18,19,20) is used.
3	$ST_1 - ST_2$	Scan Type Number (one byte, two digit, BCD). This byte must be set to FF when the Extended Channel Set Number (bytes 16 & 17) is used.
4	$CN_1 - CN_2$	Channel Set Number (one byte, two digit, BCD).
5,6	$TN_1 - TN_4$	Trace Number (two byte, four digit, BCD).
7,8,9	$T_{15} - T_8$	First Timing Word. These bytes comprise the timing word that would accompany the first sample if this data were written in the multiplexed format. To obtain the exact sample timing, the actual sample skew time (type 11 multiplied by the base can interval) must be added to the time recorded in bytes 7,8,9.
10	$THE_7 - THE_0$	Trace Header Extensions (one byte, unsigned binary). Indicates the number of Trace Header Extension blocks (32 bytes each). Set to zero when no extensions are used.
11	$SSK_{.1} - SSK_{.8}$	Sample Skew (one byte binary fraction). The fractional skew value represents the fractional part of the base Scan Interval (Byte 23 of General Header Block #1).
12	$TR_7 - TR_0$	Trace edit (one byte, unsigned binary). TR=00 No edit applied to this trace. TR=01 Trace part of dead channels for roll-on or roll-off spread. Trace intentionally zeroed. TR=02 Trace intentionally zeroed. Other codes are undefined at Rev 1.00.
13,14,15	$TW_{15} - TW_{-8}$	Time Break Window (three byte, unsigned binary, two bytes integer with one byte fraction). Bytes 13, 14, and 15 are included as an integrity check on time break. They comprise the timing word of the scan in which TWI changed to a one.
16,17	$EN_{15} - EN_0$	Extended Channel Set Number (two byte, unsigned binary). Allows Channel Set Numbers beyond the 99 which can be indicated in byte 4. To allow Channel Set Numbers greater than 99, or to allow use of a binary channel set number, set byte 4 to FF and use bytes 16 and 17 for the Channel Set Number.
18,19,20	$EFN_{23} - EFN_0$	Extended File Number (three byte, unsigned binary). Allows File Numbers beyond the 9999 which can be indicated in bytes 1 and 2. To allow File Numbers greater than 9999, or to allow use of binary file numbers, set bytes 1 and 2 to FFFF and use bytes 18, 19, and 20 for the File Number.

TRACE HEADER EXTENSION									
Bit	0	1	2	3	4	5	6	7	
BCD VALUE MSD	8	4	2	1	8	4	2	1	
BINARY VALUE MSB	128	64	32	16	8	4	2	1	
RECEIVER LINE NUMBER	RLN ₅	RLN ₂₂	RLN ₂₁	RLN ₂₀	RLN ₁₉	RLN ₁₈	RLN ₁₇	RLN ₁₆	1
	RLN ₁₅	RLN ₁₄	RLN ₁₃	RLN ₁₂	RLN ₁₁	RLN ₁₀	RLN ₉	RLN ₈	2
	RLN ₇	RLN ₆	RLN ₅	RLN ₄	RLN ₃	RLN ₂	RLN ₁	RLN ₀	3
RECEIVER POINT NUMBER	RPN ₅	RPN ₂₂	RPN ₂₁	RPN ₂₀	RPN ₁₉	RPN ₁₈	RPN ₁₇	RPN ₁₆	4
	RPN ₁₅	RPN ₁₄	RPN ₁₃	RPN ₁₂	RPN ₁₁	RPN ₁₀	RPN ₉	RPN ₈	5
	RPN ₇	RPN ₆	RPN ₅	RPN ₄	RPN ₃	RPN ₂	RPN ₁	RPN ₀	6
REC. POINT INDEX	RPI ₅	RPI ₆	RPI ₅	RPI ₄	RPI ₃	RPI ₂	RPI ₁	RPI ₀	7
NUMBER OF SAMPLES PER TRACE	NBS ₂₃	NBS ₂₂	NBS ₂₁	NBS ₂₀	NBS ₁₉	NBS ₁₈	NBS ₁₇	NBS ₁₆	8
	NBS ₁₅	NBS ₁₄	NBS ₁₃	NBS ₁₂	NBS ₁₁	NBS ₁₀	NBS ₉	NBS ₈	9
	NBS ₇	NBS ₆	NBS ₅	NBS ₄	NBS ₃	NBS ₂	NBS ₁	NBS ₀	10
	X	X	X	X	X	X	X	X	11
	X	X	X	X	X	X	X	X	12
	X	X	X	X	X	X	X	X	13
	X	X	X	X	X	X	X	X	14
	X	X	X	X	X	X	X	X	15
	X	X	X	X	X	X	X	X	16
	X	X	X	X	X	X	X	X	17
	X	X	X	X	X	X	X	X	18
	X	X	X	X	X	X	X	X	19
	X	X	X	X	X	X	X	X	20
	X	X	X	X	X	X	X	X	21
	X	X	X	X	X	X	X	X	22
	X	X	X	X	X	X	X	X	23
	X	X	X	X	X	X	X	X	24
	X	X	X	X	X	X	X	X	25
	X	X	X	X	X	X	X	X	26
	X	X	X	X	X	X	X	X	27
	X	X	X	X	X	X	X	X	28

