



SEAL

V 5.2

User's Manual

Vol. 2

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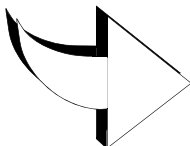
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Revision history

Note: The list below only includes major changes subsequent to the release of version 3.0.

| Date of revision | Chapters or pages affected | Description of revision or reason for change |
|------------------|---------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| June 2002 | Chap. 6 | Description of Live and Dead seismic channel log format. |
| Aug. 2002 | p. 13 p. 36 | <ul style="list-style-type: none"> - Deleted the software version from the chapter title to preclude any confusion with the SEG-D format version. - Added Trace Header Extension block #7, bytes 25-28: Number of interpolations. |
| Sep. 2002 | Chap. 2 | For explanations on Low-cut filter and sample interpolation, see Release Notes in User's Manual Vol. 3. |
| Mar. 2003 (v4.0) | Chap. 2 p. 67 Chap. 7 | <ul style="list-style-type: none"> - Reviewed SEG-D format. - Remote Spectra navigation message. - SEG-D fields modified by Trace Summing. |
| Apr. 2003 | p. 35 | Trace Header block #6 (Channel Type 1: Hydrophone, 90.9 k Ω ; 5: Hydrophone, 162 k Ω). |
| Dec. 2003 | p. 24 | Scan Type Header byte 32 (Trace Summing). |
| Mar. 2005 (V5.0) | p. 24 p. 29 p. 52 p. 53 p. 34 | <ul style="list-style-type: none"> - Array forming. - PSUM info in External Header. - Synthetic file directory. - LCI-LMP description file. - PSUM assembly code. |
| Apr. 2005 | p. 28 | - Reviewed Bytes 773-780 and 833-836. |
| June 2005 | p. 37 | Trace Header Extension block # 7 bytes 13 and 14 (not used) |
| June 2006 (V5.1) | Chap. 2 Chap. 6 | <ul style="list-style-type: none"> - SEG-D format: updated filter information fields. - Updated interface protocols. |
| Aug. 2006 | p. 26 | Water Delay recorded in Extended header bytes 81-84 (Refraction Delay). |
| Sep. 2006 | p. 20 p. 91 | <ul style="list-style-type: none"> - General Header block # 2, bytes 21-22 (Sequence No.). - Corrected typographical errors (Streamer#2 Channel Sets). |

| Date of revision | Chapters or pages affected | Description of revision or reason for change |
|------------------|---------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Oct. 2006 | p. 41 | SEGD Rev 2.1 |
| June 2007 | p. 48 p. 22 , ... Chap. 6 | Seal version 5.2 - Seal Tape Label content. - Aux traces recorded even if not connected (dead). - Reviewed ECOS and SPECTRA formats. |
| Feb. 2009 | p. 64 | Spectra message Revision 5. |
| Sep.20009 | p. 33 | DC offset recorded in Trace Header Block 3. |
| Sep. 2011 | p. 73 | Spectra / Orca Rev 0007 navigation message. |
| Jan. 2013 | 23 | Updated Scan Type Header (Low-Cut filter). |



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A Organization Codes

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Chapter 1

Introduction

This chapter includes the following sections:

- [Overview \(page 12\)](#)

Overview

This manual contains information on interfaces (description of Input/Output formats, including SEGD format).

The User's Manual is automatically loaded from the SEAL CDROM to your workstation's disk as you load the SEAL software package. Then it can be viewed using the menu that pops up when you press the mouse centre button. With a PC computer equipped with a PDF file reader (Adobe Acrobat Reader) you can view this manual direct from the SEAL CDROM's DOC directory.

SEAL documentation consists of the following manuals:

- **Installation Manual** (0311410): contains an introduction to the SEAL system, installation information, a few instructions for the operator to get started, and reference information that will help you select a SEAL configuration tailored to your needs.
- **User's Manual Volume 1** (0311411): provides operating instructions for the SEAL system's Graphic User Interface (referred to as HCI).
- **User's Manual Volume 2** (0311412): this manual.
- **User's Manual Volume 3** (0311413): contains reference information on the definition of parameters involved in the HCI or in the instrumentation.
- **Technical Manual** (0311409): contains maintenance information and associated procedures and diagrams.

Appendix

2

SEGD format

This chapter describes the SEG D format for the SEAL system. It includes the following sections:

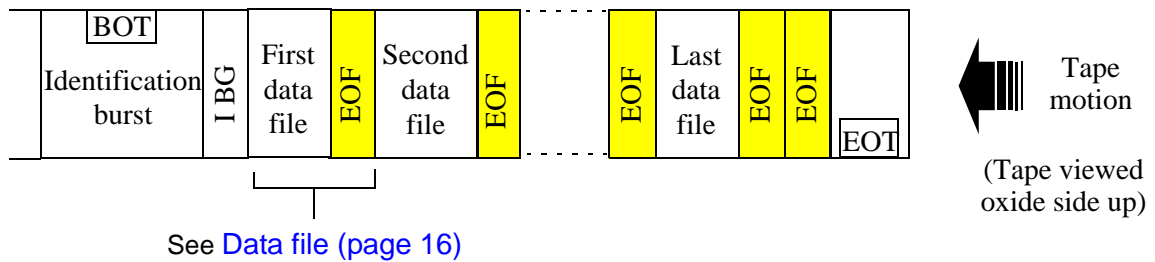
- *Overview (page 14)*
- *File Header block (page 18)*
- *Trace Data block (page 30)*

Overview

| Seal Revision | Changes |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.0 | Original release |
| 2.0 | General Header block 1 (bytes 20-22) Trace Header extension block 6 (bytes 1, 9, 17) Trace Header extension block 7 (bytes 17-24) |
| | General Header bytes 20-22: blocked record code = 100000. |
| | External Header length: 4096 characters. |
| | Extended Header: - Bytes 21-24 = dead; 25-28 = live - Filter type (bytes 765-768) - Profile number (bytes 769-772). |
| 3.0 | Extended Header: - Bytes 781-784 (T0 mode) - Bytes 785-800 (Source Line Name) - Bytes 801-804 (Sequence Number) |
| | Trace Header Extension block #7, bytes 25-28: Number of interpolations. |
| 4.0 | Extended Header: - Bytes 45-48: Test Record Type - Bytes 805-808: Nav status - Bytes 809-812: Shots to go) - Bytes 813-816: Shots before on line - Bytes 817-820: Total num. of editions - Bytes 821-824: Aux digital low-cut filter - Bytes 825-828: Seis digital low-cut filter - Bytes 829-832: -3dB seis compound low-cut filter - Bytes 833-836: Num. of chars from nav. Trace Header block #7 - Bytes 17-20: Analog low-cut filter (instead of trace max) - Bytes 21-24: Digital low-cut filter (instead of trace max time) - Bytes 25-28: Num. of editions - Bytes 29-32: -3dB compound low-cut filter Trace Header block #6 (Channel Type 1: Hydrophone, 90.9 k Ω ; 5: Hydrophone, 162 k Ω) |

| Seal Revision | Changes |
|---------------|-------------------------------------------------------|
| 5.1 | General Header block # 2, bytes 21-22 (Sequence No.). |
| 5.2.17 | Trace Header Block 3, bytes 1-4 (DC offset). |

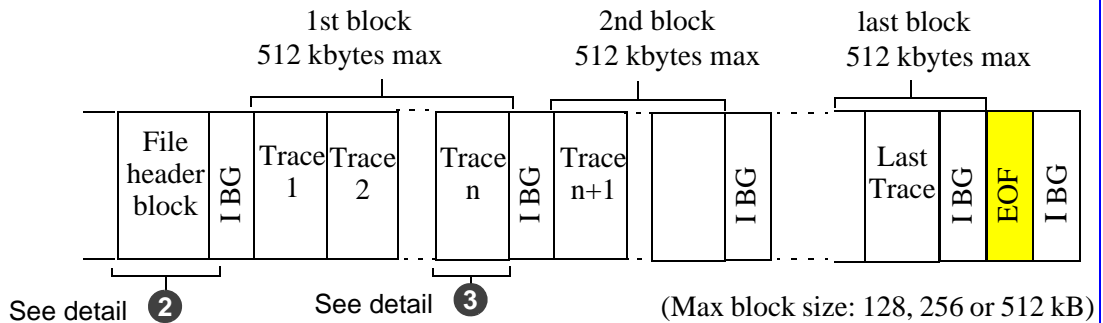
SEGD Rev 1



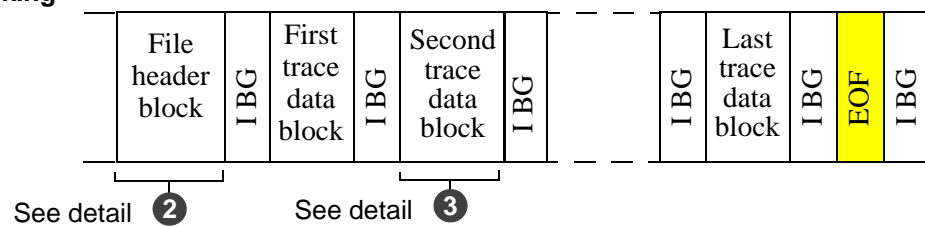
Data file

Detail ①

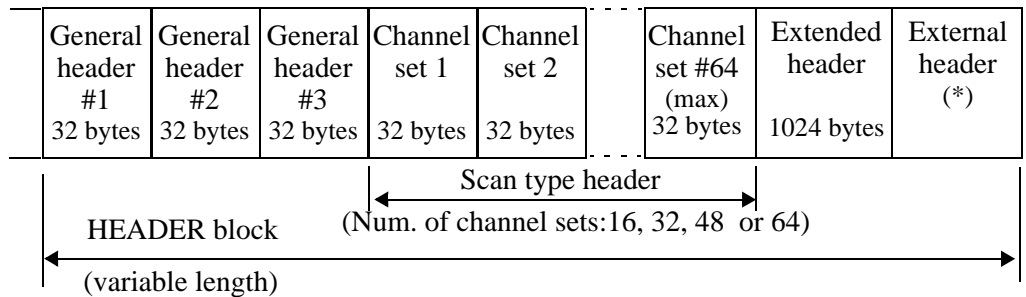
With trace blocking



No trace blocking

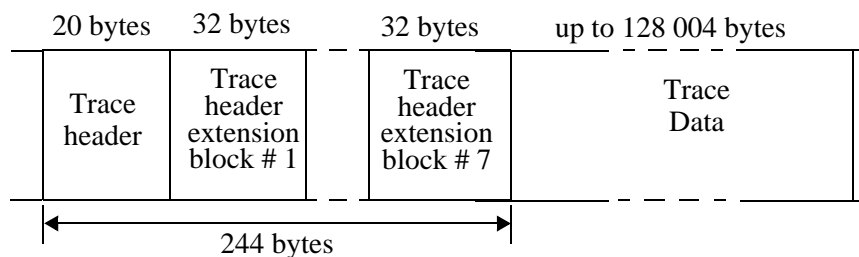


Detail ②



(*) External header length subject to change (4096 bytes by default, 65536 bytes max)

Detail ③



Conventions used in this chapter

2

In the format description tables that follow, the abbreviation in the “**fmt**” column gives the format of the value:

- **bcd** BCD
- **bin** unsigned binary
- **±bin** 2’s complement signed binary
- **asc** ASCII
- **flt** IEEE single-precision
- **dbl** IEEE double-precision format

File Header block

| General Header Block #1 | General Header Block #2 | General Header Block #3 | Channel Set #1 | | Channel Set #64 or 16, 32, 48 | Extended Header | External Header |
|----------------------------------------------------------------------------------------|-------------------------|-------------------------|----------------|-------|-------------------------------|-----------------|-----------------|
| 32 bytes | 32 bytes | 32 bytes | 32 bytes | | 32 bytes | 1024 bytes | Variable length |
| <div style="text-align: center;"> <p>Scan Type header (Variable length)</p> </div> | | | | | | | |

General header block #1

| Byte No. | Value | Fmt | Description | Notes |
|----------|-------|-----|-----------------------------------------------|---------------------------------------------------------------------|
| 1 - 2 | XXXX | bcd | Four-digit File number (0-9999) | If file nb > 9999, set to FFFF and <i>Extended File Nb</i> is used. |
| 3 - 4 | 8058 | bcd | Format code (32 IEEE demultiplexed) | |
| 5 -10 | X | | General constants | 1 for 408UL 2 for SEAL |
| 11 | XX | bcd | Last two digits of Year (0-99) | |
| 12H | 2 | bcd | Number of additional blocks in general header | |
| 12L-13 | XXX | bcd | Julian day, 3 digits (1-366) | |
| 14 | XX | bcd | Hour of day (0-23) | |
| 15 | XX | bcd | Minute of hour (0-59) | |
| 16 | XX | bcd | Second of minute (0-59) | |
| 17 | 13 | bcd | Manufacturer's code | |
| 18-19 | 0 | bcd | Manufacturer's serial nb | |

| Byte No. | Value | Fmt | Description | Notes |
|----------|--------|-----|-----------------------------------------------------------------------------------------|------------------------------------------------------------|
| 20-22 | XXXXXX | | Bytes per scan | 000000non blocked record 100000blocked record |
| 23 | XX | bcd | Base scan interval: 0.25 ms = 4 0.5 ms = 8 1 ms = 10 2 ms = 20 4 ms = 40 | |
| 24H | 0 | | Polarity (untested) | |
| 24L-25 | 0 | | Not used | |
| 26H | X | bcd | Record type: 8 = normal 2 = test record | |
| 26L-27 | FFF | | Record length (extended record length used) | |
| 28 | 01 | bcd | Scan type per record | |
| 29 | XX | bcd | Number of channel sets per record | 16 for land operations. Variable for marine operations. |
| 30 | 00 | | Number of sample skew 32 byte extensions | |
| 31 | 32 | bcd | Extended header length | |
| 32 | XX | bcd | External header length | 32 for land operations. FF for marine operations. |

