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| | | Document Title: | SeaBat 7k Data Format, Volume I | | |
| DATA FORMAT DEFINITION DOCUMENT | | | | | |

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DATA FORMAT DEFINITION DOCUMENT

SeaBat 7k Data Format, Volume I Version 0.54

RESON, Inc.
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 Goleta, California 93117
 United States of America

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1 INTRODUCTION

1.1 Purpose

This document describes the data format used to log and transmit network data with the 7k series systems and to provide general sensor support. It defines record types for generic sensors and those relevant to the 7k series sonar.

This record-based protocol encapsulates data using frames and headers. A record can hold any type of data, and all records have a unique type identifier. Each record is wrapped within a frame that identifies and describes the content of the record. TCP/UDP transmission uses an additional preceding header to facilitate packet handling.

A built-in synchronization pattern, combined with the checksum, should aid record recovery in corrupted files.

The data format also defines set conventions pertaining to position, rotation, data types and time for consistent data handling.

1.2 Terms and Acronyms

The following table contains definitions of terms and acronyms used in this document.

| Term | Definition |
|-----------|---|
| 7k Format | A record-based data format defined for data logging and network transmission for use, in part, with the SeaBat™ 7k systems. |
| Altitude | Distance from the seafloor to the sensor. |
| COG | Center of Gravity |
| Depth | Distance from the sea surface to the sensor. |
| DFD | Data Format Definition |
| Heading | True heading. |
| ICD | Interface Control Document. |
| Pitch | Rotation about the across-ship (X) axis. |
| Roll | Rotation about the along-ship (Y) axis. |



| Term | Definition |
|-------------|--|
| SeaBat™ 7k | Generic term used to describe the SeaBat™ 7000 series of sonar systems, related software components and protocols. |
| VRP | Vessel Reference Point. |
| XTF | Extended Triton Format: an open binary data logging format created by Triton Elics International, Inc. |
| Yaw | Rotation about the vertical (Z) axis. |

2 CONVENTIONS

2.1 Overview

This section describes sign conventions, data types and time definition used within this DFD.

2.2 Sign Conventions

Unless otherwise stated, all offset measurements shall be relative to the Vessel Reference Point (VRP). Distances shall be in meters and angles in radians. The convention used for 3D coordinate rotation is roll, pitch then yaw. The following sign convention shall be used:

Table 1: Sign Conventions

| Offset | Sign | Description |
|----------|------|--|
| X | + | Starboard of the VRP |
| | - | Port of the VRP |
| Y | + | Forward of the VRP |
| | - | Astern of the VRP |
| Z | + | Height above the VRP |
| | - | Depth below the VRP |
| Roll | + | Port Up |
| | - | Port Down |
| Pitch | + | Bow up |
| | - | Bow down |
| Yaw | + | Bow to Starboard |
| | - | Bow to Port |
| Heave | + | Up |
| | - | Down |
| Heading | + | Clockwise |
| | - | Counter-Clockwise |
| Altitude | + | Up |
| | - | Down |
| Depth | + | Up |
| | - | Down |
| Tide | + | High Tide (Height above a defined point) |
| | - | Low Tide (Height below a defined point) |

2.3 Vessel Axes

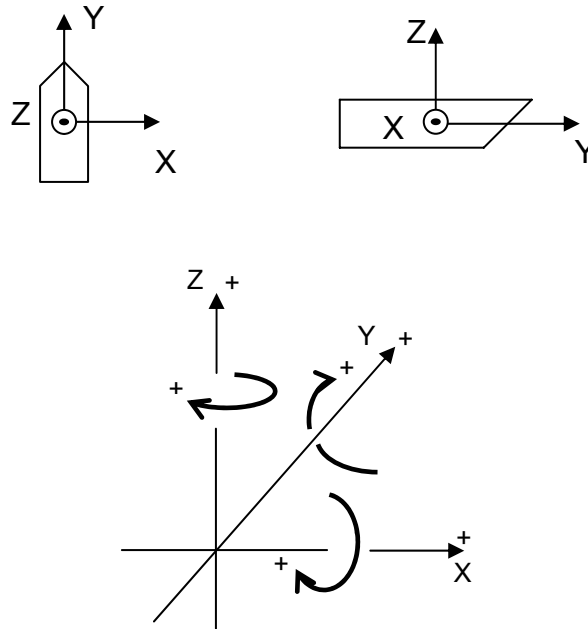


Figure 1: Vessel Axes

2.4 Beam Positions

Beam zero (first beam) is on the port (left) side of the vehicle when the array is installed with the projector facing down and pointing aft.

2.5 Data Types Definitions

The following data type formats are defined by this document.

- **Unsigned values:** 'uX' is an unsigned integer, X bits wide. (E.g. u32 = unsigned 32 bits.)
- **Signed values:** 'iX' is a signed integer, X bits wide. (.g. i16 = signed 16 bits.)
- **Floating points:** Either f32 or f64 (IEEE 1754-1994).

All headers are of static size unless stated otherwise and shall use "struct member alignment" of 1 byte (8 bits) in memory. Data shall be represented in little Endian (Intel) byte-order format unless stated otherwise.

A bit field flag will indicate whether a feature is activated or deactivated. Unless stated otherwise, a bit set to "1" will indicate the given feature is activated.

2.6 Time Definition

Time tags shall be in UTC unless stated otherwise and use the following structure (7KTIME):

Table 2: Time Definition

| Name | Size | Description |
|---------|------|---|
| Year | u16 | 0 - 65535, all four digits must be used (for example, "2004" rather than "04"). |
| Day | u16 | 1 – 366 |
| Seconds | f32 | 0.000000 - 59.999999 |
| Hours | u8 | 0 - 23 |
| Minutes | u8 | 0 - 59 |

3 TCP AND UDP

3.1 Overview

TCP sessions should conform to RFC 793 extensions. UDP session should conform to RFC 768 and later extensions.

Unless otherwise stated, TCP connections should not use the Nagle algorithm to minimize network latency.

Both source and destination port must be populated with a unique port number for TCP and UDP transmissions.

4 RECORD DEFINITION

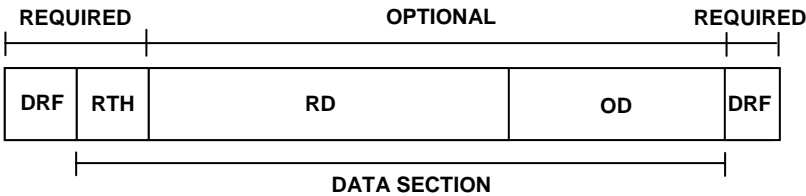
4.1 Overview

A 7k record consists of a data record frame (header and checksum), a record type header, an optional record data field and an optional data field for extra information. The optional data field typically holds sensor-specific data.

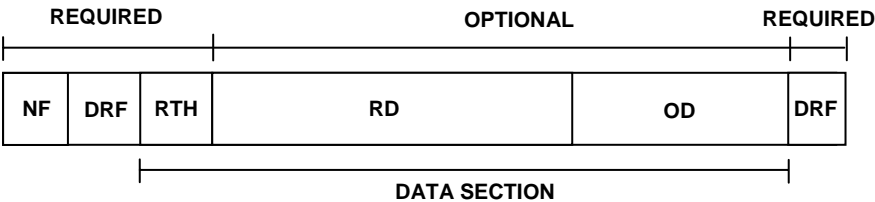
When 7k records are transmitted over a network, a network frame shall precede each record.

7k RECORD

- DRF – Data Record Frame.
- RTH – Record Type Header.
- RD – Record Data.
- OD – Optional Data.



Network prepared with the Network Frame (NF).



5 DATA RECORD FRAME

5.1 Overview

The Data Record Frame (DRF) is the generic wrapper in which all records (sensor data or otherwise) shall be embedded. The sync pattern combined with the checksum should aid recovery in the event a file becomes corrupted. A record frame shall always start with the version and offset fields and can be used to dynamically determine the protocol version, if necessary.

Size Limitation:

Although the format supports records of any length, a practical limitation of 8 MB is imposed on data records from the 7k sonar. Accordingly, if bit 2 of the Flags bit-field is set, the record is one in a sequence of multiple fragments. For the given sequence, the record's relative position in the sequence is given by the "Fragment number" field and the total number by the "Total records in fragment" field.

When a record is fragmented, subsequent Data Record Frames in the sequence shall be identical to the first in the sequence with the exception of the fragment fields. Furthermore, the Record Data fields of each fragmented component shall be a bit-wise segmentation from an equivalent record of the entire length up to and including its checksum.

Consumers of the data may re-constitute an entire record by removing the data record frames for all but the first record in the sequence then concatenating the components. The optional data field and checksum of the equivalently long record shall therefore be embedded in the data of the component records. No Optional Data fields in the record fragments are to be used.

NOTE:

"Fragment" nomenclature is used as opposed to sequence terminology used for the Network Frame (NF) — a similar concept.

The frame is defined as follows:

Table 3: Data Record Frame

| Name | Size | Description |
|--------------------------|-------|--|
| Protocol Version | u16 | Protocol Version of this frame (e.g.: 1, 2, etc.) |
| Offset | u16 | Offset in bytes from the start of the sync pattern to the start of the DATA SECTION. This allows for expansion of the header whilst maintaining backward compatibility. |
| Sync Pattern | u32 | 0x0000FFFF |
| Size | u32 | Size in bytes of this record from the start of the version field to the end of the checksum field — that is, it includes the embedded data size. |
| Optional data offset | u32 | Offset in bytes to optional data field from start of record. Zero (0) bytes implies no optional data. |
| Optional data identifier | u32 | Identifier for optional field. Zero (0) if there is no optional field. This identifier is described with each record type. |
| 7KTIME | u8*10 | Time tag. |
| Record Version | u16 | Version of Data Format used for record creation (e.g: 1, 2 etc.) |
| Record type identifier | u32 | Identifier for record type of embedded data. |
| Device identifier | u32 | Identifier of the device to which this data pertains. |
| Reserved | u16 | Reserved. |
| System enumerator | u16 | The enumerator is used to differentiate between devices with the same device identifiers in one installation / system. It is up to each application to decide what number to populate this field with. |
| Record count | u32 | Sequential record counter |

| Name | Size | Description |
|---|---------|--|
| Flags | u16 | BITFIELD: Bit 0: ChecksumReserved. 0 - Invalid checksum 1 - Valid checksum.Checksum. Bit 1: Reserved . Bit 2: Fragmentation 0 – Data Unfragmented 1 – Fragmented Sequence |
| Reserved | u16 | Reserved. |
| Reserved | u32 | Reserved. |
| Total records in fragmented data record set | u32 | Total records in fragmented data record set. (If appropriate flag is set). |
| Fragment number | u32 | Fragment number (if appropriate flag is set). |
| DATA SECTION | Dynamic | Data Section |
| Checksum | u32 | Sum of the bytes in the record from the beginning of the version field to the end of the data section. The use of this field is optional and depends on bit 1 of the Flags field. The checksum should be computed as a 64 bit unsigned integer with the least significant 32 bits used to populate this field. |

6 TCP AND UDP NETWORK FRAME

6.1 Overview

In order to facilitate network transport via both the TCP and UDP/IP protocols, records will be packetized using the following prefixed header. In this scheme, a series of network packets may contain a partial record or one or more data records, depending upon the boundary size criterion. A series of packets are allowed up to a maximum of 128 records.

When using UDP protocol, each packet shall be less than or equal to 64K bytes, including the network header. Packet sizes may not vary in a sequence except for the last packet.

The following header shall prefix the network packet:

Table 4: Network Frame

| Name | Size | Description |
|-------------------------|------|--|
| Version | u16 | Version of this frame (e.g.: 1, 2, etc.) |
| Offset | u16 | Offset in bytes to the start of data from the start of this packet. |
| Total Packets | u32 | Number of network packets for set of records transmitted. |
| Total Records | u16 | Total number of records in network packets transmitted (helper field for parsing data). Max 128 records per transmission. |
| Transmission Identifier | u16 | Transmission identifier (helper field for packet assembly). Must be the same number for each network packet in transmission. Adjacent transmissions in time from one source may not use the same identifier. |
| Packet Size | u32 | Size in bytes of this packet including the header and appended data. |
| Total Size | u32 | Total size in bytes of all packets in transmission, excluding network frame(s). |



| Name | Size | Description |
|-------------------------------|---------|--|
| Sequence Number | u32 | Sequential packet number; allows correct ordering during reconstruction. Range = 0 to n-1 packets |
| Destination Device Identifier | u32 | 0 = Unspecified 0xFFFFFFFF = Not used. Any other number is a valid address. |
| Destination enumerator | u16 | Destination enumerator unless destination device identifier is unspecified or not used. |
| Source Enumerator | u16 | Source enumerator unless Source Device Identifier is unspecified or not used. |
| Source Device Identifier | u32 | 0 = Unspecified 0xFFFFFFFF = Not used. Any other number is a valid address. |
| Data | Dynamic | Start of data with either a partial record or one or more complete records. |

7 LOGGING FILE FORMAT

7.1 Overview

A valid 7k data file shall be a binary file consisting of a series of data records.