TRACE HEADER EXTENSION									
Bit	0	1	2	3	4	5	6	7	
BCD VALUE MSD	8	4	2	1	8	4	2	1	
BINARY VALUE MSB	128	64	32	16	8	4	2	1	
	X	X	X	X	X	X	X	X	29
	X	X	X	X	X	X	X	X	30
	X	X	X	X	X	X	X	X	31
	X	X	X	X	X	X	X	X	32
X = This field undefined by format and may have any value.									

GENERAL TRAILER

This type header allows provisions for recording auxiliary seismic system and real-time navigation related data in the trailer. The trailer is optional and typically follows all other recorded data.

The addition of the trailer will allow the accumulation of system faults, data QC information, and real-time navigation position and timing information on the same tape, and contiguous with, the shotpoint that it relates to. By recording this data after all of the other data, additional time is provided for collecting the data and transferring it to the recording system.

The Trailer blocks take the same general form as the Channel Set Descriptor. Byte 11 uses the "Channel Type Identification" set to 1100 to indicate a Trailer block. Bytes 1 and 2 indicate the number of the General Trailer block, with the first block numbered as 1.

All other information in the trailer is optional and may be formatted as desired by the manufacturer/user.

The number of General Trailer blocks is indicated in bytes 13 and 14 of General Header Block #2.

Index Byte	Abbreviation	Description
1,2	$GT_{15} - GT_0$	General Trailer Number (two bytes unsigned binary). The first block is 1. The last General Trailer block should contain the same number in this field as in bytes 13 and 14 of General Header Block #2.
3 - 10	X	These fields are undefined by format. They may have any value.
11	$C_1 - C_0, X$	Channel Type Identification (one nibble, unsigned binary). Set to 1100 for General Trailers. The second nibble of this byte is undefined and may have any value.
12 - 32	X	These fields are undefined by format. They may have any value.

TRACE HEADER EXTENSION		
Index Byte	Abbreviation	Description
1,2,3	$RLN_S, RLN_{22} - RLN_0$	Receiver Line Number (three bytes, two's complement, signed binary).
4,5,6	$RPN_S, RPN_{22} - RPN_0$	Receiver Point Number (three bytes, two's complement, signed binary).
7	$RPI_S, RPI_6 - RPI_0$	Receiver Point Index (one byte, two's complement, signed binary). This index allows several locations for the receiver group in the grid, the original value is 1 and that value is incremented by 1 every time the receiver is moved, even when it is moved back to the previous location).
8,9,10	$NBS_{23} - NBS_0$	Number of Samples per Trace (three bytes, unsigned binary).
11 - 32	These fields are undefined by format and may have any value.	

GENERAL TRAILER									
Bit	0	1	2	3	4	5	6	7	
BCD VALUE MSD	8	4	2	1	8	4	2	1	
BINARY VALUE MSB	128	64	32	16	8	4	2	1	
GENERAL TRAILER NUMBER	GT ₁₅	GT ₁₄	GT ₁₃	GT ₁₂	GT ₁₁	GT ₁₀	GT ₉	GT ₈	1
	GT ₇	GT ₆	GT ₅	GT ₄	GT ₃	GT ₂	GT ₁	GT ₀	2
	X	X	X	X	X	X	X	X	3
	X	X	X	X	X	X	X	X	4
	X	X	X	X	X	X	X	X	5
	X	X	X	X	X	X	X	X	6
	X	X	X	X	X	X	X	X	7
	X	X	X	X	X	X	X	X	8
	X	X	X	X	X	X	X	X	9
	X	X	X	X	X	X	X	X	10
CHANNEL TYPE	C ₃	C ₂	C ₁	C ₀	X	X	X	X	11
	X	X	X	X	X	X	X	X	12
	X	X	X	X	X	X	X	X	13
	X	X	X	X	X	X	X	X	14
	X	X	X	X	X	X	X	X	15
	X	X	X	X	X	X	X	X	16
	X	X	X	X	X	X	X	X	17
	X	X	X	X	X	X	X	X	18
	X	X	X	X	X	X	X	X	19
	X	X	X	X	X	X	X	X	20
	X	X	X	X	X	X	X	X	21
	X	X	X	X	X	X	X	X	22
	X	X	X	X	X	X	X	X	23
	X	X	X	X	X	X	X	X	24
	X	X	X	X	X	X	X	X	25
	X	X	X	X	X	X	X	X	26