General Header block # 2

| Byte No. | Value | Fmt | Description | Notes |
|----------|--------|-----|---------------------------------------------|----------------------------------------------------------------------|
| 1 - 3 | XXXXXX | bin | Expanded file number | 0-999999 |
| 4 - 5 | 0 | | Extended Channel Sets/Scan Types (not used) | |
| 6 - 7 | 0 | | Extended header blocks (not used) | |
| 8 - 9 | XXXX | bin | External header blocks | 0 for land operations (not used). Variable for marine operations. |
| 10 | 0 | | Not used | |
| 11 - 12 | x.x | bin | SEG-D Revision Number | 1.0 |
| 13 - 14 | 0 | | Number of Blocks of General Trailer | |
| 15 - 17 | XXXXXX | bin | Extended Record Length (0-128000 ms) | |
| 18 | 0 | | Not used | |
| 19 | 2 | bin | General Header Block Number | |
| 21 - 22 | XXXX | bin | Sequence Number | 0 if prior to Seal V5.1 Patch03. |
| 23 - 32 | 0 | | Not used | |

General Header block # 3

2

| Byte No. | Value | Fmt | Description | Notes |
|----------|-----------|-----|-----------------------------------|--------------------------------------------------------------------------------|
| 1 - 3 | XXXXXXX | | Expanded file number | |
| 4 - 8 | XXXXXX.XX | bin | Source Line Number (0-999999.99) | Defaults to HCI setup, or updated by navigation shooting or navigation system. |
| 9-13 | XXXXXX.XX | bin | Source Point Number (0-999999.99) | Defaults to HCI setup, or updated by navigation shooting or navigation system. |
| 14 | XX | bin | Source Point Index (1-9) | Always 1 in marine operations |
| 15 | 0 | | Phase Control (not recorded) | |
| 16 | 0 | | Vibrator Type (not recorded) | |
| 17-18 | 0 | | Phase angle (not recorded) | |
| 19 | 3 | bin | General Header Block Number | |
| 20 | XX | bin | Source Set Number | Defaults to HCI setup, or updated by navigation shooting or navigation system. |
| 21 - 32 | 0 | | Not used | |

Scan Type Header

| Byte No. | Value | Fmt | Description | | | | | | | Notes |
|----------|-------|------|-----------------------------------------------------|------|------|------|------|------|--|-------------------------------------------------------------------------------------------------------------------------|
| 1 | 01 | bcd | Scan Type Header | | | | | | | |
| 2 | XX | bcd | Channel Set Number | | | | | | | |
| 3- 4 | XXXX | bin | Channel Set Starting Time | | | | | | | 0 for Auxes. Refraction Delay for Seis. Units: 2 ms. |
| 5- 6 | XXXX | bin | Channel Set End Time | | | | | | | Record length for Auxes. Refraction Delay + Record Length for Seis. Units: 2 ms. |
| 7-8 | XXXX | ±bin | Descale Multiplier | | | | | | | |
| | | | mV | 1600 | 400 | 100 | 50 | 25 | | |
| | | | FDU | AF6D | B76D | BF6D | | | | |
| | | | SU6R | | B6B6 | BEB6 | C2B6 | C6B6 | | |
| 9-10 | XXXX | bcd | Number of channels in this channel set | | | | | | | |
| 11H | X | bcd | Channel Type Identification: 1 = Seis 9 = Aux | | | | | | | All the auxiliary channels described in the Streamer window are recorded, even those at fault or not connected, if any. |
| 11L | 0 | | Not used | | | | | | | |
| 12H | 0 | | Number of subscans exponent | | | | | | | |
| 12L | 3 | bcd | Channel gain control method (fixed gain) | | | | | | | |
| 13-14 | XXXX | bcd | Alias filter frequency at - 3dB point | | | | | | | |
| | | | | 0.25 | 0.5 | 1 | 2 | 4 | | |
| | | | FDU | 1600 | 800 | 400 | 200 | 100 | | |
| | | | SU6R | - | - | 412 | 206 | 103 | | |
| 15-16 | XX | bcd | Alias filter slope | | | | | | | |
| | | | FDU | | | 370 | | | | |

| Byte No. | Value | Fmt | Description | Notes | | | |
|----------------------------|-------|------------------------------------|-----------------------------|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------------------|
| 17-18 | XX | bcd | Low-cut filter frequency | | See “Seal acquisition filters” in User’s Manual Vol. 3. • Fc ₁ selected in Crew Setup (Section Analog Freq.) • Fc ₂ = Digital filter freq. • $Fc = \sqrt{Fc_1 \times Fc_2}$ | | |
| | | | Chan | Operation / Test type | | Digital filter | |
| | | | | | | Off | On |
| | | | Aux. | Instrument tests (except Pulse) | | 0 | 0 |
| | | | | Operation or Instrument Pulse | | 0 | Fc ₂ |
| | | | Seis. | Operation or Sensor Noise | | Fc ₁ | Fc |
| | | | | Other Sensor tests | | Fc ₁ | Fc ₁ |
| | | | | Instrument Pulse | | 0 | Fc ₂ |
| | | | | Other Instrument tests | | 0 | 0 |
| | | | 19-20 | XX | | bcd | Low-cut filter slope |
| Low-cut filter frequency | 0 | Fc ₁ or Fc ₂ | | | Fc | | |
| Low-cut filter slope value | 0 | 6 | | | 12 | | |
| 21-22 | 0 | | First Notch Frequency | | | | |
| 23-24 | 0 | | Second Notch Frequency | | | | |
| 25-26 | 0 | | Third Notch Frequency | | | | |
| 27-28 | 0 | | Extended channel set number | | | | |
| 29H | 0 | | Extended header flag | | | | |
| 29L | 7 | bin | Trace Header Extensions | | | | |
| 30 | XX | bin | Vertical Stack | | | | |
| 31 | XX | bin | Streamer cable number | | 0 in land operations. Rcv point line in marine operations. | | |

| Byte No. | Value | Fmt | Description | Notes |
|----------|-------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| 32 | X | bin | Array forming: 0x01: No array forming 0x02: 2 groups summed 0x03: 3 groups summed 0x04: 4 groups summed 0x0N: N groups summed 0x1N: N groups summed, 1-trace overlapping 0x2N: N groups summed, 2-trace overlapping 0xPN: N groups summed, P-trace overlapping ($P < N$). | See also Trace Summing (page 109) in User's Manual Vol. 1 . |

Extended Header

2

| Byte No. | Value | Fmt | Description | Notes |
|----------|-------|-----|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 - 4 | XXXX | bin | Acquisition length | 1000 to 128000 ms |
| 5-8 | XXXX | bin | Sample rate | 250, 500, 1000, 2000, 4000 μ s |
| 9-12 | XXXX | bin | Total number of traces | 1 to 100000 |
| 13-16 | XXXX | bin | Number of Auxes | 1 to 60 All the auxiliary channels described in the Streamer window are recorded, even those at fault or not connected, if any. |
| 17-20 | XXXX | bin | Number of Seis traces | 1 to 100000 |
| 21-24 | XXXX | bin | Number of dead Seis traces | 1 to 100000 |
| 25-28 | XXXX | bin | Number of live Seis traces | 1 to 100000 |
| 29-32 | XXXX | bin | Type of source | 0 = no source 1 = Impulsive 2 = Vibro |
| 33-36 | XXXX | bin | Number of samples in trace | 1 to 128000 |
| 37-40 | XXXX | bin | Shot number | 1 to 9999 |
| 41-44 | XXXX | flt | TB window | 0 to 64 seconds |
| 45-48 | XXXX | bin | Test record type | 1 Field Noise 2 Field Impulse 3 Field Crosstalk 4 Field Capacitance 5 Field Cutoff 6 Field Leakage 7 Instr Noise 8 Instr Distortion 9 Instr Pulse 10 Instr Gain/Phase 11 Instr Crosstalk 12 Instr Common Mode 13 Synthetic 14 Similarity |
| 49-52 | XXXX | bin | Swath first line | 1 to 99999 |
| 53-56 | XXXX | bin | Swath first number | 1 to 99999 |

| Byte No. | Value | Fmt | Description | Notes |
|----------|-------|------|---------------------------------------|------------------------------------------------------------------------|
| 57-60 | XXXX | bin | Spread number | 1 to 32 |
| 61-64 | XXXX | bin | Spread type | 1 = Generic 2 = Absolute |
| 65-68 | XXXX | bin | Timebreak | 0 to 9999 microseconds |
| 69-72 | XXXX | bin | Uphole time | Microseconds Updated by navigation shooting or navigation system |
| 73-76 | XXXX | bin | Blaster id | 0 to 15 |
| 77-80 | XXXX | bin | Blaster status | Depends on blaster type |
| 81-84 | XXXX | bin | Refraction delay | ms (Water Delay). |
| 85-88 | XXXX | ±bin | Tb to T0 time | Microseconds |
| 89-92 | XXXX | bin | Internal time break | 0 = no 1 = yes |
| 93-96 | XXXX | bin | Prestack within field units | 0 = no 1 = yes |
| 97-100 | XXXX | bin | Noise elimination type | 1 None 2 Diversity stack 3 Historic 4 Off |
| 101-104 | XXXX | bin | Low trace percentage | 0 to 100% |
| 105-108 | XXXX | bin | Low trace value | 0 to 132 dB |
| 109-112 | XXXX | bin | Number of windows | 1 to 64 |
| 113-116 | XXXX | bin | Historic editing type | 1 = Zeroing 2 = Clipping |
| 117-120 | XXXX | bin | Noisy trace percentage | 0 to 100% |
| 121-124 | XXXX | bin | Historic range | 0 to 36 dB |
| 125-128 | XXXX | bin | Historic taper length 2's exponent | 0 to 8 |
| 129-132 | XXXX | bin | Threshold Hold/Var | 1 = Hold 2 = Var |
| 133-136 | XXXX | bin | Historic threshold Init value | 0 to 132 dB |
| 137-140 | XXXX | bin | Historic zeroing length | 1 to 500 ms |

| Byte No. | Value | Fmt | Description | Notes |
|----------|-------|-----|-----------------------------|---------------------------------------------------------------------------------------------------------|
| 141-144 | XXXX | bin | Type of process | 1 = No operation (raw data) 2 = Stack 3 = Correlation After stack 4 = Correlation Before stack |
| 145-272 | XXXX | bin | Acquisition type tables | 32 values (128 bytes) |
| 273-400 | XXXX | bin | Threshold type tables | 32 values (128 bytes) |
| 401-404 | XXXX | bin | Stacking fold | 1 to 32 |
| 405-484 | XXXX | asc | Aux correlation description | ASCII text, 80 characters |
| 485-488 | XXXX | bin | Investigation length | 100 to 128000 ms |
| 489-492 | XXXX | bin | Autocorrelation peak time | 1 to 128000 ms |
| 493-496 | XXXX | bin | FFT exponent | 1 to 15 |
| 497-500 | XXXX | bin | Source aux nb | 1 to 60 |
| 501-504 | XXXX | bin | Pilot length | 1000 to 128000 ms |
| 505-508 | XXXX | bin | Sweep length | 1000 to 128000 ms |
| 509-512 | XXXX | bin | Acquisition number | 1 to 32 |
| 513-516 | XXXX | flt | Max of max, Aux | IEEE format, single precision |
| 517-520 | XXXX | flt | Max of max, Seis | IEEE format, single precision |
| 521-524 | XXXX | bin | Dump stacking fold | 1..32 |
| 525-540 | XXXX | asc | Tape label | ASCII text, 16 characters |
| 541-544 | XXXX | bin | Tape number | 1 to 9999 |
| 545-560 | XXXX | asc | Software version | ASCII text, 16 characters |
| 561-572 | XXXX | asc | Date | ASCII text, 12 characters (dd mmm yyyy) |
| 573-580 | XXXX | dbl | Source easting | Defaults to HCI setup, or updated by shooting or navigation system |
| 581-588 | XXXX | dbl | Source northing | Defaults to HCI setup, or updated by shooting or navigation system |
| 589-592 | XXXX | flt | Source elevation | Defaults to HCI setup, or updated by shooting or navigation system |