Records must be complete and without the network frame. A file header record is recommended as the first record in each file thus describing the file's contents.

8 FILE NOMENCLATURE

To facilitate common file name parsing, it is recommended that file names be based on the UTC date and time when they are created and utilize a '.s7k' extension as follows:

"YYYYMMDD_HHMMSS.s7k"

Where YYYYMMDD represents the date and HHMMSS the time.

For example, 20010516_102852.s7k (Created May 16, 2001 at 10:28:52)

Multiple files created at the same time may be differentiated by appending _X to the filename (where "X" is an integer starting at zero and successively incremented for each file).

For example, 20010516_102852_0.s7k and 20010516_102852_1.s7k

9 RECORD TYPE DEFINITIONS

9.1 Overview

The following table summarizes the allocated record type identifiers pertaining to the RESON 7k sonar and generic sensors. This table is not necessarily a complete listing of allocated or reserved record types. Rather, it lists records that pertain specifically to, or are associated with, the RESON SeaBat™ 7k sonar.

Table 5: Record Type Definitions

| RECORD TYPE | DESCRIPTION |
|-------------|---|
| 1000-1999 | Reserved for generic sensor records |
| 1000 | Reference point |
| 1001 | Sensor offset position |
| 1002 | Calibrated sensor offset position |
| 1003 | Position |
| 1004 | Custom Attitude Information |
| 1005 | Tide |
| 1006 | Altitude |
| 1007 | Motion over ground |
| 1008 | Depth |
| 1009 | Sound Velocity Profile |
| 1010 | CTD |
| 1011 | Geodesy |
| 1012 | Roll Pitch Heave |
| 1013 | Heading |
| 1014 | Survey Line |
| 1015 | Navigation |
| 1016 | Attitude |
| 1050 | Generic sensor calibration parameters |
| 1200 | Generic side-scan sonar |
| 1201 | Reserved for generic sub-bottom profiler |
| 1202 | Reserved for generic embedded device data |
| 1500 – 1599 | Reserved for future QC records |
| 2000 | XYZ Data |
| 7000 – 7999 | Reserved for SeaBat™ 7k records |
| 7000 | 7k Volatile sonar settings |
| 7001 | 7k Configuration |
| 7002 | 7k Match Filter |
| 7004 | 7k Beam geometry |
| 7005 | 7k Calibration data |
| 7006 | 7k Bathymetric data |

| RECORD TYPE | DESCRIPTION |
|-------------|------------------------------------|
| 7007 | 7k Backscatter image data |
| 7008 | 7k Beam data |
| 7009 | Vertical Depth |
| 7011 | 7k Image data |
| 7021 | Reserved |
| 7022 | Reserved |
| 7030 | Sonar Installation Parameters |
| 7050 | 7k System events |
| 7051 | 7k System event message |
| 7052 | 7k Data storage status information |
| 7060 | 7k Target Data |
| 7200 | 7k File header |
| 7300 | Reserved |
| 7310 | 7k Trigger |
| 7311 | 7k Trigger Sequence Setup |
| 7312 | 7k Trigger Sequence Done |
| 7400 | 7k Time message |
| 7401 – 7499 | Reserved for future time messages |
| 7500 | 7k Remote control |
| 7501 | 7k Remote control acknowledge |
| 7502 | 7k Remote control not acknowledge |
| 7503 | 7k Remote control sonar settings |
| 7504 | Reserved |
| 7511 | Reserved |
| 7515 | Reserved |
| 7600 | 7k Roll |
| 7601 | 7k Pitch |
| 7610 | 7k Sound Velocity |
| 7611 | 7k Absorption loss |
| 7612 | 7k Spreading loss |
| 7900 – 7999 | Reserved |
| 8100 | Embedded 8100 Series Sonar Data |

9.2 1000 – Reference Point

Description: Reference Point Information

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 6: 1000: Record Type Header

| NAME | SIZE | DESCRIPTION |
|--|------|---------------------|
| Vehicle's X reference point to Center of Gravity | f32 | X offset in meters. |
| Vehicle's Y reference point to Center of Gravity | f32 | Y offset in meters. |
| Vehicle's Z reference point to Center of Gravity | f32 | Z offset in meters. |
| Water level to Center of Gravity | f32 | In meters. |

NOTE:

For submersible vehicles, since the vertical offset from the COG to the water level is not fixed, the offsets should be set to zero. Typically the offsets to the depth sensor, combined with the reported depth at the sensor and the vehicle attitude would be used to determine the depth of the COG and reference point.

9.3 1001 – Sensor Offset Position

Description: Sensor position offset information data (non-calibrated).

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 7: 1001 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|---------------------------|------|--|
| Sensor position X offset | f32 | X offset from vehicle reference point in meters. |
| Sensor position Y offset | f32 | Y offset from vehicle reference point in meters. |
| Sensor position Z offset | f32 | Z offset from vehicle reference point in meters. |
| Sensor roll angle offset | f32 | Roll angle offset in radians. |
| Sensor pitch angle offset | f32 | Pitch angle offset in radians. |
| Sensor yaw angle offset | f32 | Yaw angle offset in radians. |

9.4 1002 – Calibrated Sensor Offset Position

Description: Calibrated Sensor Position offset position information.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 8: 1002 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|---------------------------|------|--|
| Sensor position X offset | f32 | X offset from vehicle reference point in meters. |
| Sensor position Y offset | f32 | Y offset from vehicle reference point in meters. |
| Sensor position Z offset | f32 | Z offset from vehicle reference point in meters. |
| Sensor roll angle offset | f32 | Roll angle offset in radians. |
| Sensor pitch angle offset | f32 | Pitch angle offset in radians. |
| Sensor yaw angle offset | f32 | Yaw angle offset in radians. |

9.5 1003 – Position

Description: Position Record used in conjunction with Record Type 1011.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 9: 1003 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|------------------------------------|------|--|
| Datum Identifier | u32 | 0 – WGS84 >0 – Reserved. |
| Latency | f32 | In seconds. |
| Latitude or Northing | f64 | Latitude in radians or Northing in meters. |
| Longitude or Easting | f64 | Longitude in radians or Easting in meters. |
| Height relative to Datum or Height | f64 | In meters. |

| NAME | SIZE | DESCRIPTION |
|--------------------|------|---|
| Position type flag | u8 | 0 – Geographical coordinates 1 – Grid coordinates |
| UTM Zone | u8 | UTM Zone |
| Quality Flag | u8 | 0 – Navigation Data 1 – Dead-Reckoning |
| Positioning Method | u8 | 0 – GPS 1 – DGPS 2 – Start of inertial positioning system from GPS 3 – Start of inertial positioning system from DGPS 4 – Start of inertial positioning system from bottom correlation 5 – Start of inertial positioning from bottom object 6 – Start of inertial positioning from inertial positioning 7 – Start of inertial positioning from optional data 8 – Stop of inertial positioning system to GPS 9 – Stop of inertial positioning system to DGPS 10 – Stop of inertial positioning system to bottom correlation 11 – Stop of inertial positioning to bottom object 12 – Start of inertial positioning to inertial positioning 13 – Start of inertial positioning to optional data 14 – Optional Data >14 – Reserved |

9.6 1004 – Custom Attitude Information

Description: Attitude Data Record. The length of each data field is dynamic and is based on the field mask. The bit field mask will determine which elements make up a sample of fields in a given record. The number of samples (N) determines how many samples are repeated in a record at the specified sample rate (Frequency).

NOTE:

This is a custom field designed for advanced users who have specific needs. Normally, records 1012 and 1013 will be used.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 10: 1004 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|------------|------|--|
| Field Mask | u8 | BITFIELD: Bit 0: 0/1 – No pitch/pitch in radians. Bit 1: 0/1 – No Roll/roll in radians. Bit 2: 0/1 – No heading/heading in radians. Bit 3: 0/1 – No heave/heave in meters. Bit 4: 0/1 – No pitch/pitch rate of change in radians per second. Bit 5: 0/1 – No roll rate/roll rate of change in radians per second. Bit 6: 0/1 – No heading rate/heading rate of change in radians per second. Bit 7: 0/1 – No heave rate/heave rate of change in meters per second. |
| Reserved | u8 | Reserved. |
| N | u16 | Number of samples (repeated fields) in the record; data items therefore number of fields used x N. |
| Frequency | f32 | Sample rate in samples / second (required if multiple samples are used per record). |

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 11: 1004 - Record Data

| NAME | SIZE | DESCRIPTION |
|-----------|----------|--------------|
| FIELD 0 | variable | Sensor data. |
| ... | ... | ... |
| FIELD N-1 | variable | Sensor data. |

9.7 1005 – Tide

Description: Tide Data Record. Supports either measured or predicted tide values.

NOTE:

Only the tide value and its source (the first two fields) in the RTH are mandatory; positional information is optional and may be set to zero.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 12: 1005 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|------------------------------------|------|--|
| Tide | f32 | Height correction above mean sea level in meters. |
| Source | u16 | 0 – Unspecified. 1 – Table (predicted) 2 – Measured (gauge). |
| Flags | u8 | BITFIELD: Bit 0 – 0/1 for Gauge ID invalid/valid. Bit 1 – 0/1 for Position info invalid/valid. |
| Gauge Identifier | u16 | Optional field to permit discrimination between different devices. |
| Datum identifier | u32 | 0 – WGS84 >0 – Reserved. |
| Latency | f32 | In seconds. |
| Latitude or Northing | f64 | Latitude in radians or Northing in meters. |
| Longitude or Easting | f64 | Longitude in radians or Easting in meters. |
| Height relative to Datum or Height | f64 | In meters. |
| Position type flag | u8 | 0 – Geographical coordinates 1 – Grid coordinates |
| UTM Zone | u8 | UTM zone |

9.8 1006 – Altitude

Description: Altitude data record.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 13: 1006 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|----------|------|--|
| Distance | f32 | Distance from seafloor in meters to sensor, positive up (0 at sea bottom). |

9.9 1007 – Motion Over Ground

Description: Motion over ground record. The length of each data field is dynamic, based on the field mask.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 14: 1007 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|------------|------|--|
| Field mask | u8 | BITFIELD: 0: Speed in X, Y & Z directions (m/s); each an f32 if present. 1: Acceleration in X, Y & Z directions (m/s ²); each an f32 if present. 2-7: Reserved. Note: for bits 0 and 1, a set bit (1) indicates that the specified parameters are present in a field definition. If zero, then the field definition excludes the relevant parameters. |
| Reserved | u8 | Reserved field. |
| N | u16 | Number of fields. |
| Frequency | f32 | Sample rate in samples / second. |

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 15: 1007 - Record Data

| NAME | SIZE | DESCRIPTION |
|-----------|----------|--------------|
| FIELD 0 | Variable | Sensor data. |
| ... | ... | ... |
| FIELD N-1 | variable | Sensor data. |

9.10 1008 – Depth

Description: Depth data record.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 16: 1008 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|------------------|------|---|
| Depth descriptor | u8 | 0 – Depth to sensor 1 – Water depth. |
| Correction flag | u8 | 0 – RAW depth (as measured). 1 – Corrected depth (relative to mean-sea level). |
| Reserved. | u16 | Reserved. |
| Depth | f32 | The deeper, the bigger (positive) this value becomes. |

9.11 1009 – Sound Velocity Profile

Description: Sound velocity profile data record.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 17: 1009 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|---------------|------|--|
| Position flag | u8 | 0 – Invalid position fields. 1 – Valid position fields. |
| Reserved. | u8 | Reserved. |
| Reserved. | u16 | Reserved. |

| NAME | SIZE | DESCRIPTION |
|-----------|------|-------------------------------|
| Latitude | f64 | Latitude in radians (WGS84). |
| Longitude | f64 | Longitude in radians (WGS84). |
| N | u32 | Number of samples. |

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 18: 1009 - Record Data

| NAME | SIZE | DESCRIPTION |
|---------------------------|------|---------------------|
| SAMPLE 0 Depth | f32 | In meters. |
| SAMPLE 0 Sound velocity | f32 | In meters / second. |
| ... | ... | ... |
| SAMPLE N-1 Depth | f32 | In meters. |
| SAMPLE N-1 Sound velocity | f32 | In meters / second. |

9.12 1010 – CTD

Description: CTD Data Record

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 19: 1010 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|----------------------------|------|--|
| Frequency | f32 | Frequency |
| Sound velocity source flag | u8 | 0 – Not computed. 1 – CTD. 2 – User computed. |
| Sound velocity algorithm | u8 | 0 – Not computed. 1 – Checn Millero. 2 – Del Grosso. |
| Conductivity flag | u8 | 0 – Conductivity. 1 – Salinity. |
| Pressure flag | u8 | 0 – Pressure. 1 – Depth. |
| Position flag | u8 | 0 – Invalid position fields. 1 – Valid position fields. |

| NAME | SIZE | DESCRIPTION |
|-------------------------|------|--|
| Sample content validity | u8 | BITFIELD: (Bit set means field is valid otherwise zero) 0 – Conductivity / Salinity 1 – Water Temperature 2 – Pressure / Depth 3 – Sound Velocity 4 – Absorption |
| Reserved. | u16 | Reserved. |
| Latitude | f64 | Latitude in radians (WGS84). |
| Longitude | f64 | Longitude in radians (WGS84). |
| Sample rate | f32 | Sample rate. |
| N | u32 | Number of samples. |

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 20: 1010 - Record Data

| NAME | SIZE | DESCRIPTION |
|------------------------------------|------|----------------------|
| SAMPLE 0 Conductivity / Salinity | f32 | In S/m or ppt. |
| SAMPLE 0 Water temperature | f32 | In Celsius. |
| SAMPLE 0 Pressure / Depth | f32 | In Pascal or meters. |
| SAMPLE 0 Sound velocity | f32 | In meters / seconds. |
| SAMPLE 0 Absorption | f32 | In dB / kilometer |
| ... | ... | ... |
| SAMPLE N-1 Conductivity / Salinity | f32 | In S/m or ppt. |
| SAMPLE N-1 Water temperature | f32 | In Celsius. |
| SAMPLE N-1 Pressure / Depth | f32 | In Pascal or meters. |
| SAMPLE N-1 Sound velocity | f32 | In meters / seconds. |
| SAMPLE N-1 Absorption | f32 | In dB / kilometer |

9.13 1011 – Geodesy

Description: The Geodesy data record may be used to define the spheroid, datum and grid definitions for navigational data; each sequentially embedded within the RTH.