	X	X	X	X	X	X	X	X	27
	X	X	X	X	X	X	X	X	28
	X	X	X	X	X	X	X	X	29
	X	X	X	X	X	X	X	X	30
	X	X	X	X	X	X	X	X	31
	X	X	X	X	X	X	X	X	32

APPENDIX B
MANUFACTURERS OF SEISMIC DIGITAL FIELD RECORDERS

Code No.

- | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| 01 Alpine Geophysical Associates, Inc.
(Obsolete)
65 Oak St.
Norwood, New Jersey | 18 Input/Output, Inc.
12300 Parc Crest Dr.
Stafford, Texas 77477 |
| 02 Applied Magnetics Corporation
(See 09)
75 Robin Hill Rd.
Goleta, California 93017 | 10 Leach Corporation (Obsolete)
405 Huntington Dr.
San Marino, California |
| 05 Dyna-Tronics Mfg. Corporation
(Obsolete)
5820 Star Ln.
Box 22202
Houston, Texas 77027 | 03 Western Geophysical Exploration
Products
(formerly Litton Resources Systems,
Inc.)
3600 Briarpark Drive,
Houston, Texas 77042 |
| 06 Electronic Instrumentation, Inc.
(Obsolete)
601 Dooley Rd.
Box 34046
Dallas, Texas 75234 | 11 Metrix Instrument Co. (Obsolete)
8200 Westglen Box 36501
Houston, Texas 77063 |
| 07 Halliburton Energy Services;
formerly, Electro-Technical Labs, Div. of
Geosource, Inc.
6909 Southwest Freeway
Houston, Texas 77074 | 12 Redcor Corporation (Obsolete)
7800 Deering Ave. Box 1031
Canoga Park, California 91304 |
| 08 Fortune Electronics, Inc.
(Obsolete)
5606 Parkersburg Dr.
Houston, Texas 77036 | 14 Scientific Data Systems (SDS)
(Obsolete)
1649 Seventeenth St.
Santa Monica, California 90404 |
| 09 Geo Space Corporation (Subsidiary of
Applied Magnetics Company)
5803 Glenmont Dr.
Box 36374
Houston, Texas 77036 | 13 Sercel (Societe d'Etudes, Recherches Et
Constructions Electroniques)
25 X, 44040
Nantes Cedex, France |
| 17 GUS Manufacturing, Inc.
P.O. Box 10013
El Paso, Texas 79991 | 04 SIE, Inc.
5110 Ashbrook Box 36293
Houston, Texas 77036 |
| | 15 Halliburton Energy Services
formerly Texas Instruments, Inc.
6909 Southwest Freeway
Houston, Texas 77074 |
| | 31 Japex Geoscience Institute
Akasaka Twin Towers Bldg. 2; 2-17-22,
Akasaka Minato-ku;
Tokyo 107, Japan |

32 Halliburton Energy Services
6909 Southwest Freeway
Houston, Texas 77074

33 Compuseis, Inc.
8920 Business Park Dr, Ste 275,
Austin, Texas 78759

34 Syntron, Inc.
17200 Park Row
Houston, Texas 77084

35 Syntron Europe Ltd.
Birchwood Way

Cotes Park Industrial Estates
Somercotes, Alfreton,
Dergysire DE55 4QQ, U.K.

19 Geco-Prakla
Transition Zone Product Development
(formerly Terra Marine Engineering)
10420 Miller Road,
Dallas, Texas 75238