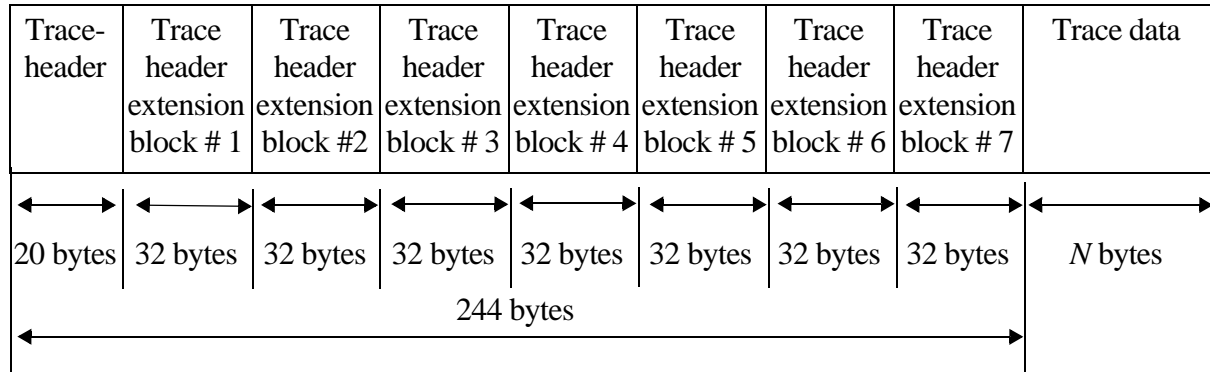
| Byte No. | Value | Fmt | Description | Notes |
|----------|---------|-----|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| 593-596 | XXXX | bin | Slip sweep mode used | 0 = No 1 = Yes |
| 597-600 | XXXX | bin | Files per tape | 1 to 9999 |
| 601-604 | XXXX | bin | File count | 1 to 9999 |
| 605-764 | XXXX | asc | Acquisition error description | ASCII text, 160 characters |
| 765-768 | XXXX | bin | Filter type | 1 0.8 Min 2 0.8 Lin 3 SU6R-like |
| 769-772 | XXXX | bin | Profile number | 1 to 99999 |
| 773-776 | XXXX | bin | Stack is dumped | 0 = No 1 = Yes |
| 777-780 | XXXX | bin | Stack sign (current) | 0 = No 1 = Plus 2 = Minus |
| 781-784 | XXXX | bin | T0 mode | 1 Internal closure 2 External closure |
| 785-800 | X ... X | asc | Source Line Name | |
| 801-804 | XXXX | bin | Sequence Number | |
| 805-808 | XXXX | bin | Nav. status | 0: no status available 1: OFFLINE (*) 2: APPROACH (*) 3: ONLINE (*) 4: RUNOUT (*) (* with Remote Spectra only) |
| 809-812 | XXXX | bin | Shots to go | |
| 813-816 | XXXX | bin | Shots before on line | |
| 817-820 | | | Total num. of editions | Sum of trace headers' num. of editions |
| 821-824 | XXXX | flt | Aux digital low-cut filter | 0 = OFF |
| 825-828 | XXXX | flt | Seis digital low-cut filter | 0 = OFF |
| 829-832 | XXXX | flt | Seis compound low-cut filter | Depends on Crew Setup "Section Analog Frequency" option setting. See "Seal acquisition filters" in User's Manual Vol. 3. |

| Byte No. | Value | Fmt | Description | Notes |
|----------|-------|-----|-----------------------------------------|-------|
| 833-836 | XXXX | bin | Number of characters in External Header | |
| 837-1024 | 0 | | not used | |

External Header

| Byte No. | Value | Fmt | Description | Notes |
|----------|-------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|
| 1 - n | XXXX | asc | Concatenation of: - Info from shooting or navigation system, - PSUM info (if any is connected), - User info from Config environment setup, - Source comment from operation window. | n = 1024 for land operations, up to 65536 for marine operations |

Trace Data block



$$N = \left(\frac{\text{acquisition length (ms)}}{\text{sample rate (ms)}} + 1 \right) \times 4$$

$$\text{Number of samples per trace} = \left(\frac{\text{acquisition length (ms)}}{\text{sample rate (ms)}} + 1 \right)$$

“+1” is there because the first sample is taken at Time Zero.

Trace header

Demultiplexed Trace Header

2

| Byte No. | Value | Fmt | Description | Notes |
|----------|---------|-----|-----------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| 1-2 | XXXX | bcd | Four-digit file number (0-9999) | if file nb > 9999, set to FFFF and <i>extended file nb</i> is used |
| 3 | 01 | bcd | Scan Type Number | |
| 4 | XX | bcd | Channel Set Number | |
| 5-6 | XXXX | bcd | Trace Number | |
| 7-9 | XXXX | bin | First Timing Word | Refraction delay |
| 10 | 7 | bin | Trace Header Extension | |
| 11 | 0 | | Sample skew | |
| 12 | XX | bin | Trace edit 00 No edit applied. 02 Muted or dead prior to acquisition. 03 Edited by acquisition system. | Traces (seismic or aux) at fault or not connected are recorded as dead. Acquisition error or noise edited. |
| 13-15 | XXXX.XX | bin | Time break window | 0 for marine operations |
| 16-17 | 0 | | Extended channel set number | |
| 18-20 | XXXXXX | | Extended file number | 0-999999 |

Trace Header Extensions

Trace Header Extension Block # 1

| Byte No. | Value | Fmt | Description | Notes |
|----------|--------|-----|--------------------------------|--------------------------------------------------------------|
| 1-3 | XXXXXX | bin | Receiver line number | Streamer identification number in marine operations |
| 4-6 | XXXXXX | bin | Receiver point number | Physical channel number within streamer in marine operations |
| 7 | XX | bin | Receiver point index | Always 1 in marine operations |
| 8-10 | XXXXXX | bin | Number of samples per trace | |
| 11-15 | 0 | | Extended receiver line number | |
| 16-20 | 0 | | Extended receiver point number | |
| 21 | XX | bin | Sensor type | |
| 22-32 | 0 | | Not used | |

Trace Header Extension block # 2

| Byte No. | Value | Fmt | Description | Notes |
|----------|----------|-----|--------------------------|-------------------------------------------------------------------------------|
| 1-8 | XXXXXXXX | dbl | Receiver point easting | Defaults to HCI setup, or updated by navigation shooting or navigation system |
| 9-16 | XXXXXXXX | dbl | Receiver point northing | Defaults to HCI setup, or updated by navigation shooting or navigation system |
| 17-20 | XXXX | flt | Receiver point elevation | Defaults to HCI setup, or updated by navigation shooting or navigation system |
| 21 | XX | bin | Sensor type nb | |
| 22-32 | 0 | | Not used | |

Trace Header Extension block # 3

| Byte No. | Value | Fmt | Description | Notes |
|----------|-------|-----|-------------|-------|
| 1-4 | XXXX | flt | DC offset. | |
| 5-32 | 0 | | Not used | |

Non significant fields are set to FFFFFFFF.

Trace Header Extension block # 4

| Byte No. | Value | Fmt | Description | Notes |
|----------|-------|-----|------------------------|----------------------|
| 1-4 | XXXX | flt | Capacitance low limit | For hydrophones only |
| 5-8 | XXXX | flt | Capacitance high limit | |
| 9-12 | XXXX | flt | Capacitance value | nano farads |
| | | | | |
| 13-16 | XXXX | flt | Cut off low limit | For hydrophones only |
| 17-20 | XXXX | flt | Cut off high limits | |
| 21-24 | XXXX | flt | Cut off value | Hz |
| | | | | |
| 25 | X | bin | Capacitance error | 0 = No 1 = Yes |
| 26 | X | bin | Cut off error | 0 = No 1 = Yes |
| 27-32 | 0 | | Not used | |

Non significant fields are set to FFFFFFFF.

Trace Header Extension block # 5

| Byte No. | Value | Fmt | Description | Notes |
|----------|-------|-----|---------------|-------------------|
| 1-4 | XXXX | flt | Leakage limit | |
| 5-8 | XXXX | flt | Leakage value | kohms |
| | | | | |
| 9-24 | 0 | | Not used | |
| 25 | X | bin | Leakage error | 0 = No 1 = Yes |
| 26-32 | 0 | | Not used | |

Non significant fields are set to FFFFFFFF.

Trace Header Extension block # 6

| Byte No. | Value | Fmt | Description | Notes |
|----------|--------|-----|-----------------------------------------------------|-----------------------|
| 1 | X | bin | Unit type 00 Not identified 01 FDU 02 SU6R | See below for details |
| 2-4 | XXXXXX | bin | Unit serial number | |
| 5 | X | bin | Channel number | |
| 6-8 | | 0 | Spare | |
| | | | | |

| Byte No. | Value | Fmt | Description | Notes |
|----------|--------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|
| 9 | X | bin | FDU assembly type 0x01 to string of n FDU's 0x10 0x20 ALS 0x21 HAU 0x22 HAPU 0x23 SAXU 0x24 AXCUC 0x25 PSUM 0x60 TZAS 0x80 RAU | Significant only for FDU channels |
| 10-12 | XXXXXX | bin | FDU assembly serial number | |
| 13 | X | bin | FDU assembly location | |
| 14-16 | | 0 | Spare | |
| 17 | XX | bin | FDU unit type 0x01 FDU1 0x02 FDU3C 0x03 FDU1M 0x04 FDU2M 0x05 FDU6 0x07 FDU2Mx2 0x09 DSU3 0x10 TZSU2 0x11 TZSU4 | |
| 18 | X | bin | Channel type 0 Geophone 1 Hydrophone, 90.9 kΩ 5 Hydrophone, 162 kΩ | |
| 19-20 | | 0 | Spare | |
| 21-24 | XXXX | flt | Sensor sensitivity | FFFF FFFF in land operations Volt/bar in marine operations |
| 25-32 | 0 | | Not used (0) | |

Trace Header Extension block # 7

| Byte No. | Value | Fmt | Description | Notes |
|----------|--------|-----|--------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| 1 | X | bin | Control unit type 01 LCI 02 LAUL 03 LAUX 11 LAULM 12 LAUXM 13 TAPU 21 REM 22 LRU 23 RAU | |
| 2-4 | XXXXXX | bin | Control unit serial number | |
| 5 | X | bin | Channel gain scale | |
| | | | | FDU SU6R |
| | | | 1 1600 mV | 0 dB |
| | | | 2 400 mV | 12 dB 24 dB |
| | | | 3 100 mV | 24 dB 36 dB |
| | | | 4 50 mV | 42 dB |
| | | | 5 25 mV | 48 dB |
| 6 | X | bin | Channel filter 1 0.8FN Minimum Phase 2 0.8FN Linear phase 3 SU6R-like | |
| 7 | X | bin | Channel data error: overscaling | |
| 8 | X | bin | Channel edited status 1 Dead 2 Acquisition/retrieve error 3 Noise edition | Traces (seismic or aux) at fault or not connected are recorded as dead. |
| 9-12 | XXXX | flt | Channel sample to mV conversion factor | 0 for Auxes (not computed). |

| Byte No. | Value | Fmt | Description | Notes |
|----------|-------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| 13 | | | | Not used. |
| 14 | | | | Not used. |
| 15 | XX | bin | Channel type id: 1 = Seis 9 = Aux | All the auxiliary channels described in the Streamer window are recorded, even those at fault or not connected, if any. |
| 16 | XX | bin | Channel process 01 Raw data 02 Aux stack 03 Correlation, negative part 04 Correlation, positive part 05 Normal correlation 06 Seis stack | |
| 17-20 | XXXX | flt | Analog low-cut filter | Channel's actual low-cut filter frequency. |
| 21-24 | XXXX | flt | Digital low-cut filter | |
| 25-28 | XXXX | bin | Number of editions | See Reference in User's Manual Vol. 3. |
| 29-32 | XXXX | flt | Compound low-cut filter | Computed from channel's actual low-cut filter frequency. See "Seal acquisition filters" in User's Manual Vol. 3. |

Trace data

| Byte No. | Value | Description |
|----------|------------------|-----------------------------------------------------------------------------|
| 1 | S, C7 thru C 1 | Sample value represented in 32 bit floating point IEEE demultiplexed format |
| 2 | C0, Q-1 thru Q-7 | |
| 3 | Q-8 thru Q-15 | |
| 4 | Q-16 thru Q-23 | |

| | | | | | | | | | |
|------------------|-----|----|----|----|---|---|---|---|-----|
| BCD value MSD | 8 | 4 | 2 | 1 | 8 | 4 | 2 | 1 | LSD |
| Binary value MSB | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 | LSB |

| | | | | | | | | | |
|---------------|------|------|------|------|------|------|------|------|-----------|
| First sample | S | C7 | C6 | C5 | C4 | C3 | C2 | C1 | 1 |
| | C0 | Q-1 | Q-2 | Q-3 | Q-4 | Q-5 | Q-6 | Q-7 | 2 |
| | Q-8 | Q-9 | Q-10 | Q-11 | Q-12 | Q-13 | Q-14 | Q-15 | 3 |
| | Q-16 | Q-17 | Q-18 | Q-19 | Q-20 | Q-21 | Q-22 | Q-23 | 4 |
| Second sample | S | C7 | C6 | C5 | C4 | C3 | C2 | C1 | 5 |
| | C0 | Q-1 | Q-2 | Q-3 | Q-4 | Q-5 | Q-6 | Q-7 | 6 |
| | Q-8 | Q-9 | Q-10 | Q-11 | Q-12 | Q-13 | Q-14 | Q-15 | 7 |
| | Q-16 | Q-17 | Q-18 | Q-19 | Q-20 | Q-21 | Q-22 | Q-23 | 8 |
| | | | | | | | | | |
| Last sample | S | C7 | C6 | C5 | C4 | C3 | C2 | C1 | Last byte |
| | C0 | Q-1 | Q-2 | Q-3 | Q-4 | Q-5 | Q-6 | Q-7 | |
| | Q-8 | Q-9 | Q-10 | Q-11 | Q-12 | Q-13 | Q-14 | Q-15 | |
| | Q-16 | Q-17 | Q-18 | Q-19 | Q-20 | Q-21 | Q-22 | Q-23 | |