There are no dynamic data elements; the optional data portion of the record is used to contain custom projection parameters. The custom identifier field of the RTH identifies the various defined types. Moreover, this identifier may be -1 indicating that the optional data portion of the record contains user specific parameters.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 21: 1011 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|-------------------------|---------|--|
| Spheroid name | u8 * 32 | A short text description of the spheroid name: e.g., "WGS84". |
| Semi-major axis | f64 | Semi-major axis in meters: e.g., 6378137.0 for WGS84. |
| Inverse flattening | f64 | Inverse flattening in meters: e.g. 298.257223563 for WGS84. |
| Reserved 1 | u8 * 16 | Reserved space; should be zeroed. |
| Datum name | u8 * 32 | Datum name: e.g., "WGS84" |
| Data calculation method | u32 | 0 – Molodensky 1 – Bursa / Wolfe 2 – DMA MRE 3 – NADCON 4 – HPGN 5 – Canadian National Transformation V2 |
| Number of parameters | u8 | Three (3), Seven (7) and Eight (8) parameter transformation is supported. |
| DX | f64 | X – Shift (m) |
| DY | f64 | Y – Shift (m) |
| DZ | f64 | Z – Shift (m) |
| RX | f64 | X Rotation (degrees) |

| NAME | SIZE | DESCRIPTION |
|----------------------|---------|--|
| RY | f64 | Y Rotation (degrees) |
| RZ | f64 | Z Rotation (degrees) |
| Scale | f64 | |
| Reserved 2 | u8 * 35 | Reserved for later extension to 9 parameter transformation |
| Grid name | u8 * 32 | Name of grid system in use: e.g., "UTM" |
| Grid distance units | u8 | 0 – Meters 1 – Feet 2 – Yards 3 – US Survey Feet 4 - Kilometers 5 – Miles 6 – US Survey Miles 7 – Nautical Miles 8 – Chains 9 – Links |
| Grid angular units | u8 | 0 – Radians 1 – Degrees 2 – Degrees, Minutes, seconds 3 – Gradians 4 – Arc-seconds |
| Latitude of Origin | f64 | |
| Central Meridian | f64 | |
| False Easting | f64 | Meters. |
| False Northing | f64 | Meters. |
| Central Scale Factor | f64 | |
| Custom identifier | i32 | Identifier for optional field definition in 7k record. Used to define projection specific parameters. -2 – Custom -1 – Not used |
| Reserved 3 | u8 * 50 | Reserved |

Appendix B provides a list of currently reserved Custom Identifiers.

9.14 1012 – Roll Pitch Heave

Description: Motion Data Record. The length of each data field is fixed.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 22: 1012 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|-------|------|-------------------------|
| Roll | f32 | Vessel Roll in radians |
| Pitch | f32 | Vessel Pitch in radians |
| Heave | f32 | Vessel Heave in meters |

9.15 1013 – Heading

Description: Vessel Heading Record. The length of each data field is fixed.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 23: 1013 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|---------|------|---------------------------|
| Heading | f32 | Vessel Heading in radians |

9.16 1014 – Survey Line

Description: This optional record describes the survey line or route associated with the data in this file.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 24: 1014 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|--------------------|---------|--|
| Waypoint Count (N) | u16 | Number of points in the line / route. |
| Position Type | u16 | 0 = Latitude / Longitude 1 = Grid Coordinates |
| Radius | f32 | Turn radius between line segments (meters, 0 = no curvature in turns). |
| Line Name | u8 * 64 | Null terminated string – line name. |

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 25: 1014 - Record Data

| NAME | SIZE | DESCRIPTION |
|--------------------------|------|---|
| Latitude or Northing 0 | f64 | Latitude (Radians) - $\pi/2$ to $\pi/2$, -south |
| Longitude or Easting 0 | f64 | Longitude (Radians) - π to π , -west |
| ... | ... | ... |
| Latitude or Northing N-1 | f64 | Northing (meters) |
| Longitude or Easting N-1 | f64 | Easting (meters) |

9.17 1015 – Navigation

Description: This record will be output at the input navigation rate.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 26: 1015 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|------------------------------|------|---|
| Vertical reference | u8 | 1=Ellipsoid 2=Geoid 3=Chart datum |
| Latitude | f64 | Latitude of vessel reference point in Radians $-\pi/2$ to $\pi/2$, -south |
| Longitude | f64 | Longitude of vessel reference point in Radians $-\pi$ to π , -west |
| Horizontal Position accuracy | f32 | Position accuracy in meters. |
| Vessel height | f32 | Height of vessel reference point above vertical reference in meters |
| Height accuracy | f32 | In meters |
| Speed over ground | f32 | Speed over ground at position time in m/s |
| Course over ground | f32 | Course over ground at position time in radians |
| Heading | f32 | Heading of vessel at position time in radians |

9.18 1016 – Attitude

Description: This record will be output at the input motion sensor rate

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 27: 1016 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|-------------------------|------|---------------------|
| Number of attitude data | u8 | Number of Data Sets |

| | | |
|---------------------------------------|-----|---------------------------------|
| sets | | |
| For each attitude data set: | | |
| Time difference with record timestamp | u16 | Time difference in milliseconds |
| Roll | f32 | Roll measured in radians |
| Pitch | f32 | Pitch measured in radians |
| Heave | f32 | Heave measured in meters |
| Heading | f32 | Heading of vessel in radians |
| End loop | | |

9.19 1050 – Generic Sensor Calibration Parameters

Description: Sensor Calibration record.

Data Definition: The raw sensor calibration data is stored in the optional data (OD) field.

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 28: 1050 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|-----------|------|-------------|
| Reserved. | u128 | Reserved. |

9.20 1200 – Generic SideScan Sonar

Description: Each side scan sonar imagery channel immediately follows the RTH and is prefixed with its own channel header structure. Port channels typically appear first then starboard. When multiple subsystems are combined in the same record (e.g. high and low frequency systems) the channels will typically be port 1, starboard 1, port 2, starboard 2.

Channel imagery is stored in ascending time order on a per channel basis.

The optional data field may be used by applications to contain application specific sundry sensor information that should be associated with this ping. The custom data descriptor field of the channel header is provided to permit discrimination on an application basis if “custom” type. Non-zero values are reserved for future expansion of standard types.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 29: 1200 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|---------------------------------------|------|--|
| Ping number | u32 | Ping number as received from the side scan sonar |
| Number of channels | u32 | Number of imagery channels to follow (typically 2). |
| Total bytes of channel data to follow | u32 | Total bytes of channel data (and headers) to follow this record type header, including optional data). |
| Data type | u32 | Format of sample time-series data contained herein, thus: 0 – Envelope 1 – I and Q (complex) |

Table 30: 1200 - Channel Header

| NAME | SIZE | DESCRIPTION |
|-------------------|--------|--|
| Channel number | u8 | Channel number: 0 to Number of channels – 1. |
| Channel type | u8 | 0 - port 1 - starboard |
| Data type | u8 | 0 - slant range 1 - ground range |
| Polarity | u8 | 0 - bipolar, 1 - unipolar |
| Bytes per sample | u8 | Bytes per sample of the imagery. Note: complex (I & Q) data can be thought of as being 2 x samples at each point in time on a per channel basis. |
| Reserved 1 | u8 * 3 | Reserved for future use. |
| Number of samples | u32 | Number of samples in this channel. |
| Start time | u32 | Start of first sample in microseconds relative to the ping time stamp in the DRF. |

| NAME | SIZE | DESCRIPTION |
|------------------------|---------|---|
| Sample interval | u32 | Data sample interval in microseconds. |
| Range | f32 | Slant range or ground range in meters; depends on the data type field above. |
| Voltage (FSD) | f32 | Analogue maximum amplitude. Should be -1 if not used. |
| Name | u8 * 16 | Channel name as a zero terminated character array. |
| Custom data descriptor | u16 | Identifier allowing different optional data formats to be identified when the optional data field is used. 0, custom > 0, reserved. |
| Reserved 2 | u8 * 18 | Padding and reserved fields. |

9.21 2000 – XYZ Data

Description: XYZ data points on local grid.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 31: 2000 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|-----------------------|------|---|
| Heading | f32 | Instantaneous heading (in radians) that the frames pertain. |
| Frames in Data Record | u32 | Number of data frames to follow |

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 32: 2000 - Record Data

| NAME | SIZE | DESCRIPTION |
|--------|---------|------------------------------------|
| 7KTIME | u8 * 10 | Time for which the point pertains. |
| X | f64 | X in meters. |
| Y | f64 | Y in meters. |
| Z | f64 | Z in meters. |
| Tide | f32 | Height in meters. |

| NAME | SIZE | DESCRIPTION |
|----------|--------|--------------------------------------|
| Height | f32 | Height in meters. |
| Heave | f32 | Heave in meters. |
| Reserved | u8 * 4 | Reserved for future use and padding. |

9.22 7000 – 7k Volatile Sonar Settings

Description: This record is produced by the SeaBat™ 7k sonar 7-P processor series. It contains the volatile sonar settings. The 7-P processor updates this record for each ping. The record can manually be requested or subscribed to from the 7-P processor. For details about requesting and subscribing to records see together with Appendix A.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 33: 7000 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|------------------------------|------|---|
| Sonar Id | u64 | Serial number. |
| Ping number | u32 | Sequential number. |
| Multi-Ping Sequence | u16 | Flag to indicate Multi-Ping Sequence. Always 0 (zero) if not in Multi-Ping mode; otherwise this represents the sequence number of the ping in the multi-ping sequence. |
| Frequency | f32 | Center transmit frequency in Hertz. |
| Sample rate | f32 | Sample rate in Hertz |
| Receiver bandwidth | f32 | In Hertz. |
| Tx Pulse width | f32 | Seconds of pulse. |
| Tx Pulse type identifier | u32 | 0 – CW 1 – Linear chirp |
| Tx Pulse envelope identifier | u32 | 0 – Tapered rectangular 1 – Tukey |
| Tx Pulse envelope parameter | f32 | Some envelopes don't use this parameter. |
| Tx Pulse reserved | u32 | Additional pulse information. |

| NAME | SIZE | DESCRIPTION |
|---|------|---|
| Max ping rate | f32 | Maximum ping rate in pings per second. |
| Ping period | f32 | Seconds since last ping. |
| Range selection | f32 | Range selection in meters. |
| Power selection | f32 | Power selection in dB re 1 μ Pa |
| Gain selection | f32 | Gain selection in dB. |
| Control flags | u32 | BITFIELD: 0-3: Auto range method. 4-7: Auto bottom detect filter method. 8: Bottom detect range filter. 9: Bottom detect depth filter. 10-14: Auto receiver gain method. 15-31: Reserved. |
| Projector magic number | u32 | Projector selection. |
| Projector beam steering angle vertical | f32 | In radians. |
| Projector beam steering angle horizontal | f32 | In radians. |
| Projector beam -3dB beam width vertical | f32 | In radians. |
| Projector beam -3dB beam width horizontal | f32 | In radians. |
| Projector beam focal point | f32 | In meters. |
| Projector beam weighting window type | u32 | 0 – Rectangular 1 – Chebychev |
| Projector beam weighting window parameter | f32 | N/A |
| Transmit flags | u32 | BITFIELD: 0-3: Pitch stabilization method. 4-7: Yaw stabilization method. 8-31: Reserved. |
| Hydrophone magic number | u32 | Hydrophone selection. |
| Receive beam weighting window | u32 | 0 – Chebychev 1 – Kaiser |
| Receive beam weighting parameter | f32 | N/A |

| NAME | SIZE | DESCRIPTION |
|------------------------------|------|---|
| Receive flags | u32 | BITFIELD: 0-3: Roll stabilization method. 4-7: Dynamic focusing method. 8-11: Doppler compensation method. 12-15: Match filtering method. 16-19: TVG method. 20-23: Multi-Ping Mode. 0 = No Multi-Ping 1 = Multi-Ping 24-31: Reserved |
| Receive Beam Width | f32 | Angle in radians |
| Bottom detection filter info | f32 | Min range (if range filter active). |
| Bottom detection filter info | f32 | Max range (if range filter active). |
| Bottom detection filter info | f32 | Min depth (if depth filter active). |
| Bottom detection filter info | f32 | Max depth (if depth filter active). |
| Absorption | f32 | Absorption in dB/km. |
| Sound velocity | f32 | Sound Velocity in m/s |
| Spreading | f32 | Spreading loss in dB. |
| Reserved | u16 | Reserved for future pulse shape description. |