22 Geco-Prakla
42, Rue Saint Dominique;
Paris, France

APPENDIX D-HEADER DESCRIPTORS

<u>Abbreviation</u>	<u>Header</u>	<u>Description</u>
AF	Channel Set Descriptor	ALIAS FILTER FREQUENCY
ARY	Channel Set Descriptor	ARRAY FORMING
AS	Channel Set Descriptor	ALIAS FILTER SLOPE
B	General Header Blk #1	BYTES PER SCAN (MULTIPLEXED ONLY)
BN	General Header Btk #2, General Header Blk #N	GENERAL HEADER BLOCK NUMBER GENERAL HEADER BLOCK NUMBER
C	Channel Set Descriptor, General Trailer	CHANNEL TYPE IDENTIFICATION CHANNEL TYPE IDENTIFICATION
CAB	Channel Set Descriptor	STREAMER NUMBER
CN	Demux Trace Header	CHANNEL SET NUMBER
	Channel Set Descriptor	CHANNEL SET NUMBER
CS	General Header Blk #1	CHANNEL SETS PER SCAN TYPE
C/S	Channel Set Descriptor	CHANNELS IN THIS CHANNEL SET
DY	General Header Blk #1	DAY OF YEAR
EC	General Header Btk #1	EXTENDED HEADER BLOCK
ECS	Channel Set Descriptor	EXTENDED CHANNEL SET NUMBER
ECX	General Header Blk #2	EXTENDED HEADER BLOCKS
EF	General Header Blk #2,	EXPANDED FILE NUMBER
EFH	Channel Set Descriptor	EXTENDED HEADER FLAG
EFN	Demux Trace Header	EXTENDED FILE NUMBER
EH	General Header Blk #2	EXTERNAL HEADER BLOCKS
EN	Demux Trace Header, General Header Blk #2	EXTENDED CHANNEL SETS AND SCAN TYPE EXTENDED CHANNEL SETS AND SCAN TYPE
EX	General Header Blk #1	EXTERNAL HEADER LENGTH
ERL	General Header Blk #2	EXTENDED RECORD LENGTH

<u>Abbreviation</u>	<u>Header</u>	<u>Description</u>
F	Demux Trace Header, General Header Blk #1	FILE NUMBER FILE NUMBER
GH	General Header Blk #1	NUMBER BLOCKS IN GENERAL HEADER
GT	General Trailer, General Header Blk #2	GENERAL TRAILER NUMBER GENERAL TRAILER NUMBER
H	General Header Blk #1	HOUR OF DAY
I	General Header Blk #1	BASE SCAN INTERVAL
J	Channel Set Descriptor	GAIN CONTROL METHOD
K	General Header Blk #1	GENERAL CONSTANTS
LC	Channel Set Descriptor	LOW CUT FILTER FREQUENCY
LS	Channel Set Descriptor	LOW CUT FILTER SLOPE
M	General Header Blk #1	MANUFACTURER'S CODE AND SERIAL NUMBER
MI	General Header Blk #1	MINUTE OF HOUR
MP	Channel Set Descriptor	DESCALING EXPONENT
NBS	Trace Header Extension	NUMBER OF SAMPLES PER TRACE
NT	Channel Set Descriptor	NOTCH FILTER FREQUENCY
P	General Header Blk #1	POLARITY
PA	General Header Blk #N	PHASE ANGLE
PC	General Header Blk #N	PHASE CONTROL
R	General Header Blk #1	RECORD LENGTH
REV	General Header Blk #2	SEG-D REVISION NUMBER
RLN	Trace Header Extension	RECEIVER LINE NUMBER

<u>Abbreviation</u>	<u>Header</u>	<u>Description</u>
RPI	Trace Header Extension	RECEIVER POINT INDEX
RPN	Trace Header Extension	RECEIVER POINT NUMBER
S/C	Channel Set Descriptor	SAMPLE/CHANNEL GAIN
SE	General Header Blk #1	SECOND
S/B, S/BX	General Header Blk #1	NUMBER OF SCANS PER BLOCK
SK	General Header Blk #1	SKEW BLOCKS
SLN	General Header Blk #N	SOURCE LINE NUMBER
SPI	General Header Blk #N	SOURCE POINT INDEX
SPN	General Header Blk #N	SOURCE POINT NUMBER
SS	General Header Blk #N	SOURCE SET NUMBER
SSK	Demux Trace Header	SAMPLE SKEW
ST	Demux Trace Header	SCAN TYPES
	Channel Set Descriptor	SCAN TYPES
ST/R	General Header Blk #1	SCAN TYPES PER RECORD
T	Demux Trace Header	FIRST TIMING WORD
TE	Channel Set Descriptor	CHANNEL SET END TIME
TF	Channel Set Descriptor	CHANNEL SET START TIME
THE	Demux Trace Header	TRACE HEADER EXTENSIONS
TN	Demux Trace Header	TRACE NUMBER
TR	Demux Trace Header	TRACE EDIT
TW	Demux Trace Header	TIME BREAK WINDOW
V	General Header Blk #N	TYPE VIBRATOR
VS	Channel Set Descriptor	VERTICAL STACK
Y	General Header Blk #1	FORMAT CODE
YR	General Header Blk #1	YEAR
Z	General Header Blk #1	RECORD TYPE