NOTE: IEEE Floating Point Format

| | | | | | | | | | |
|------------------|-----|----|----|----|---|---|---|---|-----|
| BCD value MSD | 8 | 4 | 2 | 1 | 8 | 4 | 2 | 1 | LSD |
| Binary value MSB | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 | LSB |

| | | | | | | | | |
|------------------------|------|------|------|------|------|------|------|------|
| Single precision value | S | C7 | C6 | C5 | C4 | C3 | C2 | C1 |
| | C0 | Q-1 | Q-2 | Q-3 | Q-4 | Q-5 | Q-6 | Q-7 |
| | Q-8 | Q-9 | Q-10 | Q-11 | Q-12 | Q-13 | Q-14 | Q-15 |
| | Q-16 | Q-17 | Q-18 | Q-19 | Q-20 | Q-21 | Q-22 | Q-23 |

| | | | | | | | | |
|------------------------|------|------|------|------|------|------|------|------|
| Double precision value | S | C10 | C9 | C8 | C7 | C6 | C5 | C4 |
| | C3 | C2 | C1 | C0 | Q-1 | Q-2 | Q-3 | Q-4 |
| | Q-5 | Q-6 | Q-7 | Q-8 | Q-9 | Q-10 | Q-11 | Q-12 |
| | Q-13 | Q-14 | Q-15 | Q-16 | Q-17 | Q-18 | Q-19 | Q-20 |
| | Q-21 | Q-22 | Q-23 | Q-24 | Q-25 | Q-26 | Q-27 | Q-28 |
| | Q-29 | Q-30 | Q-31 | Q-32 | Q-33 | Q-34 | Q-35 | Q-36 |
| | Q-37 | Q-38 | Q-39 | Q-40 | Q-41 | Q-42 | Q-43 | Q-44 |
| | Q-45 | Q-46 | Q-47 | Q-48 | Q-49 | Q-50 | Q-51 | Q-52 |

- Single precision

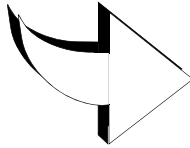
| | | | | |
|----|----|----|-----|------|
| 31 | 30 | 23 | 22 | 0 |
| s | e | | f | |
| s | C7 | C0 | Q-1 | Q-23 |

value = $(-1)^s \times 2^{e-127} \times 1.f$ (a 0 value is encoded with $e = f = 0$).

- Double precision

| | | | | |
|----|-----|----|-----|------|
| 63 | 62 | 52 | 51 | 0 |
| s | e | | f | |
| s | C11 | C0 | Q-1 | Q-52 |

value = $(-1)^s \times 2^{e-1023} \times 1.f$ (a 0 value is encoded with $e = f = 0$).



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Appendix

3

SEG-D format Rev 2.1

This chapter describes how the SEG-D Rev. 2.1 standard is implemented in the Seal system. It includes the following sections

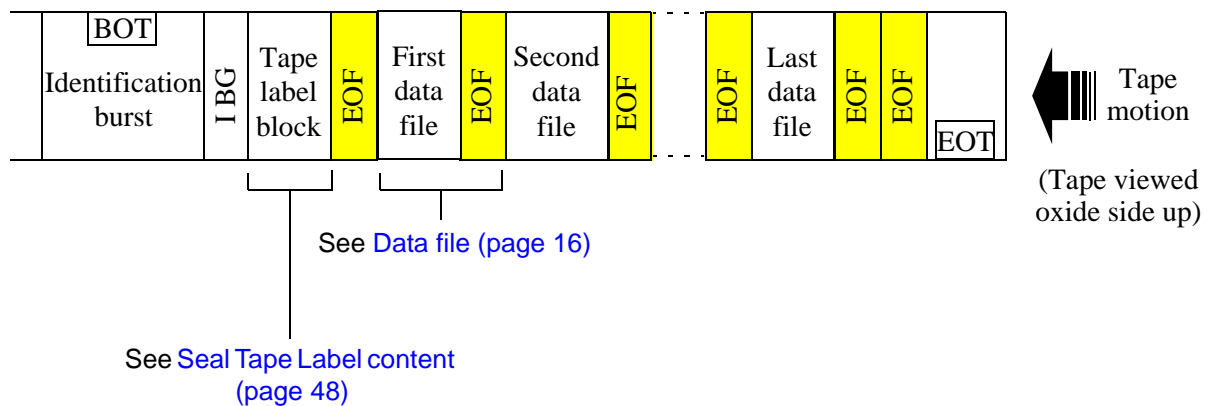
- *Changes introduced in Revision 2.1 (page 42)*
- *SEG-D Rev 2.1 Tape Label (page 43)*
- *Seal Tape Label content (page 48)*

Changes introduced in Revision 2.1

SEG-D standard Revision 2.1 supports “RECORD” (variable-length) and “FIXREC” (fixed-length) storage unit structures. SEG-D Rev. 2.1 files from the Seal system are recorded with the “RECORD” structure.

SEG-D standard Revision 2.1 requires a 128-kbyte label to be recorded at the beginning of each tape. That label is not recorded in the SEG-D file.

An EOF is written between the tape label block and the first SEG-D file.



When recording to two tape drives simultaneously, a different tape label is generated for each tape drive.

Table 3-1 SEG-D Rev. 2.1 file content

| Changes | SEG-D Rev 2.1 standard | Content generated by Seal |
|---------------------------------------------|--------------------------------------------------------|-------------------------------------------------------|
| Tape Label block | See SEG-D Rev 2.1 Tape Label (page 43) | See Seal Tape Label content (page 48) |
| General Header Block # 2 Bytes 11 and 12 | SEG-D Revision Number | 2.1 |
| General Header Block # 2 Bytes 21 and 22 | Sequence Number | Sequence Number parameter from Operation window |
| Extended Header | | Same as SEG-D Rev. 1 |

SEG-D Rev 2.1 Tape Label

The first 128 bytes of data on a Rev 2.1 (and Rev 2.0) tape must consist of ASCII characters and will constitute a storage unit label. This label is very similar to the RP-66 storage unit label. The label format is summarized in the table below.

3

Table 3-2

| Field | Description | Bytes | Start - end byte |
|-------|-----------------------------------------------|-------|------------------|
| 1 | Storage unit sequence number | 4 | 1 - 4 |
| 2 | SEG-D Revision | 5 | 5 - 9 |
| 3 | Storage unit structure (fixed or variable) | 6 | 10 - 15 |
| 4 | Binding edition | 4 | 16 - 19 |
| 5 | Maximum block size | 10 | 20 - 29 |
| 6 | API Producer organization code | 10 | 30 - 39 |
| 7 | Creation date | 11 | 40 - 50 |
| 8 | Serial number | 12 | 51 - 62 |
| 9 | Reserved | 6 | 63 - 68 |
| 10 | Storage set identifier | 60 | |
| | - External Label Name | 12 | 69 - 80 |
| | - Recording Entity Name | 24 | 81 - 104 |
| | - User defined | 14 | 105 - 118 |
| | - Max number of shot records per field record | 10 | 119 - 128 |

Field 1

The Storage Unit Sequence Number is an integer in the range 1 to 9999 that indicates the order in which the current storage unit occurs in the storage set. The first storage unit of a storage set has sequence number 1, the second 2, and so on. This number is represented using the characters 0 to 9, right justified with leading blanks if needed to fill out the field (No leading zeros). The rightmost character is in byte 4 of the label. This field is optional. If not used, it must be blank (filled with blank characters). This implies that this is the only storage unit within

the storage set. Separate Storage Sets should be used for different data types.

Field 2

The SEG-D Revision field indicates which revision of SEG-D was used to record the data on this tape. SD2.1 indicates that the data was recorded using SEG-D, Revision 2.1 (SD2.0 in previous revision)- This field is required.

Field 3

Storage Unit Structure is a name indicating the record structure of the storage unit. This name is left justified with trailing blanks if needed to fill out the field. The leftmost character is in byte 10 of the label. For SEG-D, Rev 2.1 and 2.0 tapes, this field must contain "RECORD" or "FIXREC". This field is required.

- "RECORD" -- Records may be of variable length, ranging up to the Blocksize length specified in the maximum Block size field of the storage unit label (if not zero). If the maximum Block size specified is zero, then records may be of any length.
- "FIXREC" -- All records in the storage unit have the same length, namely that specified in the maximum Block size field of the storage unit label. Although all storage units in the same storage set must have a FIXREC structure, the maximum record length may be different in different storage units. When the FIXREC option is used, then the maximum record length field shall not be 0 (zero).

Field 4

Binding edition is the character B in byte 16 of the label followed by a positive integer in the range 1 to 999 (no leading zeros), left justified with trailing blanks if needed to fill out the field. The integer value corresponds to the edition of the Part 3 of the API, RP66 standard used to describe the physical binding of the logical format to the storage unit. This field is required.

Field 5

Maximum Block Size is an integer in the range of 0 to 4,294,967,295 (232-1), indicating the maximum block length for the storage unit, or 0 (zero) if undeclared. This number is represented using the characters 0 to 9, right justified, with leading blanks if necessary to fill out the field (no leading zeros). The rightmost character is byte 29 of the label. A valid value or 0 (zero) must be recorded.

Field 6

Producer organization code is an integer in the range of 0 to 4,294,967,295 (232-1) indicating the organization code of the storage unit producer. This number is represented using the characters 0 to 9, right justified, with leading blanks if necessary to fill out the field (NO leading zeros). The rightmost character is byte 39 of the label. This field may be empty, i.e. may contain all blanks, in which case no storage unit producer is specified (e.g. same as RP-66 V2).

Organization codes are assigned by POSC (API, American Petroleum Institute in previous revision), which maintains the current list of codes. To request a new organization code, contact:

POSC

24 Greenway Plaza

Suite 1000-B

Houston, TX 77046 USA

+1 713 784-1880 telephone

+1 713 784-9219 fax

info@posc.org

Field 7

Creation date is the earliest date that any current information was recorded on the storage unit. The date is represented in the form dd-
MMM-yyyy, where yyyy is the year (e.g. 1996), MMM is one of (JAN,

FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT, NOV, DEC), and dd is the day of the month in the range 1 to 31. Days 1 to 9 may have one leading blank. The separator is a hyphen (code 4510). This field is required.

Field 8

Serial number is an ID used to distinguish the storage unit from other storage units in an archive of an enterprise. The specification and management of serial numbers is delegated to organizations using this standard. If an external label is used the name/number must be a subset of the serial number or the External Label Name in Field 10, and must occupy the rightmost characters in the serial number (or External Label Name). This field is required.

Field 9

This field is reserved and should be recorded as all blanks (code 3210).

Field 10

The **Storage set identifier** is a descriptive name for the storage set. Every storage unit in the same storage set shall have the same value for the user defined portion of the storage set identifier in its storage unit label. Included in the Storage Set Identifier is the **External Label Name**. The characters in this field are right justified with leading blank characters as required. If the tape does not have a physical label, then this field must be blank. A physical label is optional, but if it exists, then this field is required only if the external label is different from the lower 6 characters of the Serial Number in field 8.

The next field in the Storage set identifier is the **Recording Entity Name**. This must contain the crew number or name, or some other unique identifier which will differentiate the recording entity which recorded this data from any other recording entity within the organization (as included in field 6). The 24 bytes may be any alphanumeric characters. If multiple recording systems are used on a vessel or crew, then data recorded on each system must be clearly

distinguished. For example, an ABC Geophysical crew (party 13), on the M/V Gopher, recording data on two Zip 6000 recording systems might have a Recording Entity Name on tapes recording on the first recording system of:

ABC, Gopher, P13, Zip#1

On the second system, the Recording Entity Name might be:

ABC, Gopher, P13, Zip#2

The Recording Entity Name field is required.

USER DEFINED. The next 14 bytes in this field may contain any other user input information. The only restriction is that the data must be in ASCII.

Max Number of shot records per field record. Field Records are data between File Marks (10 bytes).

It is not acceptable to use an ANSI label (or any other label or data) prior to the Storage Unit Label.

An external, physical label is not required.