9.23 7001 – 7k Configuration

Description: This record is produced by the SeaBat™ 7k sonar 7-P processor series. It contains the configuration information about the sonar capabilities. Each sonar's configuration can be found in the record's Module info section (see *Table 35*). The record is created on system startup and does not change during operation. The record can be manually requested from the 7-P processor. This record is not available for subscription. For details about requesting records see record 7500 together with Appendix A.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 34: 7001 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|----------|------|-------------------------------------|
| Sonar Id | u64 | System processor serial number (7P) |
| N | u32 | Number of devices/sonars. |

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 35: 7001 - Record Data

| NAME | SIZE | DESCRIPTION |
|--------------------------|---------|---------------------------|
| Device 0 magic number | u32 | Unique identifier number. |
| Device 0 description | u8*64 | ASCII string. |
| Device 0 serial number | u64 | |
| Device 0 Info length | u32 | In Bytes. |
| Device 0 info | dynamic | Varies with device type. |
| ... | ... | ... |
| Device N-1 magic number | u32 | Unique identifier number. |
| Device N-1 description | u8*64 | ASCII string. |
| Device N-1 serial number | u64 | |
| Device N-1 Info length | u32 | In Bytes. |
| Device N-1 info | dynamic | Varies with device type. |

9.24 7002 – 7k Match Filter

Description: This record is produced by the SeaBat™ 7k sonar 7-P processor series. It contains the sonar's receive match filter settings. The 7-P processor updates this record for each ping. The record can manually be requested or subscribed to from the 7-P processor. For details about requesting and subscribing to records see record 7500 together with Appendix A.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 36: 7002 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|-----------------|------|---------------------|
| Sonar Id | u64 | Sonar serial number |
| Ping number | u32 | Sequential number. |
| Operation | u32 | 0 – Off 1 – On |
| Start frequency | f32 | Hz. |
| Stop frequency | f32 | Hz. |

9.25 7004 – 7k Beam Geometry

Description: This record is produced by the SeaBat™ 7k sonar 7-P processor series. It contains the receive beam widths and steering. The 7-P processor updates this record when any of the values have changed. The record can manually be requested or subscribed to from the 7-P processor. For details about requesting and subscribing to records see record 7500 together with Appendix A.

X represent across track beams and Y along track beams. This record does not take the sensor mounting location and where it is facing into account. The sensors mounting position and facing angle can for example instead be found in record #1001. In the case of a FLS, Y becomes Z and the definition of “nadir” changes accordingly.

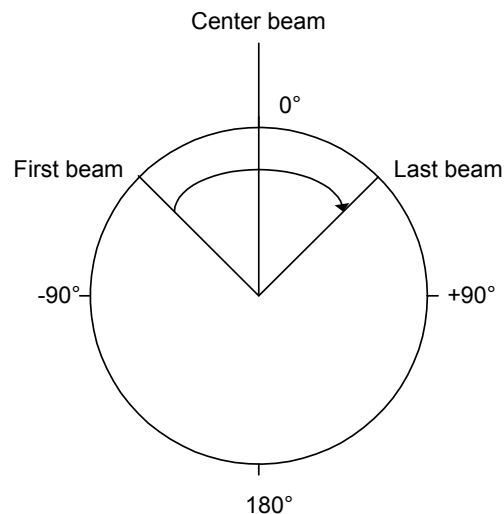


Figure 2: Sonar Beam Angle Convention

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 37: 7004 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|----------|------|---------------------------|
| Sonar Id | u64 | Sonar serial number |
| Rx | u32 | Number of receiver beams. |

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 38: 7004 - Record Data

| NAME | SIZE | DESCRIPTION |
|-------------------------------------|--------|---|
| Beam vertical direction angle[Rx] | f32*Rx | Angle in radians. The receiver beam steering angle (relative to nadir) applied in the along-track direction (typically 0). |
| Beam horizontal direction angle[Rx] | f32*Rx | Angle in radians. The receiver beam steering angle (relative to nadir) applied in the across-track direction (varies according to beam number. Typically -75 to +75 degrees. In equi-distant mode, this will not change. In equi-angle mode, steering angles will vary. |
| -3dB Beam width Y[Rx] | f32*Rx | Angle in radians. The receiver along-track beam width measured at the -3dB points (typically <30°). |
| -3dB Beam width X[Rx] | f32*Rx | Angle in radians. The receiver across-track beam width measured at the -3dB points (typically <5°). |

9.26 7005 – 7k Calibration Data

Description: This record is produced by the SeaBat™ 7k sonar 7-P processor series. It contains the receiver gain and phase offsets. The 7-P processor updates this record after receiver calibration operation. The record can be manually requested from the 7-P processor. This record is not available for

subscription. For details about requesting records see record 7500 together with Appendix A.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 39: 7005 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|----------|------|---|
| Sonar Id | u64 | Sonar serial number. |
| N | u16 | Number of hydrophone receiver channels. |

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 40: 7005 - Record Data

| NAME | SIZE | DESCRIPTION |
|--------------------|------|---|
| Receiver gain [N] | f32 | N receiver gain values relative to a nominal gain of 1.0. |
| ... | ... | ... |
| Receiver phase [N] | f32 | N receiver phase values relative to a nominal phase of 0.0 radians. |

NOTE:

There are no units for Gain in this record, as the value is dimensionless. Since the value is relative to 1.0, it is simply a ratio.

9.27 7006 – 7k Bathymetric Data

Description: This record is produced by the SeaBat™ 7k sonar 7-P processor series. It contains the sonar bottom detection results. This record is typically not available in a forward looking sonar configuration. The 7-P processor updates this record for each ping. The record can manually be requested or subscribed to from the 7-P processor. For details about requesting and subscribing to records see record 7500 together with Appendix A.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 41: 7006 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|-------------------------|------|--|
| Sonar Id | u64 | Serial number. |
| Ping number | u32 | Sequential number. |
| Multi-Ping Sequence | u16 | Flag to indicate Multi-Ping Sequence. Always 0 (zero) if not in Multi-Ping mode; otherwise this represents the sequence number of the ping in the multi-ping sequence. |
| N | u32 | Number of receiver beams. |
| Layer Compensation Flag | u8 | Flag indicating if the layer compensation is on or off 0 = Off 1 = On |
| Sound Velocity Flag | u8 | Flag indicating if Sound Velocity is measured or manually entered 0 = Measured 1 = Manually Entered |
| Sound Velocity | f32 | Sound Velocity at the sonar in meters/second |

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 42: 7006 - Record Data

| NAME | SIZE | DESCRIPTION |
|---------------|------|---|
| Range [N] | f32 | Two way travel time in seconds |
| Quality [N] | u8 | BITFIELD: 0-3: Quality value (0 = bad 15 = best). 4-7: Bottom Detection Method for each Ping. 0 = Both Amplitude and Phase 1 = Amplitude Only 2 = Phase Only |
| Intensity [N] | f32 | Signal strength dB re 1 μ Pa. Value at bottom detect. |

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

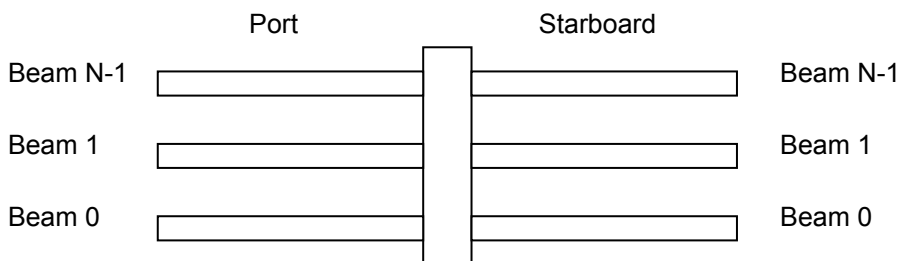
Table 43: 7006 - Optional Data

| NAME | SIZE | DESCRIPTION |
|--|------|---|
| Frequency | f32 | Ping Frequency in Hz. |
| Latitude | f64 | Latitude of vessel reference point in radians - $\pi/2$ to $\pi/2$, south negative. |
| Longitude | f64 | Longitude of vessel reference point in radians - π to π , west negative. |
| Heading | f32 | Heading of vessel at transmit time in radians. |
| Height Source | u8 | Method used to correct to chart datum. If height source = 1, then Tide = '0'. 0 = none 1 = RTK 2 = Tide |
| Tide | f32 | In meters |
| Roll | f32 | Roll at transmit time |
| Pitch | f32 | Pitch at transmit time |
| Heave | f32 | Heave at transmit time |
| Vehicle Depth | f32 | Vehicle depth at transmit time in m. |
| The following set of data items are repeated for each beam: | | |
| Beam 0 – Depth | f32 | Depth relative chart datum (or relative waterline if Height source = 0). Resolution = meters |
| Beam 0 – Along track distance | f32 | Along track distance in vessel grid. Resolution = meters |
| Beam 0 – Across track distance | f32 | Across track distance in vessel grid. Resolution = meters |
| Beam 0 – Pointing angle | f32 | Beam pointing angle from vertical in radians |
| Beam 0 – Azimuth angle | f32 | Beam azimuth angle in radians |

9.28 7007 – 7k Backscatter Imagery Data

Description: This record is produced by the SeaBat™ 7k sonar 7-P processor series. It contains the side scan sonar data. This record is typically not available in a forward looking sonar configuration. The 7-P processor updates this record for each ping. The record can manually be requested or subscribed to from the 7-P processor. For details about requesting and subscribing to records see record 7500 together with Appendix A.

Beam port and starboard numbering figure:



Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 44: 7007 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|------------------------|------|--|
| Sonar Id | u64 | Serial number. |
| Ping number | u32 | Sequential number. |
| Multi-Ping Sequence | u16 | Flag to indicate Multi-Ping Sequence. Always 0 (zero) if not in Multi-Ping mode; otherwise this represents the sequence number of the ping in the multi-ping sequence. |
| Beam position | f32 | Meters forward from position of beam 0. |
| Control flags | u32 | BITFIELD: 0-3: Yaw stabilization method. 4-7: Beam forming method. 8-15: Calibration method. 16-31: Reserved. |
| S | u32 | Samples. |
| Port -3dB beam width Y | f32 | In radians. |
| Port -3dB beam width Z | f32 | In radians. |

| NAME | SIZE | DESCRIPTION |
|---------------------------------|------|---|
| Starboard -3dB beam width Y | f32 | In radians. |
| Starboard -3dB beam width Z | f32 | In radians. |
| Port beam steering angle Y | f32 | In radians (typically positive). |
| Port beam steering angle Z | f32 | In radians (typically pi). |
| Starboard beam steering angle Y | f32 | In radians (typically positive). |
| Starboard beam steering angle Z | f32 | In radians (typically zero). |
| N | u16 | Number of beams per side. |
| Current beam number | u16 | Beam number of this record's data (0 to N-1). |
| W | u8 | Number of bytes per sample. |
| Data types | u8 | BITFIELD: 0: Amplitude 1: Phase |

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 45: 7007 - Record Data

| NAME | SIZE | DESCRIPTION |
|----------------|-------|---|
| Port beam | W * S | Amplitude/Phase series. First sample represents range 0 meters. |
| Starboard beam | W * S | Amplitude/Phase series. First sample represents range 0 meters. |

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 46: 7007 - Optional Data

| NAME | SIZE | DESCRIPTION |
|-----------|------|--|
| Frequency | f32 | Ping Frequency in Hz. |
| Latitude | f64 | Latitude of vessel reference point in radians $-\pi/2$ to $\pi/2$, south negative. |
| Longitude | f64 | Longitude of vessel reference point in radians $-\pi$ to π , west negative. |

| | | |
|---------|-----|--|
| Heading | f32 | Heading of vessel at transmit time in radians. |
| Depth | f32 | Depth for slant range correction in meters. |

9.29 7008 – 7k Beam Data

Description: This record is produced by the SeaBat™ 7k sonar 7-P processor series. It contains the sonar beam “I” and “Q” or magnitude and phase data. The 7-P processor updates this record for each ping. The record can manually be requested or subscribed to from the 7-P processor. For details about requesting and subscribing to records see record 7500 together with Appendix A.