Seal Tape Label content

Table 3-3 Tape label content

| Field | Start - End byte | Description | Content generated by Seal |
|-------|------------------|-----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| 1 | 1 - 4 | Storage Unit sequence number | Tape Number field from “Tape” setup (in Export window). |
| 2 | 5 - 9 | SEG-D revision | "SD2.1" |
| 3 | 10 - 15 | Storage unit structure | "RECORD" |
| 4 | 16 - 19 | Binding edition | "B2 " |
| 5 | 20 - 29 | Maximum block size | " 0" |
| 6 | 30 - 39 | API Producer organization code | Producer Code field from “SEGD” setup (in Config window). |
| 7 | 40 - 50 | Creation date | Recording date of first file (i. e. recording date of Tape Label itself). |
| 8 | 51 - 62 | Serial number | Prefix Serial # field from Config window’s SEG-D Setup, plus Tape Number field from Export window’s Tape Setup. |
| 9 | 63 - 68 | Reserved | " " |
| 10 | | Storage set identifier | |
| | 69 - 80 | · External label name | External Label field from “Tape Drive Information” setup (in Export window). |
| | 81 - 104 | · Recording entity name | “Recording Entity Name” field from “Tape Drive Information” setup (in Export window). |
| | 105 - 118 | · User defined | “User Defined” field from “Tape Drive Information” setup (in Export window). |
| | 119 - 128 | · Max number of shots record per field record | 1 |

All the fields are filled with ASCII characters, with padding blanks rather than string terminators.

Appendix

4

Synthetic File Format

This chapter describes the file format to be used for acquisition of seismic and aux data from a synthetic file in place of seismic receivers. It includes the following sections:

- [Overview \(page 50\)](#)
- [Synthetic Signal File Syntax \(page 51\)](#)
- [LCI-LMP processors \(page 53\)](#)
- [Examples \(page 54\)](#)

Overview

Using the SEAL synthetic signal file feature, you can generate Seismic and Aux data acquired from a file in place of receivers.

The synthetic signal file feature allows the data on the Seismic traces to be different from the data on the Auxes.

The synthetic signal file feature also allows the data to be different on each acquisition within a shot point.

Synthetic Signal File Syntax

File Content

4

The description of the synthetic signal is an ASCII file containing key symbols that identify the Seismic and Aux data, and distinguish between the data from the different acquisitions within a shot point.

The symbol "@" followed by a number ranging from 1 to 32 identifies the data section corresponding to an acquisition within a shot point. Unless the symbol "@" is used, all acquisitions within a shot point are identical.

Within a data section, the symbol "*" is used as a separator between the data for the seismic traces and the data for the Auxes. The data for the seismic traces must be placed ahead of the data for the Auxes. If the Auxes data are omitted, by default they are the same as for the seismic traces.

Blank rows and rows beginning with the symbol "#" are ignored. Any comment following the symbol "@" and the acquisition number is ignored. Any comment following the symbol "*" is ignored.

The Seismic and Aux data structure consists of a suite of samples. The samples are arranged at the rate of five values per row, preceded by the sequential number of each row's first sample (for better legibility of the file).

Each sample is an integer value ranging from -8388608 (max negative value of the FDU's converter) to +8388607 (max positive value of the FDU's converter). The maximum number of samples allowed in a trace is 32000, thus allowing the description of signals up to 32000 times the sample rate in length. If the acquisition length exceeds the synthetic signal length, then the signal restarts with the first sample, which allows you to describe periodic signals with only one period.

File Name

The file containing the description of the synthetic signal must be placed in the directory:

`/users/sealXI/sealXI/sn408File/synthetic`

with the following Permissions: Read, Write and Execute for Owner, Group and World.

After the file is copied to the directory, the SEAL must be rebooted to allow the use of the file.

To use the file, open the OPERATION main window and select the SIGNAL option. Initialize the operation sequence with a Signal Type defined as "Synthetic". In the associated menu, select the appropriate file name.

LCI-LMP processors

With two or more LCI-LMP processor pairs, an additional file is needed to define the allocation of spread lines to the processors.

A file named `modules.descr.userseal.hci408` must be created in the directory

```
/users/sealX1/sealX1/sn408File/synthetic.
```

The file should contain as many lines as there are lines in the spread, with the following syntax:

```
line #, LCI-LMP pair #
```

For instance, assuming the following `modules.descr.userseal.hci408` file:

```
10, 1
```

```
20, 2
```

```
30, 1
```

```
40, 2
```

and a spread described as follows:

```
10:1-100g1
```

```
20:1-100g1
```

```
30:1-100g1
```

```
40:1-100g1
```

As a result:

- LCI-LMP #1 will create traces 1-100 and 201-300.
- LCI-LMP #2 will create traces 101-200 and 301-400.

Examples

Auxes and Seis traces identical, all acquisitions identical

* full scale 50 Hz sine wave on all traces at 1 ms

| | | | | | |
|----|----------|----------|----------|----------|----------|
| 0 | 0 | 2592222 | 4930699 | 6786525 | 7978039 |
| 5 | 8388607 | 7978039 | 6786525 | 4930699 | 2592222 |
| 10 | 0 | -2592222 | -4930699 | -6786525 | -7978039 |
| 15 | -8388607 | -7978039 | -6786525 | -4930699 | -2592222 |

Auxes and Seis traces different, all acquisitions identical

* full scale 10 Hz sine wave on Seis traces at 2 ms

| | | | | | |
|----|----------|----------|----------|----------|----------|
| 0 | 0 | 1051371 | 2086161 | 3088052 | 4041242 |
| 5 | 4930699 | 5742396 | 6463532 | 7082735 | 7590238 |
| 10 | 7978039 | 8240021 | 8372054 | 8372054 | 8240021 |
| 15 | 7978039 | 7590238 | 7082735 | 6463532 | 5742396 |
| 20 | 4930699 | 4041242 | 3088052 | 2086161 | 1051371 |
| 25 | 0 | -1051371 | -2086161 | -3088052 | -4041242 |
| 30 | -4930699 | -5742396 | -6463532 | -7082735 | -7590238 |
| 35 | -7978039 | -8240021 | -8372054 | -8372054 | -8240021 |
| 40 | -7978039 | -7590238 | -7082735 | -6463532 | -5742396 |
| 45 | -4930699 | -4041242 | -3088052 | -2086161 | -1051371 |

* half full scale 10 Hz sine wave on Auxes at 2 ms

| | | | | | |
|----|----------|----------|----------|----------|----------|
| 0 | 0 | 525685 | 1043080 | 1544026 | 2020621 |
| 5 | 2465350 | 2871198 | 3231766 | 3541367 | 3795119 |
| 10 | 3989020 | 4120011 | 4186027 | 4186027 | 4120011 |
| 15 | 3989020 | 3795119 | 3541367 | 3231766 | 2871198 |
| 20 | 2465350 | 2020621 | 1544026 | 1043080 | 525685 |
| 25 | 0 | -525685 | -1043080 | -1544026 | -2020621 |
| 30 | -2465350 | -2871198 | -3231766 | -3541367 | -3795119 |
| 35 | -3989020 | -4120011 | -4186027 | -4186027 | -4120011 |
| 40 | -3989020 | -3795119 | -3541367 | -3231766 | -2871198 |
| 45 | -2465350 | -2020621 | -1544026 | -1043080 | -525685 |

Auxes and Seis traces identical, acquisitions different

@1

* full scale 10 Hz sine wave on all traces at 2 ms

| | | | | | |
|----|----------|----------|----------|----------|----------|
| 0 | 0 | 1051371 | 2086161 | 3088052 | 4041242 |
| 5 | 4930699 | 5742396 | 6463532 | 7082735 | 7590238 |
| 10 | 7978039 | 8240021 | 8372054 | 8372054 | 8240021 |
| 15 | 7978039 | 7590238 | 7082735 | 6463532 | 5742396 |
| 20 | 4930699 | 4041242 | 3088052 | 2086161 | 1051371 |
| 25 | 0 | -1051371 | -2086161 | -3088052 | -4041242 |
| 30 | -4930699 | -5742396 | -6463532 | -7082735 | -7590238 |
| 35 | -7978039 | -8240021 | -8372054 | -8372054 | -8240021 |
| 40 | -7978039 | -7590238 | -7082735 | -6463532 | -5742396 |
| 45 | -4930699 | -4041242 | -3088052 | -2086161 | -1051371 |

@2

* half full scale 10 Hz sine wave on all traces at 2 ms

| | | | | | |
|----|----------|----------|----------|----------|----------|
| 0 | 0 | 525685 | 1043080 | 1544026 | 2020621 |
| 5 | 2465350 | 2871198 | 3231766 | 3541367 | 3795119 |
| 10 | 3989020 | 4120011 | 4186027 | 4186027 | 4120011 |
| 15 | 3989020 | 3795119 | 3541367 | 3231766 | 2871198 |
| 20 | 2465350 | 2020621 | 1544026 | 1043080 | 525685 |
| 25 | 0 | -525685 | -1043080 | -1544026 | -2020621 |
| 30 | -2465350 | -2871198 | -3231766 | -3541367 | -3795119 |
| 35 | -3989020 | -4120011 | -4186027 | -4186027 | -4120011 |
| 40 | -3989020 | -3795119 | -3541367 | -3231766 | -2871198 |
| 45 | -2465350 | -2020621 | -1544026 | -1043080 | -525685 |

4

Auxes and Seis traces different, acquisitions different

@1

* one sample positive full scale pulse on seismic traces

| | | | | | |
|-------|---------|---|---|---|---|
| 0 | 8388607 | 0 | 0 | 0 | 0 |
| 5 | 0 | 0 | 0 | 0 | 0 |
| 10 | 0 | 0 | 0 | 0 | 0 |
| . | | | | | |
| . | | | | | |
| 31995 | 0 | 0 | 0 | 0 | 0 |

* one sample negative half full scale pulse on Auxes

| | | | | | |
|-------|----------|---|---|---|---|
| 0 | -4194304 | 0 | 0 | 0 | 0 |
| 5 | 0 | 0 | 0 | 0 | 0 |
| 10 | 0 | 0 | 0 | 0 | 0 |
| . | | | | | |
| . | | | | | |
| 31995 | 0 | 0 | 0 | 0 | 0 |

@2

* full scale 50 Hz sine wave on Seis traces at 1 ms

| | | | | | |
|----|----------|----------|----------|----------|----------|
| 0 | 0 | 2592222 | 4930699 | 6786525 | 7978039 |
| 5 | 8388607 | 7978039 | 6786525 | 4930699 | 2592222 |
| 10 | 0 | -2592222 | -4930699 | -6786525 | -7978039 |
| 15 | -8388607 | -7978039 | -6786525 | -4930699 | -2592222 |

* half full scale 50 Hz sine wave on Auxes at 1 ms

| | | | | | |
|----|----------|----------|----------|----------|----------|
| 0 | 0 | 1296111 | 2465350 | 3393263 | 3989020 |
| 5 | 4194304 | 3989020 | 3393263 | 2465350 | 1296111 |
| 10 | 0 | -1296111 | -2465350 | -3393263 | -3989020 |
| 15 | -4194304 | -3989020 | -3393263 | -2465350 | -1296111 |

Chapter 5

Instrument test limit file format

This chapter describes the format of the files containing instrument test limits. For default limit values, see User's Manual Vol. 3, Appendix 1 (Specifications). It includes the following sections:

- [FDU2 instrument tests \(page 58\)](#)

FDU2 instrument tests

Below is the `Fdu_Instr_Test_Limit.sea.fdu.2ms` file containing the limits for instrument tests with a 2-ms sample rate :

```
Fdu_Instr_Test_Limit : [
# =====

Distorsion_Limit      : -100 # (dB)
Com_Mode_Rej_Limit    : 100 # (dB)
Gain_Limit             : 1.0 # (%)
Phase_Limit           : 20 # (us)
Noise_Limit_G1600      : 1.6 # (uv)
Noise_Limit_G400       : 0.4 # (uv)
Crosstalk_Limit       : 100.00

]
```

The suffix of the file name depends on the Sample Rate (.4ms .2ms .1ms .0.5ms 0.25ms).

For other sample rates, the file structure is the same but limit values may be different, in compliance with SEAL Specifications (see User's Manual Vol. 3 Appendix 1).

Appendix

6

Navigation formats

This chapter describes communication protocols for interfacing with navigation systems. It includes the following sections:

- [SEAL interfacing capabilities \(page 60\)](#)
- [ECOS navigation system \(page 61\)](#)
- [SPECTRA navigation system \(page 63\)](#)
- [Remote SPECTRA navigation message \(page 67\)](#)
- [ORCA navigation message \(page 69\)](#)
- [Spectra / Orca Rev 0007 \(page 73\)](#)

SEAL interfacing capabilities

The Seal can receive ASCII information from a navigation system during data acquisition.

A serial port on the Blaster connector is used to interface the Seal with a navigation system. The parameters of the serial port are set as follows:

Baud Rate: 9600 (by default), or 19200, or 38400. The Baud rate is user-selected in the Config window on the HCI workstation. See Seal User's Manual Vol. 1.

Stop bits: 1.

Parity: None.

Protocol: XON/XOFF.

Alternatively, you can use an Ethernet port with the UDP transport protocol.

The message from the navigation system can be up to 64 kbytes long. It is processed by the Seal as follows:

- The entire ASCII message is copied to the **External Header** in the SEG file header.
- Information relating to the time and source location (see the table below) is copied to the relevant fields in the SEG file header.

Table 6-1

| System | Line Name | Sequence No. | Shot time | Shot No. | Source location |
|----------------|-----------|---------------|-----------|----------|-----------------|
| Spectra | ✓ | ✓ (if Rev. 5) | ✓ | ✓ | |
| Remote Spectra | ✓ | ✓ | ✓ | ✓ | |
| Ecos | ✓ | | ✓ | ✓ | ✓ |
| ORCA | ✓ | ✓ (if Rev. 4) | ✓ | ✓ | |
| Other | | | | | |



Note: some fields (e. g. Line Name, Shot Point #) are also displayed in the Operation main window on the HCI workstation. See User's Manual Vol. 1.

ECOS navigation system

The message from the ECOS navigation system is a standard SPS message followed by any number of characters.

The SPS message consists of a header with four characters (**SPS**<space>) followed by 80 characters starting with <S>:

SPS <80 characters ><LF>

The 80 characters are described in the table below:

Table 6-2

| Item | Definition of field | Cols. | Format | Min to Max | Default | Units |
|------|---------------------------------|-------|--------|----------------|---------|-------|
| 1 | Record identification | 1-1 | A1 | "S" | None | |
| 2 | Line name (left adj) | 2-17 | 4A4 | Free | None | |
| 3 | Point number (right adj) | 18-25 | 2A4 | Free | None | |
| 4 | Point index | 26-26 | I1 | 1 - 9 | | |
| 5 | Point code (*) | 27-28 | A2 | see below | None | |
| 6 | Static correction | 29-32 | I4 | -999 - 999 | Blank | ms |
| 7 | Point Depth | 33-36 | F4.1 | 0 -99.9 | None | Metre |
| 8 | Seismic datum | 37-40 | I4 | -999 - 999 | None | Metre |
| 9 | Uphole time | 41-42 | I2 | 0 99 | Blank | ms |
| 10 | Water depth (#) | 43-46 | F4.1# | 0 to 99.9/9999 | Blank | Metre |
| 11 | Map grid easting | 47-55 | F9.1 | | None | |
| 12 | Map grid northing | 56-65 | F10.1 | | None | |
| 13 | Surface Elevation | 66-71 | F6.1 | -999.9 -9999.9 | None | Metre |
| 14 | Day of year | 72-74 | I 3 | 1 - 999 | None | |
| 15 | Time hhmmss | 75-80 | 3 I 2 | 000000-235959 | None | |

(#) Water depth should be read in as F5.1 to allow for 4 character decimal and integer values.

(*) Example Point codes:

"PM" - permanent marker, "KL" - kill or omit point

"E1".. "E9" "A1".. "A9".."W1".. "W9", "S1".. "S9". - source codes

The table below shows how Header fields in the SEG D file are updated after interpreting the messages supplied by the ECOS navigation system:

Table 6-3

| SEG D Header Field | ECOS field copied to SEG D Header (if valid ECOS message) | Default (if invalid ECOS message) |
|-----------------------------------------------|-----------------------------------------------------------|-----------------------------------|
| Line Name (Extended Header block) | Line Name | Line Name from Seal system |
| Source point number (General Header block #3) | Point number | Shot Point from Seal system. |
| Source point index (General Header block #3) | Point index | 1 |
| Source easting (Extended Header) | Map grid easting | 0 |
| Source northing (Extended Header) | Map grid northing | 0 |
| Source elevation (Extended Header) | Surface elevation | 0 |
| Julian Day, Hour, Minute, Second | Time | Day and Time from Seal system |



Note: Because the SEG D "Line Name" (Extended Header) field is imported from the ECOS navigation message, receiving an erroneous message may cause a spurious directory to be created on the hard disk (/var/dump partition), containing the corresponding shots.

SPECTRA navigation system

The message from the SPECTRA navigation system consists of a header followed by a message from the gun controller system.

The format of the header is as follows:

Table 6-4 Revision 1, or 2, or 3

| Definition | Format | Description |
|------------------|-----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| Header ID | aa | '\$1' or '\$2'. '\$1' is default. If "-rstdiff <name>" command line argument is supplied, this field is changed to "\$2". |
| Length | nnnn | Length of header excluding this field and the 'Header ID' field |
| Program Revision | aaaa | '0001' or '0002' or '0003' |
| Line Status | nn | 01=Offline, 02=Approach, 03=Online, 04=Runout |
| Shot Time: | nn nn nn .nnnnnn nnnn nn nn | Hours Minutes Seconds Microseconds (optional) Year Month Day |
| Time Ref | aaa | 'UTC' |
| Shot Number | nnnnnn | 6 characters |
| Line Name | aaaaaaaaaaaaaaaa | 16 characters |
| Master Latitude | nnnn.nnnnnn | In degrees |
| Master Longitude | nnnn.nnnnnn | In degrees |
| Water Depth | nnnn.n | In metres |
| Source Latitude | nnnn.nnnnnn | In degrees |
| Source Longitude | nnnn.nnnnnn | In degrees |
| Master Gyro | nnn.n | In degrees |
| Master CMG | nnn.n | In degrees |
| Master Speed | nn.n | In knots |

Table 6-4 Revision 1, or 2, or 3 (Continued)

| | | |
|-------------------|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Vessel ID | nnn | (if Rev. 3) |
| Master Easting | eeeeeeeeee.e | meters (11.1f) |
| Master Northing | nnnnnnnnn.n | meters (11.1f) |
| Source Delta East | eeeeee.e | meters (7.1f) |
| Source Delta Nrth | nnnnn.n | meters (7.1f) |
| Line Bearing | bbb.b | degrees (5.1f) |
| Julian Day | ddd | |
| TB-Trigger Time | nnnnn | Optional. If the "-rstdiff <name>" command line argument is supplied, this field contains the time difference between the Timebreak and the specified trigger time. i.e. diff = (Trigger Time - Timebreak Time). The units are in integer millisecs. |

Table 6-5 Revision 5

| Definition | Format | Description |
|------------------|-----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| Header ID | aa | '\$1' or '\$2'. '\$1' is default. If "-rstdiff <name>" command line argument is supplied, this field is changed to "\$2". |
| Length | nnnn | Length of header excluding this field and the 'Header ID' field |
| Program Revision | aaaa | '0005' |
| Line Status | nn | 01=Offline, 02=Approach, 03=Online, 04=Runout |
| Shot Time: | nn nn nn .nnnnnn nnnn nn nn | Hours Minutes Seconds Microseconds (optional) Year Month Day |
| Time Ref | aaa | 'UTC' |
| Shot Number | nnnnnn | 6 characters |
| Line Name | aaaaaaaaaaaaaaaa | 16 characters |

Table 6-5 Revision 5 (Continued)

| | | |
|-------------------|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Master Latitude | nnnn.nnnnnn | In degrees |
| Master Longitude | nnnn.nnnnnn | In degrees |
| Water Depth | nnnn.n | In metres |
| Source Latitude | nnnn.nnnnnn | In degrees |
| Source Longitude | nnnn.nnnnnn | In degrees |
| Master Gyro | nnn.n | In degrees |
| Master CMG | nnn.n | In degrees |
| Master Speed | nn.n | In knots |
| Sequence number | nnnn | 4 characters |
| Master Easting | eeeeeeeeee.e | meters (11.1f) |
| Master Northing | nnnnnnnnn.n | meters (11.1f) |
| Source Delta East | eeeeee.e | meters (7.1f) |
| Source Delta Nrth | nnnnn.n | meters (7.1f) |
| Line Bearing | bbb.b | degrees (5.1f) |
| Julian Day | ddd | |
| TB-Trigger Time | nnnnn | Optional. If the "-rstdiff <name>" command line argument is supplied, this field contains the time difference between the Timebreak and the specified trigger time. i.e. diff = (Trigger Time - Timebreak Time). The units are in integer millisecs. |

The table below shows how Header fields in the SEG-D file are updated after interpreting the messages supplied by the SPECTRA navigation system:

Table 6-6

| SEGD Header Field | SPECTRA field copied to SEG D Header (if valid SPECTRA message) | Default (if invalid SPECTRA message) |
|-------------------------------------------------------------------------|-----------------------------------------------------------------|--------------------------------------|
| Line Name (Extended Header block) | Line Name | Line Name from Seal system |
| Sequence Number (General header block # 2 and Extended Header block) | Sequence Number (only if Spectra Revision 5) | Sequence Number from Seal system |
| Source point number (General header block #3 and Extended Header block) | Shot number | Shot Point from Seal system. |
| Year julian day, hour, minute, seconds (General header block #1) | Shot time | Day and time from Seal system. |



Note: Because the SEG D "Line Name" (Extended Header) field is imported from the SPECTRA navigation message, receiving an erroneous message may cause a spurious directory to be created on the hard disk (/var/dump partition), containing the corresponding shots.

Remote SPECTRA navigation message

With the Remote SPECTRA navigation option, in addition to the message described on [page 63](#) the following message is supplied by the Spectra system:

Table 6-7

| Definition | Format | Description |
|-----------------|-----------------------------------------------|---------------------------------------------------------------------|
| Header ID | aa | '\$S' |
| Length | nnnn | Length of header excluding this field and the 'Header ID' field |
| Spectra version | nn.nn.nn.nn | '09.08.03.01' |
| Line Status | nn | 01=Offline, 02=Approach, 03=Online, 04=Runout |
| Shot Time: | nn nn nn .nnnnnn nnnn nn nn | Hours Minutes Seconds Microseconds Year Month Day |
| Shot Number | nnnnnn | |
| Line Name | aaaaaaaaaaaaaaaa a | |
| Sequence Number | nnnn | |
| Shots To Go | nnnnnn | Not available in initial version. |

This message is supplied on each T0 in Approach, On-Line and Run-out phases, periodically (every 15 s by default) in the Off-line phase.



Note: Because the SEG D "Line Name" and "Sequence Number" (Extended Header) fields are imported from that additional message, receiving an erroneous message may cause a spurious directory to be created on the hard disk (/var/dump partition), containing the corresponding shots.

The table below shows how Header fields in the SEG-D file are updated after interpreting the messages supplied by the Remote SPECTRA navigation system:

Table 6-8

| SEG-D Header Field | Remote Spectra field copied to SEG-D Header (if valid Remote Spectra message) | Default (if invalid Remote Spectra message) |
|------------------------------------------------------------------|-------------------------------------------------------------------------------|---------------------------------------------|
| Line Name (Extended Header block) | Line Name | Line Name from Seal system |
| Sequence Number (Extended Header block) | Sequence Number | Sequence Number from Seal system |
| Source point number (general header block #3) | Shot number | Shot Point from Seal system. |
| Year julian day, hour, minute, seconds (general header block #1) | Shot time | Day and time from Seal system. |

ORCA navigation message

Table 6-9 ORCA LABO Rev 2

| Definition | Bytes | Example |
|-----------------------|-------|-----------------|
| \$ | 2 | \$2 |
| Length | 4 | 3945 |
| Revision | 4 | 0002 |
| Line status | 2 | 03 |
| Time | 6 | 055817 |
| Microsecond | 7 | .999822 |
| Year and date | 8 | 20090915 |
| Time Ref | 3 | UTC |
| Shot Point | 6 | 000125 |
| Line name | 16 | B62709-TEST9016 |
| Master Lat | 11 | 9.517893 |
| Master Lon | 11 | 100.146617 |
| Water depth | 6 | 5.9 |
| Source Lat | 11 | 9.518023 |
| Source Lon | 11 | 100.133522 |
| Master gyro | 5 | 239.8 |
| Master CMG | 5 | 346.9 |
| Master speed | 4 | 0.0 |
| Master Easting | 11 | 000625852.9 |
| Master Northing | 11 | 001052318.1 |
| Source Delta Easting | 7 | -1437.6 |
| Source Delta Northing | 7 | 00009.6 |
| Line bearing | 5 | 021.0 |
| Julian day | 3 | 258 |
| -rstdiff option | 5 | -50 |

Table 6-10 ORCA LABO Rev 3

| Definition | Bytes | Example |
|-----------------------|-------|-----------------|
| \$ | 2 | \$2 |
| Length | 4 | 3945 |
| Revision | 4 | 0003 |
| Line status | 2 | 03 |
| Time | 6 | 055817 |
| Microsecond | 7 | .999822 |
| Year and date | 8 | 20090915 |
| Time Ref | 3 | UTC |
| Shot Point | 6 | 000125 |
| Line name | 16 | B62709-TEST9016 |
| Master Lat | 11 | 9.517893 |
| Master Lon | 11 | 100.146617 |
| Water depth | 6 | 5.9 |
| Source Lat | 11 | 9.518023 |
| Source Lon | 11 | 100.133522 |
| Master gyro | 5 | 239.8 |
| Master CMG | 5 | 346.9 |
| Master speed | 4 | 0.0 |
| Vessel ID | 3 | 001 |
| Master Easting | 11 | 000625852.9 |
| Master Northing | 11 | 001052318.1 |
| Source Delta Easting | 7 | -1437.6 |
| Source Delta Northing | 7 | 00009.6 |
| Line bearing | 5 | 021.0 |
| Julian day | 3 | 258 |
| -rstdiff option | 5 | -50 |

Table 6-11 ORCA LABO Rev 4

| Definition | Bytes | Example |
|-----------------------|-------|-----------------|
| \$ | 2 | \$2 |
| Length | 4 | 3953 |
| Revision | 4 | 0004 |
| Line status | 2 | 03 |
| Time | 6 | 06075 |
| Microsecond | 7 | .999822 |
| Year and date | 8 | 20090915 |
| Time Ref | 3 | UTC |
| Shot Point | 6 | 000112 |
| Line name | 16 | B62709-TEST9018 |
| Sequence number | 5 | 09018 |
| Master Lat. | 11 | 9.516422 |
| Master Lon. | 11 | 100.365608 |
| Water depth | 6 | 5.8 |
| Source Lat. | 11 | 9.516093 |
| Source Lon. | 11 | 100.340177 |
| Master gyro | 5 | 238.9 |
| Master CMG | 5 | 143.9 |
| Master speed | 4 | 0.0 |
| Vessel ID | 3 | 001 |
| Master Easting | 11 | 000649893.9 |
| Master Northing | 11 | 001052242.5 |
| Source Delta Easting | 7 | -2791.7 |
| Source Delta Northing | 7 | -0047.3 |
| Line bearing | 5 | 021.0 |
| Julian day | 3 | 258 |
| -rstdiff option | 5 | -50 |



Note: Because the SEGD "Line Name" (Extended Header) field is imported from the ORCA navigation message, receiving an erroneous message may cause a spurious directory to be created on the hard disk (/var/dump partition), containing the corresponding shots.