This record is used for snippet output as well. Beams and samples are numbered from 0. First beam to last beam fields are always enumerated from low to high numbers.

Available SeaBat™ format type settings

| SONAR SETTING | MAGNITUDE (bits) | PHASE (bits) |
|---------------|------------------|--------------|
| 1 | 8 | None |
| 2 | 16 | None |
| 3 | 32 | None |
| 4 | 8 | 8 |
| 5 | 16 | 8 |
| 6 | 16 | 16 |
| 7 | 32 | 32 |

| SONAR SETTING | I (bits) | Q (bits) |
|---------------|----------|----------|
| 8 | 16 | 16 |
| 9 | 32 | 32 |

Additional SeaBat™ data settings (data reduction)

Both beam limits, sample limits and SeaBat™ format types can be combined.

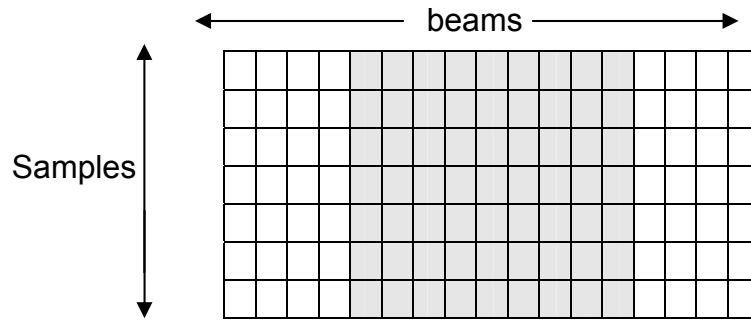


Figure 3: Beam Limits - Set Min and Max Beam

Figure 4: Beam limits

– Set min and max

beam.

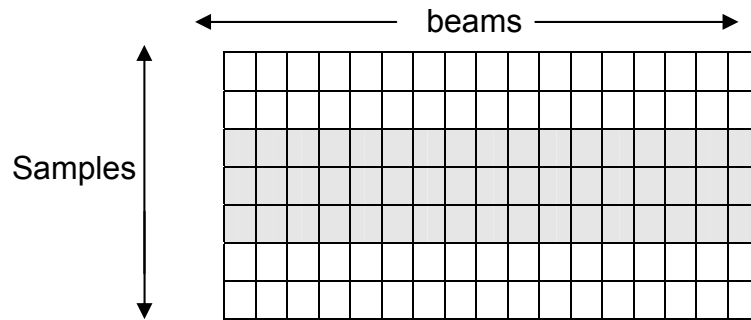


Figure 5: Sample Limits - Set Min and Max Sample

Figure 6: Sample

limits – Set min and

max sample.

Data rates:

Equation for no data reduction, beam limits and all sonar settings:

beams * data format bits * sample rate * 10% (header overhead)

E.g. 128 beams * 32 bits (sonar setting 5) * 34500 samples/s * 1.1 = 155.4432 Mbits/s

Equation for sample limits:

beams * pingrate * samples * data format bits * 10%

E.g. 128 beams * 7 ping / s * 3000 samples * 8 bits (sonar setting 1) * 1.1 = 23.6544 Mbits/s

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 47: 7008 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|--------------------------|------|---|
| Sonar Id | u64 | Sonar serial number. |
| Ping number | u32 | Sequential number. |
| Multi-Ping Sequence | u16 | Flag to indicate Multi-Ping Sequence. Always 0 (zero) if not in Multi-Ping mode; otherwise this represents the sequence number of the ping in the multi-ping sequence. |
| N | u16 | Total number of beams or elements in record. |
| Reserved | u16 | Reserved. |
| Samples | u32 | Samples in ping. Only valid if all beams and samples are in record. |
| Record subset flag | u8 | 0 – All beams and samples in ping. 1 – Beam and / or sample ping subset. |
| Row column flag | u8 | 0 – Beam followed by samples. 1 – Sample follows by beams. |
| Sample header Identifier | u16 | 0 – No sample header. |

| NAME | SIZE | DESCRIPTION |
|---------------------|------|---|
| Data sample type(s) | u32 | BITFIELD (Least significant bit corresponds to Bit 0. Each grouping of bits is to be treated as an unsigned integer of the specified width. E.g. Amplitude is a u4 with possible values in range 0 to 16) 0-3 Amplitude: 0 = No amplitude 1 = Amplitude (8 bits) 2 = Amplitude (16 bits) 3 = Amplitude (32 bits) 4-7 Phase: 0 = No phase 1 = Phase (8 bits) 2 = Phase (16 bits) 3 = Phase (32 bits) 8-11 I and Q: 0 = No I and Q 1 = Signed 16 bit I and signed 16 bit Q 2 = Signed 32 bit I and signed 32 bit Q 12 -14 Beam forming Flag: 0 = Beam formed data 1 = Element data |

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 48: 7008 - Record Data

| NAME | SIZE | DESCRIPTION |
|-------------------------|------|---|
| Beam descriptor | u16 | Beam number. |
| Begin sample descriptor | u32 | First sample number in beam from transmitter and outward. |
| End sample descriptor | u32 | Last sample number in beam from transmitter and outward. |
| ... | ... | ... |
| Beam descriptor | u16 | Beam number. |
| Begin sample descriptor | u32 | First sample number in beam from transmitter and outward |

| NAME | SIZE | DESCRIPTION |
|-----------------------|---------|---|
| End sample descriptor | u32 | Last sample number in beam from transmitter and outward. |
| First column / row | dynamic | Sample header + Amplitude/Phase series. Array is populated with samples from transmitter and outward, or beams from low beam number and increasing. |
| ... | ... | ... |
| Last column / row | dynamic | Sample header + Amplitude/Phase series. Array is populated with samples from transmitter and outward, or beams from low beam number and increasing. |

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 49: 7008 - Optional Data

| NAME | SIZE | DESCRIPTION |
|---|------|--|
| Frequency | f32 | Ping frequency in Hz. |
| Latitude | f64 | Latitude of vessel reference point in Radians $-\pi/2$ to $\pi/2$, south negative. |
| Longitude | f64 | Longitude of vessel reference point in radians $-\pi$ to π , west negative. |
| Heading | f32 | Heading of vessel at transmit time in radians |
| Following set of data items is repeated for each beam. | | |
| Beam – Along track distance | f32 | Along track distance in vessel grid. Resolution = meters |
| Beam – Across track distance | f32 | Across track distance in vessel grid. Resolution = meters |
| Center sample number | u32 | Sample number at detection point of beam. |

9.30 7009 – Vertical Depth

Description: This record provides vertical depth relative to chart datum or relative to the vessel if tidal data is unavailable.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 50: 7009 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|-----------------------|------|---|
| Frequency | f32 | Ping frequency in Hz. |
| Ping Number | u32 | Sequential number. |
| Multi-Ping Sequence | u16 | Flag to indicate Multi-Ping Sequence. Always 0 (zero) if not in Multi-Ping mode; otherwise this represents the sequence number of the ping in the multi-ping sequence. |
| Latitude | f64 | Latitude of vessel reference point in radians $-\pi/2$ to $\pi/2$, south negative. |
| Longitude | f64 | Longitude of vessel reference point in radians $-\pi$ to π , west negative. |
| Heading | f32 | Heading of vessel at transmit time in radians |
| Along Track Distance | f32 | Along track distance in vessel grid from reference point. Resolution = meters |
| Across Track Distance | f32 | Across track distance in vessel grid from vessel reference point. Resolution = meters |
| Vertical Depth | f32 | Vertical depth relative to chart datum (or relative to vessel if tidal data is unavailable). Resolution = meters |

9.31 7011 – 7k Image Data

Description: This record is produced by the SeaBat™ 7k sonar 7-P processor series. It contains the sonar image data. The image data is compressed RAW or beam formed magnitude / phase data. The 7-P processor updates this record for

each ping. The record can manually be requested or subscribed to from the 7-P processor. For details about requesting and subscribing to records see record 7500 together with Appendix A.

The image represents range versus beams or beams versus range where the sample magnitude or phase values sets the pixel intensities.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 51: 7011 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|------------------------|------|--|
| Ping number | u32 | Sequential number. |
| Multi-Ping Sequence | u16 | Flag to indicate Multi-Ping Sequence. Always 0 (zero) if not in Multi-Ping mode; otherwise this represents the sequence number of the ping in the multi-ping sequence. |
| W | u32 | Image width in pixels. |
| H | u32 | Image height in pixels. |
| Color depth | u16 | Color depth per pixel. |
| Width height flag | u16 | 0 – Width followed by height. 1 – Height followed by width. |
| Compression algorithms | u16 | Reserved for future use. |

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 52: 7011 - Record Data

| NAME | SIZE | DESCRIPTION |
|--------------------|---------|---|
| First row / column | Dynamic | Populated from left to right or from top to bottom. |
| ... | ... | ... |
| Last row / column | Dynamic | Populated from left to right or from top to bottom. |

9.32 7030 – Sonar Installation Parameters

Description: This record is sent once when a client subscribes for the record and again when a parameter is changed.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 53: 7030 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|------------------------------------|----------|---------------------|
| Frequency | f32 | Frequency in Hz. |
| Length of firmware version info | u16 | Length in bytes. |
| Firmware version info | u8 [128] | |
| Length of software version info | u16 | Length in bytes. |
| Software version info | u8 [128] | |
| Length of 7k software version info | u16 | Length in bytes. |
| 7k software version info | u8 [128] | |
| Length of record protocol info | u16 | Length in bytes. |
| Record protocol version info | u8 [128] | |
| Transmit array X | f32 | X offset in meters. |
| Transmit array Y | f32 | Y offset in meters. |
| Transmit array Z | f32 | Z offset in meters. |
| Transmit array roll | f32 | Radians |
| Transmit array pitch | f32 | Radians |
| Transmit array heading | f32 | Radians |
| Receive array X | f32 | X offset in meters. |
| Receive array Y | f32 | Y offset in meters. |
| Receive array Z | f32 | Z offset in meters. |
| Receive array roll | f32 | Radians |
| Receive array pitch | f32 | Radians |
| Receive array heading | f32 | Radians |
| Motion sensor X | f32 | X offset in meters. |
| Motion sensor Y | f32 | Y offset in meters. |

| NAME | SIZE | DESCRIPTION |
|-----------------------------------|------|--|
| Motion sensor Z | f32 | Z offset in meters. |
| Motion sensor roll calibration | f32 | Radians |
| Motion sensor pitch calibration | f32 | Radians |
| Motion sensor heading calibration | f32 | Radians |
| Motion sensor time delay | u16 | milliseconds |
| Position sensor X | f32 | X offset in meters. |
| Position sensor Y | f32 | Y offset in meters. |
| Position sensor Z | f32 | Z offset in meters. |
| Position sensor time delay | u16 | milliseconds |
| Water line vertical offset | f32 | Vertical offset from reference point to waterline in meters. |

9.33 7050 – 7k System Events

Description: This record is produced by the SeaBat™ 7k sonar 7-P processor series. It contains the 7-P processor system events. The 7-P processor updates this record when any event is added or removed in the system. The record can manually be requested or subscribed to from the 7-P processor. For details about requesting and subscribing to records see record 7500 together with Appendix A.

The events in the Record Data (RD) section are located back to back.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 54: 7050 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|----------|------|----------------------|
| Sonar Id | u64 | Sonar serial number. |
| Events | u32 | Number of events |

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 55: 7050 - Record Data

| NAME | SIZE | DESCRIPTION |
|------|------|-------------|
|------|------|-------------|

| NAME | SIZE | DESCRIPTION |
|----------------------|---------|---|
| Event type | u16 | 0 – Success. 1 – Information. 2 – Warning. 3 – Error. |
| Event identifier | u16 | 0 – Not defined. |
| Device identifier | u32 | Identifier of the device that this data pertains. |
| System enumerator | u16 | System enumerator for identical systems in one installation. 0 – N. |
| Event message length | u16 | Message length including termination character. |
| 7KTIME | u8*10 | Time tag. |
| Event message | dynamic | Null terminated string. |

9.34 7051 – 7k System Event Message

Description: This record is produced by the SeaBat™ 7k sonar 7-P processor series. It holds a single 7-P processor event. The latest record can manually be requested or subscribed to from the 7-P processor. For details about requesting and subscribing to records see record 7500 together with Appendix A.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 56: 7051 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|------------------|------|--|
| Sonar Id | u64 | Sonar serial number. |
| Event Id | u16 | 0 – Success. 1 – Information. 2 – Warning. 3 – Error. |
| Message length | u16 | Message length in Bytes. |
| Event identifier | u16 | 0 – Undefined. |

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 57: 7051 - Record Data

| NAME | SIZE | DESCRIPTION |
|---------------|---------|-------------------------|
| Event message | dynamic | Null terminated string. |

9.35 7052 – 7k Data Storage Status Information

Description: SeaBat™ 7k data storage status information.