The table below shows how Header fields in the SEGD file are updated after interpreting the ORCA navigation messages:

Table 6-12

| SEGD Header Field | ORCA field copied to SEGD Header (if valid ORCA message) | Default (if invalid ORCA message) |
|------------------------------------------------------------------|----------------------------------------------------------|-----------------------------------|
| Line Name (Extended Header block) | Line Name | Line Name from Seal system |
| Sequence Number (Extended Header block) | Sequence Number (only if Rev. 4) | Sequence Number from Seal system |
| Source point number (general header block #3) | Shot Point | Shot Point from Seal system. |
| Year julian day, hour, minute, seconds (general header block #1) | Time | Day and time from Seal system. |

Spectra / Orca Rev 0007

Table 6-13

| Byte | Format | #Bytes | Description | |
|------|------------------|--------|------------------------------------------------------------------------------|----------------|
| 1 | AA | 2 | Header ID: “\$2 “. | |
| 3 | NNNN | 4 | Length of header, excluding this field and the 'Header ID' field. | |
| 7 | AAAA | 4 | Program Revision: 0007. | |
| 11 | NN | 2 | Line Status. 01 = Offline 02 = Approach 03 = Online 04 = Runout. | |
| 13 | NN | 2 | Shot Time: | Hours. |
| 15 | NN | 2 | | Minutes. |
| 17 | NN | 2 | | Seconds. |
| 19 | . | 1 | | Decimal Point. |
| 20 | NNNNNN | 6 | | Microseconds. |
| 26 | NNNN | 4 | Date: | Year. |
| 30 | NN | 2 | | Month. |
| 32 | NN | 2 | | Day. |
| 34 | AAA | 3 | Time Ref. 'UTC' (or 'GPS' depending on RTNU reference). | |
| 37 | NNNNNN | 6 | Shot Number. | |
| 43 | AAAAAAAAAAAAAAAA | 16 | Line Name. | |
| 59 | NNNN.NNNNNN | 11 | Master Latitude in degrees. | |
| 70 | NNNN.NNNNNN | 11 | Master Longitude in degrees. | |
| 81 | NNNN.N | 6 | Water Depth in metres. | |
| 87 | NNNN.NNNNNN | 11 | Source Latitude in degrees. | |
| 98 | NNNN.NNNNNN | 11 | Source Longitude in degrees. | |

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Table 6-13 (Continued)

| Byte | Format | #Bytes | Description |
|------|-------------|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 109 | NNN.N | 5 | Master Gyro in degrees. |
| 114 | NNN.N | 5 | Master CMG in degrees. |
| 119 | NN.N | 4 | Master Speed in knots. |
| 123 | NNNN | 4 | Sequence number. |
| 127 | NNN | 3 | ID of the shooting vessel. |
| 130 | NNNNNNNNN.N | 11 | Master Easting in metres. |
| 141 | NNNNNNNNN.N | 11 | Master Northing in metres. |
| 152 | NNNNN.N | 7 | Source Delta Easting in metres. |
| 159 | NNNNN.N | 7 | Source Delta Northing in metres. |
| 166 | NNN.N | 5 | Line Bearing in degrees. |
| 171 | NNN | 3 | Julian Day. |
| 174 | NNNNN | 5 | TB-Trigger time. Time difference between the Time Break and the specified trigger time, i.e. diff = (Trigger Time – Time Break). The units are in integer millisecs. |

Vessel ID must be written whenever the software allows it.

Total Block Size = 178 bytes.

Appendix

7

Log formats

This chapter describes the predefined formats of the logs available from the Log main window. It includes the following sections:

- [Streamer description log \(page 76\)](#)
- [Streamer verbose description log \(page 77\)](#)
- [Live & Dead Seismic Channel format \(page 79\)](#)
- [HAU gauge log \(page 81\)](#)

Streamer description log

To generate a numeric description of the streamer, use the Data Base View in the Log main window: choose "Line" from the Environment option button and "Result" from the Type option button, and choose "**Streamer_Result**" in the list box. Click Apply. This loads the streamer description to the Results pane in the main window so that you can export it or print it out.

Streamer description log format

| Item | Definition of field | Cols | formats | Min.to Max. | Default | Units |
|------|------------------------|-------|---------|-------------|---------|-------|
| 1 | Streamer Number | 1-6 | A6 | Free | None | - |
| 2 | Assembly Type | 7-12 | A6 | Free | None | - |
| 3 | Assembly Serial Number | 13-22 | A10 | Free | None | - |

Example of streamer description log

```

H26 _____ Vx.x
H26 Streamer Description
H26      1      2      3      4      5      6      7      8
H26 567890123456789012345678901234567890123456789012345678901234567890
1      LAUXM 353
1      HAU   558
1      ALS   20001
1      ALS   20002
1      LAUM  218
1      ALS   40006
1      LAUM  217
1      ALS   10001
1      LAUM  216
1      ALS   40005
1      ALS   40002
1      TAPU  15

```

Note: Text lines starting with the "H26" code are "header" lines.

Streamer verbose description log

To generate a detailed numeric description of the streamer, use the Data Base View in the Log main window: choose "Line" from the Environment option button and "Result" from the Type option button, and choose "**Streamer_Vervose_Result**" in the list box. Click Apply. This loads the detailed streamer description to the Results pane in the main window so that you can export it or print it out.

Streamer verbose description log format

| Item | Definition of field | Cols | formats | Min.to Max. | Default | Units |
|------|------------------------|---------|---------|-------------|---------|-------|
| 1 | Streamer Number | 1-6 | A6 | Free | None | - |
| 2 | Assembly Type | 7-12 | A6 | Free | None | - |
| 3 | Assembly Serial Number | 13-22 | A10 | Free | None | - |
| 4 | Unit 1 : Type | 23-28 | A6 | Free | None | - |
| 5 | Unit 1 : Serial Number | 29-38 | A10 | Free | None | - |
| 6 | Unit 2 : Type | 39-44 | A6 | Free | None | - |
| 7 | Unit 2 : Serial Number | 45-54 | A10 | Free | None | - |
| 8 | Unit 3 : Type | 55-60 | A6 | Free | None | - |
| 9 | Unit 3 : Serial Number | 61-70 | A10 | Free | None | - |
| 10 | Unit 4 : Type | 71-76 | A6 | Free | None | - |
| 11 | Unit 4 : Serial Number | 77-86 | A10 | Free | None | - |
| 12 | Unit 5 : Type | 87-92 | A6 | Free | None | - |
| 13 | Unit 5 : Serial Number | 93-102 | A10 | Free | None | - |
| 14 | Unit 6 : Type | 103-108 | A6 | Free | None | - |
| 15 | Unit 6 : Serial Number | 109-118 | A10 | Free | None | - |

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Example of streamer verbose description log

```
H26 ____ Vx.x
H26
H26 Streamer Description
H26
H26      1      2      3      4      5      6      7      8
H26 567890123456789012345678901234567890123456789012345678901234567890
H26
```

```

1      LAUXM 353      lauXM 353
1      HAU   558      fdu1M 9984      fdu1M 9985
1      ALS   20001    fdu2M 4273      fdu2M 4503      fdu2M 4393      fdu2M 4511
                        fdu2M 4501      fdu2M 4513
1      ALS   20002    fdu2M 4941      fdu2M 4301      fdu2M 4041      fdu2M 4943
                        fdu2M 4541      fdu2M 4931
1      LAUM   218      lauM   218
1      ALS   40006    fdu2M 4781      fdu2M 4281      fdu2M 4531      fdu2M 4121
                        fdu2M 4081      fdu2M 4101
1      LAUM   217      lauM   217
1      ALS   10001    fdu2M 4563      fdu2M 9733      fdu2M 4571      fdu2M 4731
1      LAUM   216      lauM   216
1      ALS   40005    fdu2M 4843      fdu2M 4783      fdu2M 4653      fdu2M 4581
                        fdu2M 4431      fdu2M 4423
1      ALS   40002    fdu2M 4583      fdu2M 4613      fdu2M 4411      fdu2M 4663
                        fdu2M 4401      fdu2M 4533
1      TAPU   15      tapu   15

```

Note: Text lines starting with the "H26" code are "header" lines.

Live & Dead Seismic Channel format

The description of Live and Dead seismic traces is composed of:

- an integer value giving the number of channels,
- an ASCII descriptor giving the channel description for each streamer.

Only the number of live channels and the number of dead channels are recorded into the extended header part of the SEG-D file header (see SEG-D format in [Chapter 2](#)).

Both the number of channels and the descriptor can be viewed using a “Pagination Type” making it possible to have it in real time in the result pane of the Operation window or later in the Log window.

The ASCII descriptor gives the channels of each streamer as a succession of sections separated by commas:

<streamer number> = <section 1>, <section 2>, ...

Each section is a succession of consecutive live channels or dead channels identified by first and last channel numbers within the streamer, first and last trace numbers in SEG-D file corresponding to channels with the following format:

=<first channel> - <last channel> (<first trace> - <last trace>) ,<section 2> , ...

Example:

- Assuming 3 streamers, composed of 240 channels each, and no acquisition error occurred:

Number of live seis channels: 720

Live seis channels:

- 1 = 1-240 (1-240)
- 2 = 1-240 (241-480)
- 3 = 1-240 (481-720)

Number of dead seis channels: 0

Dead seis channels:

- Now assuming an acquisition error occurs on 12 channels in the middle of streamer 2:

Number of live seis channels: 708

Live seis channels =
1 = 1-240 (1-240)
2 = 1-114 (241-354), 127-240 (367-480)
3 = 1-240 (481-720)

Number of dead seis channels: 12

Dead seis channels: 2 = 115-126 (355-366)

HAU gauge log

Daily files containing the logged measurements of the streamer tension are available from the Log main window: click on the Log View button, choose the HAU Gauge tab, select the desired file from the list box, and click Apply. This loads the measurement file to the Results pane in the main window so that you can export it or print it out.

HAU gauge log format

| Item | Definition of field | Cols | formats | Min. to Max. | Default | Units |
|------|-----------------------|-------|---------|-----------------|---------|-------|
| 1 | Record Identification | 1-1 | A1 | G | None | - |
| 2 | Streamer Name | 2-17 | 4A4 | Free | None | - |
| 3 | Point Number | 18-25 | 2A4 | Free | None | - |
| 4 | HAU Serial Number | 27-33 | A7 | Free | None | - |
| 5 | Mean Gauge | 35-40 | F6.1 | 0.1 - 9999.9 | None | daN |
| 6 | Peak Gauge | 42-47 | F6.1 | 0.1 - 9999.9 | None | daN |
| 7 | Day of year | 66-68 | I3 | 1 - 999 | None | - |
| 8 | Time hhmmss | 69-74 | 3I2 | 000000 - 235959 | None | - |

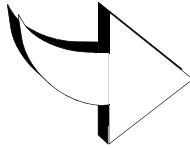
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Example of HAU gauge log

```

H26 x.x
H26
H26 HAU Gauge Attributes Record Specification
H26
H26      1      2      3      4      5      6      7      8
H26 567890123456789012345678901234567890123456789012345678901234567890
H26
G1      1      105  572.0  574.0      085074520
G1      1      105  567.0  568.0      085074646
G1      1      105  568.0  569.0      085074949
G1      1      105  567.0  569.0      085075208
G1      1      105  566.0  568.0      085075234
G1      1      105  565.0  567.0      085075239
...
```

Note: Text lines starting with the "H26" code are "header" lines.



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Appendix

8

Trace summing

This chapter describes how SEG-D Header record fields are modified by the Trace Summing process. It includes the following sections:

- *File Header (page 84)*
- *Trace Header (page 86)*
- *Channel set descriptors (page 90)*

File Header

General Header block #1

No modification.

General Header block #2

No modification.

General Header block #3

No modification.

Scan Type Header

| SEGD field | Modification caused by trace summing |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Channel Set Numer | A Channel Set contains the description of a streamer. If all traces in a streamer are summed, the same Channel Set is reused. If traces are partially summed, a Channel Set is created for each type of summing. |
| Channel set starting time | |
| Channel set starting time | |
| Nb channel in set | Recomputed. |
| Channel Id | |
| Gain control method | |
| Alias filter freq | |
| Alias filter slope | |
| Low cut filter freq | |
| Low cut filter slope | |
| Trace header extensions | |
| Vertical stack | |
| Streamer cable nb | |
| Array forming | Number of traces in each summed group. |

See [Channel set descriptors on page 90](#).

Extended Header

| SEGD field | Modification caused by trace summing |
|--------------------------|--------------------------------------|
| Total num. of traces | Recomputed |
| Num. of seis traces | Recomputed |
| Num. of dead seis traces | Recomputed |
| Num. of live seis traces | Recomputed |

Trace Header

The Trace Header of the resulting trace is computed from the headers of the traces summed, using the following scenario for each field:

- If the field has the same value in all trace headers, then the resulting field assumes that value (blank field in the tables below).
- If the field has different values in trace headers but a formula makes it possible to compute a meaningful global value, then the field is recomputed using that formula.
- If the field has different values in trace headers but no meaningful global value can be computed, then the field is set to 0.

Demultiplexed Trace Header

| SEGD field | Modification caused by trace summing |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| File Number | |
| Scan Type Number | |
| Channel Set Number | Recomputed, with a different Channel Set for each streamer and each streamer section not having the same number of channels summed. |
| Trace Number | Recomputed for ultimate numbering with 1 as increment. |
| First Timing Word | |
| Trace Header Ext | |
| Sample Skew | |
| Trace Edit | Max of trace edit. |
| Time Break Window | |
| Extended Channel Set | |
| Extended File Number | |

Trace Header Ext block #1

| SEGD field | Modification caused by trace summing |
|------------------------------|--------------------------------------------|
| Receiver Line Number | |
| Receiver Point Number | Renumbered, starting from 1 in a streamer. |
| Receiver Point Index | |
| Nb Sample Per Trace | |
| Extended Receiver Line Num. | |
| Extended Receiver Point Num. | |
| Sensor Type | |

Trace Header Ext block #2

| SEGD field | Modification caused by trace summing |
|--------------------------|--------------------------------------|
| Receiver point easting | |
| Receiver point northing | |
| Receiver point elevation | |
| Sensor type Nb | 0 if different. |

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Trace Header Ext block #3

Not used in marine operations.

Trace Header Ext block #4

| SEGD field | Modification caused by trace summing |
|------------------------|--------------------------------------|
| Capacitance low limit | 0 if different. |
| Capacitance high limit | 0 if different. |
| Capacitance value | Summed capacitance values. |
| Cut off low limit | 0 if different. |
| Cut off high limit | 0 if different. |
| Cut of value | Average value. |
| Capacitance error | Logic Or |
| Cut off error | Logic Or |

Trace Header Ext block #5

| SEGD field | Modification caused by trace summing |
|---------------|--------------------------------------|
| Leakage limit | 0 if different. |
| Leakage value | Min value. |
| Leakage error | Logic Or |

Trace Header Ext block #6

| SEGD field | Modification caused by trace summing |
|----------------------------|--------------------------------------|
| Unit Type | |
| Unit Serial Number | 0 if different. |
| Channel Number | 0 |
| FDU assembly type | |
| FDU assembly serial Number | 0 if different. |
| FDU assembly location | 0 if different. |
| FDU unit type | 0 if different. |
| Channel type | |
| Sensitivity | Equivalent Sensitivity |

Trace Header Ext block #7

| SEGD field | Modification caused by trace summing |
|----------------------------|------------------------------------------|
| Control Unit Type | 0 if different. |
| Control unit serial Number | 0 if different. |
| Channel gain | Should be the same in all trace headers. |
| Channel filter | |
| Overscaling | Logic Or. |
| Channel edit status | Max of status. |
| mV conv factor | |
| Nb stack low | |
| Nb stack noisy | |
| Remove offset | |
| Change sign | |
| Channel type | |
| Channel process | |
| Analog low cut filter | |
| Digital low cut filter | |
| Number of Editions | Summed numbers of editions. |
| Compound low cut filter | |

Channel set descriptors

Example : 60 Auxes, 6 streamers with 240 channels each.

With no trace summing, each streamer is described by one channel set.

| Channel set # | Num of channels in set | Channel type | Streamer cable # | Array forming |
|---------------|------------------------|--------------|------------------|---------------|
| 1 | 60 | aux | 0 | 1 |
| 2 | 240 | seis | 1 | 1 |
| 3 | 240 | seis | 2 | 1 |
| 4 | 240 | seis | 3 | 1 |
| 5 | 240 | seis | 4 | 1 |
| 6 | 240 | seis | 5 | 1 |
| 7 | 240 | seis | 6 | 1 |

With trace summing, a streamer is described by as many channel sets as types of array forming in the streamer.

Assuming Streamer#2 channels 1 to 120 are summed 2 by 2 and channels 121 to 240 unsummed:

| Channel set # | Num of channels in set | Channel type | Streamer cable # | Array forming |
|---------------|------------------------|--------------|------------------|---------------|
| 1 | 60 | aux | 0 | 1 |
| 2 | 240 | seis | 1 | 1 |
| 3 | 60 | seis | 2 | 2 |
| 4 | 120 | seis | 2 | 1 |
| 5 | 240 | seis | 3 | 1 |
| 6 | 240 | seis | 4 | 1 |
| 7 | 240 | seis | 5 | 1 |
| 8 | 240 | seis | 6 | 1 |

Assuming Streamer#3 channels 1 to 80 are summed 4 by 4, channels 81 to 160 summed 2 by 2 and channels 161 to 240 unsummed:

| Channel set # | Num of channels in set | Channel type | Streamer cable # | Array forming |
|---------------|------------------------|--------------|------------------|---------------|
| 1 | 60 | aux | 0 | 1 |
| 2 | 240 | seis | 1 | 1 |
| 3 | 240 | seis | 2 | 1 |
| 4 | 20 | seis | 3 | 4 |
| 5 | 40 | seis | 3 | 2 |
| 6 | 80 | seis | 3 | 1 |
| 7 | 240 | seis | 4 | 1 |
| 8 | 240 | seis | 5 | 1 |
| 9 | 240 | seis | 6 | 1 |

Assuming Streamer#2 channels 1 to 80 are unsummed, channels 81 to 160 summed 2 by 2 and channels 161 to 240 unsummed:

| Channel set # | Num of channels in set | Channel type | Streamer cable # | Array forming |
|---------------|------------------------|--------------|------------------|---------------|
| 1 | 60 | aux | 0 | 1 |
| 2 | 240 | seis | 1 | 1 |
| 3 | 160 | seis | 2 | 1 |
| 4 | 40 | seis | 2 | 2 |
| 5 | 240 | seis | 3 | 1 |
| 6 | 240 | seis | 4 | 1 |
| 7 | 240 | seis | 5 | 1 |
| 8 | 240 | seis | 6 | 1 |

Assuming all streamers have their channels 1 to 120 summed 2 by 2:

| Channel set # | Num of channels in set | Channel type | Streamer cable # | Array forming |
|---------------|------------------------|--------------|------------------|---------------|
| 1 | 60 | aux | 0 | 1 |
| 2 | 60 | seis | 1 | 2 |
| 3 | 120 | seis | 1 | 1 |
| 4 | 60 | seis | 2 | 2 |
| 5 | 120 | seis | 2 | 1 |
| 6 | 60 | seis | 3 | 2 |
| 7 | 120 | seis | 3 | 1 |
| 8 | 60 | seis | 4 | 2 |
| 9 | 120 | seis | 4 | 1 |
| 10 | 60 | seis | 5 | 2 |
| 11 | 120 | seis | 5 | 1 |
| 12 | 60 | seis | 6 | 2 |
| 13 | 120 | seis | 6 | 1 |

Appendix

A

Organization Codes

Organization codes are assigned by the Petroleum Open Standards Consortium (POSC).

To request a new organization code, contact:

POSC

24 Greenway Plaza

Suite 1000-B

Houston, TX 77046 USA

+1 713 784-1880 telephone

+1 713 784-9219 fax

info@posc.org

| Code | Organization |
|------|---------------------------------------------------------------------------|
| 0 | Subcommittee On Recommended Format For Digital Well Data, Basic Schema |
| 1 | Operator |
| 2 | Driller |
| 3 | Mud Logger |
| 9 | Amerada Hess |
| 10 | Analysts, The |
| 15 | Baker Hughes Inteq |
| 20 | Baroid |
| 30 | Birdwell |
| 40 | Reeves (1 Jan 99; formerly BPB) |
| 50 | Brett Exploration |
| 60 | Cardinal |
| 65 | Center Line Data |
| 66 | Subcommittee On Recommended Format For Digital Well Data, DLIS Schema |
| 70 | Century Geophysical |
| 77 | CGG Logging, Massey France |
| 80 | Charlene Well Surveying |
| 90 | Compagnie de Services Numerique |
| 95 | Comprobe |
| 100 | Computer Data Processors |
| 110 | Computrex |
| 115 | COPGO Wood Group |
| 120 | Core Laboratories |
| 125 | CRC Wireline, Inc. |
| 126 | Crocker Data Processing Pty Ltd |
| 127 | Tucker Wireline Services (formerly Davis Great Guns Logging, Wichita, KS) |
| 130 | Digigraph |
| 137 | Tucker Technologies (formerly Digital Logging Inc.), Tulsa, OK. |
| 140 | Digitech |
| 145 | Deines Perforating |
| 148 | Drilog Petro-Dynamics Limited |
| 150 | Baker Atlas (formerly Dresser Atlas) |
| 160 | Earthworm Drilling |

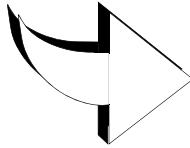
A

| Code | Organization |
|------|------------------------------------------------|
| 170 | Electronic Logging Company |
| 180 | Elgen |
| 190 | El Toro |
| 200 | Empire |
| 205 | Encom Technology, Ltd. |
| 206 | Ensigh Geophysics, Ltd. |
| 210 | Frontier |
| 215 | Geolog |
| 217 | Geoshare |
| 218 | GEO-X Systems Ltd. |
| 220 | G O International |
| 230 | Gravilog |
| 240 | Great Guns Servicing |
| 250 | Great Lakes Petroleum Services |
| 260 | GTS |
| 268 | Guardian Data Seismic Pty. Ltd. |
| 270 | Guns |
| 280 | Halliburton Logging |
| 285 | Horizon Production Logging |
| 290 | Husky |
| 300 | Jetwell |
| 305 | Landmark Graphics |
| 310 | Lane Wells |
| 315 | Logicom Computer Services (UK) Ltd |
| 320 | Magnolia |
| 330 | McCullough Tool |
| 332 | Mitchell Energy Corporation |
| 335 | Paradigm Geophysical (formerly Mincom Pty Ltd) |
| 337 | MR-DPTS Limited |
| 338 | NRI On-Line Inc |
| 339 | Oilware, Inc. |
| 340 | Pan Geo Atlas |
| 342 | Pathfinder Energy Services |
| 345 | Perfco |

| Code | Organization |
|------|----------------------------------------------------------------|
| 350 | Perfojet Services |
| 360 | Perforating Guns of Canada |
| 361 | Petcom, Inc. |
| 362 | Petroleum Exploration Computer Consultants, Ltd. |
| 363 | Petrologic Limited |
| 366 | Phillips Petroleum Company |
| 368 | Petroleum Geo-Services (PGS) |
| | |
| 370 | Petroleum Information |
| 380 | Petrophysics |
| 390 | Pioneer |
| 392 | The Practical Well Log Standards Group |
| 395 | IHS Energy Log Services (formerly Q. C. Data Collectors) |
| 400 | Ram Guns |
| 410 | Riley's Datashare |
| 418 | RODE |
| 420 | Roke |
| 430 | Sand Surveys |
| 440 | Schlumberger |
| 450 | Scientific Software |
| 460 | Seismograph Service |
| 462 | SEGDEF |
| 463 | SEG Technical Standards High Density Media Format Subcommittee |
| 464 | Shell Services Company |
| 465 | Stratigraphic Systems, Inc. |
| 467 | Sperry-Sun Drilling Services |
| 468 | SEPTCO |
| 469 | Sercel, Inc. |
| 470 | Triangle |
| 475 | Troika International |
| 480 | Welex |
| 490 | Well Reconnaissance |
| 495 | Wellsite Information Transfer Specification (WITS) |
| 500 | Well Surveys |

| Code | Organization |
|------|----------------------------|
| 510 | Western |
| 520 | Westronics |
| 525 | Winters Wireline |
| 530 | Wireline Electronics |
| 540 | Worth Well |
| 560 | Z & S Consultants Limited |
| 999 | Reserved for local schemas |
| 1000 | POSC |

A



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ABCDEFGHIJKLMNOPQRSTUVWXYZ

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U2 = [User's Manual Vol. 2](#)

U3 = [User's Manual Vol. 3](#)

TM = [Technical Manual](#)

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