Data Definition: TBD

9.36 7060 – 7k Target Data

Description: SeaBat™ 7k Target data information.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 58: 7060 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|------------------------------------|-------|---|
| Local track Identifier | u32 | Unique within each sonar system |
| System track identifier | u32 | Unique within each system |
| Time of Contact | u8*10 | 7k Time |
| Datum identifier | u16 | 0 – WGS84 >0 – Reserved |
| Position latency | f32 | In seconds |
| Latitude or Northing | f64 | Latitude in radians or in meters |
| Longitude or Easting | f64 | Longitude in radians or in meters |
| UTM Zone | u8 | UTM Zone |
| Height relative to Datum or Height | f64 | In meters |
| Position type flag | u16 | 0 – Position not used 1 – Geographical coordinates 2 – Grid coordinates |

| NAME | SIZE | DESCRIPTION |
|------------------------------|---------|---|
| Classification type | u16 | 0 – Unknown 1 – Cursor marker (speed and heading always 0) 2 – MLO 3 – Submarine 4 – Surface Ship |
| Bearing to target | f32 | In radians |
| Bearing flag | u32 | 0 – Relative to sonar array 1 – Absolute / north stabilized |
| Range to target | f32 | Range from sonar array to target |
| Holding time | f32 | In seconds. Negative value if not used |
| Detection method | u32 | 0 – Automatic, algorithm based 1 – Manual, operator selected 2 – Predicted, based on last known position, speed and direction |
| SNR | f32 | Signal to Noise Ratio in dB |
| TS | f32 | Target Strength in dB |
| Confidence value | u32 | A value from 1 to 10 where 10 – Best confidence 1 – Worst confidence |
| Target altitude | f32 | In meters, negative value if not used |
| Target depth | f32 | In meters, value >100000.0 if not used |
| Target speed | f32 | In meters / second |
| Target heading | f32 | In radians |
| Reserved | u128 | Reserved space |
| Target text information size | u32 | Size of string in Bytes including termination character |
| Target text information | dynamic | Null terminated ASCII string |

9.37 7200 – 7k File Header

Description: Optional data field can contain any customer specific information necessary to describe the file further.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 59: 7200 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|--------------------|------|--|
| File identifier | u128 | 0xF3302F43CFB04d6fA93E2AEC33DF577D |
| Version number | u16 | File format version number. |
| Reserved | u16 | Reserved. |
| Session identifier | u128 | User defined session identifier. Used to associate multiple files for a given session. |
| Record data size | u32 | Size of record data. 0 if not present. |
| N | u32 | Number of devices (N ≥ 0). |

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 60: 7200 - Record Data

| NAME | SIZE | DESCRIPTION |
|----------------------------------|--------|--|
| Recording name | u8*64 | Null terminated US-ASCII string. |
| Recording program version number | u8*16 | Null terminated US-ASCII string. |
| User defined name | u8*64 | Null terminated US-ASCII string. |
| Notes | u8*128 | Null terminated US-ASCII string. |
| Device Identifier 0 | u32 | Identifier for record type of embedded data. |
| System enumerator 0 | u16 | Identifier for the device enumerator. |
| ... | ... | ... |
| Device Identifier N-1 | u32 | Identifier for record type of embedded data. |
| System enumerator N-1 | u16 | Identifier for the device enumerator. |

9.38 7400 – Time Message

Description: The time (7KTIME) in Data Record Frame represent the new time. This message can be used together with a PPS or equivalent. The leap second offset field can be used to flag for leap second inserts ahead of time.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 61: 7400 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|--------------------|------|--|
| Leap second offset | i8 | -1, 0 or +1 second for midnight 31 Dec. |
| Pulse flag | u8 | 0 – Message is not associated with hardware pulse. 1 – Message preceding hardware pulse. 2 – Message following hardware pulse. |
| Port identifier | u16 | Port number identifier for pulse. |
| Reserved | u32 | Reserved. |
| Reserved | u64 | Reserved. |

NOTE:

SeaBat 7k Time Records have a reserved number range from 7400 through 7499.

9.39 7500 – 7k Remote Control

Description: This record is used to remotely control SeaBat™ 7k sonar 7-P processor series. It contains the 7-P processor remote control commands. A remote control command is either acknowledged (record 7501) or not acknowledged (record 7502). The record can be subscribed to from the 7-P processor. For details about subscribing to records see Appendix A. All remote control commands shall be sent to TCP or UDP port 7000 on the 7-P processor.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 62: 7500 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|-------------------|------|---|
| Remote control ID | u32 | See separate remote control table for details. See Appendix A. |
| Ticket | u32 | Ticker number. Set by client for control packet matching to ACK or NAK packets. |
| Tracking number | u128 | Unique number. Set by client for packet tracking. |

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 63: 7500 - Record Data

| NAME | SIZE | DESCRIPTION |
|---------------------|---------|--|
| Remote control data | dynamic | Value(s). See Appendix A for 7k Remote Control Descriptions. |

NOTE:

SeaBat 7k Remote Control Records have a reserved number range from 7500 through 7550.

9.40 7501 – 7k Remote Control Acknowledge

Description: This record is produced by the SeaBat™ 7k sonar 7-P processor series as a reply to a successful remote control command (record 7500) and sent to the host. It contains a copy of the ticket and tracking number specified in record 7500. This record cannot be manually requested or subscribed to.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 64: 7501 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|-----------------|------|-------------------------------|
| Ticket | u32 | Ticker number in record 7500. |
| Tracking number | u128 | Unique number in record 7500. |

9.41 7502 – 7k Remote Control Not Acknowledge

Description: This record is produced by the SeaBat™ 7k sonar 7-P processor series as a reply to a non-successful remote control command (record 7500) and sent to the host. It contains a copy of the ticket and tracking number specified in record 7500 as well as an error code to why the command wasn't accepted. This record cannot be manually requested or subscribed to.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 65: 7502 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|-----------------|------|---|
| Ticket | u32 | Ticker number in record 7500. |
| Tracking number | u128 | Unique number in record 7500. |
| Error code. | u32 | Error code 0 – Reserved 1 – Rejected command 2 – Unknown command |

9.42 7503 – Remote Control Sonar Settings

Description: This record is produced by the SeaBat 7k Sonar 7-P Processor. It contains the remote control sonar settings. The 7-P Processor updates this record for each ping. The record can manually be requested or subscribed to from the 7-P Processor. For details about requesting and subscribing to records, see 9.39 7500 – 7k Remote Control together with Appendix A 7k Remote Control Definitions.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 66: 7503 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|------------------------------|------|--|
| Sonar Id | u64 | Serial number. |
| Ping number | u32 | Sequential number. |
| Frequency | f32 | Center transmit frequency in Hertz. |
| Sample rate | f32 | Sample in Hertz |
| Receiver bandwidth | f32 | In Hertz. |
| Tx Pulse width | f32 | Seconds of pulse. |
| Tx Pulse type identifier | u32 | 0 – CW 1 – Linear chirp |
| Tx Pulse envelope identifier | u32 | 0 – Tapered rectangular 1 – Tukey |
| Tx Pulse envelope parameter | f32 | Some envelopes don't use this parameter. |
| Tx Pulse reserved | u32 | Additional pulse information. |
| Max ping rate | f32 | Maximum ping rate in pings per second. |
| Ping period | f32 | Seconds since last ping. |

| NAME | SIZE | DESCRIPTION |
|---|------|---|
| Range selection | f32 | Range selection in meters. |
| Power selection | f32 | Power selection in dB/ μ Pa |
| Gain selection | f32 | Gain selection in dB. |
| Control flags | u32 | BITFIELD: 0-3: Auto range method. 4-7: Auto bottom detect filter method. 8: Bottom detect range filter. 9: Bottom detect depth filter. 10-14: Auto receiver gain method. 15-31: Reserved. |
| Projector magic number | u32 | Projector selection. |
| Projector beam steering angle vertical | f32 | In radians. |
| Projector beam steering angle horizontal | f32 | In radians. |
| Projector beam -3dB beam width vertical | f32 | In radians. |
| Projector beam -3dB beam width horizontal | f32 | In radians. |
| Projector beam focal point | f32 | In meters. |
| Projector beam weighting window type | u32 | 0 – Rectangular 1 – Chebychev |
| Projector beam weighting window parameter | f32 | N/A |
| Transmit flags | u32 | BITFIELD: 0-3: Pitch stabilization method. 4-7: Yaw stabilization method. 8-31: Reserved. |
| Hydrophone magic number | u32 | Hydrophone selection. |
| Receive beam weighting window | u32 | 0 – Chebychev 1 – Kaiser |
| Receive beam weighting parameter | f32 | N/A |

| NAME | SIZE | DESCRIPTION |
|------------------------------|------|---|
| Receive flags | u32 | <p>BITFIELD:</p> <p>0-3: Roll stabilization method. 4-7: Dynamic focusing method. 8-11: Doppler compensation method. 12-15: Match filtering method. 16-19: TVG method. 20-23: Multi-Ping Mode.</p> <p>0 = No multi-ping If non-zero, this represents the sequence number of the ping in the multi-ping sequence.</p> <p>24-31: Reserved</p> |
| Bottom detection filter info | f32 | Min range (if range filter active). |
| Bottom detection filter info | f32 | Max range (if range filter active). |
| Bottom detection filter info | f32 | Min depth (if depth filter active). |
| Bottom detection filter info | f32 | Max depth (if depth filter active). |
| Absorption | f32 | Absorption in dB/km. |
| Sound velocity | f32 | Sound Velocity in m/s |
| Spreading | f32 | Spreading loss in dB. |
| Reserved | u16 | Reserved for future pulse shape description. |
| Tx array position offset X | f32 | Offset of the Transducer array in m, relative to the Receiver array on the X axis, positive value is to the right, if the receiver faces forward. |
| Tx array position offset Y | f32 | Offset of the Transducer array in m, relative to the Receiver array on the Y axis, positive value is forward, if the receiver faces forward. |
| Tx array position offset Z | f32 | Offset of the Transducer array in m, relative to the Receiver array on the Z axis, positive value is up, if the receiver faces forward. |
| Head Tilt X | f32 | Radians |
| Head Tilt Y | f32 | Radians |
| Head Tilt Z | f32 | Radians. Typically zero. |
| Ping on/off | u32 | <p>Ping On/Off State, 0 = pinging disabled 1 = pinging enabled</p> |

9.43 7600 – 7k Roll

Description: This record can be used to set the SeaBat™ 7k sonar 7-P processor series systems current roll value. The record can manually be requested or subscribed to from the 7-P processor. For details about requesting and subscribing to records see record 7500 together with Appendix A.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 67: 7600 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|------|------|-------------|
| Roll | f32 | In radians. |

9.44 7601 – 7k Pitch

Description: This record can be used to set the SeaBat™ 7k sonar 7-P processor series systems current pitch value. The record can manually be requested or subscribed to from the 7-P processor. For details about requesting and subscribing to records see record 7500 together with Appendix A.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 68: 7601 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|-------|------|-------------|
| Pitch | f32 | In radians. |

9.45 7610 – 7k Sound Velocity

Description: This record can be used to set the SeaBat™ 7k sonar 7-P processor series systems current sound velocity value. The record can manually be requested or subscribed to from the 7-P processor. For details about requesting and subscribing to records see record 7500 together with Appendix A.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|



Table 69: 7610 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|----------------|------|---------------------|
| Sound Velocity | f32 | In meters / second. |

9.46 7611 – 7k Absorption Loss

Description: This record can be used to set the SeaBat™ 7k sonar 7-P processor series systems current absorption loss value. The record can manually be requested or subscribed to from the 7-P processor. For details about requesting and subscribing to records see record 7500 together with Appendix A.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 70: 7611 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|-----------------|------|-------------|
| Absorption Loss | f32 | In dB / km. |

9.47 7612 – 7k Spreading Loss

Description: This record can be used to set the SeaBat™ 7k sonar 7-P processor series systems current spreading loss value. This coefficient value is used in conjunction with the absorption loss value to re-compute the TVG curve that will be applied to amplify the returned signal. The record can manually be requested or subscribed to from the 7-P processor. For details about requesting and subscribing to records see record 7500 together with Appendix A.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 71: 7612 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|----------------|------|---------------------|
| Spreading Loss | f32 | In dB (0.0 – 60.0). |

9.48 8100 – Embedded 8100 Series Sonar Data

Description: This record is provided to allow SeaBat 8100 series sonar data records to be stored for backward compatibility. 8100 data records are

embedded in their entirety within this record in either big Endian (Motorola) format (native from the sonar) or in little Endian (Intel) format thus accommodating Intel based hosts.

Where a given data type comprises multiple packets, the embedded Record Data field for a given record shall contain concatenated packets for that type. For example, data of type RAW_DATA.

Data Definition:

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

Table 72: 8100 - Record Type Header

| NAME | SIZE | DESCRIPTION |
|--------------------------|---------|---|
| Type | u8 | 0 – Unspecified 1 – R_THETA_DATA_VERY_OLD 2 – RI_THETA_DATA_VERY_OLD 3 – R_THETA_DATA_OLD 4 – RI_THETA_DATA_OLD 5 – R_THETA_DATA 6 – RI_THETA_DATA 7 – SIDESCAN_IMAGE 8 – RAW_DATA 9 – SONAR_STATUS 10 – SNIPPET >10 – Reserved. |
| Flags | u8 | BITFIELD: 0: Embedded data format is 0 = big Endian 1 = little Endian. 1: Embedded checksums are: 1 = valid 0 = invalid 2 – 7: Reserved. |
| Data size | u16 | Size in bytes of embedded data stream |
| Packets following header | u16 | Specifies the number of data packets immediately following the embedded header. Only applies to Types RAW_DATA (8) and SNIPPET (10). |
| Reserved | u8 * 10 | Reserved for future expansion and byte alignment |

10 DEVICE IDENTIFIERS

Table 73: Device Identifiers

| IDENTIFIER | VENDOR | DESCRIPTION |
|------------|------------------|-------------------------------------|
| 100 | | Generic Position Sensor (e.g., GPS) |
| 101 | | Generic Heading Sensor (e.g., Gyro) |
| 102 | | Generic Attitude Sensor. |
| 103 | | Generic MBES. |
| 104 | | Generic Sidescan Sonar. |
| 105 | | Generic Subbottom Profiler. |
| 1001 | TrueTime | PCISG |
| 2000 | CDC | SMCG |
| 2001 | CDC | SPG |
| 2002 | Empire Magnetics | YS2000 Rotator |
| 4013 | RESON | TC4013 |
| 6000 | RESON | DiverDat |
| 7000 | RESON | 7kCenter |
| 7001 | RESON | 7k User Interface |
| 7003 | RESON | PDS2000 |
| 7012 | RESON | SeaBat™ 7012 |
| 7100 | RESON | SeaBat™ 7100 |
| 7101 | RESON | SeaBat™ 7101 |
| 7102 | RESON | SeaBat™ 7102 |
| 7111 | RESON | SeaBat™ 7111 |
| 7112 | RESON | SeaBat™ 7112 |
| 7123 | RESON | SeaBat™ 7123 |
| 7125 | RESON | SeaBat™ 7125 |
| 7128 | RESON | SeaBat™ 7128 |
| 7150 | RESON | SeaBat™ 7150 |
| 7160 | RESON | SeaBat™ 7160 |
| 8100 | RESON | SeaBat™ 8100 |



| IDENTIFIER | VENDOR | DESCRIPTION |
|------------|----------|--|
| 8101 | RESON | SeaBat™ 8101 |
| 8102 | RESON | SeaBat™ 8102 |
| 8111 | RESON | SeaBat™ 8111 |
| 8123 | RESON | SeaBat™ 8123 |
| 8124 | RESON | SeaBat™ 8124 |
| 8125 | RESON | SeaBat™ 8125 |
| 8128 | RESON | SeaBat™ 8128 |
| 8150 | RESON | SeaBat™ 8150 |
| 8160 | RESON | SeaBat™ 8160 |
| 10000 | TSS | DMS 05 |
| 10001 | TSS | 335B |
| 10002 | TSS | 332B |
| 10010 | SeaBird | SeaBird SBE37 |
| 10020 | Litton | Litton 200 |
| 11000 | EdgeTech | FS-DW Sub-bottom Profiler (SBP) |
| 11001 | EdgeTech | FS-DW Low frequency side-scan sonar (LFSSS) |
| 11002 | EdgeTech | FS-DW High frequency side-scan sonar (HFSSS) |
| 11100 | BlueFin | BlueFin vehicle controller |
| 11200 | Ifremer | Techsas |
| 12000 | Simrad | Simrad RPT319 |

APPENDIX A 7K REMOTE CONTROL DEFINITIONS

SeaBat™ 7k series system support all commands or a subset of the below commands.

Table 74: 7k Remote Control Definitions

| IDENTIFIER | DESCRIPTION | POSSIBLE RETURN RECORDS |
|------------|------------------------------------|-------------------------|
| 1000 | Shutdown | 7501, 7502 |
| 1001 | Reboot | 7501, 7502 |
| 1002 | Calibrate | 7501, 7502, 7005 |
| 1003 | Range | 7501, 7502 |
| 1004 | Max ping rate | 7501, 7502 |
| 1005 | Transmit power | 7501, 7502 |
| 1006 | Transmit pulse width | 7501, 7502 |
| 1007 | Transmit pulse type | 7501, 7502 |
| 1008 | Receiver gain | 7501, 7502 |
| 1009 | Bottom detection method mask | 7501, 7502 |
| 1010 | Bottom detection filter info | 7501, 7502 |
| 1011 | Projector selection | 7501, 7502 |
| 1012 | Projector stabilization | 7501, 7502 |
| 1013 | Transmitter stabilization | 7501, 7502 |
| 1014 | Auto range | 7501, 7502 |
| 1015 | Hydrophone selection. | 7501, 7502 |
| 1017 | Receiver gain type | 7501, 7502 |
| 1018 | TVG Coefficients | 7501, 7502 |
| 1019 | Auto receiver gain | 7501, 7502 |
| 1020 | Transmit pulse envelope identifier | 7501, 7502 |
| 1021 | Transmit beam steering | 7501, 7502 |
| 1022 | Projector beam widths | 7501, 7502 |
| 1023 | Projector beam focal point | 7501, 7502 |



| IDENTIFIER | DESCRIPTION | POSSIBLE RETURN RECORDS |
|------------|---|--|
| 1024 | Projector beam weighting | 7501, 7502 |
| 1025 | Receive beam weighting | 7501, 7502 |
| 1027 | Transmit frequencies for chirps | 7501, 7502 |
| 1050 | Single record request | 7501, 7502, 7000, 7001, 7002, 7004, 7005, 7006, 7007, 7008, 7051, 7052 |
| 1051 | Volatile (Subscription) data feed | 7501, 7502, 7503, 7000, 7002, 7004, 7006, 7007, 7008, 7011, 7050, 7051, 7052 |
| 1052 | Stop volatile data feed. | 7501, 7502 |
| 1053 | Persistent data feed. | 7501, 7502 |
| 1054 | Stop persistent data feed. | 7501, 7502 |
| 1055 | Volatile Data Feed, Range of Records | 7501, 7502 |
| 1100 | Start pinging. | 7501, 7502 |
| 1101 | Stop pinging. | 7501, 7502 |
| 1102 | Load parameters | 7501, 7502 |
| 1103 | Snippet control | 7501, 7502 |
| 1104 | 7008 beam control | 7501, 7502 |
| 1105 | 7008 data sample type | 7501, 7502 |
| 1106 | Sonar sequencer control | 7501, 7502 |
| 1107 | Single Ping Request | 7501, 7502 |
| 1108 | Load Factory Parameters, Specific Sonar | 7501, 7502 |
| 1109 | System Health Verification | 7501, 7502 |
| 1200 | Start record | 7501, 7502 |
| 1201 | Stop record | 7501, 7502 |
| 1202 | Start playback | 7501, 7502 |
| 1203 | Stop playback | 7501, 7502 |
| 1300 | Add port | 7501, 7502 |
| 1301 | Control port | 7501, 7502 |
| 1302 | Add trigger | 7501, 7502 |



| IDENTIFIER | DESCRIPTION | POSSIBLE RETURN RECORDS |
|------------|------------------|-------------------------|
| 1303 | Control trigger | 7501, 7502 |
| 1304 | Add sequence | 7501, 7502 |
| 1305 | Control sequence | 7501, 7502 |

| | | | | |
|-----|-----|----|----|-----|
| DRF | RTH | RD | OD | DRF |
|-----|-----|----|----|-----|

IDENTIFIER: 1000

NAME: Shutdown

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: Software and firmware halt followed by power shutdown to dry and wet hardware.

PARAMETERS: None.

IDENTIFIER: 1001

NAME: Reboot

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: Software and firmware restart.

PARAMETERS: None.

IDENTIFIER: 1002

NAME: Calibrate

POSSIBLE RETURN RECORDS: 7501, 7502, 7005

DESCRIPTION: Initiate system calibration. Record 7005 is returned upon successful calibration.

PARAMETERS: None.

IDENTIFIER: 1003

NAME: Range

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: System range setting.

PARAMETERS:

| NAME | SIZE | DESCRIPTION |
|-------|------|--------------------------|
| Range | f32 | Range setting in meters. |

IDENTIFIER: 1004

NAME: Max ping rate

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: Max ping setting.

PARAMETERS:

| NAME | SIZE | DESCRIPTION |
|---------------|------|---|
| Max ping rate | f32 | Max ping rate setting in ping per second. |

IDENTIFIER: 1005

NAME: Transmit power

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: System transmit power setting.

PARAMETERS:

| NAME | SIZE | DESCRIPTION |
|----------------|------|---------------------------|
| Transmit power | f32 | Transmit power in dB/uPa. |

IDENTIFIER: 1006

NAME: Pulse width

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: System transmit pulse width setting.

PARAMETERS:

| NAME | SIZE | DESCRIPTION |
|----------------------|------|----------------------------------|
| Transmit pulse width | f32 | Transmit pulse width in seconds. |

IDENTIFIER: 1007

NAME: Pulse type

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: System transmit pulse type.

PARAMETERS:

| NAME | SIZE | DESCRIPTION |
|---------------------|------|----------------------------|
| Transmit pulse type | u32 | 0 – CW 1 – Linear chirp |

IDENTIFIER: 1008

NAME: Receiver gain

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: System receiver gain.

PARAMETERS:

| NAME | SIZE | DESCRIPTION |
|---------------|------|-----------------------|
| Receiver gain | f32 | Gain selection in dB. |

IDENTIFIER: 1009

NAME: Bottom detection mask

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: System bottom detection mask.

PARAMETERS:

| NAME | SIZE | DESCRIPTION |
|-----------------------|------|--|
| Bottom detection flag | u32 | BITFIELD: 0-3: Reserved. 4-7: Bottom detection method. 8: Range filter (On / Off). 9: Depth filter (On / Off). 10-31: Reserved. |

IDENTIFIER: 1010

NAME: Bottom detection filter info.

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: System bottom detection filter info.

PARAMETERS:

| NAME | SIZE | DESCRIPTION |
|------------------------------|------|-------------------------------------|
| Bottom detection filter info | f32 | Min range (if range filter active). |
| Bottom detection filter info | f32 | Max range (if range filter active). |
| Bottom detection filter info | f32 | Min depth (if depth filter active). |
| Bottom detection filter info | f32 | Max depth (if depth filter active). |

IDENTIFIER: 1011

NAME: Projector selection.

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: System projector selection.

PARAMETERS:

| NAME | SIZE | DESCRIPTION |
|--------------------------|------|----------------------|
| Projector's magic number | u32 | Projector selection. |

IDENTIFIER: 1012

NAME: Projector stabilization.

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: System projector stabilization setting.

PARAMETERS:

| NAME | SIZE | DESCRIPTION |
|----------------|------|--|
| Projector mask | u32 | BITFIELD: 0-3: Pitch stabilization method. 4-7: Yaw stabilization method. 8-31: Reserved. |

IDENTIFIER: 1013

NAME: Receive beam stabilization.

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: Receive beam stabilization settings.

PARAMETERS:

| NAME | SIZE | DESCRIPTION |
|--------------|------|---|
| Receive mask | u32 | BITFIELD: 0-3: Roll stabilization method. 4-31: Reserved. |

IDENTIFIER: 1014

NAME: Auto range.

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: System automatic range method setting.

PARAMETERS:

| NAME | SIZE | DESCRIPTION |
|-----------------|------|---|
| Auto range mask | u32 | BITFIELD: 0-3: Auto range method. 4-31: Reserved. |

IDENTIFIER: 1015

NAME: Hydrophone selection.

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: System hydrophone selection.

PARAMETERS:

| NAME | SIZE | DESCRIPTION |
|---------------------------|------|---------------------------|
| Hydrophone's magic number | u32 | Hydrophone selection. TBD |

IDENTIFIER: 1017

NAME: Receiver gain type.

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: System receiver gain type setting.

PARAMETERS:

| NAME | SIZE | DESCRIPTION |
|--------------------|------|-------------|
| Receiver gain type | u32 | TVG method. |
| Coefficients | TBD | TBD |

IDENTIFIER: 1019

NAME: Auto receiver gain.

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: System automatic receiver gain setting.

PARAMETERS:

| NAME | SIZE | DESCRIPTION |
|-------------------------|------|---------------------|
| Auto receiver gain flag | u32 | 0 – Off. 1 – On. |

IDENTIFIER: 1020

NAME: Transmit pulse envelope identifier

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: Identifies what envelope that shall be applied to the transmit pulse.

PARAMETERS:

| NAME | SIZE | DESCRIPTION |
|------------------------------------|------|--|
| Transmit pulse envelope identifier | u32 | 0 – Tapered rectangular 1 – Tukey |
| Transmit pulse envelope parameter | f32 | Different meaning for the different envelopes. |

IDENTIFIER: 1021

NAME: Transmit beam steering.

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: Horizontal and vertical projector beam steering.

PARAMETERS:

| NAME | SIZE | DESCRIPTION |
|------------------------------------|------|-------------|
| Projector beam steering horizontal | f32 | In Radians. |
| Projector beam steering vertical | f32 | In Radians. |

IDENTIFIER: 1022

NAME: Projector beam widths.

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: Horizontal and vertical projector beam widths.

PARAMETERS:

| NAME | SIZE | DESCRIPTION |
|---|------|-------------|
| Horizontal projector beam –3dB beam width | f32 | In Radians. |
| Vertical projector beam –3dB beam width | f32 | In Radians. |

IDENTIFIER: 1023

NAME: Projector beam focal point.

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: Projector beam focal point.

PARAMETERS:

| NAME | SIZE | DESCRIPTION |
|----------------------------|------|---|
| Flag | u32 | 1 - Automatic focus 0 - Manual focus |
| Projector beam focal point | f32 | In meters |

IDENTIFIER: 1024

NAME: Projector beam weighting.

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: Projector beam weighting window type.

PARAMETERS:

| NAME | SIZE | DESCRIPTION |
|---|------|----------------------------------|
| Projector beam weighting window type | u32 | 0 – Rectangular 1 – Chebychev |
| Projector beam weighting window parameter | f32 | N/A |

IDENTIFIER: 1025

NAME: Receive beam weighting.

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: Receive beam weighting window type.

PARAMETERS:

| NAME | SIZE | DESCRIPTION |
|----------------------------------|------|-----------------------------|
| Receive beam weighting window | u32 | 0 – Chebychev 1 – Kaiser |
| Receive beam weighting parameter | f32 | N/A |

IDENTIFIER: 1027

NAME: Transmit frequencies for chirps.

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: Transmit pulse start and stop frequencies.

PARAMETERS:

| NAME | SIZE | DESCRIPTION |
|-----------------|------|-------------|
| Start frequency | f32 | In Hz. |
| Stop frequency | f32 | In Hz. |

IDENTIFIER: 1050

NAME: Single record request.

POSSIBLE RETURN RECORDS: 7501, 7502, 7503, 7000, 7001, 7002, 7004, 7005, 7006, 7007, 7008, 7011, 7051 and 7052, 7600, 7601, 7610, 7611, 7612.

DESCRIPTION: Request latest record.

PARAMETERS:

| NAME | SIZE | DESCRIPTION |
|-------------|------|--|
| Record type | u32 | Possible Record Numbers: 7501, 7502, 7503, 7000, 7001, 7002, 7004, 7005, 7006, 7007, 7008, 7011, 7051 and 7052, 7600, 7601, 7610, 7611, 7612. |

IDENTIFIER: 1051

NAME: Volatile data feed.

POSSIBLE RETURN RECORDS: 7501, 7502, 7503, 7000, 7001, 7002, 7004, 7005, 7006, 7007, 7008, 7011, 7051 and 7052, 7600, 7601, 7610, 7611, 7612.

DESCRIPTION: Create volatile data feed. The host is responsible to keep this connection alive as well as re-establish a lost connection to the 7-P processor.

PARAMETERS:

| NAME | SIZE | DESCRIPTION |
|--------------------------|-------|--|
| N | u32 | Number of records. |
| Array of record numbers. | N*u32 | Possible Record Numbers: 7501, 7502, 7503, 7000, 7001, 7002, 7004, 7005, 7006, 7007, 7008, 7011, 7051 and 7052, 7600, 7601, 7610, 7611, 7612. |

IDENTIFIER: 1052

NAME: Stop volatile data feed.

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: Stop volatile data feed.

PARAMETERS: None.

IDENTIFIER: 1055

NAME: Volatile Data Feed, Range of Records

POSSIBLE RETURN RECORDS: 7501, 7502, plus all records which may be subscribed to

DESCRIPTION: Create volatile data feed for a range of numerically continuous records. The host is responsible to keep this connection alive as well as to re-establish a lost connection to the 7-P processor. Subscribers are cautioned to choose reasonable ranges of defined records to avoid numerous log file messages for as yet undefined records

PARAMETERS:

| NAME | SIZE | DESCRIPTION |
|-----------------|------|-----------------|
| Start Record ID | u32 | Start Record ID |
| End Record ID | u32 | End Record ID |

IDENTIFIER: 1100

NAME: Start Pinging.

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: Start continuous pinging.

PARAMETERS: None.

IDENTIFIER: 1101

NAME: Stop Pinging.

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: Stop pinging.

PARAMETERS: None.

IDENTIFIER: 1102

NAME: Load Factory Parameters.

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: Load Factory Parameters from disk.

PARAMETERS: None.

IDENTIFIER: 1103

NAME: Snippet control.

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: Limit record 7008's sample range to a window around the bottom detection ranges.

PARAMETERS:

| NAME | SIZE | DESCRIPTION |
|-------------|------|---|
| Enable | u32 | 0 – Disable sample limitation. 1 – Enable sample limitation. |
| Window size | u32 | Number of samples around bottom detection for each beam. |

IDENTIFIER: 1104

NAME: 7008 beam control.

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: Limit the number of beams in record 7008.

PARAMETERS:

| NAME | SIZE | DESCRIPTION |
|----------|------|-------------------------------------|
| Min beam | u32 | Minimum beam number. 0 to beams – 1 |
| Max beam | u32 | Maximum beam number. 0 to beams – 1 |

IDENTIFIER: 1105

NAME: 7008 data sample type.

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: Set the data sample type for record 7008.

PARAMETERS:

| NAME | SIZE | DESCRIPTION |
|------------------|------|--|
| Data sample type | u32 | BITFIELD (Least significant bit corresponds to Bit 0.) BIT 0-3 Amplitude: 0 = No amplitude 1 = Amplitude (8 bits) 2 = Amplitude (16 bits) 3 = Amplitude (32 bits) BIT 4-7 Phase: 0 = No phase 1 = Phase (8 bits) 2 = Phase (16 bits) 3 = Phase (32 bits) BIT 8-11 I and Q: 0 = No I and Q 1 = Signed 16 bit I and signed 16 bit Q 2 = Signed 32 bit I and signed 32 bit Q BIT 12 -14 Beam forming Flag: 0 = Beam formed data 1 = Element data |

IDENTIFIER: 1106

NAME: Sonar sequencer control.

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: Turn sequencer on or off with this command.

PARAMETERS:

| NAME | SIZE | DESCRIPTION |
|------|------|--|
| Flag | u32 | 0 – Sequencer off, ping rate based on range setting 1 – Sequencer on, ping rate based on sequencer triggers |

IDENTIFIER: 1107

NAME: Single Ping Request

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: Request for a single ping, note that this request will halt continuous pinging if it has been started.

PARAMETERS: None.

IDENTIFIER: 1108

NAME: Load Factory Parameters, Specific Sonar

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: Load factory parameters for a specific sonar when the 7P is controlling more than one sonar.

PARAMETERS: None

IDENTIFIER: 1109

NAME: System Health Verification

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: Request Acknowledgement from sonar

PARAMETERS: None

IDENTIFIER: 1200

NAME: Start record.

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: Start Recording.

PARAMETERS:

| NAME | SIZE | DESCRIPTION |
|---------------|---------|---|
| Filename size | u32 | In Bytes including termination character. |
| Filename | dynamic | Null terminated ASCII string. |

IDENTIFIER: 1201

NAME: Stop record.

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: Stop Recording.

PARAMETERS: None.

IDENTIFIER: 1202
NAME: Start playback.
POSSIBLE RETURN RECORDS: 7501, 7502
DESCRIPTION: Start playback.
PARAMETERS:

| NAME | SIZE | DESCRIPTION |
|---------------|---------|---|
| Filename size | u32 | In Bytes including termination character. |
| Filename | dynamic | Null terminated ASCII string. |

IDENTIFIER: 1203
NAME: Stop playback.
POSSIBLE RETURN RECORDS: 7501, 7502
DESCRIPTION: Stop playback.
PARAMETERS: None

IDENTIFIER: 1300
NAME: Add port.
POSSIBLE RETURN RECORDS: 7501, 7502
DESCRIPTION: Define and a port to the system.
PARAMETERS:

| NAME | SIZE | DESCRIPTION |
|-------------|------|---|
| Port ID | u32 | Port identifier |
| Type | u32 | Type identifier number 0 – Coaxial port 1 – Serial port 2 – Socket TCP 3 – Socket UDP |
| Address | u64 | If IPv4, use lower 32 bits. |
| Port number | u32 | Port index. |

IDENTIFIER: 1301
NAME: Control port
POSSIBLE RETURN RECORDS: 7501, 7502
DESCRIPTION: Control a physical or logical port.
PARAMETERS:

| NAME | SIZE | DESCRIPTION |
|--------------|------|---|
| Port ID | u32 | Port identifier |
| Control flag | u8 | 0 – Delete port (only if it isn't used by a trigger) 1 – Enable port (default state) 2 – Disable port |

IDENTIFIER: 1302

NAME: Add trigger.

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: Define and map a trigger to one port.

PARAMETERS:

| NAME | SIZE | DESCRIPTION |
|--------------|------|--|
| Trigger ID | u32 | Trigger identifier. |
| Port ID | u32 | Defines the port the trigger is mapped to. |
| Trigger type | u16 | 0 – High Z 1 – TTL 2 – Software |
| Direction | u8 | 0 – IN 1 – OUT |
| Sense | u8 | 0 – Positive sense 1 – Negative sense |
| Pulse length | u32 | Pulse length in microseconds. |

IDENTIFIER: 1303

NAME: Control trigger.

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: Control a defined trigger.

PARAMETERS:

| NAME | SIZE | DESCRIPTION |
|--------------|------|---|
| Trigger ID | u32 | Trigger identifier. |
| Control flag | u8 | 0 – Delete trigger (only if it isn't used in a sequence) 1 – Enable trigger (default state) 2 – Disable trigger |

IDENTIFIER: 1304

NAME: Add sequence.

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: Control a defined trigger. A new defined sequence does not start to execute until remote control command 1305 has been issued.

PARAMETERS:

| NAME | SIZE | DESCRIPTION |
|---------------------|------|--------------------------------------|
| Sequence ID | u32 | Sequence identifier. |
| Steps | u16 | Number of steps in sequence (0 – N). |
| Step Definition 0 | u64 | First step definition. See below. |
| ... | ... | ... |
| Step Definition N-1 | u64 | Last step definition. See below. |

Step definition:

| NAME | SIZE | DESCRIPTION |
|--------------|------|---|
| Trigger ID | u32 | Trigger ID. |
| Edge Trigger | u32 | 0 – Raising edge on previous pulse 1 – Falling edge on previous pulse |
| Delay | u32 | Delay pulse in microseconds since trigger edge of previous pulse (only valid for OUT triggers). |

IDENTIFIER: 1305

NAME: Control sequence.

POSSIBLE RETURN RECORDS: 7501, 7502

DESCRIPTION: Control a defined sequence.

PARAMETERS:

| NAME | SIZE | DESCRIPTION |
|--------------|------|--|
| Sequence ID | u32 | Sequence identifier. |
| Control flag | u8 | 0 – Delete sequence (stops sequence if running) 1 – Enable single sequence 2 – Enable repeat sequence 3 – Disable / stop sequence (default state) |

APPENDIX B PROJECTION IDENTIFIERS

The following table defines the reserved values for the custom identifier field of the Geodesy record (record number 1011). Definitions of projection specific parameters are TBD.

Table 75: Projection Identifiers

| CUSTOM IDENTIFIER | PROJECTION |
|-------------------|--|
| -1 | Not used. |
| 0 | Universal Transverse Mercator (UTM) |
| 1 | Albers Equal-Area Conic |
| 2 | Azimuthal Equal Area |
| 3 | Azimuthal Equidistant |
| 4 | Bonne |
| 5 | Cassini |
| 6 | Double Stereographic |
| 7 | Equal-Area Cylindrical |
| 8 | Equidistant Conic |
| 9 | Equidistant Cylindrical |
| 10 | European Stereographic |
| 11 | Gnomic |
| 12 | Oblique Mercator (Rectified Skew Orthomorphic - with Skew Angle parameter) |
| 13 | Hotine |
| 14 | Hungarian National System (EOV) |
| 15 | Hungarian National System (EOV) |
| 16 | IMW Polyconic |
| 17 | Lambert Conformal Conic (1 parallel) |
| 18 | Lambert Conformal Conic (2 parallel) |
| 19 | Mercator |
| 20 | Miller Cylindrical |
| 21 | Mollweide |

| CUSTOM IDENTIFIER | PROJECTION |
|-------------------|---------------------------------------|
| 22 | Orthographic |
| 23 | Polar Azimuthal |
| 24 | Equal Area |
| 25 | Polar Azimuthal Equidistant |
| 26 | Polar Stereographic |
| 27 | Polyconic |
| 28 | Robinson |
| 29 | Sinusoidal |
| 30 | Space Oblique Mercator |
| 31 | Stereographic |
| 32 | Stereographic 70 |
| 33 | Transverse Mercator (Gauss-Kruger) |
| 34 | Two-Point Fit (polynomial projection) |
| 35 | Van der Grinten 1 |